

# NASA / SPoRT Collaborations with NOAA Testbeds and Proving

SPoRT (Short-term Prediction Research and Transition) is focused on transitioning unique NASA and NOAA observations and research capabilities to the operational weather community to improve short-term weather forecasts on a regional and local scale.

- close collaboration with numerous WFOs across the country
- SPoRT activities began in 2002, first products to AWIPS in 2003
- co-funded by NOAA since 2009 through “proving ground” activities

**Proven paradigm for transition of research and experimental data to “operations”**



## Benefit

- demonstrate capability of NASA and NOAA experimental products to weather applications and societal benefit
- prepares forecasters for use of data from next generation of operational satellites (JPSS, GOES-R)

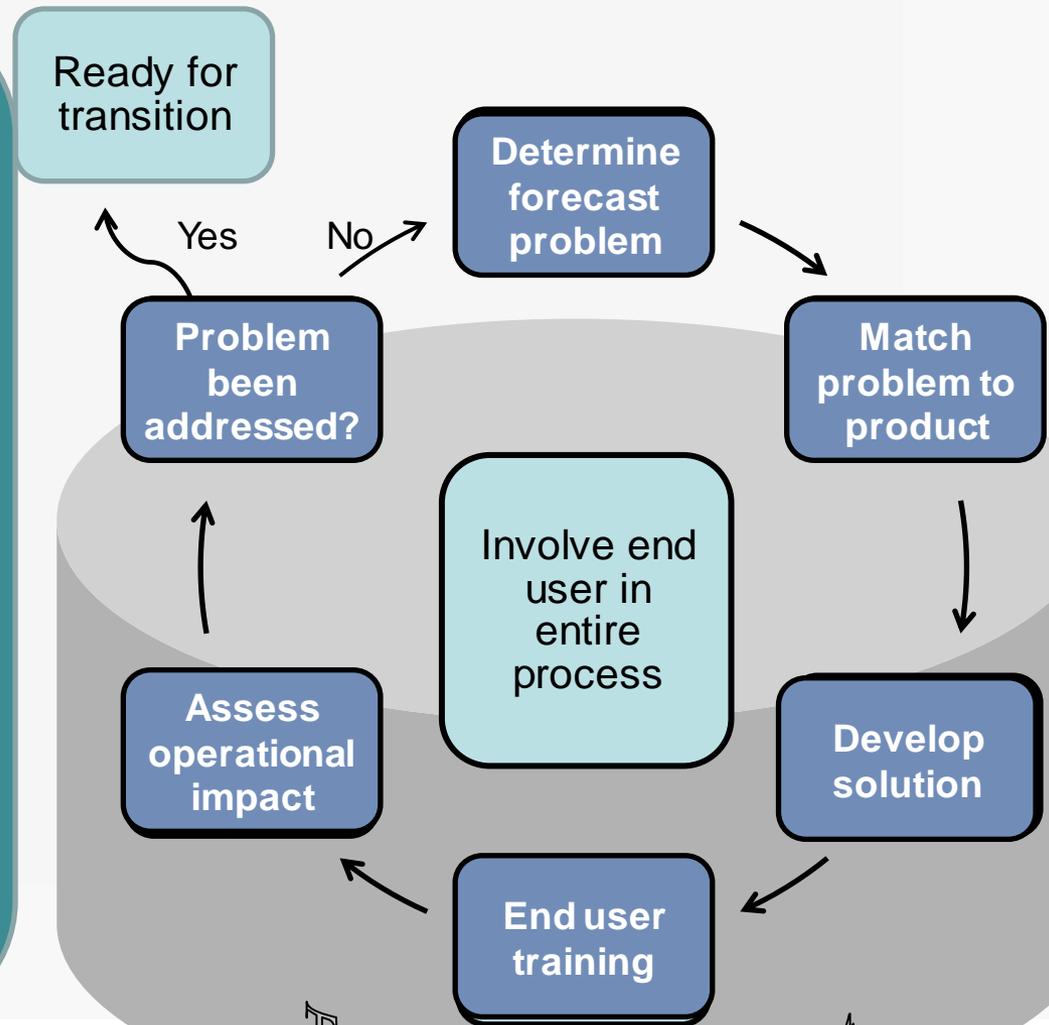
# Research Data / Products to “Operations”

## SPoRT Paradigm

- match forecast challenge to data/product
- develop solution / demonstrate in “test bed” environment
- integrate successful products into end user’s decision support tools
- create product training
- perform product assessment

**Maintain interactive partnership with end user throughout process**

**Need local end user advocate**



Test Bed Environment

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# Partnerships and End Users

## Partnered with NOAA / University community / DoD

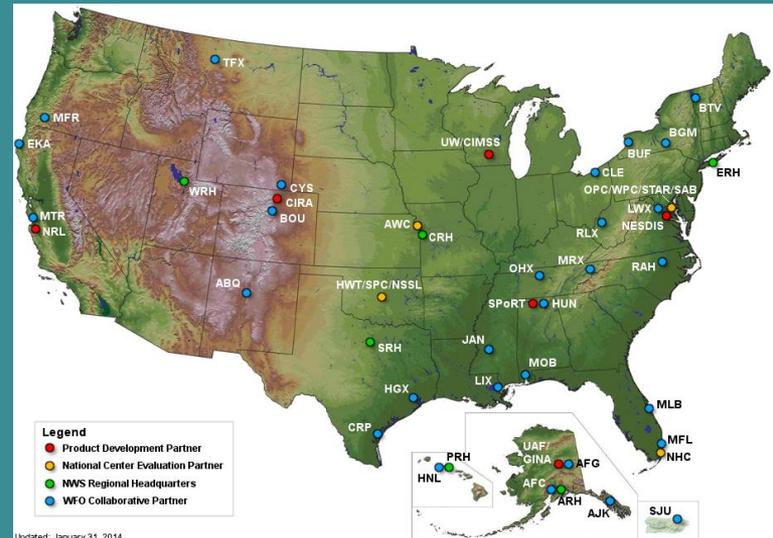
- access to real-time experimental data / products – CIMSS, CIRA, GINA, GOES-R AWGs
- share expertise and algorithms - CIRA, NRL, AWGs

## End users

- regular interactions with numerous WFOs
- National Centers
- testbeds

## Data / transition / dissemination

- suite of over 40 satellite derived products, analyses, forecast products
- public ftp, Local Data Manager (LDM), WMS
- AWIPS, NAWIPS, AWIPS2, Google Earth, and others



# 2013 Assessments

NAME	PRODUCTS	WFO / NC	DATE	Description	REPORT <sup>1</sup>
Rainfall (West Coast)	NESDIS GOES-R QPE, CIRA LPW	EKA, MTR, MFR	March – April	Assess performance of products during atmospheric river season	In press
<b>HWT Spring Experiment<sup>2</sup></b>	<b>UAH GOES-R CI, PGLM, tracking tool (AWIPS II)</b>	<b>NSSL/HWT</b>	<b>May – June</b>	<b>Test and assess products in a warning testbed environment</b>	<b>Produced by HWT</b>
VIIRS Nighttime Imagery	VIIRS DNB, Night $\mu$ physics, Dust RGBs	BOU,CYS,TFX, ABQ	July – August	VIIRS products' utility in fire, smoke, and dust detection and changes in city lights.	April 2014
Rainfall (High Latitude and PR)	NESDIS GOES-R QPE, CIRA LPW	AFC, AFG, AJK, APRFC, SJU	July 15 – Sept 15	Assess performance of products in high latitudes and in tropical environment	In press
<b>AWC Summer Experiment<sup>2</sup></b>	<b>UAH GOES-R CI, PGLM mosaic (NAWIPS)</b>	<b>AWC</b>	<b>August</b>	<b>Evaluate products' aviation applications in a testbed environment</b>	<b>Produced by AWC</b>
<b>NHC (Tropical PG)<sup>2</sup></b>	<b>SEVIRI RGBs: Airmass, Dust, Daytime<math>\mu</math>physics, Daytime Conv. Storms, NC</b>	<b>NHC, TAFB</b>	<b>August - October</b>	<b>Demonstration of GOES-R proxy products and JPSS products in operations for tropical forecasting</b>	<b>Produced by CIRA</b>
WFO Convective Products	UAH GOES-R CI	CRP, ABQ, MLB, HUN	September – October	Validate and assess new probabilistic version of product in operations	In press
Aviation and Cloud - SR Inland	VIIRS DNB, Night $\mu$ physics RGBs	ABQ, HUN, MRX, OHX, RAH, TFX	September – November 15	Utility of cloud analysis products, with a focus on training in RGBs, applied to aviation forecasting at night.	May 2014

SPoRT assessment reports can be found at <http://weather.msfc.nasa.gov/sport/evaluations>

**Green – assessment report produced by external partner**

<sup>1</sup> Status and anticipate completion date for assessment report

<sup>2</sup> Not a SPoRT led assessment



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# 2014 Assessments

NAME	PRODUCTS	WFO / NC	DATE	Description	REPORT <sup>1</sup>
Aviation and Cloud - SR Coastal	VIIRS DNB, Nightphysics RGBs	CRP, HGX, LIX, MFL, MLB, MOB	December – January 2014	Utility of cloud analysis products, with a focus on training in RGBs, applied to aviation forecasting at night.	May 2014
Aviation and Cloud - AK & WR	VIIRS DNB, Nightphysics RGBs	AAWU, AFC, AFG, AJK, APRFC, EKA, MFR	December – January 2014	Utility of cloud analysis products, with a focus on training in RGBs, applied to aviation forecasting at night.	May 2014
NESDIS Snowfall Rate	NESDIS Snowfall Rate	BTV, LWX, RLX, ABQ, SAB	January – March 2014	Assessing microwave-based snowfall rate product in operations	June 2014
NCWCP & NHC Winter Demonstration <sup>2</sup>	Airmass RGB (SEVIRI), AIRS Total Column Ozone Retrievals, Hybrid Imagery	WPC, TAFB, OPC, SAB	January - April 2014	Demonstrate GOES-R and JPSS products in pre-operations environment within operations centers	Produced by GOES-R PG
HWT Spring Experiment <sup>2</sup>	UAH GOES-R CI, PGLM, tracking tool (AWIPS II)	NSSL/HWT	May – June	Testing and assessing products in a warning testbed environment	Produced by HWT
OPG Tracking Tool <sup>2</sup>	Tracking tool (AWIPS II)	Operations PG	May 12-16 2014	Broad WFO evaluation of Tracking Tool for operational use in total lightning and other trend applications	Produced by OPG
Convection	Total lightning	CWSUs, others	Summer 2014	Additional total lightning networks used in evaluation, utility of total lightning to address CWSU forecast issues	Fall 2014
AWC Summer Experiment <sup>2</sup>	UAH GOES-R CI, PGLM mosaic	AWC	August	Evaluate aviation applications of products in a testbed environment	External to SPoRT
Drought / Local Flooding	Land Information System	HOU, RAH, HUN	June - July	Utility and impact of NASA LIS in localized flooding and extended drought	October 2014
Pacific Region	QPE	Hawaii, Guam	Conv and wet season	Evaluate GOES-R proxy QPE product (NESDIS) -	TBD

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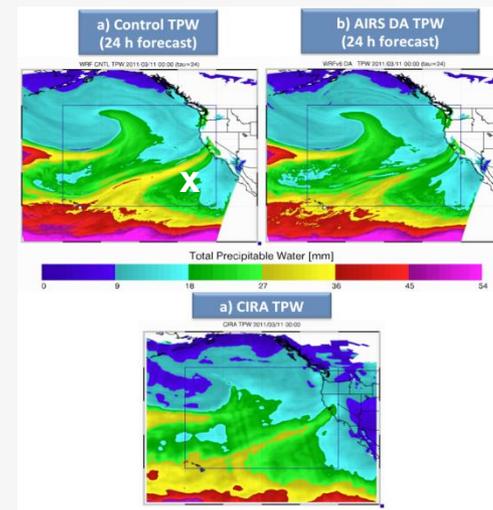
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# Collaboration with NOAA Testbeds

## HMT - atmospheric rivers Asian dust

- AIRS Level 2 T and q profiles to improve numerical analysis and forecast
- Aid in transition of HMT ensemble forecast precipitation product to AWIPS for West Coast WFOs
- Evaluating PM<sub>2.5</sub>/10 transport and precipitation

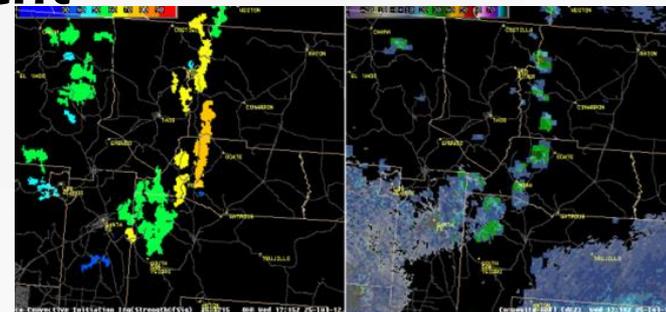


## HWT – participation in Spring program

- Transition CI, PGLM, and “tracking tool”
- Product experts and training
- Assessments - 2013 and 2014 (planned)

## AWT – participation in Summer experiment

- Transition CI, PGLM mosaic (NAWIPS and AWIPS<sub>2</sub>)
- Product experts and training
- Assessments – August 2003 and 2014 (planned)



Convective Initiation at HWT

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# Support to GOES-R Proving Ground

## Creation of a tailored suite of proxy products for GOES-R ABI and GLM

- GOES-POES hybrid imagery, suite of SEVIRI and MODIS RGB imagery
- Pseudo GLM product suite, AIRS ozone and anomaly

## Transition and evaluation of AWG / SPoRT products

- GOES-R Convective Initiation (CI)  
Assessments - SEUS WFOs (2013) – model predictors and GOES West
- GOES-R proxy QPE (NESDIS)  
Assessments - West coast, Alaska, Puerto Rico (2013); Pacific Region (2014)
- Pseudo GLM product suite  
Assessments - WFOs and CWSUs – expanded network in summer 2014
- Air mass RGB, ozone suite, hybrid products  
Assessments – NCWCP / NHC – January-April 2014
- Night microphysics and dust RGBs (MODIS) for improved situational awareness  
Assessments – Inland and front range WFOs (2013), coastal WFOs and AR / WR (winter 2013)



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# Support to JPSS Proving Ground

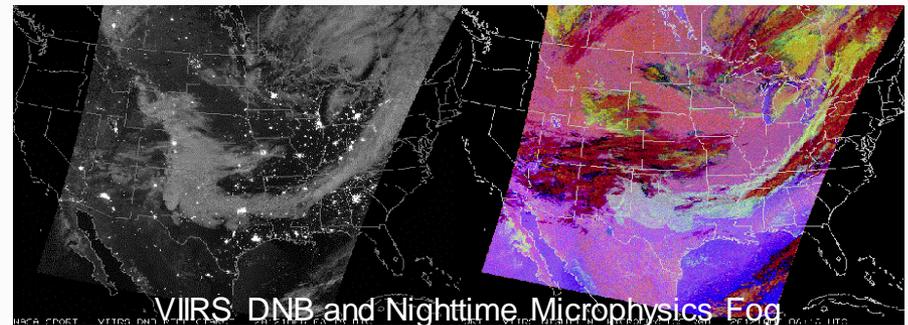
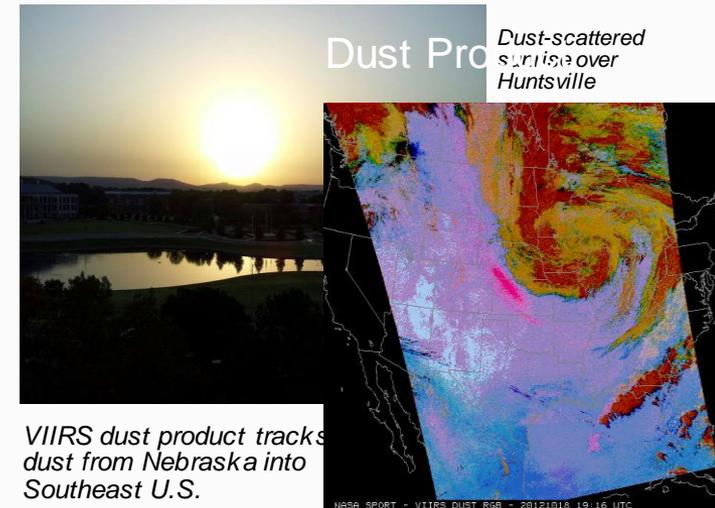
## Demonstrate the utility of Suomi NPP / JPSS data to operational weather forecasting / disaster applications

- High resolution imagery and DNB low light products
- “black out” product to support assessment and recovery from power outages
- RGB products (dust, night time microphysics, true color, low cloud / fog, DNB)

## Transition and evaluation products

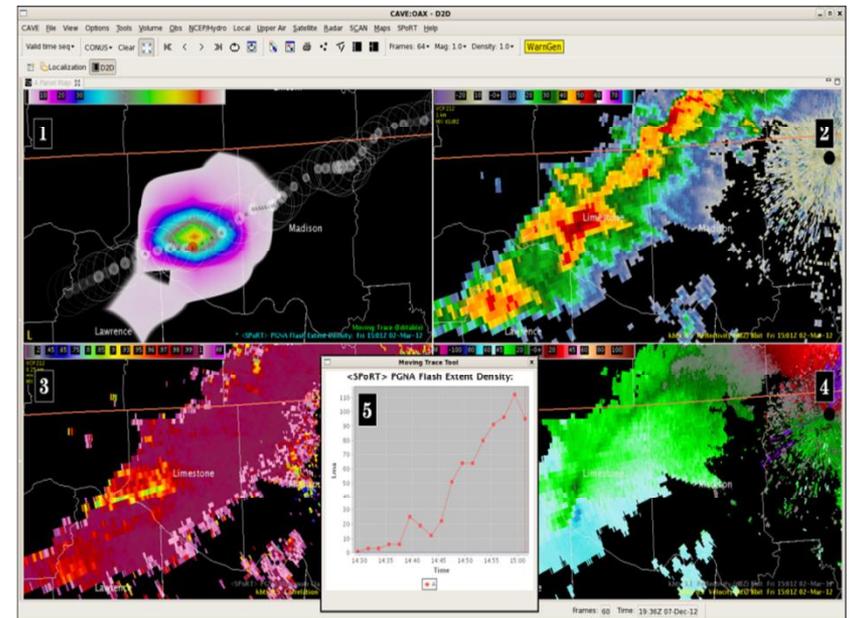
- Air mass RGB, ozone suite, hybrid products  
Assessments – NCWCP / NHC – January-April 2014
- Night microphysics and dust RGBs (MODIS) for improved situational awareness

Assessments – Inland and front range WFOs (2013), coastal WFOs and AR / WR (winter 2013)



# Operations Proving Ground (2014)

- Use of ground-based total lightning products from SPoRT in numerous WFOs since 2003
- Forecaster feedback (from HWT/EWP) indicated that a “trending tool” would greatly enhance utility of SPoRT total lightning data
  - SPoRT developed a lightning tracking tool for AWIPS2 to support this
  - tested tool at WFOs / HWT
  - submitted to Operations PG (2013)
  - worked with MDL and Experimental Product Development Team (EPDT) to develop a more generic tracking meteogram tool
  - tool to be evaluated in OPG next May 2014



*Forecaster use of the SPoRT Lightning Tracking Tool*

# Product Training

## SPoRT training addresses different learning styles by creating a variety of training modules types for end users

- “quick guides” for easy forecaster reference
- science sharing sessions
- short (15-20 minute) self-learning guides (Articulate Presenter modules with audio)
- modules in NWS LMS

## Involve end user in training module development

- user provide relevant examples
- address forecaster concerns / usage
- ownership in process / data

## End user understanding leads to additional applications

VIIRS Day-Night Band Quick Guide by NASA / SPoRT

Why is the Day-Night Band (DNB) imagery important?

The VIIRS lowlight channel (i.e. day/night band) DNB provides a nighttime image of reflected and emitted light, but with the resolution of daytime visible imagery. Analogous to how visible imagery is reflected sunlight, the DNB uses reflected moonlight to illuminate features at night that are not readily seen in standard channels. For example, users can detect distant plumes, fog, and convective cloud structures at night by using the DNB (see page 2).

DNB Products - How are the various products created and what is their purpose?

The Suomi National Polar-orbiting Partnership (NPP) satellite was developed and launched by NASA and NOAA in October 2011 and is a precursor to the operational satellites of the NOAA Joint Polar Satellite System (JPSS). The VIIRS instrument on NPP provides high-resolution multispectral imagery similar to MODIS and includes a 750 m lowlight channel called the Day-Night Band (DNB) for nighttime weather applications. From the channel level products are possible - here are two examples:

Radiance	Reflectance
<b>How it is created:</b> This product is shown image from the sensor of emitted and reflected light. Because the city lights are far brighter than reflected moonlight, the clouds can appear very faint while ground sources especially bright.	<b>How it is created:</b> The radiance product is normalized by the available amount of moonlight (phase and angle) in order to focus on the reflected portion of the imagery, hence the "DNB Reflectance" product. Normalizing provides a more consistent brightness in the resulting image throughout the moon cycle.
<b>What to look for in imagery:</b> In the absence of moonlight close to the new moon phase, emission sources like city lights and fires are most prominent. A difference in the normal city light pattern provides user awareness of clouds, fog, dust, or smoke that is obscuring the source or the presence of additional sources, such as fires. Other emission sources like lightning and auroras can also be seen.	<b>What to look for in imagery:</b> Use this product like the typical daytime MODIS visible imagery, mostly during full to quarter moon phase. Smoke plumes at night are especially visible compared to imagery. Cloud and surface features are also more subtle at times than with standard channels. In addition, cloud thickness can be inferred from amount of source light that is scattered.

When is the imagery available?

VIIRS DNB products are available 10x/night near 150 km (nominal) local time at all locations similar to the MODIS-Aqua pass. But, the swath width is larger than MODIS and therefore, a location may have a second pass near the edge of an adjacent swath. VIIRS has improved resolution resolution at the swath edge compared to MODIS.

Resources:

Operational applications can be seen on SPoRT's blog site (<http://www.spoort.org/nasa>) in addition to other sources. A primer on VIIRS and DNB could be found at the UCAR/CI/MET website. More in depth information can be found at the Suomi Mission homepage (<http://img.gsfc.nasa.gov/vis/index.html>)

Last Modified: November 2012

(See reverse side)

Examples of Day-Night Band Imagery from VIIRS

DNB Radiance 1 km, 29 August, 2012 at 08:36 UTC

DNB Reflectance 1 km, 29 August, 2012 at 08:36 UTC

Hot spots - DNB better depicts location & intensity

Hotspots are apparent, but smoke is not easily seen

VIIRS True Color RGB, 1 km, 28 Aug, 2012 at 20:55 UTC

3.9 μm channel, 1 km, 29 Aug, 2012 at 08:36 UTC

Daytime imagery of smoke plumes in the Western U.S. with Idaho outlined in blue. Visible bands are used to create this image. Clouds and smoke are easily discerned.

Typical short-wave IR imagery used to detect fire hotspots. Note that the DNB Radiance depicts varying brightness with each hotspot compared to this channel. Smoke is hard to see compared to the DNB Reflectance.

Two-side laminated “Quick Guide” for VIIRS DNB

# Summary

**SPoRT is an end-to-end transition to operations activity supported by NASA and NOAA -- NASA SPORT provides funding to external community through ROSES**

- ROSES 2010

- layered PW (CIRA), enhanced QPE (OU/NSSL)

- ROSES 2013

- snowfall rate (NESDIS), GPM data assimilation (UAH), lightning Initiation (UAH)

**Active participation in Proving Ground and Testbed activities to help facilitate the transition of research data to operations and assess impact of new products to address forecast challenges and NWS operations**

**Continue to look for ways to expand collaborations with testbeds to facilitate transition of experimental products for evaluation and testing**



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# SPoRT Focus and Direction

## Address challenges of operational community

- forecast challenges
- decision support systems (AWIPS2)
- forecast operations

## Products

- MODIS, AIRS, Lightning, GOES, VIIRS, CrIS, SEVIRI, Passive Microwave (TMI, SSMI, AMSR-2), GOES-R proxy products
- NASA/LIS analysis fields / WRF forecasts

## Funding to external community

- ROSES 2010
  - layered PW (CIRA), enhanced QPE (OU)
- ROSES 2013
  - snowfall rate (NESDIS), GPM DA (UAH), lightning Initiation (UAH)

INSTRUMENT / PRODUCT	FORECAST PROBLEM
<b>MODIS (Terra and Aqua)</b>	
Imagery (visible, 3.9, 6.7, 11 μm)	Improve situational awareness
Suite of RGB products (true, false color snow, air mass, night & day-time microphysics, dust)	Cloud structure, obstructions to visibility, extent of snow cover
Fog / low cloud (11-3.9 μm)	Improve situational awareness
Land and sea surface temperature (LST, SST)	Surface forcing for clouds and convection
SST and ice mask (Great Lakes and Arctic Ocean)	Coastal processes, lake effect precipitation
NDVI / Green Vegetation (GVF)	Model initiation / improved forecasts
<b>AMSR-E (Aqua) / AMSR2 (GCOM)</b>	
Rain rate, cloud water	Coastal weather, data in void regions
SST	Coastal weather
<b>Total Lightning Data (ground-based)</b>	
Source / flash density	Severe weather, lightning safety
<b>Combined Instrument Products</b>	
Multi-sensor SST composite	Short-term weather forecasts
Blended TPW	Moisture mapping, atmospheric rivers, precipitation
HMS/FIRMS fire/burn area	Smoke, reduced visibility, localized flooding
<b>GOES</b>	
NESDIS aviation products	Improve situational awareness
Souder air mass RGB	Storm dynamics, improved situational awareness
<b>GOES-R Proxy Products</b>	
Pseudo GLM product suite	Severe weather, lightning safety
GOES-MODIS hybrid imagery (visible, 3.9, 6.7, 11 μm)	Improved situational awareness
Hybrid RGB suite	Improved situational awareness
Quantitative Precipitation Estimates (QPE)	Precipitation mapping
Convective Initiation (CI) product	Convection, precipitation mapping
<b>JPSS Proxy Products</b>	
VIIRS imagery (visible, 3.9, 11 μm)	Improved situational awareness
Suite of VIIRS RGB products (true, air mass (w/CrIS), night & day-time microphysics, dust)	Cloud structure, obstructions to visibility, storm dynamics
VIIRS DNB (low light) – radiance, reflectance, RGB	Improved situational awareness
<b>SEVIRI</b>	
RGB products (air mass, dust, Saharan Air Layer)	Tropical storm forecasting, storm dynamics
<b>Passive Microwave</b>	
TMI (TRMM) 37(V/H), 85(V/H), composite	Precipitation monitoring, storm dynamics
SSM(S) 37(V/H), 85(V/H), 91(V)	Precipitation monitoring, storm dynamics
SSM(S) RGBs – 37/85, 37PCT	Precipitation monitoring, storm dynamics
<b>MISCELLANEOUS</b>	
Land Information System (LIS) – soil moisture	Convective initiation, drought monitoring, flooding
WindSat – Ocean Surface Wind Vectors (OSWV)	Improved situational awareness over oceans
<b>OMI</b>	
NESDIS SO2	Volcanic ash monitoring
<b>AIRS</b>	
Carbon monoxide, ozone imagery	Fires, air quality, storm dynamics



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