GOES-R Series
Mission Requirements Document (MRD)

May 22, 2019

U.S. Department of Commerce (DOC)
National Oceanic and Atmospheric Administration (NOAA)
NOAA Satellite and Information Service (NESDIS)
National Aeronautics and Space Administration (NASA)

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GOES-R Series
Mission Requirements Document (MRD)

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<thead>
<tr>
<th>Version</th>
<th>CCR #</th>
<th>CCB Date</th>
<th>DOORS ID #(#s):</th>
<th>Description</th>
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<tbody>
<tr>
<td>Original/Baseline</td>
<td>374</td>
<td>02/26/07</td>
<td></td>
<td>DOORS format implemented and Program retreat MRD restructure 1st time baseline to supersede 2B Prime version.</td>
</tr>
<tr>
<td>3.1</td>
<td>1099</td>
<td>12/05/07</td>
<td>Modify: MRD226 (3.3.3.2.41.0-1)</td>
<td>Change (relieve) the mission product latency for the low cloud and fog product Full Disk from 1 minute to 3 minutes.</td>
</tr>
<tr>
<td>3.2</td>
<td>1116</td>
<td>01/16/08</td>
<td>Modify MRD550 (3.4.2.12.0-4), MRD737 (3.6.3.0-8)</td>
<td>Reallocate the MRD requirement on the ABI for long-term calibration performance to more clearly indicate that meeting the same calibration performance will be achieved by a combination of instrument performance and ground system and calibration working group activities.</td>
</tr>
<tr>
<td>3.2</td>
<td>1121</td>
<td>01/16/08</td>
<td>Modify MRD21 MRD27, MRD28, MRD29, MRD30, MRD32, MRD791</td>
<td>Modify MRD21 - MRD32 to minimize changes to these sections with each change on the ground side.</td>
</tr>
<tr>
<td>3.2</td>
<td>1127</td>
<td>01/14/08</td>
<td>Modify MRD12, MRD463, MRD467, MRD698, MRD699, MRD723, MRD724</td>
<td>The previously planned signals for EMWIN and LRIT services will be consolidated into one signal. EMWIN and LRIT data will be separately identified using the product ID information currently in use for LRIT.</td>
</tr>
<tr>
<td>3.3</td>
<td>1186</td>
<td>05/14/08</td>
<td>Modify MRD95 (3.3.2.4.0-1), MRD789 (5.0-1),</td>
<td>Change MRD language that uses &quot;level 2 and level 2+&quot; products together to say only &quot;level 2+ products&quot;. The definition of level 2+ has been added to the MRD glossary with the same language as the program glossary. (See 2 DOORS issues and 1 attachment for reference whose DOORS issue is covered under PC 377)</td>
</tr>
<tr>
<td>3.4</td>
<td>1211</td>
<td>06/20/08</td>
<td>Numerous</td>
<td>Changes are primarily to fill TBDs in MRD product precision values, with a few other product refinements in other product parameter such as product qualifiers and product accuracy.</td>
</tr>
<tr>
<td>3.4</td>
<td>1212</td>
<td>06/20/08</td>
<td>Numerous</td>
<td>Update from the product prioritization tiers to the product set numbers in order to support the release of the GS F&amp;PS.</td>
</tr>
<tr>
<td>3.4</td>
<td>1213</td>
<td>06/20/08</td>
<td>Numerous</td>
<td>Changes to latency and refresh values reflect the minimum baseline (or threshold) performance for GOES-R.</td>
</tr>
<tr>
<td>3.4</td>
<td>1214</td>
<td>06/20/08</td>
<td>Numerous</td>
<td>GORWG proposed changes for improved product refresh or latency.</td>
</tr>
<tr>
<td>3.5</td>
<td>1273</td>
<td>09/05/08</td>
<td>Waiver: MRD506 (3.4.2.1.4.0-1), MRD515 (3.4.2.1.4.0-10)</td>
<td>Waivers are being requested for four of the ABI filters. Reference CCRs generated by Flight: CCR-01178, CCR-01179, CCR-01180, CCR-01181.</td>
</tr>
<tr>
<td>3.6</td>
<td>1295</td>
<td>11/04/08</td>
<td>Modify MRD180 (3.3.3.2.18.0-1) MRD182 (3.3.3.2.19.0-1),</td>
<td>Update Cloud Particle Size latency from 1 minute to 5 minutes for Mesoscale and 3 minutes to 15</td>
</tr>
</tbody>
</table>
Effective Date: December 5, 2007  
Expiration Date: five years from date of last change  
Responsible Organization: GOES-R Program/Code 410

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<th>Change Level</th>
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| 3.6          | 1298          | 11/04/08 | Modify MRD246 (3.3.3.4.8.0-1)  
MRD244 (3.3.3.4.7.0-1)  
Outstanding cleanup from last set of MRD product changes for Derived Stability Indicies to 1) replace the TBD for CONUS measurement precision with values and to match mesoscale and 2) under Product Measurement range for mesoscale, change temperature range to delta temperature range for Lifted Index, and 3) replace TBD with N/A under Product Vertical Resolution for the mesoscale product |
| 3.6          | 1300          | 11/04/08 | Modify MRD36 (3.2.1.1.0-1)  
Deletes dates, clarifies operational lifetime and adds reference to the GOES-R Program Management Directive. |
| 3.6          | 1301          | 11/04/08 | Modify MRD595 (3.4.2.4.0-4)  
The wavelengths for Fe XX and Fe XII need to be adjusted to ensure the SUVI bandpasses cover the wavelengths of interest with sufficient radiance levels. |
| 3.7          | 1315          | 12/11/08 | Modify MRD198 (3.3.3.2.27.0-1), MRD263 (3.3.3.5.4.0-1), MRD265 (3.3.3.5.5.0-1), MRD267 (3.3.3.5.6.0-1),  
Change geographic area from 62 degree LZA in MRD198 (Cloud Top Pressure) to Full Disk.  
Change MRD263 (Radiances) from CONUS: 62 degree LZA Clear and Cloud Regions Only to CONUS: Clear and above Cloud Regions Only.  
Change MRD265 and MRD267 by adding above in Clear and Cloud Regions Only to say Clear and above Cloud Regions Only. |
| 3.7          | 1316          | 12/11/08 | Modify MRD315 (3.3.4.2.1.0-1), MRD317 (3.3.4.2.2.0-1), MRD320 (3.3.4.3.1.0-1), MRD330 (3.3.4.5.1.0-1), MRD332 (3.3.4.5.2.0-1), MRD334 (3.3.4.5.3.0-1), MRD336 (3.3.4.5.4.0-1), MRD338 (3.3.4.5.5.0-1), MRD340 (3.3.4.5.6.0-1), MRD343 (3.3.4.6.1.0-1), MRD345 (3.3.4.6.2.0-1), MRD348 (3.3.4.6.3.0-1), MRD350 (3.3.4.6.4.0-1), MRD351 (3.3.4.6.5.0-1), MRD352 (3.3.4.6.6.0-1), MRD353 (3.3.4.6.7.0-1),  
Change product Temporal Coverage Qualifiers for from Sun at 67 degree (TBR) daytime solar zenith angle to Sun at less than 67 degree zenith angle (TBR) in MRD363 (Sea & Lake Ice: Age); MRD365 and MRD367 (adding TBR) (Sea & Lake Ice: Concentration); MRD369 (Sea & Lake Ice: Extent); MRD371 and MRD373 (Sea & Lake Ice: Motion); MRD330, MRD332 and MRD334 (Snow Cover); MRD336, RD338, and MRD340 (Snow Depth); MRD343 (Surface Albedo); MRD345 (Surface Emissivity); MRD348 (Vegetation Fraction: Green); and MRD350 (Vegetation Index).  
Also change product Temporal Coverage Qualifiers for Flood/Standing Water (MRD315 and MRD317) and Ice Cover: Landlocked: Hemispheric (MRD320) from Day with Sun at TBD solar zenith angle to Day with Sun at <67 degree solar zenith angle. Additionally, change TBD to 67 degree (TBR) in MRD334 (Snow Cover). and a adds a TBR in MRD365 & MRD367. |
| 3.7          | 1317          | 12/11/08 | Modify MRD232 (3.3.3.4.1.0-1), MRD235 (3.3.4.4.2.0-1), MRD237 (3.3.4.4.3.0-1),  
Land Surface Temperature Mesoscale latency should be updated to 5 minutes from 3 minutes. The Full Disk Measurement Range should change from 230 K - 330 K to 213 K - 333 K to be self-consistent with the Mesoscale Measurement Range. The CONUS measurement range should change |

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<tr>
<td>3.7 1345</td>
<td>02/19/09</td>
<td>Modify MRD222 (3.3.3.2.39.0-1) from 233 K - 333 K to 213 K - 333 K for the same reason.</td>
</tr>
<tr>
<td>3.7 1347</td>
<td>02/05/09</td>
<td>Modify MRD228 (3.3.3.2.42.0-1) Change the Product Extent Qualifier for the Full Disk from 62 degrees LZA to 65 degrees LZA in order to match value listed in both the CONUS and Mesoscale.</td>
</tr>
<tr>
<td>3.7 1348</td>
<td>02/19/09</td>
<td>Modify MRD284 (3.3.3.6.8.0-1) Change the Product Measurement Accuracy for Full Disk from ± 60 W/m² at high end of range (1500 W/m²) to ± 40 W/m² at high end of range (1300 W/m²); ± 40 W/m² at typical value/midpoint (350 W/m²).</td>
</tr>
<tr>
<td>3.7 1349</td>
<td>02/19/09</td>
<td>Modify MRD343 (3.3.4.6.1.0-1) In MRD343 (Surface Albedo: Hemispheric), change the Product Horizontal Resolution from TBD to 2 km and change the Product Mapping Accuracy from TBD to 2 km.</td>
</tr>
<tr>
<td>3.7 1370</td>
<td>02/19/09</td>
<td>Modify MRD292 (3.3.3.6.12.0-1) MRD292, change the Product Measurement Range from 50-900 W/m² to 50-450 W/m² to match physical limitations.</td>
</tr>
<tr>
<td>3.7 1423</td>
<td>03/23/09</td>
<td>Modify MRD#s: 12, 23, 407, 460, 461, 462, 463, 465 – 467, 698, 699, 723, 724, 791 Changes service name EMWIN/LRIT to HRIT/EMWIN</td>
</tr>
<tr>
<td>3.8 1377</td>
<td>09/11/09</td>
<td>Modify MRD310, MRD312, MRD315, MRD317, MRD343 MRD312 &amp; 310 – Changes the Product Measurement (PM) Range. MRD315 &amp; 317 - Change the PM Range. Change Precision. MRD343: Relax Precision</td>
</tr>
<tr>
<td>3.8 1420A</td>
<td>09/11/09</td>
<td>Modify MRD216, MRD302, MRD304, MRD306 MRD216: Change the PM; Change Product Statistics Qualifier MRD#s 302, 304, 306: Change PM Precision; Change the Mesoscale Product Stat Qualifier; Change the refresh:</td>
</tr>
<tr>
<td>3.8 1422A</td>
<td>07/10/09</td>
<td>Modify MRD107, MRD115 Reconcile the definitions for Product Measurement Accuracy and Product Measurement Precision</td>
</tr>
<tr>
<td>3.8 1424</td>
<td>07/10/09</td>
<td>Modify MRD595 The description corresponding to the 131.2A wavelength is corrected.</td>
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<tr>
<td>3.8 1432A 09/11/09</td>
<td>Modify MRD270, MRD272, MRD274, MRD276, MRD278, MRD280, MRD282, MRD284, MRD290, MRD292</td>
<td>MRD #s 270, 276, 280, 282, 284: Change the Precision; MRD #s 270, 272, 274, 282, 284, 290, 292: Change Cloud Cover Conditions; MRD282 &amp; 284: Change FD Horizontal Resolution</td>
</tr>
<tr>
<td>3.8 1438 09/11/09</td>
<td>Modify MRD143, MRD146, MRD210, MRD212, MRD214, MRD226, MRD228, MRD230, MRD234, MRD299, MRD 797</td>
<td>MRD #s 143, 146, 210, 212, 214, 226, 228, 299, 230, 234, 797: Change Precision MRD #s 146, 212, 214, 226, 228, 299, 230, 234: Change the Product Measurement Range MRD146: Change Prod Horizontal Resolution MRD228 &amp; 230: Change the Prod Stat Qualifier MRD234: changes PM Accuracy</td>
</tr>
<tr>
<td>3.8 1439 09/11/09</td>
<td>Modify MRD244, MRD246, MRD807, MRD808, MRD809</td>
<td>Soundings: MRD244 &amp; 246: Change Horizontal Resolution; Remove the ‘+-’ before Precision values MRD807 – 809: Change the Precision values</td>
</tr>
<tr>
<td>3.8 1460 09/11/09</td>
<td>Modify MRD237, MRD239, MRD241</td>
<td>MRD237: update Product Extent Qualifier. MRD239: Change Precision; change Measurement Range; update Product Extent Qualifier. MRD241: update Product Extent Qualifier; change Mapping Accuracy; Change Precision</td>
</tr>
<tr>
<td>3.8 1462 07/10/09</td>
<td>Modify MRD9</td>
<td>Change &quot;Program Plan&quot; to Management Control Plan.</td>
</tr>
<tr>
<td>3.8 1463 07/10/09</td>
<td>Modify MRD299</td>
<td>Change the Product Horizontal Resolution</td>
</tr>
<tr>
<td>3.8 1466 09/11/09</td>
<td>Modify: MRD #s: 148, 150, 152, 156, 158, 160, 162, 164, 166, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 257, 259, 261</td>
<td>MRD #s 148, 150, 152, 156, 158, 160, 162, 164, 166, 174, 176, 178, 180, 182, 184, 186, 188, 257, 259, 261: Change Product Measurement (PM) Range and PM Precision MRD #s 190, 192, 194, 196, 198, 200, 202: Change PM Precision MRD #s 204, 206, 208: Change description of the 7 classification types of clouds, Change PM Precision</td>
</tr>
<tr>
<td>3.8 1482 09/11/09</td>
<td>Modify: MRD #s: 127, 129, 131, 139, 141, 295, 297</td>
<td>Aerosols: MRD #s 127, 129, 131, 295, 297: Change product measurement (PM) precision MRD139 &amp; 141: Change PM range, Clarified the text description of the product. Change PM precision</td>
</tr>
<tr>
<td>3.8 1489 07/10/09</td>
<td>New: MRD818 (insert after MRD601)</td>
<td>Add SEISS level 1b definition to MRD</td>
</tr>
<tr>
<td>3.8 1490 09/04/09</td>
<td>New: MRD816 (insert after MRD591)</td>
<td>Add SUVI level 1b definition to MRD</td>
</tr>
<tr>
<td>3.8 1491 09/04/09</td>
<td>New: MRD819 (insert after MRD569)</td>
<td>Add EXIS XRS level 1b definition to MRD</td>
</tr>
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<tr>
<td>3.8</td>
<td>1492</td>
<td>09/04/09</td>
<td>New: MRD817 (insert after MRD569) Add EXIS EUVS level 1b definition to MRD</td>
</tr>
<tr>
<td>3.8</td>
<td>1499</td>
<td>09/04/09</td>
<td>MRD12, MRD757 Corrects the referenced interface requirements document for the GS to NWS Interface.</td>
</tr>
<tr>
<td>3.8</td>
<td>1542</td>
<td>09/04/09</td>
<td>numerous Delete the Goals Column from Section 3.3 Product Tables.</td>
</tr>
<tr>
<td>3.9</td>
<td>1544</td>
<td>09/18/09</td>
<td>MRD49 (deleted), MRD50 Delete MRD49 (section head) and move MRD50 after section 3.4.1.2 (MRD406), Spacecraft Payloads</td>
</tr>
<tr>
<td>3.9</td>
<td>1545</td>
<td>09/18/09</td>
<td>MRD70 Move MRD70 to section 3.6.1, General Ground Segment Requirements</td>
</tr>
<tr>
<td>3.9</td>
<td>1546</td>
<td>09/18/09</td>
<td>MRD#: 52 (deleted), 53 (deleted), 54, 55 (deleted), 56 (deleted), 57 (deleted), 58, 59, 792 (deleted), 793, 794 Change location in document of MRD793 MRD794 MRD58 MRD59 MRD54 so that Space Segment, Spacecraft and Ground Segment requirements are collected together. Delete empty section headings</td>
</tr>
<tr>
<td>3.9</td>
<td>1559</td>
<td>10/21/09</td>
<td>MRD12 Update IT Security Document Name</td>
</tr>
<tr>
<td>3.9</td>
<td>1571A</td>
<td>11/02/09</td>
<td>MRD12, MRD68 Change document from Program MAR, which doesn't exist, to Spacecraft, Instrument and ABI and Ground MAR docs.</td>
</tr>
<tr>
<td>3.9</td>
<td>1572A</td>
<td>11/04/09</td>
<td>MRD #: 12, 64, 65, 66, 415, 2058 (new) Add NPR 2810.1; Change GS to &quot;Ground Segment&quot;; update IT standards document references; Move MRD 65 to after MRD708; Add security requirement for space segment project.</td>
</tr>
<tr>
<td>3.9</td>
<td>1578</td>
<td>11/02/09</td>
<td>MRD #: 450, 2053 (new), 2054 (new) Modify MRD450 to specify the interface between the Space and Ground Segments.</td>
</tr>
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</table>
| 3.9 | 1579 | 10/30/09 | MRD2078 (new)  
Add a requirement for the GS to receive GRB data from the SS |
| 3.9 | 1580 | 10/30/09 | TOC, MRD2057 (new)  
Add new section for system level interface requirements |
| 3.9 | 1581 | 10/27/09 | MRD2077 (new)  
Add system level GRB interface requirement |
| 3.9 | 1582 | 10/30/09 | MRD2076 (new)  
Add requirement for Space Segment to receive HRIT/EMWIN data from the Ground Segment |
| 3.9 | 1583 | 10/30/09 | MRD2056 (new)  
Add requirement for Ground Segment to send HRIT/EMWIN data to the Space Segment |
| 3.9 | 1584A | 10/30/09 | MRD#s: 2064 (new), 2065 (new)  
Add requirements for the System to send HRIT/EMWIN data and to receive HRIT/EMWIN data. |
| 3.9 | 1585 | 11/02/09 | MRD#s: 2074 (new), 2075 (new)  
Adds two requirements for Space Segment DCS interface from/to Ground Segment |
| 3.9 | 1586 | 11/02/09 | MRD#s: 2059 (new), 2060 (new)  
Adds two requirements for Ground Segment DCS interface from/to Space Segment. |
| 3.9 | 1587 | 11/02/09 | MRD#s: 2068 - 2072 (all are new)  
Add five system requirements to address the interface(s) between GOES-R and the external DCS systems. |
| 3.9 | 1588 | 11/02/09 | MRD#s: 2066 (new), 2067 (new)  
Add two Space Segment requirements for the SARSAT interface. |
| 3.9 | 1589A | 11/02/09 | MRD#s: 2061 (new), 2062 (new)  
Add two System level requirements for the SARSAT interface. |
| 3.9 | 1590 | 10/21/09 | MRD#s: 759, 2063 (new), 2064 (new), 2065 (new)  
Add a System level interface requirement for the CLASS system. Also revised MRD759 to call out L0, L1b, L2+ data more specifically. |
| 3.9 | 1591A | 11/02/09 | MRD#s: 12, 2055 (new)  
Add a requirement to specify the ADRS to GOES-R System interface. |
| 3.9 | 1593A | 11/02/09 | MRD#s: 12, 62  
Add GS to GOES-N/O/P IRD to MRD12; Clarify text by referencing interface description document and move to appear with other interface requirements in new section 3.2.9. |
| 3.9 | 1594 | 11/02/09 | MRD2073 (new)  
Add a System level requirement for the AWIPS interface |
| 3.9 | 1595A | 10/21/09 | MRD716  
Add Ground Segment (GS) TLM interface req. |
| 3.9 | 1596 | 11/02/09 | MRD717  
Modify Ground Segment CMD interface req. |
| 3.9 | 1602 | 11/02/09 | MRD757  
Clarify and correct doc reference GS AWIPS Interface requirement |
| 3.9 | 1609 | 11/09/09 | MRD#s: 12, 2095 (new), 61 (deleted), 2091 - 2094 (all new)  
Delete MRD61 (Continuity) and replace with a series of verifiable system requirements. The added system requirements include: Continuity Facilities Compliance; Section 508 of the Rehabilitation Act Compliance; Accessibility Standards Compliance; Electromagnetic Interference Compliance; System Time Accuracy Compliance |

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<tr>
<td>3.9 1610</td>
<td>10/29/09</td>
<td>MRD864 (new)</td>
<td>Remove TBR from product measurement precision in MRD133/Aerosols.</td>
</tr>
<tr>
<td>3.9 1611</td>
<td>10/29/09</td>
<td>MRD#s: 1004/168, 1014/170, 1024/172, 1140/196, 1150/198, 1202/208, 1203/208</td>
<td>Remove TBXs (TBD, TBR, TBS) in Clouds:</td>
</tr>
<tr>
<td>3.9 1612</td>
<td>10/29/09</td>
<td>MRD#s: 1254/216, 1669/302, 1679/304, 1689/306</td>
<td>Remove TBRs in Winds:</td>
</tr>
<tr>
<td>3.9 1613</td>
<td>10/29/09</td>
<td>MRD228/1277 and 1278, MRD230/1287 and 1288</td>
<td>Remove TBXs (TBD, TBR, TBS) in Turbulence:</td>
</tr>
<tr>
<td>3.9 1614</td>
<td>10/29/09</td>
<td>MRD237/1314, MRD248/1440, 1441 and 1445</td>
<td>Remove TBXs (TBD, TBR, TBS) in Hydrology:</td>
</tr>
<tr>
<td>3.9 1615</td>
<td>10/29/09</td>
<td>MRD#s: 244/1400 &amp; 1404; 246/1417, 1420 &amp; 1424; 801/1337, 1343 &amp; 1344; 802/1347, 1353 &amp; 1354; 803/1357, 1363 &amp; 1364; 807/1367 &amp; 1373; 808/1377 &amp; 1383, 809/1387 &amp; 1393; 822/1410</td>
<td>Remove TBXs (TBD, TBR, TBS) in Sounding:</td>
</tr>
<tr>
<td>3.9 1616</td>
<td>10/29/09</td>
<td>MRD257/1458; MRD259/1468; MRD261/1479; MRD263/1496; MRD265/1506; MRD267/1516</td>
<td>Remove TBXs (TBD, TBR, TBS) in Radiiances and Clear Sky Masks:</td>
</tr>
<tr>
<td>3.9 1617</td>
<td>10/29/09</td>
<td>MRD#s: 272/1536; 274/1546; 286/1602 &amp; 1606; 288/1612 &amp; 1616; 290/1622, 1623 &amp; 1626; 292/1632, 1633 &amp; 1636</td>
<td>Remove TBXs (TBD, TBR, TBS) in Radiation:</td>
</tr>
<tr>
<td>3.9 1618</td>
<td>10/29/09</td>
<td>MRD#s: 310/1706; 312/1716; 315/1727; 317/1737; 320/1747; 323/1756; 325/1766; 327/1776; 330/1787; 332/1797; 334/1807; 336/1817; 338/1827; 340/1837; 343/1844, 1845, &amp; 1847; 345/1856 &amp; 1857; 348/1866 &amp; 1867; 350/1876 &amp; 1877; 363/1927; 365/1937; 367/1947; 371/1957; and 373/1967</td>
<td>Remove TBXs (TBD, TBR, TBS) in Land, including Cryosphere</td>
</tr>
<tr>
<td>3.9 1619</td>
<td>11/08/09</td>
<td>MRD139, MRD141</td>
<td>Remove SO2 from Aerosol Optical Depth definitions</td>
</tr>
<tr>
<td>3.9 1620</td>
<td>10/29/09</td>
<td>MRD354/1886; MRD356/1896; MRD378/1976</td>
<td>Remove TBXs (TBD, TBR, TBS) in SST and Currents</td>
</tr>
<tr>
<td>3.9 1621</td>
<td>10/29/09</td>
<td>MRD222/1264; MRD637</td>
<td>Remove TBXs (TBD, TBR, TBS) in Lightning</td>
</tr>
<tr>
<td>3.9 1622</td>
<td>10/29/09</td>
<td>MRD14, MRD789, MRD794</td>
<td>Removal TBXs in general Program sections. Change MRD14 TBD reference from non-existent plan to existent plan in doc tree.</td>
</tr>
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<tbody>
<tr>
<td>3.9</td>
<td>1623</td>
<td>11/09/09 MRD12, MRD2088 - MRD2090 (all new)</td>
<td>Add document to MRD12 and add introductory text to the start of MRD Section 4, Verification and Validation.</td>
</tr>
<tr>
<td>3.9</td>
<td>1624</td>
<td>10/29/09 MRD2080 (new)</td>
<td>Add requirement for the GS to process UID data rates specified on Flight side.</td>
</tr>
<tr>
<td>3.9</td>
<td>1625</td>
<td>10/29/09 MRD32, MRD442, MRD695, MRD764</td>
<td>Remove TBD on Ground Remote Backup Location; Remove TBR on level of scalability.</td>
</tr>
<tr>
<td>3.9</td>
<td>1626A</td>
<td>11/08/09 MRD12, MRD44, MRD2081 – 2083 (new), MRD45, MRD46, MRD2084 – 2086 (new)</td>
<td>Update orbital requirements to create separate requirements with separate concepts.</td>
</tr>
<tr>
<td>3.9</td>
<td>1627A</td>
<td>11/09/09 MRD12, MRD2087 (new)</td>
<td>Add a system requirement to address the GOES-R to GOES-R Data Portal interface.</td>
</tr>
<tr>
<td>3.9</td>
<td>1630</td>
<td>11/09/09 MRD#s: MRD393/2022; 400/2046, 2047 &amp; 2057; 596, and 660</td>
<td>Remove TBXs (TBD, TBR, TBS) in Solar products and Magnetometer.</td>
</tr>
<tr>
<td>3.9</td>
<td>1633</td>
<td>11/10/09 MRD#s: 384, 386, 388, 390, 603</td>
<td>Remove TBXs (TBD, TBR, TBS) in SEISS.</td>
</tr>
<tr>
<td>3.9</td>
<td>1636</td>
<td>11/11/09 MRD442</td>
<td>Clean up footnote text per comments in CCR-1652 that went beyond TBX changes. Text implied RBU backs up all WCDAS functionality for NESDIS.</td>
</tr>
<tr>
<td>3.10</td>
<td>1601</td>
<td>03/12/10 MRD#s 12, 701, 753, 760</td>
<td>Corrects the GS IRD references. It also corrects the EM MTTR from 5 minutes to 120 minutes.</td>
</tr>
<tr>
<td>3.10</td>
<td>1677A</td>
<td>01/26/10 MRD645</td>
<td>Specifies how many flashes per second the GLM should detect over the full field of view.</td>
</tr>
<tr>
<td>3.10</td>
<td>1681</td>
<td>03/17/10 MRD596</td>
<td>Deletes the &quot;**&quot; and the notation that states 40 seconds of the Product Latency should be allocated to SEC.</td>
</tr>
<tr>
<td>3.10</td>
<td>1720</td>
<td>03/17/10 MRD45</td>
<td>Corrects typo from last rev. by changing the orbital control parameter from +/- 1 deg back to +/- 0.1 deg.</td>
</tr>
<tr>
<td>3.10</td>
<td>1721A</td>
<td>06/02/10 MRD99</td>
<td>Add a note to clarify that Mapping Accuracy requirements.</td>
</tr>
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<td>MRD#s: 12, 62 (deleted), 745 (deleted), 756 (deleted), 791</td>
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<td>MRD#s: 122, 1491, 1501, 1511, 2099 (new), 2100 (new) (new)</td>
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<td>MRD#s: 1433, 1902, 1903, 1906, 1912, 1913, 1916 (all deleted)</td>
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<td>1503A</td>
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<td>3.11</td>
<td>1818</td>
<td>09/28/10</td>
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<td></td>
<td>Modify: MRD323 (3.3.4.1.0-1), MRD325 (3.3.4.2.0-1), and MRD327 (3.3.4.3.0-1)</td>
<td>Change Land Surface Temperature (LST) definition to include a computation of Land Surface Temperature over ice covering the land.</td>
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<tr>
<td>3.11</td>
<td>1839</td>
<td>09/28/10</td>
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<td>Modify: MRD818 (3.4.2.5.0-1)</td>
<td>Update the SEISS level 1b description in the MRD to include the dosimeter.</td>
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<tr>
<td>3.11</td>
<td>1866</td>
<td>09/28/10</td>
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<tr>
<td></td>
<td>Waiver: MRD506 (3.4.2.1.4.0-1), MRD519 (3.4.2.1.4.0-14)</td>
<td>Waives FPA redundant side NEdT performance and pixel to pixel relative accuracy for the 13.3 um band of Flight Model 1. (related to FP CCR-01833)</td>
</tr>
<tr>
<td>3.11</td>
<td>1888</td>
<td>11/22/10</td>
</tr>
<tr>
<td></td>
<td>Modify: MRD2031 (3.3.6.3.1.0-10), MRD2038 (3.3.6.3.2.0-7), MRD2039 (3.3.6.3.2.0-8), MRD2040 (3.3.6.3.2.0-9), MRD2041 (3.3.6.3.2.0-10)</td>
<td>Eliminate TBRs in the Solar Flux X-ray L1b product Refresh Rate, Latency and Product Precision and Solar Flux EUV L1b Product Precision. Refine L1b XRS product accuracy.</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td>3.12 1917A 04/25/11</td>
<td>Modify: MRD781 (4.1.0-4)</td>
<td>Refine MRD End-to-End verification to clarify text to address IRT concern that verification is not readily done with Level 0 data but depends employing Level 1b algorithm. Remove validation aspect of this requirement. Add information about verification employing simulated data</td>
</tr>
<tr>
<td>3.13 2115 08/02/11</td>
<td>Modify: MRD#s: 12, 54, 58, 59, 65, 66, 70, 407, 411, 416, 419, 427, 444, 480, 491, 493, 504, 506, 519, 522, 523, 527, 529 – 533, 535, 536, 538, 539, 541 – 543, 545, 567, 572, 577, 579, 580, 584, 586, 588, 589, 593, 595, 599, 603, 615, 616, 619, 620, 631, 636 – 639, 642, 644, 655, 657, 662 – 664, 668, 694, 695, 705, 713, 714, 719, 722, 728, 731, 737, 739 – 743, 752, 764, 771, 775</td>
<td>Re-baseline of the MRD to eliminate element and below requirements (i.e. mission management, instrument, etc.) by re-capturing technical detail at Level 2 or driving it down to Project requirements.</td>
</tr>
<tr>
<td>3.13 2115 08/02/11</td>
<td>New: MRD#s: 2104 – 2108, 2110 – 2154</td>
<td></td>
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<tr>
<td>3.14</td>
<td>1977</td>
<td>07/06/11</td>
<td>Modify: MRD#s: 864, 1034, 1044, 1054, 1064, 1074, 1404. New product relaxations to Product Measurement Precision for Aerosol Particle Size, Derived Stability Indices (K-Index), Cloud Optical Depth, Cloud Particle Size in support of 100% ATBDs.</td>
</tr>
<tr>
<td>3.14</td>
<td>2071</td>
<td>01/06/12</td>
<td>Modify: MRD#s: 236, 265, 267. Remove the term &quot;infrared&quot; from the definition of Radiance product, which has created confusion by implying it is limited to IR bands only.</td>
</tr>
<tr>
<td>3.14</td>
<td>2153</td>
<td>01/12/12</td>
<td>Modify: MRD#s: 2016 &amp; 2019. Deviation for MRD2019 (Geomagnetic Field Measurement Accuracy) to &quot;2.3 nT after calibration, with 4 nT at end of life&quot; and MRD2016 (Geomagnetic Field Pointing/Mapping Accuracy) to &quot;+/-.5 degree&quot;. See related CCR-02139 SCFPS.</td>
</tr>
<tr>
<td>3.14</td>
<td>2163</td>
<td>12/28/11</td>
<td>Modify: MRD#s: 8, 12, 22, 71, 133, 407, 475, 504, 642, 729, 763, 776, 795, 2105, 2108, 2110, 2114, , Deleted Sections 3.1.2.4, 4.1, 4.2. Many changes are administrative: deletion/renaming of headings which were changed or orphaned in the re-base line; spelling/grammar. The following requirements have been rewritten or modified: MRD2105; MRD2108; MRD71; MRD2110; MRD2114; MRD504; MRD642; MRD795.</td>
</tr>
<tr>
<td>3.14</td>
<td>2168</td>
<td>12/30/11</td>
<td>Modify: MRD #s: 2084, 2085, 2086 Deleted: MRD46, 2097 New: MRD-2155. This adds a new MRD requirement (triggered by LIRD v3.0) to restore service to GOES-East or GOES-West with an on-orbit spare spacecraft within 3 weeks.</td>
</tr>
<tr>
<td>3.14</td>
<td>2221</td>
<td>01/19/12</td>
<td>Modify: MRD74. Change the formal risk classification from Class A to Class B.</td>
</tr>
<tr>
<td>3.15</td>
<td>1867A</td>
<td>06/20/13</td>
<td>Modify: MRD82 New: MRD #s: 2166, 2170, 2171 – 2180, 2167, 2181 - 2191. Update MRD to reflect 1) proposed LIRD product changes for only area changes (increases) and 2) proposed changes by AWG in support of the 100% algorithm deliveries including only area changes.</td>
</tr>
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<td>3.15</td>
<td>1892</td>
<td>03/28/12 Modify: MRD #s: 347, 348, 910, 911, 914, 915, 920, 921, 924, 925, 930, 931, 934, 935, 944, 954, 964, 970, 971, 974, 975, 980, 981, 984, 985, 990, 991, 994, 995, 1030, 1031, 1034, 1035, 1040, 1041, 1044, 1045, 1051, 1054, 1055, 1061, 1064, 1065, 1071, 1074, 1075, 1084, 1085, 1094, 1095, 1104, 1105, 1115, 1125, 1135, 1145, 1155, 1184, 1194, 1204, 1251, 1254, 1335, 1446, 1533, 1536, 1543, 1546, 1670, 1672, 1676, 1680, 1682, 1686, 1690, 1692, 1696, 1747, 1786, 1796, 1806, 1856, 1857, 1863, 1866, 1883, 1886, 1893, 1903, 1906, 1913, 1916, (increases). Vegetation Fraction: Green: Hemispheric; Vegetation Index: Hemispheric Update MRD to reflect 1) proposed LIRD product changes representing requirement relaxations only, 2) proposed relaxation changes by AWG in support of the 100% algorithm deliveries later this year, and 3) proposed changes from PSE to clean up a few observed disconnects.</td>
</tr>
<tr>
<td>3.15</td>
<td>2166</td>
<td>05/15/12 Modify: MRD #s: 480, 491, 493, 529 - 533, 535, 536, 538, 539, 542, 543, 589, 737, 2107, 2110, 2114, 2128, 2131 New: MRD #s: 2156, 2157, 2158 Technical baseline cleanups following the MRD re-baseline.</td>
</tr>
<tr>
<td>3.15</td>
<td>2167</td>
<td>10/26/12 Modify: MRD #s: 390 &amp; 2009 Remove from MRD Solar Galactic Proton Product Measurement Range requirement and modify MRD Solar Galactic Proton definition to remove SEISS alpha particles.</td>
</tr>
<tr>
<td>3.15</td>
<td>2183</td>
<td>05/15/12 Deviation: Numerous (600 plus occurrences) Deviation of updated latency/refresh changes and Products (related to LIRD CCR-02169)</td>
</tr>
<tr>
<td>3.15</td>
<td>2369</td>
<td>02/28/13 Deviation: MRD1260 Deviation of Lightning Detection product: Product Measurement Range limit specification (related to GSP CCR-02386)</td>
</tr>
<tr>
<td>3.15</td>
<td>2415</td>
<td>10/24/13 Deviation: MRD#s 330, 332, 334 Deviation to delay implementation of a baseline Snow Cover product</td>
</tr>
<tr>
<td>3.15</td>
<td>2416</td>
<td>02/28/13 Deviation: MRD616 Deviate Magnetospheric Electron and Proton-Low Energy temporal uncertainty in the energy bandwidth (related to FP CCR-02451)</td>
</tr>
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<td>3.15 2501 04/19/13</td>
<td>Waiver: MRD506</td>
<td>Waive ABI system spectral response lower limit on shortwave side of the bandwidth for the 8.5 um band of PFM (FM1). (Related to FP CCR-02445)</td>
</tr>
<tr>
<td>3.15 2551 07/23/13</td>
<td>Deviation: MRD1334</td>
<td>Deviate Rainfall Rate/ QPE Product Precision rates (Related to GSP CCR-02537)</td>
</tr>
<tr>
<td>3.15 2589 09/30/13</td>
<td>Delete: MRD644</td>
<td>Deletes an unnecessary requirement for calibration accuracy on GLM</td>
</tr>
<tr>
<td>3.15 2600 09/19/13</td>
<td>Modify: MRD #s 529, 530, 531, 536, 2154</td>
<td>Change co-registration requirements from not-to-exceed values, Cleanup misnamed Radiance relief near sun from &quot;keep out zones&quot; to &quot;zones of reduced data quality&quot;, change co-registration value, change swath to swath registration from</td>
</tr>
<tr>
<td>3.15 2601 09/19/13</td>
<td>Waiver: MRD/#s 506, 519,1490, 1500, 1510</td>
<td>Waive Radiance relative accuracy, horizontal resolution, and NEdT specified at 240 K for 6.185 um band (related to FP CCR-01963)</td>
</tr>
<tr>
<td>3.15 2602 09/19/13</td>
<td>Waiver: MRD/#s 829, 839, 851</td>
<td>Waiver Aerosol Detection Product Measurement Accuracy for Dust (not smoke) (related to FP CCR-02590)</td>
</tr>
<tr>
<td>3.15 CMO Notes 01/07/13</td>
<td>Entire document, MRD12, MRD2088, MRD14, MRD789, MRD791, footer</td>
<td>In keeping with direction from GPO, revising document numbers (as document is updated) to reflect the NASA code assignment of Code 410 for the GPO. Changed P417-R-MRD.. to 410-R-MRD.., changed P417-R-PLN-0083 to 410-R-PLN-0083, changed P417-R-PLN-0067 to 410-R-PLN-0067, for consistency changed – to : in MRD789, cleaned up some spacing in MRD791, revised portal link to Check the VSDE at <a href="https://goesv3.ndc.nasa.gov">https://goesv3.ndc.nasa.gov</a> to verify correct version prior to use.</td>
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<tr>
<td>3.16 2588 10/24/13</td>
<td>Waiver: MRD2156</td>
<td>ABI FM3 and up, waive current required Radiance low light visible band SNR (related to FP CCR-02584)</td>
</tr>
<tr>
<td>3.16 2662 01/17/14</td>
<td>Modify: MRD #s 399 &amp; 400</td>
<td>Change product name in MRD from Solar Imagery: X-ray to Solar Imagery: EUV</td>
</tr>
<tr>
<td>3.17 2731 04/14/14</td>
<td>Modify: MRD36</td>
<td>Brings MRD36 in line with the LIRD system lifetime description and de-couples it from the PMD</td>
</tr>
<tr>
<td>3.18 2837 09/09/14</td>
<td>Waiver: MRD/#s 829, 839, &amp; 851</td>
<td>Waive Aerosol Detection Product Measurement Accuracy for Dust (not smoke) (related to FP CCR-02234)</td>
</tr>
<tr>
<td>3.19 2970 09/10/15</td>
<td>Modify: MRD2063</td>
<td>Change Core GS Interface from CLASS to PDA</td>
</tr>
<tr>
<td>3.19 3006 12/14/15</td>
<td>Modify: MRD502</td>
<td>Inserts ABI Mode 6 into the list of operational collect modes of that section</td>
</tr>
<tr>
<td>3.20 2923 01/04/16</td>
<td>Waiver: MRD506</td>
<td>Waive Radiance (ABI FM2) spectral response bandwidth on shortwave side of 8.5 um band (related to FP CCR-02199)</td>
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<td>3.20</td>
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<td>01/04/16 Waiver: MRD506 Waive Radiances (ABI FM3) spectral response bandwidth on shortwave side of 8.5 um band (related to FP CCR-02311)</td>
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<tr>
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<td>3195</td>
<td>09/16/16 Waiver: MRD1039, 1129, 1399, 1409, 1419, 1429, 1440, 1450 Waive to Product Mapping Accuracy: 2km</td>
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<td>3195</td>
<td>09/16/16 Waiver: MRD1109, 1119, 1139, 1149, 1339, 1349, 1359, 1369, 1379, 1389 Waive to Product Mapping Accuracy: 5km</td>
</tr>
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<td>03/31/17 Waiver MRD719 Waive to Ground Segment satellite alignment activities (related to GSP CCR-02481)</td>
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<tr>
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<td>05/02/17 MRD2019, MRD2022 Added Administrative Notes to Geomagnetic Field Product Measurement Accuracy and Product Measurement Precision.</td>
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<td>02/07/18 Waiver: MRD662, 663 Waive to MRD Product Geomagnetic Field transient fluctuation level (related to FP CCR-03306)</td>
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<tr>
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<td>2/17/180 Waiver: MRD480 Waive to MRD Space Segment raw instrument measurement performance requirements outage. (related to FP CCR-03349)</td>
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<td>3.27</td>
<td></td>
<td>09/12/2018 CMO NOTE There was a delay in the processing of this CCR pending NOSC/AESOP concurrence and SC/MAG vendor analysis</td>
</tr>
<tr>
<td>3.28</td>
<td>3446</td>
<td>05/15/2019 Modify: MRD #s 23, 407, 2082, 2087 New: MRD #s 2193, 2194, 2195, 2196, 2197 Update MRD for addition of the Compact Coronagraph (CCOR) instrument to GOES-U,</td>
</tr>
</tbody>
</table>

Check the GOES-R portal at [https://goessp.ndc.nasa.gov](https://goessp.ndc.nasa.gov) to verify correct version prior to use.
Check the GOES-R portal at https://goessp.ndc.nasa.gov to verify correct version prior to use.
/NOAA Level I-II

MRD

410-R-MRD-0070, RM Version, Mission Requirements Document (MRD)

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1 Introduction

1.1 Document Scope

This document provides the Level IIA interface, functional, and performance requirements for the Geostationary Operational Environmental Satellite-R (GOES-R) Series mission. The GOES-R requirements are traceable to NOAA/NESDIS GOES-R Program Plan Level II requirements and as such are the source for all lower level requirements.

1.2 Document Overview

This mission specification is comprised of three sections. Section 1 of this document provides the introduction including the GOES-R specification hierarchy. Section 2 provides the applicable and reference documents. Section 3 of the document is the core, listing the mission requirements including: system overview, system requirements, functional segment requirements, system design and construction requirements and maintenance requirements. Section 4 refers to the documents describing how these requirements will be Verified and Validated. Sections 5 and 6 are references for terminology used throughout.

1.3 Requirements Terminology

The following requirements terminology is used throughout this document:

The term “shall” designates a requirement that must be achieved and is synonymous with the term “threshold.”

The term “should” designates a desired level of performance the government would like the contractor to strive towards achieving and is synonymous with the term “goal.”

All other terms, including “will”, only designate statements of fact or intentions of the government and are not to be interpreted as contractor requirements.

The term “(TBD)”, which means “to be determined”, applied to a missing requirement means that the contractor determines the missing requirement.

The term “(TBR)”, which means “to be refined/reviewed”, means that the requirement is subject to review for appropriateness and subject to revision. The contractor is liable for compliance with the requirement as if the “TBR” notation did not exist. The “TBR” merely provides an indication that the value is more likely to change in a future modification than requirements not accompanied by a “TBR.”

1.4 GOES-R Specification Hierarchy

The requirements of this specification are derived from the GOES-R Management Control Plan (MCP). This specification provides the source document for the requirement allocation to lower specifications shown in the GOES-R Specification Tree shown below.
GOES-R Specification Tree Figure

(CCR 01462) (CCR 02163)
2 Documents

2.1 Applicable Documents

The following documents of the exact issue shown form part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification are considered the superseding requirements.

1. Security Requirements for Information Management Technology Resources (Oct 2003) CAR 1352.239-73
3. Deleted
4. Deleted
5. Deleted
6. Deleted
7. Deleted
8. Deleted
9. Deleted
10. Deleted
11. GOES-R Series, Space Segment (SS) to Ground Located - Command, Control, and Communications Segment (GL-C3S) Interface Requirements Document (IRD), 417-R-IRD-0001
12. GOES-R Series, Space Segment (SS) to GOES Rebroadcast (GRB) Service Interface Requirements Document (IRD), 417-R-IRD-0002
15. GOES-R Series, Space Segment (SS) to Data Collection System (DCS) Interface Requirements Document (IRD), 417-R-IRD-0005
16. GOES-R Series, Space Segment (SS) to Search and Rescue (SAR) Service Interface Requirements Document (IRD), 417-R-IRD-0006
18. OMB Memorandum M-05-22
19. NASA Procedural Requirements, Risk Classification of NASA Payloads, NPR 8705.4, June 14, 2004
20. Launch Services Risk Mitigation Policy for NASA-Owned and/or NASA-Sponsored Payloads/Missions, NPD 8610.7C
22. GOES-R Series, Ground Segment (GS) to Emergency Managers Weather Information Network (EMWIN) Service Interface Requirements Document (IRD), 417-R-IRD-0096
23. GOES-R Series, Ground Segment (GS) to Search and Rescue Satellite (SARSAT) Service Interface Requirements Document (IRD), 417-R-IRD-0093
24. GOES-R Series, Ground Segment (GS) to Data Collection System (DCS) Interface Requirements Document (IRD), G417-R-IRD-0160
25. GOES-R Series, Ground Segment (GS) to Advance Weather Interactive Processing System (AWIPS) Interface Requirements Document (IRD), P417-R-IRD-0160
26. Reserved
27. Reserved
28. GOES-R Series, Ground Segment (GS) to Comprehensive Large Array-Data Stewardship System (CLASS) Interface Requirements Document (IRD), 417-R-IRD-0090
29. Deleted
30. Use of the SI (Metric) System of Measurement in NASA Programs, NPD 8010.2D
31. GOES-R Series, Ground Segment (GS) to Ancillary Data Relay System (ADRS) Interface Requirements Document (IRD), G417-R-IRD-0157
32. NASA Procedural Requirements, Security of Information Technology, NPR 2810.1
33. GOES-R Series, Ground Segment Project MAR Document, G417-R-GSMAR-0068
34. GOES-R Series, Flight Project Spacecraft MAR, 417-R-SCMAR-0011
35. GOES-R Series, Instrument Mission Assurance Requirements, 417-R-IMAR-0039
2.2 Reference Documents

The following documents are listed below for reference purposes only.

- GOES-R/S Satellites, Level I Requirements Document
- GOES-R Series, Management Control Plan, 410-R-PLN-0067
- International Vocabulary of Basic and General Terms in Metrology, 1993
- GOES-R Series Concept of Operations (CONOPS), P417-OPS-0008

(CCR 01622)
3 Mission Requirements

3.1 Mission Overview

3.1.1 Mission Objectives

United States Code Title 15 Chapter 9 has chartered Department of Commerce to forecast weather, issue storm warnings, and display weather and flood signals that will benefit agriculture, commerce, and navigation. The National Oceanic and Atmospheric Administration's (NOAA's) primary environmental mission therefore is to provide forecasts and warnings for the United States, its territories, adjacent waters and ocean area, for the protection of life and property and the enhancement of the national economy. The following are the primary and secondary mission objectives for the GOES-R mission.

a) Primary Mission Objectives

1) To maintain GOES mission continuity and quality in environmental observations in the GOES-R timeframe, extending from 2014 through at least 2028 (or the equivalent duration if starting later).
2) To provide enhanced environmental data products
3) To improve services and data being provided to Users
4) To be responsive to technology infusion to meet evolving User needs
5) To protect, restore, and manage the use of coastal and ocean resources through ecosystem management approaches
6) To understand climate variability and change to enhance society's ability to plan and respond
7) To serve society's need for weather and water information
8) To support society's need for weather and water information

b) Secondary Mission Objective

1) To support ties to the NOAA/National/International Observing System

3.1.2 Mission Architecture
The GOES-R System consists of segments for space and launch and for ground. A brief description of the segments is contained in the following paragraphs. A more detailed description is contained in the reference document GOES-R Series Concept of Operations (CONOPS).

The notional architecture of the GOES-R system is shown below.

(CCR 01121)

3.1.2.1 Space Segment Description

The Space Segment consists of the spacecraft bus, instrument payload, and associated communications equipment. The GOES-R spacecraft will be 3-axis stabilized and capable of the fine pointing control necessary for mission requirements. The primary instrument is the Advanced Baseline Imager (ABI) that will provide climatic, synoptic, and mesoscale imagery for global and CONUS forecasting and severe weather warning. Secondary instruments include the EUVS XRS Irradiance Sensors (EXIS), the Solar UltraViolet Imager (SUVI), the Space Environment In-Situ Suite (SEISS), the Magnetometer (MAG) and the Geostationary Lightning Mapper (GLM). For GOES-U, the Compact Coronagraph (CCOR) instrument will be accommodated and L0 data only will be distributed. Additionally, GOES-R will provide a set of auxiliary communications services in support of the GOES Rebroadcast service (GRB), Data Collection System (DCS), High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN), and Search-and-Rescue Satellite (SARSAT).

Note: For this specification the Level I requirements for the Solar Imaging Suite (SIS) have been decomposed into EUVS XRS Irradiance Sensors (EXIS) and the Solar UltraViolet Imager (SUVI) requirements. The GOES-NOP Low Rate Information Transfer (LRIT) and the Emergency Managers Weather Information Network (EMWIN) services have been combined into a single service for the GOES-R series spacecraft and renamed High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN). The EMWIN/LRIT terminology in older documents and contracts is a valid equivalent to the new service name. (CCR 01423) (CCR 02163) (CCR 03446)

3.1.2.2 Launch Segment Description

The Launch Segment provides those assets and services associated with the launch vehicle (LV) and the payload integration. The launch vehicle element is an evolved expendable launch vehicle (EELV). Included, along with the LV, are all the ground support equipment, property, and facilities to integrate the spacecraft to the LV, verify their integration, conduct pre-launch testing with the ground system, and launch operations.

3.1.2.3 Ground Segment Description

The GOES-R Ground Segment (GS) is comprised of four functional architectural categories: Mission Management, Product Generation, Product Distribution, and Enterprise Management. These categories have been defined as a basis for grouping functional elements and are not intended to specify implementation or design. (CCR 01121)
The Mission Management (MM) functional grouping includes mission scheduling, satellite (spacecraft and instrument) operations, satellite state-of-health trending, orbital analysis, and ground system operations. The Product Generation (PG) functional grouping includes algorithm support, processing of raw science data, processing to Level 1b (including calibration, navigation and registration), generation of the data for rebroadcast and for higher level data creation including operational derived products. The Product Distribution (PD) grouping includes the distribution of Level 1b, Level 2+, and derived products to users. The NOAA interfaces include the interface to the Comprehensive Large Array-data Stewardship System (CLASS) system for storage and retrieval of GOES-R series measurements. *(CCR 01121)*

### 3.1.3 Concept of Operations Summary

GOES-R satellites will have two operational locations; 75°W and 137°W. Any GOES-R satellite stored on-orbit will be located at 105°W. The location for testing on orbit (check-out) is 90° W. Data from the instruments are packetized in CCSDS data format and transmitted via X-band to Wallops Command and Data Acquisition Station and a Remote Backup facility.

The Ground Segment will operate from three sites: the NOAA Satellite Operations Facility (NSOF) in Suitland, MD, the Wallops Command and Data Acquisition Station (WCDAS), and Remote Backup facility (RBU) located at a geographically diverse site of Fairmont, WV. This remote site location will have visibility to operational and on-orbit spare satellites. The Enterprise Management (EM) function lies over all ground segment components and locations.

Full detail of the concept of operations is contained in the GOES-R Series Concept of Operations (CONOPS) [Reference Document 5]. *(CCR 01121) (CCR 01625)*

### 3.2 General Requirements

#### 3.2.1 Level I Schedule Requirements

##### 3.2.1.1 System Life

The GOES-R System **shall** provide an individual satellite lifetime of 5 years of storage and 10 years of operations for each satellite in the series. *(CCR 01300) (CCR 02731)*

##### 3.2.1.2 System Initial Operating Capability (IOC)

The constellation will begin with the launch of a satellite(s) from the GOES-R Series into geostationary orbit. An Initial Operating Capability will be achieved when quality Cloud and Water Vapor imagery are available, with either west or east coverage, exclusively from GOES-R Series satellite(s) and associated Ground Segment capabilities.

##### 3.2.1.3 System Full Operational Capability (FOC)

Full Operational Capability (FOC) will provide the full coverage of the east and west positions and associated Ground Segment capabilities.

#### 3.2.2 Constellation Requirements

There will be multiple satellites in the GOES-R constellation. A satellite consists of a spacecraft to support the instruments, the instruments, the associated communication systems, and the communications payload services.

The GOES-R System will be verified and validated in accordance with the Program Verification and Validation Plan. *(CCR 02115)*

##### 3.2.2.1 Orbits

The GOES-R System **shall** position satellites at 75 degrees West longitude and 137 degrees West longitude at geosynchronous altitude during nominal operations. *(CCR 01626A)*
The GOES-R System shall operate satellites at 89.5 degrees West longitude at geosynchronous altitude for initial satellite checkout. \((CCR\ 01626A)\)

The GOES-R System shall operate satellites at 105 degrees West longitude at geosynchronous altitude for on-orbit storage and periodic check-out in storage. \((CCR\ 01626A)\) \((CCR\ 03446)\)

The GOES-R System shall dispose of satellites in accordance with NASA STD 8719.14, “Process for Limiting Orbital Debris”, [Applicable Document 38]. \((CCR\ 01626A)\)

The GOES-R System shall control the satellites to within +/- 0.1 degree in latitude and longitude at the equator for the nominal operational and checkout orbits. \((CCR\ 01626A)\) \((CCR\ 01720)\)

The GOES-R System shall relocate each satellite between the checkout location and the storage location. \((CCR\ 01626A)\) \((CCR\ 02168)\)

The GOES-R System shall relocate each satellite between the storage location and the operational locations. \((CCR\ 01626A)\) \((CCR\ 02168)\)

The GOES-R System shall relocate each satellite between the two nominal operational locations. \((CCR\ 01626A)\) \((CCR\ 02168)\)

The GOES-R System shall operate in the attitude resulting from Yaw Flips during equinox seasons. \((CCR\ 02115)\) \((CCR\ 02163)\)

The GOES-R Space Segment satellites shall transition from storage mode at the storage location to operational mode at either operational location within 21 days. \((CCR\ 02168)\)

### 3.2.2.2 Coverage

Satellite coverage zones are defined in the Coverage Zone Definition Table below.

<table>
<thead>
<tr>
<th>Coverage Zone Definitions Table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>West</strong></td>
</tr>
<tr>
<td>Latitude: From 68° North to 68° South</td>
</tr>
<tr>
<td>Longitude: From 150° East to 64° West</td>
</tr>
<tr>
<td><strong>Central</strong></td>
</tr>
<tr>
<td>Latitude: From 68° North to 68° South</td>
</tr>
<tr>
<td>Longitude: From 178° West to 32° West</td>
</tr>
<tr>
<td><strong>Central Subset</strong></td>
</tr>
<tr>
<td>Latitude: From 45° North to 45° South</td>
</tr>
<tr>
<td>Longitude: From 178° West to 32° West</td>
</tr>
<tr>
<td><strong>East</strong></td>
</tr>
<tr>
<td>Latitude: From 68° North to 68° South</td>
</tr>
<tr>
<td>Longitude: From 148° West to 2° West</td>
</tr>
</tbody>
</table>

Central (Subset) coverage zone is a subset that can be provided from either the sum of the East or West coverage areas or from single satellite view including all of CONUS. \((CCR\ 02165)\)

### 3.2.3 Availability and Reliability

The GOES-R System shall have an availability of 0.83 each month for the KPP at each geosynchronous orbital location, over System lifetime. \((CCR\ 02115)\)

The GOES-R System shall have a monthly KPP availability of 0.98 over mission lifetime for the CONUS region contained in the overlap of both operational coverage areas. \((CCR\ 02115)\) \((CCR\ 02166)\)

### 3.2.4 Mission Continuity

The GOES-R System shall operate continuously using primary and alternate facilities as defined in Federal Continuity Directive 1 (FCD-1), Annex G, Continuity Facilities, [Applicable Document 41]. \((CCR\ 01609)\)
3.2.5 System Security

MRD64 The GOES-R System shall prevent unauthorized use and access. (CCR 01572A)

3.2.6 System Safety


MRD2091 The GOES-R System shall comply with Section 508 of the Rehabilitation Act (29 USC 749d) as amended [Applicable Document 46]. (CCR 01609)

MRD2108 The GOES-R System shall preclude a single credible failure from inducing mission failure. (CCR 02115) (CCR 02163)

MRD419 The GOES-R System shall perform fault detection and correction. (CCR 02115)

3.2.7 System Standards

MRD71 The GOES-R System shall be compliant with the Consultative Committee for Space Data Systems (CCSDS) recommendations in Applicable Document 47 and 48. (CCR 02163)

MRD72 The International System of Units (SI) shall be used in accordance with NPD 8010.2D [Applicable Document 30].

MRD2092 The GOES-R System shall comply with 36 CFR, Parts 1193 - Telecommunications Act Accessibility Guidelines, and 1194 - Electronic and Information Technology Accessibility Standards [Applicable Documents 42 and 43]. (CCR 01609)

MRD2093 The GOES-R System shall maintain a time accuracy of 100 milliseconds with respect to Coordinated Universal Time. (CCR 01609)

MRD2094 The GOES-R System shall comply with the electromagnetic interference (EMI) requirements of FCC rules CFR 47, Part 15, Subpart B, Sections 15.107 and 15.109 for Class A or B conducted and radiated emissions [Applicable Documents 44 and 45]. (CCR 01609)

3.2.8 Risk Classification

The GOES-R mission primary payload risk classification is Class B per NPR 8705.4 [Applicable Document 19]. (CCR 02221)

3.2.9 External Interface Requirements (CCR 01580)

MRD2055 The GOES-R System shall receive data from ADRS as defined in the interface document, "Ground Segment to ADRS IRD", G417-R-IRD-0157 [Applicable Document 31]. (CCR 01591A)

MRD2061 The GOES-R System shall receive signals from SARSAT Distress Beacons as defined in the interface document, "Space Segment to SAR IRD", 417-R-IRD-0006 [Applicable Document 16]. (CCR 01589A)

MRD2062 The GOES-R System shall send SARSAT Distress Beacon signals to SAR Terminals as defined in the interface document, "Space Segment to SAR IRD", 417-R-IRD-0006 [Applicable Document 16]. (CCR 01589A)

MRD2063 The GOES-R System shall provide information, defined in the GOES-R Ground Segment (GS) To GOES-R Access Subsystem (GAS) Interface Requirements Document (IRD) (G417-R-IRD-0196), for use by the NOAA Archival Data Centers. (CCR 01590) (CCR 02970)


The GOES-R System shall receive DCS data from Data Collections Platforms as defined in the interface document, “Space Segment to DCS IRD”, 417-R-IRD-0005 [Applicable Document 15]. (CCR 01587)

The GOES-R System shall send commands to Data Collections Platforms as defined in the interface document, “Space Segment to DCS IRD”, 417-R-IRD-0005 [Applicable Document 15]. (CCR 01587)

The GOES-R System shall send DCS data to DCS Direct Readout Ground Stations as defined in the interface document, “Space Segment to DCS IRD”, 417-R-IRD-0005 [Applicable Document 15]. (CCR 01587)

The GOES-R System shall receive commands from the DCS ground system as defined in the interface document, “Ground Segment to DCS IRD”, G417-R-IRD-0094 [Applicable Document 24]. (CCR 01587)

The GOES-R System shall send DCS data to the DCS ground system as defined in the interface document, “Ground Segment to DCS IRD”, G417-R-IRD-0094 [Applicable Document 24]. (CCR 01587)

The GOES-R System shall send products to the National Weather Service AWIPS as defined in the interface document, "Ground Segment to AWIPS IRD", P417-R-IRD-0160 [Applicable Document 25]. (CCR 01594)

The GOES-R System shall send GRB data including Level 0 data from CCOR to GRB Terminals as defined in the interface document, "Space Segment to GRB IRD", 417-R-IRD-0002 [Applicable Document 12]. (CCR 01581) (CCR 03446)

The GOES-R System shall send Level 0 data from CCOR, L1b data, L2+ data, and associated metadata to the GOES-R data portal (aka GAS) users as defined in the “GOES-R Series, GOES-R Access Subsystem (GAS)-to-User Interface Description Document” P417-R-IDD-0226, [Applicable Document 39]. (CCR 01627A) (CCR 03446)

3.3 Product Requirements

3.3.1 Product Primary Instrument Sources and Prioritization

The GOES-R Program Plan divided the remote sensing needs of NOAA into the following categories: atmospheric, land, ocean, and space and solar. The observational requirements that are met by this MRD are derived from those in the GOES-R Program Plan. The atmospheric category contains observational requirements for atmospheric observations relating to short-term weather forecasting and weather prediction. The land category contains observational requirements for the land surface focusing on shorter term variations in these quantities than polar observations. The ocean category contains observational requirements for measurements of ocean, large lake, and ice properties relevant to the environment and transportation. The space and solar category (or space weather) contains observational requirements for measurements and forecasts of the space environment as well as for solar activity.

The GOES-R series satellite observational requirements are prioritized as follows:

a) **Product Set 1**: Includes Key Performance Parameters (KPPs), where inability to meet threshold level requirements is cause for system reevaluation or termination, and other high priority and related legacy products
b) **Product Set 2**: Includes next highest priority legacy and related products
c) **Product Set 3**: Includes next highest priority and related products
d) **Product Set 4**: Includes remaining products

(CCR 01212) (CCR 02183(RDW))
3.3.1.1 Atmosphere Products Primary Instrument Sources/Prioritization

The GOES-R Program Plan Atmosphere Products primary instrument sources and priorities are repeated here for reference.

<table>
<thead>
<tr>
<th>AEROSOLS</th>
<th>Primary Instrument Source</th>
<th>Product Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerosol Particle Size</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Aerosol Detection: CONUS (including Smoke and Dust)</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Aerosol Detection: Hemispheric (including Smoke and Dust)</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Aerosol Detection: Mesoscale (including Smoke and Dust)</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Aerosol Optical Depth: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Aerosol Optical Depth: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Volcanic Ash: Detection and Height</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>CLOUDS</td>
<td>Primary Instrument Source</td>
<td>Product Set</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Aircraft Icing Threat</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Cloud Imagery: Coastal</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud and Moisture Imagery: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud and Moisture Imagery: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud and Moisture Imagery: Mesoscale</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Ice Water Path: CONUS</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Ice Water Path: Hemispheric</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Ice Water Path: Mesoscale</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Layers/Heights: CONUS</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Layers/Heights: Hemispheric</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Layers/Heights: Mesoscale</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Liquid Water: CONUS</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Liquid Water: Hemispheric</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Liquid Water: Mesoscale</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Optical Depth: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Optical Depth: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Optical Depth: Mesoscale</td>
<td>ABI</td>
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</tr>
<tr>
<td>Cloud Particle Size Distribution: CONUS</td>
<td>ABI</td>
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</tr>
<tr>
<td>Cloud Particle Size Distribution: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Particle Size Distribution: Mesoscale</td>
<td>ABI</td>
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</tr>
<tr>
<td>Cloud Top Phase: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Top Phase: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Top Phase: Mesoscale</td>
<td>ABI</td>
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</tr>
<tr>
<td>Cloud Top Height: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Top Height: Hemispheric</td>
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<td>1</td>
</tr>
<tr>
<td>Cloud Top Height: Mesoscale</td>
<td>ABI</td>
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</table>
### CLOUDS (continued)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Primary Instrument Source</th>
<th>Product Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud Top Pressure: CONUS</td>
<td>ABI and NWP</td>
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</tr>
<tr>
<td>Cloud Top Pressure: Hemispheric</td>
<td>ABI and NWP</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Top Temperature: Hemispheric</td>
<td>ABI and NWP</td>
<td>1</td>
</tr>
<tr>
<td>Cloud Top Temperature: Mesoscale</td>
<td>ABI and NWP</td>
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</tr>
<tr>
<td>Cloud Type: CONUS</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Type: Hemispheric</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Cloud Type: Mesoscale</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Convective Initiation: CONUS</td>
<td>ABI and NWP</td>
<td>3</td>
</tr>
<tr>
<td>Convective Initiation: Mesoscale</td>
<td>ABI and NWP</td>
<td>3</td>
</tr>
<tr>
<td>Enhanced &quot;V&quot;/Overshooting Top Detection: CONUS</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Enhanced &quot;V&quot;/Overshooting Top Detection: Mesoscale</td>
<td>ABI</td>
<td>4</td>
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<tr>
<td>Hurricane Intensity</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Lightning Detection: Hemispheric</td>
<td>GLM</td>
<td>2</td>
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<tr>
<td>Low Cloud and Fog</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Tropopause Folding Turbulence Prediction: Hemispheric</td>
<td>ABI and NWP</td>
<td>3</td>
</tr>
<tr>
<td>Tropopause Folding Turbulence Prediction: Mesoscale</td>
<td>ABI and NWP</td>
<td>3</td>
</tr>
<tr>
<td>Visibility: Hemispheric</td>
<td>ABI</td>
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</tr>
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</table>

### PRECIPITATION

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Primary Instrument Source</th>
<th>Product Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of Rainfall</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Rainfall Potential</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Rainfall Rate/QPE</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>PROFILES, INDICES, TOTAL WATER</td>
<td>Primary Instrument Source</td>
<td>Product Set</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Legacy Vertical Moisture Profile: CONUS</td>
<td>ABI and NWP</td>
<td>1</td>
</tr>
<tr>
<td>Legacy Vertical Moisture Profile: Hemispheric</td>
<td>ABI and NWP</td>
<td>1</td>
</tr>
<tr>
<td>Legacy Vertical Moisture Profile: Mesoscale</td>
<td>ABI and NWP</td>
<td>1</td>
</tr>
<tr>
<td>Legacy Vertical Temperature Profile: CONUS</td>
<td>ABI and NWP</td>
<td>1</td>
</tr>
<tr>
<td>Legacy Vertical Temperature Profile: Hemispheric</td>
<td>ABI and NWP</td>
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</tr>
<tr>
<td>Legacy Vertical Temperature Profile: Mesoscale</td>
<td>ABI and NWP</td>
<td>1</td>
</tr>
<tr>
<td>Derived Stability Indices: CONUS</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Derived Stability Indices: Hemispheric</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Derived Stability Indices: Mesoscale</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Total Precipitable Water: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Total Precipitable Water: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Total Precipitable Water: Mesoscale</td>
<td>ABI</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RADIANCES</th>
<th>Primary Instrument Source</th>
<th>Product Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Sky Masks: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Clear Sky Masks: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Clear Sky Masks: Mesoscale</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Radiances: CONUS</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Radiances: Hemispheric</td>
<td>ABI</td>
<td>1</td>
</tr>
<tr>
<td>Radiances: Mesoscale</td>
<td>ABI</td>
<td>1</td>
</tr>
</tbody>
</table>
### RADIATION

<table>
<thead>
<tr>
<th>Radiation Type</th>
<th>Primary Instrument Source</th>
<th>Product Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbed Shortwave Radiation: Surface/Mesoscale</td>
<td>ABI makes proxy</td>
<td>3</td>
</tr>
<tr>
<td>Downward Longwave Radiation: Surface/CONUS</td>
<td>ABI and NWP</td>
<td>3</td>
</tr>
<tr>
<td>Downward Longwave Radiation: Surface/Hemispheric</td>
<td>ABI and NWP</td>
<td>3</td>
</tr>
<tr>
<td>Downward Shortwave Radiation: Surface/CONUS</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Downward Shortwave Radiation: Surface/Hemispheric</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Downward Shortwave Radiation: Surface/Mesoscale</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Reflected Shortwave Radiation: TOA/CONUS</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Reflected Shortwave Radiation: TOA/Hemispheric</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Upward Longwave Radiation: Surface/CONUS</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Upward Longwave Radiation: Surface/Hemispheric</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Upward Longwave Radiation: TOA/CONUS</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Upward Longwave Radiation: TOA/Hemispheric</td>
<td>ABI</td>
<td>3</td>
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</tbody>
</table>

### TRACE GASES

<table>
<thead>
<tr>
<th>Trace Gas</th>
<th>Primary Instrument Source</th>
<th>Product Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone Total: CONUS</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Ozone Total: Hemispheric</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>SO₂ Detection</td>
<td>ABI</td>
<td>3</td>
</tr>
</tbody>
</table>

### WINDS

<table>
<thead>
<tr>
<th>Wind Type</th>
<th>Primary Instrument Source</th>
<th>Product Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derived Motion Winds: CONUS</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Derived Motion Winds: Hemispheric</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Derived Motion Winds: Mesoscale</td>
<td>ABI</td>
<td>2</td>
</tr>
</tbody>
</table>

*(CCR 01212) (CCR 01543)*

**3.3.1.2 Land Products Primary Instrument Sources/Prioritization**

The GOES-R Program Plan Land Products primary instrument sources and priorities are repeated here for reference.
### LAND Primary Instrument Sources/Prioritization

<table>
<thead>
<tr>
<th>Category</th>
<th>Primary Instrument Source</th>
<th>Prioritization Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire/Hot Spot Characterization: CONUS</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Fire/Hot Spot Characterization: Hemispheric</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Flood/Standing Water: Hemispheric</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Flood/Standing Water: Mesoscale</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Ice Cover: Hemispheric</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Land Surface (Skin) Temperature: CONUS</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Land Surface (Skin) Temperature: Hemispheric</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Land Surface (Skin) Temperature: Mesoscale</td>
<td>ABI and NWP</td>
<td>2</td>
</tr>
<tr>
<td>Snow Cover: CONUS</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Snow Cover: Hemispheric</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Snow Cover: Mesoscale</td>
<td>ABI</td>
<td>2</td>
</tr>
<tr>
<td>Snow Depth (over Plains): CONUS</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Snow Depth (over Plains): Hemispheric</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Snow Depth (over Plains): Mesoscale</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Surface Albedo: Hemispheric</td>
<td>ABI</td>
<td>3</td>
</tr>
<tr>
<td>Surface Emissivity</td>
<td>ABI and NWP</td>
<td>3</td>
</tr>
<tr>
<td>Vegetation Fraction: Green: CONUS</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Vegetation Fraction: Green: Hemispheric</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Vegetation Index: CONUS</td>
<td>ABI</td>
<td>4</td>
</tr>
<tr>
<td>Vegetation Index: Hemispheric</td>
<td>ABI</td>
<td>4</td>
</tr>
</tbody>
</table>

(CCR 01212) (CCR 01543) (CCR 01867A)

#### 3.3.1.3 Ocean Products Primary Instrument Sources/Prioritization

The GOES-R Program Plan Ocean Products primary instrument sources and priorities are repeated here for reference.
### OCEAN

| Currents: Hemispheric                  | ABI | 4  |
| Currents: Mesoscale                  | ABI | 4  |
| Currents: Offshore/CONUS             | ABI | 4  |
| Currents: Offshore/Hemispheric       | ABI | 4  |
| Sea and Lake Ice: Age/Hemispheric   | ABI | 4  |
| Sea and Lake Ice: Concentration/CONUS| ABI | 4  |
| Sea and Lake Ice: Concentration/Hemispheric | ABI | 4  |
| Sea and Lake Ice: Motion/CONUS       | ABI | 4  |
| Sea and Lake Ice: Motion/Hemispheric | ABI | 4  |
| Sea Surface Temperature: CONUS/Offshore| ABI | 2  |
| Sea Surface Temperature (skin): Hemispheric | ABI | 2  |

(CCR 01212) (CCR 01543)

#### 3.3.1.4 Space Weather (Space and Solar) Products Primary Instrument Sources/Prioritization

The GOES-R Program Plan Space Weather Products primary instrument sources and priorities are repeated here for reference.

### ENERGETIC PARTICLES

| Energetic Heavy Ions                  | SEISS: EHIS | 2  |
| Magnetospheric Electrons and Protons: Low Energy | SEISS: MPS - Lo | 2  |
| Magnetospheric Electrons and Protons: Medium and High Energy | SEISS: MPS - Hi | 2  |
| Solar and Galactic Protons            | SEISS: SGPS  | 2  |

(CCR 01212) (CCR 01731)

### MAGNETIC FIELD

| Geomagnetic Field                    | Magnetometer | 2  |

### SOLAR

| Solar Flux: EUV                      | EXIS: EUVS   | 2  |
| Solar Flux: X-ray                    | EXIS: XRS    | 2  |
| Solar Imagery: X-Ray                | SUVI         | 2  |

(CCR 01212) (CCR 01731)

#### 3.3.1.5 Product System Requirements (CCR 02115)
The GOES-R System shall calibrate raw instrument samples to maintain product requirements. (CCR 02115) (CCR 02163) (CCR 02166)

The GOES-R System shall collect data during System operation for instrument calibration purposes. (CCR 02115)

The GOES-R System shall time tag product observations. (CCR 02115)

The GOES-R System shall have a commandable acquisition pattern for imagery products. (CCR 02115)

The GOES-R System shall use standard data products coordinate systems and formats to allow for integration with other appropriate NOAA data sources. (CCR 02115) (CCR 02163) (CCR 02166)

### 3.3.2 Product Parameter Definitions

#### 3.3.2.1 Product Geographic Coverage/Conditions

Product geographic coverage is defined as the size of the area that must be observed in the revisit time in order to complete the product; in the case of CONUS, it also specifies a particular area as well as location.

The GOES-R products are calculated for the coverage areas of the Level 1b data provided by the instrument subject to the qualifiers listed in each product table.

#### 3.3.2.2 Product Orthogonality/Coverage

Product Orthogonality/Coverage is defined for the Space and Solar Products only and is nominally the equivalent of the Product Geographic Coverage.

#### 3.3.2.3 Product Vertical Resolution

Product vertical resolution is defined as layering averaging of the resultant samples corresponding to different heights in the atmosphere; where only one vertical sample is collected, no layer averaging is needed.

The GOES-R System will produce the required vertical layering of the GOES-R products employing external data sources if needed.

Discussion: For typical imaging products, the vertical layering is typically over the total column.

#### 3.3.2.4 Product Horizontal Resolution

Product horizontal resolution is defined as the finest horizontal spatial element of the product measured at nadir.

The GOES-R System will not spatially degrade the product horizontal resolution beyond that of the Level 1b data of the earth-looking instruments when making Level 2+ products, except in the generation of GOES-R products with coarser horizontal resolution. (CCR 01186)

#### 3.3.2.5 Product Horizontal/Angular Resolution

Product Horizontal/Angular Resolution is defined for the Space and Solar Products only and is nominally the equivalent of the Product Horizontal Resolution.

#### 3.3.2.6 Product Mapping Accuracy (Product Geolocation)
Product geolocation or more generally product mapping accuracy is defined as the accuracy of the registration of the collected data to the appropriate earth or other reference frame.

The GOES-R System will geolocate the GOES-R series Level 1b data (which meets instrument image navigation and registration requirement for earth-looking instruments) to comply with the product mapping accuracy requirements.

Note: The product mapping accuracy requirements for Atmospheric, Land and Ocean products in sections 3.3.3, 3.3.4 and 3.3.5 are only applicable while the satellites are in their nominal operational orbit locations. The nominal orbit locations are defined as a box of +/- 0.1 degree about the operational longitude. (CCR 01721A)

3.3.2.7 Product Pointing/Mapping Accuracy

Product Pointing/Mapping Accuracy is defined for the Space and Solar Products only and is the equivalent of the Product Mapping Accuracy.

3.3.2.8 Product Pointing Knowledge/Mapping Uncertainty

Product Pointing Knowledge/Mapping Uncertainty is defined for the Space and Solar Products only as the knowledge of the line of sight of the space and solar instruments.

3.3.2.9 Product Measurement Range

Product Measurement Range is defined as the range from the minimum to the maximum values over which the product will be measured.

3.3.2.10 Product Measurement Accuracy

Product Measurement Accuracy is defined for non-categorical products as the systematic difference or bias between the derived parameter and ground truth. It is determined by computing the absolute value of the average of differences between the derived parameter and ground truth over a statistically significant population of data such that the magnitude of the random error is negligible relative to the magnitude of the systematic error.

Product Measurement Accuracy is defined for categorical products in terms of the percentage of correct classification over a statistically significant population of data.
(CCR 01422A)

3.3.2.11 Product Refresh Rate/Coverage Time

Product Refresh Rate/Coverage Time is defined as the time between the completion of the nth update of the product and the completion of the (n+1)th update of the same product.

The mission product will be refreshed by the GOES-R system, while meeting the mission product data latency, when new data from the product coverage region is available, with the following three exceptions:

a) Products that may be made at a NESDIS Infrastructure Interface site
b) Products from the land group
c) Products of the ocean subgroupings of currents and sea and lake ice

Discussion: The GOES-R baseline product tables list refresh times for products. However, ABI data may be produced more frequently than the listed times, particularly due to the different scan modes of ABI. Products that rely on surface observations with product refreshes that are long compared to the instrument image refresh times benefit from observations with no obstructions caused by clouds, although the full system impacts would have to be assessed.

For exceptions b) and c) above (which refresh at the product refresh values), the intervening observations available since the most recent product generation will be used to generate a composite of cloud-free pixels for the generation of that product, with pixels that are cloudy throughout the observation period employing the most recent cloudy pixel value for the product and pixels that are clear supplying the most recent clear pixel value for the product.
### 3.3.2.12 Mission Product Data Latency

Mission Product Data Latency is product dependent and is defined as the time from the collection of the last photons through the time that the data is converted to a specified GOES-R product (often beyond the level 1b) and delivered to the user portal.

### 3.3.2.13 Long-Term Stability

Product Long Term Stability is defined as the deviation in accuracy over a period of time, typically the lifetime of the mission, unless otherwise specified in the product long term stability values.

### 3.3.2.14 Product Measurement Precision

Product measurement precision for non-categorical products is the one-sigma standard deviation of the differences between the derived parameters and ground truth over the same population of data used to compute the product measurement accuracy. For products that are classified into three or more categories, the precision is defined as the standard deviation of the misclassification error (number of bins away from the correct bin) over a statistically significant population of data. For products that are classified into two categories, the precision measure is not applicable.

(CCR 01422A)

### 3.3.2.15 Temporal Coverage Qualifier

The Temporal Coverage Qualifier provides product-specific limitations to the solar zenith angle coverage of the products. When the term Day is used in the temporal qualifier, Day is defined as solar zenith angles less than or equal to 96 degrees. When the term Night is used in the temporal qualifier, Night is defined as solar zenith angles greater than 96 degrees and includes the period of twilight.

### 3.3.2.16 Product Extent Qualifier

The Product Extent Qualifier provides product specific limitations to the solar zenith angle coverage of the products over which a product can be computed. The use of the term quantitative in any of the product extent qualifiers defines the generation of the product while meeting the threshold product measurement accuracy performance in that region, whereas the use of qualitative in any of the product extent qualifiers defines the generation of the product without meeting the threshold product measurement accuracy performance requirements. For CONUS (3000 km x 5000 km) products and mesoscale (1000 km x 1000 km) products, the product will be computed within the CONUS-sized measurement area and the mesoscale-sized measurement area that falls within the product qualifier limitations.

### 3.3.2.17 Cloud Cover Conditions Qualifier

The Cloud Cover Conditions Qualifier provides product specific limitations to the cloud cover associated with the threshold accuracy.

### 3.3.2.18 Product Statistics Qualifier

The Product Statistics Qualifier provides product specific limitations, where applicable, to the product generation scene statistics under which the product measurement accuracies apply.

### 3.3.2.19 Product Parameter Verification Criteria (CCR 01764)

The product parameter requirements in section 3.3 of the MRD will be verified based via the following classes of criteria: Not To Exceed (NTE), No Less Than (NLT), No Less than Input Zones (NLTIZ), 1-sigma and 3-sigma (distribution statistics, at less than |μ±3σ| or |μ± σ|).

- Product Mapping Accuracy: 3σ
- Product Refresh Rate/Coverage Time: NTE
- Mission Product Data Latency: NTE
- Product Orthogonality/Coverage (Space and Solar Products): NLTIZ
- Product Horizontal/Angular Resolution (Space and Solar Products): NLT
MRD127

Product Pointing/Mapping Accuracy (Space and Solar Products): 3 σ
Product Pointing Knowledge/Mapping Uncertainty (Space and Solar Products): 3 σ
Long-Term Stability (Some Space and Solar Products): NTE

For all other product parameters, see the qualifiers and evaluation criteria defined in each individual product.

The product parameter requirements in section 3.3 of the MRD will reflect performance thresholds under nominal operational conditions, unless otherwise specified.

The geometric product parameter requirements in section 3.3 of the MRD will reflect performance thresholds, at Nadir, under nominal operational conditions, unless otherwise specified. (CCR 01764)

### 3.3.3 Atmospheric Products Tables (GOES-R Baseline)

#### 3.3.3.1 Aerosols

##### 3.3.3.1.1 Aerosol Detection: CONUS (including Smoke and Dust)

The GOES-R System shall produce an Aerosol Detection: CONUS (including Smoke and Dust) product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Detection (including Smoke and Dust) is a summary map that indicates the extent of smoke/aerosol coverage and a measure of smoke albedo indicates relative intensity. The detection is above a nominal level that can vary depending on conditions. For reference this product is used for verifying operational smoke forecasts and documenting trends in biomass burning and urban aerosols and to estimate the impact of biomass burning on human health, ecology, and climate.

(CCR 01211) (CCR 01543) (CCR 01482) (CCR 01542) (CCR 01631)

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions</th>
<th>CONUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution</td>
<td>Total column</td>
</tr>
<tr>
<td>Product Horizontal Resolution</td>
<td>2 km</td>
</tr>
<tr>
<td>Product Mapping Accuracy</td>
<td>1 km</td>
</tr>
<tr>
<td>Product Measurement Range</td>
<td>Binary yes/no detection above threshold 0.2 for aerosol optical thickness</td>
</tr>
<tr>
<td>Product Measurement Accuracy</td>
<td>Dust: 80% correct detection over land and ocean Smoke: 80% correct detection over land; 70% correct detection over ocean (CCR 02602 (RDW)) (CCR 02837 (RDW))</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time</td>
<td>15 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 2183(RDW))</td>
</tr>
<tr>
<td>Mission Product Data Latency</td>
<td>15 min</td>
</tr>
<tr>
<td>Product Measurement Precision</td>
<td>N/A</td>
</tr>
<tr>
<td>Temporal Coverage Qualifier</td>
<td>Day</td>
</tr>
<tr>
<td>Product Extent Qualifier</td>
<td>Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA</td>
</tr>
<tr>
<td>Cloud Cover Conditions Qualifier</td>
<td>Clear conditions associated with Threshold Accuracy</td>
</tr>
<tr>
<td>Product Statistics Qualifier</td>
<td>Over specified geographic coverage</td>
</tr>
</tbody>
</table>

#### 3.3.3.1.2 Aerosol Detection: Hemispheric (including Smoke and Dust)

The GOES-R System shall produce an Aerosol Detection: Hemispheric (including Smoke and Dust) product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Detection (including Smoke and Dust) is a summary map that indicates the extent of smoke/aerosol...
Aerosol Detection: Mesoscale (including Smoke and Dust)

The GOES-R System shall produce an Aerosol Detection: Mesoscale (including Smoke and Dust) product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Detection (including Smoke and Dust) is a summary map that indicates the extent of smoke/aerosol coverage and a measure of smoke albedo indicates relative intensity. The detection is above a nominal level that can vary depending on conditions. For reference this product is used for verifying operational smoke forecasts and documenting trends in biomass burning and urban aerosols and to estimate the impact of biomass burning on human health, ecology, and climate (same as CONUS product except this version provides mesoscale coverage).

Product Geographic Coverage/Conditions: Mesoscale
Product Vertical Resolution: Total column
Product Horizontal Resolution: 2 km
Product Mapping Accuracy: 1 km
Product Measurement Range: Binary yes/no detection above threshold 0.2 for aerosol optical thickness
Product Measurement Accuracy: Dust: 80% correct detection over land and ocean Smoke: 80% correct detection over land; 70% correct detection over ocean
Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)
Mission Product Data Latency: 3 min
Product Measurement Precision: N/A
Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.1.3 Aerosol Detection: Mesoscale (including Smoke and Dust)

The GOES-R System shall produce an Aerosol Detection: Mesoscale (including Smoke and Dust) product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Detection (including Smoke and Dust) is a summary map that indicates the extent of smoke/aerosol coverage and a measure of smoke albedo indicates relative intensity. The detection is above a nominal level that can vary depending on conditions. For reference this product is used for verifying operational smoke forecasts and documenting trends in biomass burning and urban aerosols and to estimate the impact of biomass burning on human health, ecology, and climate (same as CONUS product except this version provides mesoscale coverage).

Product Geographic Coverage/Conditions: Mesoscale
Product Vertical Resolution: Total column
Product Horizontal Resolution: 2 km
Product Mapping Accuracy: 1 km
Product Measurement Range: Binary yes/no detection above threshold 0.2 for aerosol optical thickness
Product Measurement Accuracy: Dust: 80% correct detection over land and ocean Smoke: 80% correct detection over land; 70% correct detection over ocean

(CCR 01211) (CCR 01543) (CCR 01482) (CCR 01542) (CCR 01631)
3.3.3.1.4 Aerosol Particle Size

The GOES-R System shall produce an Aerosol Particle Size product in accordance with the requirements and qualifiers provided in the product table below.

The Aerosol Particle Size provides a measure of the bimodal size distribution of the aerosol population in terms of the effective radius $r_e$ and effective variance $v_e$ of each mode. The effective radius is the ratio of the third moment of the aerosol size distribution to the second moment. The effective variance characterizes the width of the size distribution. The aerosol particle size is determined in regions where aerosols have been detected above a nominal level that can vary depending on conditions.

(Product Table)

3.3.3.1.5 Aerosol Optical Depth: CONUS (CCR 01543)
The GOES-R System shall produce an Aerosol Optical Depth: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Depth is a measure of the fine solids suspended in the air including dust, sand, volcanic ash, smoke, and urban/industrial aerosols. Aerosol Optical Depth characterization will consist of elements of aerosol optical depth and fine particulate matter. The fine particulate matter will be derived from the aerosol optical depth translated to mass concentration in the observed vertical path (microgram per cubic meter), where translation to concentration depends on particle type and vertical location of the aerosols and determined in regions where aerosols have been detected above a nominal level that can vary depending on conditions.

Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: Total column

Product Horizontal Resolution: 2 km

Product Mapping Accuracy: 1 km

Product Measurement Range: -1 - 5 in optical depth

Product Measurement Accuracy: Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.06 0.04 - 0.80: 0.04 > 0.80: 0.12 Over water: < 0.40: 0.02 > 0.40: 0.10

Product Refresh Rate/Coverage Time: 5 min

Mission Product Data Latency: 1 min (CCR 01899) (CCR 02183 (RDW))

Product Measurement Precision: Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.13 0.04 - 0.80: 0.25 > 0.80: 0.35 Over water: < 0.40: 0.15 > 0.40: 0.23

Temporal Coverage Qualifier: Daytime at a minimum

Product Extent Qualifier: Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA

Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy

Product Statistics Qualifier: Over specified geographic coverage

3.3.3.1.6 Aerosol Optical Depth: Hemispheric (CCR 01543)

The GOES-R System shall produce a Aerosol Optical Depth: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Aerosol Optical Depth is a measure of the fine solids suspended in the air including dust, sand, volcanic ash, smoke, and urban/industrial aerosols. Aerosol Optical Depth characterization will consist of elements of aerosol optical depth and fine particulate matter. The fine particulate matter will be derived from the aerosol optical depth translated to mass concentration in the observed vertical path (microgram per cubic meter), where translation to concentration depends on particle type and vertical location of the aerosols and determined in regions where aerosols have been detected above a nominal level that can vary depending on conditions (same as CONUS product except this version provides larger coverage).

Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: Total column

Product Horizontal Resolution: 2 km

Product Mapping Accuracy: 1 km
MRD880  **Product Measurement Range:** -1 - 5 in optical depth

MRD881  **Product Measurement Accuracy:** Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.06 0.04 - 0.80: 0.04 > 0.80: 0.12 Over water: < 0.40: 0.02 > 0.40: 0.10

MRD882  **Product Refresh Rate/Coverage Time:** 15 min (5 min when 5 minute Full Disk data available)  
*(CCR 01899) (CCR 02183 (RDW))*

MRD883  **Mission Product Data Latency:** 3 min *(CCR 01899) (CCR 02183 (RDW))*

MRD884  **Product Measurement Precision:** Based on Aerosol Optical Depth ranges: Over land: < 0.04: 0.13 0.04 - 0.80: 0.25 > 0.80: 0.35 Over water: < 0.40: 0.15 > 0.40: 0.23

**Temporal Coverage Qualifier:** Daytime at a minimum  
**Product Extent Qualifier:** Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA  
**Cloud Cover Conditions Qualifier:** Clear conditions down to feature of interest associated with threshold accuracy  
**Product Statistics Qualifier:** Over specified geographic coverage

### 3.3.3.1.7 Volcanic Ash: Detection and Height

MRD143  The GOES-R System **shall** produce a Volcanic Ash: Detection and Height product in accordance with the requirements and qualifiers provided in the product table below.

Volcanic ash detection and height maps the location and concentration of volcanic ash after an eruption and dispersion by the wind. The top height of the ash is detected at a minimum in regions where aerosols have been detected above a nominal level that can vary depending on conditions.

*(CCR 01213) (CCR 01214) (CCR 01211) (CCR 01438) (CCR 01542) (CCR 01631)*

MRD886  **Product Geographic Coverage/Conditions:** Full Disk

MRD887  **Product Vertical Resolution:** 3 km (top height)

MRD888  **Product Horizontal Resolution:** 2 km

MRD889  **Product Mapping Accuracy:** 1 km

MRD890  **Product Measurement Range:** 0-50 tons/km^2

MRD891  **Product Measurement Accuracy:** 2 ton/km^2

MRD892  **Product Refresh Rate/Coverage Time:** 15 min (5 min when 5 minute Full Disk data available)  
*(CCR 01899)(CCR 02183 (RDW))*

MRD893  **Mission Product Data Latency:** 1 min *(CCR 01728) (CCR 01728) (CCR 01899) (CCR 02183 (RDW))*

MRD894  **Product Measurement Precision:** 2.5 tons/km^2 *(CCR 01728)*

**Temporal Coverage Qualifier:** Day and night  
**Product Extent Qualifier:** Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA  
**Cloud Cover Conditions Qualifier:** Clear conditions down to feature of interest associated with threshold accuracy  
**Product Statistics Qualifier:** Over volcanic ash cases

### 3.3.3.2 Clouds

#### 3.3.3.2.1 Aircraft Icing Threat

MRD146  The GOES-R System **shall** produce an Aircraft Icing Threat product in accordance with the requirements and qualifiers provided in the product table below.
Aircraft icing threat product maps the location of supercooled water clouds, which can lead to in-flight aircraft icing, and the severity of icing based on the highest cloud layer, which is the layer observed. The cloud top height is provided in regions where icing is likely.

\[(CCR 01211)\) \((CCR 01543)\) \((CCR 01438)\) \((CCR 01542)\) \((CCR 01631)\) \((CCR 02183 (RDW))\)

**MRD896**  
*Product Geographic Coverage/Conditions:* Full Disk \((CCR 02183 (RDW))\)

**MRD897**  
*Product Vertical Resolution:* Cloud Top \((CCR 02183 (RDW))\)

**MRD898**  
*Product Horizontal Resolution:* 2 km \((CCR 02183 (RDW))\)

**MRD899**  
*Product Mapping Accuracy:* 5 km \((CCR 02183 (RDW))\)

**MRD900**  
*Product Measurement Range:* Day: Unknown, None, Light, Moderate or Greater (MOG); Night: Unknown, None, Possible Icing \((CCR 02183 (RDW))\)

**MRD901**  
*Product Measurement Accuracy:* 50% correct classification \((CCR 02183 (RDW))\)

**MRD902**  
*Product Refresh Rate/Coverage Time:* 60 min (5 min when 5 minute Full Disk data available) \((CCR 01899)\) \((CCR 02183 (RDW))\)

**MRD903**  
*Mission Product Data Latency:* 15 min \((CCR 02183 (RDW))\)

**MRD904**  
*Product Measurement Precision:* 1 category \((CCR 02183 (RDW))\)

**Temporal Coverage Qualifier:** Day and night  
**Product Extent Qualifier:** Quantitative out to at least 60 degrees LZA (Threshold) and Qualitative at Larger LZA  
**Cloud Cover Conditions Qualifier:** Clear conditions associated with threshold accuracy  
**Product Statistics Qualifier:** Over specified geographic coverage \((CCR 02183 (RDW))\)

### 3.3.3.2.2 Cloud Ice Water Path: CONUS

The GOES-R System **shall** produce a Cloud Ice Water Path: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Ice Water Path reports the total equivalent water content of ice particles integrated in a vertical column through the atmosphere. The measured information is dependent on the number of particles, their sizes, and their densities.

\[(CCR 01211)\) \((CCR 01543)\) \((CCR 01466)\) \((CCR 01542)\) \((CCR 01631)\) \((CCR 02183 (RDW))\)

**MRD906**  
*Product Geographic Coverage/Conditions:* CONUS/for limited cloudiness \((CCR 02183 (RDW))\)

**MRD907**  
*Product Vertical Resolution:* SFC - 20 km \((CCR 02183 (RDW))\)

**MRD908**  
*Product Horizontal Resolution:* 2 km \((CCR 02183 (RDW))\)

**MRD909**  
*Product Mapping Accuracy:* 1 km \((CCR 02183 (RDW))\)

**MRD910**  
*Product Measurement Range:* 25 - 1500 g/m\(^2\) (Day), and 25 - 175 g/m\(^2\) (Night) \((CCR 01892)\) \((CCR 02183 (RDW))\)

**MRD911**  
*Product Measurement Accuracy:* 40% (Day), and Greater of 25g/m\(^2\) or 30% (Night) \((CCR 01892)(CCR 02183 (RDW))\)

**MRD912**  
*Product Refresh Rate/Coverage Time:* 5 min \((CCR 02183 (RDW))\)

**MRD913**  
*Mission Product Data Latency:* 1 min \((CCR 02183 (RDW))\)
3.3.3.2.3 Cloud Ice Water Path: Hemispheric

MRD150 The GOES-R System shall produce a Cloud Ice Water Path: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Ice Water Path reports the total equivalent water content of ice particles integrated in a vertical column through the atmosphere. The measured information is dependent on the number of particles, their sizes, and their densities (same as CONUS product except this version provides larger coverage).

(Product Geographic Coverage/Conditions: Full Disk/for limited cloudiness (CCR 02183 (RDW))

MRD916 Product Geographic Coverage/Conditions: Full Disk/for limited cloudiness (CCR 02183 (RDW))

MRD917 Product Vertical Resolution: SFC - 20 km (CCR 02183 (RDW))

MRD918 Product Horizontal Resolution: 2 km (CCR 02183 (RDW))

MRD919 Product Mapping Accuracy: 1 km (CCR 02183 (RDW))

MRD920 Product Measurement Range: 25 - 1500 g/m² (Day), and 25 - 175 g/m² (Night) (CCR 01892) (CCR 02183 (RDW))

MRD921 Product Measurement Accuracy: 40% (Day), and Greater of 25 g/m² or 30% (Night) (CCR 01892) (CCR 02183 (RDW))

MRD922 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))

MRD923 Mission Product Data Latency: 3 min (CCR 02183 (RDW))

MRD924 Product Measurement Precision: Greater of 100 g/ m² or 40% (Day), and Greater of 25 g/m² or 40% (Night) (CCR 01892) (CCR 02183 (RDW))

Temporal Coverage Qualifier: Day with SZA of less than 65 degrees, and Night with SZA of greater than 96 degrees

Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA

Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depths < 1.0 and > 50 (Day), and In presence of limited clouds with optical depth > 1 and < 5 (Night)

Product Statistics Qualifier: Over specified geographic coverage (CCR 01892) (CCR 02183 (RDW))

3.3.3.2.4 Cloud Ice Water Path: Mesoscale
The GOES-R System **shall** produce a Cloud Ice Water Path: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Ice Water Path reports the total equivalent water content of ice particles integrated in a vertical column through the atmosphere. The measured information is dependent on the number of particles, their sizes, and their densities (same as CONUS product except this version provides mesoscale coverage).

\[(CCR\ 01211)\ (CCR\ 01543)\ (CCR\ 01466)\ (CCR\ 01542)\ (CCR\ 01631)\ (CCR\ 02183\ (RDW))\]

**Product Geographic Coverage/Conditions:** Mesoscale/for limited cloudiness *(CCR 02183 (RDW))*

**Product Vertical Resolution:** SFC - 20 km *(CCR 02183 (RDW))*

**Product Horizontal Resolution:** 2 km *(CCR 02183 (RDW))*

**Product Mapping Accuracy:** 1 km

**Product Measurement Range:** 25 - 1500 g/m² (Day), and 25 - 175 g/m² (Night) *(CCR 01892)(CCR 02183 (RDW))*

**Product Measurement Accuracy:** 40% (Day), and Greater of 25 g/m² or 30% (Night) *(CCR 01892) (CCR 02183 (RDW))*

**Product Refresh Rate/Coverage Time:** 5 min *(CCR 02183 (RDW))*

**Mission Product Data Latency:** 1 min *(CCR 02183 (RDW))*

**Product Measurement Precision:** Greater of 100 g/ m² or 40% (Day), and Greater of 25 g/m² or 40% (Night) *(CCR 01892) (CCR 02183 (RDW))*

**Temporal Coverage Qualifier:** Day with SZA of less than 65 degrees, and Night with SZA of greater than 96 degrees

**Product Extent Qualifier:** Quantitative out to at least 65 degrees LZA (Threshold) and Qualitative at Larger LZA

**Cloud Cover Conditions Qualifier:** In presence of limited clouds with optical depths > 1.0 and <50 (Day), and In presence of limited clouds with optical depth >1 and < 5 (Night)

**Product Statistics Qualifier:** Over specified geographic coverage *(CCR 01892) (CCR 02183 (RDW))*

### 3.3.3.2.5 Cloud Layers/Heights: CONUS *(CCR 01543)*

The GOES-R System **shall** produce a Cloud Layers/Heights: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Layers/Heights reports the fractional amount of the cloud coverage detected over a horizontal region that occurs within the high, middle and low layers. The high layer shall be defined for regions of the atmosphere with pressures less than 440 hPa. The low layer is defined for regions with pressures greater than 680 hPa and the middle layer resides between 440 and 680 hPa.

\[(CCR\ 01211)\ (CCR\ 01543)\ (CCR\ 01466)\ (CCR\ 01542)\ (CCR\ 01631)\ (CCR\ 02183\ (RDW))\]

**Product Geographic Coverage/Conditions:** CONUS *(CCR 02183 (RDW))*

**Product Vertical Resolution:** 1 cloud layer *(CCR 02183 (RDW))*

**Product Horizontal Resolution:** 10 km *(CCR 02183 (RDW))*

**Product Mapping Accuracy:** 5 km *(CCR 02183 (RDW))*

**Product Measurement Range:** Low, Mid, High *(CCR 02183 (RDW))*

**Product Measurement Accuracy:** 80% correct classification *(CCR 02183 (RDW))*
MRD942  Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available)
(CCR 01899) (CCR 02183 (RDW))

MRD943  Mission Product Data Latency: 15 min (CCR 02183 (RDW))

MRD944  Product Measurement Precision: Not applicable (CCR 01892) (CCR 02183 (RDW))

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depth > 1. Clear conditions down to
cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW))

3.3.3.2.6 Cloud Layers/Heights: Hemispheric (CCR 01543)

MRD158  The GOES-R System shall produce a Cloud Layers/Heights: Hemispheric product in accordance with the
requirements and qualifiers provided in the product table below.

Cloud Layers/Heights reports the fractional amount of the cloud coverage detected over a horizontal region that
occurs within the high, middle and low layers. The high layer shall be defined for regions of the atmosphere with
pressures less than 440 hPa. The low layer is defined for regions with pressures greater than 680 hPa and the middle
layer resides between 440 and 680 hPa (same as CONUS product except this version provides larger coverage).
(CCR 01211) (CCR 01543) (CCR 01466) (CCR 01542) (CCR 01631) (CCR 02183 (RDW))

MRD946  Product Geographic Coverage/Conditions: Full Disk (CCR 02183 (RDW))

MRD947  Product Vertical Resolution: 1 cloud layer (CCR 02183 (RDW))

MRD948  Product Horizontal Resolution: 10 km (CCR 02183 (RDW))

MRD949  Product Mapping Accuracy: 5 km (CCR 02183 (RDW))

MRD950  Product Measurement Range: Low, Mid, High (CCR 02183 (RDW))

MRD951  Product Measurement Accuracy: 80% correct classification (CCR 02183 (RDW))

MRD952  Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available)
(CCR 01899) (CCR 02183 (RDW))

MRD953  Mission Product Data Latency: 15 min (CCR 02183 (RDW))

MRD954  Product Measurement Precision: Not applicable (CCR 01892) (CCR 02183 (RDW))

Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depth > 1. Clear conditions down to
cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW))

3.3.3.2.7 Cloud Layers/Heights: Mesoscale (CCR 01543)
The GOES-R System **shall** produce a Cloud Layers/Heights: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Layers/Heights reports the fractional amount of the cloud coverage detected over a horizontal region that occurs within the high, middle and low layers. The high layer shall be defined for regions of the atmosphere with pressures less than 440 hPa. The low layer is defined for regions with pressures greater than 680 hPa and the middle layer resides between 440 and 680 hPa (same as CONUS product except this version provides mesoscale coverage).

(Product Geographic Coverage/Conditions: Mesoscale (CCR 02183 (RDW)))

(Product Vertical Resolution: 1 cloud layer (CCR 02183 (RDW)))

(Product Horizontal Resolution: 4 km (CCR 02183 (RDW)))

(Product Mapping Accuracy: 2 km (CCR 02183 (RDW)))

(Product Measurement Range: Low, Mid, High (CCR 02183 (RDW)))

(Product Measurement Accuracy: 80% correct classification (CCR 02183 (RDW)))

(Product Refresh Rate/Coverage Time: 5 min (CCR 02183 (RDW)))

(Mission Product Data Latency: 5 min (CCR 02183 (RDW)))

(Product Measurement Precision: Not applicable (CCR 01892) (CCR 02183 (RDW)))

(Temporal Coverage Qualifier: Day and night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and Qualitative at Larger LZA
Cloud Cover Conditions Qualifier: In presence of limited clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW)))

3.3.3.2.8 Cloud Liquid Water: CONUS

The GOES-R System **shall** produce a Cloud Liquid Water: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Liquid Water reports the total equivalent amount of water in a vertical column of air.

(Product Geographic Coverage/Conditions: CONUS (CCR 02183 (RDW)))

(Product Vertical Resolution: Total Column (CCR 02183 (RDW)))

(Product Horizontal Resolution: 2 km (CCR 02183 (RDW)))

(Product Mapping Accuracy: 1 km (CCR 02183 (RDW)))

(Product Measurement Range: 25 - 1000 g/m² (Day), and 25 - 100 g/m² (Night) (CCR 01892) (CCR 02183 (RDW)))

(Product Measurement Accuracy: Greater of 50 g/m² or 30% (Day), and Greater of 25 g/m² or 15% (Night) (CCR 01892) (CCR 02183 (RDW)))

(Product Refresh Rate/Coverage Time: 5 min (CCR 02183 (RDW)))
3.3.3.2.9 Cloud Liquid Water: Hemispheric

The GOES-R System shall produce a Cloud Liquid Water: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Liquid Water reports the total equivalent amount of water in a vertical column of air (same as CONUS product except this version provides larger coverage).

(Product Geographic Coverage/Conditions: Full Disk) (Product Vertical Resolution: Total Column) (Product Horizontal Resolution: 2 km) (Product Mapping Accuracy: 1 km) (Product Measurement Range: 25 - 1000 g/m² (Day), and 25 - 100 g/m² (Night)) (Product Measurement Accuracy: Greater of 50 g/m² or 30% (Day), and Greater of 25 g/m² or 15% (Night)) (Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available))

3.3.3.2.10 Cloud Liquid Water: Mesoscale
The GOES-R System shall produce a Cloud Liquid Water: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Liquid Water reports the total equivalent amount of water in a vertical column of air (same as CONUS product except this version provides mesoscale coverage).

(Product Table)

3.3.3.2.11 Cloud and Moisture Imagery: CONUS

The GOES-R System shall produce a Cloud and Moisture Imagery: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud and Moisture Imagery reports digital maps of clouds, moisture, and atmospheric windows through which land and water are observed, by reporting radiance measurements converted first to brightness temperature and then digital counts from 0-255 from all of the bands sensing clouds and moisture from an imaging instrument. Infrared imagery bands are often chosen along spectral absorption features including those of water vapor bands or CO2 and in regions with no absorption that permit observations of the surface. Visible bands are also chosen to sense the surface and the low lying cloud and fog interfering with observations of the surface. Low light imagery in the visible band is also included. Cloud and moisture imagery provides input to other algorithms producing other environmental products.

(Product Table)
3.3.3.2.12 Cloud and Moisture Imagery: Hemispheric

The GOES-R System shall produce a Cloud and Moisture Imagery: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud and Moisture Imagery reports digital maps of clouds, moisture, and atmospheric windows through which land and water are observed, by reporting radiance measurements converted first to brightness temperature and then to digital counts from 0-255 from all of the bands sensing clouds and moisture from an imaging instrument. Infrared imagery bands are often chosen either along spectral absorption features including those of water vapor bands or CO$_2$ and in regions with no absorption that permit observations of the surface. Visible bands are also chosen to sense the surface and the low-lying cloud and fog interfering with observations of the surface. Low light imagery in the visible band is also included. Cloud and moisture imagery provides input to other algorithms producing other environmental products (same as CONUS product except this version provides larger coverage).

(Product Measurement Range: N/A
Product Measurement Accuracy: N/A
MRD1002 Product Refresh Rate/Coverage Time: 5 min
MRD1003 Mission Product Data Latency: 1 min
Product Measurement Precision: N/A
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: N/A
Cloud Cover Conditions Qualifier: In presence of clear air and clouds
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.13 Cloud and Moisture Imagery: Mesoscale

The GOES-R System shall produce a Cloud and Moisture Imagery: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.
Cloud and Moisture Imagery reports digital maps of clouds, moisture, and atmospheric windows through which land and water are observed, by reporting radiance measurements converted first to brightness temperature and then digital counts from 0-255 from all of the bands sensing clouds and moisture from an imaging instrument. Infrared imagery bands are often chosen either along spectral absorption features including those of water vapor bands or CO$_2$ and in regions with no absorption that permit observations of the surface. Visible bands are also chosen to sense the surface and the low-lying cloud and fog interfering with observations of the surface. Low light imagery in the visible band is also included. Cloud and moisture imagery provides input to other algorithms producing other environmental products (same as CONUS product except this version provides mesoscale coverage).

(CC 01211) (CCR 01542) (CCR 01611) (CCR 01631)

<table>
<thead>
<tr>
<th>MRD1016</th>
<th>Product Geographic Coverage/Conditions: Mesoscale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Product Vertical Resolution: N/A</td>
</tr>
<tr>
<td>MRD1018</td>
<td>Product Horizontal Resolution: 2 km, with finer daytime observations</td>
</tr>
<tr>
<td>MRD1019</td>
<td>Product Mapping Accuracy: 1 km</td>
</tr>
<tr>
<td></td>
<td>Product Measurement Range: N/A</td>
</tr>
<tr>
<td></td>
<td>Product Measurement Accuracy: N/A</td>
</tr>
<tr>
<td>MRD1022</td>
<td>Product Refresh Rate/Coverage Time: 30 sec</td>
</tr>
<tr>
<td>MRD1023</td>
<td>Mission Product Data Latency: 30 sec</td>
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<tr>
<td></td>
<td>Product Measurement Precision: N/A</td>
</tr>
<tr>
<td></td>
<td>Temporal Coverage Qualifier: Day and Night</td>
</tr>
<tr>
<td></td>
<td>Product Extent Qualifier: N/A</td>
</tr>
<tr>
<td></td>
<td>Cloud Cover Conditions Qualifier: In presence of clear air and clouds</td>
</tr>
<tr>
<td></td>
<td>Product Statistics Qualifier: Over specified geographic coverage</td>
</tr>
</tbody>
</table>

3.3.3.2.14 Cloud Optical Depth: CONUS

The GOES-R System shall produce a Cloud Optical Depth: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Optical Depth is a measure of the extinction along the vertical column of air due to scattering and absorption in the path associated with water vapor, ice particles, and the associated particle size.

(CC 01214) (CCR 01211) (CCR 01543) (CCR 01466) (CCR 01542) (CCR 01631)

<table>
<thead>
<tr>
<th>MRD1026</th>
<th>Product Geographic Coverage/Conditions: CONUS/optical depth &gt; 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRD1027</td>
<td>Product Vertical Resolution: Total Column</td>
</tr>
<tr>
<td>MRD1028</td>
<td>Product Horizontal Resolution: 2 km</td>
</tr>
<tr>
<td>MRD1029</td>
<td>Product Mapping Accuracy: 1 km (CCR 03195(RDW))</td>
</tr>
<tr>
<td>MRD1030</td>
<td>Product Measurement Range: 1 - 50 (Day), and 1 - 5 (Night) (CCR 01892)</td>
</tr>
<tr>
<td>MRD1031</td>
<td>Product Measurement Accuracy: Liquid phase: Maximum of 2 or 20% (Day), and 30% (Night). Ice phase: Maximum of 3 or 30% (Day), and 30% (Night) (CCR 01892)</td>
</tr>
<tr>
<td>MRD1032</td>
<td>Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))</td>
</tr>
</tbody>
</table>
MRD1033  Mission Product Data Latency: 15 min

MRD1034  Product Measurement Precision: Liquid Phase: Maximum of 0.5 or 20% (Day), and Maximum of 0.8 or 30% (Night).
          Ice Phase: Maximum of 0.8 or 30% (Day), and
          Maximum of 0.8 or 30% (Night) (CCR 01977) (CCR 01892)

          Temporal Coverage Qualifier: Day with SZA of less than 65 degrees, and
          Night with SZA of greater than 96 degrees
          Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
          Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1
          Product Statistics Qualifier: Over specified geographic coverage
          (CCR 01892)

3.3.3.2.15 Cloud Optical Depth: Hemispheric

MRD176  The GOES-R System shall produce a Cloud Optical Depth: Hemispheric product in accordance with the
          requirements and qualifiers provided in the product table below.

          Cloud Optical Depth is a measure of the extinction along the vertical column of air due to scattering and absorption
          in the path associated with water vapor, ice particles, and the associated particle size (same as CONUS product
          except this version provides larger coverage).
          (CCR 01213) (CCR 01214) (CCR 01211) (CCR 01543) (CCR 01466) (CCR 01542) (CCR 01631)

MRD1036  Product Geographic Coverage/Conditions: Full disk/optical depth > 1

MRD1037  Product Vertical Resolution: Total Column

MRD1038  Product Horizontal Resolution: 4 km

MRD1039  Product Mapping Accuracy: 2 km (CCR 03195(RDW))

MRD1040  Product Measurement Range: 1 - 50 (Day), and 1 - 5 (Night) (CCR 01892)

MRD1041  Product Measurement Accuracy: Liquid phase: Maximum of 2 or 20% (Day), and 30% (Night).
          Ice phase: Maximum of 3 or 30% (Day), and 30% (Night) (CCR 01892)

MRD1042  Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)
          (CCR 01899) (CCR 02183 (RDW))

MRD1043  Mission Product Data Latency: 3 min (CCR 01899) (CCR 02183 (RDW))

MRD1044  Product Measurement Precision: Liquid Phase: Maximum of 0.5 or 20% (Day), and Maximum of 0.8 or 30% (Night).
          Ice Phase: Maximum of 0.8 or 30% (Day), and Maximum of 0.8 or 30% (Night) (CCR 01977) (CCR 01892)

          Temporal Coverage Qualifier: Day with SZA of less than 65 degrees, and Night with SZA of greater than 96 degrees
          Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
          Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1
          Product Statistics Qualifier: Over specified geographic coverage
          (CCR 01892)

3.3.3.2.16 Cloud Particle Size Distribution: CONUS

MRD178  The GOES-R System shall produce a Cloud Particle Size Distribution: CONUS product in accordance with the
          requirements and qualifiers provided in the product table below.
Cloud particle size distribution reports the width or effective variance \( \sigma_e \) of a single mode particle size distribution having effective radius \( r_e \). By definition, the effective radius is the ratio of the third moment of the size distribution to the second moment; however the higher moments cannot effectively be measured with GOES-R. Thus, the cloud particle size is determined from the radiance measurements and depends on a threshold cloud optical depth varying with conditions.

\[(CCR\ 01213)\ (CCR\ 01211)\ (CCR\ 01466)\ (CCR\ 01542)\ (CCR\ 01631)\]

**MRD1046**  
**Product Geographic Coverage/Conditions:** CONUS

**MRD1047**  
**Product Vertical Resolution:** Cloud Top

**MRD1048**  
**Product Horizontal Resolution:** 2 km

**MRD1049**  
**Product Mapping Accuracy:** 1 km

**MRD1050**  
**Product Measurement Range:** 2 - 32 \( \mu m \) for liquid phase; 2 - 50 \( \mu m \) for ice phase

**MRD1051**  
**Product Measurement Accuracy:**  
- Liquid phase: 4 \( \mu m \) (Day), and Maximum of 4 \( \mu m \) or 30% (Night).
- Ice Phase: 10 \( \mu m \) (Day), and 10 \( \mu m \) (Night) \((CCR\ 01892)\)

**MRD1052**  
**Product Refresh Rate/Coverage Time:** 5 min

**MRD1053**  
**Mission Product Data Latency:** 1 min \((CCR\ 01899)\ (CCR\ 02183\ (RDW))\)

**MRD1054**  
**Product Measurement Precision:**  
- Liquid Phase: 2 \( \mu m \) (Day), and Maximum of 4 \( \mu m \) or 25% (Night).
- Ice Phase: 4 \( \mu m \) (Day), and Maximum of 10 \( \mu m \) or 25% (Night). \((CCR\ 01977)\ (CCR\ 01892)\)

**Temporal Coverage Qualifier:** Day with SZA of less than 65 degrees, and Night with SZA of greater than 96 degrees

**Product Extent Qualifier:** Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA

**Cloud Cover Conditions Qualifier:** In presence of clouds with optical depth > 1 and < 50 (Day), and In presence of clouds with optical depth >1 and < 5 (Night)

**Product Statistics Qualifier:** Over specified geographic coverage \((CCR\ 01892)\)

### 3.3.3.2.17 Cloud Particle Size Distribution: Hemispheric

**MRD180**  
**The GOES-R System shall** produce a Cloud Particle Size Distribution: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud particle size distribution reports the width or effective variance \( \sigma_e \) of a single mode particle size distribution having effective radius \( r_e \). By definition, the effective radius is the ratio of the third moment of the size distribution to the second moment; however the higher moments cannot effectively be measured with GOES-R. Thus, the cloud particle size is determined from the radiance measurements and depends on a threshold cloud optical depth varying with conditions (same as CONUS product except this version provides larger coverage).

\[(CCR\ 01211)\ (CCR\ 01295)\ (CCR\ 01466)\ (CCR\ 01542)\ (CCR\ 01631)\]

**MRD1056**  
**Product Geographic Coverage/Conditions:** Full Disk

**MRD1057**  
**Product Vertical Resolution:** Cloud Top

**MRD1058**  
**Product Horizontal Resolution:** 2 km

**MRD1059**  
**Product Mapping Accuracy:** 1 km

**MRD1060**  
**Product Measurement Range:** 2 - 32 \( \mu m \) for liquid phase; 2 - 50 \( \mu m \) for ice phase
Product Measurement Accuracy: Liquid Phase: 4 µm (Day), and Maximum of 4 µm or 30% (Night). 
Ice Phase: 10 µm (Day), and 10 µm (Night) (CCR 01892)

Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) 
(CCR 01899) (CCR 02183 (RDW))

Mission Product Data Latency: 15 min (5 min when 5 minute Full Disk data available) 
(CCR 01899) (CCR 02183 (RDW))

Product Measurement Precision: Liquid Phase: 2 µm (Day), and 
Maximum of 4 µm or 25% (Night). 
Ice Phase: 4 µm (Day), and Maximum of 10 µm or 25% (Night). 
(CCR 01977) (CCR 01892)

Temporal Coverage Qualifier: Day with SZA of less than 65 degrees, and Night with SZA of greater than 96 
degrees
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA 
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1 and < 50 (Day), and 
In presence of clouds with optical depth >1 and < 5 (Night)
Product Statistics Qualifier: Over specified geographic coverage 
(CCR 01892)

3.3.3.2.18 Cloud Particle Size Distribution: Mesoscale

The GOES-R System shall produce a Cloud Particle Size Distribution: Mesoscale product in accordance with the 
requirements and qualifiers provided in the product table below.

Cloud particle size distribution reports the width or effective variance $\sigma_e$ of a single mode particle size distribution 
having effective radius $r_e$. By definition, the effective radius is the ratio of the third moment of the size distribution 
to the second moment; however the higher moments cannot effectively be measured with GOES-R. Thus, the cloud 
particle size is determined from the radiance measurements and depends on a threshold cloud optical depth varying 
with conditions (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211) (CCR 01295) (CCR 01466) (CCR 01542) (CCR 01631)

Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: Cloud Top

Product Horizontal Resolution: 2 km

Product Mapping Accuracy: 1 km

Product Measurement Range: 2 - 32 µm for liquid phase; 2 - 50 µm for ice phase

Product Measurement Accuracy: Liquid Phase: 4 µm (Day), and Maximum of 4 µm or 30% (Night). 
Ice Phase: 10 µm (Day), and 10 µm (Night) (CCR 01892)

Product Refresh Rate/Coverage Time: 5 min

Mission Product Data Latency: 5 min

Product Measurement Precision: Liquid Phase: 2 µm (Day), and Maximum of 4 µm or 25% (Night). 
Ice Phase: 4 µm (Day), and Maximum of 10 µm or 25% (Night) (CCR 01977) (CCR 01892)
Temporal Coverage Qualifier: Day with SZA of less than 65 degrees, and Night with SZA of greater than 96 degrees
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1 and < 50 (Day), and
In presence of clouds with optical depth > 1 and < 5 (Night)
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.19 Cloud Top Phase: CONUS

MRD184 The GOES-R System **shall** produce a Cloud Top Phase: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Phase reports the state of aggregation of a cloud, namely liquid, supercooled, mixed, or solid, for each detectable layer.

(CCR 01213) (CCR 01211) (CCR 01543) (CCR 01466) (CCR 01542) (CCR 01631)

<table>
<thead>
<tr>
<th>MRD1076</th>
<th>Product Geographic Coverage/Conditions: CONUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRD1077</td>
<td>Product Vertical Resolution: Cloud Top</td>
</tr>
<tr>
<td>MRD1078</td>
<td>Product Horizontal Resolution: 2 km</td>
</tr>
<tr>
<td>MRD1079</td>
<td>Product Mapping Accuracy: 1 km</td>
</tr>
<tr>
<td>MRD1080</td>
<td>Product Measurement Range: Liquid/Solid/Supercooled/Mixed</td>
</tr>
<tr>
<td>MRD1081</td>
<td>Product Measurement Accuracy: 80% correct classification</td>
</tr>
<tr>
<td>MRD1082</td>
<td>Product Refresh Rate/Coverage Time: 5 min</td>
</tr>
<tr>
<td>MRD1083</td>
<td>Mission Product Data Latency: 1 min (CCR 01899) (CCR 02183 (RDW))</td>
</tr>
</tbody>
</table>

        | Product Measurement Precision: Not applicable (CCR 01892) |

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

(CCR 01892)

3.3.3.2.20 Cloud Top Phase: Hemispheric

MRD186 The GOES-R System **shall** produce a Cloud Top Phase: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Phase reports the state of aggregation of a cloud, namely liquid, supercooled, mixed, or solid, for each detectable layer (same as CONUS product except this version provides larger coverage).

(CCR 01213) (CCR 01211) (CCR 01543) (CCR 01466) (CCR 01542) (CCR 01631)

<table>
<thead>
<tr>
<th>MRD1086</th>
<th>Product Geographic Coverage/Conditions: Full Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRD1087</td>
<td>Product Vertical Resolution: Cloud Top</td>
</tr>
<tr>
<td>MRD1088</td>
<td>Product Horizontal Resolution: 2 km</td>
</tr>
<tr>
<td>MRD1089</td>
<td>Product Mapping Accuracy: 1 km</td>
</tr>
</tbody>
</table>
MRD1090 \hspace{1cm} \textbf{Product Measurement Range:} Liquid/Solid/Supercooled/Mixed

MRD1091 \hspace{1cm} \textbf{Product Measurement Accuracy:} 80\% correct classification

MRD1092 \hspace{1cm} \textbf{Product Refresh Rate/Coverage Time:} 15 min (5 min when 5 minute Full Disk data available)
\hspace{1cm} (CCR 01899) (CCR 02183 (RDW))

MRD1093 \hspace{1cm} \textbf{Mission Product Data Latency:} 3 min (CCR 01899) (CCR 02183 (RDW))

MRD1094 \hspace{1cm} \textbf{Product Measurement Precision:} Not applicable (CCR 01892)

\hspace{1cm} \textbf{Temporal Coverage Qualifier:} Day and Night
\hspace{1cm} \textbf{Product Extent Qualifier:} Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA
\hspace{1cm} \textbf{Cloud Cover Conditions Qualifier:} In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
\hspace{1cm} \textbf{Product Statistics Qualifier:} Over specified geographic coverage (CCR 01892)

\textbf{3.3.3.2.21 Cloud Top Phase: Mesoscale}

MRD188 \hspace{1cm} The GOES-R System shall produce a Cloud Top Phase: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Phase reports the state of aggregation of a cloud, namely liquid, supercooled, mixed, or solid, for each detectable layer (same as CONUS product except this version provides mesoscale coverage).

\hspace{1cm} (CCR 01213) (CCR 01211) (CCR 01543) (CCR 01466) (CCR 01542) (CCR 01631)

MRD1096 \hspace{1cm} \textbf{Product Geographic Coverage/Conditions:} Mesoscale

MRD1097 \hspace{1cm} \textbf{Product Vertical Resolution:} Cloud Top

MRD1098 \hspace{1cm} \textbf{Product Horizontal Resolution:} 2 km

MRD1099 \hspace{1cm} \textbf{Product Mapping Accuracy:} 1 km

MRD1100 \hspace{1cm} \textbf{Product Measurement Range:} Liquid/Solid/Supercooled/Mixed

MRD1101 \hspace{1cm} \textbf{Product Measurement Accuracy:} 80\% correct classification

MRD1102 \hspace{1cm} \textbf{Product Refresh Rate/Coverage Time:} 5 min

MRD1103 \hspace{1cm} \textbf{Mission Product Data Latency:} 1 min (CCR 01899) (CCR 02183 (RDW))

\hspace{1cm} \textbf{Product Measurement Precision:} Not applicable (CCR 01892)

\hspace{1cm} \textbf{Temporal Coverage Qualifier:} Day and Night
\hspace{1cm} \textbf{Product Extent Qualifier:} Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA
\hspace{1cm} \textbf{Cloud Cover Conditions Qualifier:} In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
\hspace{1cm} \textbf{Product Statistics Qualifier:} Over specified geographic coverage (CCR 01892)

\textbf{3.3.3.2.22 Cloud Top Height: CONUS}
The GOES-R System shall produce a Cloud Top Height: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Height reports the height of the cloud layer above the local terrain or above mean sea level. An average cloud height and thickness is reported for each layer for the portion of the field of view being covered by the cloud layer.

(CCR 01213) (CCR 01211) (CCR 01543) (CCR 01466) (CCR01542) (CCR 01631)

Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: Cloud Top

Product Horizontal Resolution: 10 km

Product Mapping Accuracy: 5 km (CCR 03195(RDW))

Product Measurement Range: 100m - 300hPa

Product Measurement Accuracy: 500m for clouds with emissivity > 0.8

Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))

Mission Product Data Latency: 3 min (CCR 01899) (CCR 02183 (RDW))

Product Measurement Precision: 1500m for clouds with emissivity > 0.8 (CCR 03190(RDW))

Temporal Coverage Qualifier: Day and Night

Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and qualitative at larger LZA

Cloud Cover Conditions Qualifier: Clear conditions down to cloud top

Product Statistics Qualifier: Over specified geographic coverage (CCR 01892)

3.3.3.2.23 Cloud Top Height: Hemispheric

The GOES-R System shall produce a Cloud Top Height: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Height reports the height of the cloud layer above the local terrain or above mean sea level. An average cloud height and thickness is reported for each layer for the portion of the field of view being covered by the cloud layer (same as CONUS product except this version provides larger coverage).

(CCR 01213) (CCR 01211) (CCR 01543) (CCR 01466) (CCR01542) (CCR 01631)

Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: Cloud Top

Product Horizontal Resolution: 10 km

Product Mapping Accuracy: 5 km (CCR 03195(RDW))

Product Measurement Range: 0 - 15 km

Product Measurement Accuracy: 500m for clouds with emissivity > 0.8

Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))
3.3.3.2.24 Cloud Top Height: Mesoscale

The GOES-R System shall produce a Cloud Top Height: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Height reports the height of the cloud layer above the local terrain or above mean sea level. An average cloud height and thickness is reported for each layer for the portion of the field of view being covered by the cloud layer (same as CONUS product except this version provides mesoscale coverage).

Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: Cloud top

Product Horizontal Resolution: 4 km

Product Mapping Accuracy: 2 km (CCR 03195(RDW))

Product Measurement Range: 0 - 20 km

Product Measurement Accuracy: 500m for clouds with emissivity > 0.8

Product Refresh Rate/Coverage Time: 5 min

Mission Product Data Latency: 5 min

Product Measurement Precision: 1500m for clouds with emissivity > 0.8 (CCR 03190(RDW))

Temporal Coverage Qualifier: Day and Night

Product Extent Qualifier: Quantitative out to at least 62 degrees LZA (Threshold) and qualitative at larger LZA

Cloud Cover Conditions Qualifier: Clear conditions down to cloud top

Product Statistics Qualifier: Over specified geographic coverage (CCR 01892)

3.3.3.2.25 Cloud Top Pressure: CONUS

The GOES-R System shall produce a Cloud Top Pressure: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Pressure reports the atmospheric pressure at the top of the observed cloud layer. An average cloud top pressure is reported for each layer for the portion of the field of view being covered by the cloud layer.

Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: Cloud top

Product Horizontal Resolution: 10 km
3.3.3.2.26 Cloud Top Pressure: Hemispheric

The GOES-R System shall produce a Cloud Top Pressure: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Pressure reports the atmospheric pressure at the top of the observed cloud layer. An average cloud top pressure is reported for each layer for the portion of the field of view being covered by the cloud layer (same as CONUS product except this version provides larger coverage).

(CCR 01213) (CCR 01211) (CCR 01315) (CCR 01543) (CCR 01466) (CCR 01542) (CCR 01611)(CCR 01631)
The GOES-R System shall produce a Cloud Top Temperature: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Temperature reports the temperature at the top of the observable cloud layer. An average cloud top temperature is reported for each layer for the portion of the field of view being covered by the cloud layer.

(Product Geographic Coverage/Conditions: Full Disk)

(Product Vertical Resolution: At Cloud Tops)

(Product Horizontal Resolution: 2 km)

(Product Mapping Accuracy: 1 km)

(Product Measurement Range: 180 - 300 K)

(Product Measurement Accuracy: 3 K for clouds with emissivity > 0.8)

(Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available))

(Product Mapping Accuracy: 1 km)

(Product Measurement Range: 180 - 300 K)

(Product Measurement Accuracy: 3 K for clouds with emissivity > 0.8)

(Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available))

(The GOES-R System shall produce a Cloud Top Temperature: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Top Temperature reports the temperature at the top of the observable cloud layer. An average cloud top temperature is reported for each layer for the portion of the field of view being covered by the cloud layer (same as hemispheric product except this version provides mesoscale coverage).

(Product Geographic Coverage/Conditions: Mesoscale)

(Product Vertical Resolution: At Cloud Tops)

(Product Horizontal Resolution: 2 km)

(Product Mapping Accuracy: 1 km)

(Product Measurement Range: 180 - 300 K)

(Product Measurement Accuracy: 3 K for clouds with emissivity > 0.8)

(Product Refresh Rate/Coverage Time: 5 min)

(Mission Product Data Latency: 5 min)
MRD1174  Product Measurement Precision: 5 K for clouds with emissivity > 0.8

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.2.29 Cloud Type: CONUS

MRD204  The GOES-R System shall produce a Cloud Type: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Type reports a cloud genus based on cloud characteristics, both at the microphysical and macrophysical level for all observable cloud layers. For the threshold the seven types of clouds are warm liquid water (water cloud with a cloud top warmer than 273.16 K), supercooled liquid water (water cloud with a cloud top colder than 273.16 K), mixed phase clouds (high probability of containing some ice near cloud top), cirrus clouds (ice clouds that are semi-transparent in the infrared), opaque ice clouds (high emissivity ice clouds), multilayered clouds (most often ice cloud overlapping water cloud) and clear (per the cloud mask).

(CCR 01214) (CCR 01211) (CCR 01543) (CCR 01466) (CCR01542) (CCR 01631) (CCR 02183 (RDW))

MRD1176  Product Geographic Coverage/Conditions: CONUS (CCR 02183 (RDW))

Product Vertical Resolution: N/A (CCR 02183 (RDW))
MRD1178  Product Horizontal Resolution: 10 km (CCR 02183 (RDW))
MRD1179  Product Mapping Accuracy: 5 km (CCR 02183 (RDW))
MRD1180  Product Measurement Range: 7 types (CCR 02183 (RDW))
MRD1181  Product Measurement Accuracy: 60% correct classification (CCR 02183 (RDW))
MRD1182  Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))
MRD1183  Mission Product Data Latency: 10 min (CCR 02183 (RDW))
MRD1184  Product Measurement Precision: Not applicable (CCR 01892) (CCR 02183 (RDW))

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW))

3.3.3.2.30 Cloud Type: Hemispheric
The GOES-R System shall produce a Cloud Type: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Type reports a cloud genus based on cloud characteristics, both at the microphysical and macrophysical level for all observable cloud layers. For the threshold the seven types of clouds are warm liquid water (water cloud with a cloud top warmer than 273.16 K), supercooled liquid water (water cloud with a cloud top colder than 273.16 K), mixed phase clouds (high probability of containing some ice near cloud top), cirrus clouds (ice clouds that are semi-transparent in the infrared), opaque ice clouds (high emissivity ice clouds), multilayered clouds (most often ice cloud overlapping water cloud) and clear (per the cloud mask) (same as CONUS product except this version provides larger coverage).

(Product Geographic Coverage/Conditions: Full Disk (CCR 02183 (RDW))
Product Vertical Resolution: N/A (CCR 02183 (RDW))
Product Horizontal Resolution: 2 km (CCR 02183 (RDW))
Product Mapping Accuracy: 1 km (CCR 02183 (RDW))
Product Measurement Range: 7 types (CCR 02183 (RDW))
Product Measurement Accuracy: 60% correct classification (CCR 02183 (RDW))
Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))
Mission Product Data Latency: 3 min (CCR 02183 (RDW))
Product Measurement Precision: Not applicable (CCR 01892) (CCR 02183 (RDW))
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW))

3.3.3.2.31 Cloud Type: Mesoscale

The GOES-R System shall produce a Cloud Type: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Cloud Type reports a cloud genus based on cloud characteristics, both at the microphysical and macrophysical level for all observable cloud layers. For the threshold the seven types of clouds are warm liquid water (water cloud with a cloud top warmer than 273.16 K), supercooled liquid water (water cloud with a cloud top colder than 273.16 K), mixed phase clouds (high probability of containing some ice near cloud top), cirrus clouds (ice clouds that are semi-transparent in the infrared), opaque ice clouds (high emissivity ice clouds), multilayered clouds (most often ice cloud overlapping water cloud) and clear (per the cloud mask) (same as CONUS product except this version provides mesoscale coverage).

(Product Geographic Coverage/Conditions: Mesoscale (CCR 02183 (RDW))
Product Vertical Resolution: N/A (CCR 02183 (RDW))
Product Horizontal Resolution: 2 km (CCR 02183 (RDW))
MRD199  Product Mapping Accuracy: 1 km \( (CCR\ 02183\ (RDW)) \) 
MRD200  Product Measurement Range: 7 types \( (CCR\ 02183\ (RDW)) \) 
MRD201  Product Measurement Accuracy: 60% correct classification \( (CCR\ 02183\ (RDW)) \) 
MRD202  Product Refresh Rate/Coverage Time: 15 min \( (CCR\ 02183\ (RDW)) \) 
MRD203  Mission Product Data Latency: 5 min \( (CCR\ 02183\ (RDW)) \) 
MRD204  Product Measurement Precision: Not applicable \( (CCR\ 01892)\ (CCR\ 02183\ (RDW)) \) 

**Temporal Coverage Qualifier:** Day and Night  
**Product Extent Qualifier:** Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA  
**Cloud Cover Conditions Qualifier:** In presence of clouds with optical depth > 1. Clear conditions down to cloud top associated with threshold accuracy.  
**Product Statistics Qualifier:** Over specified geographic coverage \( (CCR\ 02183\ (RDW)) \) 

### 3.3.3.2.32 Convective Initiation: CONUS

The GOES-R System shall produce a Convective Initiation: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Convective Initiation reports atmospheric conditions that precede and attend rapid convective storm development based on the rapid evolution and motion of daytime cumulus indicating boundary layer convergence and high water vapor content. Observations of boundary layer moisture can indicate convective initiation even prior to cloud formation and prior to ground-based radar measured rainfall reflectivity of -35 dBZ. \( (CCR\ 01214)\ (CCR\ 01211)\ (CCR\ 01543)\ (CCR\ 01438)\ (CCR 001542)\ (CCR\ 01631)\ (CCR\ 02183\ (RDW)) \)

MRD206  Product Geographic Coverage/Conditions: CONUS \( (CCR\ 02183\ (RDW)) \) 
MRD208  Product Horizontal Resolution: N/A \( (CCR\ 02183\ (RDW)) \) 
MRD209  Product Mapping Accuracy: 2 km \( (CCR\ 02183\ (RDW)) \) 
MRD210  Product Measurement Range: Binary yes/no detection \( (CCR\ 02183\ (RDW)) \) 
MRD211  Product Measurement Accuracy: 70% correct detection \( (CCR\ 02183\ (RDW)) \) 
MRD212  Product Refresh Rate/Coverage Time: 5 min \( (CCR\ 02183\ (RDW)) \) 
MRD213  Mission Product Data Latency: 3 min \( (CCR\ 02183\ (RDW)) \) 
MRD214  Product Measurement Precision: N/A \( (CCR\ 02183\ (RDW)) \) 

**Temporal Coverage Qualifier:** Day and Night  
**Product Extent Qualifier:** Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA  
**Cloud Cover Conditions Qualifier:** Clear conditions down to feature of interest associated with threshold accuracy.  
**Product Statistics Qualifier:** Over specified geographic coverage \( (CCR\ 02183\ (RDW)) \)

### 3.3.3.2.33 Convective Initiation: Mesoscale

The GOES-R System shall produce a Convective Initiation: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.
Convective Initiation reports atmospheric conditions that precede and attend rapid convective storm development based on the rapid evolution and motion of daytime cumulus indicating boundary layer convergence and high water vapor content. Observations of boundary layer moisture can indicate convective initiation even prior to cloud formation and prior to ground-based radar measured rainfall reflectivity of -35 dBZ (same as CONUS product except this version provides mesoscale coverage).

 niên (CCR 01214) (CCR 01211) (CCR01543) (CCR 01438) (CCR01542) (CCR 01631) (CCR 02183 (RDW))

MRD1216  Product Geographic Coverage/Conditions: Mesoscale (CCR 02183 (RDW))
         Product Vertical Resolution: N/A (CCR 02183 (RDW))

MRD1218  Product Horizontal Resolution: 2 km (CCR 02183 (RDW))

MRD1219  Product Mapping Accuracy: 1 km (CCR 02183 (RDW))

MRD1220  Product Measurement Range: Binary yes/no detection (CCR 02183 (RDW))

MRD1221  Product Measurement Accuracy: 70% correct detection (CCR 02183 (RDW))

MRD1222  Product Refresh Rate/Coverage Time: 5 min (CCR 02183 (RDW))

MRD1223  Mission Product Data Latency: 3 min (CCR 02183 (RDW))
         Product Measurement Precision: N/A (CCR 02183 (RDW))

Temporal CoverageQualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW))

3.3.3.2.34 Enhanced "V"/Overshooting Top Detection: CONUS

MRD212  The GOES-R System shall produce an Enhanced "V"/Overshooting Top Detection: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Enhanced "V"/Overshooting Top Detection reports very cold (cirrus) cloud matter in a multiple satellite images with the ‘V’ pattern likely representing a wake at tropospheric (overshooting) heights resulting from a strong vertical updraft. This updraft results in a warm region inside the V shape that is indicative of very rapid latent heat release in the thunderstorm, indicating intensification is occurring.

 niên (CCR 01214) (CCR 01211) (CCR01543) (CCR 01438) (CCR01542) (CCR 01631) (CCR 02183 (RDW))

MRD1226  Product Geographic Coverage/Conditions: CONUS (CCR 02183 (RDW))
         Product Vertical Resolution: N/A (CCR 02183 (RDW))

MRD1228  Product Horizontal Resolution: 2 km (CCR 02183 (RDW))

MRD1229  Product Mapping Accuracy: 1 km (CCR 02183 (RDW))

MRD1230  Product Measurement Range: Binary yes/no detection (160 - 270 K) (CCR 02183 (RDW))

MRD1231  Product Measurement Accuracy: 75% correct detection (in terms of 1 - False Alarm Rate) (CCR 02183 (RDW))

MRD1232  Product Refresh Rate/Coverage Time: 5 min (CCR 02183 (RDW))

MRD1233  Mission Product Data Latency: 3 min (CCR 02183 (RDW))
3.3.3.2.35 Enhanced "V"/Overshooting Top Detection: Mesoscale

The GOES-R System shall produce an Enhanced "V"/Overshooting Top Detection: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Enhanced "V"/Overshooting Top Detection reports very cold (cirrus) cloud matter in multiple satellite images with the ‘V’ pattern likely representing a wake at tropospheric (overshooting) heights resulting from a strong vertical updraft. This updraft results in a warm region inside the V shape that is indicative of very rapid latent heat release in the thunderstorm, indicating intensification is occurring (same as CONUS product except this version provides mesoscale coverage).

Product Geographic Coverage/Conditions: Mesoscale (CCR 02183 (RDW))
Product Vertical Resolution: N/A (CCR 02183 (RDW))
Product Horizontal Resolution: 2 km (CCR 02183 (RDW))
Product Mapping Accuracy: 1 km (CCR 02183 (RDW))
Product Measurement Range: Binary yes/no detection (160 - 270 K) (CCR 02183 (RDW))
Product Measurement Accuracy: 75% correct detection (in terms of 1 - False Alarm Rate) (CCR 02183 (RDW))
Product Refresh Rate/Coverage Time: 5 min (CCR 02183 (RDW))
Mission Product Data Latency: 3 min (CCR 02183 (RDW))
Product Measurement Precision: N/A (CCR 02183 (RDW))
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier: Over enhanced V / Overshooting top cases (CCR 02183 (RDW))

3.3.3.2.36 Hurricane Intensity

The GOES-R System shall produce a Hurricane Intensity product in accordance with the requirements and qualifiers provided in the product table below.

Hurricane Intensity will report the position and strength of tropical storms based on the maximum surface wind speed via the Dvorak technique or an improved methodology. Tropical storms and hurricanes will be classified in the North Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and in the Eastern North Pacific off the west coast of Mexico to the International Dateline.

Product Geographic Coverage/Conditions: Full Disk
Product Vertical Resolution: N/A
MRD1248  Product Horizontal Resolution:  2 km

MRD1249  Product Mapping Accuracy:  1 km

MRD1250  Product Measurement Range:  Dvorak hurricane intensity scale values of 1.5 - 8 or leading to wind speeds of 12.8 m/s (25 knots) to 87.5 m/s (170 knots)

MRD1251  Product Measurement Accuracy:  6.5 m/s over ocean (CCR 01892)

MRD1252  Product Refresh Rate/Coverage Time:  30 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))

MRD1253  Mission Product Data Latency:  3 min (CCR 01899) (CCR 02183 (RDW))

MRD1254  Product Measurement Precision:  8.0 m/s over ocean (CCR 01892)

Temporal Coverage Qualifier:  Day and Night
Product Extent Qualifier:  Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier:  Clear conditions down to feature of interest associated with threshold accuracy.
Product Statistics Qualifier:  Over oceanic tropical systems

3.3.3.2.37 Lightning Detection: Hemispheric

MRD222  The GOES-R System shall produce a Lightning Detection: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

The Product will include the collection of Lightning Events, identification of contiguous Events as “Lightning Groups” and events having discrete time and space continuity as “Lightning Flashes."

Lightning Detection reports the location of lightning discharges observed by the satellite over the product observing period. The product includes cloud to cloud lightning and cloud to ground lightning when detectable in the near infrared.

(CCR 01211) (CCR 01345) (CCR 01543) (CCR01542) (CCR 01621) (CCR 01631)

MRD1256  Product Geographic Coverage/Conditions:  100° by 100° rectangle from each satellite centered at nadir; aggregate of two satellites covers 25° W through 175° W and 50° N through 50° S

MRD1257  Product Vertical Resolution:  Surface to cloud top

MRD1258  Product Horizontal Resolution:  10 km

MRD1259  Product Mapping Accuracy:  5 km

MRD1260  Product Measurement Range:  41900 events / sec for 0 – 84 events per frame; 0 – 8170 groups /sec for 0 – 16.5 groups per frame; 600 flashes/sec for 0 – 1.5 flashes per frame. (CCR 01975) (CCR 02369 (RDW))

MRD1261  Product Measurement Accuracy:  70% total flash detection

MRD1262  Product Refresh Rate/Coverage Time:  20 sec

MRD1263  Mission Product Data Latency:  20 sec (CCR 01729)

MRD1264  Product Measurement Precision:  5%

Temporal Coverage Qualifier:  Day and Night
Product Extent Qualifier:  Quantitative out to at least 65 degrees LZA (Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier:  Cloud cover conditions permitting observation of lightning associated with threshold accuracy
Product Statistics Qualifier:  Over lightning cases
### 3.3.3.2.38 Low Cloud and Fog

The GOES-R System **shall** produce a Low Cloud and Fog product in accordance with the requirements and qualifiers provided in the product table below.

The Low Cloud and Fog product reports the location and thickness of low cloud and fog using multispectral imagery.

**(CCR 01099) (CCR 01211) (CCR 01543) (CCR 01438) (CCR 01542) (CCR 01631) (CCR 02183 (RDW))**

**MRD1266**  
**Product Geographic Coverage/Conditions:** Full Disk *(CCR 02183 (RDW))*

**MRD1267**  
**Product Vertical Resolution:** 0.5 km (depth) *(CCR 02183 (RDW))*

**MRD1268**  
**Product Horizontal Resolution:** 2 km *(CCR 02183 (RDW))*

**MRD1269**  
**Product Mapping Accuracy:** 1 km *(CCR 02183 (RDW))*

**MRD1270**  
**Product Measurement Range:** Binary yes/no detection *(CCR 02183 (RDW))*

**MRD1271**  
**Product Measurement Accuracy:** 70% correct detection *(CCR 02183 (RDW))*

**MRD1272**  
**Product Refresh Rate/Coverage Time:** 15 min (5 min when 5 minute Full Disk data available) *(CCR 01899) (CCR 02183 (RDW))*

**MRD1273**  
**Mission Product Data Latency:** 3 min *(CCR 02183 (RDW))*

**Product Measurement Precision:** N/A *(CCR 02183 (RDW))*

**Temporal Coverage Qualifier:** Day and Night

**Product Extent Qualifier:** Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA

**Cloud Cover Conditions Qualifier:** Clear conditions down to feature of interest (no high clouds obscuring fog) associated with threshold accuracy

**Product Statistics Qualifier:** Over low cloud and fog cases with at least 42% occurrence in the region *(CCR 02183 (RDW))*

### 3.3.3.2.39 Tropopause Folding Turbulence Prediction: Hemispheric *(CCR 01543)*

The GOES-R System **shall** produce a Tropopause Folding Turbulence Prediction: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Tropopause Folding Turbulence Prediction product reports hazardous vertical windshear conditions associated with upper level fronts and indicated by increased temperature contrast.

**(CCR 01211) (CCR 01347) (CCR 01543) (CCR 01438) (CCR 01542) (CCR 01613) (CCR 01631) (CCR 02183 (RDW))**

**MRD1276**  
**Product Geographic Coverage/Conditions:** Full Disk *(CCR 02183 (RDW))*

**MRD1277**  
**Product Vertical Resolution:** Sfc-100 mb *(CCR 02183 (RDW))*

**MRD1278**  
**Product Horizontal Resolution:** 2 km *(CCR 02183 (RDW))*

**MRD1279**  
**Product Mapping Accuracy:** 1 km *(CCR 02183 (RDW))*

**MRD1280**  
**Product Measurement Range:** Binary yes/no detection above boundary layer for moderate of greater conditions *(CCR 02183 (RDW))*

**MRD1281**  
**Product Measurement Accuracy:** 50% correct detection of moderate or greater turbulence *(CCR 02183 (RDW))*
3.3.3.2.40 Tropopause Folding Turbulence Prediction: Mesoscale  

The GOES-R System shall produce a Tropopause Folding Turbulence Prediction: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Tropopause Folding Turbulence Prediction product reports hazardous vertical windshear conditions associated with upper level fronts and indicated by increased temperature contrast (same as Hemispheric product except this version provides mesoscale coverage).

<table>
<thead>
<tr>
<th>MRD1282</th>
<th>Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(CCR 01899) (CCR 02183 (RDW))</td>
</tr>
</tbody>
</table>

3.3.3.2.41 Visibility: Hemispheric

The GOES-R System shall produce a Visibility: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Visibility product reports the greatest horizontal distance at which objects can be seen by the unaided eye before being obscured by clouds, fog, aerosols, or darkness. The product is azimuthally average visibility.

<table>
<thead>
<tr>
<th>MRD230</th>
<th>The GOES-R System shall produce a Tropopause Folding Turbulence Prediction: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tropopause Folding Turbulence Prediction product reports hazardous vertical windshear conditions associated with upper level fronts and indicated by increased temperature contrast (same as Hemispheric product except this version provides mesoscale coverage).</td>
</tr>
<tr>
<td></td>
<td>(CCR 01211) (CCR 01543) (CCR 01438) (CCR 01542) (CCR 01613) (CCR 01631) (CCR 02183 (RDW))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MRD1283</th>
<th>Mission Product Data Latency: 3 min (CCR 02183 (RDW))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Product Measurement Precision: N/A (CCR 02183 (RDW))</td>
</tr>
<tr>
<td></td>
<td>Temporal Coverage Qualifier: Day and Night</td>
</tr>
<tr>
<td></td>
<td>Product Extent Qualifier: Quantitative out to at least 70 degrees LZA (Threshold) and qualitative at larger LZA</td>
</tr>
<tr>
<td></td>
<td>Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy</td>
</tr>
<tr>
<td></td>
<td>Product Statistics Qualifier: Over the lengths of separate flight transects through the regions of positive prediction (CCR 02183 (RDW))</td>
</tr>
<tr>
<td></td>
<td>(CCR 02183 (RDW))</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MRD234</th>
<th>The GOES-R System shall produce a Visibility: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visibility product reports the greatest horizontal distance at which objects can be seen by the unaided eye before being obscured by clouds, fog, aerosols, or darkness. The product is azimuthally average visibility.</td>
</tr>
<tr>
<td></td>
<td>(CCR 01211) (CCR 01543) (CCR 01438) (CCR 01542) (CCR 01613) (CCR 02183 (RDW))</td>
</tr>
</tbody>
</table>
3.3.3.3 Precipitation

3.3.3.3.1 Probability of Rainfall

The GOES-R System shall produce a Probability of Rainfall product in accordance with the requirements and qualifiers provided in the product table below.

Probability (or chance) of Rainfall is the likelihood of occurrence, expressed as a percentage, that measurable rainfall (0.01 inch or more) will occur at any point within a specified forecast area during the next three hours.

Product Geographic Coverage/Conditions: Full Disk
Product Vertical Resolution: N/A
Product Horizontal Resolution: 2 km
Product Mapping Accuracy: 1 km
Product Measurement Range: 0 to 100%
Product Measurement Accuracy: 25%
Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)
Mission Product Data Latency: 5 min
Product Measurement Precision: 40%
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA or 60 degrees latitude, whichever is less, and qualitative beyond
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over rainfall cases

3.3.3.3 Rainfall Potential

The GOES-R System shall produce a Rainfall Potential product in accordance with the requirements and qualifiers provided in the product table below.

Rainfall potential provides a gridded quantitative assessment of the 3-hour rainfall potential.

Product Geographic Coverage/Conditions: Full Disk
Product Vertical Resolution: N/A
Product Horizontal Resolution: 2 km
Product Mapping Accuracy: 1 km
Product Measurement Range: 0 to 100 mm
Product Measurement Accuracy: 5 mm for pixels designated as raining
Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)
Mission Product Data Latency: 5 min
Product Measurement Precision: 5 mm for pixels designated as raining

3.3.3.3.3 Rainfall Rate/QPE

The GOES-R System shall produce a Rainfall Rate/QPE product in accordance with the requirements and qualifiers provided in the product table below.

Rainfall Rate/Quantitative Precipitation Estimation (QPE) provides a gridded quantitative estimate of instantaneous rainfall rate.

Product Geographic Coverage/Conditions: Full Disk
Product Vertical Resolution: N/A
Product Horizontal Resolution: 2 km
Product Mapping Accuracy: 2 km
3.3.3.4 Profiles, Indices, Total Water

3.3.3.4.1 Legacy Vertical Moisture Profile: CONUS

The GOES-R System shall produce a Legacy Vertical Moisture Profile: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Moisture Profile draws upon Numerical Weather Prediction (NWP) input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data.

Product Geographic Coverage/Conditions: CONUS
Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km
Product Horizontal Resolution: 10 km
Product Mapping Accuracy: 5 km (CCR 03195 (RDW))
Product Measurement Range: 0 to 100%
Product Measurement Accuracy: Sfc-500 mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100 mb: 20% relative humidity
Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))
Mission Product Data Latency: 5 min
Product Measurement Precision: Scf-500mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100mb: 20% relative humidity
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA or 60 degrees latitude, whichever is less, and qualitative beyond
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over rain cases and mesoscale-sized surrounding regions. Quantitative for convective rainfall and qualitative for stratiform rainfall. (CCR 01892)

3.3.3.4.2 Legacy Vertical Moisture Profile: Hemispheric
The GOES-R System **shall** produce a Legacy Vertical Moisture Profile: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Moisture Profile draws upon Numerical Weather Prediction (NWP) input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data (same as CONUS product except this version provides hemispheric coverage).

(CCR 01211) (CCR 01543) (CCR 01542) (CCR 01615) (CCR 01631)

**Product Geographic Coverage/Conditions:** Full Disk

**Product Vertical Resolution:** Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

**Product Horizontal Resolution:** 10 km

**Product Mapping Accuracy:** 5 km (CCR 03195(RDW))

**Product Measurement Range:** 0 to 100%

**Product Measurement Accuracy:** Sfc-500 mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100 mb: 20% relative humidity

**Product Refresh Rate/Coverage Time:** 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))

**Mission Product Data Latency:** 5 min

**Product Measurement Precision:** Sfc-500mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100mb: 20% relative humidity

**Temporal Coverage Qualifier:** Day and Night

**Product Extent Qualifier:** Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy

**Product Statistics Qualifier:** Over specified geographic coverage

### 3.3.3.4.3 Legacy Vertical Moisture Profile: Mesoscale

The GOES-R System **shall** produce a Legacy Vertical Moisture Profile: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Moisture Profile draws upon Numerical Weather Prediction (NWP) input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data (same as CONUS product except this version provides mesoscale coverage).

(CCR 01214) (CCR 01211) (CCR 01543) (CCR 01542) (CCR 01615) (CCR 01631)

**Product Geographic Coverage/Conditions:** Mesoscale

**Product Vertical Resolution:** Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km

**Product Horizontal Resolution:** 10 km

**Product Mapping Accuracy:** 5 km (CCR 03195(RDW))

**Product Measurement Range:** 0 to 100%

**Product Measurement Accuracy:** Sfc-500 mb: 18% relative humidity 500-300 mb: 18% relative humidity 300-100 mb: 20% relative humidity

**Product Refresh Rate/Coverage Time:** 5 min
3.3.3.4.4 Legacy Vertical Temperature Profile: CONUS

The GOES-R System shall produce a Legacy Vertical Temperature Profile: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Temperature Profile draws upon NWP input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data.

Product Geographic Coverage/Conditions: CONUS
Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km
Product Horizontal Resolution: 10 km
Product Mapping Accuracy: 5 km (CCR 03195(RDW))
Product Measurement Range: 180 - 320 K
Product Measurement Accuracy: 1K below 400 hPa and above boundary layer
Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))
Mission Product Data Latency: 5 min
Product Measurement Precision: 2K below 400 hPa and above boundary layer
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.5 Legacy Vertical Temperature Profile: Hemispheric

The GOES-R System shall produce a Legacy Vertical Temperature Profile: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Legacy Vertical Temperature Profile draws upon NWP input and adds the moisture band information from ABI to provide an improved profile following the inherent vertical resolution (or layer averaging) of the input NWP data (same as CONUS product except this version provides hemispheric coverage).

Product Geographic Coverage/Conditions: Full Disk
Product Vertical Resolution: Reflects layering of NWP Models; inherent vertical resolution is only 3 to 5 km
Product Horizontal Resolution: 10 km
3.3.3.4.6 Legacy Vertical Temperature Profile: Mesoscale

MRD1379  Product Mapping Accuracy: 5 km *(CCR 03195(RDW))*

MRD1380  Product Measurement Range: 180 - 320 K

MRD1381  Product Measurement Accuracy: 1K below 400 hPa and above boundary layer

MRD1382  Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) *(CCR 01899) (CCR 02183 (RDW))*

MRD1383  Mission Product Data Latency: 5 min

MRD1384  Product Measurement Precision: 2K below 400 hPa and above boundary layer

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.4.7 Derived Stability Indices: CONUS

MRD244  The GOES-R System shall produce a Derived Stability Indices: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

The following Derived Stability Indices are addressed by these five products.

* Lifted Index (LI) (Degrees Celsius): The Lifted Index is calculated by lifting (frontal, orographic, upper air
dynamics, etc.) a parcel of air dry adiabatically while conserving moisture until it reaches saturation. At that point
the parcel is lifted moist adiabatically up to 500 mb. The Lifted Index is the ambient air temperature minus the lifted
parcel temperature at 500 mb.

*Convective Available Potential Energy (CAPE, Joules/kg):* Convective Available Potential Energy, a measure of the
cumulative buoyancy of a parcel as it rises, in units of Joules per kilogram. CAPE values larger than 1000 J/kg
represent moderate amounts of atmospheric potential energy. Values exceeding 3000 J/kg are indicative of very
large amounts of potential energy, and are often associated with strong/severe weather. Graphically, the CAPE is the
positively buoyant area (shaded purple) on the skew-t diagram.

*Total Totals Index (TT):* The Total Totals Index is computed using discrete pressure level information and is
indicative of severe weather potential. Its formula is: TT=(T850+TD850)-2(T500). Generally, TT values below 40-
45 are indicators of little or no thunderstorm activity, while values exceeding 55 in the Eastern and Central United
States or 65 in the Western United States are indicators of considerable severe weather, including the potential for
tornadic activity.

*Showalter Index (SI):* The SI is a parcel-based index, calculated in the same manner as the Lifted Index, using a
parcel at 850 mb. That is, the 850 mb parcel is lifted to saturation, then moist adiabatically to 500 mb. The
difference between the parcel and environment at 500 mb is the Showalter Index.

*K index (KI):* The K-Index is a simple index using data from discrete pressure levels, instead of a lifted parcel. It is
based on vertical temperature changes, moisture content of the lower atmosphere, and the vertical extent of the moist
layer. The higher the K-Index the more conducive the atmosphere is to convection. The formula for KI is:

\[ KI = (T_{850} \text{ mb} - T_{500} \text{ mb}) + [(TD_{850} \text{ mb} - (T_{700} \text{ mb} - TD_{700} \text{ mb})] \]

where:
- \( T \) = Temperature

**(CCR 01298) (CCR 01543) (CCR 01439) (CCR 01542) (CCR 01615) (CCR 01631)**

The GOES-R System shall produce a Derived Stability Indices: Hemispheric product in accordance with the
requirements and qualifiers provided in the product table below.
The following Derived Stability Indices are addressed by these five products.

**Lifted Index (LI) (Degrees Celsius):** The Lifted Index is calculated by lifting (frontal, orographic, upper air dynamics, etc.) a parcel of air dry adiabatically while conserving moisture until it reaches saturation. At that point the parcel is lifted moist adiabatically up to 500 mb. The Lifted Index is the ambient air temperature minus the lifted parcel temperature at 500 mb.

**Convective Available Potential Energy (CAPE, Joules/kg):** Convective Available Potential Energy, a measure of the cumulative buoyancy of a parcel as it rises, in units of Joules per kilogram. CAPE values larger than 1000 J/kg represent moderate amounts of atmospheric potential energy. Values exceeding 3000 J/kg are indicative of very large amounts of potential energy, and are often associated with strong/severe weather. Graphically, the CAPE is the positively buoyant area (shaded purple) on the skew-t diagram.

**Total Totals Index (TT):** The Total Totals Index is computed using discrete pressure level information and is indicative of severe weather potential. Its formula is: TT=(T850+TD850)-2(T500). Generally, TT values below 40-45 are indicators of little or no thunderstorm activity, while values exceeding 55 in the Eastern and Central United States or 65 in the Western United States are indicators of considerable severe weather, including the potential for tornadic activity.

**Showalter Index (SI):** The SI is a parcel-based index, calculated in the same manner as the Lifted Index, using a parcel at 850 mb. That is, the 850 mb parcel is lifted to saturation, then moist adiabatically to 500 mb. The difference between the parcel and environment at 500 mb is the Showalter Index.

**K index (KI):** The K-Index is a simple index using data from discrete pressure levels, instead of a lifted parcel. It is based on vertical temperature changes, moisture content of the lower atmosphere, and the vertical extent of the moist layer. The higher the K-Index the more conducive the atmosphere is to convection. The formula for KI is:

\[
KI=(T_{850\text{mb}}-T_{500\text{mb}}) + [(TD_{850\text{mb}} - (T_{700\text{mb}} - TD_{700\text{mb}})]
\]

T=Temperature

(same as CONUS product except this version provides hemispheric coverage)

(CCR 01543) (CCR 01542) (CCR 01615) (CCR 01631)

MRD1406  Product Geographic Coverage/Conditions: Full Disk

MRD1408  Product Vertical Resolution: N/A

MRD1409  Product Mapping Accuracy: 2 km (CCR 03195(RDW))

MRD1410  Product Measurement Range: Lifted Index: -10 K - 40 K CAPE: 0-5000 J/kg Showalter index: >4 to -10 K Total totals Index: -43 to > 56 K index: 0 - 40

MRD1411  Product Measurement Accuracy: Lifted Index: 2.0 K CAPE: 1000 J/ kg Showalter index: 2 Total totals Index: 1 K index: 2

MRD1412  Product Refresh Rate/Coverage Time: 60 min (15 min when 5 minute data available)

(CCR 01899) (CCR 02183 (RDW))

MRD1413  Mission Product Data Latency: 3 min

MRD1414  Product Measurement Precision: Lifted Index: 6.5 K CAPE: 2500 J/ kg Showalter index: 6.5 K Total totals Index: 4 K K index: 5 K

Temporal Coverage Qualifier: Day and Night

Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA

Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy

Product Statistics Qualifier: Over specified geographic coverage
3.3.3.4.9 Derived Stability Indices: Mesoscale

The GOES-R System shall produce a Derived Stability Indices: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

The following Derived Stability Indices are addressed by these five products.

**Lifted Index (LI) (Degrees Celsius):** The Lifted Index is calculated by lifting (frontal, orographic, upper air dynamics, etc.) a parcel of air dry adiabatically while conserving moisture until it reaches saturation. At that point the parcel is lifted moist adiabatically up to 500 mb. The Lifted Index is the ambient air temperature minus the lifted parcel temperature at 500 mb.

**Convective Available Potential Energy (CAPE, Joules/kg):** Convective Available Potential Energy, a measure of the cumulative buoyancy of a parcel as it rises, in units of Joules per kilogram. CAPE values larger than 1000 J/kg represent moderate amounts of atmospheric potential energy. Values exceeding 3000 J/kg are indicative of very large amounts of potential energy, and are often associated with strong/severe weather. Graphically, the CAPE is the positively buoyant area (shaded purple) on the skew-t diagram.

**Total Totals Index (TT):** The Total Totals Index is computed using discrete pressure level information and is indicative of severe weather potential. Its formula is: TT=(T850+TD850)-2(T500). Generally, TT values below 40-45 are indicators of little or no thunderstorm activity, while values exceeding 55 in the Eastern and Central United States or 65 in the Western United States are indicators of considerable severe weather, including the potential for tornadic activity.

**Showalter Index (SI):** The SI is a parcel-based index, calculated in the same manner as the Lifted Index, using a parcel at 850 mb. That is, the 850 mb parcel is lifted to saturation, then moist adiabatically to 500 mb. The difference between the parcel and environment at 500 mb is the Showalter Index.

**K index (KI):** The K-Index is a simple index using data from discrete pressure levels, instead of a lifted parcel. It is based on vertical temperature changes, moisture content of the lower atmosphere, and the vertical extent of the moist layer. The higher the K-Index the more conducive the atmosphere is to convection. The formula for KI is:

\[ KI = (T_{850 \text{ mb}} - T_{500 \text{ mb}}) + [(TD_{850 \text{ mb}} - (T_{700 \text{ mb}} - TD_{700 \text{ mb}})] \]

Where:

- \( T \) = Temperature

(same as CONUS product except this version provides mesoscale coverage)

**Product Geographic Coverage/Conditions:** Mesoscale
**Product Vertical Resolution:** N/A
**Product Horizontal Resolution:** 10 km
**Product Mapping Accuracy:** 2 km (CCR 03195(RDW))
**Product Measurement Range:** Lifted Index: -10 K - 40 K CAPE: 0-5000 J/kg Showalter index: >4 to -10 K Total totals Index: -43 to > 56 K index: 0 - 40
**Product Measurement Accuracy:** Lifted Index: 2.0 K CAPE: 1000 J/kg Showalter index: 2 Total totals Index: 1 K index: 2
**Product Refresh Rate/Coverage Time:** 5 min
**Mission Product Data Latency:** 5 min
**Product Measurement Precision:** Lifted Index: 6.5 K CAPE: 2500 J/kg Showalter index: 6.5 K Total totals Index: 4 K K index: 5 K
3.3.3.4.10 Total Precipitable Water: CONUS (CCR 01214)

The GOES-R System shall produce a Total Precipitable Water: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Total Precipitable Water is the amount of atmospheric water vapor contained in a vertical column of unit cross-sectional area, subdivided by height when more than column measurements are made.

(Product Geographic Coverage/Conditions: CONUS, Product Vertical Resolution: N/A, Product Horizontal Resolution: 10 km, Product Mapping Accuracy: 2 km (CCR 03195(RDW)), Product Measurement Range: 0 - 100 mm, Product Measurement Accuracy: 1 mm, Product Refresh Rate/Coverage Time: 30 min (5 min when 5 minute Full Disk data available), Mission Product Data Latency: 5 min (CCR 01798), Product Measurement Precision: 3 mm, Temporal Coverage Qualifier: Day and Night, Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy, Product Statistics Qualifier: Over specified geographic coverage)

3.3.3.4.11 Total Precipitable Water: Hemispheric

The GOES-R System shall produce a Total Precipitable Water: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Total Precipitable Water is the amount of atmospheric water vapor contained in a vertical column of unit cross-sectional area, subdivided by heights when more than column measurements are made.

(Product Geographic Coverage/Conditions: Full Disk, Product Vertical Resolution: N/A, Product Horizontal Resolution: 10 km, Product Mapping Accuracy: 2 km (CCR 03195(RDW)), Product Measurement Range: 0 - 100 mm, Product Measurement Accuracy: 1 mm, Temporal Coverage Qualifier: Day and Night, Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy, Product Statistics Qualifier: Over specified geographic coverage)
Product Refresh Rate/Coverage Time: 60 min (15 min when 5 minute data available) 
(CCR 01899) (CCR 02183 (RDW))

Mission Product Data Latency: 15 min

Product Measurement Precision: 3 mm

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage
(CCR 01892)

3.3.3.12 Total Precipitable Water: Mesoscale (CCR 01214)

The GOES-R System shall produce a Total Precipitable Water: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Total Precipitable Water is the amount of atmospheric water vapor contained in a vertical column of unit cross-sectional area, subdivided by height when more than column measurements are made.

(CCR 01214) (CCR 01543) (CCR 01542) (CCR 01631)

Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

Product Horizontal Resolution: 10 km

Product Mapping Accuracy: 2 km (CCR 03195(RDW))

Product Measurement Range: 0 - 100 mm

Product Measurement Accuracy: 1 mm

Product Refresh Rate/Coverage Time: 5 min

Mission Product Data Latency: 5 min

Product Measurement Precision: 3 mm

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA Threshold) and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions down to feature of interest associated with threshold accuracy

3.3.3.5 Radiances

3.3.3.5.1 Clear Sky Masks: CONUS

The GOES-R System shall produce a Clear Sky Masks: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Clear Sky Mask reports the location of the cloud free vertical columns of the atmosphere. It is the opposite of a cloud mask.

(CCR 01214) (CCR 01211) (CCR 01543) (CCR 01466) (CCR 01616) (CCR 01631)

Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A
3.3.3.5.2 Clear Sky Masks: Hemispheric

The GOES-R System shall produce a Clear Sky Masks: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Clear Sky Mask reports the location of the cloud free vertical columns of the atmosphere. It is the opposite of a cloud mask (same as CONUS product except this version provides larger coverage).

3.3.3.5.3 Clear Sky Masks: Mesoscale
The GOES-R System shall produce a Clear Sky Masks: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Clear Sky Mask reports the location of the cloud free vertical columns of the atmosphere. It is the opposite of a cloud mask (same as CONUS product except this version provides mesoscale coverage).

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions: Mesoscale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution: N/A</td>
</tr>
<tr>
<td>Product Horizontal Resolution: 2 km</td>
</tr>
<tr>
<td>Product Mapping Accuracy: 1 km</td>
</tr>
<tr>
<td>Product Measurement Range: Binary yes/no detection</td>
</tr>
<tr>
<td>Product Measurement Accuracy: 87% correct detection</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time: 5 min</td>
</tr>
<tr>
<td>Mission Product Data Latency: 5 min</td>
</tr>
<tr>
<td>Product Measurement Precision: N/A</td>
</tr>
</tbody>
</table>

Temporal Coverage Qualifier: Day and Night
Product ExtentQualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.5.4 Radiances: CONUS

The GOES-R System shall produce Radiances: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Radiances are the spectral radiance measurements resulting from observations of the atmosphere calibrated into units of mW/(m² µm sr) or mW/(m² cm⁻¹ sr).

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions: CONUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution: N/A</td>
</tr>
<tr>
<td>Product Horizontal Resolution: Individual channel resolutions (0.5 km, 1.0 km, and 2.0 km)</td>
</tr>
<tr>
<td>Product Mapping Accuracy: 1 km</td>
</tr>
<tr>
<td>Product Measurement Range: 180K-320K when converted to brightness temperature units</td>
</tr>
<tr>
<td>Product Measurement Accuracy: 1.0 K when converted to brightness temperature units for known emissivity</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)</td>
</tr>
<tr>
<td>Mission Product Data Latency: 5 min</td>
</tr>
<tr>
<td>Product Measurement Precision: 0.4 K when converted to brightness temperature units for known emissivity</td>
</tr>
</tbody>
</table>
3.3.3.5.5 Radiances: Hemispheric

The GOES-R System shall produce Radiances: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Radiances are the spectral radiance measurements resulting from observations of the atmosphere calibrated into units of mW/(m² μm sr) or mW/(m² cm⁻¹ sr) (same as CONUS product except this version provides larger coverage).

Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

Product Horizontal Resolution: Individual channel resolutions (0.5 km, 1.0 km, and 2.0 km) (CCR 02601(RDW))

Product Mapping Accuracy: 1 km (CCR 01764)

Product Measurement Range: 180K-320K

Mission Product Data Latency: 15 min

Product Measurement Precision: 0.4 K when converted to brightness temperature units for known emissivity

Temporal Coverage Qualifier: Day and Night

Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA

Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy

Product Statistics Qualifier: Over specified geographic coverage

3.3.3.5.6 Radiances: Mesoscale

The GOES-R System shall produce Radiances: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Radiances are the spectral radiance measurements resulting from observations of the atmosphere calibrated into units of mW/(m² μm sr) or mW/(m² cm⁻¹ sr) (same as CONUS product except this version provides mesoscale coverage).

Product Geographic Coverage/Conditions: Mesoscale

Product Vertical Resolution: N/A

Product Horizontal Resolution: Individual channel resolutions (0.5 km, 1.0 km, and 2.0 km) (CCR 02601(RDW))

Product Mapping Accuracy: 1 km (CCR 01764)

Product Measurement Range: 180K-320K
3.3.3.6 Radiation

3.3.3.6.1 Absorbed Shortwave Radiation: Surface/Mesoscale

The GOES-R System shall produce an Absorbed Shortwave Radiation: Surface/Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Absorbed Shortwave Radiation: Surface reports incoming solar radiation at wavelengths shorter than 4 microns absorbed by the surface of the earth.

Product Geographic Coverage/Conditions: Mesoscale (CCR 02183 (RDW))
Product Vertical Resolution: N/A (CCR 02183 (RDW))
Product Horizontal Resolution: 5 km (CCR 02183 (RDW))
Product Mapping Accuracy: 1.0 km (CCR 02183 (RDW))
Product Measurement Range: 0 - 1200 W/m² (CCR 02183 (RDW))
Product Measurement Accuracy: 90 W/m² at low value (100 W/m²); 45 W/m² at mid value (400 W/m²); 55 W/m² at high value (800 W/m²) (CCR 02183 (RDW))
Product Refresh Rate/Coverage Time: 60 min (CCR 02183 (RDW))
Mission Product Data Latency: 60 min (CCR 02183 (RDW))
Product Measurement Precision: 75 W/m² for low and high values (100 and 800 W/m²) and 95 W/m² for mid values (400 W/m²) (CCR 02183 (RDW))
Temporal Coverage Qualifier: Day
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW))

3.3.3.6.2 Downward Longwave Radiation: Surface/CONUS

The GOES-R System shall produce a Downward Longwave Radiation: Surface/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Downward Longwave Radiation: Surface reports the downward component of longwave radiation originating in emission by clouds and greenhouse gases impinging on the earth’s surface.

Product Geographic Coverage/Conditions: CONUS (CCR 01211) (CCR 01432A) (CCR 01542) (CCR 01617) (CCR 01631) (CCR 02183 (RDW))
3.3.3.6.3 Downward Longwave Radiation: Surface/Hemispheric

The GOES-R System shall produce a Downward Longwave Radiation: Surface/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Downward Longwave Radiation: Surface reports the downward component of longwave radiation originating in emission by clouds and greenhouse gases impinging on the earth’s surface (same as CONUS product except this version provides larger coverage).

(CC 01211) (CC 01432A) (CC 01542) (CC 01617) (CC 01631) (CC 02183 (RDW))

MRD274

Product Geographic Coverage/Conditions: Full Disk (CC 02183 (RDW))

Product Vertical Resolution: N/A (CC 02183 (RDW))

MRD1530

Product Horizontal Resolution: 25 km (CC 02183 (RDW))

MRD1531

Product Mapping Accuracy: 5 km (CC 02183 (RDW))

MRD1532

Product Measurement Range: 50 -750 W/m² (CC 02183 (RDW))

MRD1533

Product Measurement Accuracy: 25 W/m² (CC 01892) (CC 02183 (RDW))

MRD1534

Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CC 01899) (CC 02183 (RDW))

MRD1535

Mission Product Data Latency: 60 min (CC 02183 (RDW))

MRD1536

Product Measurement Precision: 20 W/m² (CC 01892) (CC 02183 (RDW))

Temporal Coverage Qualifier: Day and Night

Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA

Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy

Product Statistics Qualifier: Over specified geographic coverage (CC 02183 (RDW))
3.3.3.6.4 Downward Shortwave Radiation: Surface/CONUS \((CCR\ 01543)\)

MRD276 The GOES-R System shall produce a Downward Shortwave Radiation: Surface/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Downward Shortwave Radiation: Surface reports the incoming total solar radiation received at the earth’s surface from the components of the direct solar radiation and the diffuse sky.

\((CCR\ 01211)\) \((CCR\ 01543)\) \((CCR\ 01432A)\) \((CCR\ 01542)\) \((CCR\ 01631)\)

MRD1548 Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1550 Product Horizontal Resolution: 25 km

MRD1551 Product Mapping Accuracy: 2 km

MRD1552 Product Measurement Range: 0 -1500 W/m²

MRD1553 Product Measurement Accuracy: 85 W/m² at high end of range (1000 W/m²); 65 W/m² at typical value/midpoint (350 W/m²); 110 W/m² at low end of range (100 W/m²)

MRD1554 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available)

\((CCR\ 01899)\) \((CCR\ 02183 (RDW))\)

MRD1555 Mission Product Data Latency: 60 min

MRD1556 Product Measurement Precision: 100 W/m² for low and high values (100 and 1000 W/m²) and 130 for mid values (350 W/m²)

Temporal Coverage Qualifier: Day for SZA values greater than 25 degrees

Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA

Cloud Cover Conditions Qualifier: N/A

Product Statistics Qualifier: Over specified geographic coverage

3.3.3.6.5 Downward Shortwave Radiation: Surface/Hemispheric \((CCR\ 01543)\)

MRD278 The GOES-R System shall produce a Downward Shortwave Radiation: Surface/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Downward Shortwave Radiation: Surface reports the incoming total solar radiation received at the earth’s surface from the components of the direct solar radiation and the diffuse sky (same as CONUS product except this version provides larger coverage).

\((CCR\ 01211)\) \((CCR\ 01543)\) \((CCR\ 01432A)\) \((CCR\ 01542)\) \((CCR\ 01631)\)

MRD1558 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1560 Product Horizontal Resolution: 50 km

MRD1561 Product Mapping Accuracy: 4 km

MRD1562 Product Measurement Range: 0 -1500 W/m²

MRD1563 Product Measurement Accuracy: 85 W/m² at high end of range (1000 W/m²); 65 W/m² at typical value/midpoint (350 W/m²); 110 W/m² at low end of range (100 W/m²)
3.3.3.6.6 Downward Shortwave Radiation: Surface/Mesoscale (CCR 01543)

The GOES-R System shall produce a Downward Shortwave Radiation: Surface/Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Downward Shortwave Radiation: Surface reports the incoming total solar radiation received at the earth’s surface from the components of the direct solar radiation and the diffuse sky (same as CONUS product except this version provides mesoscale coverage).

(CCR 01211) (CCR 01543) (CCR 01432A) (CCR 01542) (CCR 01631)

3.3.3.7 Reflected Shortwave Radiation: TOA/CONUS (CCR 01543)

The GOES-R System shall produce a Reflected Shortwave Radiation: TOA/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Reflected Shortwave Radiation: TOA reports the solar irradiance reflected off the earth's surface back to the top of the atmosphere.

(CCR 01211) (CCR 01543) (CCR 01432A) (CCR 01542) (CCR 01631)
Product Vertical Resolution: N/A

MRD1580 Product Horizontal Resolution: 25 km

MRD1581 Product Mapping Accuracy: 2 km

MRD1582 Product Measurement Range: 0 -1300 W/m²

MRD1583 Product Measurement Accuracy: 85 W/m² at high end of range (1000 W/m²); 65 W/m² at typical value/midpoint (350 W/m²)

MRD1584 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available)

MRD1585 Mission Product Data Latency: 60 min

MRD1586 Product Measurement Precision: 100 W/m² for low and high values (100 and 1000 W/m²) and 130 for mid values (350 W/m²)

Temporal Coverage Qualifier: Day

Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1590 Product Horizontal Resolution: 25 km

MRD1591 Product Mapping Accuracy: 4 km

MRD1592 Product Measurement Range: 0 -1300 W/m²

MRD1593 Product Measurement Accuracy: 85 W/m² at high end of range (1000 W/m²); 65 W/m² at typical value/midpoint (350 W/m²)

MRD1594 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available)

MRD1595 Mission Product Data Latency: 60 min

MRD1596 Product Measurement Precision: 100 W/m² for low and high values (100 and 1000 W/m²) and 130 for mid values (350 W/m²)

Temporal Coverage Qualifier: Day

3.3.3.6.8 Reflected Shortwave Radiation: TOA/Hemispheric (CCR 01543)

The GOES-R System shall produce a Reflected Shortwave Radiation: TOA/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Reflected Shortwave Radiation: TOA reports the solar irradiance reflected off the earth's surface back to the top of the atmosphere (same as CONUS product except this version provides larger coverage).

(CCR 01211) (CCR 01348) (CCR 01543) (CCR 01432A) (CCR 01542) (CCR 01631)

MRD1588 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1590 Product Horizontal Resolution: 25 km

MRD1591 Product Mapping Accuracy: 4 km

MRD1592 Product Measurement Range: 0 -1300 W/m²

MRD1593 Product Measurement Accuracy: 85 W/m² at high end of range (1000 W/m²); 65 W/m² at typical value/midpoint (350 W/m²)

MRD1594 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available)

(CCR 01899) (CCR 02183 (RDW))

MRD1595 Mission Product Data Latency: 60 min

MRD1596 Product Measurement Precision: 100 W/m² for low and high values (100 and 1000 W/m²) and 130 for mid values (350 W/m²)

Temporal Coverage Qualifier: Day

Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA

Cloud Cover Conditions Qualifier: N/A

Product Statistics Qualifier: Over specified geographic coverage
3.3.3.6.9 Upward Longwave Radiation: Surface/CONUS

The GOES-R System shall produce an Upward Longwave Radiation: Surface/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: Surface reports outward longwave emitted radiation by the surface and atmosphere of the earth as reported for the surface of the earth. Climate variations can be measured from longer-term variations of upward longwave radiation: Surface/CONUS.

(CCR 01211) (CCR 01543) (CCR 01542) (CCR 01617) (CCR 01631) (CCR 02183 (RDW))

<table>
<thead>
<tr>
<th>Product</th>
<th>MRD Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Geographic Coverage/Conditions: CONUS (CCR 02183 (RDW))</td>
<td>MRD1598</td>
</tr>
<tr>
<td>Product Vertical Resolution: N/A (CCR 02183 (RDW))</td>
<td>MRD1600</td>
</tr>
<tr>
<td>Product Horizontal Resolution: 25 km (CCR 02183 (RDW))</td>
<td>MRD1601</td>
</tr>
<tr>
<td>Product Mapping Accuracy: 5 km (CCR 02183 (RDW))</td>
<td>MRD1602</td>
</tr>
<tr>
<td>Product Measurement Range: 50 - 900 W/m(^2) (CCR 02183 (RDW))</td>
<td>MRD1603</td>
</tr>
<tr>
<td>Product Measurement Accuracy: 30 W/m(^2)</td>
<td>MRD1604</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))</td>
<td>MRD1605</td>
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<tr>
<td>Mission Product Data Latency: 60 min (CCR 02183 (RDW))</td>
<td>MRD1606</td>
</tr>
<tr>
<td>Product Measurement Precision: 20 W/m(^2) (CCR 02183 (RDW))</td>
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<tr>
<td>Temporal Coverage Qualifier: Day and Night</td>
<td></td>
</tr>
<tr>
<td>Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA</td>
<td></td>
</tr>
<tr>
<td>Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy</td>
<td></td>
</tr>
<tr>
<td>Product Statistics Qualifier: Over specified geographic coverage</td>
<td></td>
</tr>
</tbody>
</table>

3.3.3.6.10 Upward Longwave Radiation: Surface/Hemispheric

The GOES-R System shall produce an Upward Longwave Radiation: Surface/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: Surface/CONUS reports outward longwave emitted radiation by the surface and atmosphere of the earth as reported for the surface of the earth. Climate variations can be measured from longer-term variations of upward longwave radiation: Surface/CONUS (same as CONUS product except this version provides larger coverage).

(CCR 01211) (CCR 01543) (CCR 01542) (CCR 01617) (CCR 01631) (CCR 02183 (RDW))

<table>
<thead>
<tr>
<th>Product</th>
<th>MRD Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Geographic Coverage/Conditions: Full Disk (CCR 02183 (RDW))</td>
<td>MRD1608</td>
</tr>
<tr>
<td>Product Vertical Resolution: N/A (CCR 02183 (RDW))</td>
<td>MRD1610</td>
</tr>
<tr>
<td>Product Horizontal Resolution: 100 km (CCR 02183 (RDW))</td>
<td>MRD1611</td>
</tr>
<tr>
<td>Product Mapping Accuracy: 5 km (CCR 02183 (RDW))</td>
<td>MRD1612</td>
</tr>
<tr>
<td>Product Measurement Range: 50 - 900 W/m(^2) (CCR 02183 (RDW))</td>
<td>MRD1613</td>
</tr>
<tr>
<td>Product Measurement Accuracy: 30 W/m(^2) (CCR 02183 (RDW))</td>
<td></td>
</tr>
</tbody>
</table>
3.3.3.6.11 Upward Longwave Radiation: TOA/CONUS

MRD290 The GOES-R System shall produce an Upward Longwave Radiation: TOA/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: TOA reports outward longwave emitted by the surface and atmosphere of the earth as observed at the top of the atmosphere. Climate variations can be measured from longer-term variations of upward longwave radiation: TOA.

(CCR 01211) (CCR 01432A) (CCR 01542) (CCR 01617) (CCR 01631) (CCR 02183 (RDW))

MRD168 Product Geographic Coverage/Conditions: CONUS (CCR 02183 (RDW))

Product Vertical Resolution: N/A (CCR 02183 (RDW))

MRD1620 Product Horizontal Resolution: 25 km (CCR 02183 (RDW))

MRD1621 Product Mapping Accuracy: 5 km (CCR 02183 (RDW))

MRD1622 Product Measurement Range: 50 - 450 W/m² (CCR 02183 (RDW))

MRD1623 Product Measurement Accuracy: 20 W/m² (CCR 02183 (RDW))

MRD1624 Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183 (RDW))

MRD1625 Mission Product Data Latency: 60 min (CCR 02183 (RDW))

MRD1626 Product Measurement Precision: 5 W/m² (CCR 02183 (RDW))

Temporal Coverage Qualifier: Day and Night

Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA

Cloud Cover Conditions Qualifier: N/A

Product Statistics Qualifier: Over specified geographic coverage (CCR 02183 (RDW))

3.3.3.6.12 Upward Longwave Radiation: TOA/Hemispheric

MRD292 The GOES-R System shall produce an Upward Longwave Radiation: TOA/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Upward Longwave Radiation: TOA reports outward longwave emitted by the surface and atmosphere of the earth as observed at the top of the atmosphere. Climate variations can be measured from longer-term variations of upward longwave radiation: TOA (same as CONUS product except this version provides larger coverage).

(CCR 01211) (CCR 01370) (CCR 01432A) (CCR 01542) (CCR 01617) (CCR 01631) (CCR 02183 (RDW))
3.3.3.7 Trace Gases

3.3.3.7.1 Ozone Total: CONUS

The GOES-R System shall produce an Ozone Total: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Ozone Total reports the abundance of ozone in the vertical column in terms of Dobson units, which are the number of molecules of ozone in the vertical column normalized by the neutral density under standard temperature and pressure (0.1 atm-cm = 100 DU).

\[(CCR\ 01211)\ (CCR\ 01543)\ (CCR\ 01482)\ (CCR\ 01542)\ (CCR\ 01631)\ (CCR\ 02183(RDW))\]

Product Geographic Coverage/Conditions: CONUS (CCR 02183(RDW))
Product Vertical Resolution: Total Column (CCR 02183(RDW))
Product Horizontal Resolution: 10 km (CCR 02183(RDW))
Product Mapping Accuracy: 5 km (CCR 02183(RDW))
Product Measurement Range: 100 - 650 DU (where 1 DU = 2.7 x 10^{16} \text{ mol/cm}^2) (CCR 02183(RDW))
Product Measurement Accuracy: 15 Dobson Units (CCR 02183(RDW))
Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183(RDW))
Mission Product Data Latency: 5 min (CCR 02183(RDW))
Product Measurement Precision: 25 DU (CCR 02183(RDW))
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: N/A
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.7.2 Ozone Total: Hemispheric

MRD297 The GOES-R System shall produce an Ozone Total: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Ozone Total reports the abundance of ozone in the vertical column in terms of Dobson units, which are the number of molecules of ozone in the vertical column normalized by the neutral density under standard temperature and pressure (0.1 atm-cm = 100 DU) (same as CONUS product except this version provides larger coverage).

(Product Geographic Coverage/Conditions: Full Disk (CCR 02183(RDW))
Product Vertical Resolution: Total Column (CCR 02183(RDW))
Product Horizontal Resolution: 10 km (CCR 02183(RDW))
Product Mapping Accuracy: 5 km (CCR 02183(RDW))
Product Measurement Range: 100 - 650 DU (where 1 DU = 2.7 x 10^{16} mol/cm^2) (CCR 02183(RDW))
Product Measurement Accuracy: 15 Dobson Units (CCR 02183(RDW))
Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183(RDW))
Mission Product Data Latency: 5 min (CCR 02183(RDW))
Product Measurement Precision: 25 DU (CCR 02183(RDW))

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.3.7.3 SO2 Detection

MRD299 The GOES-R System shall produce an SO2 Detection product in accordance with the requirements and qualifiers provided in the product table below.

SO2 Detection only reports regions of high sulfuric acid above a threshold value. SO2 is produced anthropogenically (coal-fired power plants and other fossil fuel combustion) and naturally (volcanic eruptions).

(Product Geographic Coverage/Conditions: Full Disk (CCR 02183(RDW))
Product Vertical Resolution: Total Column (CCR 02183(RDW))
Product Horizontal Resolution: 2 km (CCR 02183(RDW))
Product Mapping Accuracy: 1 km (CCR 02183(RDW))
Product Measurement Range: Binary yes/no detection from 10 - 700 Dobson Units (DU) (CCR 02183(RDW))

Product Measurement Accuracy: 70% correct detection (CCR 02183(RDW))

Product Refresh Rate/Coverage Time: 60 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183(RDW))

Mission Product Data Latency: 15 min (CCR 02183(RDW))

Product Measurement Precision: N/A (CCR 02183(RDW))

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage (CCR 01728) (CCR 02183(RDW))

3.3.3.8 Winds

3.3.3.8.1 Derived Motion Winds: CONUS

The GOES-R System shall produce a Derived Motion Winds: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Derived Motion Winds report atmospheric winds resulting from tracking features in satellite water vapor and longwave and shortwave IR window channels measurements. These are designated as ‘water vapor’ and ‘cloud drift’ (or ‘cloud motion vector’) winds respectively.

(CCR 01214) (CCR 01211) (CCR 01543) (CCR 01420A) (CCR 01542) (CCR 01612) (CCR 01631)

Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: Cloud Motion Vector Winds: At cloud tops; Clear-Sky Water Vapor Winds: 200 mb

Product Horizontal Resolution: 38 km (CCR 01892)

Product Mapping Accuracy: 5 km

Product Measurement Range: Speed: 5.83-300 kts (3-155 m/s), Direction: 0 to 360 degrees (CCR 01892)

Product Measurement Accuracy: Mean Vector Difference: 7.5 m/s

Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available) (CCR 01899) (CCR 02183(RDW))

Mission Product Data Latency: 3 min (CCR 01899) (CCR 02183(RDW))

Product Measurement Precision: Mean Vector Difference: 4.2 m/s (CCR 01892)

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage (CCR 01728) (CCR 02183(RDW))

3.3.3.8.2 Derived Motion Winds: Hemispheric

The GOES-R System shall produce a Derived Motion Winds: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.
Derived Motion Winds report atmospheric winds resulting from tracking features in satellite water vapor and longwave and shortwave IR window channels measurements. These are designated as ‘water vapor’ and ‘cloud drift’ (or ‘cloud motion vector’) winds respectively (same as CONUS product except this version provides larger coverage).

**MRD1678**  
Product Geographic Coverage/Conditions: Full Disk

**MRD1679**  
Product Vertical Resolution: Cloud Motion Vector Winds: At cloud tops; Clear-Sky Water Vapor Winds: 200 mb

**MRD1680**  
Product Horizontal Resolution: 38 km (CCR 01892)

**MRD1681**  
Product Mapping Accuracy: 5 km

**MRD1682**  
Product Measurement Range: Speed: 5.83-300 kts (3-155 m/s), Direction: 0 to 360 degrees (CCR 01892)

**MRD1683**  
Product Measurement Accuracy: Mean Vector Difference: 7.5 m/s

**MRD1684**  
Product Refresh Rate/Coverage Time: 60 min (based on a single set of 3 sequential images 5 or more minutes apart) (15 min updated when set of 5 minute Full Disk data available) (CCR 01899) (CCR 02183(RDW))

**MRD1685**  
Mission Product Data Latency: 3 min (CCR 01899) (CCR 02183(RDW))

**MRD1686**  
Product Measurement Precision: Mean Vector Difference: 4.2 m/s (CCR 01892)

**3.3.3.8.3 Derived Motion Winds: Mesoscale**

**MRD306**  
The GOES-R System **shall** produce a Derived Motion Winds: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Derived Motion Winds report atmospheric winds resulting from tracking features in satellite water vapor and longwave and shortwave IR window channels measurements. These are designated as ‘water vapor’ and ‘cloud drift’ (or ‘cloud motion vector’) winds respectively (same as CONUS product except this version provides mesoscale coverage).

**MRD1688**  
Product Geographic Coverage/Conditions: Mesoscale

**MRD1689**  
Product Vertical Resolution: Cloud Motion Vector Winds: At cloud tops; Clear-Sky Water Vapor Winds: 200 mb

**MRD1690**  
Product Horizontal Resolution: 38 km (CCR 01892)

**MRD1691**  
Product Mapping Accuracy: 5 km

**MRD1692**  
Product Measurement Range: Speed: 5.83-300 kts (3-155 m/s), Direction: 0 to 360 degrees (CCR 01892)

**MRD1693**  
Product Measurement Accuracy: Mean Vector Difference: 7.5 m/s

**MRD1694**  
Product Refresh Rate/Coverage Time: 5 min

**MRD1695**  
Mission Product Data Latency: 3 min (CCR 01899) (CCR 02183(RDW))
MRD1696  Product Measurement Precision: Mean Vector Difference: 4.2 m/s (CCR 01892)

Temporal Coverage Qualifier: Day and Night  
Product Extent Qualifier: Quantitative out to at least 62 degrees LZA and qualitative at larger LZA  
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy  
Product Statistics Qualifier: Over specified geographic coverage

3.3.4 Land Products Tables (GOES-R Baseline)

3.3.4.1 Fire/Hot Spot Characterization

3.3.4.1.1 Fire/Hot Spot Characterization: CONUS

The GOES-R System shall produce a Fire/Hot Spot Characterization: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

The fire/hot spot characterization product provides a fire mask indicating the location of active fires, saturated pixels, opaque cloud coverage, and processing block-out zones. Sub-pixel fire characterization is provided for non-saturated, clear-sky, active fire pixels (where subpixels assessments are made with pixel values). Fire characterization will consist of instantaneous sub-pixel estimates of fire size and temperature and fire radiative power. Information about pixels with saturated detector samples are used for processing.

(CCR 01211) (CCR 01377) (CCR 01542) (CCR 01618) (CCR 01631)

MRD1698  Product Geographic Coverage/Conditions: CONUS

Product Vertical Resolution: N/A

MRD1700  Product Horizontal Resolution: 2 km

MRD1701  Product Mapping Accuracy: 1 km

MRD1702  Product Measurement Range: 275 - 400 K for pixel brightness temperature for 3.9 µm channel; 600 – 1200 K for fire temperature; 0.004 - 4 km² for fire size; 75 – 50000 MW for fire radiative power (CCR 01975)

MRD1703  Product Measurement Accuracy: 2.0 K within dynamic range

MRD1704  Product Refresh Rate/Coverage Time: 5 min

MRD1705  Mission Product Data Latency: 5 min

MRD1706  Product Measurement Precision: 2 K

Temporal Coverage Qualifier: Day and Night  
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA  
Cloud Cover Conditions Qualifier: If feature is obscured by thick clouds, product will not meet threshold measurement accuracy  
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.1.2 Fire/Hot Spot Characterization: Hemispheric
MRD312 The GOES-R System shall produce a Fire/Hot Spot Characterization: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

The fire/hot spot characterization product provides a fire mask indicating the location of active fires, saturated pixels, opaque cloud coverage, and processing block-out zones. Sub-pixel fire characterization is provided for non-saturated, clear-sky, active fire pixels (where subpixels assessments are made with pixel values). Fire characterization will consist of instantaneous sub-pixel estimates of fire size and temperature and fire radiative power. Information about pixels with saturated detector samples are used for processing (same as CONUS product except this version provides larger coverage).

(CC 01211) (CCR 01377) (CCR 01542) (CCR 01618) (CCR 01631)

MRD1708 Product Geographic Coverage/Conditions: Full Disk

Product Vertical Resolution: N/A

MRD1710 Product Horizontal Resolution: 2 km

MRD1711 Product Mapping Accuracy: 1 km

MRD1712 Product Measurement Range: 275 - 400 K for pixel brightness temperature for 3.9 µm channel

MRD1713 Product Measurement Accuracy: 2.0 K within dynamic range

MRD1714 Product Refresh Rate/Coverage Time: 15 min (5 min when 5 minute Full Disk data available)

(CC 01899) (CCR 02183(RDW))

MRD1715 Mission Product Data Latency: 5 min (CCR 01899) (CCR 02183(RDW))

MRD1716 Product Measurement Precision: 2.0 K

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 65 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: If feature is obscured by thick clouds, product will not meet threshold measurement accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.2 Flood/Standing Water

3.3.4.2.1 Flood/Standing Water: Hemispheric

The GOES-R System shall produce a Flood/Standing Water: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Flood/Standing Water reports significant areas of accumulation of water over areas that are not usually submerged, namely with 5 cm vertical depth or greater.

(CC 01213) (CCR 01211) (CCR 01316) (CCR 01543) (CCR 01377) (CCR 01542) (CCR 01618)(CCR 01631)(CCR 02183(RDW))

MRD1718 Product Geographic Coverage/Conditions: Full Disk (CCR 02183(RDW))

Product Vertical Resolution: N/A (CCR 02183(RDW))

MRD1720 Product Horizontal Resolution: 10 km (CCR 02183(RDW))

MRD1721 Product Mapping Accuracy: 5 km (CCR 02183(RDW))

MRD1722 Product Measurement Range: Binary yes/no detection of water accumulation over 5 cm vertical depth (CCR 02183(RDW))
3.3.4.2 Flood/Standing Water: Mesoscale

The GOES-R System **shall** produce a Flood/Standing Water: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Flood/Standing Water reports significant areas of accumulation of water over areas that are not usually submerged, namely with 5 cm vertical depth or greater (same as hemispheric product except this version provides mesoscale coverage).

(CC R 01213) (CC R 01211) (CC R 01316) (CC R 01543) (CC R 01377) (CC R 01542) (CC R 01618) (CC R 01631) (CC R 02183(RDW))

3.3.4.3 Ice Cover (CC R 01543)

3.3.4.3.1 Ice Cover: Hemispheric (CC R 01543)
The GOES-R System shall produce an Ice Cover: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Ice Cover product reports the location of ice over frozen inland lakes, rivers, and open waters.

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions: Full Disk (CCR 02183(RDW))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution: N/A (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Horizontal Resolution: 2 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Mapping Accuracy: 1 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Range: Binary yes/no detection (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Accuracy: 85% correct detection (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time: 180 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Mission Product Data Latency: 24 hr (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Precision: N/A (CCR 02183(RDW))</td>
</tr>
</tbody>
</table>

Temporal Coverage Qualifier: Day with Sun at less than 67 degrees solar zenith angle and night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.4 Land Surface (Skin) Temperature

3.3.4.4.1 Land Surface (Skin) Temperature: CONUS

The GOES-R System shall produce a Land Surface (Skin) Temperature: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Land surface temperature is defined as the skin temperature of the uppermost layer of the land surface. In the event of heavy vegetation where the emission from the ground is not detected, the temperature is defined as the top of canopy temperature. To determine a physical surface temperature instead of an effective surface temperature, the surface emissivity must be known or determined in advance of the surface temperature calculation. In the event of ice covering the land (here including inland lakes and rivers), the temperature is defined at the ice surface instead of the land (here including inland lakes and rivers) surface.

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions: CONUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution: N/A</td>
</tr>
<tr>
<td>Product Horizontal Resolution: 2 km</td>
</tr>
<tr>
<td>Product Mapping Accuracy: 1 km</td>
</tr>
<tr>
<td>Product Measurement Range: 213 - 330 K</td>
</tr>
<tr>
<td>Product Measurement Accuracy: 2.5 K with known emissivity, known atmospheric correction, and 80% channel correlation; 5 K otherwise</td>
</tr>
</tbody>
</table>
3.3.4.4.2 Land Surface (Skin) Temperature: Hemispheric

The GOES-R System shall produce a Land Surface (Skin) Temperature: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Land surface temperature is defined as the skin temperature of the uppermost layer of the land surface. In the event of heavy vegetation where the emission from the ground is not detected, the temperature is defined as the top of canopy temperature. To determine a physical surface temperature instead of an effective surface temperature, the surface emissivity must be known or determined in advance of the surface temperature calculation. In the event of ice covering the land (here including inland lakes and rivers), the temperature is defined at the ice surface instead of the land (here including inland lakes and rivers) surface. (same as CONUS product except this version provides larger coverage).

Product Geographic Coverage/Conditions: Full Disk
Product Vertical Resolution: N/A
Product Horizontal Resolution: 10 km
Product Mapping Accuracy: 5 km
Product Measurement Range: 213 - 333 K
Product Measurement Accuracy: 2.5 K with known emissivity, known atmospheric correction, and 80% channel correlation; 5 K otherwise
Product Refresh Rate/Coverage Time: 60 min
Mission Product Data Latency: 3 min (CCR 01899) (CCR 02183(RDW))
Product Measurement Precision: 2.3 K
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.4.3 Land Surface (Skin) Temperature: Mesoscale

The GOES-R System shall produce a Land Surface (Skin) Temperature: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Land surface temperature is defined as the skin temperature of the uppermost layer of the land surface. In the event of heavy vegetation where the emission from the ground is not detected, the temperature is defined as the top of canopy temperature. To determine a physical surface temperature instead of an effective surface temperature, the surface emissivity must be known or determined in advance of the surface temperature calculation. In the event of ice covering the land (here including inland lakes and rivers), the temperature is defined at the ice surface instead of...
the land (here including inland lakes and rivers) surface. (same as CONUS product except this version provides mesoscale coverage).

\( (CCR\ 01211)\ (CCR\ 01317)\ (CCR\ 01542)\ (CCR\ 01618)\ (CCR\ 01631)\ (CCR\ 01818) \)

MRD1768  **Product Geographic Coverage/Conditions**: Mesoscale

**Product Vertical Resolution**: N/A

MRD1770  **Product Horizontal Resolution**: 2 km

MRD1771  **Product Mapping Accuracy**: 1 km

MRD1772  **Product Measurement Range**: 213 - 330 K

MRD1773  **Product Measurement Accuracy**: 2.5 K with known emissivity, known atmospheric correction, and 80% channel correlation; 5 K otherwise

MRD1774  **Product Refresh Rate/Coverage Time**: 60 min

MRD1775  **Mission Product Data Latency**: 3 min \( (CCR\ 01899) \)

MRD1776  **Product Measurement Precision**: 2.3 K

**Temporal Coverage Qualifier**: Day with Sun at 67 degree solar zenith angle

**Product Extent Qualifier**: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA

**Cloud Cover Conditions Qualifier**: Clear conditions associated with threshold accuracy

**Product Statistics Qualifier**: Over specified geographic coverage

### 3.3.4.5 Snow Cover/Depth

#### 3.3.4.5.1 Snow Cover: CONUS

MRD330  The GOES-R System **shall** produce a Snow Cover: CONUS product in accordance with the requirements and qualifiers provided in the product table below. Snow Cover reports the fractional area covered by snow in each reported product pixel.

\( (CCR\ 01211)\ (CCR\ 01316)\ (CCR\ 01543)\ (CCR\ 01421)\ (CCR\ 01542)\ (CCR\ 01618)\ (CCR\ 01631)(CCR\ 02415\ (RDW)) \)

MRD1778  **Product Geographic Coverage/Conditions**: CONUS

**Product Vertical Resolution**: N/A

MRD1780  **Product Horizontal Resolution**: 2 km

MRD1781  **Product Mapping Accuracy**: 1 km

MRD1782  **Product Measurement Range**: 0.0 - 1.0 fractional cover

MRD1783  **Product Measurement Accuracy**: 0.30

MRD1784  **Product Refresh Rate/Coverage Time**: 60 min

MRD1785  **Mission Product Data Latency**: 60 min

MRD1786  **Product Measurement Precision**: 0.15 \( (CCR\ 01892) \)
3.3.4.5.2 Snow Cover: Hemispheric

The GOES-R System shall produce a Snow Cover: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Snow Cover reports the fractional area covered by snow in each reported product pixel (same as CONUS product except this version provides larger coverage).

Product Geographic Coverage/Conditions: Full Disk
Product Vertical Resolution: N/A
Product Horizontal Resolution: 2 km
Product Mapping Accuracy: 1 km
Product Measurement Range: 0.0 - 1.0 fractional cover
Product Measurement Accuracy: 0.30
Product Refresh Rate/Coverage Time: 60 min
Mission Product Data Latency: 60 min
Product Measurement Precision: 0.15 (CCR 01892)

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

3.3.4.5.3 Snow Cover: Mesoscale

The GOES-R System shall produce a Snow Cover: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Snow Cover reports the fractional area covered by snow in each reported product pixel (same as CONUS product except this version provides mesoscale coverage).

Product Geographic Coverage/Conditions: Mesoscale
Product Vertical Resolution: N/A
Product Horizontal Resolution: 2 km
Product Mapping Accuracy: 1 km
Product Measurement Range: 0.0 - 1.0 fractional cover
### 3.3.4.5.4 Snow Depth (over Plains): CONUS

The GOES-R System **shall** produce a Snow Depth (over Plains): CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Snow Depth (over Plains) refers to the depth of snow over regions covered with tall grasses, where snow depth can be sensed.

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions:</th>
<th>CONUS / Tall Grassy Plains Only (CCR 02183(RDW))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution:</td>
<td>N/A (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Horizontal Resolution:</td>
<td>2 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Mapping Accuracy:</td>
<td>1 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Range:</td>
<td>0 - 27 cm (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Accuracy:</td>
<td>9 cm (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time:</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Mission Product Data Latency:</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Precision:</td>
<td>15 cm (CCR 02183(RDW))</td>
</tr>
</tbody>
</table>

Temporality Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

### 3.3.4.5.5 Snow Depth (over Plains): Hemispheric

The GOES-R System **shall** produce a Snow Depth (over Plains): Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Snow Depth (over Plains) refers to the depth of snow over regions covered with tall grasses, where snow depth can be sensed (same as CONUS product except this version provides larger coverage).

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions:</th>
<th>Full Disk / Tall Grassy Plains Only (CCR 02183(RDW))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution:</td>
<td>N/A (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Horizontal Resolution:</td>
<td>2 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Mapping Accuracy:</td>
<td>1 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Range:</td>
<td>0 - 27 cm (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Accuracy:</td>
<td>9 cm (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time:</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Mission Product Data Latency:</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Precision:</td>
<td>15 cm (CCR 02183(RDW))</td>
</tr>
</tbody>
</table>

Temporality Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

(CCR 01211) (CCR 01316) (CCR 01543) (CCR 01421) (CCR 01542) (CCR 01618) (CCR 01631)(CCR 02183(RDW))
MRD1820  Product Vertical Resolution: N/A (CCR 02183(RDW))

MRD1821  Product Horizontal Resolution: 2 km (CCR 02183(RDW))

MRD1822  Product Mapping Accuracy: 1 km (CCR 02183(RDW))

MRD1823  Product Measurement Range: 0 - 27 cm (CCR 02183(RDW))

MRD1824  Product Measurement Accuracy: 9 cm (CCR 02183(RDW))

MRD1825  Product Refresh Rate/Coverage Time: 60 min (CCR 02183(RDW))

MRD1826  Mission Product Data Latency: 60 min (CCR 02183(RDW))

MRD1830  Product Mapping Precision: 15 cm (CCR 02183(RDW))

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

(Product Geography Coverage/Conditions: Mesoscale / Tall Grassy Plains Only (CCR 02183(RDW))

MRD340  The GOES-R System shall produce a Snow Depth (over Plains): Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Snow Depth (over Plains) refers to the depth of snow over regions covered with tall grasses, where snow depth can be sensed (same as CONUS product except this version provides mesoscale coverage).

(Product Geography Coverage/Conditions: Mesoscale / Tall Grassy Plains Only (CCR 02183(RDW))

MRD1828  Product Vertical Resolution: N/A (CCR 02183(RDW))

MRD1830  Product Horizontal Resolution: 2 km (CCR 02183(RDW))

MRD1831  Product Mapping Accuracy: 1 km (CCR 02183(RDW))

MRD1832  Product Measurement Range: 0 - 27 cm (CCR 02183(RDW))

MRD1833  Product Measurement Accuracy: 9 cm (CCR 02183(RDW))

MRD1834  Product Refresh Rate/Coverage Time: 60 min (CCR 02183(RDW))

MRD1835  Mission Product Data Latency: 60 min (CCR 02183(RDW))

MRD1836  Product Mapping Precision: 15 cm (CCR 02183(RDW))

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage

(Product Geography Coverage/Conditions: Mesoscale / Tall Grassy Plains Only (CCR 02183(RDW))

3.3.4.6 Surface Albedo/Emissivity

3.3.4.6.1 Surface Albedo: Hemispheric
### The GOES-R System shall produce a Surface Albedo: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Surface Albedo reports the ratio of the amount of incoming radiation to the amount of reflected radiation often computed as a proxy using the visible band.

(CCR 01211) (CCR 01316) (CCR 01349) (CCR 01542) (CCR 01618) (CCR 01631)(CCR 02183 (RDW))

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions</th>
<th>Full Disk (CCR 02183(RDW))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution</td>
<td>N/A (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Horizontal Resolution</td>
<td>2 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Mapping Accuracy</td>
<td>2 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Range</td>
<td>0 - 1 Albedo Units (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Accuracy</td>
<td>0.08 (Albedo units) (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Mission Product Data Latency</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Mission Product Data Latency</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
</tbody>
</table>

#### Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle  
#### Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA  
#### Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy  
#### Product Statistics Qualifier: Over specified geographic coverage (CCR 02183(RDW))

### 3.3.4.6.2 Surface Emissivity

The GOES-R System shall produce a Surface Emissivity product in accordance with the requirements and qualifiers provided in the product table below.

The ratio of the radiation emitted by a surface to the radiation emitted by a perfect blackbody radiator at the same temperature.

(CCR 01213) (CCR 01211) (CCR 01316) (CCR 01543) (CCR 01542) (CCR 01618) (CCR 01631)(CCR 02183 (RDW))

<table>
<thead>
<tr>
<th>Product Geographic Coverage/Conditions</th>
<th>CONUS (CCR 02183(RDW))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Vertical Resolution</td>
<td>N/A (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Horizontal Resolution</td>
<td>10 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Mapping Accuracy</td>
<td>5 km (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Range</td>
<td>0.85 - 1.0 (unitless) (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Measurement Accuracy</td>
<td>0.05 (unitless) (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Product Refresh Rate/Coverage Time</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
<tr>
<td>Mission Product Data Latency</td>
<td>60 min (CCR 02183(RDW))</td>
</tr>
</tbody>
</table>
3.3.4.7 Vegetation Fraction/Index

3.3.4.7.1 Vegetation Fraction: Green: CONUS (CCR 01892)

The GOES-R System shall produce a Vegetation Fraction: Green: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Vegetative Fraction: Green reports the unitless fraction of green vegetation occupying each pixel.

Product Geographic Coverage/Conditions: CONUS (CCR 02183(RDW))
Product Vertical Resolution: N/A (CCR 02183(RDW))
Product Horizontal Resolution: 2 km (CCR 02183(RDW))
Product Mapping Accuracy: 1 km (CCR 02183(RDW))
Product Measurement Range: 0.0 - 1.0 (unitless) (CCR 02183(RDW))
Product Measurement Accuracy: 0.10 (SZA < 55 degrees), and 0.20 (55 degrees < SZA < 70 degrees) (CCR 01892) (CCR 02183(RDW))
Product Refresh Rate/Coverage Time: 60 min (CCR 02183(RDW))
Mission Product Data Latency: 60 min (CCR 02183(RDW))
Product Measurement Precision: 0.10 (SZA < 55 degrees), and 0.20 (55 degrees < SZA < 70 degrees) (CCR 01892) (CCR 02183(RDW))
Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle
Product Extent Qualifier: Quantitative out to at least 55 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage (CCR 01892) (CCR 02183(RDW))

3.3.4.7.2 Vegetation Fraction: Green: Hemispheric (CCR 01867A)

The GOES-R System shall produce a Vegetation Fraction: Green: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Vegetative Fraction: Green reports the unitless fraction of green vegetation occupying each pixel.

Product Geographic Coverage/Conditions: Full Disk (CCR 01867A)
Product Vertical Resolution: N/A (CCR 01867A)
Product Horizontal Resolution: 2 km (CCR 01867A)
**3.3.4.7.3 Vegetation Index: CONUS**

The GOES-R System shall produce a Vegetation Index: CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Vegetative Index reports the state of growth (biomass greenness) in units of Normalized Difference Vegetation Index (NDVI).

(CCR 01211) (CCR 01316) (CCR 01542) (CCR 01618) (CCR 01631) (CCR 02183(RDW))

**Product Geographic Coverage/Conditions:** CONUS (CCR 02183(RDW))

**Product Vertical Resolution:** N/A (CCR 02183(RDW))

**Product Horizontal Resolution:** 2 km (CCR 02183(RDW))

**Product Mapping Accuracy:** 1 km (CCR 02183(RDW))

**Product Measurement Range:** 0 - 1 (NDVI units) (CCR 02183(RDW))

**Product Measurement Accuracy:** 0.04 NDVI Units (CCR 02183(RDW))

**Product Refresh Rate/Coverage Time:** 60 min (CCR 02183(RDW))

**Mission Product Data Latency:** 60 min (CCR 02183(RDW))

**Product Measurement Precision:** 0.04 NDVI units (CCR 02183(RDW))

Temporal Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle  
Product Extent Qualifier: Quantitative out to at least 70 degrees LZA and qualitative at larger LZA  
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy  
Product Statistics Qualifier: Over specified geographic coverage

(CCR 02183(RDW))

**3.3.4.7.4 Vegetation Index: Hemispheric (CCR 01867A)**

The GOES-R System shall produce a Vegetation Index: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.
Vegetative Index reports the state of growth (biomass greenness) in units of Normalized Difference Vegetation Index (NDVI).

(CCR 01867A)

**MRD2182**  
**Product Geographic Coverage/Conditions:** Full Disk (CCR 01867A)

**Product Vertical Resolution:** N/A (CCR 01867A)

**MRD2184**  
**Product Horizontal Resolution:** 2 km (CCR 01867A)

**MRD2185**  
**Product Mapping Accuracy:** 1 km (CCR 01867A)

**MRD2186**  
**Product Measurement Range:** 0 - 1 (NDVI units) (CCR 01867A)

**MRD2187**  
**Product Measurement Accuracy:** 0.04 NDVI Units (CCR 01867A)

**MRD2188**  
**Product Refresh Rate/Coverage Time:** 60 min (CCR 01867A)

**MRD2189**  
**Mission Product Data Latency:** 60 min (CCR 01867A)

**MRD2190**  
**Product Measurement Precision:** 0.04 NDVI units (CCR 01867A)

Temoral Coverage Qualifier: Sun at less than 67 degree daytime solar zenith angle  
**Product Extent Qualifier:** Quantitative out to at least 70 degrees LZA and qualitative at larger LZA  
**Cloud Cover Conditions Qualifier:** Clear conditions associated with threshold accuracy  
**Product Statistics Qualifier:** Over specified geographic coverage

(CCR 01867A)

### 3.3.5 Ocean Products Tables (GOES-R Baseline)

#### 3.3.5.1 Currents

**3.3.5.1.1 Currents: Hemispheric**

**MRD354**  
The GOES-R System **shall** produce a **Currents**: Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Currents product reports large-scale movements of the surface waters of the ocean.

(CCR 01211) (CCR 01543) (CCR 01542) (CCR 01620) (CCR 01631) (CCR 02183(RDW))

**MRD1878**  
**Product Geographic Coverage/Conditions:** Full Disk (CCR 02183(RDW))

**MRD1879**  
**Product Vertical Resolution:** Surface (CCR 02183(RDW))

**MRD1880**  
**Product Horizontal Resolution:** 2 km (CCR 02183(RDW))

**MRD1881**  
**Product Mapping Accuracy:** 1 km (CCR 02183(RDW))

**MRD1882**  
**Product Measurement Range:** 0 to 2 m/s (0-7.2 km/hr), 0 to 360 degrees (CCR 02183(RDW))

**MRD1883**  
**Product Measurement Accuracy:** 1 km/hr (0.3 m/sec) in both meridional and zonal directions (CCR 01892) (CCR 02183(RDW))

**MRD1884**  
**Product Refresh Rate/Coverage Time:** 6 hr (CCR 02183(RDW))

**MRD1885**  
**Mission Product Data Latency:** 60 min (CCR 02183(RDW))
3.3.5.1.2 Currents: Mesoscale

The GOES-R System shall produce a Currents: Mesoscale product in accordance with the requirements and qualifiers provided in the product table below.

Currents product reports large-scale movements of the surface waters of the ocean (same as Hemispheric product except this version provides mesoscale coverage).

Product Geographic Coverage/Conditions: Mesoscale (CCR 02183(RDW))
Product Vertical Resolution: Surface (CCR 02183(RDW))
Product Horizontal Resolution: 2 km (CCR 02183(RDW))
Product Mapping Accuracy: 1 km (CCR 02183(RDW))
Product Measurement Precision: 1 km/hr (0.3 m/sec) in both meridional and zonal directions (CCR 02183(RDW))
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183(RDW))

3.3.5.1.3 Currents: Offshore/CONUS

The GOES-R System shall produce a Currents: Offshore/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Currents: Offshore product reports large-scale movements of the surface waters of the ocean for the US Exclusive Economic Zone and CONUS waters.

Product Geographic Coverage/Conditions: CONUS and US navigable waters through EEZ (CCR 02183(RDW))
Product Vertical Resolution: Surface (CCR 02183(RDW))
Product Horizontal Resolution: 2 km (CCR 02183(RDW))
Product Mapping Accuracy: 1 km (CCR 02183(RDW))

Product Measurement Range: 0 to 7.2 km/hr (CCR 01798) (CCR 02183(RDW))

Product Measurement Accuracy: 1 km/hr (0.3 m/sec) in both meridional and zonal directions (CCR 01798) (CCR 01892) (CCR 02183(RDW))

Product Refresh Rate/Coverage Time: 180 min (CCR 02183(RDW))

Mission Product Data Latency: 60 min (CCR 02183(RDW))

Product Measurement Precision: 1 km/hr (0.3 m/sec) in both meridional and zonal directions (CCR 01798) (CCR 01892) (CCR 02183(RDW))

Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183(RDW))

3.3.5.1.4 Currents: Offshore/Hemispheric

The GOES-R System shall produce a Currents: Offshore/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Currents: Offshore product reports large-scale movements of the surface waters of the ocean for the US Exclusive Economic Zone and CONUS waters (same as CONUS product except this version provides larger coverage).

Product Geographic Coverage/Conditions: Full Disk (CCR 02183(RDW))
Product Vertical Resolution: Surface (CCR 02183(RDW))
Product Horizontal Resolution: 2 km (CCR 02183(RDW))
Product Mapping Accuracy: 1 km (CCR 02183(RDW))
Product Measurement Range: 0 to 7.2 km/hr (CCR 01798)/CCR 02183(RDW))
Product Measurement Accuracy: 1 km/hr (0.3 m/sec) in both meridional and zonal directions (CCR 01798) (CCR 01892) (CCR 02183(RDW))
Product Refresh Rate/Coverage Time: 180 min (CCR 02183(RDW))
Mission Product Data Latency: 60 min (CCR 02183(RDW))
Product Measurement Precision: 1 km/hr (0.3 m/sec) in both meridional and zonal directions (CCR 01798) (CCR 01892) (CCR 02183(RDW))
Temporal Coverage Qualifier: Day and Night
Product Extent Qualifier: Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
Cloud Cover Conditions Qualifier: Clear conditions associated with threshold accuracy
Product Statistics Qualifier: Over specified geographic coverage (CCR 02183(RDW))

3.3.5.2 Sea and Lake Ice

3.3.5.2.1 Sea and Lake Ice: Age/Hemispheric
The GOES-R System **shall** produce a Sea and Lake Ice: Age/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Age classifies ice cover by duration. Ice older than first year ice is thicker and more ridged and can be more hazardous to ships. Older ice can be less reflective due to dirt and soot accumulation and can also be melt-water covered if at polar regions during high-sun months.

**(CCR 01211) (CCR 01316) (CCR 01421) (CCR 01542) (CCR 01543) (CCR 01618) (CCR 01631)(CCR 02183 (RDW))**

**3.3.5.2.2 Sea and Lake Ice: Concentration/CONUS**

The GOES-R System **shall** produce a Sea and Lake Ice: Concentration/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Concentration reports the fraction (in tenths) of the sea or lake surface covered by ice. Total concentration includes all stages of development that are present. The concentration of sea ice varies within the ice pack due to deformation, new ice development, melting, and motion.

**(CCR 01211) (CCR 01316) (CCR 01421) (CCR 01542) (CCR 01543) (CCR 01618) (CCR 01631)(CCR 02183 (RDW))**
3.3.5.2.3 Sea and Lake Ice: Concentration Hemispheric

The GOES-R System shall produce a Sea and Lake Ice: Concentration/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Concentration reports the fraction (in tenths) of the sea or lake surface covered by ice. Total concentration includes all stages of development that are present. The concentration of sea ice varies within the ice pack due to deformation, new ice development, melting, and motion (same as CONUS product except this version provides Hemispheric coverage).

(CCR 01211) (CCR 01316) (CCR 01421) (CCR 01542) (CCR 01618) (CCR 01631) (CCR 02183(RDW))

3.3.5.2.4 Sea and Lake Ice: Motion/CONUS

The GOES-R System shall produce a Sea and Lake Ice: Motion/CONUS product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Motion reports the instantaneous measurement of the direction and magnitude of the movement of the ice.

(CCR 01211) (CCR 01316) (CCR 01543) (CCR 01421) (CCR 01542) (CCR 01618) (CCR 01631) (CCR 02183(RDW))
3.3.5.2.5 Sea and Lake Ice: Motion/Hemispheric

The GOES-R System shall produce a Sea and Lake Ice: Motion/Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea and Lake Ice: Motion reports the instantaneous measurement of the direction and magnitude of the movement of the ice (same as CONUS product except this version provides larger coverage).

3.3.5.3 Sea Surface Temperature

3.3.5.3.1 Sea Surface Temperature (skin): Hemispheric (CCR 01543)
The GOES-R System shall produce a Sea Surface Temperature (skin) Hemispheric product in accordance with the requirements and qualifiers provided in the product table below.

Sea Surface Temperature (skin) reports the skin temperature of the ocean at depths on the order of 10 microns.

(CCR 01211) (CCR 01543) (CCR 01542) (CCR 01620) (CCR 01631)

- **Product Geographic Coverage/Conditions:** Full Disk
- **Product Vertical Resolution:** N/A
- **Product Horizontal Resolution:** 2 km
- **Product Mapping Accuracy:** 1 km
- **Product Measurement Range:** 271 - 313 K
- **Product Measurement Accuracy:** 2.1 K with known emissivity, known atmospheric correction, and 80% channel correlation; 3.1 K otherwise
- **Product Refresh Rate/Coverage Time:** 60 min (5 min when 5 minute Full Disk data available)

**Mission Product Data Latency:** 15 min

**Product Measurement Precision:** 1.0 K

**Temporal Coverage Qualifier:** Day and Night
**Product Extent Qualifier:** Quantitative out to at least 67 degrees LZA and qualitative at larger LZA
**Cloud Cover Conditions Qualifier:** Clear conditions associated with threshold accuracy
**Product StatisticsQualifier:** Over specified geographic coverage

### 3.3.6 Space and Solar Products Tables (GOES-R Baseline)

#### 3.3.6.1 Energetic Particles

#### 3.3.6.1.1 Energetic Heavy Ions

The GOES-R System shall produce an Energetic Heavy Ions product in accordance with the requirements provided in the product table below.

Energetic Heavy Ions reports measurements of energetic heavy ions.

(CCR 01211) (CCR 01542) (CCR 01631) (CCR 01633)

- **Product Orthogonality/Coverage:** 1 direction
- **Product Horizontal/Angular Resolution:** N/A
- **Product Pointing/Mapping Accuracy:** N/A
- **Product Pointing Knowledge/Mapping Uncertainty:** N/A
- **Product Measurement Range:** 10 -200 MeV/n 5 mass groups: H, He, (C,N,O), Ne-S, & Fe

(CCR 01731)

- **Product Measurement Accuracy:** 25% when flux level above background is greater than 10 times minimum flux; 45% when flux level above background is between minimum flux and 10 times minimum flux (N/A when SEISS is operated during spacecraft storage) (CCR 01725) (CCR 02129)
3.3.6.1.2 Magnetospheric Electrons and Protons: Low Energy

The GOES-R System shall produce a Magnetospheric Electrons and Protons: Low Energy product in accordance with the requirements provided in the product table below.

Magnetospheric Electrons and Protons: Low Energy reports measurements of low energy magnetospheric electrons and protons.

Product Orthogonality/Coverage: 5 directions

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

Product Pointing Knowledge/Mapping Uncertainty: N/A

Product Measurement Range: Electron and Protons: 30 eV - 30 keV

Product Measurement Accuracy: 25% when flux level above background is greater than 10 times minimum flux; 45% when flux level above background is between minimum flux and 10 times minimum flux (N/A when SEISS is operated during spacecraft storage) (CCR 01725) (CCR 02129)

Product Refresh Rate/Coverage Time: 30 sec

Mission Product Data Latency: 1 min, except during Spacecraft storage mode after SEISS operation is requested wherein latency is 36 hours (CCR 01503A)

Product Measurement Precision: Flux values associated with 10 counts above background in 5-min interval (N/A when SEISS is operated during spacecraft storage) (CCR 02129) (CCR 03074(RDW)) (CCR 03377 (RDW))

3.3.6.1.3 Magnetospheric Electrons and Protons: Medium and High Energy

The GOES-R System shall produce a Magnetospheric Electrons and Protons: Medium and High Energy product in accordance with the requirements provided in the product table below.

Magnetospheric Electrons and Protons: Medium and High Energy reports measurements of medium and high energy magnetospheric electrons and protons.

Product Orthogonality/Coverage: 5 directions

Product Horizontal/Angular Resolution: N/A

Product Pointing/Mapping Accuracy: N/A

Product Pointing Knowledge/Mapping Uncertainty: N/A

Product Measurement Range: Electrons: 50 keV - 4 MeV Protons: 80 keV - 10 MeV (CCR 01731)

Product Measurement Accuracy: 25% when flux level above background is greater than 10 times minimum flux; 45% when flux level above background is between minimum flux and 10 times minimum flux (N/A when SEISS is operated during spacecraft storage) (CCR 01725) (CCR 02129)
3.3.6.1.4 Solar and Galactic Protons

The GOES-R System shall produce a Solar and Galactic Protons product in accordance with the requirements provided in the product table below.

Solar and Galactic Protons reports measurements of solar energetic protons and galactic cosmic ray protons.

3.3.6.2 Magnetic Field

3.3.6.2.1 Geomagnetic Field

The GOES-R System shall produce a Magnetic Field product in accordance with the requirements provided in the product table below.

Geomagnetic Field reports measurements of earth's magnetic field and its variations at geosynchronous orbit.
3.3.6.3 Solar

3.3.6.3.1 Solar Flux: EUV

The GOES-R System shall produce a Solar Flux: EUV product in accordance with the requirements provided in the product table below.

Solar Flux: EUV reports measurements of the disk-integrated solar extreme ultraviolet flux.

(CCR 01211) (CCR 01542) (CCR 01631)

3.3.6.3.2 Solar Flux: X-Ray

The GOES-R System shall produce a Solar Flux: X-Ray product in accordance with the requirements provided in the product table below.

Solar Flux: X-Ray reports measurements of the disk-integrated solar X-ray flux.

(CCR 01211) (CCR 01542) (CCR 01631)
Product Horizontal/Angular Resolution: N/A
Product Pointing/Mapping Accuracy: N/A

MRD2036
Product Pointing Knowledge/Mapping Uncertainty: ± 2 arcmin

MRD2037
Product Measurement Range: XRSA: \(5 \times 10^{-9}\) to \(5 \times 10^{-4}\) W/m² XRSB: \(2 \times 10^{-8}\) to \(2 \times 10^{-3}\) W/m²

MRD2038
Product Measurement Accuracy: ± 20% at 20 times the specified minimum flux (CCR 01888)

MRD2039
Product Refresh Rate/Coverage Time: 3 sec (CCR 01888)

MRD2040
Mission Product Data Latency: 5 sec (CCR 01888)

MRD2041
Product Measurement Precision: 2% (CCR 01888)

MRD2042
Long-Term Stability: < 5% over mission, or ability to track changes

3.3.6.3.3 Solar Imagery: EUV (CCR 02662)

MRD400
The GOES-R System shall produce a Solar Imagery: EUV product in accordance with the requirements provided in the product table below.

Solar Imagery: EUV reports solar images in the EUV region.

(CCR 01211) (CCR 01542) (CCR 01630) (CCR 01631) (CCR 02662)

MRD2043
Product Orthogonality/Coverage: 0.0-1.3 Solar Radii

MRD2044
Product Horizontal/Angular Resolution: 7.0 arcsec

MRD2045
Product Pointing/Mapping Accuracy: Pointing Accuracy: ± 3.0 arcmin (3 sigma) (N-S, E-W) of Sun Center; Stability during 60 seconds: ± 2.0 arcsec (1 sigma), ± 6.0 arcsec (3 sigma) (N-S, E-W)

MRD2046
Product Pointing Knowledge/Mapping Uncertainty: ± 2.5 arcsec

MRD2047
Product Measurement Range: Radiance: \(0.3-10^6\) ph/cm²/arcsec²/sec (CCR 01760) (CCR 03194(RDW))

MRD2048
Product Measurement Accuracy: ± 40% in radiance

MRD2049
Product Refresh Rate/Coverage Time: Image: < 2 min (CCR 01760)

MRD2050
Mission Product Data Latency: < 1 min

MRD2051
Product Measurement Precision: +/- 40% in radiance

MRD2052
Long-Term Stability: 30%

3.4 Space Segment Requirements

MRD54
The GOES-R Space Segment shall employ spacecraft with a reliability of at least 0.73 after 15 years.

Reliability is defined as the probability that each spacecraft performs its required functions over a fifteen year period (five years on-orbit storage plus ten years on-orbit operation). The required performance of the spacecraft includes all functionality required to produce KPP user products. (CCR 01546) (CCR 02115)

3.4.1 Spacecraft Payloads
The GOES-R System shall operate the following instrument and auxiliary communication payloads at each geosynchronous orbital location:

a) Advanced Baseline Imager (ABI)
b) EUVS XRS Irradiance Sensors (EXIS)
   1) Solar X-Ray Sensor (XRS)
   2) Extreme Ultraviolet Sensor (EUVS)
c) Solar Ultraviolet Imager (SUVI)
d) Space Environment In-Situ Suite (SEISS)
   1) Magnetospheric Particle Sensor (MPS)
   2) Energetic Heavy Ion Sensor (EHIS)
   3) Solar and Galactic Proton Sensor (SGPS)
e) Geostationary Lightning Mapper (GLM)
f) Magnetometer
g) Auxiliary Communication Services
   1) GOES Rebroadcast (GRB)
   2) High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN)
   3) Deleted
   4) Data Collection System (DCS)
   5) Search and Rescue (SAR)
h) CCOR (For GOES-U only)

Upon ground command, the GOES-R system shall downlink Magnetometer data and sub-sampled SEISS data in the telemetry stream. (CCR 01503A)

The GOES-R system shall make Level 0 data from the GOES-U CCOR available to users within 15 minutes. (CCR 03446)

3.4.2 Launch Vehicle Compatibility

The GOES-R Space Segment shall employ an Evolved Expendable Launch Vehicle (EELV) - Medium class for all launches. (CCR 02115)

3.4.3 Security

The GOES-R System shall encrypt Space Segment commands. (CCR 02115)

The GOES-R System shall decrypt encrypted Space Segment commands. (CCR 02115)

The GOES-R Space Segment shall respond to encrypted and to unencrypted commands. (CCR 02115)

3.4.4 Continuity (CCR 02115)

The GOES-R Space Segment shall operate on-orbit functions continuously during eclipse periods in geosynchronous orbit. (CCR 02115)

The GOES-R Space Segment shall meet Radiances product performance requirements during eclipse periods in geosynchronous orbit for all data acquired outside of instrument designated zones of reduced data quality. (CCR 02115) (CCR 02600)

3.4.4.1 Autonomous Operations

The GOES-R Space Segment shall autonomously provide real-time instrument data without command contact between Space and Ground segments for a period of 7 days. (CCR 02115)

3.4.5 Communications
The GOES-R Series Satellites - Summary of Parameters for NTIA Filing (as of 1-6-06) is provided in the table below for reference purposes only. (Note heading are those that are required for NTIA filing.)

<table>
<thead>
<tr>
<th>Function</th>
<th>Frequency (MHz)</th>
<th>Emission Designator</th>
<th>Station Class/Services</th>
<th>Direction</th>
<th>Main Power (Watts)</th>
<th>Average SPD (dBW/Hz)</th>
<th>Data Rate after coding (bps)</th>
<th>Receive Eys Temp.</th>
<th>Cooperating Earth Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCPC</td>
<td>468.825</td>
<td>88KG1D00C</td>
<td>EM/Metsat</td>
<td>S-E</td>
<td>10.0</td>
<td>-13.9</td>
<td>530</td>
<td>700</td>
<td>Worldwide</td>
</tr>
<tr>
<td>SAR</td>
<td>1544.550</td>
<td>100KG7D0F</td>
<td>EM/SS</td>
<td>S-E</td>
<td>10.0</td>
<td>-40.0</td>
<td>FDM Signal 120</td>
<td>Worldwide</td>
<td></td>
</tr>
<tr>
<td>CDA Tim 1</td>
<td>1572.000</td>
<td>84KG1D00C</td>
<td>EM/Metsat</td>
<td>S-E</td>
<td>6.0</td>
<td>-40.3</td>
<td>32k or 4k</td>
<td>100</td>
<td>Wallops CDA Goddard CDA</td>
</tr>
<tr>
<td>CDA Tim 2</td>
<td>1572.250</td>
<td>82KG1D00C</td>
<td>EM/Metsat</td>
<td>S-E</td>
<td>6.0</td>
<td>-31.2</td>
<td>32k or 4k</td>
<td>100</td>
<td>Wallops CDA Goddard CDA</td>
</tr>
<tr>
<td>CDA Tim 3</td>
<td>1572.500</td>
<td>83KG1D00C</td>
<td>EM/Metsat</td>
<td>S-E</td>
<td>6.0</td>
<td>-27.1</td>
<td>32k or 4k</td>
<td>100</td>
<td>Wallops CDA Goddard CDA</td>
</tr>
</tbody>
</table>

Notes:
1. Both Raw Data link options are shown with necessary bandwidth for QPSK modulation but power shown is that necessary for 8PSK modulation. No emission limiting filtering is included.
2. Both Raw Data link options assume 140 Mbps before FEC coding.
3. DCPC (was DCPI) link is CDMA direct sequence spread spectrum with a chip rate of 44.45 kHz. Necessary Bandwidth is 88.9 kHz.
4. All GRB link options are shown with power calculated for 8PSK modulation.
5. The Average PSD is simply the output power divided by the necessary bandwidth, as defined in the emission designation.
6. The X-band power levels were taken from Aerospace link analyses.
7. The L- and S-band power levels were taken from GOES N/P actuals, and scaled when necessary.
8. Guard bands required relative to IPO (NPOESS) use above 1698 MHz, and NESDIS (GOES) use below 1698 MHz to avoid RFI.
9. NOAA envisions a spec requiring the use of SRRC filters to allow NOAA to get the BW authorization necessary. NOAA requires out-of-band filtering.
10. NOAA envisions a spec for directional antenna focused on the CDA stations, which NOAA believes is necessary to get its authorization. Wallops is the prime GOES-R CDA station. Fairmont, WV is the remote backup (RBU).
11. NTIA oversees use of RF spectrum by all federal agencies.
12. Earth Exploration Satellite-Service (EESS) - a radio communication payload services between earth stations and one or more space stations. Per ITU definition, Metsats are a subset of EESS used for meteorological purposes.
13. ITU PFD limits for EESS and Metsat services must be met.
14. NESDIS is working to obtain operational X-band approval. If this fails it will attempt to obtain Ku (18.1-18.3 GHz) and/or Ka (25.5-27 GHz) operational approval.

3.4.5.1 Mission Space to Ground Communications

The GOES-R System shall maintain radio communication links between the Space and Ground Segments as defined in the SS to C3S IRD. (CCR 02115)

3.4.5.2 Auxiliary Communications Services

3.4.5.2.1 GOES Rebroadcast (GRB)

The GOES Rebroadcast data service provides GOES ground processed sensor data, other NWS products and related information to the weather research and Earth sciences community. The rebroadcast data for GOES-R is called GOES Rebroadcast (GRB).

The GRB link relays the GOES processed sensor data independently through the GOES-East and GOES-West satellites, and downlinks the data to the various GRB users. This system provides unidirectional broadcast link connectivity between the originating uplink from the NOAA Command and Data Acquisition Stations (CDAS) and a large number of outlying GRB Ground Terminals (GRBT) including NOAA's NWS and other research organizations.

3.4.5.2.2 Search and Rescue (SAR)

The SAR subsystem onboard each GOES satellite is a dedicated transponder that receives UHF distress signals broadcast by:

a) Emergency Locator Transmitters (ELTs) carried on aircraft
b) Emergency Position Indicating Radio Beacons (EPIRBs) aboard marine vessels
c) Personal Locator Beacons (PLB) used in land-based applications
d) System Beacons used for calibration and performance monitoring
e) Ship Security Alerting System (SSAS) beacons

The distress signals are relayed by the GOES-R satellite to a ground station located within the field of view of the satellite. The information is then ultimately passed to the rescue coordination center from where the help is dispatched.

3.4.5.2.3 Data Collection System (DCS)
The Data Collection System (DCS) provides predominately uplink and the capability for bidirectional link connectivity between a large number of outlying Data Collection Platforms (DCP) and the NOAA Command and Data Acquisition Stations (CDAS) and/or Direct Readout Ground Stations (DRGS). These DCPs are typically small remote monitoring stations used for the collection and reporting of near real-time environmental data.

The DCS data is provided through the satellite bent pipe transponders. These correspond to (1) the links required for the Data Collection Platforms (DCP’s) to provide reported data to the CDAS and other Direct Readout Ground Stations (DRGS) termed Data Collection Platform Report (DCPR) links and (2) an outbound polling link from the CDAS to the DCP’s termed the Data Collection Platform Interrogate (DCPI) link. The Data Collection Platform Report (DCPR) transponder supports the link from a large number of small data platforms in the DCS to the CDAS and other Direct Readout Ground Stations (DRGS). The Data Collection Platform Interrogate (DCPI) transponder supports a command link from the CDAS to selected platforms.

### 3.4.5.2.4 High Rate Information Transmission (HRIT) (CCR 01423)

In response to the World Meteorological Organization’s (WMO) recommendations for digital meteorological satellite broadcasts a new digital service called Low Rate Information Transmission (LRIT) will transition from the (analog) WEFAX format to the digital LRIT format for GOES-NOP. For the GOES-R series, the data rate will again increase and, to keep in agreement with international usage, the new digital service will be called High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN). The HRIT/EMWIN data stream is designed to contain digital images, temperature and moisture profile information, and other products including *in situ* observations, forecasts, analyses, and numeric model output.

The High Rate Information Transmission/Emergency Managers Weather Information Network (HRIT/EMWIN) service provides unidirectional broadcast link connectivity between the originating uplink from the NOAA Command and Data Acquisition Stations (CDAS) and a large number of outlying HRIT/EMWIN terminals. *(CCR 01423)*

### 3.4.5.2.5 Emergency Managers Weather Information Network (EMWIN)


The Emergency Managers Weather Information Network (EMWIN) data will be transmitted from the NOAA Command and Data Acquisition Stations (CDAS) at Wallops Island, Virginia (WCDAS) (or its backup) to the spacecraft for distribution to a large data user community. EMWIN data will be part of the High Rate Information Transmission and Emergency Managers Weather Information Network service. This system provides unidirectional broadcast link connectivity between the originating uplink from the CDAS and a large number of outlying ground EMWIN User Terminals (EUTs). *(CCR 01423)*

### 3.4.6 Software (CCR 02163)

The GOES-R System shall utilize open hardware and software standards. *(CCR 02115)*

### 3.4.7 Recovery after Spacecraft Maneuvers

The GOES-R Space Segment raw instrument measurement performance requirements shall not apply for up to three total hours per year per spacecraft due to on-orbit maneuvers. *(CCR 02115) (CCR 02166) (CCR 03353B (RDW))*

The GOES-R Space Segment shall produce Compact Coronagraph (CCOR) sensor data for coronal mass ejection observations with outages of less than 70 hours per year due to the Space Segment. *(CCR 03446)*

### 3.4.8 Observational Payloads

#### 3.4.8.1 Advanced Baseline Imager (ABI)

#### 3.4.8.1.1 Top Priority Imager Requirements
The following four requirements are considered to be the highest priority by NOAA’s National Weather Service for the imager:

a) Operation during eclipse and keep out zone periods

b) Meet “simultaneous” global/synoptic/mesoscale imaging needs

c) Improve the temporal resolution of the imager to address the scan modes below with concurrent image activities such as calibration, space looks, and any necessary star looks

1) Scan mode 3: Full Earth disk (stepped-edge acceptable) every 15-minutes; plus CONUS, or the equivalent of a nadir-viewed rectangle 5000 kilometers by 3000 kilometers in dimension, every 5 minutes and at least one 1000 by 1000 kilometer area (nadir) every 30 seconds.

2) Scan mode 4: Full Earth disk (stepped-edge acceptable) every 5-minutes.

d) Improve spatial resolution of the imager data by a factor of two

The GOES-R System Radiance product performance shall not apply in the immediate vicinity of the solar disk. (CCR 02115) (CCR 02166)

The GOES-R Space Segment shall acquire Earth images for each product coverage area in a cadence including simultaneous collection. (CCR 02115) (CCR 02166)

### 3.4.8.1.2 Imager Performance Summary

A summary of the imager requirements is provided in the ABI Performance Summary Table below and is intended as a quick reference guide only.
<table>
<thead>
<tr>
<th>Requirement Name and Source</th>
<th>Requirement Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spatial Resolution and Uniformity</strong></td>
<td></td>
</tr>
<tr>
<td>Visible (0.64 µm band)</td>
<td>0.5 km (14 µrad)</td>
</tr>
<tr>
<td>0.47 µm, 0.865 µm, and 1.61 µm bands</td>
<td>1.0 km (28 µrad)</td>
</tr>
<tr>
<td>1.378 µm and all bands &gt; 2 µm</td>
<td>2 km (56 µrad)</td>
</tr>
<tr>
<td><strong>Spatial Coverage</strong></td>
<td></td>
</tr>
<tr>
<td>Full disk</td>
<td>Scan Mode 6: 6 per hour</td>
</tr>
<tr>
<td></td>
<td>Scan Mode 4: 12 per hour</td>
</tr>
<tr>
<td></td>
<td>Scan Mode 3: 4 per hour</td>
</tr>
<tr>
<td>CONUS (3000 x 5000 km)</td>
<td>Scan Mode 6: 12 per hour</td>
</tr>
<tr>
<td></td>
<td>Scan Mode 4: no additional CONUSs</td>
</tr>
<tr>
<td></td>
<td>Scan Mode 3: 12 per hour</td>
</tr>
<tr>
<td>Mesoscale (1000 x 1000 km) when required</td>
<td>Scan Mode 6: Every 30 sec</td>
</tr>
<tr>
<td></td>
<td>Scan Mode 4: no additional mesoscales</td>
</tr>
<tr>
<td></td>
<td>Scan Mode 3: Every 30 sec</td>
</tr>
<tr>
<td><strong>Operation During Eclipse</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Simultaneity</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within 5 sec. for all bands at any FOV</td>
</tr>
<tr>
<td></td>
<td>Within 30 sec. for any adjacent (N/S) pixels</td>
</tr>
<tr>
<td></td>
<td>Within 15 sec. for any adjacent (E/W) pixels</td>
</tr>
<tr>
<td><strong>Number of Bands</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>Spectral Bands, Radiometric Sensitivity, Dynamic Range</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Navigation</strong></td>
<td>≤ 1.0 km (≤ 28 µrad)</td>
</tr>
<tr>
<td><strong>Registration within Frame</strong></td>
<td>≤ 1.0 km (≤ 28 µrad)</td>
</tr>
<tr>
<td><strong>Line-to-Line Registration</strong></td>
<td>≤ 0.25 km (at SSP) or ≤ 7 µrad</td>
</tr>
<tr>
<td><strong>Registration Image to Image</strong></td>
<td>≤ 0.75 km (at SSP) or ≤ 21 µrad for 0.5 km bands and 1.0 km bands</td>
</tr>
<tr>
<td></td>
<td>≤ 1.0 km (at SSP) or 28 µrad for 2.0 km bands</td>
</tr>
<tr>
<td><strong>Band to Band Co-Registration (pre-margining)</strong></td>
<td></td>
</tr>
<tr>
<td>0.5 km to 2.0 km bands</td>
<td>≤ 0.3 km (at SSP) or ≤ 8.4 µrad</td>
</tr>
<tr>
<td>2.0 km to 2.0 km bands</td>
<td>≤ 0.3 km (at SSP) or ≤ 8.4 µrad</td>
</tr>
<tr>
<td>0.5 km to 1.0 km bands</td>
<td>≤ 0.3 km (at SSP) or ≤ 7 µrad</td>
</tr>
<tr>
<td>1.0 km to 1.0 km bands</td>
<td>≤ 0.25 km (at SSP) or ≤ 7 µrad</td>
</tr>
<tr>
<td>1.0 km to 2.0 km bands</td>
<td>≤ 0.3 km (at SSP) or ≤ 8.4 µrad</td>
</tr>
<tr>
<td><strong>On-Orbit Calibration</strong></td>
<td></td>
</tr>
<tr>
<td>Visible and reflected solar &lt; 3 µm</td>
<td>Pre-launch to ±5%</td>
</tr>
<tr>
<td></td>
<td>On-board to ±3%</td>
</tr>
<tr>
<td></td>
<td>0.2% short-term repeatability</td>
</tr>
<tr>
<td>Emissive IR</td>
<td>0.2 K repeatability</td>
</tr>
<tr>
<td></td>
<td>1.0 K abs. Accuracy</td>
</tr>
<tr>
<td><strong>IR Band Linearity</strong></td>
<td>±1%</td>
</tr>
<tr>
<td><strong>Lifetime</strong></td>
<td></td>
</tr>
<tr>
<td>Ground Storage</td>
<td>5 years</td>
</tr>
<tr>
<td>On-Orbit Storage</td>
<td>5 years is max possible</td>
</tr>
<tr>
<td>Mean Mission Duration (MMD)</td>
<td>8.4 years</td>
</tr>
<tr>
<td>Instrument On life</td>
<td>10 years with R=0.6</td>
</tr>
</tbody>
</table>

(CCR 03006)

### 3.4.8.1.3 Lifetime

**MRD504** The GOES-R Space Segment shall employ an ABI instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage. (CCR 02115) (CCR 02163)
3.4.8.1.4 Types of Observations and Accuracies

The GOES-R Space Segment shall collect Earth imagery observations in bands meeting the properties given in the table below: *(Some portion of these requirements has been waived)* (CCR 01273) (CCR 01866) (CCR 02115) (CCR 02501 (RDW)) (CCR 02601(RDW)) (CCR 02923 (RDW)) (CCR 02924 (RDW))

### Radiometric Sensitivity and Dynamic Range Table

<table>
<thead>
<tr>
<th>Wavelength (µm)</th>
<th>NEdT @300K (K)</th>
<th>NEdT @240K (K)</th>
<th>NEdN, or SNR at 100% albedo (mW/m²/sr/cm⁻¹)</th>
<th>Tmin (K)</th>
<th>Tmax (K)</th>
<th>Rmax (mW/m²/sr/cm⁻¹)</th>
<th>Rmax /NEdN</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.47 ± 0.02</td>
<td>-</td>
<td>-</td>
<td>300:1</td>
<td>N/A</td>
<td>-</td>
<td>14.4</td>
<td>-</td>
</tr>
<tr>
<td>0.64 ± 0.05</td>
<td>-</td>
<td>-</td>
<td>300:1, except &lt; 1% smaller than 300:1 and greater than 150:1</td>
<td>N/A</td>
<td>-</td>
<td>21.1 (day) 1.05 (night)</td>
<td>-</td>
</tr>
<tr>
<td>0.865 ± 0.0195</td>
<td>-</td>
<td>-</td>
<td>300:1</td>
<td>N/A</td>
<td>-</td>
<td>22.8</td>
<td>-</td>
</tr>
<tr>
<td>1.378 ± 0.0075</td>
<td>-</td>
<td>-</td>
<td>300:1</td>
<td>N/A</td>
<td>-</td>
<td>21.7</td>
<td>-</td>
</tr>
<tr>
<td>1.61 ± 0.03</td>
<td>-</td>
<td>-</td>
<td>300:1</td>
<td>N/A</td>
<td>-</td>
<td>20.0</td>
<td>-</td>
</tr>
<tr>
<td>2.25 ± 0.25</td>
<td>-</td>
<td>-</td>
<td>300:1</td>
<td>N/A</td>
<td>-</td>
<td>12.1</td>
<td>-</td>
</tr>
<tr>
<td>3.9 ± 0.1</td>
<td>0.10 1.4</td>
<td>0.004</td>
<td>4 400</td>
<td>19.7</td>
<td>4925</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.185 ± 0.415</td>
<td>0.10 0.4</td>
<td>0.10</td>
<td>4 300</td>
<td>37</td>
<td>411</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.95 ± 0.2</td>
<td>0.10 0.37</td>
<td>0.09</td>
<td>4 300</td>
<td>67.3</td>
<td>1224</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.34 ± 0.1</td>
<td>0.10 0.32</td>
<td>0.055</td>
<td>4 320</td>
<td>116</td>
<td>892</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5 ± 0.2</td>
<td>0.10 0.27</td>
<td>0.13</td>
<td>4 330</td>
<td>161</td>
<td>947</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.61 ± 0.19</td>
<td>0.10 0.22</td>
<td>0.154</td>
<td>4 300</td>
<td>176</td>
<td>1035</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.35 ± 0.25</td>
<td>0.10 0.21</td>
<td>0.17</td>
<td>4 330</td>
<td>190</td>
<td>1118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.2 ± 0.4</td>
<td>0.10 0.19</td>
<td>0.17</td>
<td>4 330</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.3 ± 0.5</td>
<td>0.10 0.18</td>
<td>0.18</td>
<td>4 330</td>
<td>161</td>
<td>947</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.3 ± 0.3</td>
<td>0.30 0.48</td>
<td>0.53</td>
<td>4 305</td>
<td>150</td>
<td>283</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(CCR 01733)*

Due to the increased spatial resolution of the ABI, the temperature maximum for the 3.9 µm band will be at least 375 K to maintain the current (GOES-8 and GOES-M and beyond) fire detection capability.

The phenomena observed and the critical applications are described by band:

a) 0.47 µm band: Daytime aerosol-on-land/coastal water mapping.

b) Visible (0.64 µm band): Daytime cloud imaging; snow and ice cover; severe weather onset detection; low-level cloud drift winds; fog; smoke; volcanic ash; flash flood analyses, hurricane analysis; winter storm analysis.

c) 0.865 µm: Provides synergy with the AVHRR/3 and VIIRS, as the band is similar to band 2 on AVHRR/3 and matches the band center and bandwidth of a band of VIIRS. This band is used for determining vegetation amount, aerosols and ocean/land studies. Characterizing aerosols and their optical properties is essential for improving a number of satellite products, for example SST, ocean color and surface temperatures. This band also enables very localized vegetation stress monitoring, fire danger monitoring, and albedo retrieval.

d) 1.378 µm: Similar to a band on MODIS that sees into the lower troposphere due to water vapor sensitivity and thus it provides excellent daytime sensitivity to very thin cirrus. Bandwidth and band center matched to a VIIRS band. This will aid several products relying on clear skies in the infrared windows, for example SST. CIMSS work with MODIS data in this band has set the out-of-band signal level contamination.

e) 1.61 µm: Daytime cloud/snow/ice discrimination; total cloud cover; aviation weather analyses for icing; smoke from low-burn-rate fires.

f) 2.25 µm: Daytime land/cloud properties, particle size, and vegetation. Matches bandwidth and band center of a VIIRS band.
g) 3.9 µm: Fog and low-cloud discrimination at night; fire identification; volcanic eruption and ash; daytime reflectivity for snow/ice.

h) 6.185 µm: Upper-tropospheric water vapor tracking; jet stream identification; hurricane track forecasting; mid-latitude storm forecasting; severe weather analysis.

i) 6.95 µm: Middle-tropospheric water vapor tracking; mid-tropospheric flow tropical storm track prediction weather; winter storm analyses.

j) 7.34 µm: Lower tropospheric water vapor tracking and SO2 detection.

k) 8.5 µm: Allows for detection of volcanic cloud with sulfuric acid aerosols, thin cirrus in conjunction with the 11 µm band and determination of cloud micro-physical properties with the 11.2 and 12.3 µm bands. This includes a more accurate delineation of ice from water clouds during the day or night.

l) 9.61 µm: Total Ozone.

m) 10.35 µm: Allows for determination of micro-physical properties of clouds with the 11.2 and 12.3 µm bands. This includes a more accurate determination of cloud particle size during the day or night.

n) 11.2 µm: Continuous day/night cloud analyses for many general forecasting applications; precipitation estimates; severe weather analyses and prediction; cloud drift winds; hurricane strength and track analyses; cloud top heights; volcanic ash; fog (in multi-band products); winter storms; cloud phase/particle size (in multi-band products).

o) 12.3 µm: Continuous cloud monitoring for numerous applications; low-level moisture; volcanic ash trajectories; cloud particle size (in multi-band products).

p) 13.3 µm: Cloud top height assignments for cloud-drift winds; cloud products for ASOS supplement; tropopause delineation; cloud opacity.

The GOES-R Space Segment shall produce Radiance product observations with relative accuracy in each band within 1-σ of the noise of the same band for the following categories of relative error:
a) Swath to swath (where a swath is one traversal of the scan mirror in the east-west directions over the entire scene of interest)
b) Detector to detector
c) Channel to channel
d) Calibration to calibration. (CCR 02115)

(Some portion of these requirements has been waived) (CCR 01866) (CCR 02601(RDW))

3.4.8.1.5 Imager System Navigation

The GOES-R System shall navigate Radiance product observations with errors not to exceed 1.0 kilometer (3-σ) at SSP, except during eclipse. (CCR 02115)

The GOES-R System shall navigate Radiance product observations with errors not to exceed 1.5 kilometer (3-σ) at SSP, during eclipse. (CCR 02115)

3.4.8.1.6 Data Format

The GOES-R System Earth imagery product data samples shall have an angular separation that is half the spatial resolution of each band in both the East/West and North/South dimensions, centered on the SSP. (CCR 02115)

3.4.8.1.7 Co-Registration

The GOES-R System shall co-register Radiance product observations between spectral bands having 2.0 km spatial resolution with 99.73% absolute error of 0.4 km at SSP. (CCR 02115) (CCR 02166) (CCR 02600)

The GOES-R System shall co-register Radiance product observations between spectral bands having 2.0 km and 0.5 km spatial resolution with 99.73% absolute error of 0.4 km at SSP. (CCR 02115) (CCR 02166) (CCR 02600)
MRD531 The GOES-R System shall co-register Radiance product observations between spectral bands having 2.0 km and 1.0 km spatial resolution with 99.73% absolute error of 0.4 km at SSP. (CCR 02115) (CCR 02166) (CCR 02600)

MRD532 The GOES-R System shall co-register Radiance product observations between spectral bands having 1.0 km spatial resolution with error not to exceed 0.25 km at SSP. (CCR 02115) (CCR 02166)

MRD533 The GOES-R System shall co-register Radiance product observations between spectral bands having 1.0 km and 0.5 km spatial resolution with error not to exceed 0.25 km at SSP. (CCR 02115) (CCR 02166)

3.4.8.1.8 Pixel-to-Pixel Registration Within Frame

MRD535 The GOES-R System shall separate two Radiance product navigated data samples in the same band by a known fixed distance not to exceed 1.0 km at SSP (28 µrad). (CCR 02115) (CCR 02166)

MRD536 The GOES-R System shall register to 99.73% absolute error two adjacent Radiance product lines/swaths of navigated data samples by a known fixed distance of 0.28 km at SSP (7.84 µrad). (CCR 02115) (CCR 02166) (CCR 02600)

3.4.8.1.9 Frame-to-Frame Registration

MRD538 The GOES-R System shall register the same Radiance product sample location in two consecutive products ("frame-to-frame registration") within 0.75 km at SSP (21 µrad) for spectral bands with 0.5 km and 1.0 km spatial resolution. (CCR 02115) (CRR 02166)

MRD539 The GOES-R System shall register the same Radiance product sample location in two consecutive products ("frame-to-frame registration") within 1.0 km at SSP (28 µrad) for spectral bands with 2.0 km spatial resolution. (CCR 02115) (CCR 02166)

3.4.8.1.10 Data Simultaneity

MRD541 The GOES-R Space Segment shall acquire coincident Radiance product measurements of the same Earth location for all spectral bands within 5 seconds. (CCR 02115)

MRD542 The GOES-R Space Segment shall acquire adjacent Radiance product North/South samples within 30 seconds. (CCR 02115) (CCR 02166)

MRD543 The GOES-R Space Segment shall acquire adjacent Radiance product East/West measurements within 15 seconds for at least 99.5% of samples. (CCR 02115) (CCR 02166)

3.4.8.1.11 Full Operations

MRD545 The GOES-R Space Segment shall experience Radiance product measurement non-compliance time following on-orbit maneuvers not to exceed 30 minutes per maneuver. (CCR 02115)

3.4.8.1.12 Reflected Solar Calibration

MRD2120 The GOES-R System shall provide calibrated Radiances product measurements for the solar reflective channels to within an absolute accuracy of 5%. (CCR 02115)

MRD2121 The GOES-R System shall provide calibrated Radiances product measurements for the solar reflective channels with relative deviations (short-term repeatability) less than 0.2% (1-σ). (CCR 02115)

MRD2122 The GOES-R System shall provide calibrated Radiances product measurements for the solar reflective channels with deviations (long-term drift) less than 1.5%. (CCR 02115)

3.4.8.1.13 Emissive Infrared Calibration

Radiometric accuracy of the ABI system should be independent of scan position (or location of the target in the field of regard).
The GOES-R System shall provide calibrated Radiances product measurements for the emissive infrared channels to within a precision of 0.2 K. (CCR 02166)

3.4.8.1.14 Low-Light Imager

The GOES-R System shall relieve Radiance product performance for all low light visible samples acquired when any point on the Earth falls within 10 degrees of the sun, as viewed from the operational location. (CCR 02115)

The GOES-R Space Segment shall produce Radiance product observations in low light (5% albedo) conditions in the 0.64 micron band at a 50:1 SNR. (Some portion of this requirement has been waived.) (CCR 01733) (CCR 02166) (CCR 02588 (RDW))

3.4.8.2 EUVS XRS Irradiance Sensors (EXIS)

The XRS near-real-time calibrated data product (Level 1b data) algorithm consists of the following operations: background subtraction; application of gain; and application of responsivity to convert to irradiance units; and inclusion of a 1-AU correction factor that is supplied with the data, but not applied. No geometric coordinate transformation is applied.

(CCR 01491)

The EUVS near-real-time calibrated data product algorithm (Level 1b proxy algorithm) consists of the following operations: application of gain and linearity corrections; background and scattered light subtraction; application of responsivity to convert to irradiance units; determination of modeled irradiance product; and inclusion of a 1-AU correction factor that is supplied with the data, but not applied. Note that no geometric coordinate transformation is applied.

(CCR 01492)

The GOES-R Space Segment shall employ an EXIS instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage.

(CCR 02115)

3.4.8.2.1 Extreme Ultraviolet Sensor (EUVS)

The GOES-R System shall constrain Solar Flux: EUV product long term stability (over the life of the mission) to be less than 5% or have the ability to track changes over mission. (CCR 02115)

The GOES-R System shall measure and track the Solar Flux: EUV product out of band signal if greater than 10%. (CCR 02115)

The GOES-R Space Segment shall constrain Solar Flux: EUV product spatial response variation not to exceed +/- 5% from uniformity. (CCR 02115)

The GOES-R System shall produce a Solar Flux: EUV product for wavelengths from 5 to 127 nm. (CCR 02166)

Full instrument calibration is required before launch. NIST assets will be brought to bear as appropriate.

3.4.8.2.2 X-Ray Sensor (XRS)

The GOES-R Space Segment shall report Solar Flux: X-ray product flux levels throughout solar X-ray flares events. (CCR 02115)

The GOES-R Space Segment Solar Flux: X-ray product shall report flux levels throughout quiet solar activity periods. (CCR 02115)

The GOES-R System shall measure and track Solar Flux: X-ray product out of band signal if greater than 10%. (CCR 02115)

The GOES-R System Solar Flux: X-ray product mean signal shall be greater than the standard deviation of the data over a 10-minute interval for the Product Measurement Range minimum. (CCR 02115) (CCR 02166)
3.4.8.3 Solar UltraViolet Imager (SUVI)

The SUVI near-real-time calibrated data product (Level 1b data) algorithm consists of the following operations: application of gain and signal linearity corrections; background subtraction; vignetting corrections; bad pixel corrections (not including cosmic rays); flat fielding; conversion to incident photon flux; application of fixed conversion to radiance; and with time tag, S/C position, and S/C attitude information appended to enable conversion to heliographic coordinate system. (CCR 01490)

The GOES-R Space Segment shall employ a SUVI instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage. (CCR 02115)

The GOES-R Space Segment shall collect Solar imagery observations in channels given in the table below:

<table>
<thead>
<tr>
<th>SUVI Spectral Bands Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe XVIII</td>
</tr>
<tr>
<td>Fe VIII</td>
</tr>
<tr>
<td>Fe IX</td>
</tr>
<tr>
<td>Fe XII</td>
</tr>
<tr>
<td>Fe XV</td>
</tr>
<tr>
<td>He II</td>
</tr>
</tbody>
</table>

(CCR 01301) (CCR 01424) (CCR 02115)

The GOES-R System shall detect radiance variations of at least 0.1% in the Solar Imagery: X-Ray product observations. (CCR 02115)

The GOES-R Space Segment shall have gaps of not greater than 2 minutes in duration in the Solar Imagery: X-Ray product observations. (CCR 02115)

The GOES-R System shall time tag the Solar Imagery: X-ray product with Universal Time with 1.0 msec accuracy (1-σ). (CCR 02115)

Full instrument calibration is required before launch. NIST assets will be brought to bear as appropriate.

3.4.8.4 Space Environment In-Situ Suite (SEISS)

SEISS Level 1b data consist of output from algorithms that convert count rate to flux per energy range, direction, and species; correct out-of-band response using SEISS data only; correct observing direction to produce invariance to yaw flip (i.e. the northernmost (westernmost) measurement would always be expressed as from the northernmost (westernmost) telescope system, regardless of yaw flip), and include dosimeter measurements for higher level product processing. (CCR 01489) (CCR 01839)

The GOES-R Space Segment shall employ a SEISS instrument suite with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years for each instrument, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on-orbit storage for each instrument. (CCR 01633) (CCR 01731) (CCR 02115)

3.4.8.4.1 Stability

The GOES-R Space Segment shall measure Energetic Heavy Ions, Solar Galactic Protons and Magnetospheric Electrons and Protons: Medium and High Energy products where energies greater than 30 keV shall have a temporal uncertainty in the energy bandwidth less than 3%. (CCR 02115)
The GOES-R Space Segment shall measure a Magnetospheric Electrons and Protons: Low Energy product where energies less than or equal to 30 keV have a temporal uncertainty in the energy bandwidth less than 3%. (CCR 02115) (CCR 02416 (RDW)) (CCR 03376 (RDW))

3.4.8.4.2 In-Flight Calibration

The GOES-R Space Segment shall determine the Magnetospheric Electrons and Protons: Medium and High Energy, Energetic Heavy Ions and Solar Galactic Protons product precision energy uncertainty due to sensor hardware to within ±3%. (CCR 02115)

The GOES-R Space Segment shall determine the Magnetospheric Electrons and Protons: Low Energy product precision energy uncertainty due to sensor hardware to within ±3%. (CCR 02115)

3.4.8.4.3 Contaminants

Correction algorithms for out-of-band response may be provided if necessary to comply with the out of band response requirement.

3.4.8.5 Geostationary Lightning Mapper (GLM)

The lightning measurements will be related on a continuous basis to other observable data, such as radar returns, cloud images, and other meteorological variables.

The GOES-R Space Segment shall employ a GLM instrument that will detect lightning in an area spanned by a 100 degree (east-west) by 100 degree (north-south) rectangle, centered at the SSP. (CCR 02115)

The GOES-R System shall navigate Lightning Detection: Hemispheric product observations with errors not to exceed 5.0 km (3-σ) at SSP. (CCR 02115)

The GOES-R System shall register the same Lightning Detection: Hemispheric product sample location in two consecutive products ("frame-to-frame registration") within 5.0 km at SSP over 1 second. (CCR 01621) (CCR 02115)

The GOES-R Space Segment shall measure the Lightning Detection: Hemispheric product detection of valid lightning events using rapid optical pulses. (CCR 02115)

The GOES-R System shall constrain the Lightning Detection: Hemispheric product to contain no more than a 5% false positive lightning event rate. (CCR 02115)

The GOES-R Space Segment shall employ a GLM instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on orbit storage. (CCR02115) (CCR 02163)

3.4.8.5.1

3.4.8.6 Magnetometer

3.4.8.6.1 General Magnetometer Requirements

The GOES-R Space Segment shall employ a Magnetometer instrument with an 8.4 year Mean Mission Duration (MMD) at the end of 10 years, or equivalently a reliability of 0.6 after 10 years of on-orbit operations, preceded by up to 5 years of ground storage and up to 5 years of on orbit storage. (CCR 02115) (CCR 02163) (CCR 03265 (RDW))

3.4.8.6.2 Data Sampling Rate

The GOES-R Space Segment shall sample each Geomagnetic Field product spatial component uniformly in time and simultaneously within 25% of the sample period (i.e., within 0.125 seconds for a 2 Hz sampling rate). (CCR 02115)
3.4.8.6.3 Bandwidth

MRD657 The GOES-R System shall discriminate Geomagnetic Field product observations against frequency aliasing of the data from background sources and instrument-external interference. (CCR 02115)

3.4.8.6.4 Noise

MRD662 The GOES-R Space Segment shall constrain Geomagnetic Field product magnitude outputs computed on the ground from measurements in each axis from fluctuating by more than 0.3 nT when the spacecraft is in a normal operational mode. (CCR 02115) (CCR 03362 (RDW))

MRD663 The GOES-R Space Segment shall average no more than one transient measurement per hour in the production of the Geomagnetic Field product. (CCR 02115) (CCR 03362 (RDW))

MRD664 The GOES-R Space Segment shall include transients of no more than five seconds in duration in Geomagnetic Field product measurements. (CCR 02115) (CCR 03362 (RDW))

3.4.8.6.5 CCOR Accommodation on GOES-U Spacecraft (CCR 03446)

MRD2196 The GOES-R Space Segment shall collect coronal mass ejections observations utilizing the GOES-U spacecraft. (CCR 03446)

3.5 Launch Segment Requirements

MRD2125 The GOES-R System shall maintain continuous telemetry functions during all mission-critical events. (CCR 02115)

MRD2126 The GOES-R System shall maintain continuous command functions during all mission-critical events that are subsequent to the separation from the launch vehicle. (CCR 02115)

3.6 Ground Segment Requirements

3.6.1 General Ground Segment Requirements

MRD58 The GOES-R Ground Segment monthly availability shall be at least 0.989 over the system lifetime. (CCR 02115)

Availability is defined as the fraction of time the ground segment has full functionality over a monthly interval. (CCR 01546)

MRD59 The GOES-R Ground Segment mean time to restore functionality shall be less than 2 hours. (CCR 01546) (CCR 02115)

MRD70 The GOES-R Ground Segment terrestrial digital communications shall conform to IPv6 standards per OMB Memorandum M-05-22 [Applicable Document 18]. (CCR 01545) (CCR 02115)

MRD688 The GOES-R Ground Segment shall provide mission management, product generation and product distribution functionality. (CCR 02115)

MRD2127 The GOES-R System shall provide command and control of the satellites in the GOES-R series during all test phases for the life of the GOES-R mission set. (CCR 02115)

MRD2128 The GOES-R Ground Segment shall archive all software versions for the life of the GOES-R mission set. (CCR 02115) (CCR 02166)

MRD2129 The GOES-R Ground Segment shall archive data supporting product performance evaluation. (CCR02115)

MRD694 The GOES-R System shall have a primary location distributed over the NOAA facilities in Suitland, MD and Wallops, VA. (CCR 02115)

MRD695 The GOES-R System shall have a back-up ground station at Fairmont, WV. (CCR 01625) (CCR 02115)
The GOES-R Ground Segment shall monitor the quality of all products. (CCR 02115)

The GOES-R Ground Segment shall maintain operational software. (CCR 02115)

The GOES-R System shall make Magnetometer data and sub-sampled SEISS data available to users when received via the telemetry stream. (CCR 01503A)

The GOES-R Ground Segment shall comply with security standards listed in Security Requirements for Information Management Technology Resources [Applicable Document 1]. (CCR 01572A) (CCR 02115)


The GOES-R Ground Segment shall produce CCOR Level 0 data. (CCR 03446)

3.6.2 Mission Management

The GOES-R Ground Segment shall provide terrestrial interface components to support the SS to C3S IRD [Applicable Document 11]. (CCR 02115)

The GOES-R Ground Segment shall perform engineering analysis on telemetry, command and event data for the life of the mission. (CCR 02115)

The GOES-R Ground Segment shall perform satellite alignment activities. (CCR 02115) (CCR 03236 (RDW))

The GOES-R Ground Segment Maximum Time To Restore (MaxTTR) functionality related to system health and safety shall be no greater than 5 minutes. (CCR 02115)

The GOES-R Ground Segment shall monitor the quality of communications links with the Space Segment. (CCR 02115)

The GOES-R Ground Segment shall collect and report metrics related to system performance and product production. (CCR 02115)

3.6.3 Product Generation (CCR 02163)

The GOES-R Ground Segment shall store all data required to reproduce the full compliment of GOES-R series products (all Level 1b, Level 2, and Level 2+ products) for 7 days from all input data (Level 0 data), auxiliary and metadata. (CCR 02115)

The GOES-R Ground Segment shall provide for the maintenance of product quality. (CCR 02115) (CCR 02166)

The GOES-R Ground Segment shall provide for the correction of the long-term radiometric drift of the Radiances product accuracy by 1% over its lifetime. (CCR 01116) (CCR 02115) (CCR 02166)

The GOES-R Ground Segment shall employ algorithms that produce the Atmospheric product group. (CCR 02115)

The GOES-R Ground Segment shall employ algorithms that produce the Land product group. (CCR 02115)

The GOES-R Ground Segment shall employ algorithms that produce the Ocean product group. (CCR 02115)

The GOES-R Ground Segment shall employ algorithms that produce the Space and Solar product group. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Radiances product. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Lightning Detection: Hemispheric product. (CCR 02115)
The GOES-R Space Segment shall develop a ground processing algorithm for the Solar Imagery: X-ray product. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Energetic Heavy Ions product. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Magnetospheric Electrons and Protons: Low Energy. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Magnetospheric Electrons and Protons: Medium and High Energy product. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Solar and Galactic Protons product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Geomagnetic Field product. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Solar Flux: EUV product. (CCR 02115)

The GOES-R Space Segment shall develop a ground processing algorithm for the Solar Flux: X-Ray. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Radiances product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Solar Imagery: X-ray product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Energetic Heavy Ions product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Magnetospheric Electrons and Protons: Low Energy. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Magnetospheric Electrons and Protons: Medium and High Energy product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Solar and Galactic Protons product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Geomagnetic Field product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Solar Flux: EUV product. (CCR 02115)

The GOES-R Ground Segment shall implement a ground processing algorithm for the Solar Flux: X-Ray. (CCR 02115)

The GOES-R Ground Segment shall produce content for the GRB communication link to include product data, ancillary and metadata. (CCR 02115)

3.6.4 Ground Segment Design and Construction (CCR 02163)

The GOES-R Ground Segment shall scale up to 100% for all functionalities and interfaces supporting product generation and distribution. (CCR 01625) (CCR 02115)
3.6.5 Integrated Logistics

3.6.5.1 Maintenance

MRD2152 The GOES-R System shall provide components and interfaces for the maintenance of operational functions. *(CCR 02115)*

MRD2153 The GOES-R Ground Segment shall provide components and interfaces for the development of operational functions. *(CCR 02115)*

MRD771 The GOES-R System shall remain operational during all planned maintenance activities. *(CCR 02115)*

3.6.5.2 Training

MRD775 The GOES-R System shall simulate operational activities with high fidelity. *(CCR 02115)*
4 Validation and Verification (CCR 02163)

A Verification approach and method for each System level requirement will be found in the GOES-R Series, Program Verification and Validation Plan, 410-R-PLN-0083 [Applicable Document 40]. The reader is referred to the V&V Plan for details of a specific verification approach. (CCR 01623)

The requirements in sections 3.4, 3.5 and 3.6 of this document will be verified as part of the Flight Project and Ground Project verification activities. (CCR 01623)
5 Definitions and Abbreviations

The following definitions are provided here to clarify requirements using the defined terms.

**Anomaly:** a deviation or departure from the normal. It doesn't necessarily require an action, but it needs to be explained and/or investigated.

**Bus:** is also a spacecraft (see Spacecraft definition).

**Contingency:** either a description of an activity, or a type of procedure or other documentation written to correct, and/or prevent, and/or mitigate a potential problem or an anomaly.

**Constellation:** is the grouping of GOES satellites in orbit.

**Critical Life and Property Products:** are those ranked as Key Performance Parameters.

**Discussion:** is text appearing below a requirement provides background, additional information, or rationale for a requirement. It is not a requirement.

**East Geostationary Orbit Location:** is at 75 degrees West Longitude.

**Guidance Navigation and Control (GN&C):** comprises the disciplines of attitude determination and control, orbit determination, propulsion, and flight dynamics.

**Information Rate:** is the rate of earth observation data prior to coding or other overhead that contributes to the total transmission rate.

**Instruments:** are highly valuable measurement devices for atmospheric, space environment, and solar data collection forming a subset of the payloads.

**Inter-Grouping Communications:** are communications between the functional groupings of the ground segments.

**Level 0:** Raw data reconstructed to unprocessed instrument data at full space-time resolution with all available supplemental information to be used in subsequent processing (e.g. ephemeris, health and safety) appended.

**Level 1a:** Unpacked, reformatted and resampled Level 0 data with all supplemental information to be used in subsequent processing appended. Data generally presented as full space/time resolution. A wide variety of sub-level products are possible.

**Level 1b data:** Unpacked, reformatted, and resampled Level 0 data with all supplemental information to be used in subsequent processing appended. Radiometric and geometric correction applied to produce parameters in physical units. Data generally presented as full space/time resolution. (This is identical to the earth-referenced instrument data with radiometric calibration applied and all calibration data appended).

**Level 2:** Retrieved environmental variables (e.g. sea surface temperature) at the same resolution and location as the Level 1 source.

**Level 2+:** All Level 2 and higher products.

**Level 3:** Data or retrieved environmental variables which have been spatially and/or temporally resampled (i.e. derived from Level 1 or 2). Such resampling may include and averaging and compositing.

**Level 4:** Model output or results from analyses of lower level data (i.e. variable that is not directly measured by the instruments, but are derived from these measurements).

**Mean Time Between Failure:** the average time that a system/component that works without failure.

**Mean Time to Failure:** the expected time that a system/component will operate before the first failure will occur.

**Mean Time to Repair:** the average time required to repair a system/component.

**Metadata:** is non-radiometric data that provides additional information on the data collection conditions including latitude and longitude information, day, time, data quality flags that depend on the level (0, 1, 1b, 2, etc.) of the data associated with the metadata, and any additional space-ground ICD required information.

**Mission Availability:** is the probability that the entire GOES-R series system can be successfully used for its specified mission over the stated period of time.

**Non-Interference Basis:** means that no interference causing loss of data or reduction in data quality occurs
between affected systems.

**Notifications:** unsolicited communications from the Ground Segment to Users. These messages may be communicated using a variety of communication methods.

**Off-Line Development:** is the build-up and testing of components for an operational system without interference with the operational system.

**On-Orbit Check-Out Location:** is at 90 degrees West Longitude.

**On-Orbit Storage Location:** is at 105 degrees West Longitude.

**Operational Lifetime:** of the GOES-R series begins immediately after instrument check-out of the first satellite on-orbit and extends through the operational usage of a GOES-R series satellite (providing at least partial CONUS coverage) while meeting the mission availability requirements.

**Payloads:** are the highly valuable contents of the satellite and include the instruments and the Payload Services including both the GRB and the Unique Payload Services.

**Primary Instruments:** are the ABI instruments.

**Raw Data:** X-band data (instrument and some telemetry data) in their original packets, as received from a satellite.

**Real Time:** the designation applied to the propagation of data through a system with minimum time delays. Examples of minimum time delays include any of the following: speed of light propagation; buffering due to compressing, packetizing, framing, and coding; and channel sharing such as required for the CCSDS CVCDU protocols.

**Satellite:** consists of a spacecraft to support the instruments, the instruments, the associated communication systems, and the communications payload services.

**Satellite Failure:** occurs when one of the primary instruments fails to meet the specified performance required to produce its prioritization product set 1 products. A satellite failure may be caused by a hardware or software failure on the satellite that prevents the satellite from fulfilling its mission. A satellite may be deemed a failure as a result of a primary instrument failure, described under primary instrument failure or a communications failure that does not permit the primary instruments to downlink their instrument data. In addition, all conditions that produce no signal or permit no data transmission on the data downlink and consequently yield indeterminate instrument noise performance also constitute a failure. NOAA will review the operational status if the level of performance for a given satellite is sufficient to continue operations when any requirement for the primary instruments is unmet; instrument requirements already reflect end-of-life operational performance criteria. NOAA will also decide if the level of performance for a given satellite is sufficient to continue operation of any satellite beyond the lifetime of the primary instrument.

**Service Request:** any type of request for information or service including requests for products.

**Service Response:** a response to the customer regarding a service request.

**Single point failure:** is a failure of a hardware or software element with no redundancy.

**Single string of equipment:** is a system capable of performing all required functionality from data input through data output.

**Spacecraft:** is a vehicle without instruments, but including the magnetometer and the raw data downlink satellite service, propulsion system, power system, thermal system, GN&C, and structure, that is intended to be launched into space by a launch vehicle.

**Space and Launch Segment Availability:** is the probability that the Space and Launch Segment can be successfully used for any specified mission over the stated period of time; this is a probability of success.

**Transmission rate:** is the total downlink or uplink data rate that includes the rate of observation data as well as coding or other overhead.

**User Community:** is a general term describing the aggregate of GOES-R users composed of the subset of rebroadcast users, data subscription users, data products subscription users, retrospective users, and communication systems data users.

**User Service Functionality:** includes the software and hardware of the system that provides the capacity of the
system to interface with the user through the Mission Management Functionality.

**West Geostationary Orbit Location:** is at 137 degrees West Longitude. *(CCR 01186) (CCR 01622)*
### 6 Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ABI</td>
<td>Advanced Baseline Imager</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>AVHRR</td>
<td>Advanced Very High Resolution Radiometer</td>
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<tr>
<td>AWG</td>
<td>Algorithm Working Group</td>
</tr>
<tr>
<td>BW</td>
<td>Bandwidth</td>
</tr>
<tr>
<td>CAPE</td>
<td>Convective Available Potential Energy</td>
</tr>
<tr>
<td>CCAS</td>
<td>Cape Canaveral Air Station (Florida)</td>
</tr>
<tr>
<td>CCSDS</td>
<td>Consultative Committee for Space Data Systems</td>
</tr>
<tr>
<td>CDA(S)</td>
<td>Command Data Acquisition (Station)</td>
</tr>
<tr>
<td>CDRL</td>
<td>Contract Data Requirements List</td>
</tr>
<tr>
<td>CLASS</td>
<td>Comprehensive Large Array-data Stewardship System</td>
</tr>
<tr>
<td>CIMSS</td>
<td>Cooperative Institute for Meteorological Satellite Studies</td>
</tr>
<tr>
<td>CONUS</td>
<td>Contiguous United States</td>
</tr>
<tr>
<td>CORL</td>
<td>Consolidated Observational Requirements List</td>
</tr>
<tr>
<td>DAPS</td>
<td>DCS Automated Processing System</td>
</tr>
<tr>
<td>dBZ</td>
<td>Radar Reflectivity Factor (10logZ)</td>
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<td>DCS</td>
<td>Data Collection Systems</td>
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<tr>
<td>DCP</td>
<td>Data Collection Platforms</td>
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<tr>
<td>DCPI</td>
<td>Data Collection Platform Interrogate</td>
</tr>
<tr>
<td>DCPR</td>
<td>Data Collection Platform Report</td>
</tr>
<tr>
<td>DRGS</td>
<td>Direct Readout Ground Stations</td>
</tr>
<tr>
<td>DU</td>
<td>Dobson Units</td>
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<tr>
<td>EELV</td>
<td>Evolved expendable launch vehicle</td>
</tr>
<tr>
<td>EELVM</td>
<td>Evolved Expendable Launch Vehicle - Medium</td>
</tr>
<tr>
<td>EESS</td>
<td>Earth Exploration Satellite Services</td>
</tr>
<tr>
<td>EEZ</td>
<td>Exclusive Economic Zone</td>
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<tr>
<td>EHIS</td>
<td>Energetic Heavy Ion Sensor</td>
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<tr>
<td>ELT</td>
<td>Emergency Locator Transmitters</td>
</tr>
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<td>EM</td>
<td>Enterprise Management</td>
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<tr>
<td>EMWIN</td>
<td>Emergency Managers Weather Information Network</td>
</tr>
<tr>
<td>EPIRB</td>
<td>Emergency Position Indicating Radio Beacons</td>
</tr>
<tr>
<td>EUVS</td>
<td>Extreme Ultraviolet Sensor</td>
</tr>
<tr>
<td>EXIS</td>
<td>EUVS XRS Irradiance Sensors</td>
</tr>
<tr>
<td>F&amp;PS</td>
<td>Functional and Performance Specifications</td>
</tr>
<tr>
<td>FEC</td>
<td>Forward Error Correction</td>
</tr>
<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
</tr>
<tr>
<td>FOC</td>
<td>Full Operation Capability</td>
</tr>
<tr>
<td>FWHM</td>
<td>Full Width Half Maximum</td>
</tr>
<tr>
<td>GIRD</td>
<td>General Interface Requirements Document</td>
</tr>
<tr>
<td>GLM</td>
<td>Geostationary Lighting Mapper</td>
</tr>
<tr>
<td>GN&amp;C</td>
<td>Guidance Navigation and Control</td>
</tr>
<tr>
<td>GOES-R</td>
<td>Geostationary Operational Environmental Satellite - R</td>
</tr>
<tr>
<td>GRB</td>
<td>GOES Rebroadcast</td>
</tr>
<tr>
<td>GRBT</td>
<td>GOES Rebroadcast Terminals</td>
</tr>
<tr>
<td>GS</td>
<td>Ground Station</td>
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<tr>
<td>GSE</td>
<td>Ground Support Equipment</td>
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<tr>
<td>hPa</td>
<td>Hectopascals</td>
</tr>
<tr>
<td>HRIT/EMWIN</td>
<td>High Rate Information Transmission/Emergency Managers Weather Information Network (formerly known as EMWIN/LRIT)</td>
</tr>
<tr>
<td>ILS</td>
<td>Integrated Logistics Support</td>
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<tr>
<td>IPO</td>
<td>Integrated Program Office</td>
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<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>IRD</td>
<td>Interface Requirements Documents</td>
</tr>
<tr>
<td>ISO</td>
<td>International Office for Standardization</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
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<tr>
<td>ITU</td>
<td>International Telecommunications Union</td>
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<tr>
<td>K</td>
<td>Kelvin</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>KI</td>
<td>K-Index</td>
</tr>
<tr>
<td>km</td>
<td>kilometer</td>
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<tr>
<td>KPP</td>
<td>Key Performance Parameter</td>
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<tr>
<td>LI</td>
<td>Lifted Index</td>
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<tr>
<td>LRT</td>
<td>Low Rate Information Transmission</td>
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<tr>
<td>LV</td>
<td>Launch Vehicle</td>
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<tr>
<td>LZA</td>
<td>Local Zenith Angle</td>
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<tr>
<td>m</td>
<td>meter</td>
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<tr>
<td>MAP</td>
<td>Mission Assurance Plan</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MODIS</td>
<td>Moderate Resolution Imaging Spectrometer</td>
</tr>
<tr>
<td>MM</td>
<td>Mission Management</td>
</tr>
<tr>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>MMD</td>
<td>Mean Mission Duration</td>
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<tr>
<td>MPS</td>
<td>Magnetospheric Particle Sensor</td>
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<tr>
<td>MRD</td>
<td>Mission Requirements Document</td>
</tr>
<tr>
<td>MTF</td>
<td>Modulation Transfer Function</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time to Restore</td>
</tr>
<tr>
<td>NeD</td>
<td>Noise Equivalent Delta Temperature</td>
</tr>
<tr>
<td>NESDIS</td>
<td>National Environmental Satellite, Data and Information Service</td>
</tr>
<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
</tr>
<tr>
<td>NOAA</td>
<td>The National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NOSA</td>
<td>NOAA Observing System Architecture</td>
</tr>
<tr>
<td>NSOF</td>
<td>NOAA Satellite Operations Facility</td>
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<tr>
<td>NTIA</td>
<td>National Telecommunications and Information Administration</td>
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<tr>
<td>NWP</td>
<td>Numerical Weather Prediction</td>
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<tr>
<td>NWS</td>
<td>National Weather Service</td>
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<tr>
<td>PD</td>
<td>Product Distribution</td>
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<tr>
<td>PFD</td>
<td>Power Flux Density</td>
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<tr>
<td>PG</td>
<td>Product Generation</td>
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<tr>
<td>PLB</td>
<td>Personal Locator Beacons</td>
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<tr>
<td>PORD</td>
<td>Performance and Operational Requirements Document</td>
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<tr>
<td>PRAD</td>
<td>Payload Resource Allocation Document</td>
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<tr>
<td>PSD</td>
<td>Power Spectral Density</td>
</tr>
<tr>
<td>QPE</td>
<td>Quantitative Precipitation Estimation</td>
</tr>
<tr>
<td>QPSK</td>
<td>Quadrature Phase Shift Keying (modulation)</td>
</tr>
<tr>
<td>RBU</td>
<td>Remote Backup facility</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
</tr>
<tr>
<td>RMA</td>
<td>Reliability, Maintainability and Availability</td>
</tr>
<tr>
<td>SAR</td>
<td>Search and Rescue</td>
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<tr>
<td>SARSAT</td>
<td>Search and Rescue Satellite Aided Tracking</td>
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<tr>
<td>SCGPS</td>
<td>Solar and Galactic Proton Sensor</td>
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<tr>
<td>SEISS</td>
<td>Space Environment in-Situ Suite</td>
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<tr>
<td>Sfc</td>
<td>Surface</td>
</tr>
<tr>
<td>SI</td>
<td>International System of Units</td>
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<tr>
<td>SI</td>
<td>Saltwater Index</td>
</tr>
<tr>
<td>SIS</td>
<td>Solar Imaging Suite</td>
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<tr>
<td>SOCC</td>
<td>Satellite Operational Control Center</td>
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<td>SOW</td>
<td>Statement of Work</td>
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<tr>
<td>sr</td>
<td>Steradian</td>
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<tr>
<td>SRRS</td>
<td>Square Root Raised Cosine</td>
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<tr>
<td>SSAS</td>
<td>Ship Security Alerting System</td>
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<tr>
<td>SSP</td>
<td>Sub-Satellite Point</td>
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<tr>
<td>SST</td>
<td>Sea Surface Temperature</td>
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<tr>
<td>SUVI</td>
<td>Solar UltraViolet Imager</td>
</tr>
<tr>
<td>TBD</td>
<td>To be Determined</td>
</tr>
<tr>
<td>TBR</td>
<td>To be Refinned/Reviewed</td>
</tr>
<tr>
<td>TOA</td>
<td>Top of Atmosphere</td>
</tr>
<tr>
<td>TT</td>
<td>Total Totals Index</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>UIID</td>
<td>Unique Instrument Interface Document</td>
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<tr>
<td>VIIRS</td>
<td>Visible Infrared Imaging Radiometer Suite</td>
</tr>
<tr>
<td>WCDAS</td>
<td>Wallops Command and Data Acquisition Station</td>
</tr>
<tr>
<td>WEFAWX</td>
<td>Weather Facsimile</td>
</tr>
<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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<tr>
<td>WX</td>
<td>Weather</td>
</tr>
<tr>
<td>XRS</td>
<td>Solar X-Ray Sensor</td>
</tr>
</tbody>
</table>

*(CCR 01121) (CCR 01423) (CCR 01761)*