# Cooperative Research Programs
## Quarterly Newsletter

January-March, 2017

Editors: Satya Kalluri, Ralph Ferraro, Don Hillger, Jeff Key
*https://www.star.nesdis.noaa.gov/star/CoRP_index.php*

## NEWS

### STAR Scientists Create the GOES-16 'First Light' Image

Media outlets around the world picked up the GOES-16 First Light Advanced Baseline Imager (ABI) images produced by the Geostationary Operational Environmental Satellite (GOES)-R Algorithm Working Group (AWG) imagery team. The University of Wisconsin-Madison Cooperative Institute for Meteorological Satellite Studies (CIMSS) and the Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University processed the images that were released by NOAA on January 23, 2016 (16 panel of all Advanced Baseline Imager (AB bands) [Figure 1] and enhanced true color [Figure 2], respectively). These universally acclaimed images demonstrated ABI capabilities.

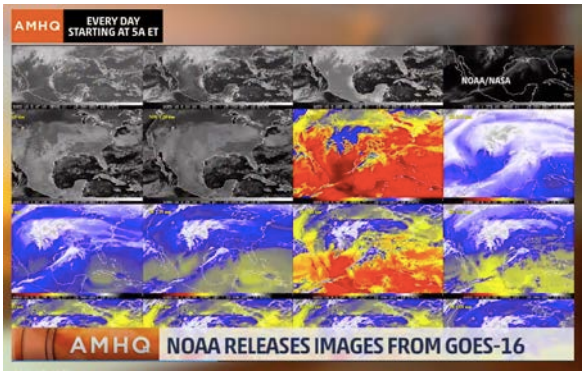


*Figure 1. The graphic of the 16 ABI spectral bands that was shown on The Weather Channel during an interview with T. Schmit*

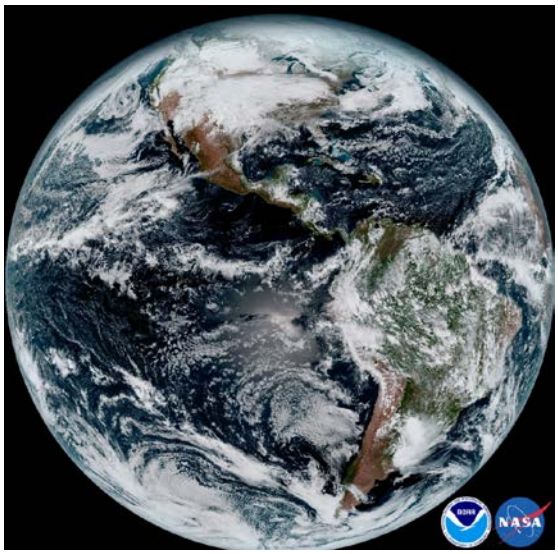


*Figure 2. Full disk GOES-16 true color image used in the press release from 15 Jan. 2017 produced via Rayleigh correction and using a simulated green band. The algorithm was developed at CIRA.*

An algorithm developed at CIRA was used to create the true color imagery (Figure 2) used in the GOES-16 ABI first light imagery release. It involves performing a Rayleigh correction to improve the clarity of the imagery, simulating a green component since the ABI lacks a band in the green portion of the spectrum, and modifying the base green band (trained from Himawari-8 AHI) to produce a hybrid green that is reminiscent of those green bands found on MODIS and VIIRS. The photos below (Figure 3) shows CIRA Scientist Dr. Steve Miller and STAR Scientist Dr. Dan Lindsey working on the imagery on Sunday, January 15; and Figure 4 shows Tim Schmit from the Advanced Satellite Products Branch working with the imagery team at CIMSS to create the 16 panel mosaic.

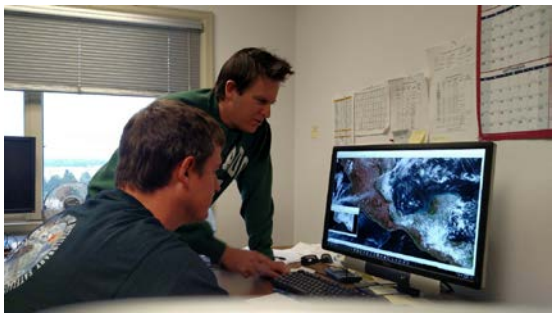

*Figure 3. Photo of STAR scientist Dan Lindsey (left) and CIRA scientist Steve Miller (right) working on the true color imagery on Sunday, 15 January 2017.*

*Figure 4. Imagery team lead by Tim Schmit creating the 16 panel first light ABI mosaic. Clockwise from lower left: Hong Zhang, Kaba Bah, Jim Nelson, Mat Gunshor, Tim Schmit.*

Media coverage included: 1) A Weather Channel interview with T. Schmit that aired Wednesday morning on the AMHQ program (https://www.facebook.com/AMHQonTWC/videos/1535470476483444/); 2) the Milwaukee Journal Sentinel talked with M. Pavolonis and T. Schmit (http://www.jsonline.com/story/news/local/wisconsin/2017/01/25/uw-madison-team-key-developing-game-changing-weather-satellite/97002694/); 3) Channel 3 in Madison, WI did an on-camera piece with M. Pavolonis which aired at 10:00 pm January 24; 4) a University of Wisconsin-Madison news story (http://news.wisc.edu/goes-16-offers-earths-first-light-in-true-color/); and 5) an SSEC News article: (http://www.ssec.wisc.edu/news/articles/9626). Many more articles can be found at https://goo.gl/oZk5MY. (T. Schmit, E/RA2, 608-263-0291, tim.j.schmit@noaa.gov; D. Lindsey, E/RA1, S. Miller, CIRA, D. Hillger, E/RA1, D. Molenar, E/RA1, C. Seaman, CIRA, N. Tourville, CIRA, 970-491-8446, Dan.Lindsey@noaa.gov, Steven.Miller@colostate.edu, Don.Hillger@noaa.gov, Debra.Molenar@noaa.gov, Curtis.Seaman@colostate.edu, Natalie.Tourville@colostate.edu)

### *Wall Street Journal* Article on Volcanic Ash

Mike Pavolonis (NOAA/NESDIS/STAR) was interviewed for a *Wall Street Journal* article on the use of next generation satellite data to mitigate volcanic ash related aviation hazards in Indonesia. The article is available at http://www.wsj.com/articles/indonesia-fights-volcanic-risk-to-air-travel-1485086405?mg=id-wsj. (M. Pavolonis, E/RA2, 608-263-9597, Mike.Pavolonis@noaa.gov)

### Tim Schmit in the News

On February 15, 2017, Tim Schmit discussed the Geostationary Operational Environmental Satellites (GOES)-16 on the Carolina Weather Group show (http://www.carolinaweathergroup.com/the-show), which "covers weather, science, technology and more ... interview newsmaking experts in meteorology and other fields of atmospheric science". This hour-long weekly program is posted at https://www.youtube.com/watch?v=fVBh7uhJRxs; the GOES-16 section starts at the 9 min mark. (T. Schmit, E/RA2, 608-263-0291, tim.j.schmit@noaa.gov)

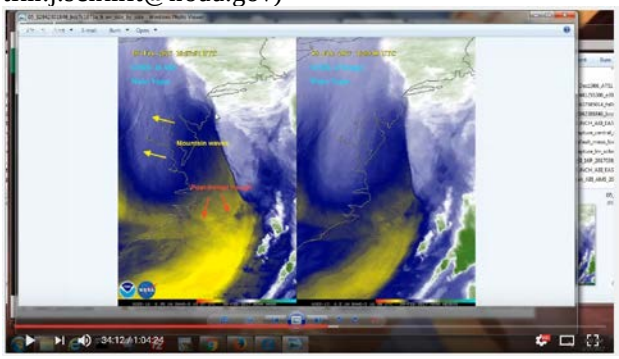

*Figure 5. Screen shot of the You Tube recording of the Google hangouts of the Carolina Weather Group show. The image is a comparison between GOES-16 and -13 water vapor bands.*

### Community Satellite Processing Package (CSPP) for Geostationary Data (CSPP GEO) interim software released

Version 0.4.1 of the GOES Rebroadcast (GRB) software package for the GOES_R satellites has been released by CSPP developers at the University of Wisconsin, Madison. This version of the software includes various accumulated improvements and bug fixes since the 0.4 release. The primary motivation for releasing this software is to give users a way to run end-to-end tests of their GRB receiving and processing systems, running on real data from the GRB stream from GOES-

16. Users can download GRB v0.4.1, refer to this post in the forum: https://forums.ssec.wisc.edu/viewtopic.php?f=68&t=5799

**BTN Interview**

The Big Ten Network interviewed T. Schmit about the history of geostationary satellites, from the Applications Technology Satellite (ATS)-1 in 1966 to Geostationary Operational Environmental Satellite (GOES)-16.
See https://twitter.com/GOESguy/status/832368350500102144. (T. Schmit, E/RA2, 608-263-0291, tim.j.schmit@noaa.gov)


**Great LAkes Winter Experiment (GLAWEX), 2017**:

The Great Lakes Winter Experiment (GLAWEX) took place in Green Bay, Wisconsin and the Upper Peninsula of Michigan, 24-27 February 2017. Scientists from a number of government agencies and universities collected measurements of ice in Green Bay and of snow and lake ice properties in Michigan's Upper Peninsula, including NOAA/STAR, the Cooperative Institute for Meteorological Satellites Studies (CIMSS), the National Ice Center (NIC), and the Great Lakes Environmental Research Lab (GLERL, Ann Arbor). GLAWEX was supposed to have overflights of the Naval Research Lab (NRL) P3 aircraft, but mechanical problems prevented it from making the flight from Colorado, where it was participating in NASA's SnowEx campaign, to the Great Lakes region. The U.S. Coast Guard icebreaker *Mobile Bay* took some GLAWEX scientists further into the bay to make ice measurements and to deploy two drifting buoys provided by the University of Washington. Yinghui Liu and Aaron Letterly from CIMSS, and Jeff Key (STAR), participated (Figure 6). The purpose of the CIMSS/NOAA portion of the GLAWEX campaign was to collect ground based and airborne measurements in support of GOES-16 ABI baseline and future product validation during the GOES-16 Post Launch Test (PLT). JPSS (S-NPP) product validation will also be performed. (J. Key, E/RA2, 608-263-2605, jkey@ssec.wisc.edu)

*Figure 6. Left: Aaron Letterly (CIMSS), Matt Welshans (NIC), Sean Helfrich (NIC), and Yinghui Liu (CIMSS) on the ice of Green Bay. Right: George Leshkevich (GLERL) drilling a hole near the USCG Mobile Bay ice breaker.*

**Publication Award**

D. Hillger, was one of numerous co-authors to receive the Donald E. Osterbrock Prize "to the author or authors of a book judged to advance the field of the history of astronomy"(Figure 7). The 2017 recipient of the prize was the *Biographical Encyclopedia of Astronomers (2nd edition)* which was published in 2014. Hillger generated biographies for 2 astronomers for the first edition of the encyclopedia, which were also used in the second edition: one biography for Gabriel Mouton, and the other for C. H. D. Buys Ballot (also a 'meteorologist'). The award was given by the AAS (American Astronomical Society) Historical Astronomy Division. (D. Hillger, E/RA1, 970-491-8446, Don.Hillger@noaa.gov)

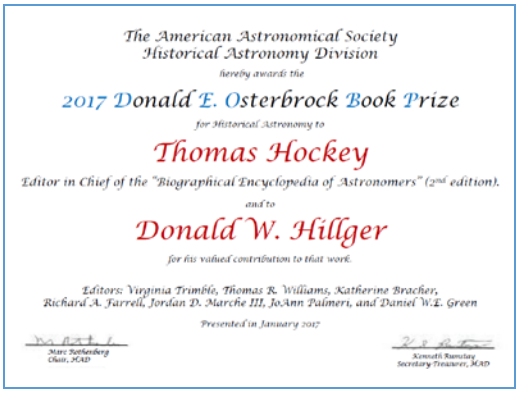
The American Astronomical Society
Historical Astronomy Division
hereby awards the
2017 Donald E. Osterbrock Book Prize
for Historical Astronomy to
Thomas Hockey
Editor in Chief of the "Biographical Encyclopedia of Astronomers" (2nd edition).
and to
Donald W. Hillger
for its valued contribution to that work.
Editors: Virginia Trimble, Thomas R. Williams, Katherine Bracher, Richard A. Farrell, Jordan D. Marché III, JoAnn Palmeri, and Daniel W.E. Green
Presented in January 2017

*Figure 7. The 2017 Donald E. Osterbrock Book Prize*

### D. Lindsey received the NOAA David Johnson Award

D. Lindsey received the NOAA David Johnson Award, "for outstanding innovative use of earth observation satellite data," at the Goddard Memorial Dinner held at the Washington DC Hilton on Friday, 10 March 2017 (Figure 8). The dinner was hosted by the National Space Club (http://www.spaceclub.org/events/gmd-current.html). (D. Lindsey, E/RA1, 970-491-8446, Dan.Lindsey@noaa.gov)


*Figure 8. Dan Lindsey receiving the NOAA David Johnson Award at the Goddard Memorial Dinner on 10 March 2017.*

Details of the award can be found in the press release: https://www.nesdis.noaa.gov/sites/default/files/asset/document/March_2017_AwardPressRelease.pdf

### Rudlosky Appears on The Weather Channel to Show First GOES-R Lightning Images

On Monday March 6, NOAA released the first public imagery from the GOES-16 Geostationary Lightning Mapper (GLM). This initial animation displayed 30 seconds of lightning data from tornadic storms that occurred on February 14, 2017 near Houston, TX. The release of this imagery has garnered interest from many news sources and the general public.


*Figure 9. Scott Rudlosky appearing on The Weather Channel*

On Tuesday March 7, Scott Rudlosky was interviewed live on The Weather Channel to discuss this new technology (Figure 9). This interview provided a tremendous opportunity to share our excitement about the new instrument with a broad audience. Scott has been interviewed by several other news outlets including live radio interviews, telephone interviews for print media, and Skype interviews with various local news channels.

The abstract should appear at the top of the left-hand column of text, about 0.5 inch (12 mm) below the title area and no more than 3.125 inches (80 mm) in length. Leave a 0.5 inch (12 mm) space between the end of the abstract and the beginning of the main text. The abstract should contain about 100 to 150 words, and should be identical to the abstract text submitted electronically along with the paper cover sheet. All manuscripts must be in English, printed in black ink.

## SCIENCE AND APPLICATIONS

### NOAA/CIMSS Products Alert Forecasters to Developing Fog Hazard

On several occasions during the week of January 29, 2017, the National Weather Service (NWS) in Hanford, CA utilized quantitative fog and low stratus products developed by NOAA/NESDIS/STAR, in collaboration with the Cooperative Institute for Meteorological Satellite Studies (CIMSS), to identify regions of developing fog in California's Great Central Valley (Figure 10). The Great Central Valley fog, known as Tule fog, can reduce surface visibility to less than 1/4 of a mile. As such, the Tule fog is a major hazard that severely disrupts travel, even resulting in school delays. The NOAA/CIMSS fog products were also used by the NWS to directly communicate the hazard to the general public via social media (https://twitter.com/NWSHanford/status/8264362111

78876928). The NWS routinely utilizes the NOAA/CIMSS fog products via an experimental data feed from the University of Wisconsin. NESDIS operations is tentatively expected to begin production of the NOAA/CIMSS fog products by August of 2017. For additional information on the recent Tule fog events, refer to the CIMSS Satellite Blog (http://cimss.ssec.wisc.edu/goes/blog/archives/23023 ). (M. Pavolonis, E/RA2, 608-263-9597, Mike.Pavolonis@noaa.gov, S. Bachmeier, CIMSS, C. Calvert, CIMSS, S. Lindstrom, CIMSS)

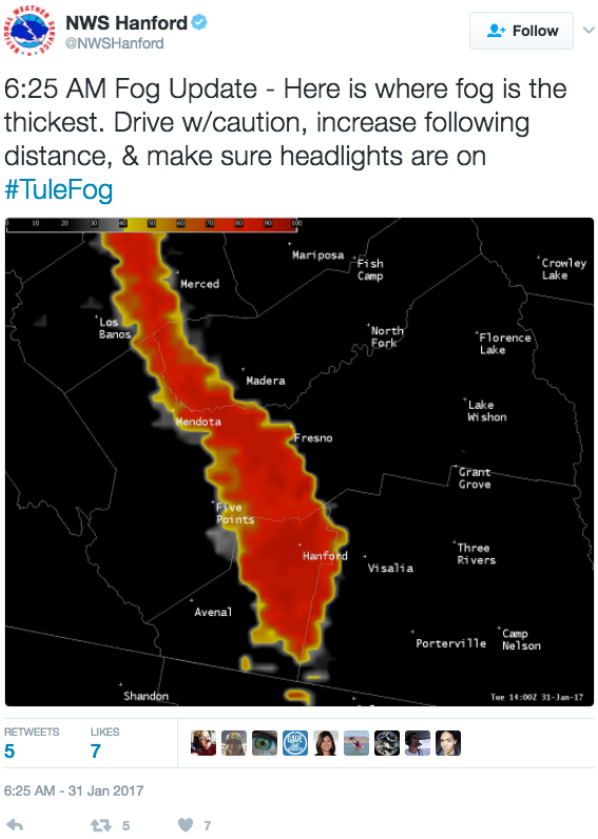


*Figure 10. Fog and low stratus products developed by NOAA/NESDIS/STAR, in collaboration with the Cooperative Institute for Meteorological Satellite Studies (CIMSS), are used by the National Weather Service (NWS) to directly communicate low visibility hazards to the general public via social media. The orange and red colors in the image indicate a high probability of low visibility conditions as determined by the NOAA/CIMSS algorithm.*

### ENSO Forecasts for North America

CICS-MD Scientist Li-Chuan Chen (CPC/OMB) is the lead author on a publication on the analysis and validation of the El Niño–Southern Oscillation (ENSO) forecast for precipitation and temperature from six models in the North American Multimodel Ensemble (NMME) (Chen, Li-Chuan, Huug van den Dool, Emily Becker, and Qin Zhang, 2017: ENSO precipitation and temperature forecasts in the North American Multimodel Ensemble: Composite analysis and validation, J. Climate, 30, 1103–1125, http://dx.doi.org/10.1175/JCLI-D-15-0903.1). Figure 11 shows the La Niña Precipitation anomaly composites for NDJFM based on 1982–2010 and 1950–2010 observations, NMME, and the six models. The composite analysis is conducted using the 1982–2010 hindcasts for each of the six models with selected ENSO episodes based on the seasonal oceanic Niño index just prior to the date the forecasts were initiated. All NMME models predict ENSO precipitation patterns well during wintertime; however, some models have large discrepancies between the model temperature composites and the observed. Most models perform slightly better in predicting El Niño patterns than La Niña patterns.

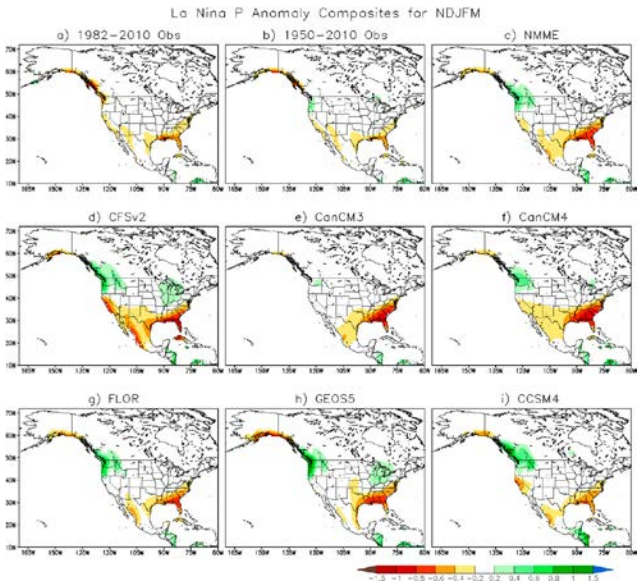


*Figure 11. La Niña precipitation anomalies based on observations (a & b), the ensemble (c), and the six models (d–i). The composites apply to monthly mean conditions in November, December, January, February, and March (NDJFM) as well as to the 5-month aggregates representing the winter conditions. All models* have superior performance in predicting *ENSO precipitation patterns compared to temperature patterns.*

### Snowfall Detection Algorithm Enhancement

A new set of snowfall detection (SD) algorithms for ATMS and AMSU/MHS has been developed by SCSB scientist Huan Meng and CICS-MD scientist Cezar

Kongoli. They optimally combine a satellite-based snowfall detection module and a NWP model-based module to achieve improved snowfall detection capability. Previous SD algorithms only relied on the satellite module. The input to the model-based module includes atmospheric variables such as moisture profile and cloud thickness etc. The satellite component utilizes all high frequencies at 88/89 GHz. Both modules employ logistic regression model and were trained using in-situ observations. The combined algorithm improves the detection of snowfall from both shallow and deep clouds. Figure 12 shows that the combined algorithm detects snowfall over a large area in the Midwest that was missed by the previous SD algorithm from a snowstorm. As a QA measure, the combined SD was incorporated in a test Snowfall Rate (SFR) processing system that ran in parallel to the SFR system at CICS. The SFR retrieval was monitored for a few weeks before it was implemented in the CICS SFR system. The product generated from this system is supporting an ongoing product assessment at NWS WPC Winter Weather Experiment. The data is also provided to several NWS WFOs via NASA SPoRT.

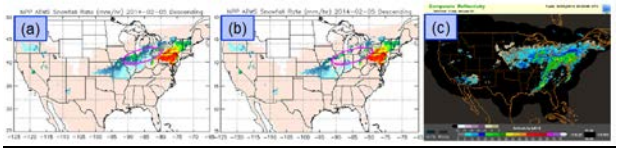


*Figure 12. SFR product from a snowstorm on Feb 5, 2014 using (a) the newly developed combined SD algorithm, and (b) the previous single-module SD algorithm. Image (c) is the coincident composite NEXRAD reflectivity.*

**Improving volcanic ash predictions with the HYSPLIT**

A manuscript entitled "Improving volcanic ash predictions with the HYSPLIT dispersion model by assimilating MODIS satellite retrievals" was published in Atmospheric Chemistry and Physics (http://www.atmos-chem-phys.net/17/2865/2017/). The paper demonstrates that satellite-based volcanic ash retrievals from the VOLcanic Cloud Analysis Toolkit (VOLCAT) can be assimilated into NOAA's operational dispersion model (HYSPLIT) and have a significant positive impact on forecast accuracy. The Co-authors are Tianfeng Chai (NOAA/OAR), Alice Crawford (NOAA/OAR), Barbara Stunder (NOAA/OAR), Michael Pavolonis (STAR), Roland Draxler (NOAA/OAR), and Ariel Stein (NOAA/OAR). (M. Pavolonis, E/RA2, 608-263-9597, Mike.Pavolonis@noaa.gov)

**AWIPS-II Product Generation and Display of Snow Fall Products**

The CICS-MD Proving Ground and Training Center (PGTC) has implemented its first STAR product in AWIPS-II, which is produced locally at CICS-MD. The NESDIS snowfall rate (SFR) product is produced at CICS-MD, converted to an AWIPS-readable format, and displayed on the AWIPS systems. These procedures have been running in the CICS-MD system routinely for over a month, giving the scientists confident that computing process is robust. SCSB scientist Huan Meng, lead of the SFR product, now has the ability to see the SFR product alongside other NWS products in the operational system. Figure 13 shows the SFR product along with surface weather observations which allows for a quick qualitative validation of the product. The ability to overlay STAR satellite products in the operational NWS system will provide tremendous insights to STAR scientists and will help to ensure the relevance and utility of newly developed products. The next products planned for implementation in AWIPS are the JPSS Active Fire, Aerosol Detection, and Aerosol Optical Depth products. CICS-MD scientists also are working to ingest the GOES-16 data including both the ABI and GLM.

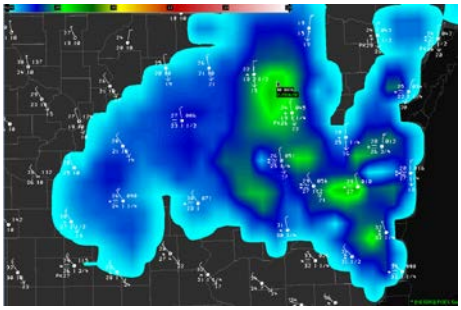

*Figure 13. Display of the snow fall product along with surface weather observations in AWIPS II*

**New Model for Improving Tornado Warnings**:

NOAA/NESDIS/STAR, in collaboration with the Cooperative Institute for Meteorological Satellite Studies (CIMSS), have developed the Probability of Tornado (ProbTor) short term forecast model. ProbTor, which is an extension of the Probability of Severe (ProbSevere) model, is aimed at improving the lead time and accuracy of operational tornado warnings through the provision of probabilistic storm centric guidance (Figure 14). ProbTor combines Numerical Weather Prediction (NWP), radar, and lightning data to determine the probability that a given existing storm cell will produce a tornado up to 30 minutes in the future. In extensive testing, ProbTor was shown to improve the lead time of tornado warnings by 5 to 10 minutes. National Weather Service

forecasters at the 2017 Hazardous Weather Testbed will evaluate ProbTor. It is anticipated that cloud property and lightning measurements from GOES-16 will add significant value to ProbTor in the future. (M. Pavolonis, E/RA2, 608-263-9597, Mike.Pavolonis@noaa.gov, J. Cintineo, CIMSS, J. Sieglaff, CIMSS, J. Brunner, CIMSS)

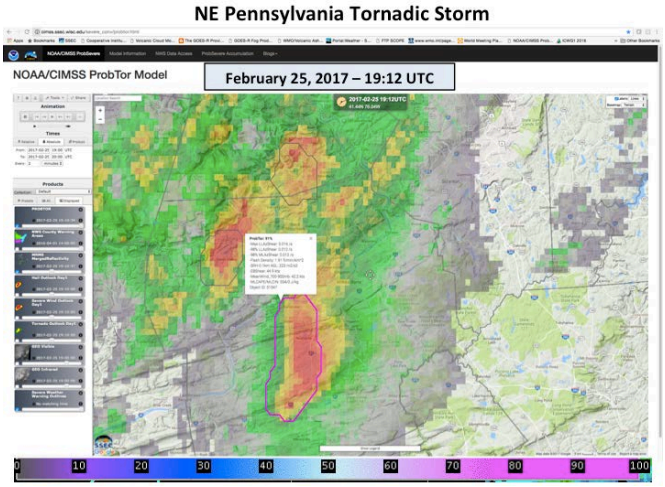


*Figure 14. A storm cell in Northeastern Pennsylvania on February 25 at 19:12 UTC (2:12PM EST) is given a 91% chance of producing a tornado by the ProbTor model (radar depicted storm cell with text readout). The storm did produce a damaging tornado, with 120 mph winds, from 19:35 UTC (2:35PM EST) to 19:50 UTC (2:50PM EST). ProbTor strongly implied that tornado generation was very likely 23 minutes before the tornado formed and 10 minutes before the National Weather Service issued a tornado warning.*

## NOAA Hydrobundle Released

NOAA's National Centers for Environmental Information (NCEI) has released a new "hydrobundle" Climate Data Record (CDR) that pulls together several types of water data to provide a clearer, broader picture of Earth's climate (https://www.ncdc.noaa.gov/news/new-climate-data-record-focuses-water). This CDR, generated from the Advanced Microwave Sounding Unit (AMSU) and the Microwave Humidity Sounder (MHS) spans the period 2000-2010 and can be used for forecasting trends as well as to monitor changes in hydrological phenomena (Figure 15).

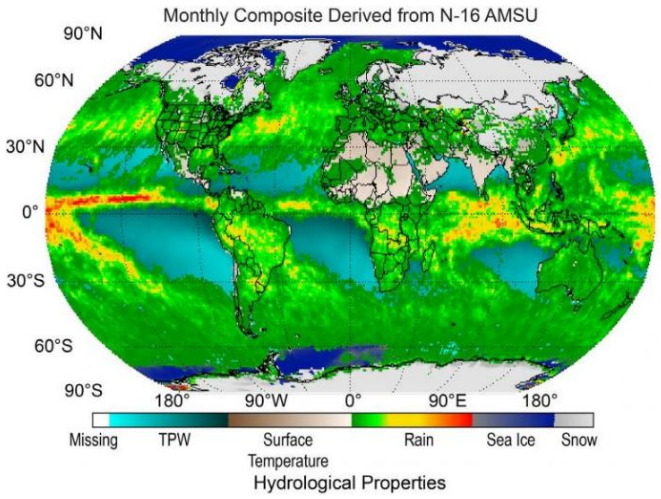


*Figure 15. Monthly composite of hydrological properties derived from Advanced Microsounding Unit (N-16 AMSU) radiometer readings*

The time series will be expanded to 2015 by April of this year. The "hydrobundle" has been a long-term project at SCSB and CICS, involving Ralph Ferraro, Huan Meng, Wenze Yang, Isaac Moradi, and Jim Beachamp.

## Improvements in forecasting wind radii from satellite observations

John Knaff and his colleagues from CIRA published a paper titled "A Global Statistical–Dynamical Tropical Cyclone Wind Radii Forecast Scheme" in *Weather and Forecasting* which demonstrates an improvement in hurricane wind radii from using historical satellite infrared observations. Figure 16 illustrates the steps taken to estimate wind radii given inputs based on the best track and satellite imagery. The method produces stable forecasts of wind radii that are competitive with the current operational methods. Furthermore, the addition of these independent forecasts into wind radii consensus forecasts suggests that the forecasts provide independent information that reduces forecast errors and bias among the consensus forecasts at most forecast lead times and all wind radii. This forecast system is being run in real-time as part of the Joint Hurricane Testbed and will be transitioned to JTWC operations this coming typhoon season. The reference follows.

Knaff, J., C. Sampson, and G. Chirokova, 2017: A global statistical–dynamical tropical cyclone wind radii forecast scheme. *Wea. Forecasting*, **32**, 629–644, doi: 10.1175/WAF-D-16-0168.1.

| Inputs | |
|---|---|
| **Variable Names** | **Values for Amanda (2014)** |
| TC size (R5) | 11.02 |
| Intensity ($V_m$) | 90.00 |
| Latitude ($\gamma$) | 11.50 |
| Storm Heading | 297.00 |
| Storm Speed (c) | 4.40 |
| **Calculated** | |
| **Variable Names** | **Values for Amanda (2014)** |
| R5 climatology ($R5_c$) | 13.06 |
| Normalized size ($F_{R5}$) | 0.84 |
| Averaged R34 | 107.40 |
| Averaged R50 | 55.90 |
| Averaged R64 | 29.60 |
| $R_m$ (Climatology) | 18.20 |
| 34-kt Bias correction | 0.91 |
| 50-kt Bias correction | 0.86 |
| 64-kt Bias correction | 0.79 |
| Asymmetry (a) | 3.32 |
| Phase ($\theta_p$) | 11.3 |
| **Output** | |
| **Variable Names** | **Values for Amanda (2014)** |
| R34 (NE, SE, SW, NW) | 120,105,95,120 |
| R50 (NE, SE, SW, NW) | 55, 50, 50, 55 |
| R64 (NE, SE, SW, NW) | 30,25,20,30 |

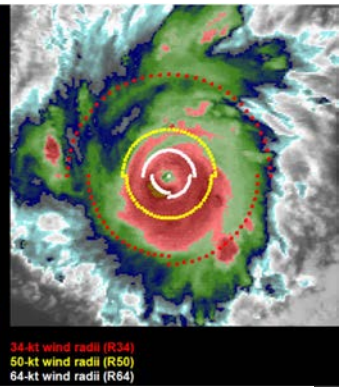


*Figure 16. (left) The inputs needed, values calculated, and resulting wind radii estimates based on the best track of Hurricane Amanda (2014) at 0000 UTC 25 May and (right) the corresponding IR image with the wind radii estimates overlaid. (J. Knaff, E/RA1, G. Chirokova, CIRA, 970 491-8446, John.Knaff@noaa.gov, Galina.Chirokova@colostate.edu).*