AMS Talk Summaries from STAR & CIs

American Meteorological Society

98th Annual Meeting | AUSTIN | 2018

Compiled by Ralph Ferraro, STAR/CoRP/SCSB & Deb Baker, CICS-MD

STAR

- Sid Boukabara
- Lori Brown
- Changyong Cao
- Don Hillger
- Dan Lindsey
- Huan Meng
- Biljana Orescanin
- Mike Pavolonis
- Michael Pettey
- Tony Reale
- Tim Schmidt
- Ryan Smith
- Wenze Yang

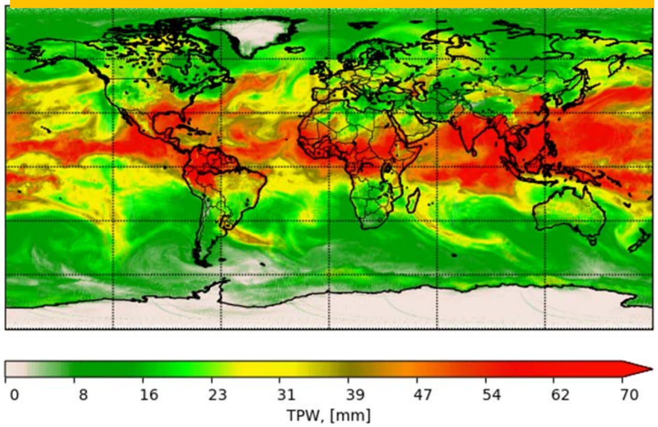
Exploring Using Artificial Intelligence (AI) for Remote Sensing, NWP and Situational Awareness (SA)

S. Boukabara (STAR), E. Maddy*, A. Neiss*, K. Garrett*, E. Jones*, K. Ide~, N. Shahroudi*, K. Kumar*
*Riverside Technology Inc. ~University of Maryland

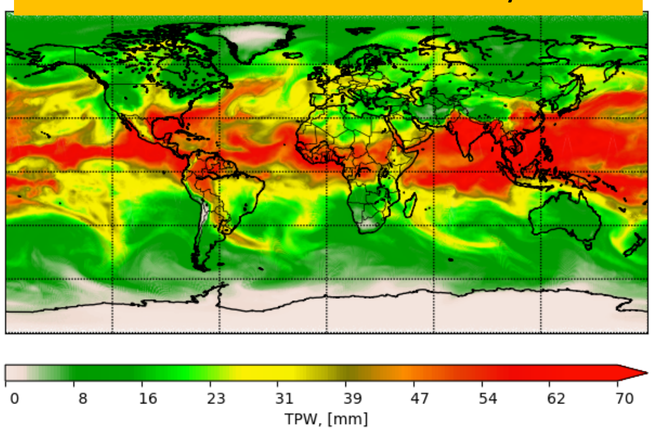
The pilot project applies AI to the Multi-Instrument Inversion and Data Assimilation Preprocessing System (MIIDAPS) algorithm, utilizing Google TensorFlow.

- Increase in quantity and quality of global observing systems presents unprecedented (and welcome) challenges: cost and infrastructure to leverage/exploit them.
- Constraints may require us to explore new approaches for the future (not so distant). AI-based analyses (satellite-exlusive) are found to be radiometrically, spatially and geophysically consistent with traditional analyses.
- Goal of this study is not to show AI can do better, but that it can provide at least similar quality, much faster. It appears to be doing that.
- Different data-processing components can benefit from AI (Inversion, Data Assimilation, RT, QC, Data Fusion) for NWP and Situational Awareness SA.

MIIDAPS-AI outputs (TPW) Using SNPP/ATMS Real Data



Reference source of TPW: ECMWF Analysis



Processing Time for a full day data. A single sensor (ATMS). Excluding I/O	MIIDAPS-AI	MIIDAPS
	~5 seconds	~ 2 hours

NOAA STAR CENTER FOR SATELLITE APPLICATIONS AND RESEARCH

Careers • Intranet • Contact • Skip navigation

cics-md Cooperative Institute for Climate & Satellites

CIRA

CUNY NOAA - Cooperative Remote Sensing Science and Technology Center

CIMSS

An Innovative System to Generate and Present GOES-16 Images Over the Web

In March 2017, the NOAA Center for Satellite Applications and Research (STAR) was asked to develop a website to present the GOES-16 images on a near-real-time basis. The GOES-16 image stream during ordinary operations produces 3 image types continuously.

Lori K. Brown[1], Matthew Jochum[2], Brian Keffer[3], Dan Lindsey[4]

E-mail contact: lori.brown@noaa.gov

[1] IM Systems Group, Rockville, Maryland

[2] NOAA/NESDIS/STAR, College Park, Maryland

[3] Caelum Research Corporation, Rockville, Maryland

[4] NOAA / NESDIS / STAR / RAMMB, Ft. Collins, Colorado

GOES-16 – typical data stream

- A full disk view every 15 minutes
- CONUS every 5 minutes
- Two mesoscale views (1000km x 1000km) every minute

The challenge was to produce this image stream multiplied by 16 channels + GeoColor, while minimizing image production latency; and to develop a site that could deliver the very large, continuously updated image stream in a lightweight, easy-to-use framework. On a minimal budget and a short timeline.

The Site

Written in PHP, uses Bootstrap 3.3.7, JQuery, javascript, CSS, Fancybox, and Cycle2 for animation. As of 5 January 2018, the site has had one million page views since launch on 18 December 2017. The average site visit is over 5 minutes, which is extraordinarily long for any site, let alone one that delivers satellite imagery.

Key features:

- Every image type, channel, and resolution has a static link that allows users to access the latest copy of any image.
- Mobile-ready, attractive, and easy-to-navigate for all display types
- Every image type and channel is animated, all animations are configurable
- Pan and zoom on higher resolutions
- Continually updated JSON image catalogs allow users to independently access and reference images

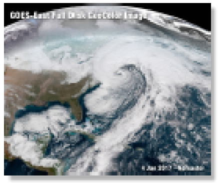
What is a catalog file?

A central performance challenge for the site was capturing and rendering the correct, newest set of images for each page load. New images are created every single minute, so how can the site code efficiently figure out what to load? Typical methods involving list operations on the image directories would not perform quickly enough on a heavily used site. For security reasons using a database was not desirable

The solution: During the image generation process, we update a set of JSON files that list the latest set of images at every resolution for each view / channel. (451 files) On page load, the page code calls the relevant catalog files to assemble animations and reference newest images, without performing any costly operations on the image directories.

The added benefit of the catalogs is that they function as a dynamically updated API to the image set, enabling outside users to download, link, and reference the images for their own uses.

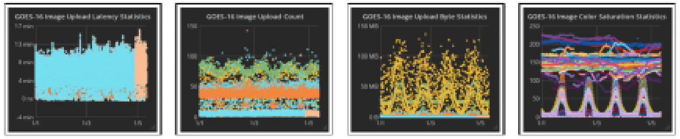
GeoColor Images



- Nighttime images use bands 7 and 13 and differentiates between low liquid water clouds and higher ice clouds
- McIDAS-X is used to create the final resulting image for both Full Disk and CONUS
- The product is output on the ABI 1-km grid

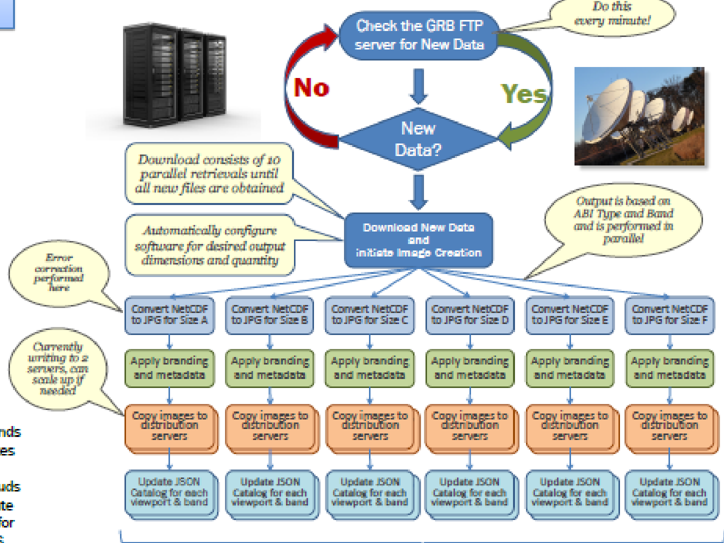
- GeoColor images for GOES-East are generated with an algorithm developed by Steve Miller at CIRA.
- The processing uses 5 ABI bands and is performed primarily via fortran-90
- Daytime images require Rayleigh correction of bands 1-3, and the green component is obtained using a lookup table built using Himawari-8 data

Performance Metrics



GOES-East Website Image Generation Process

From satellite to webserver in as little as 1 minute



This process is then multiplied by 16 channels x each view: Full disk, CONUS, Meso 1, Meso 2, 16 regional views

Views	Daily File Count	Daily File Volume (bytes)
Full Disk	6,624	14,953,425,408
CONUS	19,872	7,938,805,824
Mesoscales	106,560	6,162,393,600
Regional Sectors	165,888	7,303,487,040
Totals	298,944	36,358,111,872

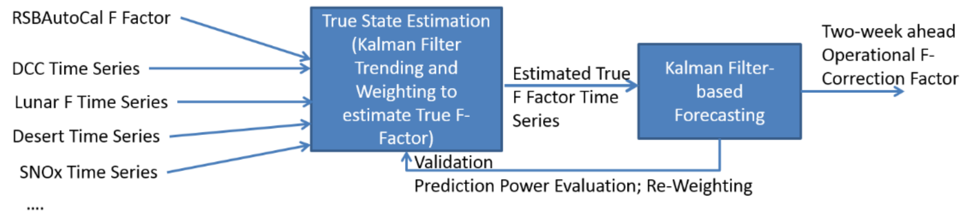
NOAA GOES-East Imagery Site: https://www.star.nesdis.noaa.gov/GOES/

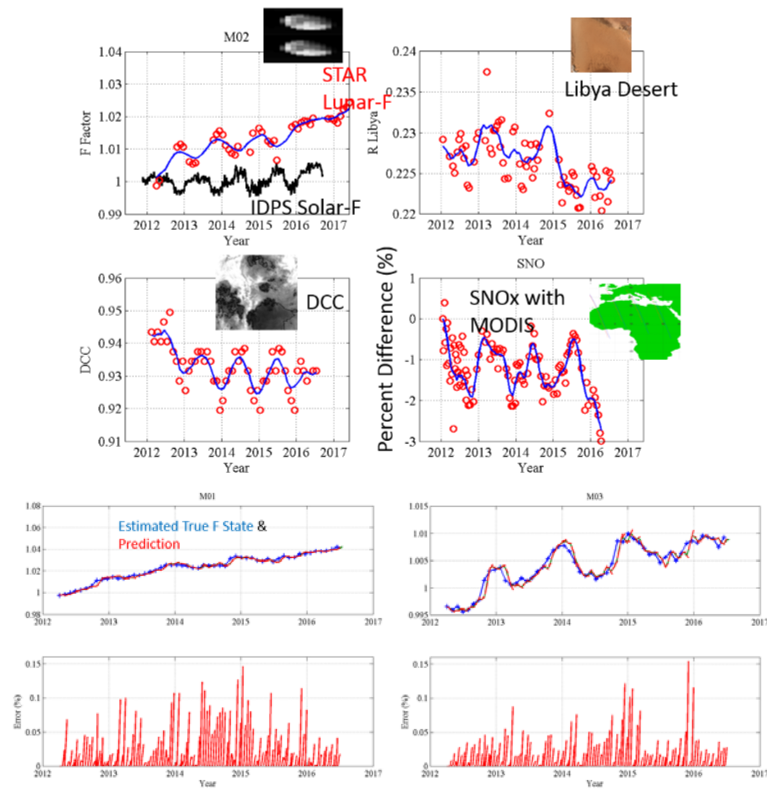
Special thanks and credit to the entire STAR GOES-R development team, whose efforts underpin the success of this project.

Improving the Operational Calibration Stability of VIIRS SDR Using Advanced Kalman Filtering

Changyong Cao(NOAA/NESDIS/STAR); Xi Shao(CICS-MD)

- VIIRS onboard solar calibration has a residual degradation which has to be corrected based on other measurements
- NOAA VIIRS SDR team has developed a novel method using an offline Kalman filtering model to estimate the residual degradation of VIIRS SDR by assimilating inputs from a number of independent measurements
  - lunar calibration
  - deep convective cloud observations
  - desert calibration
  - and simultaneous nadir overpass calibration
- The model is able to predict ahead up to two weeks and potentially be used for offline analysis to provide operational correction to the near realtime data
- Results can be used for bias correction either as part of the VIIRS SDR, or separately.

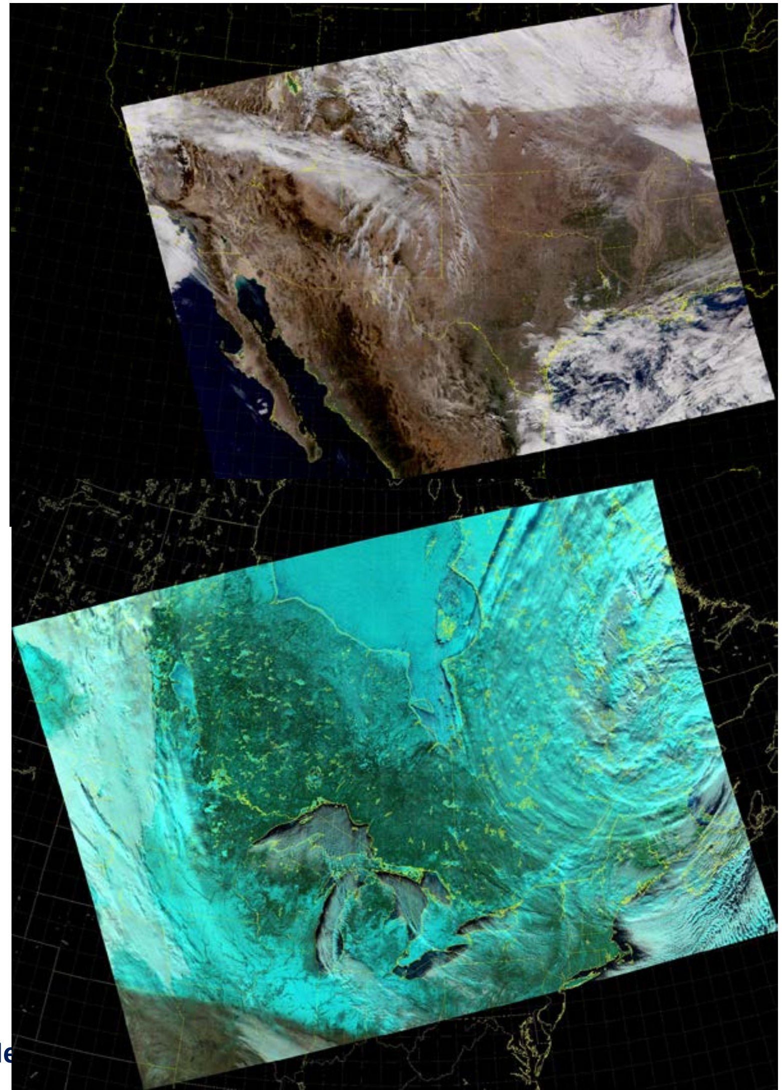




First VIIRS Imagery from NOAA-20 (JPSS-1)

Don Hillger (NOAA), Tom Kopp (Aerospace), Steven Miller (CIRA), Daniel Lindsey (NOAA), Curtis Seaman (CIRA), Jorel Torres (CIRA), and William Straka III (CIMSS/SSEC)

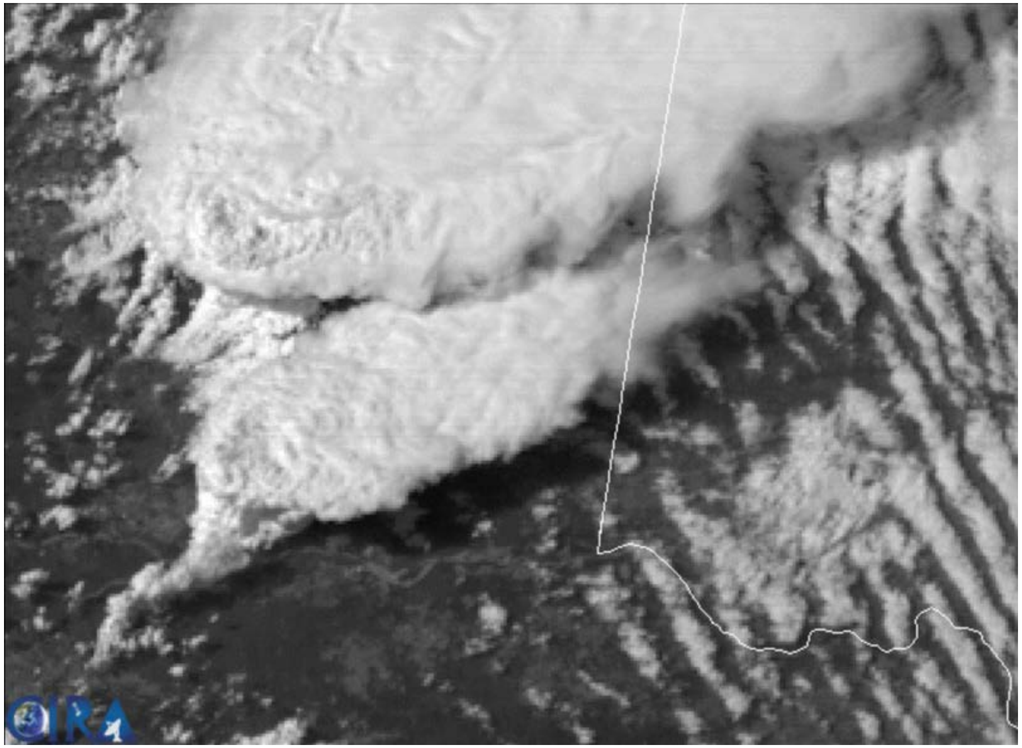
- **Introduction to VIIRS EDR Imagery**
  - Advantages over pre-VIIRS Imagery
  - EDR vs SDR
  - NCC vs. DNB
- **Interesting examples of S-NPP Imagery** from 2017
- **First-light VIIRS from NOAA-20** (JPSS-1)
  - 13 Dec 2017 Visible
  - 5/6 Jan 2018 IR/DNB



Highlights of the First Year of GOES-16 ABI Imagery

Dan Lindsey (NESDIS), Steve Miller (CIRA), Curtis Seaman (CIRA), Steve Goodman(ret. NESDIS)

- **The presentation showed the best animations from the first year of GOES-16 ABI imagery**
- **Examples included single band and RGB imagery, including CIRA's GeoColor product**
- **Mesoscale 1-minute loops continue to "wow" both forecasters and the general public**

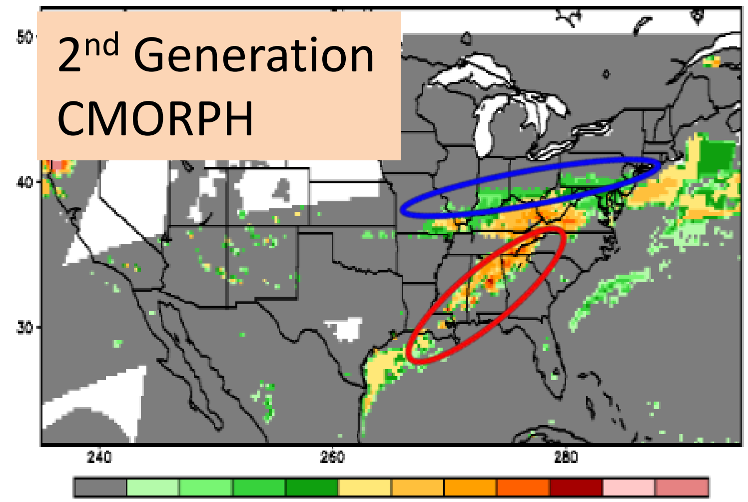


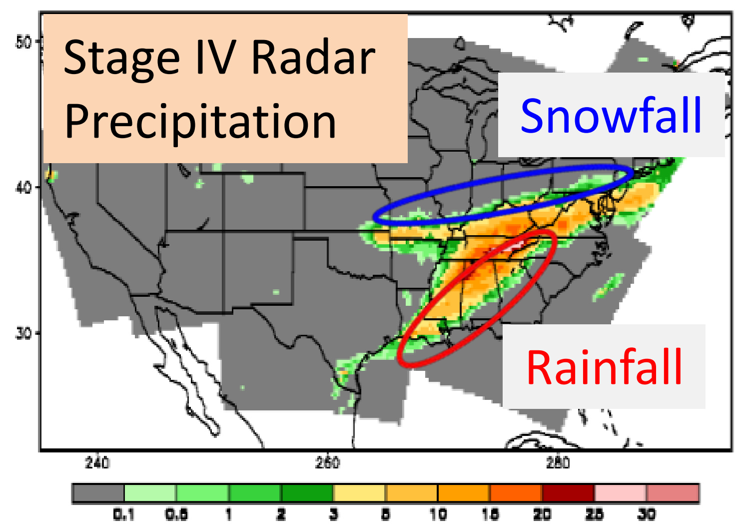
Sample image from a loop of 1-min imagery from 16 May 2017 in north Texas showing supercell thunderstorms

An Operational Passive Microwave Snowfall Rate Product and Its Application in Hydrology

Huan Meng, Jun Dong, Cezar Kongoli, Ralph Ferraro, Banghua Yan, Limin Zhao, Pingping Xie, Robert Joyce

- NESDIS Snowfall Rate (SFR) product retrieved using measurements from passive microwave sensors
  - Existing operational sensors: AMSU/MHS, ATMS (transition to operation soon)
  - Expanded to GMI and SSMIS sensors
  - Nine satellites: SNPP, NOAA POES, EUMETSAT Metop, NASA GPM, DMSP
  - Eighteen snowfall rate estimates per day on average in mid-latitudes, more in higher latitudes
- SFR application in hydrology
  - Most blended satellite precipitation datasets do not include satellite snowfall rate in the past due to the lack of such product
  - NOAA/NCEP CMORPH is a global blended precipitation analysis
  - The 1st-generation CMORPH is rain-only; the SFR product is integrated in the 2nd-generation CMORPH to cover winter precipitation



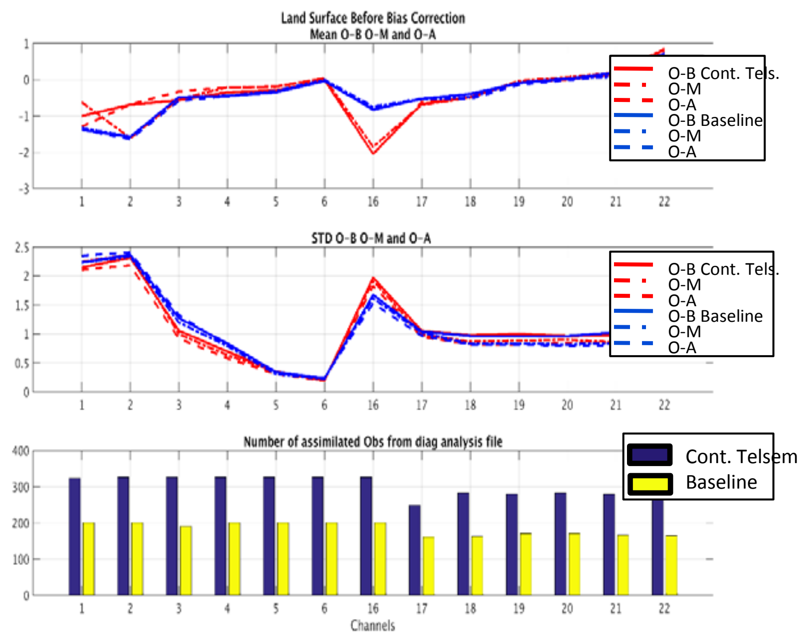


Surface Emissivity as an Analysis Variable in Gridpoint Statistical Interpolation (GSI) System

Biljana Orescanin1, Benjamin Johnson2, Andrew Collard3, and Thomas Aulig né2
1. RTI @ JCSDA/STAR/NOAA, 2. UCAR @ JCSDA/NOAA, 3.IMSG@EMC/NOAA

- Land emissivity in GSI
  - CRTM as a first guess for emissivity over land for MW needs improvements. New physical emissivity model in development (Ming Chen)
  - TELSEM (climatology atlas) serves as a solid substitute over land for emissivity
  - TELSEM without control variable implementation does degrade OmB even though it brings significant increase in assimilated observations

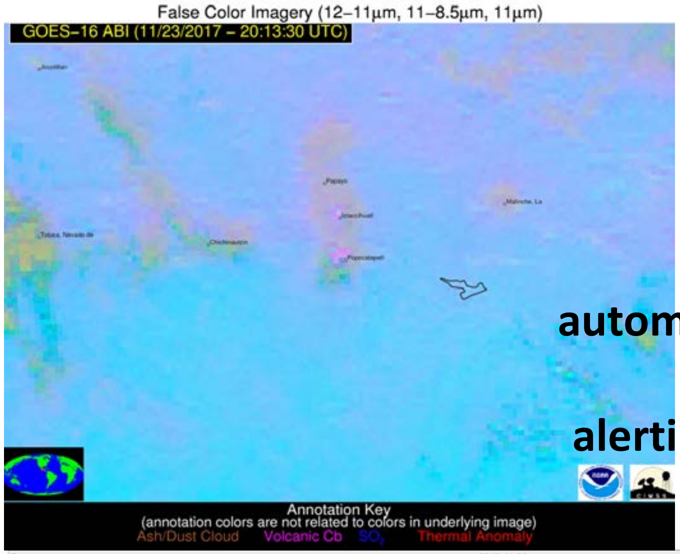
- Preliminary results with Emissivity as a control variable in GSI with TELSEM as FG
  - Shown on right one cycle for May 1st 2015
  - Greater number of assimilated observations compared to the baseline run with same tight operational QC
  - Different emissivity errors can be assigned to each channel, which increases the number of observations when tuned for every channel separately, they also improve the performance statistics



GOES-R and JPSS: Volcanic Clouds:

Mike Pavolonis (NESDIS); Justin Sieglaff, John Cintineo, & Bill Bellon (CIMSS)

- Advanced algorithms for detecting, tracking, and characterizing volcanic clouds from satellite have been developed as part of the Volcanic Cloud Analysis Toolkit (VOLCAT)
- When the VOLCAT algorithms are applied to JPSS and GOES-R measurements, the accuracy and timeliness of volcanic ash advisories is improved

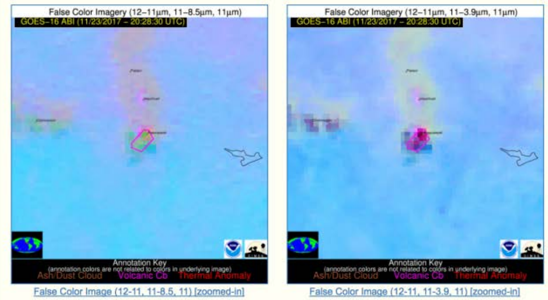


Example of automated eruption detection and alerting with GOES-16

Date:	2017-11-23
Time:	20:28:30
Production Date and Time:	2017-11-23 20:33:57 UTC
Primary Instrument:	GOES-16 ABI

More details ▼

Possible Volcanic Cb



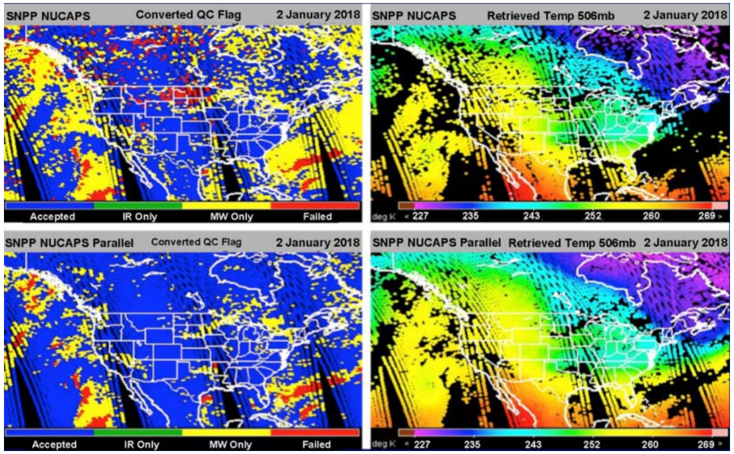
Basic Information	
Volcanic Region(s)	Mexico and Central America
Country/Countries	Mexico
Volcanic Subregion(s)	Mexico
VAAC Region(s) of Nearby Volcanoes	Washington
Identification Method	Basic Growth
Mean Object Date/Time	2017-11-23 20:28:30UTC
Radiative Center (Lat, Lon):	19.000°, -98.630°
Nearby Volcanoes (meeting alert criteria):	Popocatepetl (0.90 km)
Trend in IR Brightness Temperature	-17.10 °C
Vertical Growth Rate Time Interval	5 minutes
Vertical Growth Rate Anomaly	13.40 number of stddev above mean
Maximum Height [AMSL]	6.50 km ; 21325 ft
90th Percentile Height [AMSL]	6.70 km ; 21982 ft
Mean Tropopause Height [AMSL]	16.30 km ; 53478 ft

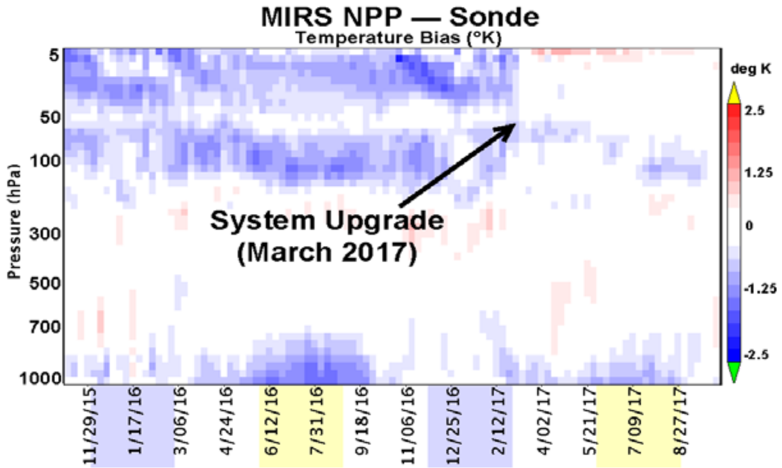
Show More ▲ View all event imagery »

Ten Years Of Collocated Satellite Products From The NOAA Products Validation System (NPROVS)

Michael Pettey, Bomin Sun (I.M. Systems Group); Tony Reale (NOAA/NESDIS/STAR)

- The JPSS NPROVS team provided a brief overview of the NOAA Products Validation System
  - NPROVS was designed to be an independent, centralized system to validate and monitor the performance of satellite processing platforms
- An oral presentation was delivered at the 13th Symposium On New Generation Operational Environmental Satellite Systems
  - The NPROVS suite of graphical evaluation tools was discussed with examples provided to highlight validation and monitoring capabilities
  - Examples of uses of NPROVS by users outside of STAR/JPSS were presented

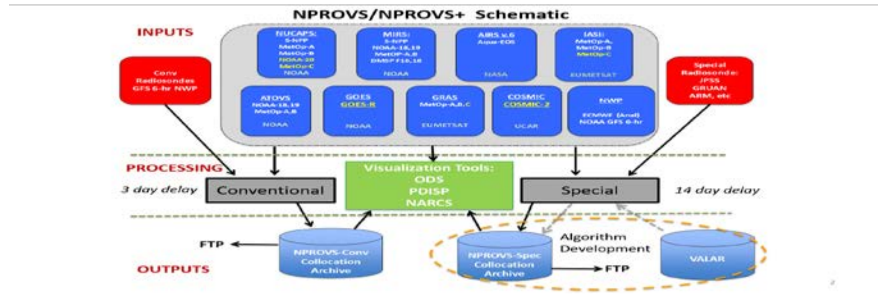




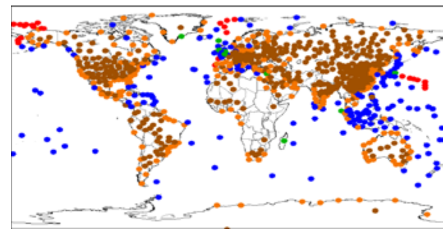
NOAA Products Validation System: STAR, GRUAN and NWS Applications

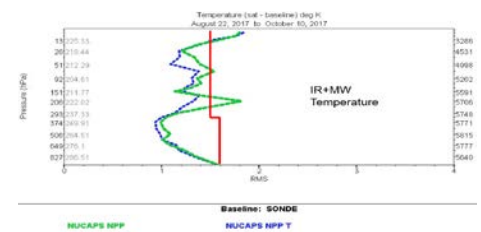
Tony Reale (NOAA NESDIS/STAR)
Bomin Sun, Ryan Smith, Michael Pettey (I.M. Systems Group)
Lihang Zhou (STAR) and Jennifer Dover (NOAA/NWS/SFSC)

NPROVS: Schematic showing the processing of the separate sets of collocated conventional (left) and special (right) radiosondes with each satellite product suite (middle). Product suites are comprised of temperature and moisture soundings from Polar Orbiting, Geostationary and GPSRO (Radio Occultation) constellation satellites; yellow indicates pending suites. Final collocation datasets are archived at STAR and available in NetCDF format, visit our web site at: **https://www.star.nesdis.noaa.gov/smcd/opdb/nprovs/ods.php.**

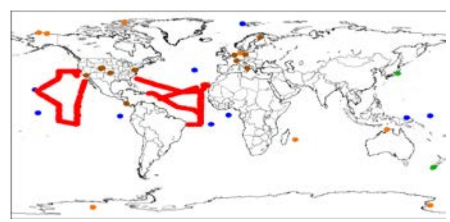


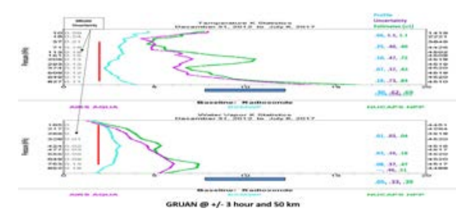
STAR Cal/val: The above panels show **NUCAPS (Old)** versus **NUCAPS (FSR**) versus specification **(red)** for temperature (left) and H20 vapor fraction (right). The NUCAPS FSR shows overall smaller differences relative to the ground truth conventional radiosondes compared to the current operation for both temperature and water vapor.



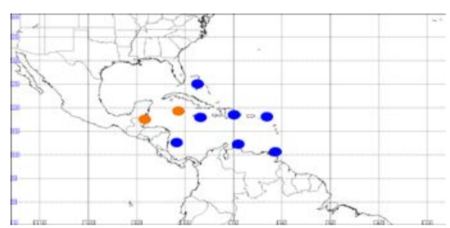


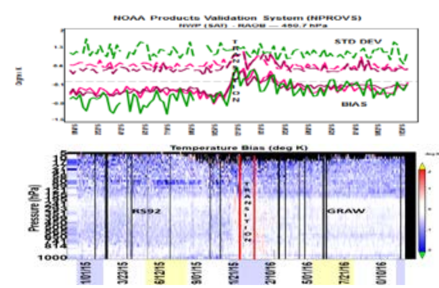
GRUAN: Collocations of satellite sounding products and GRUAN radiosonde observations (left) provide a unique opportunity to estimate satellite and ECMWF profile uncertainty and a potential enhancement to current NOAA sanctioning specification protocol (right).





NWS: During late 2015, the NWS CHUAS transitioned from the Vaisala RS92 to GRAW raiosonde. Time series of numerical weather prediction (ECMWF analysis) and satellite sounding (MetOp-A) minus CHUAS radiosonde differences through the transition period were generated using historical NPROVS data. The upper panel shows time series for 450 hPa temperature, lower panel shows a full atmosphere view of ECMWF-minus-Raob bias indicating. Both indicates a decreased bias (Raob warmer) before and after transition on the order of 0.5K … a good sign!



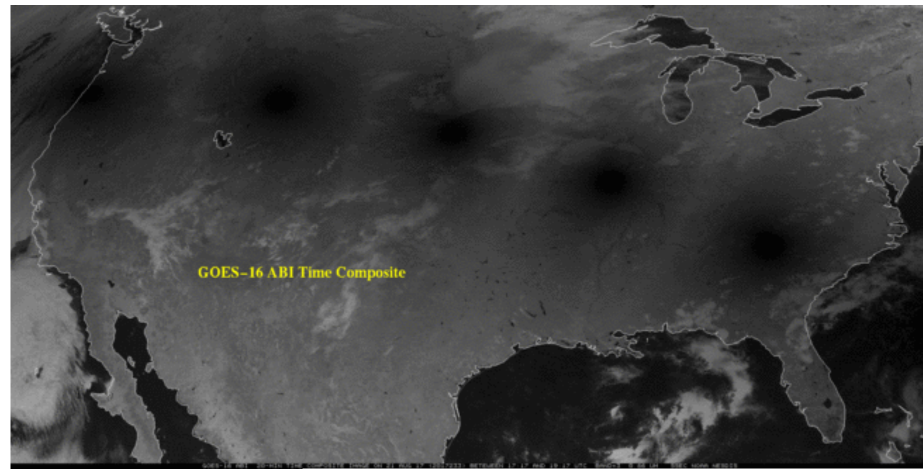


Using the Advanced Baseline Imager (ABI) on GOES-16 to Visualize Solar Eclipses

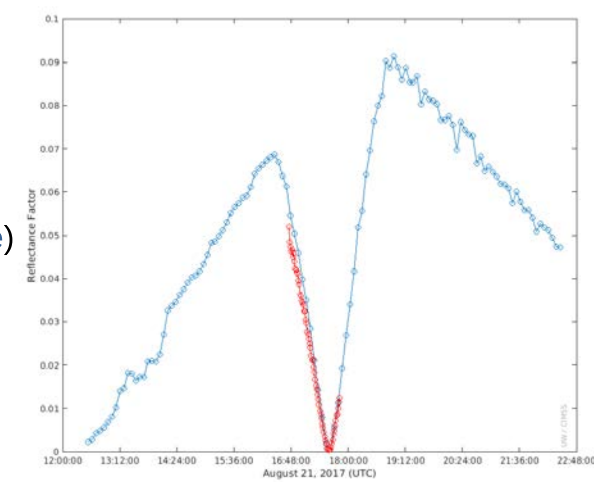
Tim Schmit (NESDIS), Mathew M. Gunshor (CIMSS), Joleen M. Feltz (CIMSS),
Kaba Bah (CIMSS), Kathyrn W. Mozer (NESDIS), and James P. Nelson III (CIMSS) and several others

- The ABI data collected during the Great American Eclipse is unique
  - 5-minute data, of the 16 ABI bands over the CONUS
  - 1-minute data of the 16 ABI from the mesoscale sector that "followed" the shadow

- Provides the opportunity for many science studies related to baseline products
  - Imagery
  - Fires
  - Land/Sea Surface Temperature
  - Surface Radiation
  - Clouds
  - Atmospheric Motion Vectors
  - Atmospheric temperature/moisture profiles
  - etc.



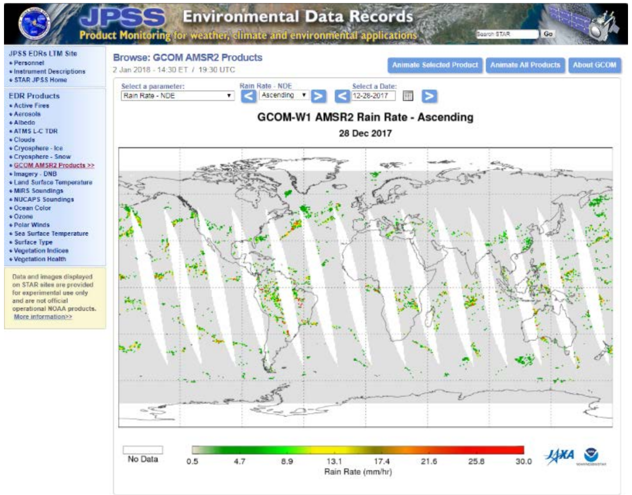
Reflectance Factor average of the ABI visible band at 0.64 µm for CONUS (blue) and Meso-scale sector 1 (red)

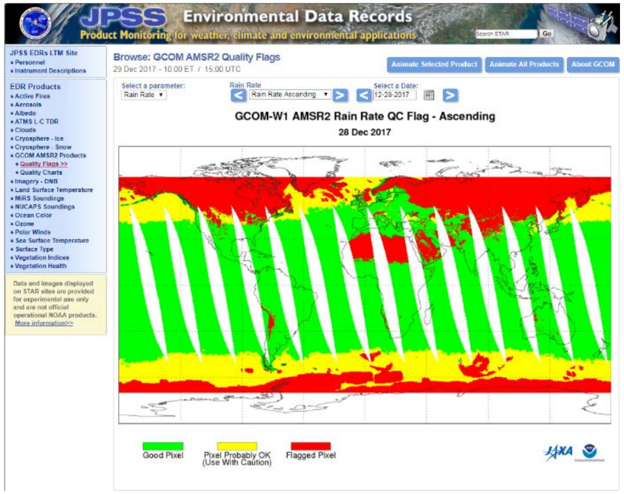


Status of JPSS EDR LTM Website

Ryan Smith, Lori Brown, Thomas Atkins, Charles Brown (I.M. Systems Group); Lihang Zhou (NOAA/NESDIS/STAR)

- The JPSS EDR LTM team provided a brief overview of team activities
  - Established a site where users and product teams can view and monitor the performance of JPSS EDR products
  - Updated code to generate images directly from Star's Central Data Repository (SCDR); reduces latency time
  - Currently generate 950+ global and polar images of JPSS EDR products daily
- Phase 2 efforts were discussed at the Tuesday Poster Session
  - New quality flag maps will be available to assist with quality monitoring of EDR products
  - Interactive time series plots of quality metrics will also be available

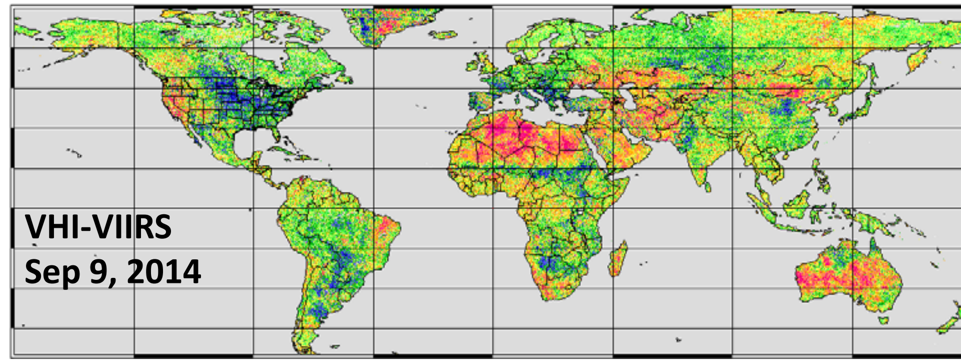




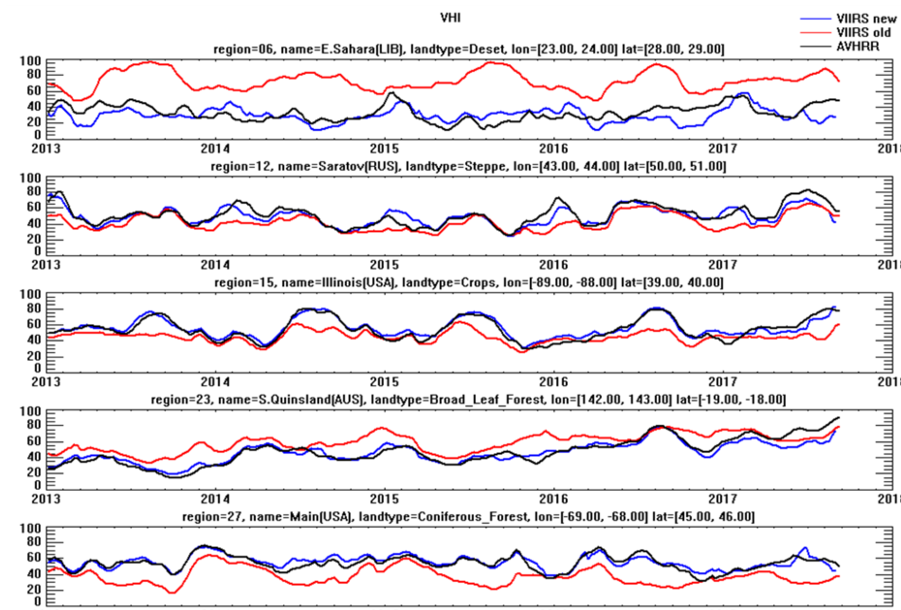
VIIRS-based high resolution spectral vegetation indices for quantitative assessment of vegetation health

Wenze Yang & Wei Guo (IMSG @ NESDIS); Felix Kogan (NESDIS)

- The 37-year (1981-2017) AVHRR-based 4km resolution vegetation health products (VHP) has been widely used
  - Drought applications
  - Agriculture production
  - Enso impacts
  - Modeling and predicting Malaria



- The second version of VIIRS VHP has just been developed
  - Directly use VIIRS smoothed NDVI/BT
  - Adjust VIIRS short-term to AVHRR long-term climatology
  - The second version VIIRS VHP displays much better spatial-temporal consistency with regards to AVHRR VHP, comparing to the first version
  - 1km resolution VIIRS VHP has also been produced



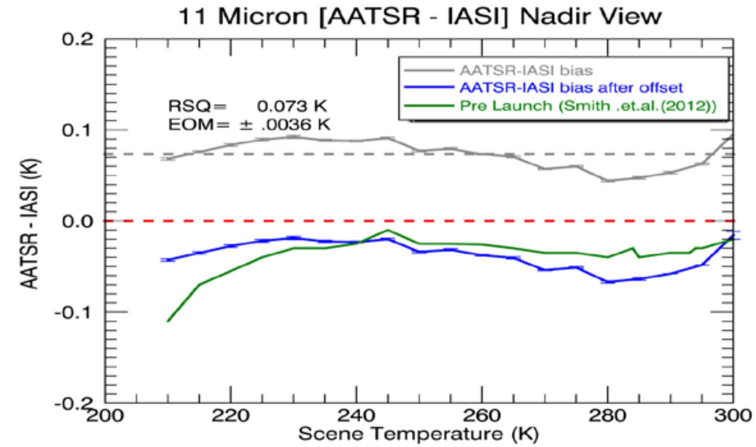
CICS-MD

- Manik Bali
- Yong Chen
- Chris Grassotti (2)
- Melissa Kenney
- Yuan Li
- Katherine Lukens
- Patrick Meyers
- Mitchell Schull
- Narges Shahroudi
- Augustin Vintzileos
- Hui Xu
- Yalei You
- Yan Zhou (2)
- Xiaolei Zou

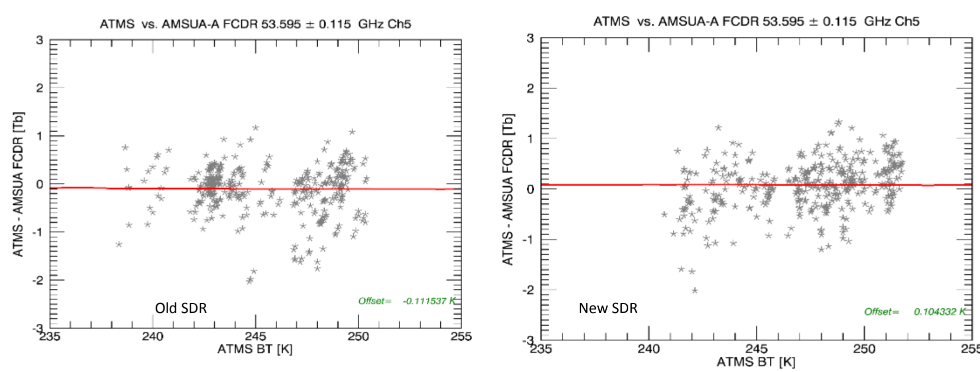
In-orbit references for Geostationary and Polar Satellites in Global Space Based Inter-Calibration System (GSICS)

by Manik Bali (CICS), Lawrence E Flynn, Cheng-Zhi Zou and Ralph Ferraro (NOAA)

- In-Orbit References for IR been evaluated and proposed.
  - IASI-A is nearly as good as a pre-launch reference with a minor offset of 0.07 K
  - AIRS has a similar ability to replicate its pre-launch design levels stability.
  - The AIRS – IASI-A combined has the ability to monitor GEO instruments worldwide at different times of the day (morning/evening and Afternoon-midnight).
- For the first time we propose an in-orbit reference for Microwave instruments
  - The Fundamental Climate Data Record (Zou et al 20131) has been proposed as a reference for Microwave Instruments.
  - The idea is to exploit its climate scale stability which is not matched by native measurements of Microwave instruments.



IASI-A inter- comparison with AATSR shows the bias in IASI is of the order of 0.07 K and is able to replicate pre-launch behavior of AATSR scene dependent bias

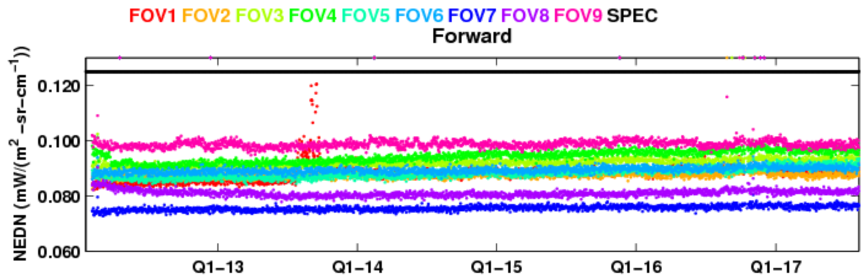


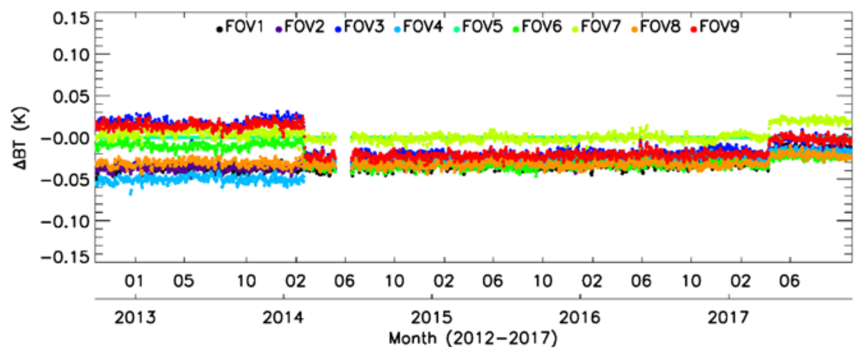
Inter- comparison of FCDR with ATMS-SDR shows that changes in SDR processing can be seen when compared with FCDR

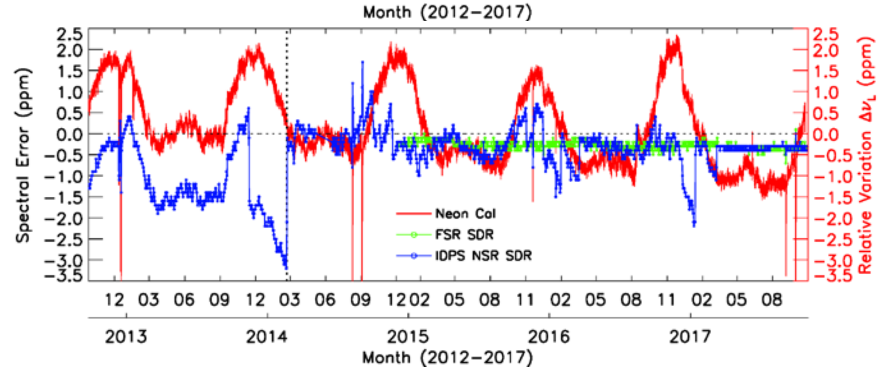
Improving Suomi NPP CrIS SDR Data Quality to Support Satellite Data Assimilation

Yong Chen (CICS), Likun Wang (CICS), and Changyong Cao

- SNPP CrIS SDR data quality continuously improved during the mission to support satellite data assimilation
- Overall radiometric biases (O-S) are small and stable over time, FOV-2-FOV differences are less than ~0.1 K, indicating that any FOV can be assimilated in NWP model
- It is shown that CrIS metrology laser wavelength varies within 3 ppm as measured by the Neon calibration subsystem. The new improved CrIS SDR in both NSR and FSR have spectral errors less than 0.5 ppm after IDPS block 2.0
- CrIS is well-suited for operational weather applications and for creating a long term climate record using SNPP, J1, J2 and J2 beyond





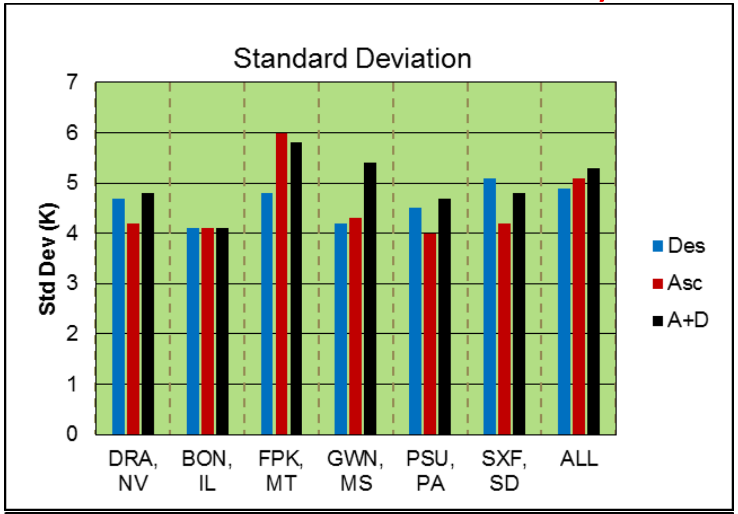


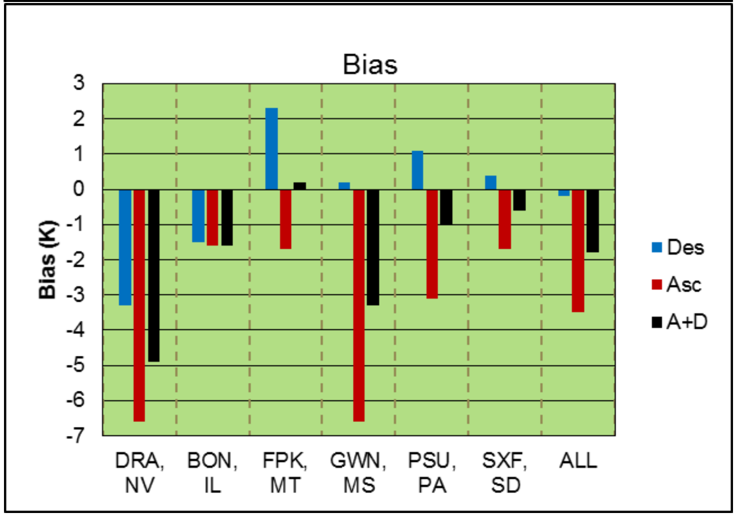
Microwave Integrated Retrieval System (MiRS): Land Surface Temperature Comparison with In Situ Measurements from SURFRAD

Christopher Grassotti, Carlos Perez-Diaz, Quanhua Liu

AMS 14th Symposium on New Generation Operational Environmental Satellite Systems

- MiRS Retrievals of Land Surface Temperature (LST) were collocated with SURFRAD measurements (6 stations over CONUS) for a 13 month period (May 2016 – May 2017)
  - Performance statistics for 6 stations individually and combined are shown. Also shown are separate performances for ascending, descending and combined passes.
  - Performance is similar between stations, with larger negative bias for ascending (daytime) passes



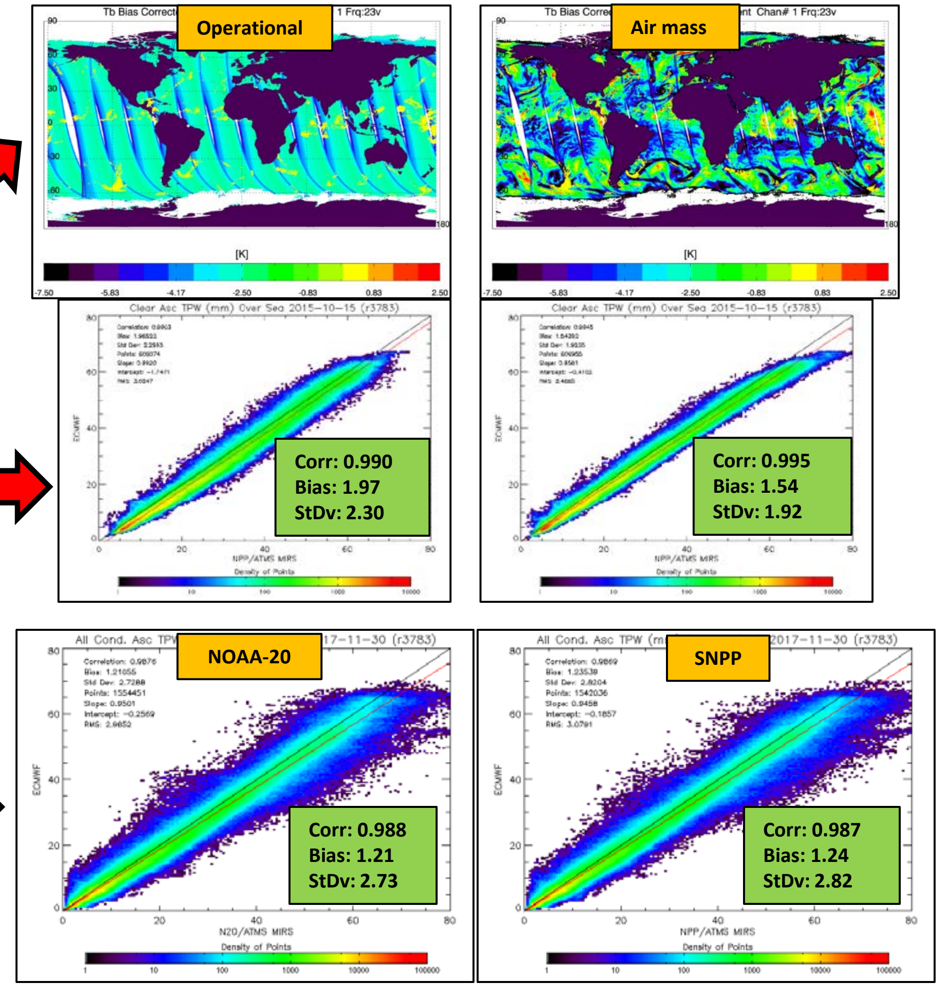


Microwave Integrated Retrieval System (MiRS): Recent Activity, Science Improvements, and First Look at NOAA-20/ATMS

<u>Christopher Grassotti</u>, Quanhua Liu, Shuyan Liu

AMS 14th Symposium on New Generation Operational Environmental Satellite Systems

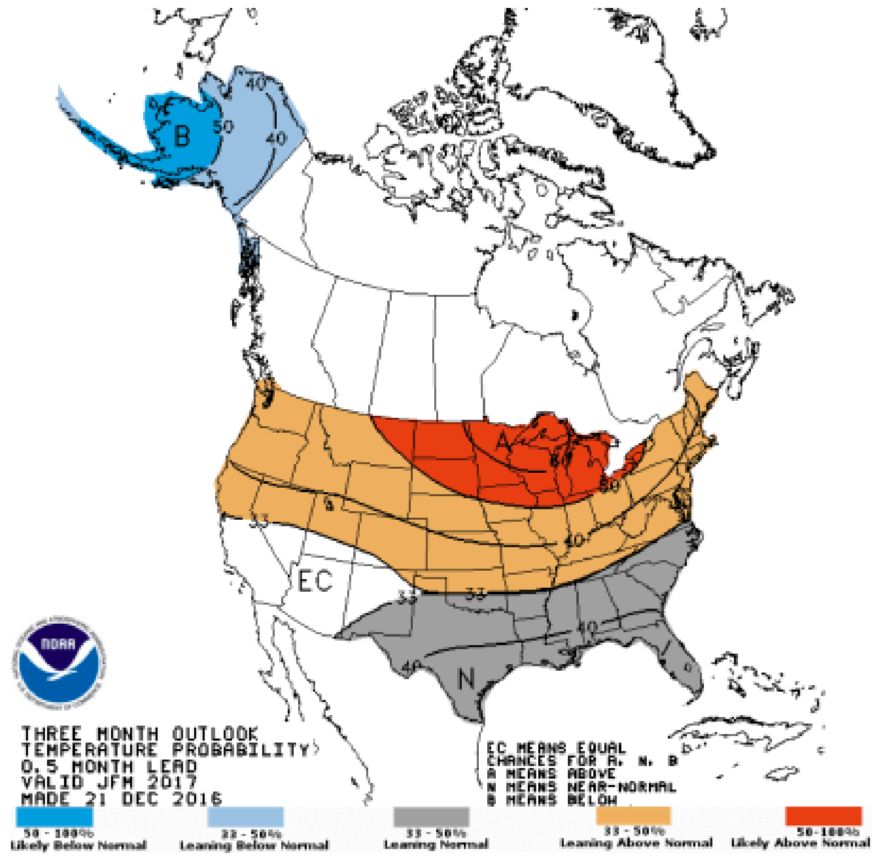
- Example of MiRS Science Improvement: Air mass-based radiometric bias correction
  - Operational (left) and air mass (right) bias correction for channel 1 (23 GHz)
  - Retrieved Total Precipitable Water (TPW) using operational (left) and air mass (right) bias correction shows improved performance.
- MiRS Retrievals from NOAA-20
  - Global Retrieval of TPW from NOAA-20 (left) and SNPP (right) showing very similar performance compared to ECMWF



NOAA Climate Outlooks

Melissa A. Kenney, Michael D. Gerst, Allison E. Baer, Amanda Speciale (University of Maryland Earth System Science Interdisciplinary Center Cooperative Institute for Climate and Satellites-Maryland), David DeWitt, Jon Gottschalck, Scott Handel (National Oceanic and Atmospheric Administration, National Centers for Environmental Prediction, Climate Prediction Center)

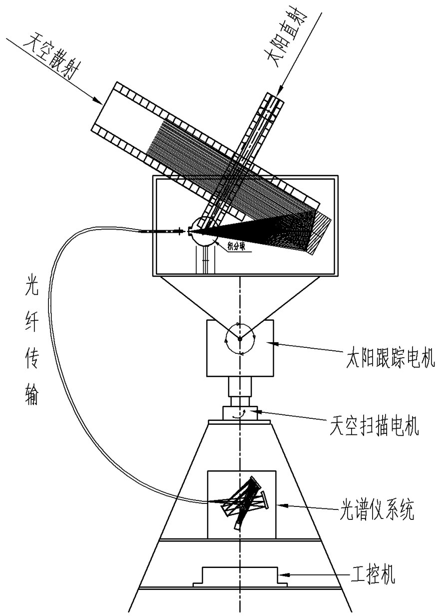
- Survey and interview results with expert users show four understandability challenges with the climate outlooks
  - White space outside of US
  - Understanding of normal (white space inside of US)
  - Clarity and clutter
  - Probability vs. Intensity
- A/B testing of redesigned outlooks
  - Determine if visual modifications improve understandability and utility of information for decision-making
  - Provide evidence-based approach to improve forecast visualizations to support NOAA decision-making



Example redesigned outlook

A New Method for Ground-Based Sun Photometer Radiometric Calibration Using AERONET Data inside the Same City

Yuan Li (NSMC/CMA & CICS-MD/UMD) , Xiaojing Li, Weihe Wang, Huanhuan Yan (NSMC/CMA), Houmao Wang, Yongmei Wang (NSSC/CAS)



DMAX-DOAS was developed by NSSC/CAS.

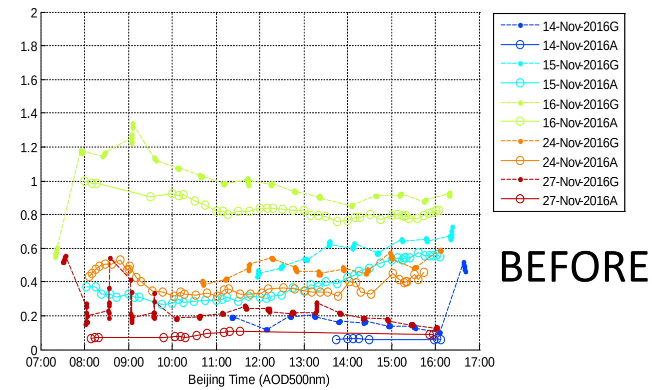
- 290-420nm
- 0.4-0.6 nm Wavelength resolution

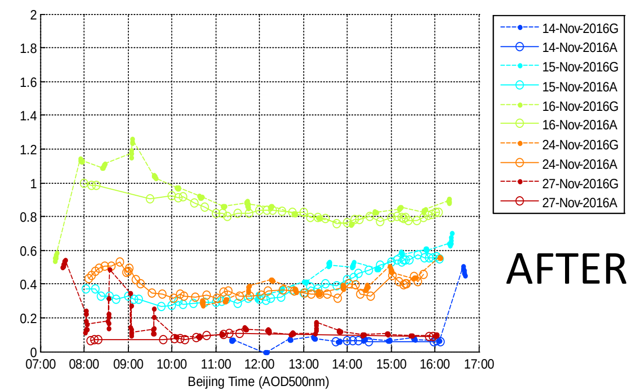
Measurement mode

- Direct sun
- diffuse sky: 2°, 5°, 10°, 20°, 30°, 50°, 60° and 90°

The closest AERONET station is 15 km away, need to develop a new calibration method

- Min(AOD_AERONET)=Min(AOD_DMAX)
- Distance:<30 km
- Time difference: <30 days
- V0=EXP(LOG(IRR_DMAX)-LOG(DS)+(Min(AOD_AERONET)+TAU_RAY)*MASS)





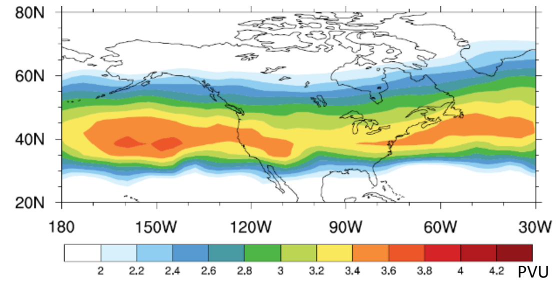
The relative absolute error of AOD products is < 7.53% by new calibration method

Subseasonal-to-Seasonal (S2S) Predictability of Storm Tracks and Related Winter Weather in the NCEP Climate Forecast System

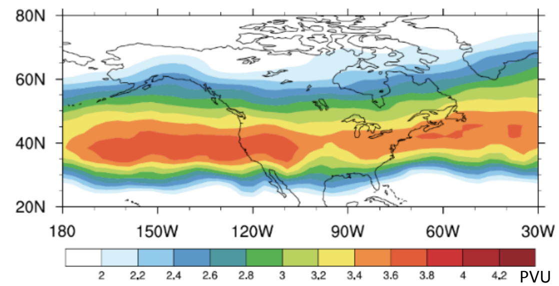
Katherine E. Lukens & E. Hugo Berbery (CICS-MD/ESSIC)

- Using week-4 CFS Reforecasts in DJF for 1983-2010:
  - **Bias corrected storm track (ST) intensity reforecast corresponds well with the reanalysis (CFSR)**, and yields improvements in other general ST features (not shown).
  - Removal of wind bias considerably **reduces root mean squared error (RMSE) in higher mid-latitude ST regions**.
  - Removal of precipitation bias **reduces RMSE over oceans** where ST intensity is high.
- Similar results are found using shorter lead times (e.g., week-2) (not shown).
- Findings support the potential use of storm track statistics to improve S2S winter weather outlooks.
  - *Ongoing*: Exploring real time applications using operational forecasts of CFSv2 model.

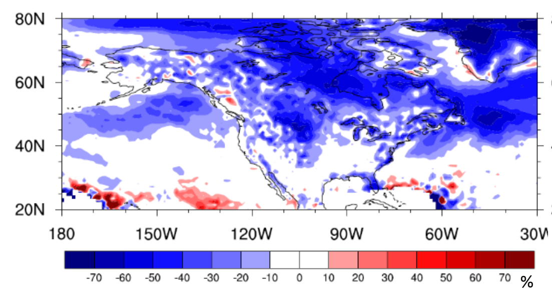
ST Intensity from Reanalysis



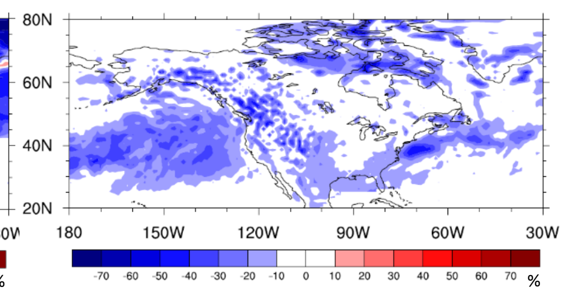
ST Intensity Reforecast (Bias Corrected)



% Change in Wind RMSE (hybrid level 1) after bias is removed



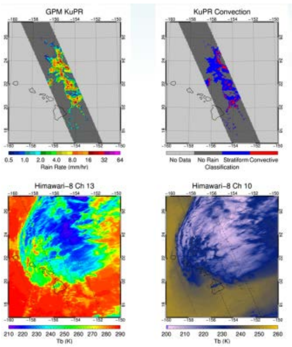
% Change in Precipitation RMSE after bias is removed

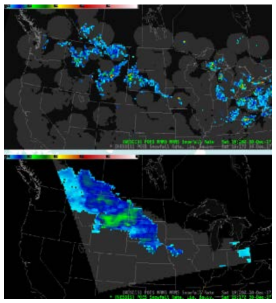


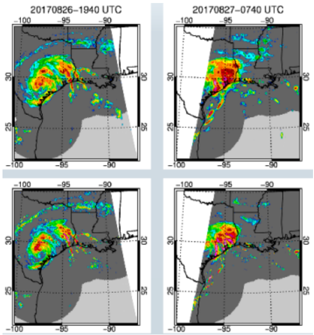
CICS-MD Contributions to NOAA Satellite Water Cycle Products and Services

Patrick Meyers (CICS), Scott Rudlosky (NESDIS), Nai-Yu Wang (CICS), Huan Meng (NESDIS), Jun Dong(CICS), Mark Sannutti (CICS), Shenjian Su (CICS), Ralph Ferraro (NESDIS), Hugo Berbery (CICS)

- The CICS-MD Proving Ground and Training Center continues to grow
  - Supports JPSS and GOES-R3 initiatives
  - 4 AWIPS-II Workstations
  - 3 Large screen displays, plus projector
  - NOAAPort antenna fully operational
  - Can host training and seminars
- Overview of several CICS-MD Projects
  - Extreme rainfall in Tropical Pacific
  - 2017 Hurricanes as seem from geostationary and low earth orbit
  - ATMS Snowfall Rate in operations





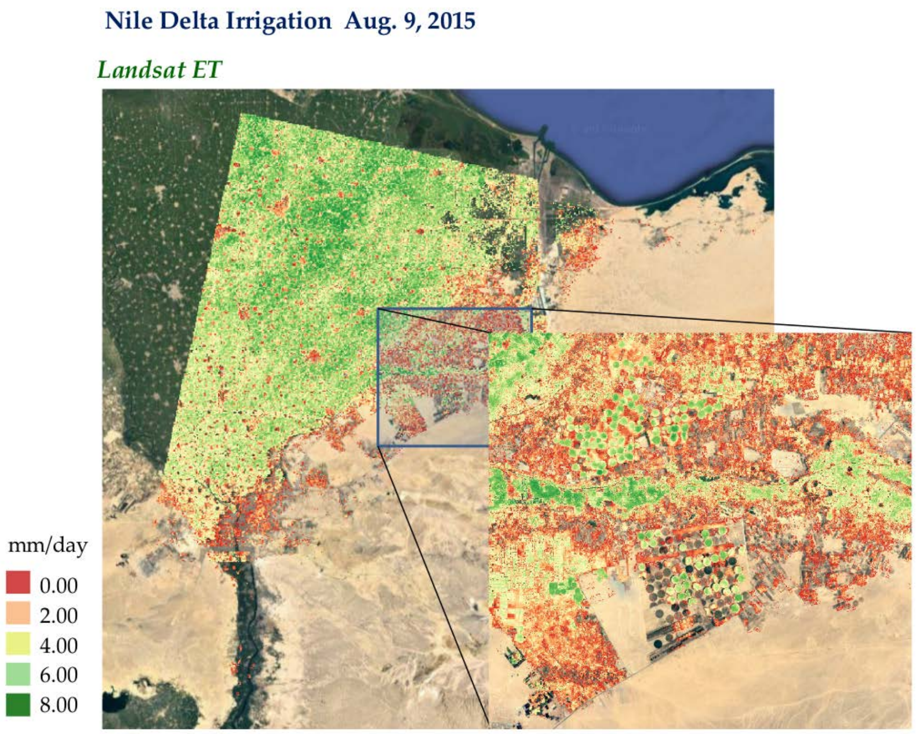


Regional and field-scale ET estimates over the MENA region using an open-source developed tool

Mitch Schull[1], Chris Hain[2], Martha Anderson[3], Feng Gao[3], Christopher Neale[4], and Xiwu Zhan[5]

[1]Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD
[2]Marshall Space Flight Center, Huntsville, AL
[3]USDA-ARS Hydrology and Remote Sensing Lab, Beltsville,MD
[4]Daugherty Water for Food Institute, University of Nebraska, Lincoln,NE
[5]NOAA NESDIS/STAR, College Park,MD

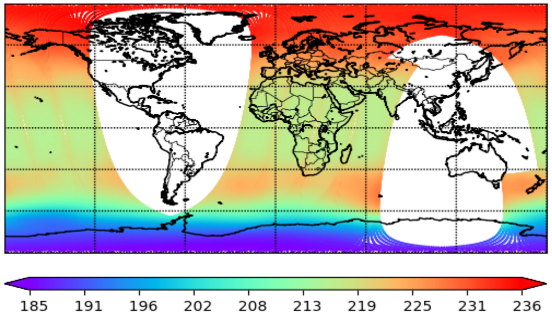
- DisALEXI has been ported to python for open source implementation.
  - Scientific code from proprietary programs (IDL) has been replaced with pythonic versions.
  - All datasets can be accessed (OpeNDAP, RESTful services) and processed on the fly.
- Parallel processing is important!
  - PyDisALEXI divides Landsat scenes into over a thousand parts and runs in parallel
  - Cannot run without parallelism as it will run out memory.



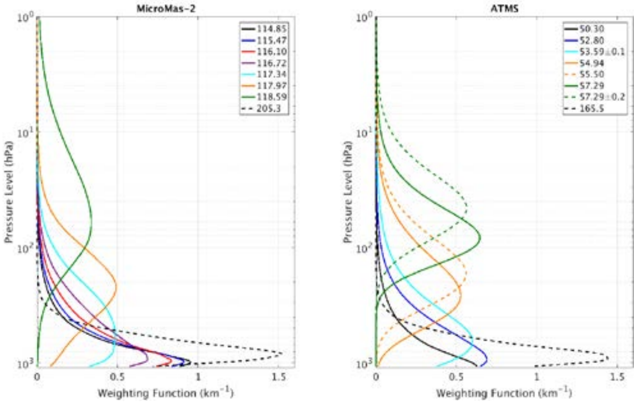
Assessing CubeSat MicroMAS-2 on NWP through Global OSSE

N. Shahroudi(Riverside Technology, Inc, NOAA/NESDIS), Yan Zhou(CICS-MD, NOAA/NESDIS), K. Ide(CICS-MD), T. Zhu(CIRA, NOAA/NESDID), S. A. Boukabara(NOAA/NESDID), R.N.Hoffman(U. Miami), R. Atlas(NOAA/OAR)

- The CubeSat MicroMAS-2 observations have been simulated, validated, and assimilated through the Community Global OSSE Package
  - being developed by MIT Lincoln Laboratory.
  - validated with ATMS observations.
- The impacts of MicroMAS-2 on top of a Control and a data-gap scenario are investigated, respectively.
  - Control: current operational observing system
  - Data-gap: Control minus all secondary satellites and without afternoon polar orbiting satellites, named as 2Polar
- The matrix representing the performance of an experiment is overall score.
  - Global Anomaly Correlation and RMSE scores are normalized for geopotential height, temperature, vector wind, and relative humidity over different pressure levels and forecast lead time.
  - Overall Analysis Score (OAS) is the GDAS analysis at 00, 06, 12, and 18Z
  - Overall Forecast Score (OFS) is the GFS 7-day forecast at 00Z
  - Adding CubeSat MicroMAS-2 on top of Control and 2Polar experiments showed positive impact at global scale, for both analysis and forecast.

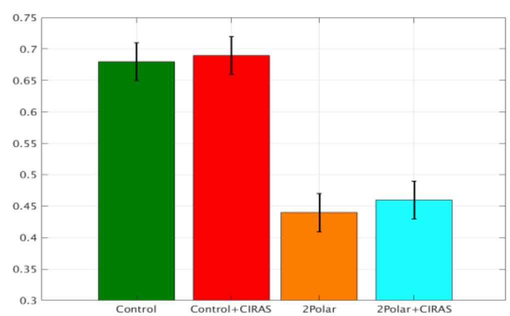


- ❑ MicroMAS-2 Brightness Temperature at 118.59 GHz

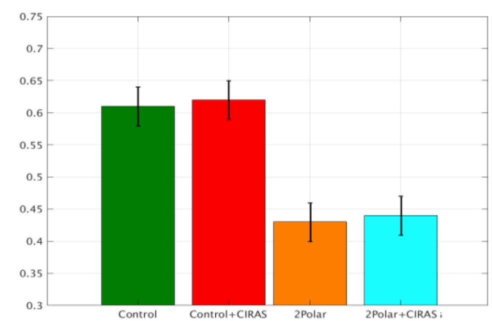


- ❑ Weighting functions of MicroMAS-2 channels and correspondent ATMS channels

Overall Analysis Score



Overall Forecast Score



Heat & Climate: Building resilience based on the next generation of Subseasonal-to-Seasonal Excessive Heat Outlook Systems (S2SHEOS)

Augustin Vintzileos – University of Maryland

- Experience gained by developing a baseline S2SEHOS and providing quasi-operationally real-time forecasts to the Climate Prediction Center during summers of 2016 and 2017 served in developing the next-gen system.
- The new system is primarily based on the Excessive Heat Factor (EHF) of Nairn and Fawcett (2014) but additional heat discomfort indices are also used.
  - Figure 1 depicts the July 1995 Chicago heat wave based on the EHF.
  - Figure 2 shows the forecast skill of the developed system for Week-2 and Week-3&4
- Experimental quasi-operational real-time forecasts will be provided to the health sector and forecasters starting March 2018.
- Please contact the PI avintzil@umd.edu if you would like to receive weekly or bi-weekly, real-time, experimental, subseasonal forecasts of excessive heat events.

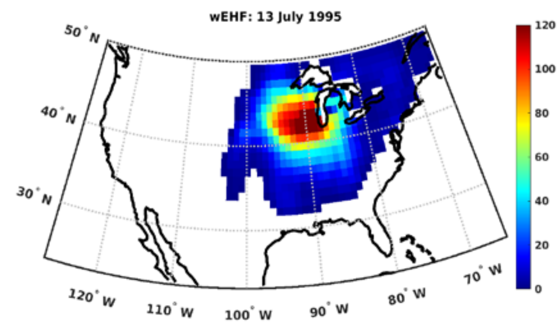


Fig. 1

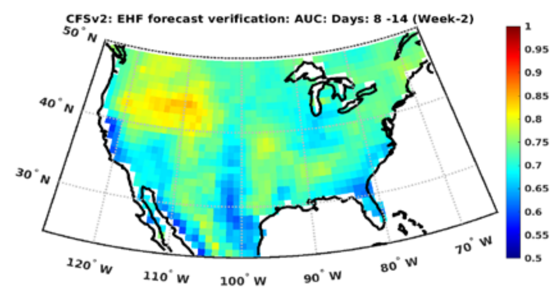


Fig. 2a

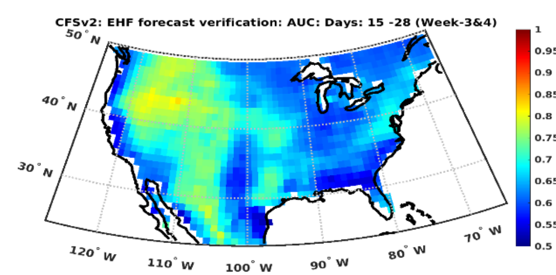


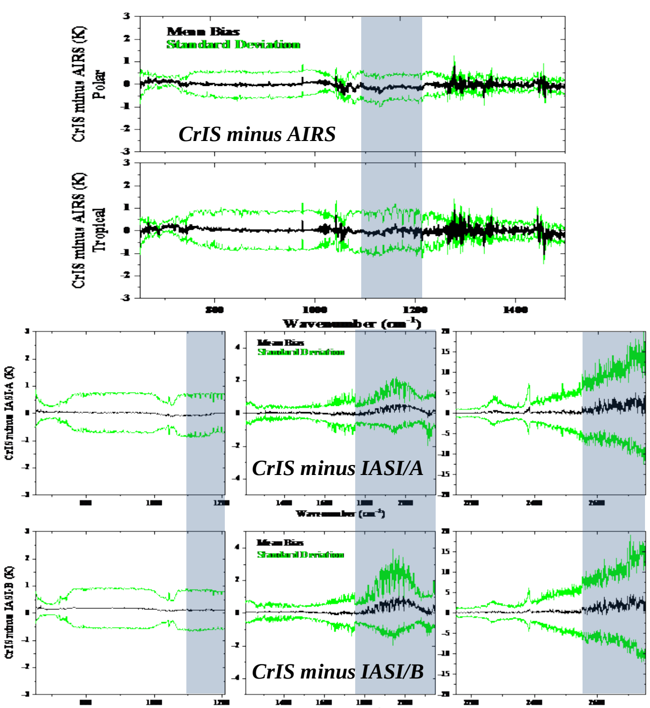
Fig. 2b

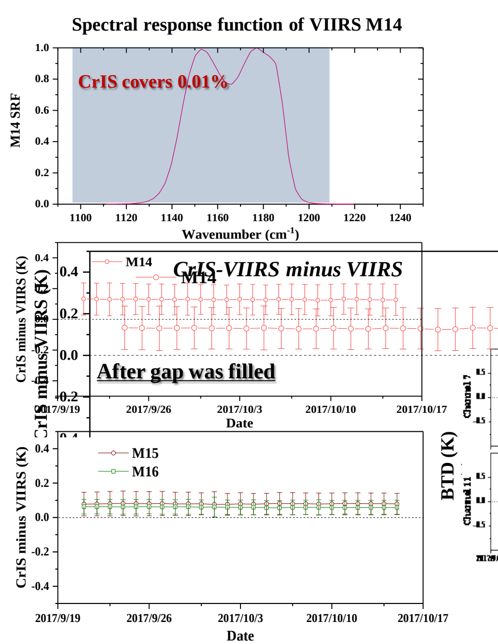
SNPP CrIS Gap Channels Prediction, Validation and Application

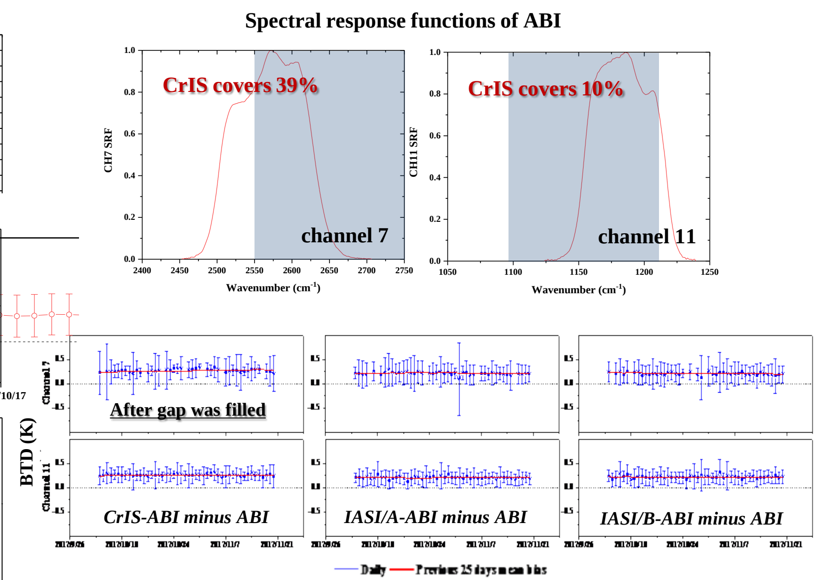
Hui Xu & Yong Chen & Likun Wang (CICS-MD)

- There are spectral gaps between the CrIS bands, which impacts accuracy of inter-comparison between CrIS and other instruments.
- To solve this issue, a new prediction algorithm was developed to fill up the CrIS gap channels from the spectral range of 650 to 2755 cm^{-1}, based on the principal component based regression (PCR) method.
- The inter-comparison between predicted CrIS gap radiances and other hyperspectral sounders and broadband channels that fall within the spectral gap regions show very stable and promising results, indicating that the CrIS gap channel radiances can be successfully generated with relatively high accuracy that is good enough for the inter-calibration comparison purpose.

Inter-comparison between CrIS(without gap) and other instruments







Hui Xu
(CICS/ESSIC/Univ. of Maryland, College Park, MD)
Email: huixu@umd.edu

Precipitation Retrieval By TB Temporal Variation

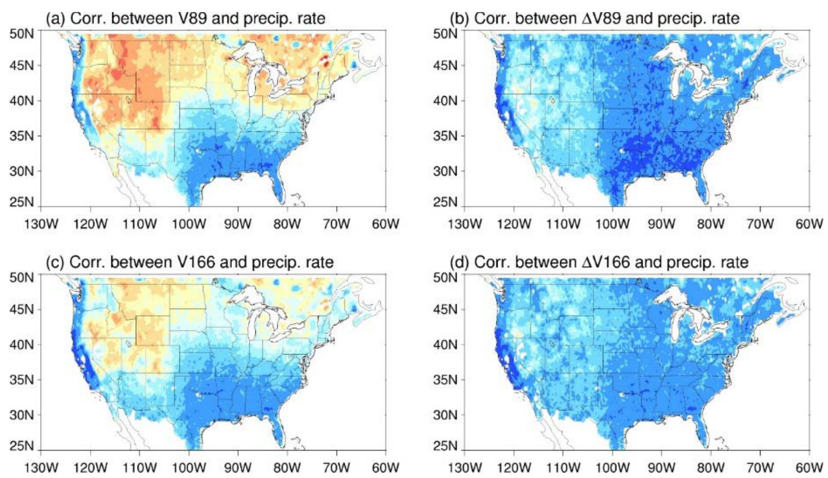
Yalei You(CICS), Christa Peters-Lidard (NASA), Joseph Turk (JPL), Sarah Ringerud (ESSIC), Song Yang (NRL), Nai-Yu Wang (ESSIC), Ralph Ferraro (NOAA)

- Results show that ΔTB correlates more strongly with the precipitation rate, because it can significantly mitigate the cold surface contamination (e.g., snow-cover).

- Not only does this study highlights the importance of maintaining the current microwave constellation, it also implies that increasing the temporal resolution of microwave radiometer in the future mission (either from small satellite constellation or geostationary microwave) can significantly improve the precipitation retrieval in the cold season and over the complex terrain, by capitalizing on the surface and atmosphere “background” information in TB temporal variation (ΔTB).

A common and serous issue in the precipitation retrieval algorithm development is the cold land surface contamination (e.g., snow/ice covered land).

This study proposes to use TB temporal variation (ΔTB), which is derived from 8 polar-orbiting satellites, including S-NPP, NOAA-18, NOAA-19, F17, F18, Metop-A and Metop-B and GPM.



Assessments of CubeSat MicroMAS-2 and CIRAS Impacts on Global NWP through OSSE

Yan Zhou(CICS-MD, NOAA/NESDIS), N. Shahroudi(Riverside Technology, Inc, NOAA/NESDIS), K. Ide(CICS-MD), S. A. Boukabara(NOAA/NESDID), T. Zhu(CIRA, NOAA/NESDID), R.N.Hoffman(U. Miami), R. Atlas(NOAA/OAR)

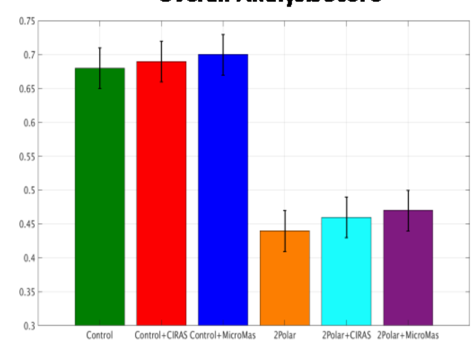
- The CubeSat MicroMAS-2 and CIRAS observations have been simulated, validated, and assimilated through the Community Global OSSE Package
  - MicroMAS-2 is a microwave sensor, which has 7 temperature, 3 water vapor, and 2 imagery channels.
  - CIRAS is an IR sensor which has 625 channels, 1950-2450 cm^{-1}
  - The global analysis and forecast system is GDAS/GFS, using Hybrid 3DEnVar as data assimilation scheme.
- The impacts of MicroMAS-2 and CIRAS on top of a Control and a data-gap scenario are investigated, respectively.
  - Control: current operational observing system
  - Data-gap: Control minus all secondary satellites and without afternoon polar orbiting satellites, named as 2Polar
- The matrix representing the performance of an experiment is overall score.
  - Global Anomaly Correlation and RMSE scores are normalized for geopotential height, temperature, vector wind, and relative humidity over different pressure levels and forecast lead time.
  - Overall Analysis Score (OAS) is the GDAS analysis at 00, 06, 12, and 18Z
  - Overall Forecast Score (OFS) is the GFS 7-day forecast at 00Z

OSSE Experiments Design

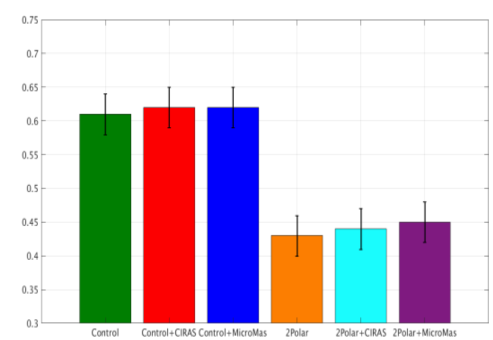
Assimilated	(green)
Not-Assimilated	(red)

PLATFORM/SENSOR	ORBIT	Control	Control+ MicroMas	Control +CIRAS	2Polar	2Polar +MicroMas	2Polar +CIRAS
F16(SSMI/S)	Polar/Early AM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
F17(SSMI/S)	Polar/Early AM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
F18(SSMI/S)	Polar/Early AM	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
MetOp-A(AMSU,MHS,IASI,HIRS)	Polar/Mid-AM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
MetOp-B (AMSU,MHS,IASI)	Polar/Mid-AM	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
N15(AMSU)	Polar/PM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
N18(AMSU/MHS)	Polar/PM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
N19(AMSU/MHS)	Polar/PM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
SNPP(ATMS,CrIS)	Polar/PM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
AQUA (AIRS,AMSUA)	Polar/PM	Assimilated	Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Not-Assimilated
MicroMas-2	Polar/PM	Not-Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Assimilated	Not-Assimilated
CIRAS	Polar/PM	Not-Assimilated	Not-Assimilated	Assimilated	Not-Assimilated	Not-Assimilated	Assimilated
GOES 15(SNDRS)	GEO	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
M10 (SEVIRI)	GEO	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
COSMIC, MetOp-A, MetOp-B, TSX	RO	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
Satellite Wind	GEO & Polar	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
Conventional Wind	n/a	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
Moisture	n/a	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
Surface Pressure	n/a	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated
Temperature	n/a	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated	Assimilated

Overall Analysis Score



Overall Forecast Score



- Adding CubeSat MicroMAS-2 and CIRAS on top of Control and 2Polar experiments showed positive impact at global scale, for both analysis and forecast.

Assessments of CubeSat CIRAS Impacts on Global NWP through OSSE

Yan Zhou(CICS-MD, NOAA/NESDIS), N. Shahroudi(Riverside Technology, Inc, NOAA/NESDIS), K. Ide(CICS-MD), S. A. Boukabara(NOAA/NESDID), T. Zhu(CIRA, NOAA/NESDID), R.N.Hoffman(U. Miami), R. Atlas(NOAA/OAR)

- The CubeSat CIRAS observations have been simulated, validated, and assimilated through the Community Global OSSE Package
  - CIRAS is an IR sensor which has 625 channels, 1950-2450 cm^{-1}
  - 101 out of 625 channels were assimilated.
  - The global analysis and forecast system is NOAA GDAS/GFS, using Hybrid 3DEnVar as data assimilation scheme.
- The impacts of CIRAS on top of a Control and a data-gap scenario are investigated, respectively.
  - Control: current operational observing system
  - Data-gap: Control minus all secondary satellites and without afternoon polar orbiting satellites, named as 2Polar
- The matrix representing the performance of an experiment is overall score.
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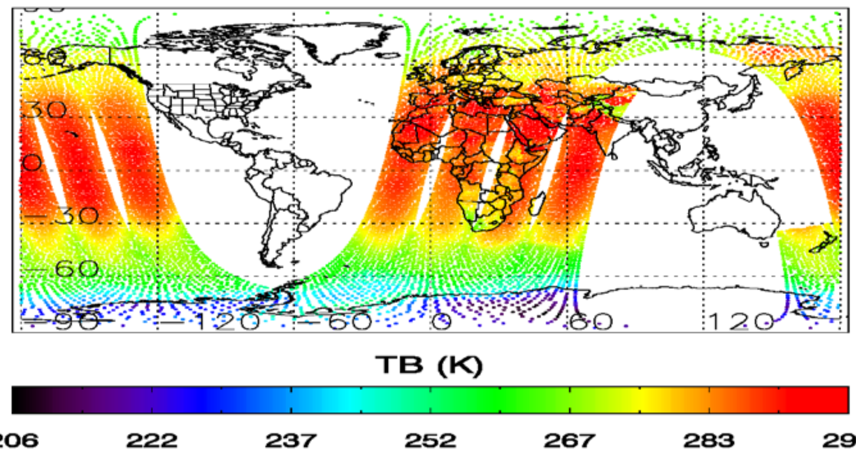
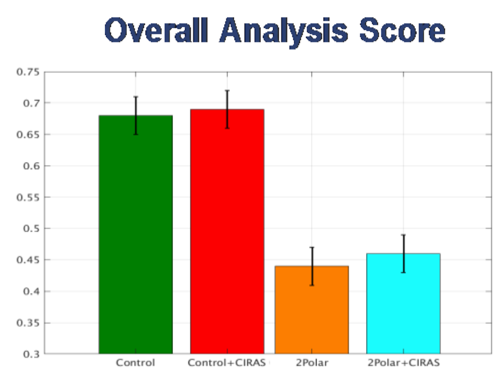
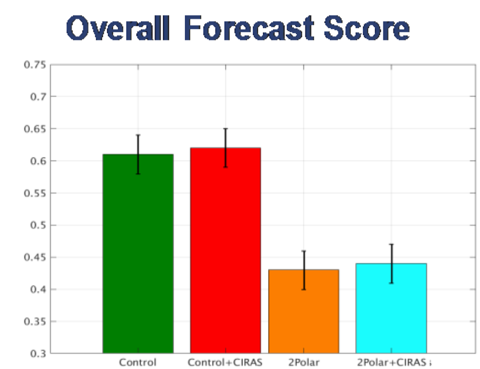
  - Overall Analysis Score (OAS) is the GDAS analysis at 00, 06, 12, and 18Z
  - Overall Forecast Score (OFS) is the GFS 7-day forecast at 00Z

Simulated CIRAS (2412.25 cm^{-1}) on NPP orbit







- Adding CubeSat CIRAS on top of Control and 2Polar experiments showed positive impact at global scale, for both analysis and forecast.

Direct Assimilation of ABI Infrared Radiances in NWP Models

Xiaolei Zou, Earth System Science Interdisciplinary Center (ESSIC), University of Maryland, College Park, Maryland, USA

- Assimilation of ABI data improves short-range forecasts over the continental U.S.
  - QPFs are improved at 1-, 5-, 10- and 15-mm thresholds during the 24 hours forecast times
  - The 24-h forecasts of temperature and specific humidity profiles are more accurate when compared to radiosonde observations if ABI data are assimilated

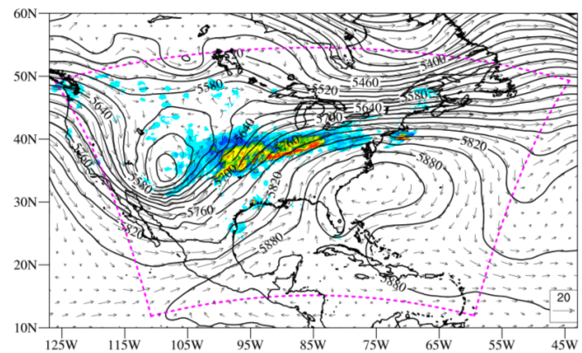


Fig. 1: Geopotential height and wind (black) at 500 hPa from NCEP GFS analysis at 1200 UTC April 29, the 3 hours rainfall observations (color shading) and model domain (magenta).

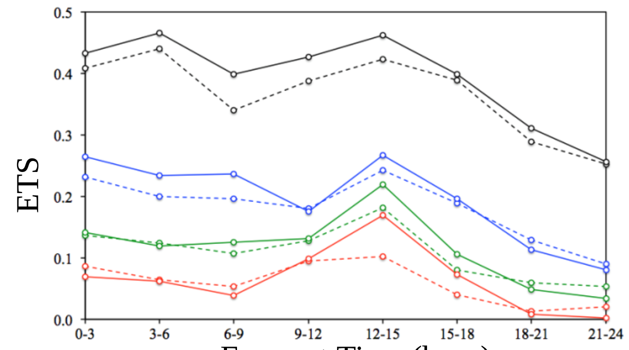


Fig. 2: Equitable threat scores for the 24-h rainfall forecasts on 30 April 2017 without (dashed) and with (solid) ABI DA.

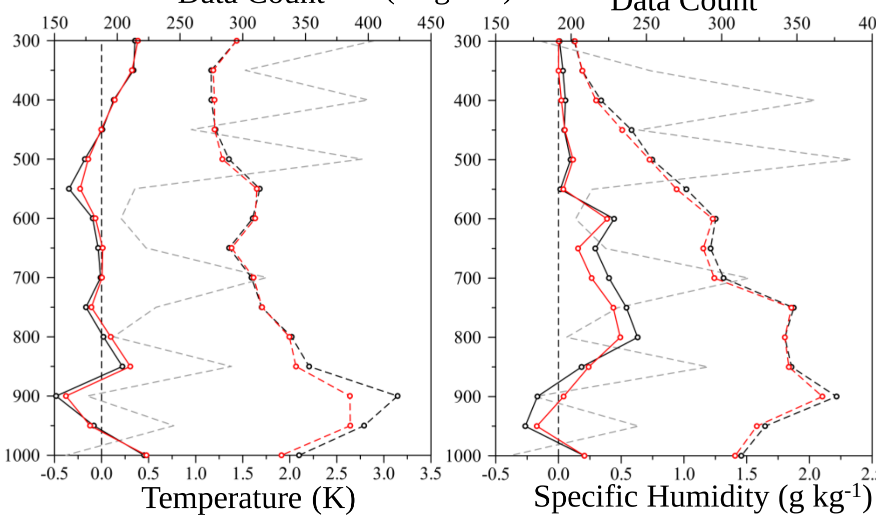


Fig. 3: Biases (solid curve) and standard deviations (dashed curve) of the vertical differences of temperature and specific humidity between radiosonde observations and the 24-h forecasts from CTRL (black) and ABI (red), experiments.

CIMSS

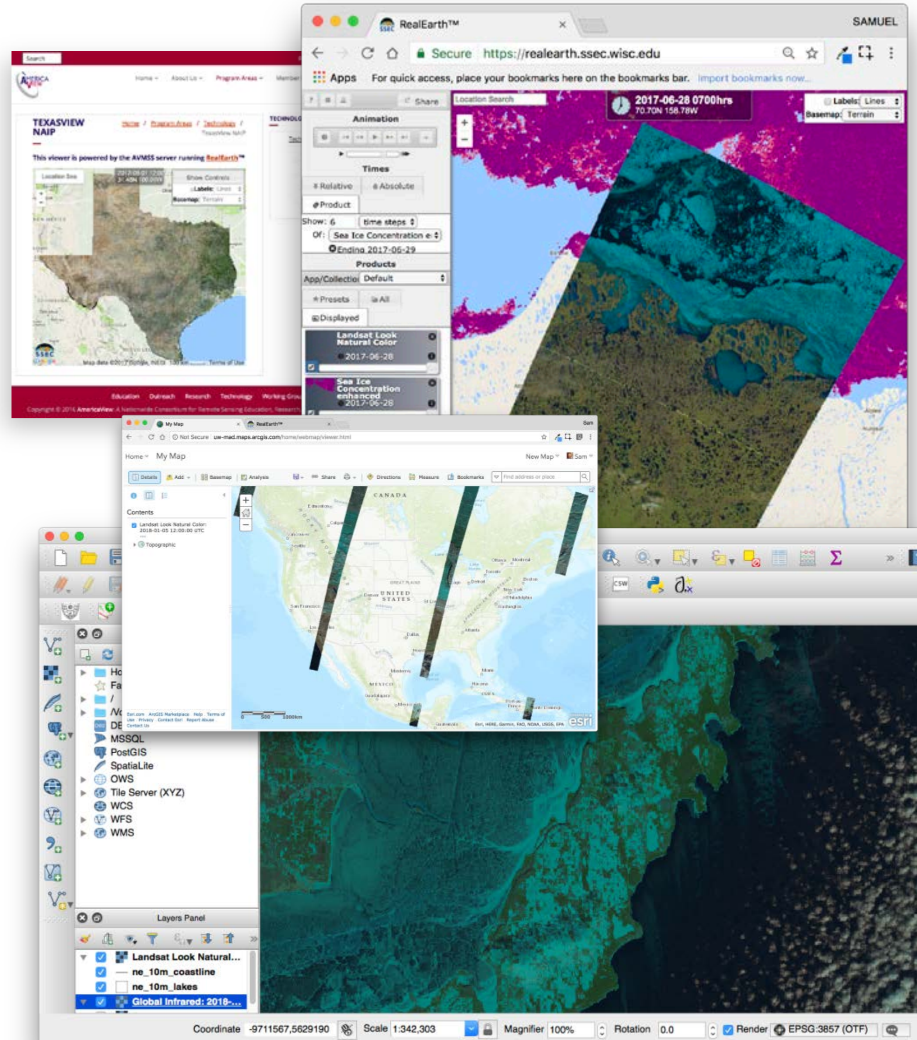
- Sam Batzli
- John Cintineo
- Geoff Cureton
- Jordan Gerth
- Mat Gunshor
- Tommy Jasmin
- Yong-Keun Lee
- Agnes Lim
- Jun Li (3)
- Scott Lindstrom (2)
- Graeme Martin
- Margaret Mooney(2)
- Jason Otkin
- Christopher Schmidt
- William Smith
- William Straka III
- Pei Wang
- Elisabeth Weisz
- Tony Wimmers

Bringing Meteorological and Atmospheric Science Imagery and Data to GIS

Sam Batzli, Dave Parker, Russ Dengel, Nick Bearson, Dave Santek, Tommy Jasmin
Space Science & Engineering Center, University of Wisconsin-Madison

- RealEarth is Available for GIS
  - Supporting OGC Standards
  - WMS and *now WMTS*
  - Works in ArcGIS Desktop, ArcGIS Online and QGIS
  - Well Documented API

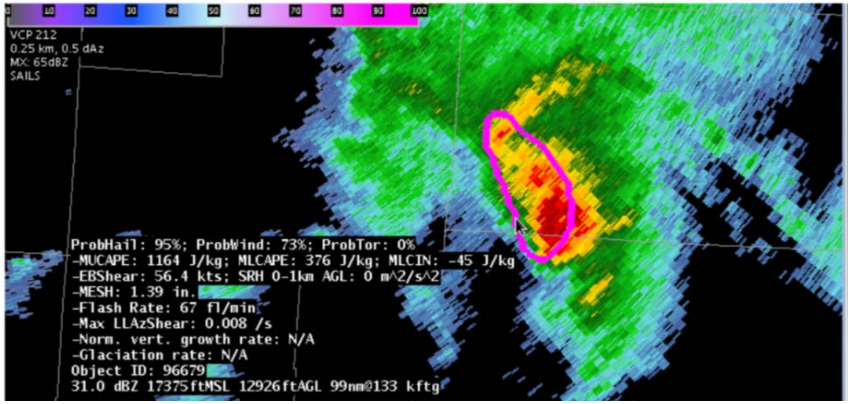
- Now Over 580 Products, Many in Near Real-time. Especially Popular in GIS:
  - VIIRS and GOES Active Fires
  - JPSS River Flood and Ice
  - Polar Sea Ice
  - Near Real-time Landsat



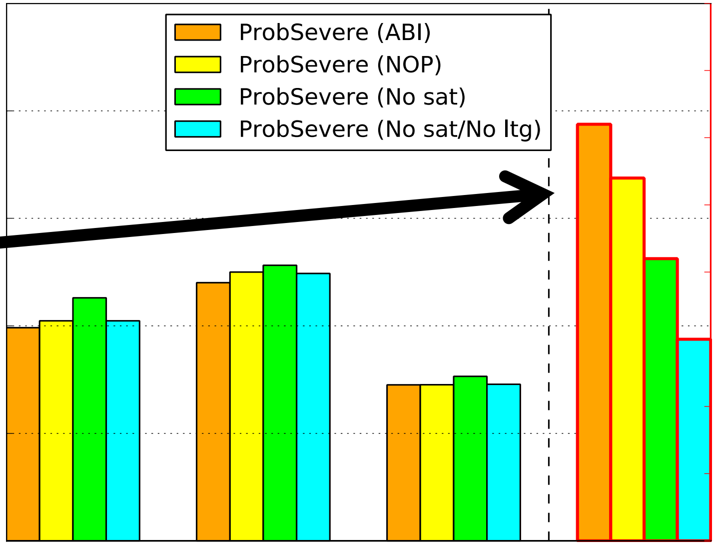
Automated severe weather guidance from the NOAA/CIMSS ProbSevere model within the Hazardous Weather Testbed

John Cintineo (UW-CIMSS), Mike Pavolonis (NESDIS), Justin Sieglaff (UW-CIMSS), Chris Karstens (OU-CIMMS), Kristin Calhoun (OU-CIMMS)

- ProbHail, ProbWind, and ProbTor evaluated in HWT
  - **88%** of forecasters said ProbSevere increased confidence
  - **60%** said ProbSevere increased lead time
  - **43%** said ProbTor increased confidence
  - **43%** said ProbTor increased lead time
  - **100%** said they would use ProbSevere in ops.



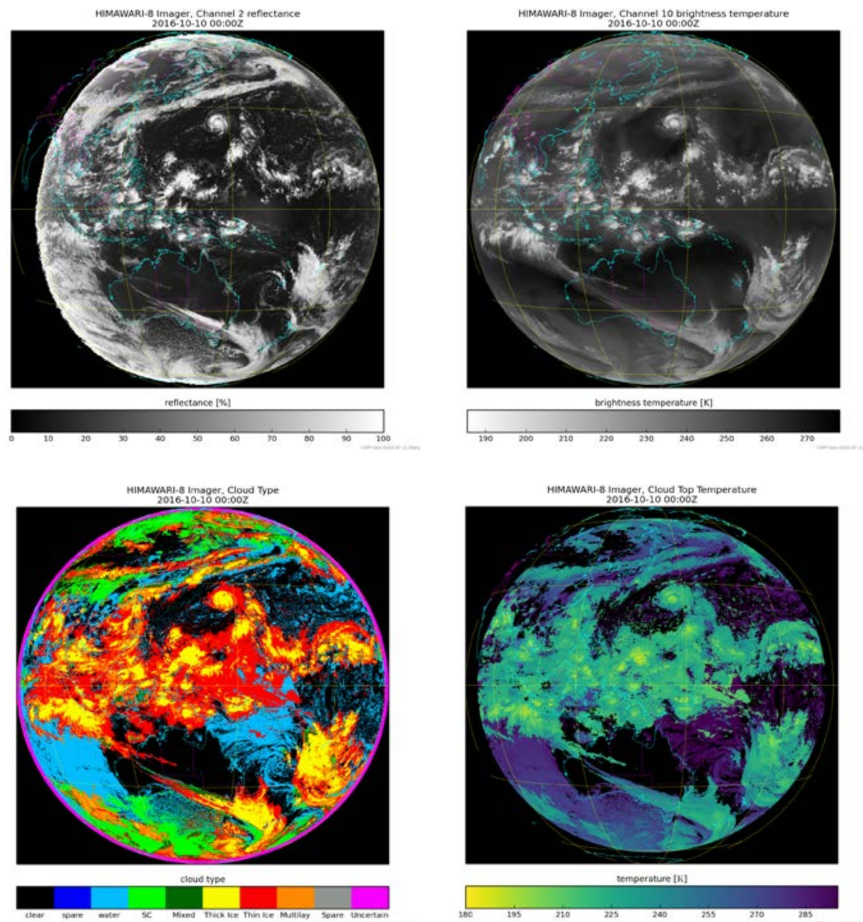
- ProbSevere in PHI experiment
  - Forecasters' median override of ProbSevere was 8%, suggesting decent trust in probabilities
- Initial retraining with GOES-16
  - Increase in median lead time of **4 minutes** to initial severe reports, for storms with strong satellite growth



Himawari Support In The CSPP-GEO Direct Broadcast Package

Geoff Cureton,(CIMSS)

- CSPP GEO-Geocat package v1.0 released to beta testers
  - GOES 13/15, level 1 & 2
  - Himawari 8, level 1 & 2
- Near-Real-Time Support for Himawari level 2
  - Processes cloud mask, type, COT, cloud top press/temp/height, fog
  - Runs in less than 10min Him8 FD duty cycle by parallel processing.
- For post- release 1.0:
  - Enhancement quicklook generation.
  - Support for Himawari-9
  - Expected Q1 2018 release.



How NOAA Jump-Started the 2017 Satellite Conference to Engage the Audience

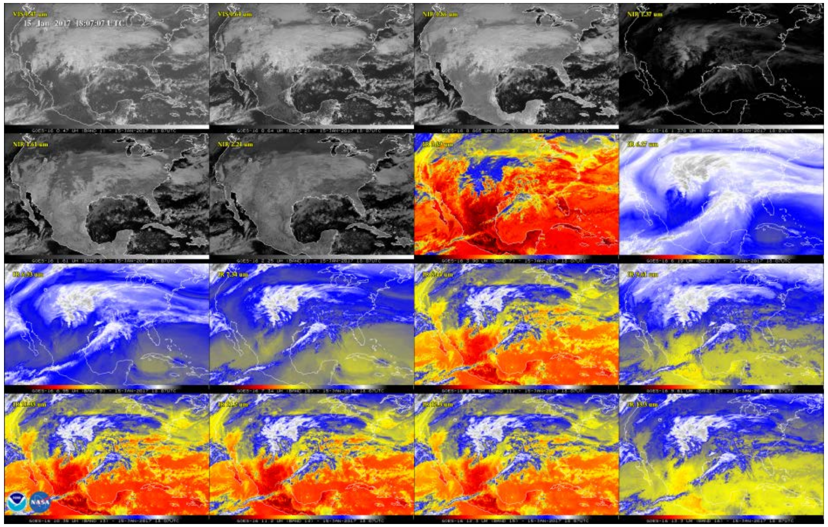
Jordan Gerth[1], Mark Paese[2], Mara Browne[2]
[1]CIMSS/SSEC, UW-Madison, [2]NOAA/NESDIS/ODAA

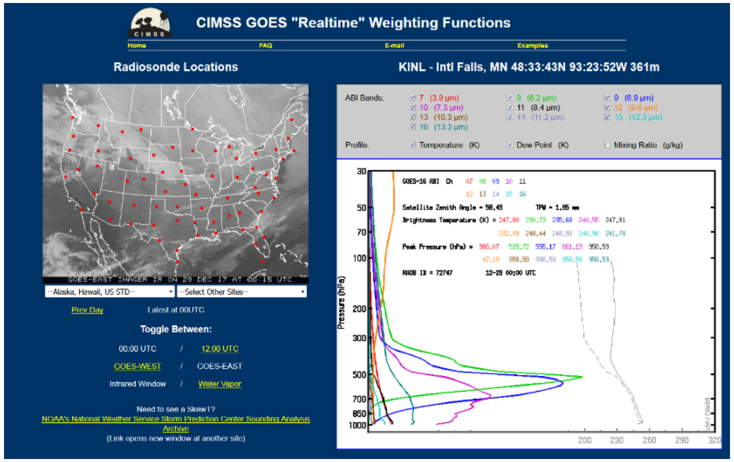
- Revamped agenda for 2017 NOAA Satellite Conference
- Focus on major NOAA satellite missions and future plans
- Inclusive of students
  - Held at NOAA cooperative institute, CREST, in New York City
- Online platform
  - Question submission and audience polling via computer, smart phone
  - Sli.do (slido.com)
- Open format
  - Panel discussions
  - Poster presentations
  - Town hall meetings

ABI Imagery: From Concept to Operations

Mat Gunshor, Kaba Bah, Joleen Feltz, Jim Nelson, & Hong Zhang (CIMSS); Tim Schmit (NESDIS)

- A history of the work done by CIMSS and ASPB to prepare the nation for for the ABI, including by AWG Imagery Team
  - Band selection studies began in 1999 and soon settle on the 16 bands of the ABI
  - Generated mock spectral response functions for ABI bands which are used to generate proxy data and do band-trade-off studies with forward models.
  - Proxy data evolved from existing satellites in the early 2000s to super-computer/NWP generated by 2007.
  - By 2007 AWG Imagery Team formed and work begins on Cloud and Moisture Imagery Product (CMIP) algorithm development, finalized in 2010.
  - Proxy data continued to be generated in near-real-time from CIMSS and ASPB beyond launch.
  - This early work crucial to the early success of the GOES-16 post-launch activities as software systems at NESDIS, NWS, and elsewhere had largely been tested already with highly realistic proxy data.
- GOES-R launches Nov 19, 2016, First Light on Jan 15, 2017, and GOES-16 operational on Jan 18, 2018.
  - First light images generated at CIMSS (Right, top) and CIRA
  - CIMSS and ASPB provide critical support in GOES-16 post-launch test with imagery, calibration, navigation, training, and other issues affecting users.
  - GOES-16 real-time weighting functions added to the web (Right)
- GOES-V, which ostensibly should replace GOES-T by around 2033, should begin planning now.

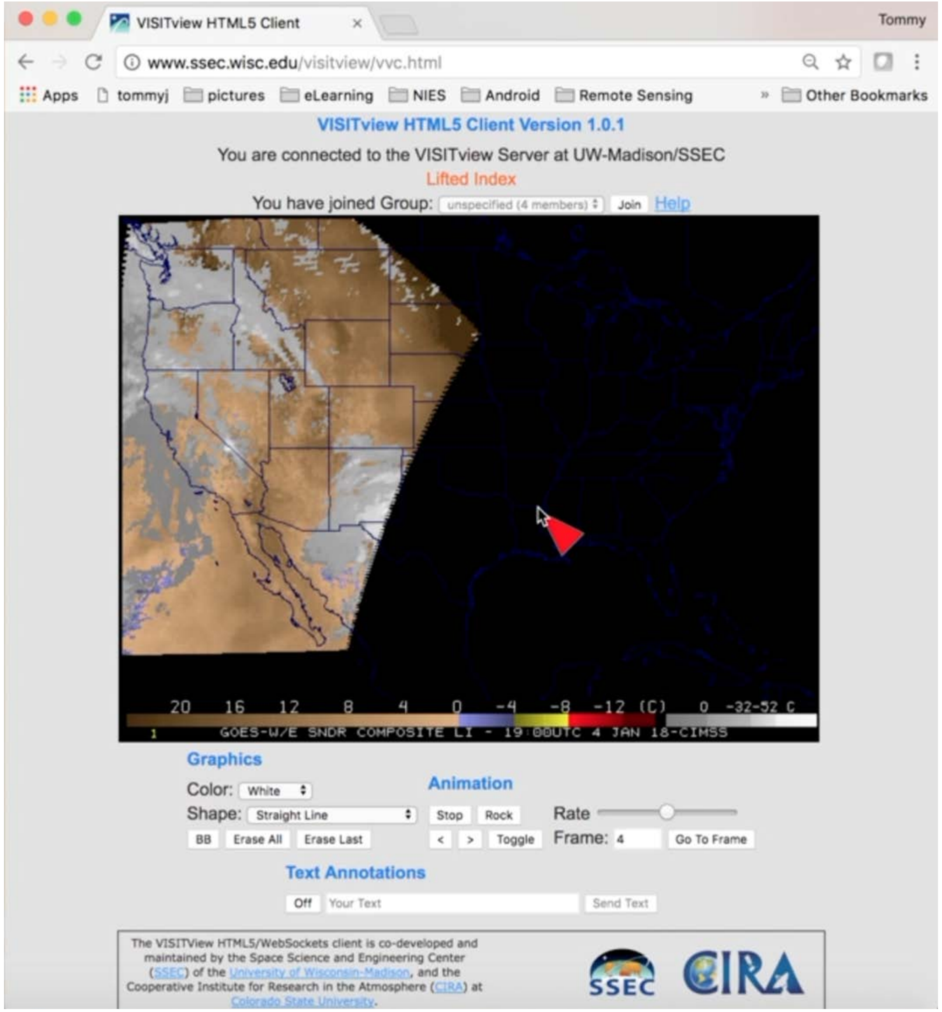




VISITView: 20 Years of Forecaster Training and Counting

Tommy Jasmin, Scott Lindstrom, Tom Whittaker, Scott Bachmeier (UW Space Science & Engineering Center)

- 1998: VISITView provides distance education and remote collaboration system for forecasters
  - Success of the tools outlive the underlying technologies
  - Next generation client developed using HTML5 and WebSockets (live, full-duplex connection in single web page)
  - Version 1.0 release announced January 11, 2018:
    - [34th Conference on Environmental Information Processing Technologies]
    - [Session 11A.1: Adding Value to Weather and Water Forecasts through Communication via APIs and Web Services]



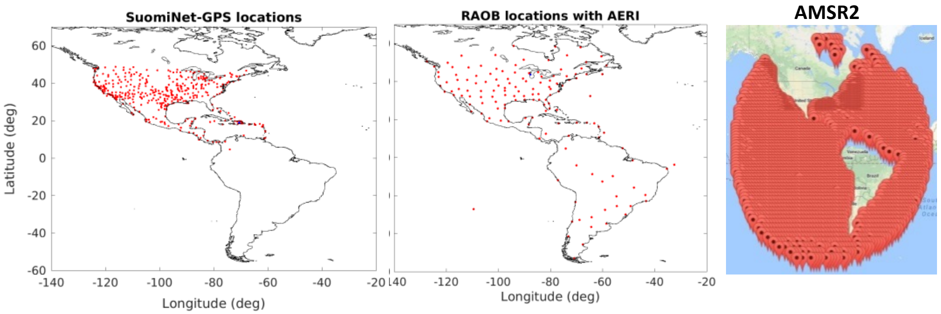
Validation of GOES-16 atmospheric precipitable water and instability index products

Yong-Keun Lee, Jun Li, Zhenglong Li (CIMSS), Tim Schmit (NESDIS)

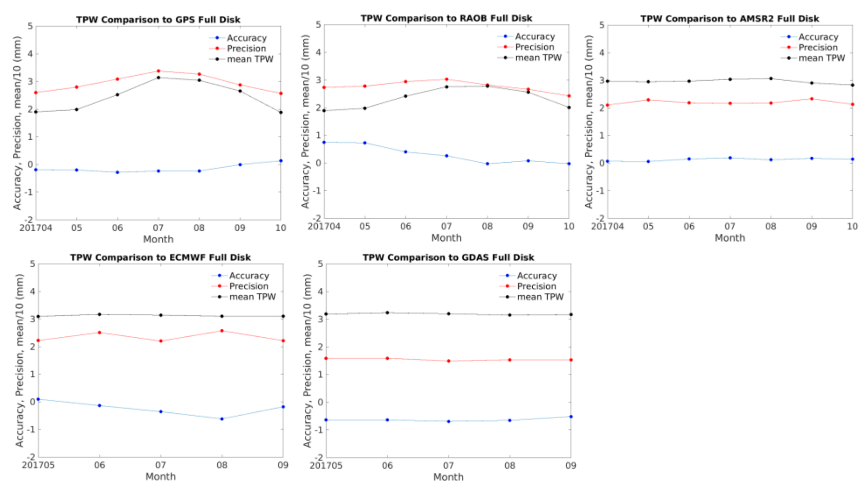
- The continuation of the legacy atmospheric profile (LAP) products with the ABI
  - Legacy atmospheric temperature profile
  - Legacy atmospheric moisture profile
  - Total precipitable water (TPW)
  - Atmospheric stability indices

- Validation of the LAP products with the reference datasets
  - Conventional Radiosonde observation (12 hourly)
  - Suomi-Net GPS (hourly)
  - AMSR2 (around 2 times/day)
  - ECMWF analysis (6 hourly)
  - GDAS analysis (6 hourly)
  - AERI special observation (2 minute interval)

Reference datasets



Comparison of TPW with reference datasets



J7.5 Impact Analysis of LEO Hyperspectral Sensor IFOV Size on the Next Generation High-Resolution NWP Model Forecast Performance

Agnes Lim[1], Allen Huangi[1], James Jung[1], Zhenglong Li[1], Jack Woollen[2], Greg Quinn[1], Fred Nagle[1], S. B. Healy[3], Jason Otkin[1,] , Mitch Goldberg[4] and Robert Atlas[5]

1. Cooperative Institute for Meteorological Satellite Studies
2. IMSG/NOAA/NCEP/EMC
3. ECMWF
4. NOAA/JPSS Program Science Office
5. NOAA Atlantic Oceanographic and Meteorological Laboratory

- **To assess the impact obtained from assimilation of next generation CrIS observations with increased spatial resolution in a high resolution global mode.**
- **G5NR, OSSE, GFS T1534**
- **Conventional data – All observation types simulated except dropsondes, NEXRAD winds and satellite track winds.**
- **Satellite radiances from current observing system (2 IASI, CrIS, AIRS, ATMS, 6 AMSU-A and 4 MHS)**
  - **Flying satellites in the simulated atmosphere using orbit simulator developed by CIMSS**
- **Increased nuZmber of clear FOVs with increased spatial resolution (Figure 1)**
- **Calibrated Global OSSE using FY2015 GFS @ 13km resolution**
- **1-month forecast impact assessment**
- **Results : Slight positive impact for bias, overall neutral results**
- **Areas for improvements: simulation of observations, calibration and noise estimation for increased resolution CrIS, nature run and GSI thinning**
- **Under the support from JPSS Program Office, a global OSSE framework is developed, dedicated to support future JPSS impact studies**

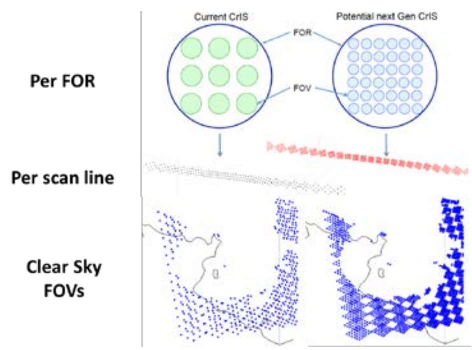
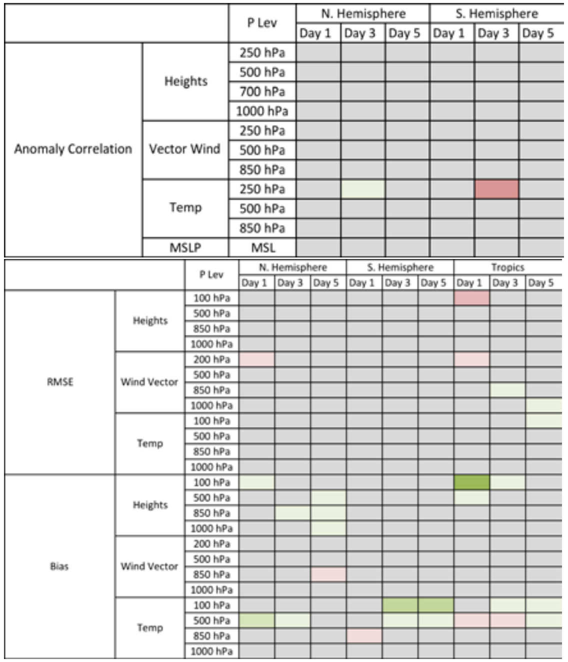


Figure 1 Comparison of current CrIS and future CrIS



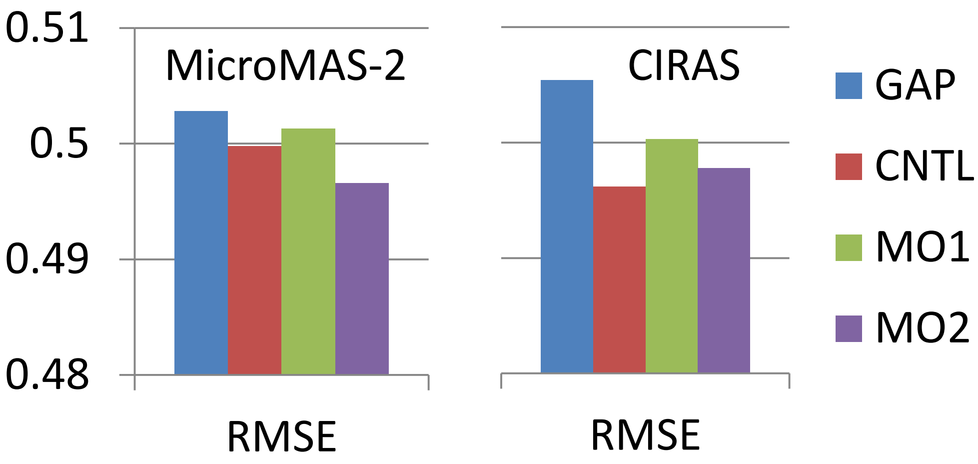
OSSE_EXP		99.9% signififcant l
better than		99% signififcant level
OSSE_CTRL		95% signififcant level
Neutral		No statistcal significant difference
OSSE_CTRL		95% signififcant level
worse than		99% signififcant level
OSSE_EXP		99.9% signififcant level

Figure 2 Forecast Performance width the assimilation of increased spatial resolution CrIS observations

Evaluating the potential of CIRAS and MicroMAS-2 in mitigating the data gap of CrIS and ATMS

Jun Li, Zhenglong Li, Pei Wang, Agnes Lim, Timothy Schmit (STAR), Jinlong Li, Fredrick Nagle, Robert Atlas (AOML), Sid Boukabara (STAR), William Blackwell (MIT), Thomas Pagano (JPL), John Pereira (OAR)

- A Quick regional OSSE (r-OSSE) impact study of MicroMAS-2 and CIRAS on one local severe storm (LSS) case is carried out, results show that
  - 1 MicroMAS-2 is not as good as ATMS
  - 3 MicroMAS-2 show better impacts than single MicroMAS-2, even better than ATMS
  - 1 CIRAS is not as good as CrIS
  - 3 CIRAS show better impacts than single CIRAS, close to CrIS but still not as good as CrIS
- For this particular LSS case
  - three MicroMAS-2 are able to mitigate the loss of ATMS
  - 3 CIRAS are not able to mitigate the loss of CrIS, but more should be able to.



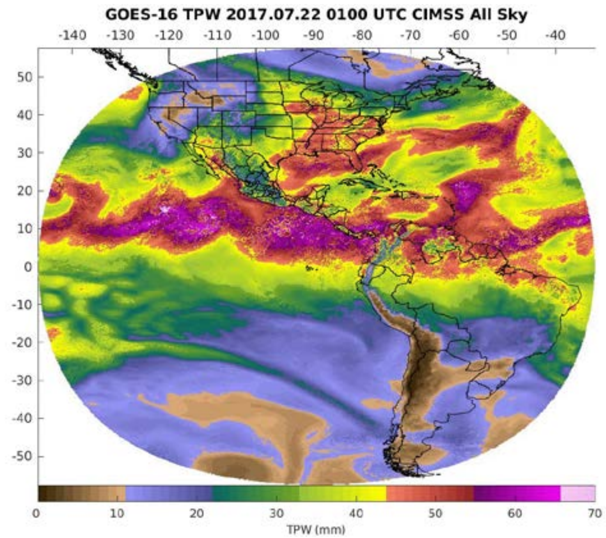
Shown are normalized RMSE values from different experiments using Nature Run as reference:

- GAP means either ATMS or CrIS is lost;
- CNTL is control run with either ATMS or CrIS;
- MO1 is mitigation option 1 with one MicroMAS-2 or CIRAS in SNPP orbit (1:30 pm);
- MO2 is mitigation option 2 with three MicroMAS-2 or CIRAS in 10:30 am, 1:30 pm, and 4:30 pm.

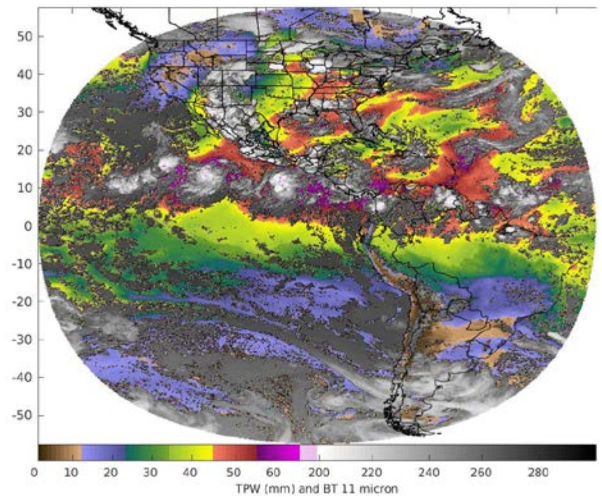
All-sky layered precipitable water products from ABI/AHI and their applications in nowcasting and forecasting the severe storms

Jun Li, Jordan Gerth, Yong-Keun Lee (CIMSS), Timothy J. Schmit (STAR), Zhenglong Li, Pei Wang, Scott Lindstrom (CIMSS)

- All-sky three layered precipitable water (LPW) products from advanced imagers (ABI/AHI) are developed and available in near real-time for applications;
- Applications in nowcasting and severe weather situation awareness demonstrated in 2016 HWT;
- Improvement on severe storm forecasts through assimilation in regional and storm scale numerical weather prediction (NWP) models demonstrated with local severe storm (LSS) and tropical cyclone (TC) cases.



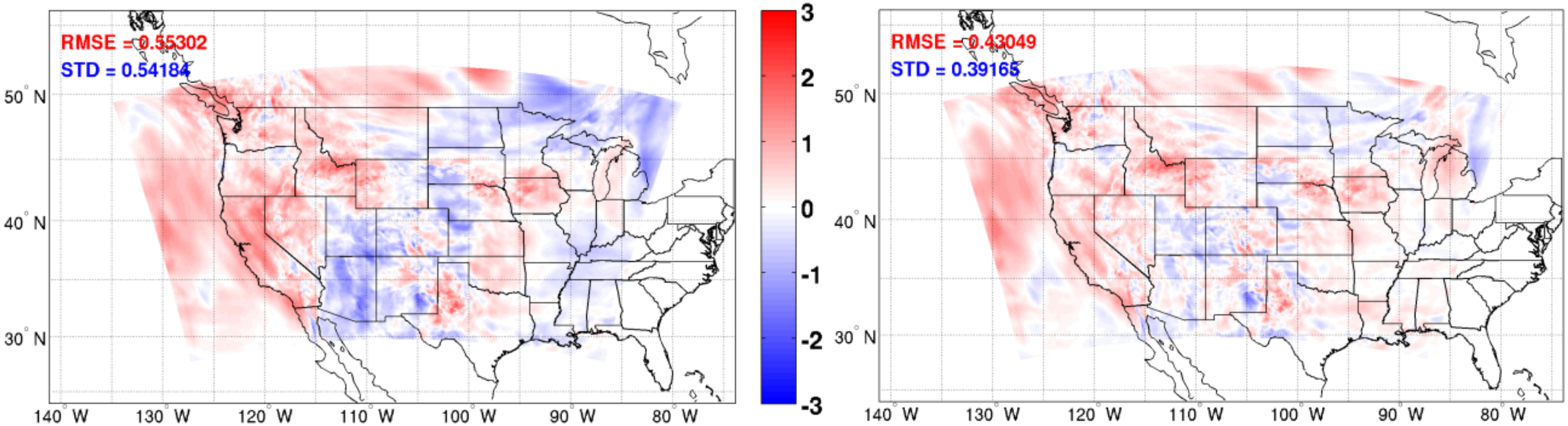
GOES-16 ABI TPW 1-day animation: all-sky (research)



GOES-16 ABI clear skies (Baseline LAP) **beta, operational soon**

Value-added impact from geostationary hyperspectral infrared sounding on nowcasting and forecasting local severe storms

Jun Li (CIMSS), and Timothy J. Schmit (STAR)



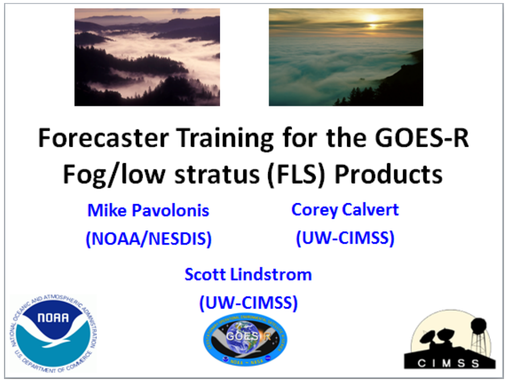
The differences between Nature Run and experiments for temperature analysis at 500 hPa: (left) Nature Run (true) – CNTRL, and (right) Nature Run – GEO (unit: K), at 1200 UTC 26 May 2006.

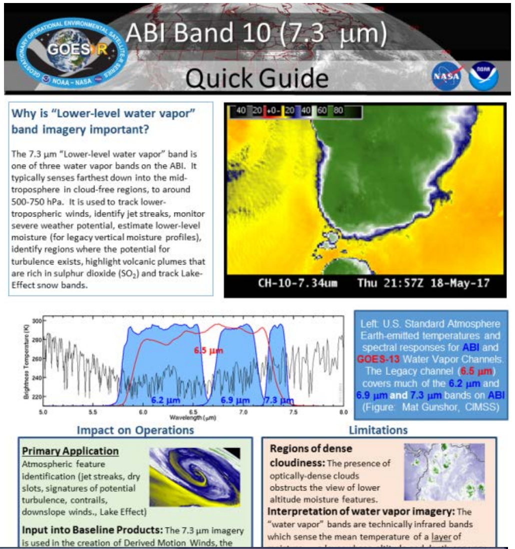
- GEO advanced IR sounder could provide warning information for local severe storms hours before radar measurements;
- A regional OSSE (r-OSSE) impact study of GEO IR sounder (IASI as example) on LSS case indicates value added impact on most severe weather related parameters over the existing observing systems due to large spatial coverage and frequent observations;
- While the GSI is not optimal to take full advantage of high temporal resolution from GEO IR sounder in this OSSE study, analysis/forecast errors can be further reduced when temporal information from GEO advanced IR sounder is taken into account in the assimilation.

VISIT and SHyMet Training Activities at CIMSS

Scott Lindstrom, A. S. Bachmeier, J. Gerth, M.Gunshor (CIMSS), T. J. Schmit (NOAA), D. Bikos, E. J. Szoke, and B. H. Connell (CIRA)

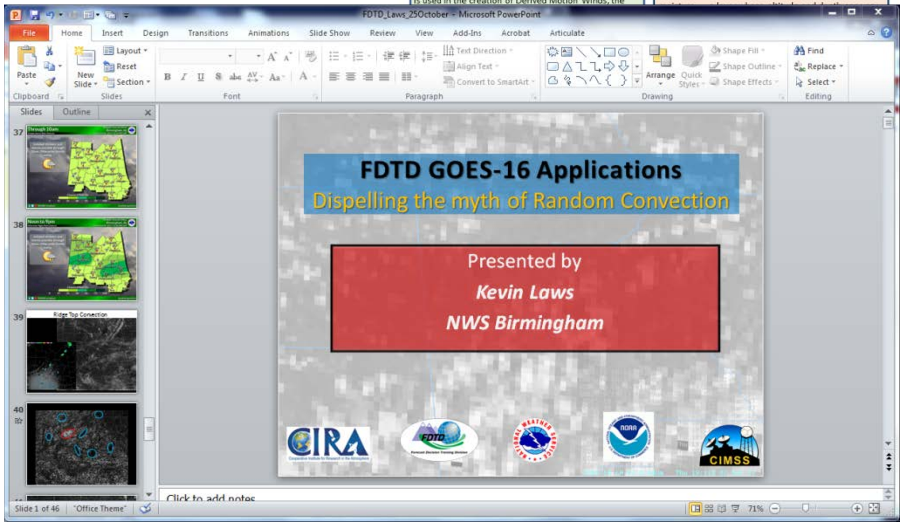
- Teletraining
  - Live distance training in NWS Offices





- GOES-16 Quick Guides created with ABI Imagery
  - Single Bands
  - Band Differences.
  - Baseline Products

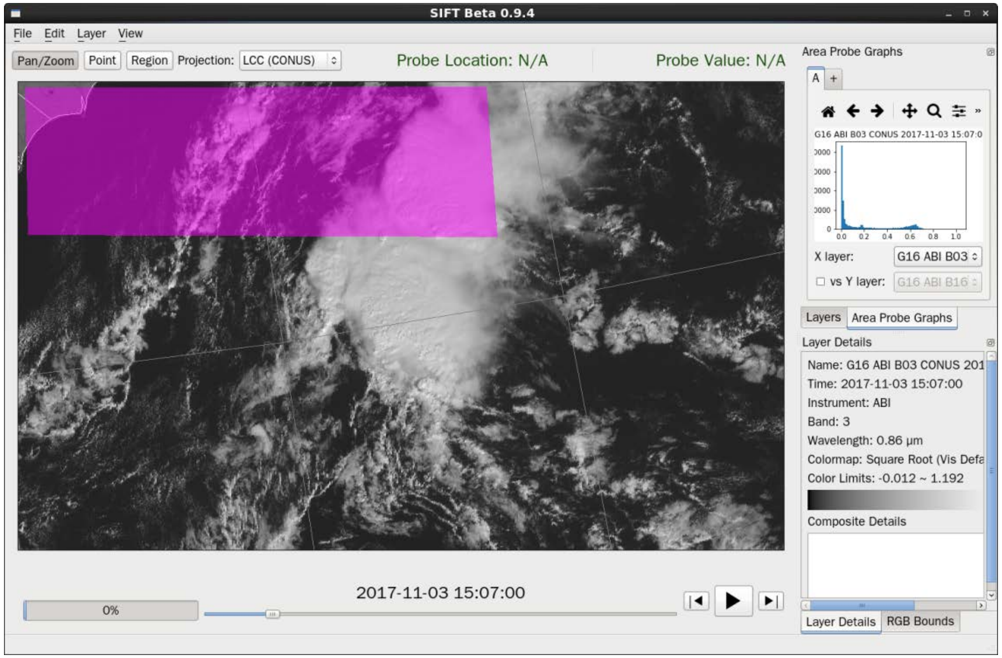
- FDTD Training Webinars
  - Led by NWS Line Forecasters
  - Peer-to-peer training



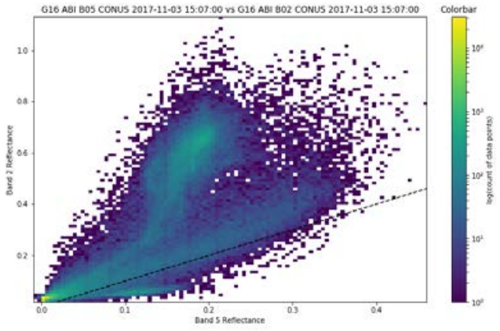
Using the Satellite Information Familiarization Tool (SIFT) to train on new multi-spectral geostationary satellite sensors

Scott Lindstrom, Jordan Gerth, Ray Garcia, Dave Hoese

- SIFT loads up raw ABI or AHI data
  - Seamless roam/pan
  - Quick visual comparisons of bands
  - Probe values tell a story of a scene
  - Area Probe Graphs compare two bands
  - Create Channel Differences
  - Create RGBs



- Training Software
  - Used in National Weather Service Forecast Offices, Chile/Argentina.
  - Learn uses of 1 or combined channels



CSPP Geo Software for Direct Broadcast

Graeme Martin[1], Liam Gumley[1], Nick Bearson[1], Jessica Braun[1], Geoff Cureton[1], Alan De Smet[1], Ray Garcia[1], Tommy Jasmin[1], Scott Mindock[1], Eva Schiffer[1], Kathy Strabala[1], Andy Heidinger[2], Mike Pavolonis[2], Walter Wolf[2], Shanna Sampson[3]
[1]CIMSS/SSEC, UW-Madison, [2]NOAA/NESDIS/STAR, [3]IMSG

CSPP Geo software is currently being run by direct broadcast users throughout the world to generate products from GOES-16 and other satellites in real-time on their local machines.

The project is funded by the GOES-R Program and utilizes product software that was developed for GOES-R. All software is available free of charge.

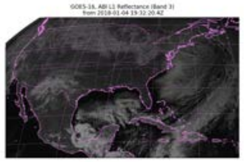
Supported satellites:

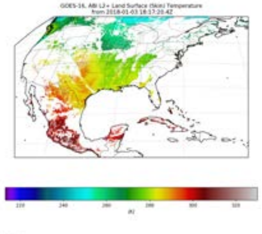
- GOES-16
- GOES-15
- Himawari-8

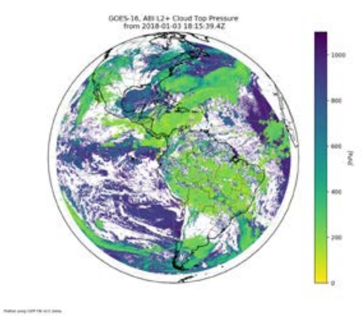
Software capabilities include:

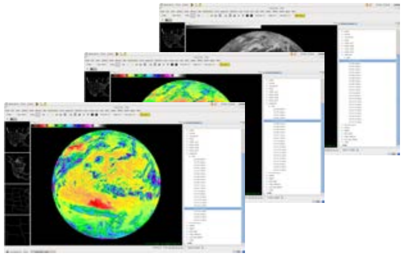
- Process the GOES-16 data stream, generating ABI (imager), GLM (lightning mapper) and space weather products
- Further process ABI data to generate Level 2 derived geophysical products, using core software developed at STAR with algorithms developed by the GOES-R Science Team
- Generate Level 2 products from Himawari-8 AHI data
- Data conversion and tiling for AWIPS compatibility
- “Quicklook” and Composite RGB image generation

Quicklook images of CSPP Geo ABI products



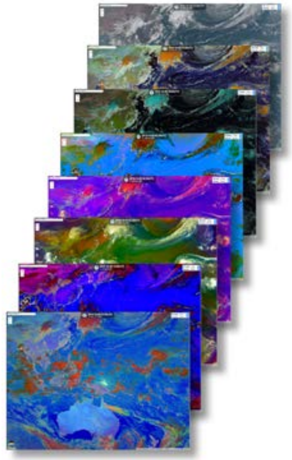






AHI data converted to SCMI format and loaded in AWIPS2

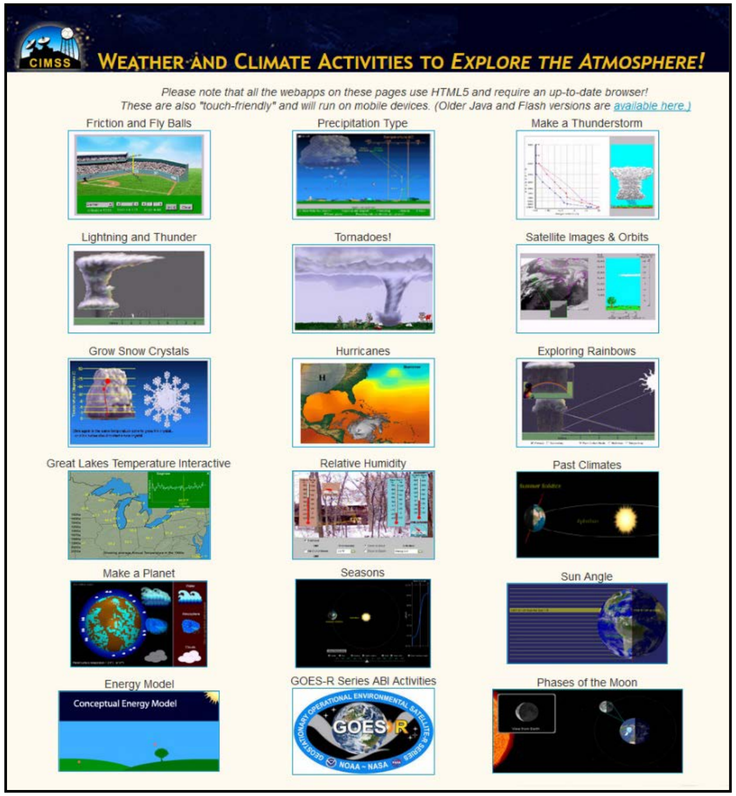
AHI Composite RGB products



HTML5 WebApps from CIMSS

Margaret Mooney

The Cooperative Institute for Meteorological Satellite Studies (CIMSS) has converted long-standing educational applets developed in Java and Flash to HTML5. We've also developed several new webapps directly in HTML5, in particular, activities that demonstrate improved capabilities of the Advanced Baseline Imager (ABI) on the GOES-16 satellite. These new *GOES-R Series* webapps help train science teachers, K12 through college students, TV broadcasters and National Weather Service meteorologists. If you are teaching any weather or climate topic, CIMSS has an app for that!



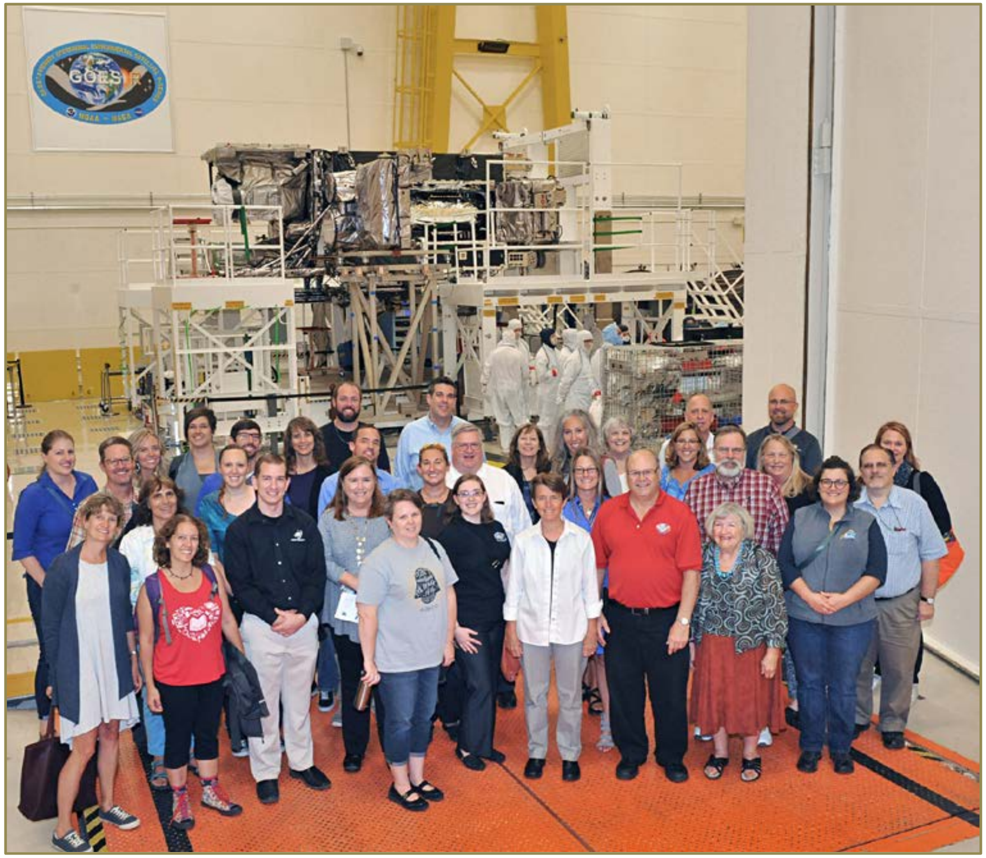
http://cimss.ssec.wisc.edu/wxfest/

http://cimss.ssec.wisc.edu/education/goesr/webapps

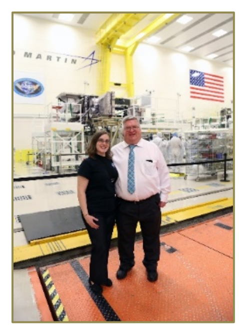
GOES-S Teacher Workshop

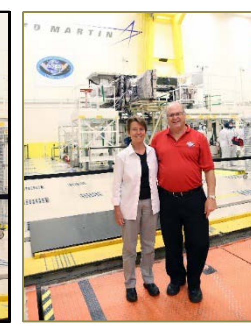
August 23 at Lockheed Martin in Littleton Colorado

Margaret Mooney



The Cooperative Institute for Meteorological Satellite Studies (CIMSS) organized a teacher workshop hosted by Lockheed Martin on August 23rd 2017. Presentations included Laird Kantruss from Lockheed Martin (LM), GOES-R Program Director Mike Stringer and GOES-R Science Lead Steve Goodman. In addition, National Weather Service (NWS) meteorologist Paul Schlatter presented on GOES-16 contributions to the NWS Weather-Ready Nation initiative. Educators also had an up-close view of the GOES-S Satellite in the clean room. The experience was awe-inspiring. As one teacher shared on the evaluation, “It was amazing to see the actual spacecraft!”





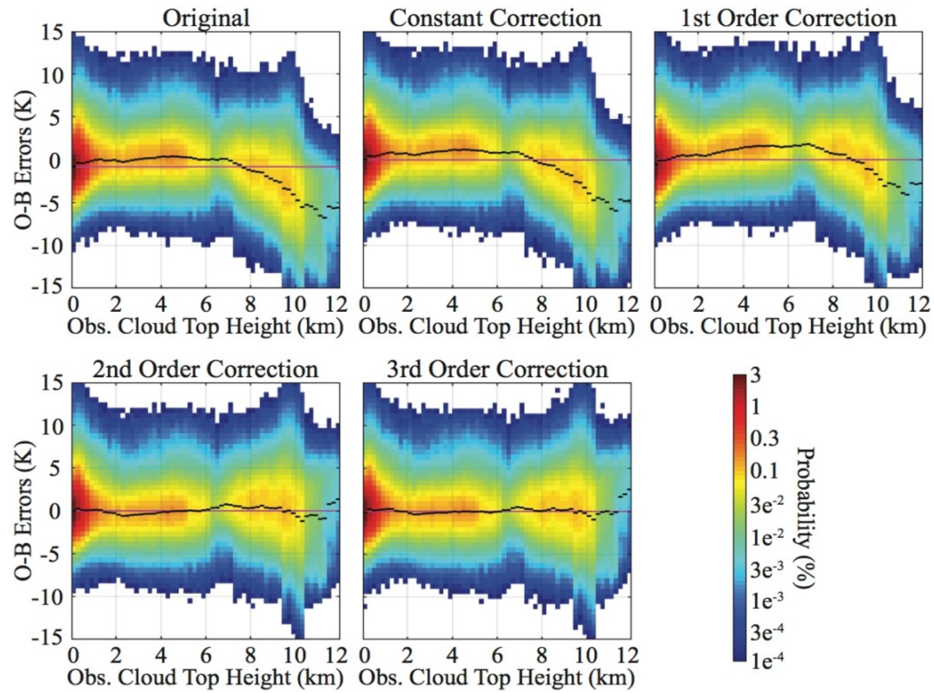
A **GOES-R Education Proving Ground** initiative
http://cimss.ssec.wisc.edu/education/goesr/GOES-S.html

Nonlinear Bias Correction for Satellite Data Assimilation Using Taylor Series Polynomials

Jason Otkin (UW/CIMSS), Roland Potthast (DWD), and Amos Lawless (U. Reading)

22nd IOAS/AOLS Conference

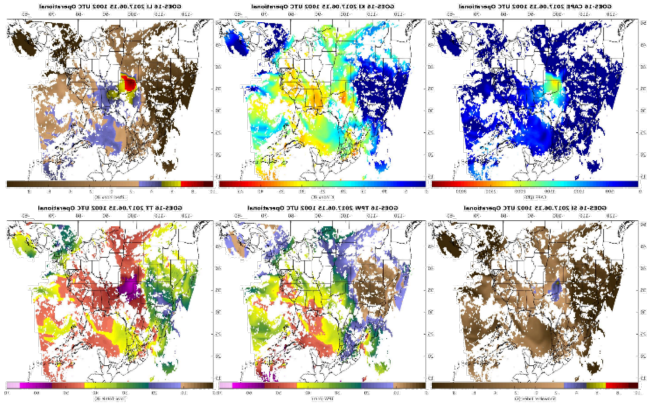
- Developed a new bias correction method that uses a Taylor series polynomial expansion of the observation departures to remove linear and nonlinear conditional biases from all-sky brightness temperatures
- Figure shows example where the observed cloud top height is used as the bias predictor
- Complex error pattern where the conditional biases (indicated by short black lines) are removed only when the higher order (2nd order quadratic and 3rd order cubic) nonlinear terms are used

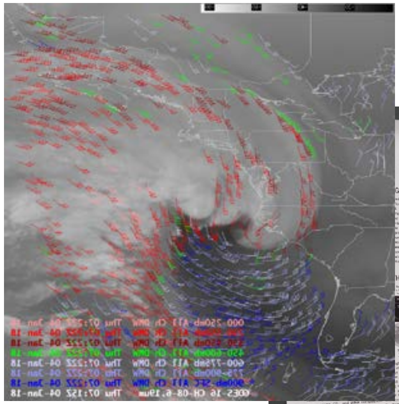


GOES-16: Year One

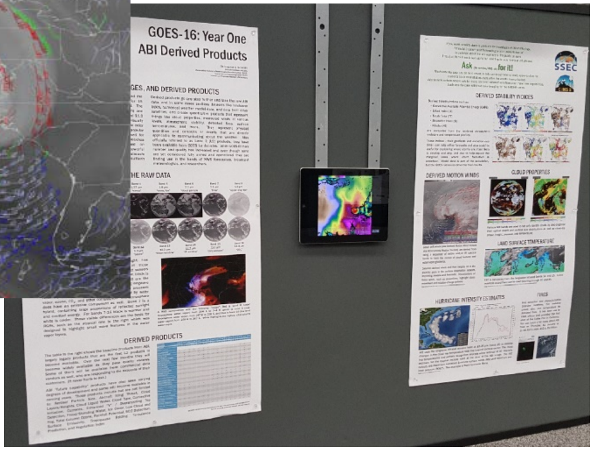
Christopher C. Schmidt (CIMSS)

- A general overview of GOES-R Derived Products (Level 2)
- Proposed as a talk for the joint session with the Broadcast Meteorology Conference to show that user group the new products
- Presented as a poster with a tablet used to show animations
- Products highlighted included
  - Derived Stability Indices
  - Hurricane Intensity Estimates
  - Derived Motion Winds
  - Land Surface Temperature
  - Cloud Properties
  - Fire detection





DMW loop courtesy Bill Line, NWS



Fire Detection with GOES-16: Year One

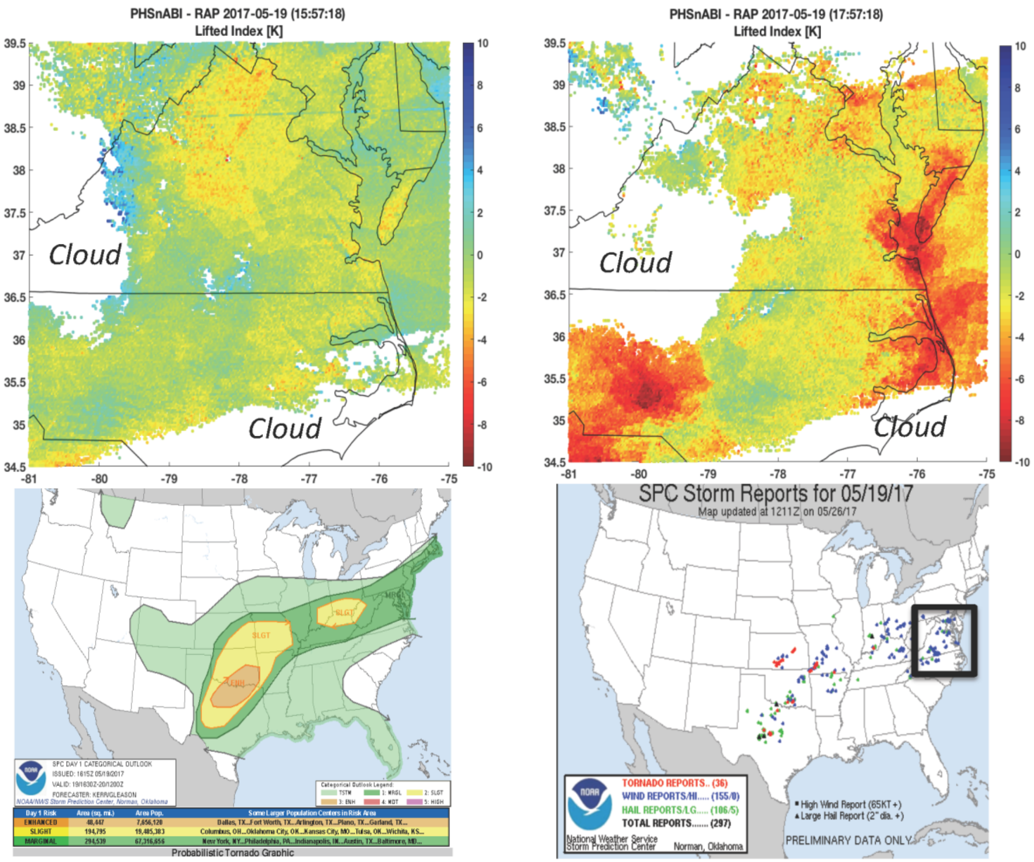
Christopher C. Schmidt (CIMSS)

- Provided update on GOES-16 fire product and showed examples
- Example at right from the Tubbs Fire
  - Recorded start time: 9:45 PDT on October 8, 2017
  - Most destructive wildfire in California history
  - Burned nearly 37,000 acres and killed at least 22 people and untold numbers of animals
  - The first alert of the fire at the Bay Area NWS came from the GOES-16 ABI fire product, which detected it on the 4:47 UTC (9:47 PDT) scan.
  - This fire underwent very rapid intensification.

The Tubbs Fire

The use of combined direct broadcast polar hyper-spectral soundings and geostationary multi-spectral imagery for regional weather forecasting

W. L. Smith[1,2], E. Weisz[1], J. McNabb[2], and M. Dutter[3]
[1]University of Wisconsin, Madison WI; [2]Hampton University, Hampton VA; [3]NOAA/NWS Wakefield VA



It is shown that GOES-16 ABI data can be combined with Direct Broadcast Polar Hyperspectral Soundings (PHS) to provide atmospheric sounding products at high spatial (2-km) and temporal (15-min) resolution for predicting the onset of severe convective storms. Shown is an example of the difference between the PHS+ABI Lifted Index (LI) and the RAP forecast LI at 16 UTC (UL) and 18 UTC (UR) 20170519 showing where severe weather not forecast (red region in UR) would occur. Surface reports of subsequent severe weather are shown in the LR panel.

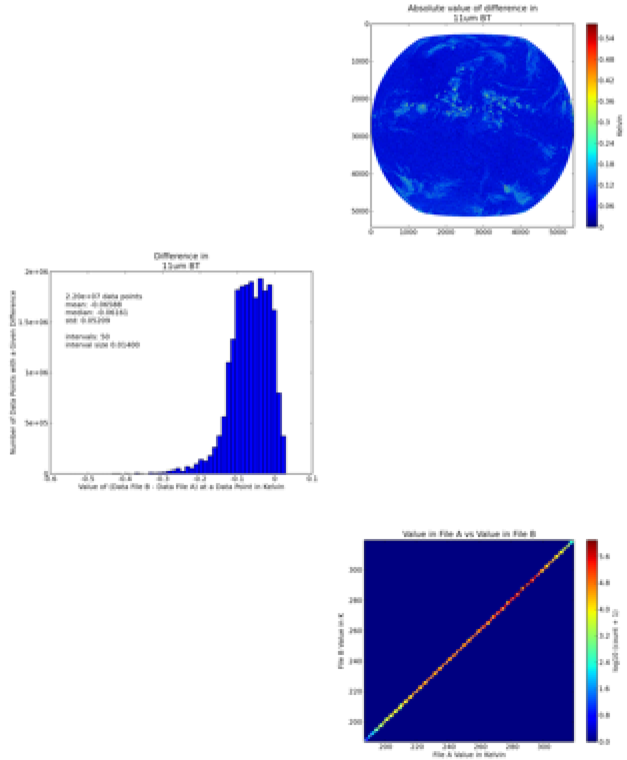
8th Conference on the Transition of Research to Operations, American Meteorological Society 98th Annual Meeting, Austin Texas 2018

Routine Validation of the STAR Algorithm Processing Framework (SAPF)

William Straka III[1], S. Sampson[3], R. Kuehn[1], G. Quinn[1], E. Schiffer[1], R. Garcia[1], G. Martin[1], R. Holz[1], T. Yu[3], A. Li[3], R. Rollins[3], W. Wolf[2] and J. Daniels[2]

[1]CIMSS/SSEC, University of Wisconsin-Madison, [2]NOAA/NESDIS/STAR, Camp Springs, MD 20746 USA,
[3]IMSG, Kensington, MD 20895, USA

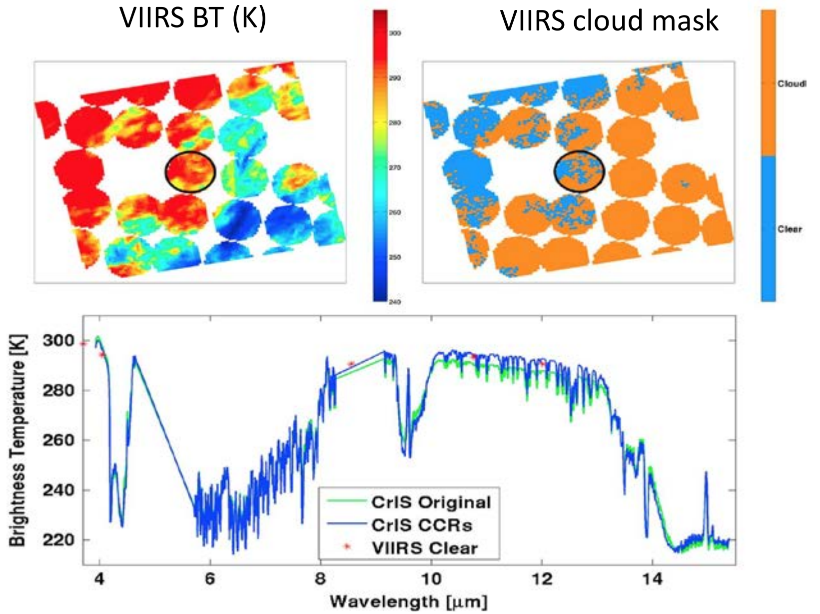
- Product Visualization
  - McIDAS-V can visualize output from the GOES-R GS as well as the STAR Algorithm Processing Framework (SAPF)
  - McIDAS-V can be used to provide interactive comparisons between various products and satellites
- Product Verification
  - “Glance” tool can be used to compare output from various frameworks to verify proper integration
  - “Glance” output provides a variety of statistics and visual comparisons
  - Glance is being used in the GOES-R Ground Segment's (GS) Product Production Zone (PPZ) Development Environment (DE) by the L2 Product Area Leads (PALs) to compare products against reference datasets, in particular after algorithm updates have been applied.
- Real-time collocation and verification
  - Web interface that provides quick looks and validation products
  - Also provides as physically collocated quantitative performance information searchable by day or month averages.
  - Currently supports comparisons with all most current GEO and LEO imagers (ex. AHI, ABI, SEVIRI)



Each image in the detailed report can be selected to show a larger image. In this case the mapped image of the absolute difference between the two datasets (top), a histogram of the differences (middle) and a density-scatter plot comparing the datasets (bottom) are shown.

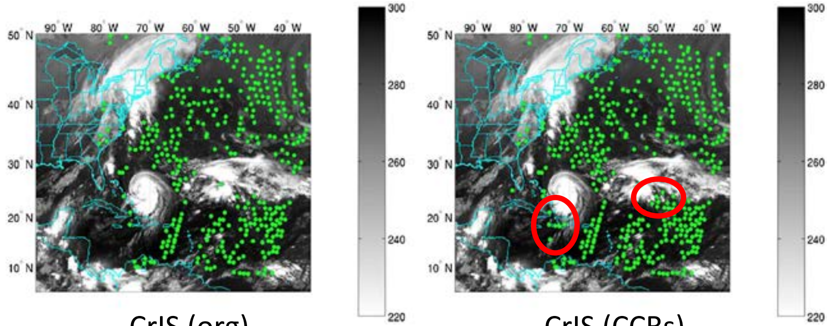
Impact of Assimilating the CrIS Thermodynamic Information in Cloudy Skies on Hurricane

Pei Wang, Jun Li, Zhenglong Li, Jinlong Li, Agnes Lim & Jung-Rim Lee (CIMSS); Tim Schmit (NOAA/NESDIS); Mitchell Goldberg (NOAA)

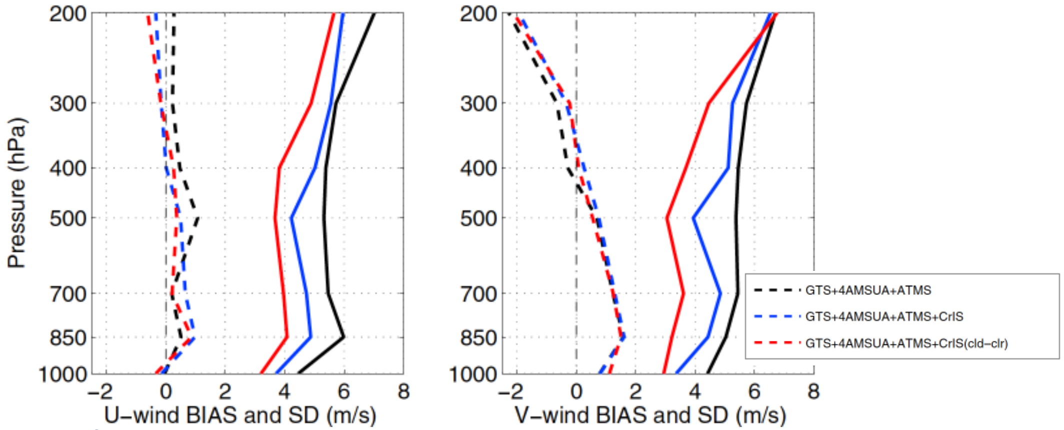


- Adapt MODIS/AIRS CCR algorithm to VIIRS/CrIS by taking into account the geometry differences between VIIRS/CrIS observing systems.
- Add QC to reduce the uncertainties of CrIS CCRs, due to no absorption band:
- Similarity test: abandon pairs of similar FOVs from CC.
- Homogeneous test: FOVs with more clouds should be colder
- Assimilating high resolution ABI moisture information and CrIS CCRs show positive impact on recent hurricane forecasts;
- QC is important, since atmosphere might be inhomogeneous within IR sounder sub-pixel in cloudy condition, and high resolution ABI can help CrIS assimilation in cloudy skies;

CrIS data coverage at ch 87



CrIS (org) CrIS (CCRs)



Generating Sounder Products at Imager Resolution

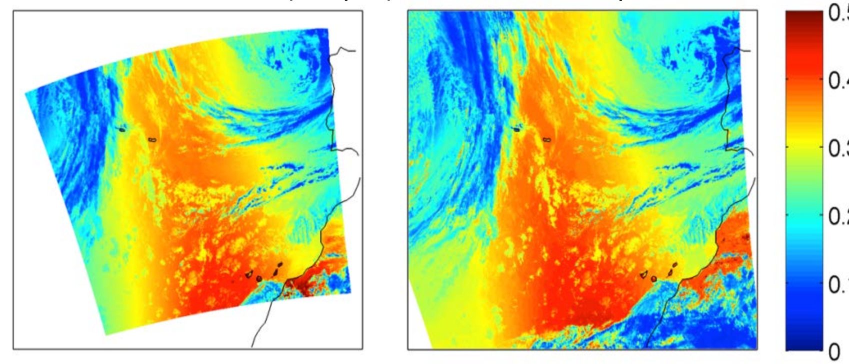
Elisabeth Weisz, Eva Borbas, Bryan Baum and Paul Menzel

Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin-Madison

22nd Conference on Satellite Meteorology and Oceanography: Advanced Satellite Data Applications

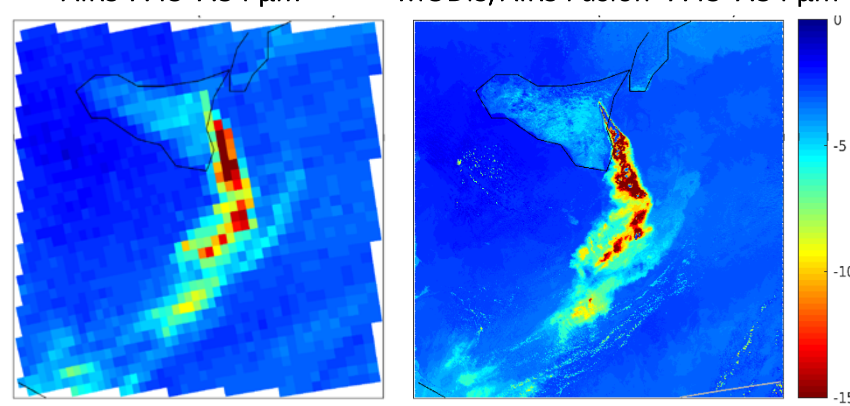
- New H_2O and CO_2 absorption bands can be added to VIIRS (and other imagers such as AVHRR) through **Imager/Sounder Fusion**
- VIIRS/CrIS fusion: all MODIS bands can be constructed by using VIIRS split window radiances in a k-d tree search to find most appropriate combination of CrIS radiances
- Fusion technique can be applied directly to sounder radiances as well as retrieval products
- Preliminary product fusion results are shown for Lifted Index, Cloud Top Pressure, Total Precipitable Water as well as Spectral Differences (for SO_2 detection)
- Leo/Geo Fusion (e.g. ABI/IASI, ABI/CrIS) produces promising results as well

Observed MODIS B25 (4.5 µm) New VIIRS 4.5 µm Band



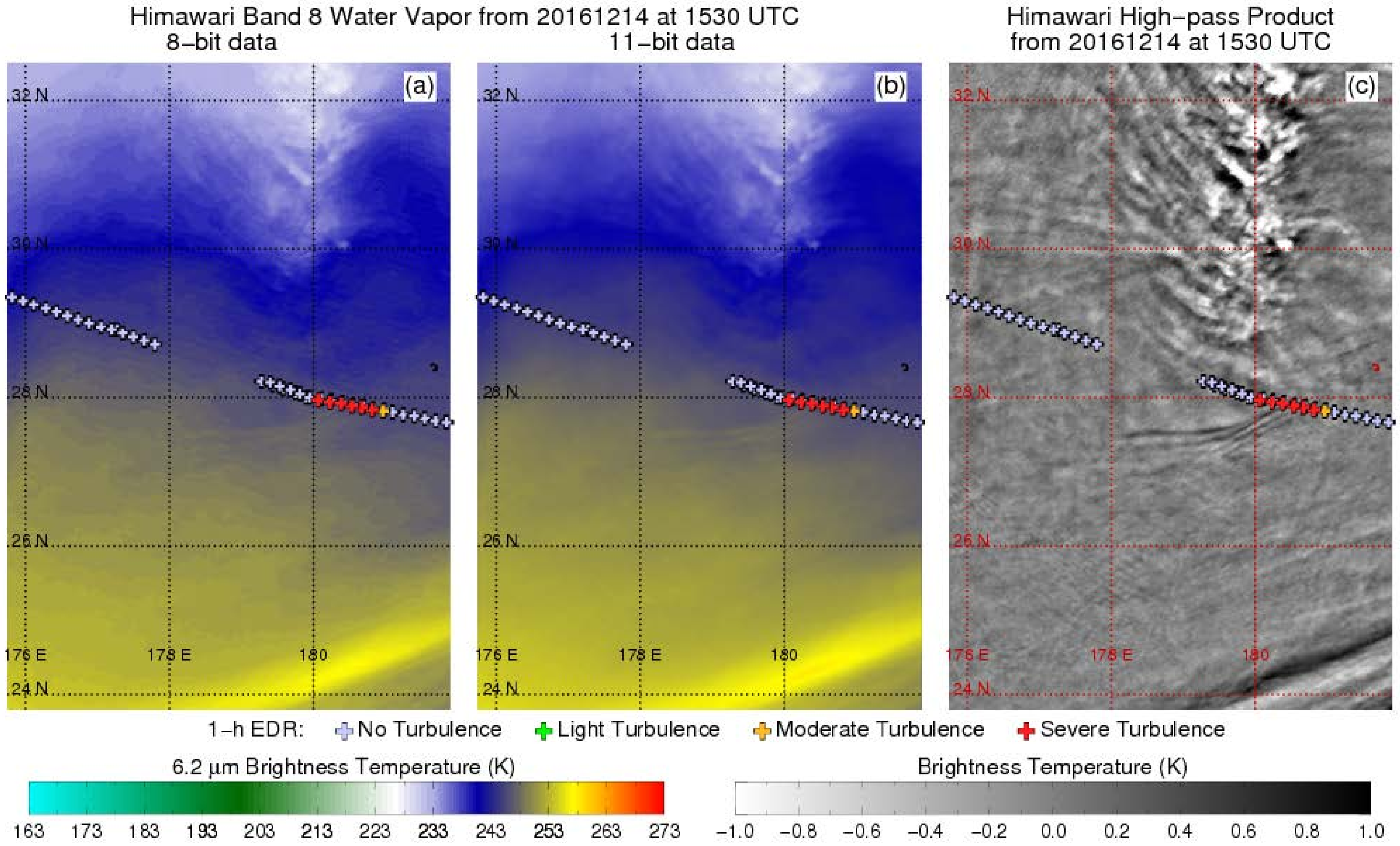
Mt. Etna SO_2 plume

AIRS 7.43-7.54 µm MODIS/AIRS Fusion 7.43-7.54 µm



Resolving gravity waves with Himawari-8 at the new limit of resolution, and the application to large-scale turbulence [Sponsored by GOES-R Risk Reduction – Turbulence]

Tony Wimmers, Sarah Griffin, Jordan Gerth, Scott Bachmeier and Scott Lindstrom (CIMSS)



- We have a new spatially-filtered product (right) revealing gravity waves that can be otherwise "hidden" in the insufficient contrast of the standard viewing tools (left and center)
- These features are found to coincide with severe clear air turbulence (red crosses). Aspects of these events indicate that this has potential for automated advanced warning.

CIRA

- Bernie Connell (2)
- Jack Dostalek
- John Forsythe
- Louie Grasso (2)
- John Haynes
- Kyle Hilburn
- Kevin Micke
- Steve Miller (3)
- Jorel Torres
- Tong Zhu

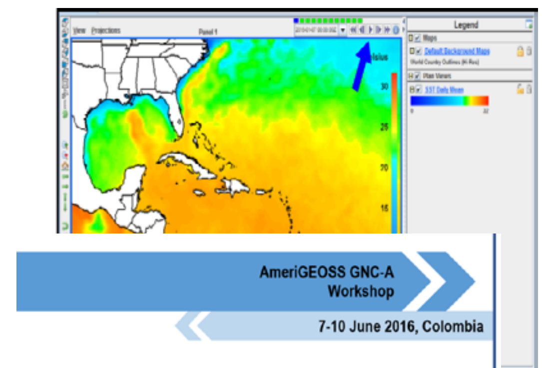
Linking Data Access And Display, Hands-on Exploratory Training, and Adaptations for Learners of Various Skills

B. Connell and E. Dagg (CIRA, USA), K-A. Caesar (CIMH, Barbados), M. Garbanzo (UCR, Costa Rica), D. Souza, (CPTEC, Brazil)

Target Audience: International Communities

Addressing recurring gaps over the past 20 years :

- Affordable access to real-time data
- Access to low cost software for both display and manipulation
- Training (on access, display, and interpretation)



McIDAS-V Tutorial 4:
Sea Surface Temperatures

17 Years of Interactions Between NOAA and the WMO VLab Members in Regions III and IV to Ensure Satellite Usage Through Training

B. Connell (CIRA, USA), K-A. Caesar (CIMH, Barbados), M. Garbanzo (UCR, Costa Rica),
N. Rudorff & D. Souza, (CPTEC, Brazil), and M. Campos (SMN, Argentina)

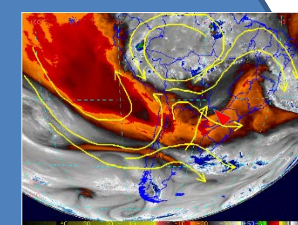
Target Audience:
International Communities

Ready to Promote Weather Ready Nations

Training Cycle

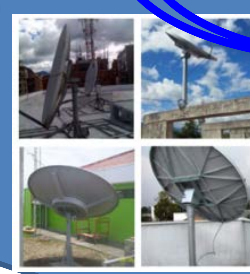
Training Event Weeks

Monthly Weather and Climate Discussions

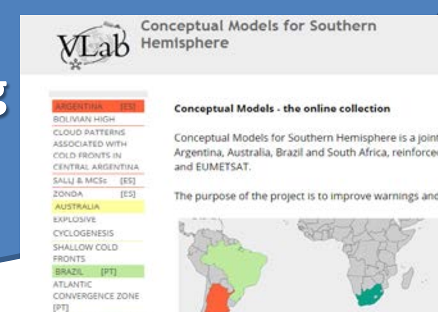


Multi-lingual

Data Access and Display



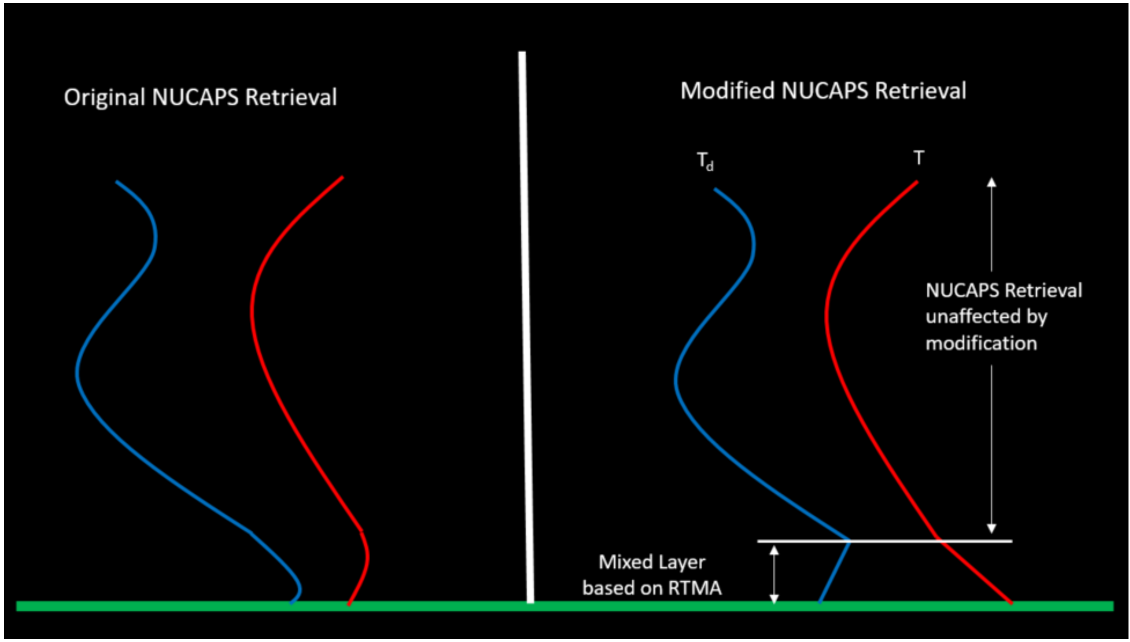
Optimizing "Tools"



Automated Modifications to SNPP NUCAPS Soundings using Surface Data for Severe Weather Analysis

Jack Dostalek (CIRA), Dan Lindsey (NESDIS, presenting), Antonia Gambacorta (STC), Nadia Smith (STC), Chris Barnet (STC)

- **Operational NUCAPS retrievals have relatively large errors in the boundary layer, limiting their usefulness for pre-convective mesoscale analysis utility**
- **This algorithm uses ancillary data from the Real Time Mesoscale Analysis (RTMA) and some GOES-16 data**
- **The boundary layer is modified in a post-processing step in order to make the product more operationally useful**



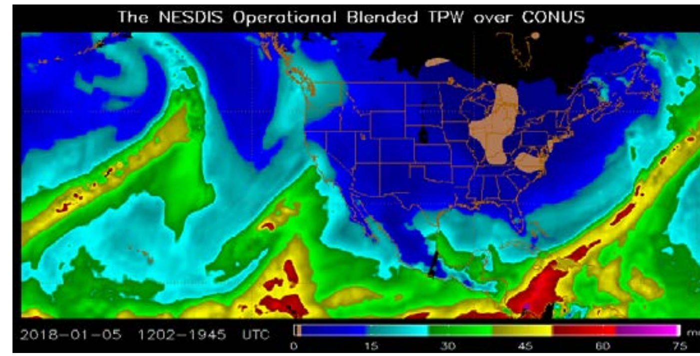
Schematic diagram showing what portions of a NUCAPS retrieval are modified by the algorithm

Tracking Water Vapor with Multisensor Blended Products for Forecasters

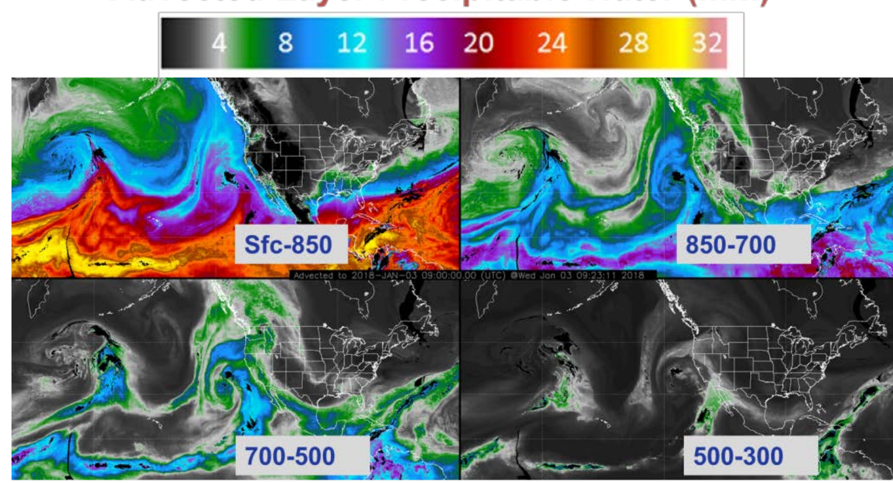
John Forsythe, Stan Kidder, Andy Jones, Dan Bikos, Ed Szoke (CIRA), Sheldon Kusselson (NESDIS retired)

- **Current operational products**
  - Blended Total Precipitable Water (TPW) and TPW anomaly
  - GOES-R being studied for inclusion in blended TPW
- **Advected layer precipitable water (ALPW) being created under JPSS Proving Ground**
  - Being used by WPC, NHC and select WFO's (via NASA SPoRT)
  - Not currently operational
- **ALPW versus GFS comparisons in near-realtime being created via NOAA Hydrometeorology Testbed**
  - Model QPF impacts studied

Operational Blended TPW



Advected Layer Precipitable Water (mm)



09 UTC January 3, 2018 CIRA ALPW

GOES-16 ABI channel differencing used to reveal cloud-free zones of 'precursors of convective initiation'

Louie Grasso (CIRA), John Dostalek (CIRA), Dan Lindsey(NESDIS)

- **The presentation showed examples of precursors within GOES-16 ABI imagery**
- **Examples included band differences between 10.35 and 12.3 µm**
- **Positive feedback from an NWS forecaster from the San Antonio office**

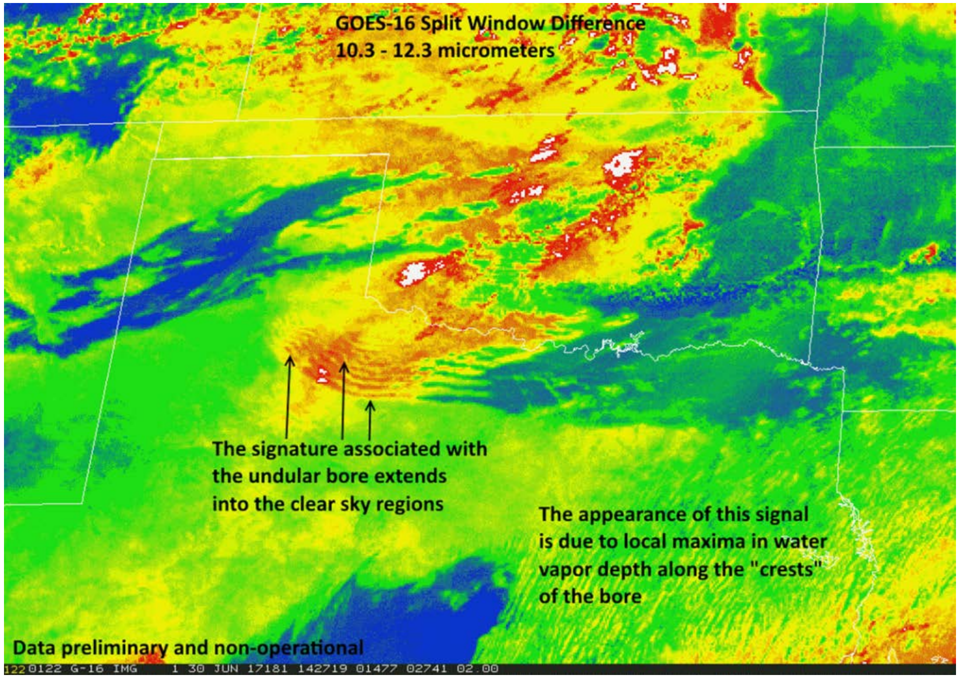


Figure 1: GOES-16 channel difference over north central Texas on 30 June 2017. This imagery provides an example of the ability of the channel difference to detect and display features that were undetectable in the visible imagery.

GOES-16 ABI Observations of Lower Tropospheric Structures of Water Vapor at 1.38 µm

Louie Grasso (CIRA), Dan Bikos (CIRA), Steven Miller(CIRA)

- **The presentation showed examples of boundary layer circulations within GOES-16 ABI cirrus-band imagery**
- **Examples included imagery from two different cases**
- **Positive feedback from Dong Wu of the Goddard Space Flight Center**

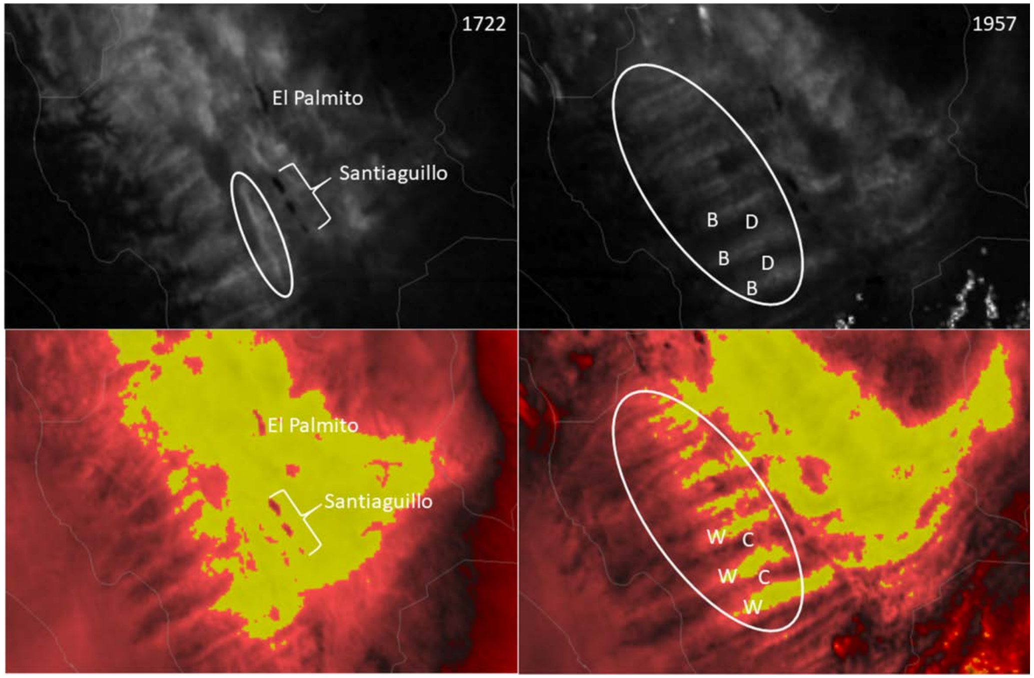
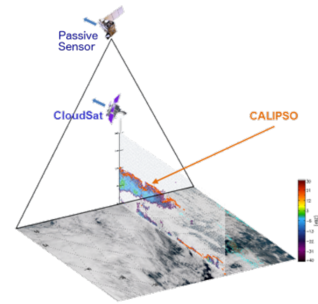


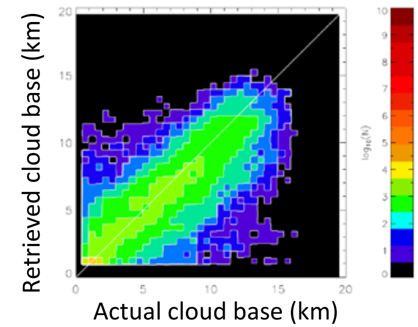
Figure 1: Observed GOES-R ABI imagery at 1.38 µm (top) and 7.34 µm (bottom) at 1722 UTC (left) and 1957 UTC (right) on 16 April 2016 over Durango, Mexico. At 1957 UTC, a large oval bounds banded structures in both ABI images. Some of the bright (B) and dark (D) bands within the large oval are indicated at 1.38 µm along with warmer (W) and cooler (C) regions at 7.34 µm.

Improving Cloud Layer Boundaries from GOES-16

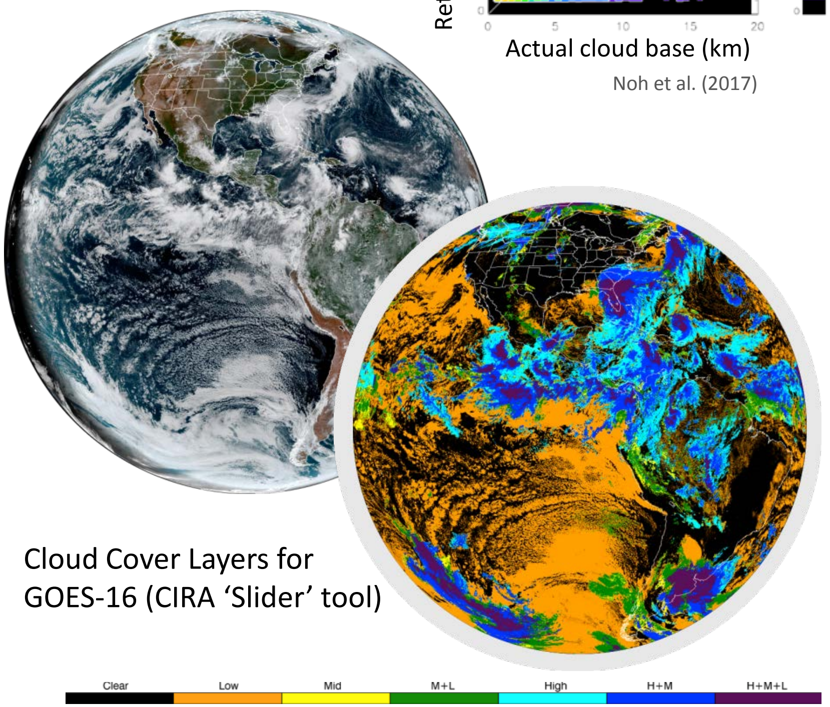
John Haynes, Yoo-Jeong Noh, Steven Miller, John Forsythe (CIRA); Daniel Lindsey and Andrew Heidinger (NESDIS/STAR)

- An improved Cloud Cover Layers product for GOES-16
  - Highlighted development of a passive sensor **cloud base height retrieval** that is trained on matched active sensor observations
  - Currently exploring improvements in **multi-layer cloud layer height quantification**, using passive-active fusion and a multispectral approach
- Preliminary improved product is running in real time at CIRA
  - Transition to NOAA **operational status** is underway





Noh et al. (2017)

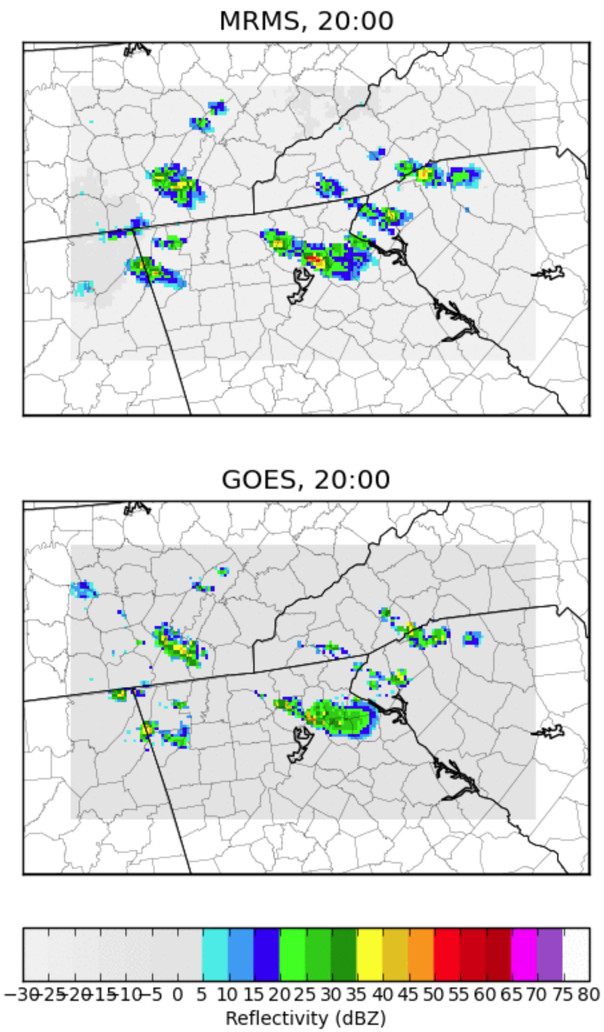


Cloud Cover Layers for GOES-16 (CIRA 'Slider' tool)

Using GOES-16 to Improve Short Term Forecasts

Kyle Hilburn (CIRA/CSU), Max Marchand (CIRA/CSU), Yoonjin Lee (CSU), Chris Kummerow (CIRA/CSU), and Curtis Alexander (NOAA)

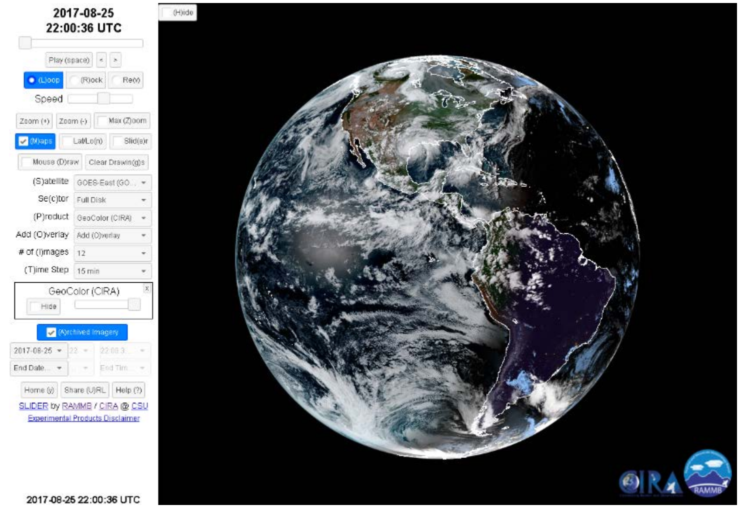
- **For precipitation detection and estimation, GOES-16 offers information on:**
  - Cloud optical depth (C02)
  - Cloud particle phase and size (C06)
  - Cloud top temperature (C13)
- **An observation operator was developed to transform GOES-16 reflectances and brightness temperatures into 3D radar reflectivity fields**
  - This loop compares MRMS composite reflectivity (top) with GOES-16 derived composite reflectivity (bottom) for a convective initiation case over the Southeast United States
- **This allows initialization of the HRRR model with GOES-16 using the radar initialization pathway in the HRRR system**

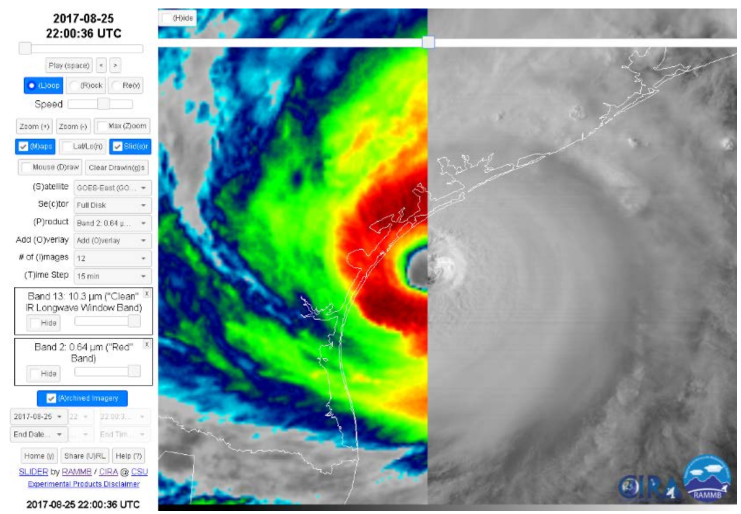


SLIDER: GOES-16 Imagery on the Web

Kevin Micke, Steven Miller, Renate Brummer, Steve Finley, Natalie Tourville (CIRA); Don Hillger, Debra Molenar, Dan Lindsey (NESDIS)

- SLIDER (Satellite Loop Interactive Data Explorer in Real-time) Web Application
  - Developed at CIRA to facilitate exploration of large data sets like GOES-16 over the web
  - Allows users to zoom in to full resolution
  - Works on desktops, phones, and tablets
  - The Today Show, New York Times, and others have used imagery and linked to site
- Front End Design
  - Uses image “tiling” to make imagery download faster /use less bandwidth
  - Built with HTML5, CSS, and JavaScript (using the jQuery library)
  - Uses JSON files for “database” to increase scalability
- Explore GOES-16 and Himawari Imagery
  - http://rammb-slider.cira.colostate.edu/
  - http://col.st/MjXeN



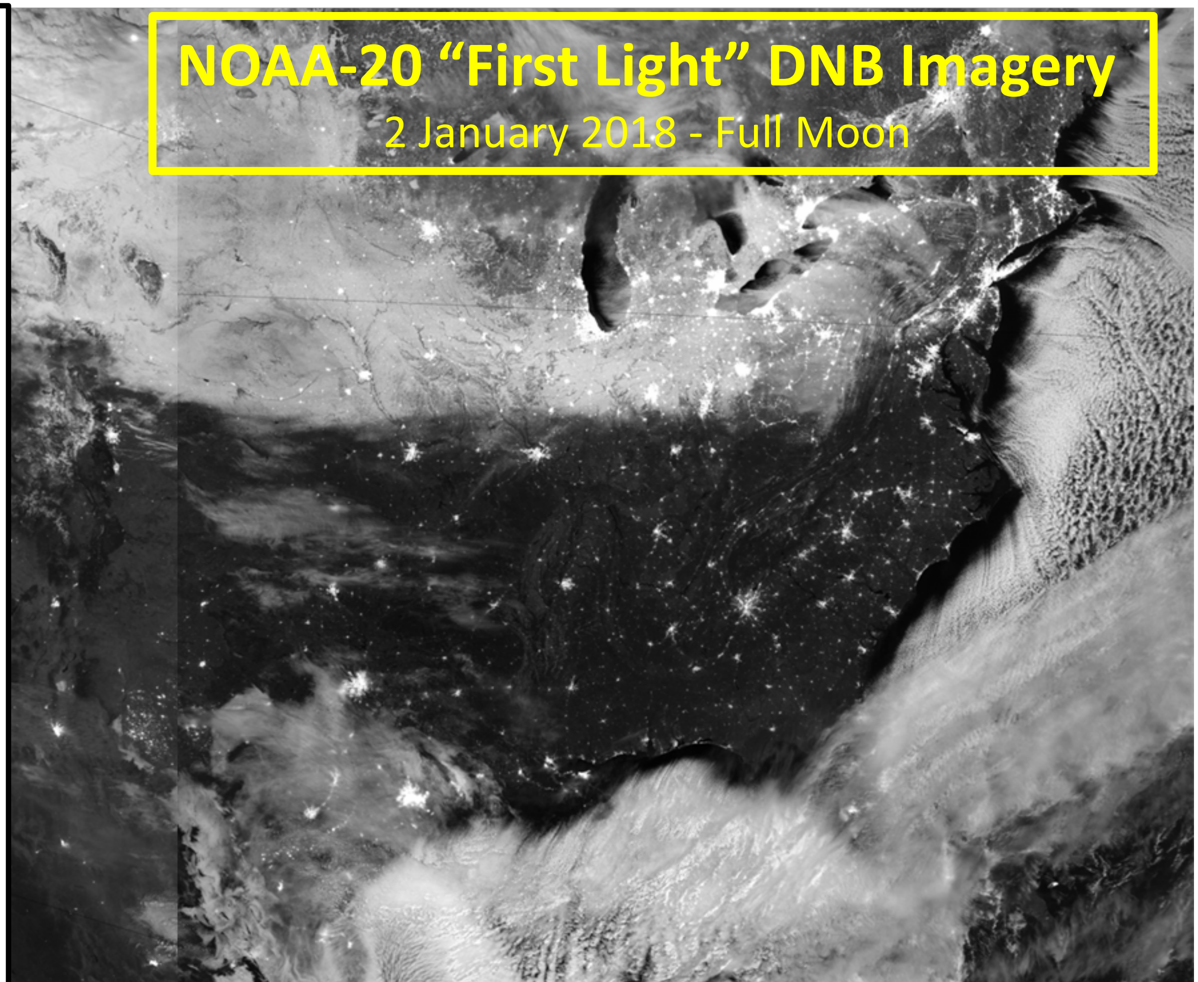


Chasing the Shadows with the VIIRS Day/Night Band

Steven Miller, William Straka, III, Curtis Seaman, Cindy Combs, Jeremy Solbrig - (CSU/CIRA)
Andrew Heidinger (NOAA/NESDIS), Andi Walther (UW/CIMSS)

Review of the VIIRS Day/Night Band and its unique nocturnal sensing capabilities:

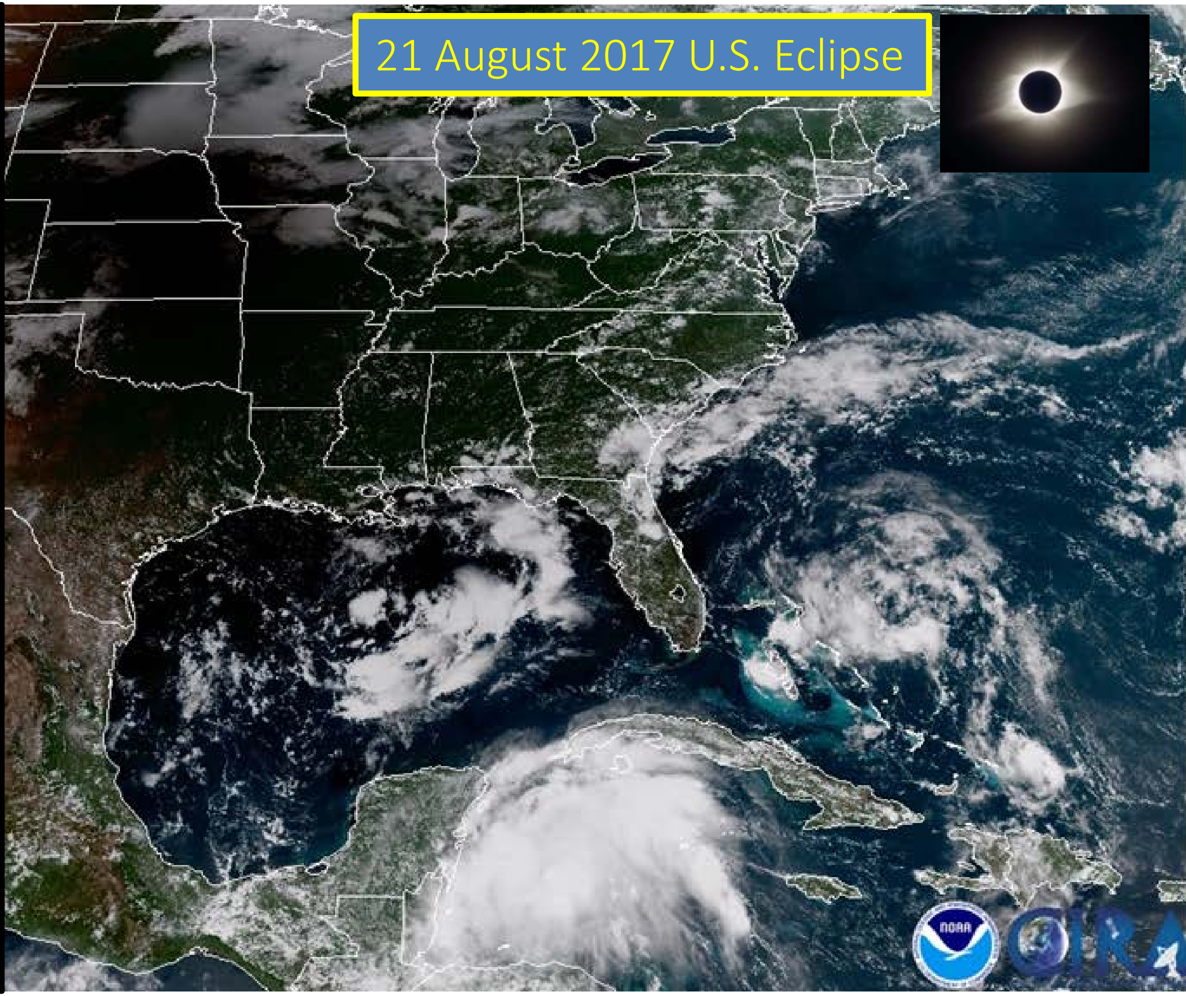
- Nocturnal Smoke AOD
- Detecting Active Fire Lines
- Hurricane Maria (2017) Power Outages
- Nighttime Snow Detection
- Gravity Waves in Nightglow
- NOAA-20 & S-NPP In Tandem Flight
- NOAA-20 “First Light” DNB Imagery



Advanced Imagery Application Development for GOES-R ABI

Steven Miller, Curtis Seaman, Jeremy Solbrig, Yoo-Jeong Noh, Louie Grasso and Kevin Micke - (CSU/CIRA)
Daniel Lindsey - (NOAA/NESDIS)

- The Next Generation of Geostationary Imagers: across-the-board increases to all dimensions of resolution is a true game changer to the operational forecaster.
- Selected Examples of ABI Multispectral Imagery: We are seeing new things in the ABI imagery all the time!
- A Focus on True Color: synthetic green data are combined with ABI native blue and red bands to form a True Color image.

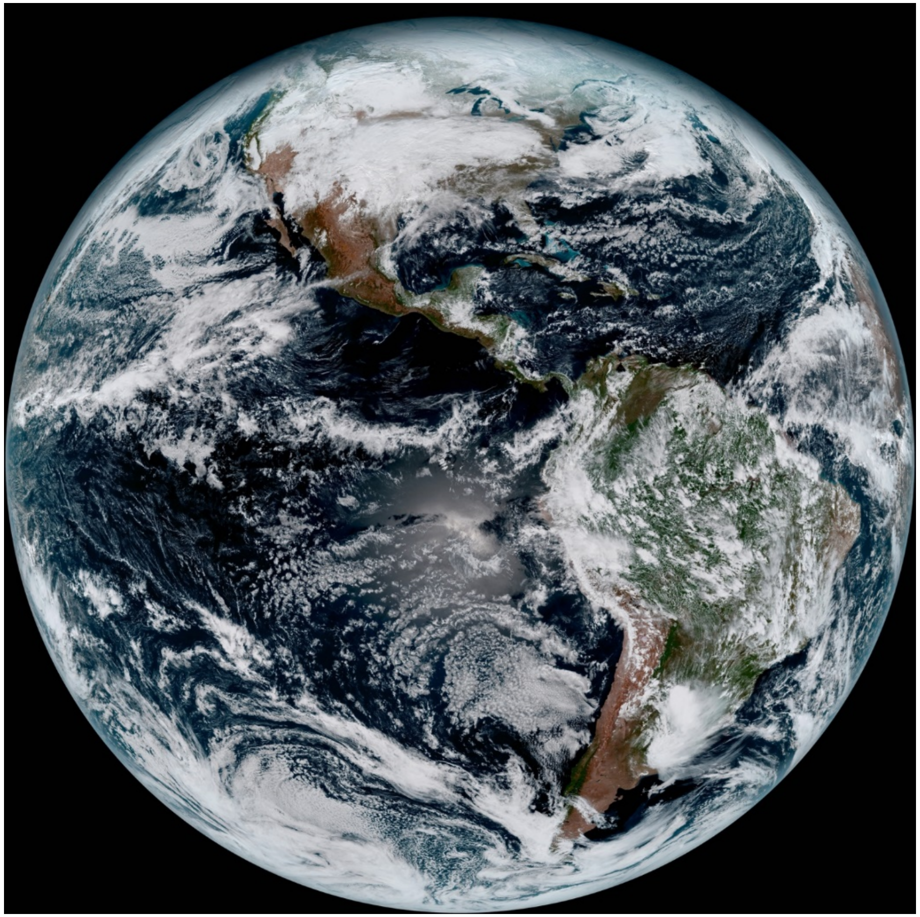


New GOES-R Risk Reduction Activities at CIRA

Steven Miller, John Forsythe, Louie Grasso, John Haynes, Yoo-Jeong Noh, Milija Zupanski, Renate Brummer, Jeremy Solbrig - (CSU/CIRA)
Daniel Lindsey - (NOAA/NESDIS)

New CIRA GOES-R3 Projects:

- **Developing an Environmental Awareness Repertoire of ABI Imagery (*'DEAR-ABII'*) to Advise the Operational Weather Forecaster**.
- **GOES-R ABI Channel Differencing used to Reveal Cloud-Free Zones of 'Precursors of Convective Initiation'.**
- **Improving the ABI Cloud Layers Product for Multiple Layer Cloud Systems and Aviation Forecast Applications.**
- **Using the New Capabilities of GOES-R to Improve Blended, Multisensor Water Vapor Products for Forecasters.**
- **Data Assimilation of GLM Observations in HWRF/GSI System.**
- **SLIDER (Satellite Loop Interactive Data Explorer in Real-time) Web Application**

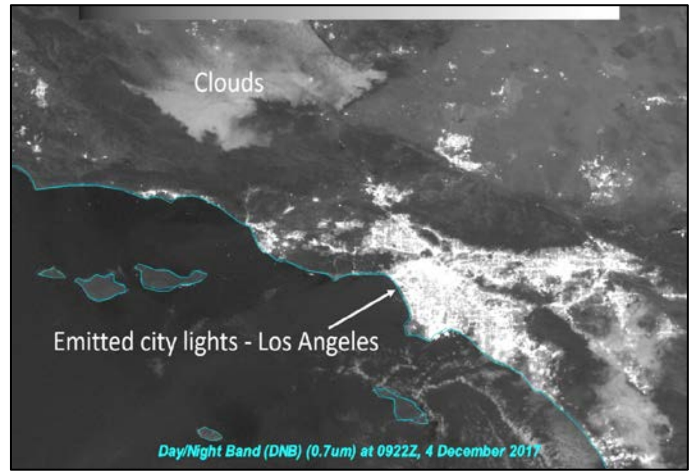


Caption: First Light ABI True Color Imagery

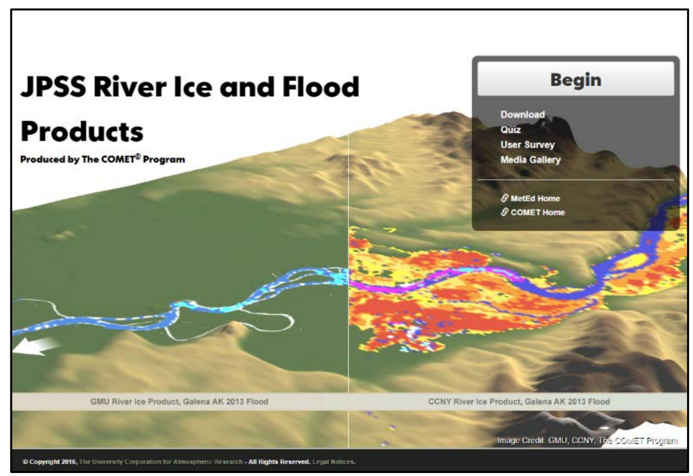
JPSS Products, Applications and Training

Jorel Torres, Bernie Connell, and Steve Miller (CIRA)

- Key concepts for users
  - Need for JPSS Training
  - Key Aspects of LEO satellites
- Overview of JPSS Products
  - Day/Night Band (DNB) and Near-Constant Contrast (NCC)
  - NUCAPS
  - Blended TPW
  - VIIRS Flood Detection Map
- Satellite Foundational Course for JPSS
  - Under development training and available training resources



'Emitted lights from the Thomas fire via DNB, and see how close in proximity the fire is to the Los Angeles Metropolitan area. Animation from 4-11 December 2017 between 9-11Z.'

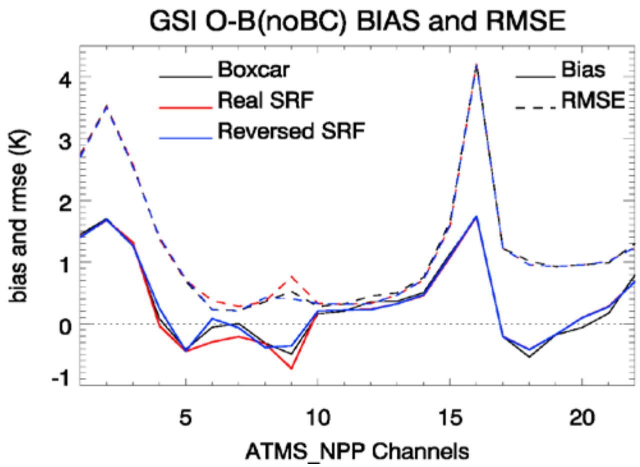


'An example of available JPSS training: the JPSS River Ice and Flood Product COMET module'.

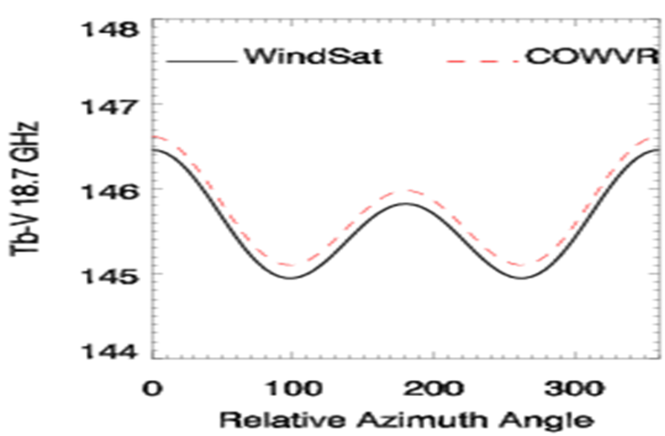
Generation and Testing CRTM Coefficients for JPSS-1 and ORS-6 Mission Sensors

Tong Zhu(CIRA), Mark Liu(STAR), Ben Johnson(UCAR), Yong Chen, Ming Chen(ESSIC), Yanqiu Zhu, Andrew Collard(EMC), Thomas Auligne(UCAR)

- Investigated CRTM coefficient for ATMS_NPP real SRF data
  - Re-generated CRTM coefficient using NASA released real SRF data,
  - Generated CRTM coefficient using reversed real SRF data,
  - Studied the impacts of above two and boxcar coefficients on the ATMS assimilation in GSI system.



- Generated CRTM new release Rel-2.3.0, along with many new CRTM coefficients
  - A new CRTM release, REL-2.3.0, was generated on November 27, 2017. Available at: http://ftp.emc.ncep.noaa.gov/jcsda/CRTM/REL-2.3.0/,
  - which includes a new function for all-sky radiance simulation,
  - And new CRTM coefficients: atms_n20, atms_n20-srf, cris-fsr, cris-fsr431, viirs, abi_g16, ahi_h9, cowvr_ors6, tropics (CubeSat), et al.



CREST

- Anjeza Arapi
- Mark Campmier
- Aris Fernandez
- Equisha Glenn
- Meredith Sperling
- Yonghua Wu

Assessment of optical properties variation and discrimination of aerosol and cloud with a multiple-wavelength elastic-Raman lidar in New York City

Anjeza Arapi* (CREST), Yonghua Wu, Aris Fernandez, Mark Arend, and Fred Moshary (CREST)

- Low-clouds and aerosols discrimination from the attenuated color-ratio
  - Enhanced backscatter around the low-clouds from the elastic-lidar profile measurements
  - Color-ratio for aerosol-cloud-discrimination
  - Hydrated aerosols nearby the clouds

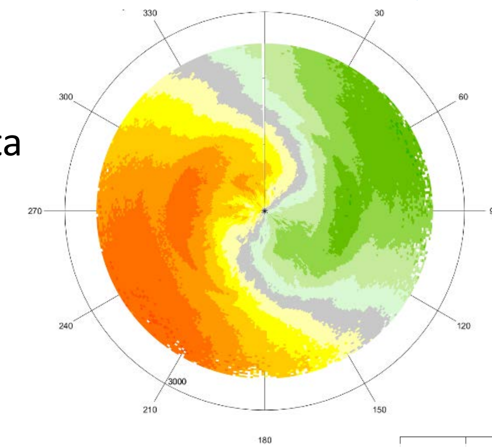
- Vertical wind measurement by a co-located coherent wind Doppler lidar
  - Strong convection under the low clouds indicating the updraft motion in the PBL at 12:00-18:00 EDT.

- Spatial variability and difference of color-ratio and relative backscatter under the cloudy and clear skies
  - Larger color-ratio and backscatter indicating hydrated enhancement effects around the clouds (within 0.4 km from the cloud base).

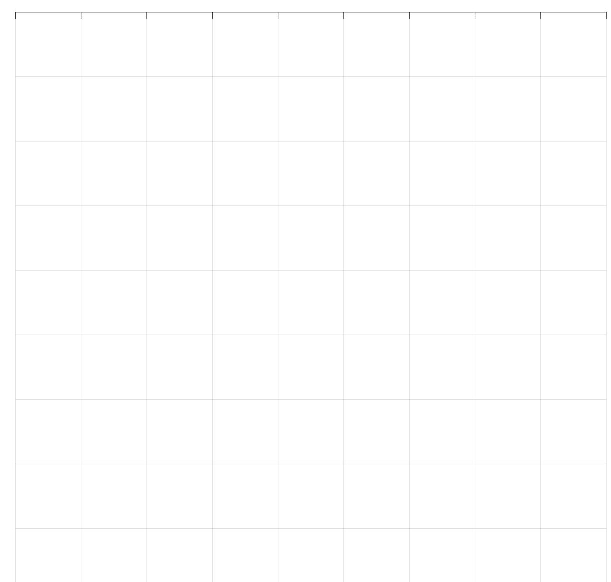
Wind in the New York City Built Environment: Applications of LIDAR and In-Situ Observations

Mark Campmier (CUNY CSURP); Aris Fernandez, Mark Arend, & Fred Moshary (CUNY NOAA-CREST)

- Leosphere 200S Doppler LIDAR used in conjunction with passive remote sensing devices to capture wind and atmospheric data near the CUNY City College of New York Campus
  - Velocity-Azimuth Display (VAD) conical scan strategy implemented to measure vertical profiles of the horizontal wind.
  - Instrument calibrated in late July 2017, and took automated measurements throughout the course of August 2017



- Measurements analyzed for accuracy based on wind velocity magnitude and divergence profiles given by VAD algorithm
  - Images Determined "sweet spot" of reliable VAD measurements during the early morning when the atmosphere is most stable, since VAD assumes the atmosphere is stable
  - Power Law, and Log Law Scaling correlations can be made for applications in Air Pollution Control and Structural Engineering.



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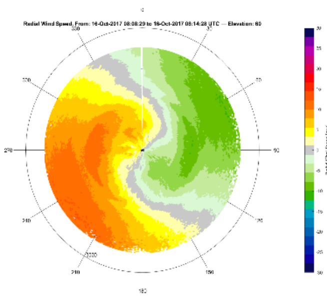
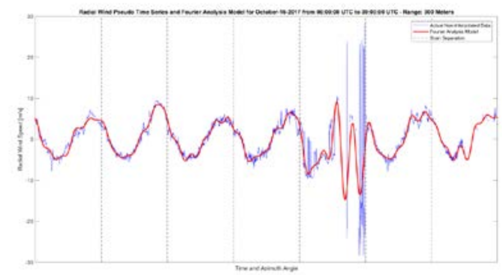
Applications of Doppler LIDAR Technology to Air Quality Management

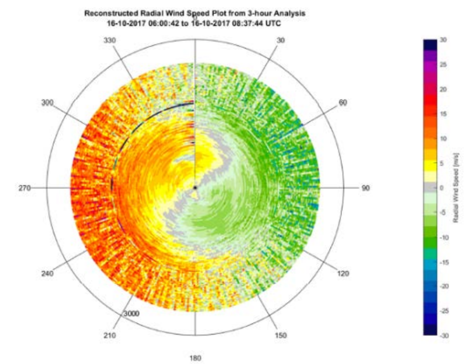
Aris Fernandez, Mark Campmier, Anjez Arapi, Yonghau Wu, Fred Moshary and Mark Arend

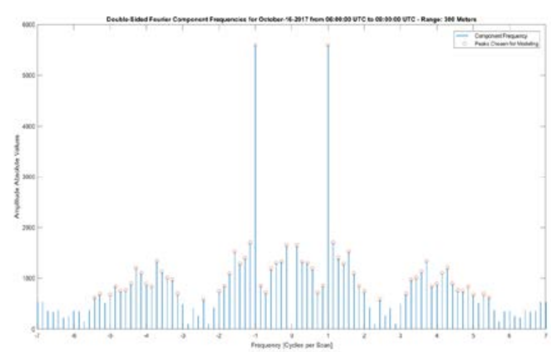
19th Symposium on Meteorological Observation and Instrumentation

- Scanning Doppler LIDAR retrieves wind profile
  - VAD scanning strategy captures winds at 60 degrees of elevation
  - Series of scans viewed as a single time series
- Scan data reconstructed from model
  - Frequency components chosen from frequency domain version of time series
  - Boundary layer mixing observed which impacts air quality





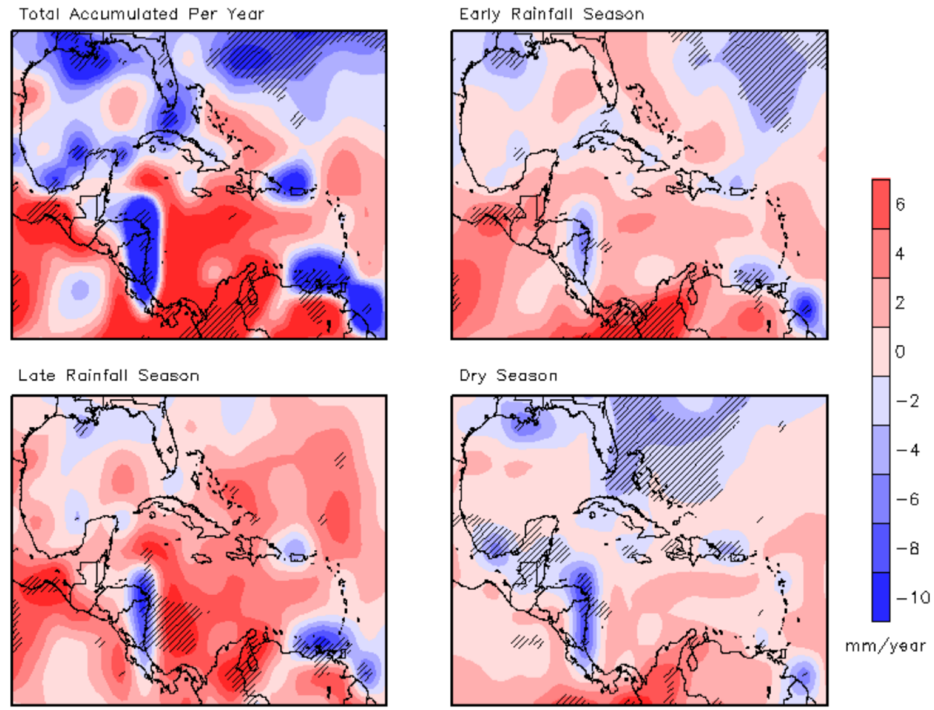




Caribbean Precipitation Trends During a Regional Sea-Surface Temperature Warming Period, 1982-2014

Equisha Glenn, Jorge E. Gonzalez (NOAA –CREST, The City College of New York); Tom Smith (STAR/SCSB/CICS/ESSIC)

- Trend analysis for Caribbean precipitation was generated using satellite-based data from the Global Precipitation Climatology Project (GPCP) for 1982 - 2014
  - Land-based data has many data gaps/incomplete records
  - Sea-Surface Temperature warming detected during 1982 – 2014 → SSTs shown to influence Tropical precipitation
  - Statistically significant (at 95% test level) drying trends observed during the Dry Season → December to March
- Sea-Surface Temperatures explain the interannual variability and annual trend observed for precipitation during 1982-2014
  - Principal Component Analysis was used to get the principal components (PCs) for SSTs and precipitation
  - Principal Components for SSTs and precipitation were used for the linear model
    - SSTs explain the annual trends observed for precipitation
    - Additional parameters needed to explain trends observed for the individual seasons



Precipitation Trend
1982–2015

	Annual	ERS	LRS	DS
Trend	-1.024	-0.288	0.739	-1.236
P-value	0.3606	0.5577	0.0707	5.018×10^{-5}

Points determined to be significant at the 95% test level are shaded with black, diagonal lines.

Evaluating Wind Power Prediction Uncertainty Using Scanning Doppler Wind Lidar

Meredith Sperling[1,2], Alexandra St. Pé[3], Aditya Choukulkar[4], Cristina L. Archer[5], Ruben Delgado[2,6]
1. UMBC Departments of Mechanical Engineering and Mathematics 2. NOAA CREST 3. UMBC Department of Geography and Environmental Systems
3. UMBC Department of Geography and Environmental Systems 4. NOAA CIRES 5. University of Delaware 6. UMBC Joint Center for Earth Systems Technology

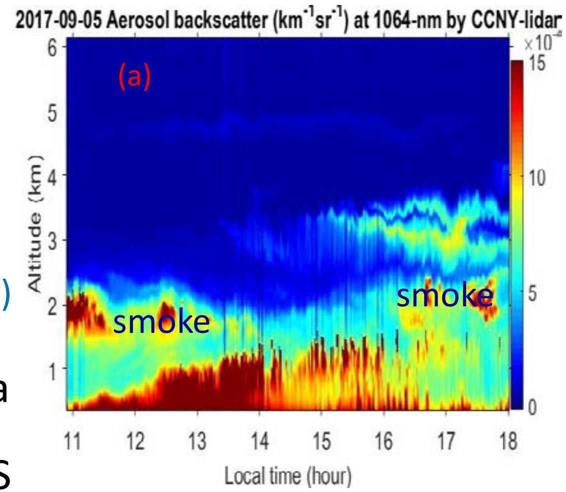
- Turbine Power Output is not a function of hub-height wind speed alone.
  - Significant variation in power output at the same hub-height wind speed
- Rotor equivalent wind speed (REWS) reduces available power uncertainty.
  - In total, REWS reduces power prediction uncertainty by 1.9%
- Classified vertical wind profile types address wind resource uncertainty.
  - Standard, Power-Law profiles have the lowest uncertainty associated with hub-height wind speed predictions (only 7.9%).
  - Strong Inflection types have the largest uncertainty reduction achieved by REWS.

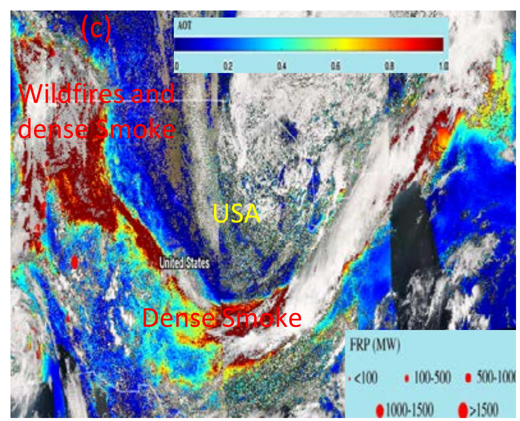
NOAA STAR CENTER FOR SATELLITE APPLICATIONS AND RESEARCH

Assessment of Smoke Plume Transport and Impact on Air Quality with a Synergistic Ground-Based and Satellite Observation in New York City

Yonghua Wu, Anjeza Arapi, Adrian Diaz, Aris Fernandez, Barry Gross, Fred Moshary (NOAA CREST)

- Wildfire smoke plumes and mixing down into PBL observed by a lidar-ceilometer in NYC
  - Smoke plumes below 4-km observed by the CCNY-lidar in Fig.(a).
  - Mixing down into PBL /surface from a ceilometer 24-hr obs. on Sep.5, 2017 in Fig.(b)
- Wildfire sources in the NW US and Canada and coast-to-coast or continental-scale transport indicated from the satellite VIIRS fire/smoke/aerosol product in Fig.(c).
- Big impact on the ground air quality in NYS indicated from a coincident increase and strong correlation of ground $PM_{2.5}$ and CO at the Pinnacle site in Fig.(d); hourly $PM_{2.5}$ in exceedance of NAAQS (35 µg/m^3 24hr mean); black-carbon increases from 0.2- to 1.1 µg/m^3.





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