2015 Satellite Proving Ground Demonstration Proposal:
Satellite Proving Ground for Marine, Precipitation, and Satellite Analysis
Theme: Marine Hazards and Heavy Rainfall

1. **Project Title:** 2015 Satellite Demonstrations at the Satellite Proving Ground for Marine, Precipitation, and Satellite Analysis (MPS).

2. **Organizations**: The Ocean Prediction Center (OPC), NESDIS Satellite Analysis Branch (SAB), NHC Tropical Analysis and Forecast Branch (TAFB), and the Weather Prediction Center (WPC)

3. **Products to be Demonstrated as a GOES-R and/or JPSS Proving Ground Activity in the PG:**

   a. Phase I: Winter (Jan-Apr)
      i. Fog and Low Stratus – new (GOES-R/JPSS)
      ii. GeoColor – new to assist in Fog/Low Stratus (GOES-R/JPSS)
      iii. Nighttime Microphysics RGB – new to assist in Fog/Low Stratus (GOES-R/JPSS)
      iv. Air Mass RGB – continued for applications (GOES-R/JPSS)
      v. Ozone Products (AIRS and CrIS) – continued (JPSS)

   b. Phase II: Convective Season (June-Nov)
      i. Atmospheric Motion Vectors – new (GOES-R)
      ii. Layered Precipitable Water – new (GOES-R/JPSS)
      iii. Air Mass RGB – continued for applications (GOES-R/JPSS)
      iv. Daytime Convection RGB – new (GOES-R)
      v. Daytime Microphysics RGB – new (GOES-R)
      vi. Dust RGB – continued (GOES-R/JPSS)
      vii. Overshooting Top Detection – continued (GOES-R)
      viii. GOES-R Lightning Detection – continued (GOES-R)
      ix. Convective Initiation – continued (GOES-R)
      x. Nearcast – continued (GOES-R/JPSS)
      xi. NESDIS Snowfall Rate – new (JPSS)

4. **Demonstration Project Summary:**
   a. Overview: The GOES-R and JPSS Proving Grounds will provide demonstration products to the OPC, SAB, TAFB, and WPC. Pre-operational demonstrations of these products will give forecasters the opportunity to evaluate and provide feedback to algorithm developers on the performance and usefulness of the products in forecast operations. The GOES-R and JPSS Proving Ground and product developers can use this information to potentially improve the GOES-R and JPSS algorithms during the

pre-launch phase. Due to the diverse range of focus in each of these national centers, it is necessary to demonstrate these products for an extended period to allow forecasters the opportunity to evaluate the products in various weather regimes. Michael Folmer, the GOES-R and JPSS Satellite Liaison at the Satellite Proving Ground for Marine, Precipitation, and Satellite Analysis (MPS), will be handling all logistics and coordination of the product demonstrations within this proposal. The demonstration and report deadline dates are not finalized and should only be considered as placeholders.

b. Plan, Purpose, and Scope: The OPC, SAB, TAFB, and WPC will provide the GOES-R and JPSS Proving Grounds with pre-operational environments within which to deploy and demonstrate algorithms at the operational centers. These product demonstrations are designed to familiarize end users with the next generation of geostationary satellite and polar-orbiting satellite products prior to launch.

c. Goals: The main objectives of the GOES-R and JPSS product demonstrations proposed herein are to integrate products into OPC, SAB, TAFB, and WPC operations, and have forecasters evaluate and provide feedback through text products, a feedback form, online surveys, and/or email correspondence. These demonstrations will allow forecasters the opportunity to evaluate the products for their readiness in providing decisions support information for both forecasters and partners. Feedback will be gathered during each demonstration by the Satellite Liaison and a final report will be written and submitted to the GOES-R and JPSS Proving Grounds.

5. Participants Involved:

a. Providers:

- **i.** Atmospheric Motion Vectors (Daniels – NESDIS/STAR)
- **ii.** Fog/Low Stratus (Pavolonis – NESDIS/STAR)
- **iii.** Geocolor (Miller – CIRA)
- **iv.** RGB Nighttime Microphysics (Molthan – SPoRT)
- **v.** Layered Precipitable Water (Li – CIMSS, Kidder – CIRA)
- **vi.** Air Mass RGB (Molthan – SPoRT)
- **vii.** Ozone Products (Berndt and Zavodsky – SPoRT)
- **viii.** NESDIS Snowfall Rate (Meng – NESDIS/STAR, Zavodsky – SPoRT)
- **ix.** Daytime Convection RGB – (Molthan – SPoRT)
- **x.** Daytime Microphysics RGB – (Molthan – SPoRT)
- **xi.** Dust RGB – (Molthan – SPoRT)
- **xii.** Overshooting Top Detection – (Bedka – NASA)
- **xiii.** Lightning Detection – (Rudlosky – NESDIS/STAR, Stano – SPoRT, Sienkiewicz – OPC)
- **xiv.** Convective Initiation – (Mecikalski – UAH)
- **xv.** Nearcast – (Petersen – CIMSS, Line – CIMMS)

b. End Users:

i. Ocean Prediction Center (OPC)

ii. NESDIS Satellite Analysis Branch (SAB)

iii. NHC Tropical Analysis and Forecast Branch (TAFB)

iv. Weather Prediction Center (WPC)

6. Project Schedule/Duration (some dates are preliminary and subject to change):

Atmospheric Motion Vectors – Baseline

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	June 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016
SAB	June 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016
TAFB	July 2015	N-AWIPS	20 July – 15 Aug 2015	15 July – 30 Nov 2015	31 Jan 2016
WPC	June 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016

Fog/Low Stratus – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	15 Mar – 15 May 2015	15 Mar – 30 June 2015	31 Jan 2016
TAFB	Dec 2014	N-AWIPS	15 Jan – 15 Feb 2015	15 Jan – 30 Apr 2015	31 Jan 2016

Geocolor – Baseline

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	15 Mar – 15 May 2015	15 Mar – 30 June 2015	31 Jan 2016
TAFB	Dec 2014	N-AWIPS	15 Jan – 15 Feb 2015	15 Jan – 30 Apr 2015	31 Jan 2016

RGB Nighttime Microphysics – Decision Aid

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	15 Mar – 15 June 2015	15 Mar – 30 June 2015	31 Jan 2016
TAFB	Dec 2014	N-AWIPS	15 Jan – 15 Feb 2015	15 Jan – 30 Apr 2015	31 Jan 2016

Layered Precipitable Water – Baseline

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	June 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016
SAB	June 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016
WPC	June 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 15 Nov 2015	31 Jan 2016
TAFB	June 2015	N-AWIPS	July 2015	15 July – 30 Nov 2015	31 Jan 2016

RGB Air Mass – Decision Aid

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS AWIPS II	15 Jan – 15 Aug 2015	15 Jan – 30 Nov 2015	31 Jan 2016
SAB	Available year-round	N-AWIPS	15 Jan – 15 Aug 2015	15 Jan – 30 Nov 2015	31 Jan 2016
TAFB	Available year-round	N-AWIPS	26 Jan – 01 Feb 2015	26 Jan – 30 Nov 2015	31 Jan 2016
WPC	Available year-round	N-AWIPS	15 Jan – 15 Aug 2015	15 Jan – 30 Nov 2015	31 Jan 2016

Ozone Products (AIRS, NUCAPS, IASI) – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	July 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016
SAB	July 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016
TAFB	July 2015	N-AWIPS	20 July – 24 July 2015	20 July – 30 Nov 2015	31 Jan 2016
WPC	July 2015	N-AWIPS	15 June – 15 Aug 2015	15 June – 30 Nov 2015	31 Jan 2016

NESDIS Snowfall Rate – Baseline

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
SAB	Jan 2015	N-AWIPS	15 Sept – 15 Nov 2015	15 Sept – 31 Dec 2015	31 Jan 2016
WPC	Jan 2015	N-AWIPS	15 Sept – 15 Nov 2015	15 Sept – 31 Dec 2015	31 Jan 2016

Overshooting Top Detection – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
SAB	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
TAFB	July 2015	N-AWIPS	20 July – 24 July 2015	20 July – 30 Nov 2015	31 Jan 2016
WPC	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016

Lightning Detection – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
SAB	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
TAFB	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
WPC	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016

Convective Initiation – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
SAB	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
TAFB	July 2015	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
WPC	Available year-round	N-AWIPS	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016

Nearcast – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS AWIPS II	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
SAB	Available year-round	N-AWIPS AWIPS II	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
TAFB	July 2015	N-AWIPS AWIPS II	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016
WPC	Available year-round	N-AWIPS AWIPS II	1 June – 15 Aug 2015	1 June – 30 Nov 2015	31 Jan 2016

7. **Project Decision Points and Deliverables:**
   - **a.** Proving Ground Operations Plan – First Draft: 15 December 2014
   - **b.** Proving Ground Operations Plan – Final Draft: 8 May 2015
   - **c.** Proving Ground Final Report: 31 January 2016

8. **Responsibilities and Coordination:**
   - **a.** Michael Folmer, UMCP/ESSIC/CICS – Satellite Liaison
   - **b.** Joseph Sienkiewicz, NOAA/NWS/NCEP/OPC – OAB Branch Chief
   - **c.** David Novak, NOAA/NWS/NCEP/WPC – DTB Branch Chief
   - **d.** Hugh Cobb, NOAA/NWS/NCEP/NHC/TAFB – Branch Chief
   - **e.** Jamie Kibler, NOAA/NESDIS/OSPO/SAB – GOES-R Lead
   - **f.** Kathryn Miretzky, AS&D for GOES-R Program Office – PG Coordinator
   - **g.** Janel Thomas, Omitron – End User Coordinator

9. **Budget and Resource Estimate:** Funded through the GOES-R and JPSS Science Offices as part of the Omnibus Proving Ground funding to CIRA, CIMSS, UAH, CICS, and NASA/SPoRT.

Product Name: Atmospheric Motion Vectors

Primary Investigator: Jaime Daniels (NESDIS/STAR)

MPS Relevance:

- Allows the forecasters to overlay satellite derived winds on satellite imagery to better diagnose and analyze atmospheric features such as jet streaks, shortwave troughs, etc.
- Can be used to assess model initialization accuracy of jet streaks, shortwave troughs, tropical cyclones, etc.

Product Overview:

- The algorithm uses ABI visible and infrared observations to extract atmospheric motion. The choice of spectral band will determine the intended target (cloud or moisture gradient) to be traced, its height in the atmosphere, as well as the scale of its motion.

Product Methodology:

- The mid- to upper tropospheric levels (100-600 hPa) use the mid-wave (6.7um – 7.3um) water vapor channels and longwave (10.7um) infrared channel for deriving vectors.
- The lower levels (600-950 hPa) are provided by combining the visible and infrared channels, depending on the time of day. Prior to GOES-R, the algorithm uses current Legacy GOES channels to derive the motion vectors.
- During daylight imaging periods, the visible channel usually provides superior low-level tracer detection than the longwave infrared channel due to its finer spatial resolution and decreased susceptibility to attenuation by low-level moisture.
- During the nighttime imaging period, the shortwave (3.9um) infrared channel compliments the longwave infrared channel to derive the motion vectors.

Products:

- The product is currently available for GOES-E and GOES-W at 15-minute increments.
- The product is displayed as wind barbs that can be overlaid on satellite imagery.

Concept for Operational Demonstration:

- The product is created in ASCII format and it converted to a GEMPAK readable upper-air observation file using an adapted Perl script developed at the NHC and OPC. These files will be used by N-AWIPS and AWIPS II NCP.

Concept for Operations:

- The AMVs product is a baseline GOES-R product and will be provided as part of the operational processing system.

Document last updated: 13 December 2014

Product Name: GOES-R Fog and Low Stratus

Primary Investigator: Mike Pavolonis (NOAA/NESDIS/STAR)

MPS Relevance:

- Provides decision support and tactical decision aids for NWS forecasters when identifying the presence and location of fog and low stratus.
- Products can be used during the day and when high cirrus or ice clouds are present.
- Comparisons to surface observations indicate the IFR probability product outperforms (almost twice as much skill) the traditional 3.9–11 μm brightness temperature difference.
- Fused product that incorporates GOES satellite observations and Rapid Refresh model output.
- Addresses one of the top future-capability priorities of the NOAT.
- Will be used in OPC and TAFB to identify fog threats in areas with very few observations, mainly by using the IFR and LIFR products.

Product Overview:

- GOES-R Fog and Low Stratus detection products are designed to quantitatively (expressed as a probability) identify clouds that produce MVFR, IFR, and LIFR conditions.
- Physical thickness of water cloud layers is estimated in the Water Cloud Thickness product.
- Primary limitation is that some discontinuity will be associated with the transition from sunlit to non-sunlit conditions and vice-versa.

Product Methodology:

- Satellite and NWP model data are used as predictors and ceilometer based surface observations of cloud ceiling are used to train the algorithm.
- During the day, the 0.65, 3.9, and 11 μm channels (in various ways) along with boundary layer relative humidity information from the NWP model are used as predictors (similar approach is utilized at night without the 0.65 μm channel).

GOES-R Fog and Low Stratus Products:

- MVFR, IFR, and LIFR Probabilities
- Water Cloud Thickness (Fog Depth)
- The products are available using GOES-13, GOES-15, and MODIS data.

Concept for Operational Demonstration:

- Fog and Low Stratus product will be delivered to the MPS PG through the University of Wisconsin LDM where they are converted to a format suitable for N-AWIPS and AWIPS 2.

Concept for Operations:

- The Fog and Low Stratus Products are currently scheduled to be operationalized on OSPO ESPC systems and will be delivered to NWS users via SBN, NCO backbone, Direct Broadcast, and possibly AWIPS DDS as alternative.

Document Last Updated: 12 November 2013

Product Name: GeoColor Imagery

Primary Investigator: Steve Miller, Ed Szoke and Dan Bikos (CIRA)

MPS Relevance:

- An alternative overview type of imagery that represents some of the potential for image combination that will be available in the GOES-R era but can be replicated now.
- Provides a seamless transition between day- (visible imagery) and nighttime (10.7um – 3.9um) imagery with ice clouds appearing white in both day and night, while low clouds are enhanced for fog and low stratus identification at night.

Product Overview:

- In addition to the basic characteristics of the imagery noted above, at night low clouds and fog are highlighted in a pinkish hue by utilizing the AWIPS fog product that uses the difference between the 10.7 and 3.9 μm channels. Also, a natural color background is provided during the day while at night city lights are used.

Product Methodology:

- The basic satellite imagery comes from GOES East and West visible and infrared imagery.
- The daytime background true color image comes from the NASA Blue Marble data set that is derived from MODIS imagery. It is currently a static image but could be updated using real-time MODIS and VIIRS imagery.
- The nighttime background is also a static image from the "Nighttime Lights of the World" dataset. Future versions could also use real-time Polar Orbiter satellite data.
- Opacity of the cloud layers (determining how much of the background imagery bleeds through) is determined by various transparency factors.
- Additional cloud discrimination is applied at night using the 10.7-3.9 micron difference.
- More detailed information can be found at http://rammb.cira.colostate.edu/research/goes-r/proving_ground/cira_product_list/geocolor_imagery_detailed.asp

Image Products:

- Images are available over the full Continental United States.
- Time resolution is 30 minutes.
- Spatial resolution is 1 km during the daytime and 4 km at night.

Concept for Operational Demonstration:

- The product is created in netcdf format, converted to McIDAS AREA format, then read in and displayed by NAWIPS.

Concept for Operations:

- The GeoColor imagery is expected to be generated and displayed as an AWIPS-2 plug-in.

Last Updated: 6 May 2015

Product Name: MODIS/MSG RGB Nighttime Cloud-Top Microphysics (draft version)

Primary Investigators: Kevin Fuell (SPoRT) and John Knaff (NESDIS/STAR/RAMMB)

MPS Relevance and Product Overview:

- Cloud top microphysics are related to cloud properties such as precipitation type, updraft strength, hail product, and cloud thickness. These have implications for a number of NWS forecast applications.
- This product can be used to differentiate ice clouds from low clouds or stratus, assisting the forecaster in highlighting potential areas of reduced ceilings and visibility.

Product Methodology:

- Product is generated from MODIS and Meteosat Second Generation SEVIRI channels IR3.9, IR10.8, and IR12.0.
- Highlights differences in cloud top particle size and phase by
    - Using IR12.0-IR10.8 in Red for optical depth
    - Using IR10.8-IR3.9 in Green for particle phase and size
    - Using IR10.8. in Blue to for cloud top temperature

RGB Daytime Cloud-Top Microphysics Products:

- MSG-based imagery will be generated every 15 minutes.
- MODIS-based imagery will be generated ~4 times per day over any given location (2 satellites, 2 passes per day).

Recent Product Modifications:

- None

Concept for Pre-Operational Demonstration:

- Product is generated at SPoRT, converted to a format suitable for N-AWIPS, and provided via an ftp server or the LDM.

Concept for Operations:

- It is anticipated that by the time GOES-R is operational, the AWIPS2 deployment will be completed, so that this RGB product can be locally generated from the individual ABI bands.

Document last updated: 6 May 2015

Product Name: GOES Sounder and Passive Microwave Layered Precipitable Water (draft version)

Primary Investigator: Jun Li (CIMSS), Stan Kidder (CIRA), and John Forsythe (CIRA)

MPS Relevance:

- Allows the forecasters to view high, mid-, and low-level precipitable water to assess the risk for heavy rainfall and potential flash flooding.
- Most forecasters are familiar with using the total precipitable water to assess rainfall threats, but layered precipitable water will provide more information on the potential for warm-cloud process heavy rainfall and atmospheric rivers which tend to be among the biggest forecast challenges at the MPS PG.

Product Overview:

- The current Legacy GOES Sounders have been used to create TPW, high, mid-, and low-level precipitable water products and this has also been adapted to microwave sensors on polar-orbiters to cover a larger extent of the globe not covered by the GOES Sounders. GOES-R will not have a sounder, but will be capable of providing similar products using the ABI. These products provide forecasters the opportunity to become more familiar with the algorithms prior to the change in capabilities.

Product Methodology:

- TPW, high, mid-, and low-level PW products are created using the GOES Sounder
- TPW, high, mid-, and low-level PW products are created using the Passive Microwave instruments on select polar-orbiters.

Products:

- The TWP, high, mid-, and low-level PW is currently available for GOES-E and GOES-W Sounders at 1-hour increments.
- The TWP, high, mid-, and low-level PW is currently available for microwave imagers from select polar-orbiters (need a brief listing).

Concept for Operational Demonstration:

- The products are created in McIDAS and converted to AREA files that can be ingested by the local LDM and displayed in N-AWIPS.

Concept for Operations:

- The LPW product is a baseline GOES-R product and will be provided as part of the operational processing system.

Document last updated: 6 May 2015

Product Name: MSG, MODIS, and GOES Sounder Air Mass RGB

Primary Investigator: John Knaff (NESDIS/STAR/RAMMB) and Kevin Fuell (SPoRT)

MPS Relevance and Product Overview:

- Product allows for a three-dimensional assessment of the best state of the atmosphere.
- Allows for a more accurate analysis of where rapid cyclogenesis, jet streaks, and PV anomalies occur which is critical to forecasters in identifying the risks associated with convection, explosive cyclogenesis, and heavy rainfall.

Product Methodology:

- MSG Air Mass RGB Product is generated from Meteosat Second Generation SEVIRI channels 12 (WV6.51), 10 (WV7.43), 9 (IR9.71), and 8 (IR11.03) with 3 km spatial resolution.
- MSG product was adapted to GOES sounder to provide coverage over and near the U.S. Sounder version uses WV6.2 and WV7.3, IR9.7 and IR10.8 in place of the SEVIRI channels mentioned above. Sounder version is 10 km spatial resolution.
- Highlights differences between dry, tropical and cold air masses and is accomplished by:
    - Differencing the two water vapor channels (i.e., at 6.2 µm and 7.3 µm or 6.51 µm and 7.41 µm). (Red)
    - Differencing the ozone channels (i.e., 9.7 µm and 10.8 µm or 9.71 µm and 11.03 µm). (Green)
    - Uses the 6.2 µm or 6.51 µm channel to indicate gross air mass temperature differences. (Blue)

Air Mass Products:

- MSG-based Air Mass RGB imagery will be generated every 15 minutes.
- Sounder-based Air Mass RGB imagery will be generated once per hour.

Concept for Pre-Operational Demonstration:

- MSG Product is generated at SPoRT and then provided to NWS Regional HQ via the SPoRT LDM and on to local NWS Weather Service Offices where they are converted to a format suitable for display in AWIPS. For National Centers they are converted to a format suitable for N-AWIPS at SPoRT and provided via an ftp server or the LDM.
- GOES Sounder RGB Air Mass product is generated at CIRA and then provided to NWS Regional HQ via the SPoRT LDM and on to local NWS Weather Service Offices and National Centers where they are converted to a format suitable for display in AWIPS. For National Centers they are converted to a format suitable for N-AWIPS at SPoRT and provided via an ftp server or the LDM.

Concept Operations:

- It is anticipated that by the time GOES-R is operational, the AWIPS2 deployment will be completed, so that these RGB products can be locally generated from the individual ABI bands.

Document last updated: 6 May 2015

Product Name: AIRS, NUCAPS, and IASI Ozone Retrievals (JPSS)

Primary Investigators: Emily Berndt and Bradley Zavodsky (SPoRT)

MPS Relevance and Product Overview:

- Product(s) allows identification of potential stratospheric air intrusions into the troposphere by highlighting anomalous ozone levels, which also identifies regions of increased potential vorticity.
- Allows for a more accurate analysis of where PV anomalies will occur and assists in the interpretation of the Air Mass RGB product.

Product Methodology:

- Products are generated from the Atmospheric Infrared Sounder (AIRS) aboard the Aqua polar-orbiting satellite. Both a total column ozone and ozone anomaly product are available. The products are available twice a day with a latency of approximately four hours.

- The products are then made available in VGF to overlay on current satellite imagery. The total column ozone concentration is mapped in a way to easily identify areas of interest with measurements made in Dobson units. Additionally the ozone anomaly product highlights regions where the ozone values significantly deviate from climatology and are representative of stratospheric air.

AIRS Ozone Products:

- Total Column Ozone and Ozone Anomalies in VGF format to be overlaid on satellite imagery (works best with the RGB Air Mass product).

Concept for Pre-Operational Demonstration:

- Products are generated at SPoRT and then provided to the HAZMAP Proving Ground in VGF format for use in N-AWIPS and provided via LDM.

Concept for Operations:

- It is anticipated that this product will be created using CrIS and/or OMPS on S-NPP satellite as part of the JPSS mission. The product would be generated by NESDIS and distributed to NWS WFOs and National Centers. If the product is not adopted by NESDIS, then SPoRT would provide an operational version of these products (if global data latencies are reduced over currently available data).

Document last updated: 6 May 2015

Product Name: NESDIS Snowfall Rate (SFR) (draft version)

Primary Investigator: Huan Meng (NESDIS/STAR) and Bradley Zavodsky (NASA SPoRT)

National Center/WFO Relevance:

- Provides a unique perspective for forecasters to identify the extent of a snowstorm and the location of the most intense snowfall using a multi-channel satellite approach.
- The product will be evaluated by SAB and WPC for monitoring the potential for heavy snowfall, especially in radar-poor regions.

Product Overview:

- The NESDIS snowfall rate product is derived using passive microwave measurements taken from the Advanced Microwave Sounding Unit (AMSU)/Microwave Humidity Sounder (MHS) aboard a suite of four NOAA and EUMETSAT polar-orbiting satellites. The product has a spatial resolution of approximately 16 km at nadir. The microwave signal is able to penetrate clouds, hence bearing the signatures of the snow inside and beneath the clouds.

Product Methodology:

- The SFR algorithm uses multiple channels that are sensitive to different atmospheric levels in order to sample the intensity of snowfall through the entire precipitation layer.
- This provides an advantage over ground-based radar, which scans single vertical levels and may miss higher concentrations of precipitation above or below the scan of the beam.

Products:

- Using the four polar-orbiting satellites provides up to eight SFR retrievals per day at any given location in the mid-latitudes with a latency between 30 minutes and three hours depending on the satellite orbit.

Concept for Operational Demonstration:

- The products are created at CICS and delivered to NASA SPoRT where the files are reformatted for use in AWIPS or N-AWIPS before being sent over the LDM or FTP.

Concept for Operations:

- The SFR product is baseline product that is part of the current NESDIS suite of products, but has not been available to forecasters. This product can be adapted to future polar-orbiting satellites to increase the amounts of retrievals.

Document last updated: 6 May 2015

Product Name: Overshooting Top Detection and Magnitude

Primary Investigator: Kristopher Bedka (NASA) and Wayne Feltz (UW-CIMSS)

MPS Relevance:

- Product has been shown to assist in the diagnosis and nowcasting of hazardous convective weather because there are strong overshooting top relationships with hazardous convective weather (i.e., severe weather, total lightning, and heavy rainfall).
- Presence of a persistent overshooting top feature can signify an especially strong and long-lived storm and early recognition of an OT can raise situational awareness of impending hazardous weather critical to MPS operations, such as heavy rainfall and severe convective winds in offshore zones.
- Currently, OPC and WPC have 30-minute imagery available in N-AWIPS, but the product is available in 15-minute increments or better (Rapid Scan Operations) allowing for better analysis of potentially significant storms.

Product Overview:

- Overshooting convective cloud tops are domelike bulges atop an anvil cloud that indicate a strong updraft within a convective storm system.
- Convection with either overshooting tops or enhanced-V signatures often produce hazardous weather conditions such as frequent lightning, heavy rainfall, and damaging winds.

Product Methodology:

- Overshooting-top product identifies clusters of 11.2 mm IR pixels significantly colder (at least 6.5K) than the surrounding anvil cloud with a diameter consistent with commonly observed overshooting tops.
- Provides a detection accuracy that exceeds that of an existing overshooting top detection technique based on the water vapor minus infrared window brightness temperature difference.
- Enhanced-V features occur when flow diverted around the OT region erodes the updraft summit and carries cloud debris downwind which is reflected in the cold brightness temperatures.
- Brightness temperature difference (at least12K) between the OT and enhanced-V feature.

Overshooting Top Detection Products:

- Overshooting Top detection
- Overshooting Top Magnitude

Concept for Operational Demonstration:

- The Overshooting Top Detection products were delivered to the MPS via the CIMSS LDM in Nov 2011 and were formatted for display in N-AWIPS.

Concept for Operations:

- None at this time. The idea is for it to be centrally produced at OSPO/ESPC, but for the moment the goal is to expose users to the data and collect feedback through organized demonstrations within the GOES-R Proving Ground.

Document last updated: 6 May 2015

Product Name: GOES-R Lightning Detection

Primary Investigator: Scott Rudlosky (NESDIS/STAR), Joseph Sienkiewicz (OPC), Geoffrey Stano (SPoRT)

MPS Relevance:

- Can be used to identify convection that may contain a significant amount of mainly cloud-to-ground (CG) lightning strikes.
- Will prepare forecasters to receive data from the GLM, baseline GOES-R instrumentation designed to measure total lightning.
- Provides better continuity in tracking persistent and potentially significant thunderstorms that could lead to heavy rainfall and strong winds. This product is especially useful in the OPC and TAFB offshore zones where radar is not available and will be evaluated alongside the OTD product.

Product Overview:

- Provides an 8x8 km boxed average estimation of CG lightning activity within the Vaisala GLD-360 network.
- Designed to give forecasters the opportunity to use and critique a demonstration of GLM type data to help improve future visualizations of these data.
- Serves as reference for comparison with full GLM proxies and derived products.

Product Methodology:

- Takes the raw lightning observations, or sources, from the Vaisala GLD-360 network and recombines them into a flash extent gridded field.
- These data are then mapped to a GLM resolution of 8 km and are available at 2, 5, 15, and 30-minute refresh rate.
- With the flash data, when a flash enters a grid box, the flash count will be increased by one and no flash is counted more than once for a give grid box.

Concept for Pre-Operational Demonstration:

- The GLD-360 lightning feed is used to create the 8x8 density grids at OPC. These grids are then made available to WPC, OPC, and SAB through the NCEP network for use in N-AWIPS.

Concept for Operations:

- This topic is still to be discussed, but it is more likely that the lightning density will be generated and displayed via plug-in in AWIPS-II.

Document last updated: 6 May 2015

Product Name: GOES-R Convective Initiation

Primary Investigator: John Mecikalski

MPS Relevance:

- Provides 0-2 h probabilistic forecasts that highlight where convective initiation is likely.
- Attempts to address a difficult short-term forecast challenge with a fused NWP-satellite approach and the top future-capability priority of the NOAT.
- Will be particularly useful in identifying areas of potential concern for heavy rain and severe wind, especially in areas with no radar coverage. This product will be used coincident with NWP to assist the MPS in highlighting these threats.

Product Overview:

- NWP-satellite fused probabilistic product that serves as a strategic aid for convective initiation.
- True probabilistic product (unlike previous versions of the convective initiation algorithm) because the algorithm incorporates information about the local atmospheric environment.

Product Methodology:

- Convective initiation probabilistic product is produced using a logistic regression framework.
- Convective cloud properties and 20 fields from the Rapid Refresh model are used to create 0-2 h probabilistic forecasts.
- Early verification statistics have much improved skill scores when the environmental data is included.
- GOES ABI proxies are 10.7µm T 0°C, 10.7µm T time trend, 6.5-10.7µm difference, 13.3-10.7µm difference, 6.5-10.7µm time trend, and 13.3-10.7µm time trend.

GOES-R Convective Initiation Products:

- 0-2 h Probabilistic Forecasts of Convective Initiation

Concept for Operational Demonstration:

- GOES-R Convective Initiation product will be delivered to the MPS via the LDM where they are converted to a format suitable for display in N-AWIPS.

Concept for Operations:

- Convective Initiation is expected to be centrally produced at OSPO/ESPC and delivered by SBN or PDA.

Document last updated: 6 May 2015

Product Name: NearCasting Model

Primary Investigator: Ralph Petersen (UW-CIMSS)

MPS Relevance:

- Provides MPS forecasters with an additional decision support and situational awareness tool, particularly for the development and intensification of convection that have the potential to produce high winds or heavy rainfall.

Product Overview:

- Provides 1 – 9 hour forecasts of future atmospheric moisture, equivalent potential temperature, and stability indices, and have shown skill in identifying rapidly developing, convective destabilization up to 6-9 hours in advance.
- The system fills the 1-9 hour information gap that exists between radar nowcasts and longer-range numerical forecasts.

Product Methodology:

- The NearCasting system uses a Lagrangian approach to optimize the impact and retention of information provided by the GOES sounder.
- Its primary data source is hourly, full resolution (10-12 km) multi-layer retrieved parameters from the GOES sounder.
- Results from the NearCasting model increases the areal coverage of single-time GOES data and enhances current operational NWP forecasts by successfully capturing and retaining details (maxima, minima, and extreme gradients) critical to the development of convective instability several hours in advance, even after subsequent infrared satellite observations become cloud contaminated.

NearCasting Model Products:

- Vertical theta-e difference
- 500-mb mean-layer theta-e
- 780-mb mean-layer theta-e
- Vertical precipitable water difference
- 500-mb mean-layer precipitable water
- 780-mb mean-layer precipitable water
- Vertical mean-layer CAPE

Concept for Operational Demonstration:

- The NearCasting Model products were delivered to the MPS via the CIMSS LDM in Nov 2013 and have been formatted for display in N-AWIPS and AWIPS II.

Concept for Operations:

- Expected to be centrally produced at OSPO/ESPC.

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