2014 Summer Satellite Proving Ground Demonstration Proposal:
Marine, Precipitation, and Satellite Analysis Proving Ground
Theme: Convection Initiation and Maintenance

1. **Project Title:** 2014 Summer 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.** Overshooting Top Detection – 2nd look (GOES-R)
   - **b.** Lightning Detection – 2nd look (GOES-R)
   - **c.** Convective Initiation – new (GOES-R)
   - **d.** Nearcast – new (GOES-R and JPSS)
   - **e.** Fog and Low Stratus – new (GOES-R)
   - **f.** Hybrid Imagery – 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.** Overshooting Top Detection (Bedka - SSAI)
- **ii.** Lightning Detection (Rudlosky – NESDIS/STAR, Stano – SPoRT, Sienkiewicz - OPC)
- **iii.** Convective Initiation (Mecikalski – UAH)
- **iv.** Nearcast (Petersen – CIMSS, Line – CIMMS)
- **v.** Fog/Low Stratus (FLS) (Pavolonis – NESDIS/STAR)
- **vi.** Hybrid Imagery (Smith/McGrath – SPoRT)

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):

Overshooting Top Detection – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
SAB	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
TAFB	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
WPC	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014

Lightning Detection – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
SAB	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
TAFB	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
WPC	Available year-round	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014

Convective Initiation – Level 2

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	April 15	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
SAB	April 15	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
TAFB	April 15	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
WPC	April 15	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014

Nearcast – Level 2(?)

	Product Ingest Date	Display	Training Period	Evaluation Period	Final Evaluation Report
OPC	April 15	AWIPS II	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
SAB	April 15	AWIPS II	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
TAFB	April 15	AWIPS II	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014

WPC	April 15	AWIPS II	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014

Fog/Low Stratus – Level 2

	Product Ingest Date	**Display**	**Training Period**	**Evaluation Period**	**Final Evaluation Report**
OPC	1 Apr 2014	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
TAFB	18 Apr 2014	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014

Hybrid Imagery – Baseline

	Product Ingest Date	**Display**	**Training Period**	**Evaluation Period**	**Final Evaluation Report**
OPC	1 Mar 2014	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
SAB	1 Mar 2014	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
TAFB	18 Apr 2014	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014
WPC	1 Mar 2014	N-AWIPS	15 May – 15 Sept 2014	15 May – 15 Sept 2014	30 Sept 2014

7. Project Decision Points and Deliverables:

- **a.** Proving Ground Operations Plan – First Draft: 1 April 2014
- **b.** Proving Ground Operations Plan – Final Draft: 15 May 2014
- **c.** Proving Ground Final Report: 30 September 2014

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 Science Office as part of the Omnibus Proving Ground funding to CIRA, CIMSS, UAH, and NASA/SPoRT.

Product Name: Overshooting Top Detection

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.

Product Name: GLD-360 Lightning Density

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.

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.

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.

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.

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Product Name: Hybrid Imagery (JPSS)

Primary Investigators: Matt Smith and Kevin McGrath (SPoRT)

MPS Relevance and Product Overview:

- Products allow forecasters at the MPS to utilize polar-orbiting imagery, while keeping the consistency of geostationary imagery in space and time.
- As the forecasters become more familiar with using polar-orbiting imagery in operations, this product will take advantage of the geostationary 15-minute increments and overlay polar-orbiting imagery from MODIS and VIIRS when available. These images replace a portion of the geostationary image at the time that most closely matches the geostationary time stamp, while retaining the continuity forecasters have grown accustomed to seeing in their workstations.

Product Methodology:

- The product is created in 15-minute increments using geostationary imagery from GOES-13 and GOES-15. MODIS and VIIRS swaths are then inserted with the geostationary imagery when available and a file is resent to replace the first GOES-only image.
- There may be seams due to the different scan times.
- The products are made available in McIDAS AREA format to be displayed in N-AWIPS.

Hybrid Imagery Products:

- Longwave Infrared
- Shortwave Infrared
- Visible
- Water Vapor

Concept for Pre-Operational Demonstration:

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

Concept for Operations:

- It is anticipated that this capability will be available within the AWIPS II framework, allowing for forecasters to overlay polar-orbiting imagery on geostationary imagery as part of a routine. This product allows forecasters the opportunity to use high-resolution

imagery from JPSS for mesoscale analysis as will occur in the GOES-R era and during AWIPS II transitions.

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