AMS Talk Summaries from STAR & CIs

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

STAR

- Connelly, Ryan
- Das, Bigyani
- Ferraro, Ralph
- Han, Yong
- Hillger, Donald W.
- Iturbide-Sanchez, Flavio
- Meng, Huan
- Nalli, N.R.
- Schmit, Timothy J.
- Smith, Jonathon
- Wrotny, Jonathan
- Xu, Deyong
- Yu, Yunyue

Use of NDVI Satellite Data to Identify and Document Destructive Hail Swaths

RYAN CONNELLY, Valparaiso University; PHILIP SCHUMACHER NOAA/NWS Forecast Office, Sioux Falls, SD; and KEVIN GALLO NOAA/NESDIS/STAR, USGS EROS Center, Sioux Falls, SD

AMS 14th Annual Student Conference

- Simulated GOES-R ABI NDVI examined for hail events
  - NDVI change between pre- and post-storm events can be used to document hail swaths (Figure 1).
  - NDVI change corresponds to greater crop damage, as documented by photos, compared to radar reflectivity (Figure 2) or Maximum Expected Size of Hail (MESH) product values.
- Additional hail events being evaluated
  - NDVI derived from VIIRS, as well as GOES-R ABI, planned for future analysis.

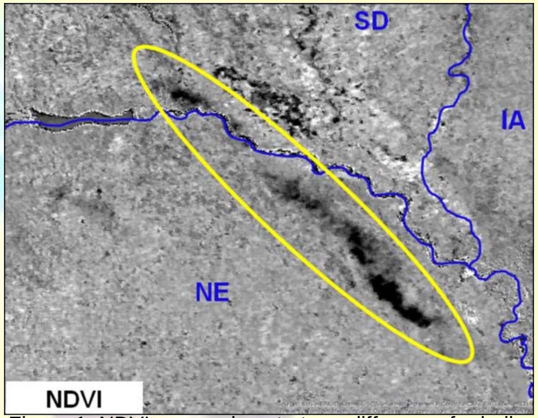


Figure 1. NDVI pre- and post-storm difference for hail event of 18 August 2011 in northeast Nebraska and southeast South Dakota (simulated GOES-R ABI).

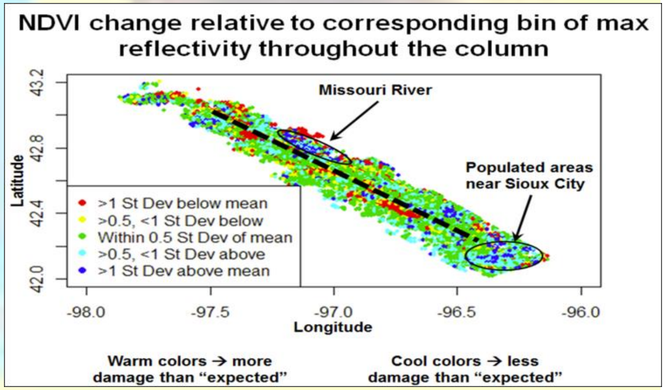


Figure 2. Spatial plot of NDVI change for each square 1 km, relative to the mean NDVI change for each point's corresponding composite reflectivity bin, where reflectivity is binned every 2 dBZ.

Poster: Testing, Troubleshooting and Integrating Changes to Joint Polar Satellite Systems (JPSS) Algorithms using Algorithm Development Library (ADL)

Bigyani Das, Weizhong Chen, Marina Tsidulko, Yunhui Zhao, Valerie Mikles, Kristina Sprietzer, Vipuli Dharmawardane, Walter Wolf

20th Conference on Satellite Meteorology and Oceanography

- **Eight Step Process in Algorithm Integration**
  - Obtain ADL version from Raytheon CM
  - Integrate this in STAR AIT CM
  - Create a Test Stream
  - Work with the Test Stream
  - Create Future Emulation Scenario
  - Select the Golden Days
  - Collect the Input Files
  - Build ADL and Run the Executables
- **Four Step Quality Check**
  - ADL Version Check
  - Science Check
  - Document Check
  - Algorithm Package Check
- **Life Cycle Reviews**
  - Technical Interchange Meeting (TIM)
  - Critical Design Review (CDR)
  - Unit Test Readiness Review (UTRR)
  - Delivery to DPES (DTD)
  - Algorithm Readiness Review (ARR)

Life Cycle Reviews

TIM	• Candidate algorithm design is discussed to ensure it meets all scientific and operational requirements
CDR	• STAR AIT and science team describe the chosen algorithm • Implementation Concept and Software Architecture are discussed
UTRR	• Present test plan, procedures, and results • Tests must demonstrate that software is meeting its functional requirements
DTD	• The algorithm is delivered to DPES for implementation into G-ADA
ARR	• Demonstrate that all data products are meeting requirements

AIT: Algorithm Integration Team
DPES: Data Products Engineering Services

J12.1

Current Status and Future Outlook for NOAA/NESDIS Operational Precipitation Products

20th AMS Conference on Satellite Meteorology and Oceanography

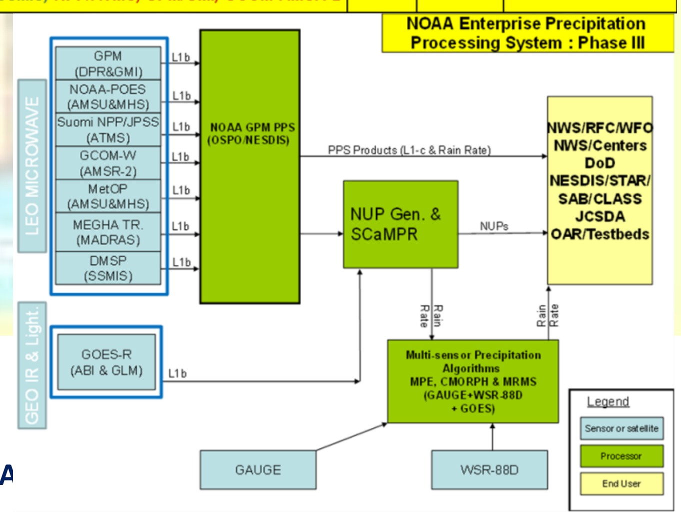
Ralph Ferraro, NOAA/NESDIS
Limin Zhao, Stan Kidder, Chandra Kondragunta, Bob Kuligowski, Huan Meng, Patrick Meyers, Brian Nelson, Nai-Yu Wang, Jerry Zhan

- Several product systems that generated operational precipitation products
  - POES specific
  - GOES specific
  - Emerging blended products
- Future goal is to consolidate into a unified systems called GEARS
  - Challenge is to meet all user requirements, including latency
    - Direct broadcast can be exploited for POES and JPSS
  - New sensors offer new capabilities to develop fused products
    - GOES-R (ABI, GLM)
    - JPSS (VIIRS, ATMS)
    - Non-NOAA (GPM, GCOM)
- A NOAA-wide "Roadmap toward a One-NOAA Precipitation Product Enterprise" is being developed

Primary NESDIS Operational Precipitation Products/Systems

Algo	Products	Satellites/Sensors	Res	Type	Formats
MSPPS	Rainfall rate, Snowfall rate, TPW, CLW, Snow Cover, Sea Ice, etc	NOAA-18&NOAA-19&Metop-A & Metop-B /*AMSU-A&MHS*	16 km	Level-2, Level-3	HDF-EOS, McIDAS area, PNG
MiRS	Rainfall rate, Snowfall rate, TPW, CLW, Snow Cover, Sea Ice, etc	NOAA-18 & NOAA-19 & Metop-A & Metop-B /*AMSU-A&MHS*; DMSP F17&F18/*SSMIS*, *NPP/ATMS*, *M-T/SAPHIR*, *GPM/GMI*	Varies (Lo and Hi Res)	Level-2, Level-3	HDF-EOS,netCDF4, McIDAS area, PNGs
GHE	Rainfall rate, multi-hours and multi-days rainfall total	GOES-E & GOES-W & MTSAT & Meteosat-7 & Meteosat-10 *IR Imager*	4 km	Level-3	netCDF4, McIDAS area, GRIB1/GRIB2, GIFs
bTPW	Global Total Precipitable Water Map	NOAA-18, NOAA-19, Metop-A and Metop-B /*AMSU-A&MHS, GOES-W/-E, GPS-Met, DMSP F17&F18/SSMIS, NPP/ATMS, GPM/GMI, GCOM AMSR-2*	16 km	Level-4	HDF-EOS, McIDAS area, AWIPS, PNGs
bRR	Global Rainfall Rate Map	NOAA-18, NOAA-19, Metop-A and Metop-B /*AMSU-A&MHS, DMSP 17&F18/SSMIS, NPP/ATMS, GPM/GMI, GCOM-AMSR-2*	16 km	Level-4	HDF-EOS, McIDAS area, AWIPS, PNGs
eTRAP	Prob-matched QPF, Probability	NOAA-18, NOAA-19, Metop-A and Metop-B /*AMSU-A&MHS, GOES-W/-E, DMSP F17, F18/SSMIS, NPP/ATMS, GPM/GMI, GCOM-AMSR-2*	4 km	Level-3	ASCII, McIDAS area, GIFs

A concept for a future precipitation processing system at NOAA that optimizes satellite and ground assets, yet, reduces the number of systems



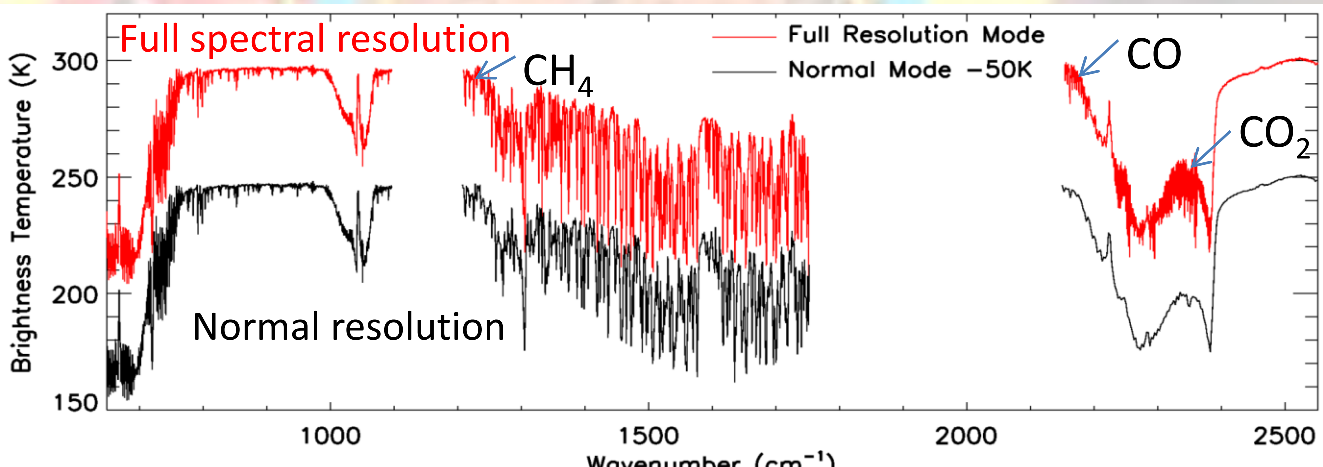
S-NPP CrIS Full Spectral Resolution SDR Processing and Quality Assessment

Yong Han, Yong Chen, Xiaozhen Xiong, Xin Jin, Likun Wang and Denis Tremblay
NOAA Center for Satellite Application and Research, College Park, MD

11th Annual Symposium on New Generation Operational Environmental Satellite System

Oral presentation

- NOAA/STAR Full Spectral Resolution (FSR) processing system
  - **On Dec 4, 2014, S-NPP CrIS was turned into FSR mode**
  - **While the NOAA Operational processing system (IDPS) continues to provide normal resolution radiance spectra, the STAR FSR processing system provides the FSR radiance spectra to the public**
- FSR SDR data quality assessment
  - **The spectral and radiometric calibrations meet specifications**
  - **Noise performance is characterized and results are presented**



Suomi-NPP VIIRS Imagery Update

Donald W. Hillger, NOAA/NESDIS, Fort Collins, CO; and C. J. Seaman, S. D. Miller, T. J. Kopp, R. Williams, and G. Mineart

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VIIRS Imagery is excellent:

The I-bands provide high-resolution imagery of tropical storms, thunderstorms, RGB imagery, etc., depicting details in cloud formations or features on the ground which were not seen before (as noted in many of the VIIRS Blogs and VIIRS Imagery websites).

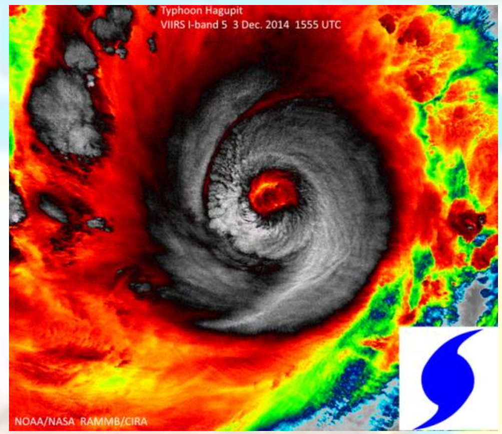
Users especially like DNB and/or NCC.

Some Improvements in VIIRS Imagery are possible:

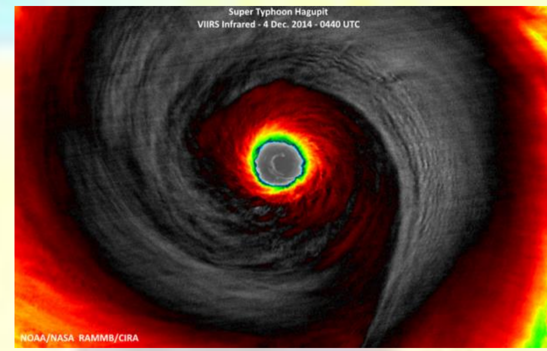
Additional (all 16) M-band EDRs desired (currently only 6 M bands)

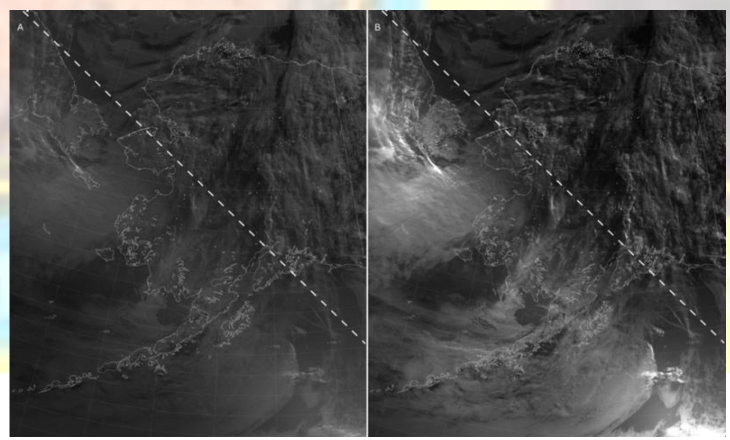
Improved "erf-dynamic scaling" (EDS) DNB

Data latency is main realtime usage issue (6 hour delay is not user friendly).



VIIRS I-band-5 Image of Typhoon Hagupit: rapidly-intensifying 1555 UTC on 3 Dec 2014, maximum intensify 0440 UTC on 4 Dec 2014.





VIIRS DNB and NCC images of a twilight scene on the night following a last quarter moon (13:23 UTC 19 July 2014). A) DNB image produced using the EDS method. B) NCC image. The dashed lines in (A) and (B) represent the 89° solar zenith angle contour with daylight in the upper right corner and night in the lower left corner.

Improvement of the Satellite-Based Microwave Physical Retrieval of Temperature and Water Vapor in NUCAPS

Flavio Iturbide-Sanchez[1], Antonia Gambacorta[3], Quanhua Liu[2], Anthony Reale[2], Nicholas R. Nalli[1], Changyi Tan[1], and Bomin Sun[1]
1. I.M. Systems Group at NOAA/NESDIS/Center for Satellite Applications and Research, College Park, MD 20740.
2. NOAA/NESDIS/Center for Satellite Applications and Research, College Park, MD 20740.
3. Science and Technology Corporation, Columbia, MD 21046.

- This work presents the performance evaluation and initial improvements of the Microwave-only physical retrieval algorithm of the National Oceanic and Atmospheric Administration (NOAA) Unique CrIS/ATMS Processing System (NUCAPS).
- Figure 1 presents an improvement in the temperature retrieved by NUCAPS (blue histogram) after using a modified version of MiRS as the NUCAPS Microwave-only algorithm. This result is particular of a polar vortex case developed during January 2014 over the United States. For comparison purposes, the red line represents the actual performance of the NUCAPS Microwave-only algorithm.
- A new NUCAPS ocean/land rainfall rate algorithm based on the MSPPS precipitation algorithm was implemented and evaluated. Figure 2 shows a comparison between the MSPPS (left) and the NUCAPS (right) rainfall rate. Reduced number of false alarms over the sea-ice edge are observed for the NUCAPS case.
- Major problems in the quality of the NUCAPS Microwave-Only retrieval algorithm have been identified and initial efforts for their solution are in progress.

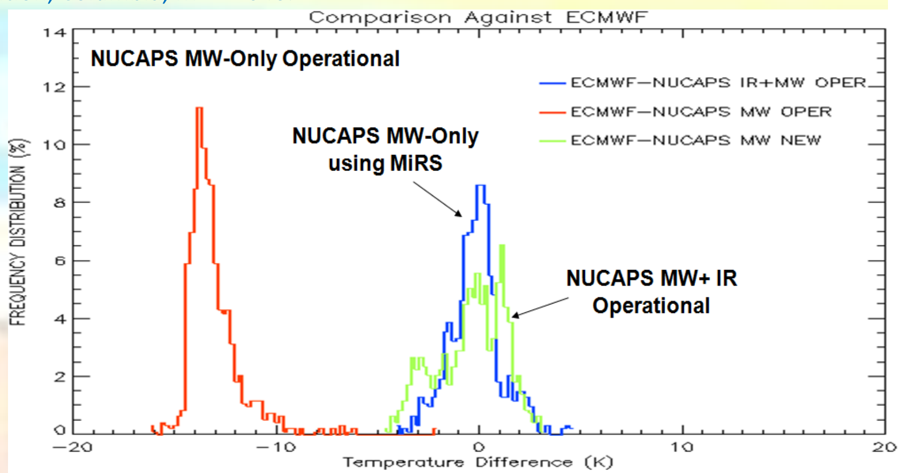


Figure 1. Histogram of the NUCAPS retrieved temperature minus ECMWF temperature over a winter polar vortex case.

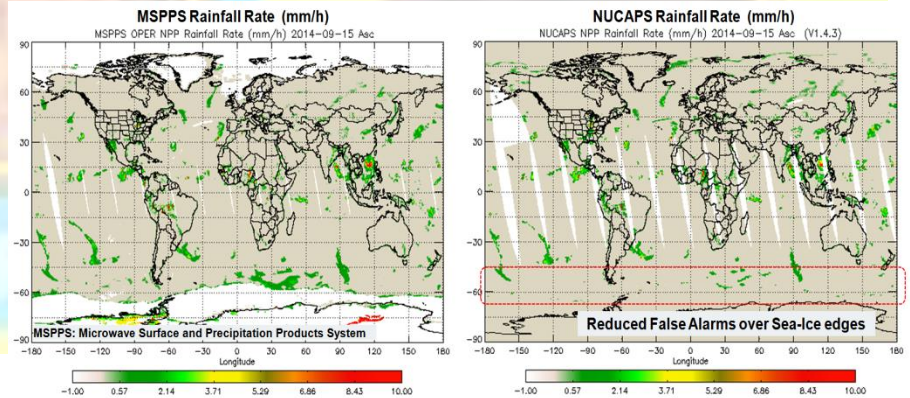


Figure 2. Rainfall rate estimated by the MSPPS (left) and NUCAPS(right) precipitation algorithms.

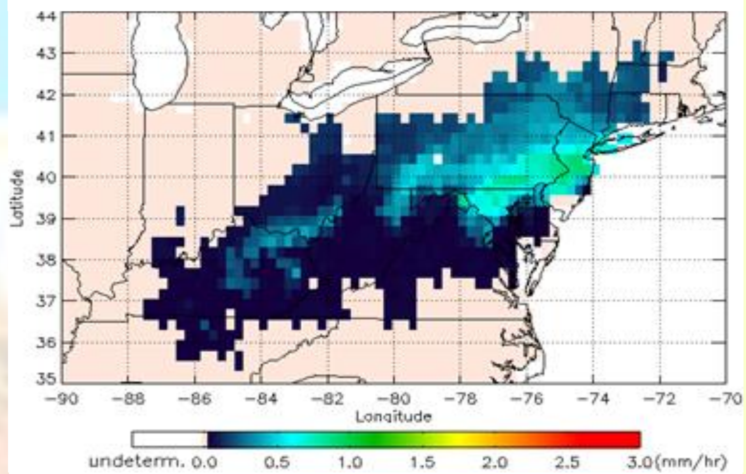
Snowfall Rate Retrieval using Passive Microwave Measurements and Its Applications in Weather Forecast and Hydrology

Huan Meng[1,2], Ralph Ferraro[1,2], Cezar Kongoli[2], Banghua Yan[1,2], Bradley Zavodsky[3], Limin Zhao[1,2], Jun Dong[2], Nai-Yu Wang[1,4]
[1]NOAA/NESDIS, College Park, MD; [2]ESSIC/CICS-MD, University of Maryland, College Park, MD
[3]NASA/SPoRT, Huntsville, AL; [4]IMSG, Inc., Rockville, MD

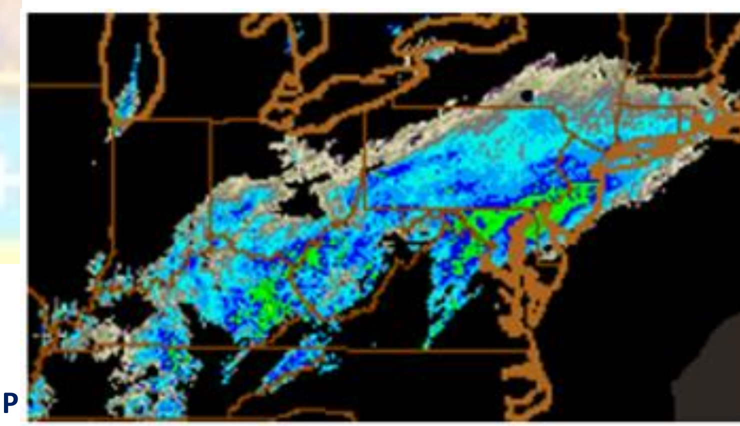
20th Conference on Satellite Meteorology and Oceanography

- Developed ATMS Snowfall Rate (SFR) algorithm
  - More advanced algorithm than the operational MHS SFR product
  - Snowfall detection employs principal component analysis and logistic regression model
  - Cold air extension greatly improved snowfall detection
- Applications
  - Two-year product assessment at WFOs and SAB; feedback helps product improvement
  - Global blended precipitation analysis such as CMORPH-Snow

Retrieved Snowfall Rate



NEXRAD Composite Reflectivity

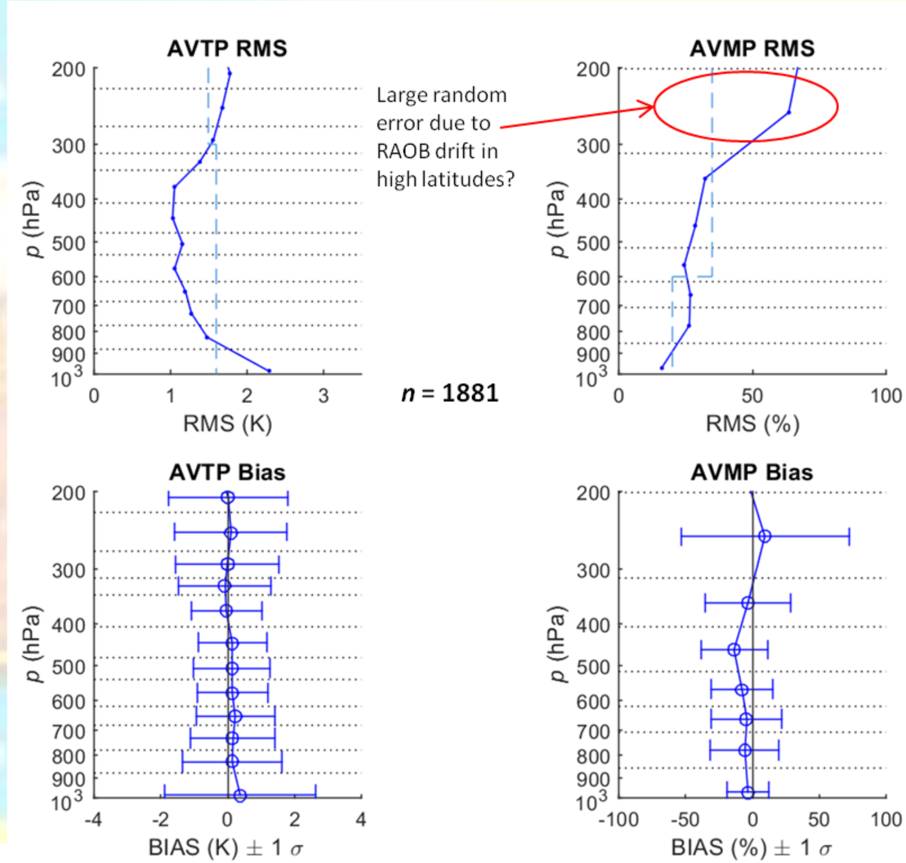


Validation of the JPSS NOAA-Unique CrIS/ATMS Processing System (NUCAPS) Operational EDR

N. R. Nalli, A. Gambacorta, C. Barnet, Q. Liu, T. Reale, C. Tan, F. Iturbide-Sanchez, B. Sun, L. Borg, D. Tobin, E. Joseph, V. R. Morris, A. K. Mollner, T. King, W. W. Wolf, J. W. Smith, F. Tilley, D. Wolfe

11th Annual Symposium on New Generation Operational Environmental Satellite Systems

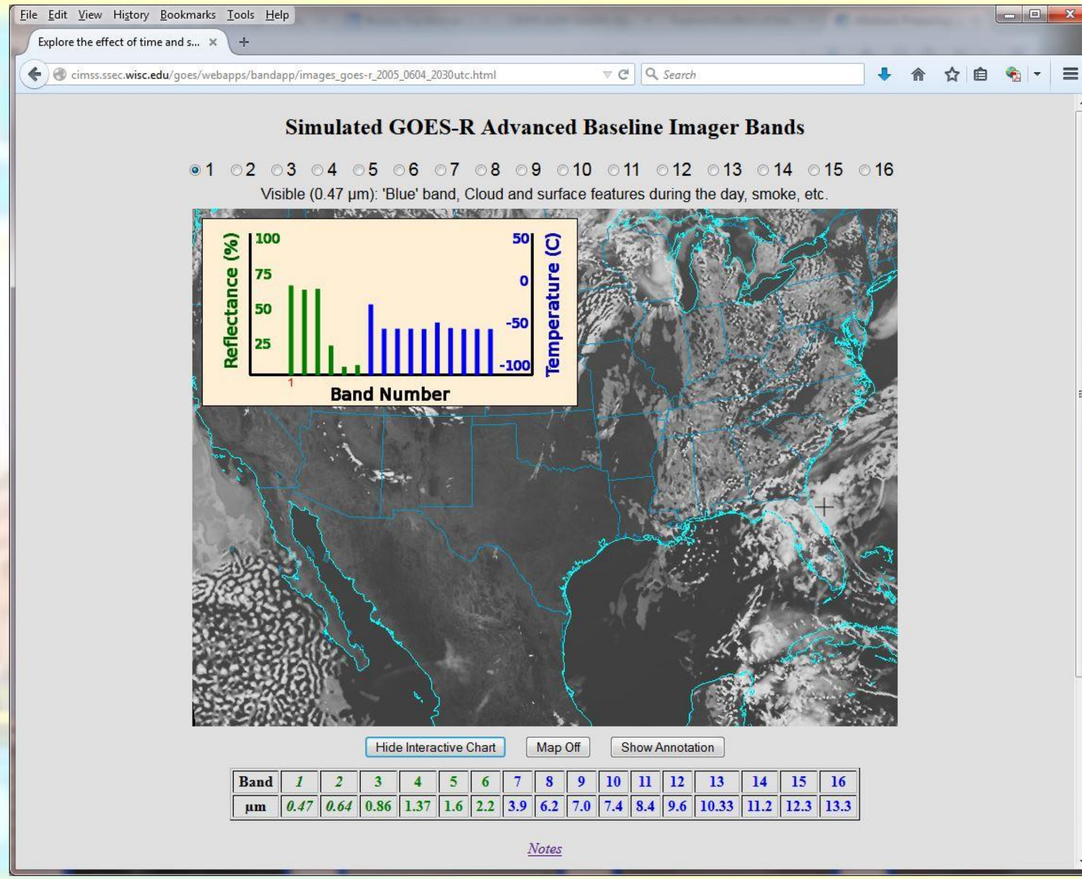
- An overview was given of JPSS Sounder EDR Cal/Val
  - The sounder EDR validation methodology was reviewed
  - The NUCAPS algorithm and validation datasets were summarized
- The current status of the NUCAPS operational EDR product validation was presented
  - Temperature, moisture profiles
  - Ozone profiles and trace gases
  - Long-Term Monitoring (LTM)



Preparing Users for the ABI on GOES-R

Timothy J. Schmit, 11th Annual Symposium on New Generation Operational Environmental Satellite Systems

- Methods for preparing for the Advanced Baseline Imager (ABI)
  - Simulations
    - Triplet datasets
    - WRF Chem
  - Education
    - webapps
  - Training
  - Other sensors
    - MAS
    - AHI
    - SRSOR (Rapid Scans)



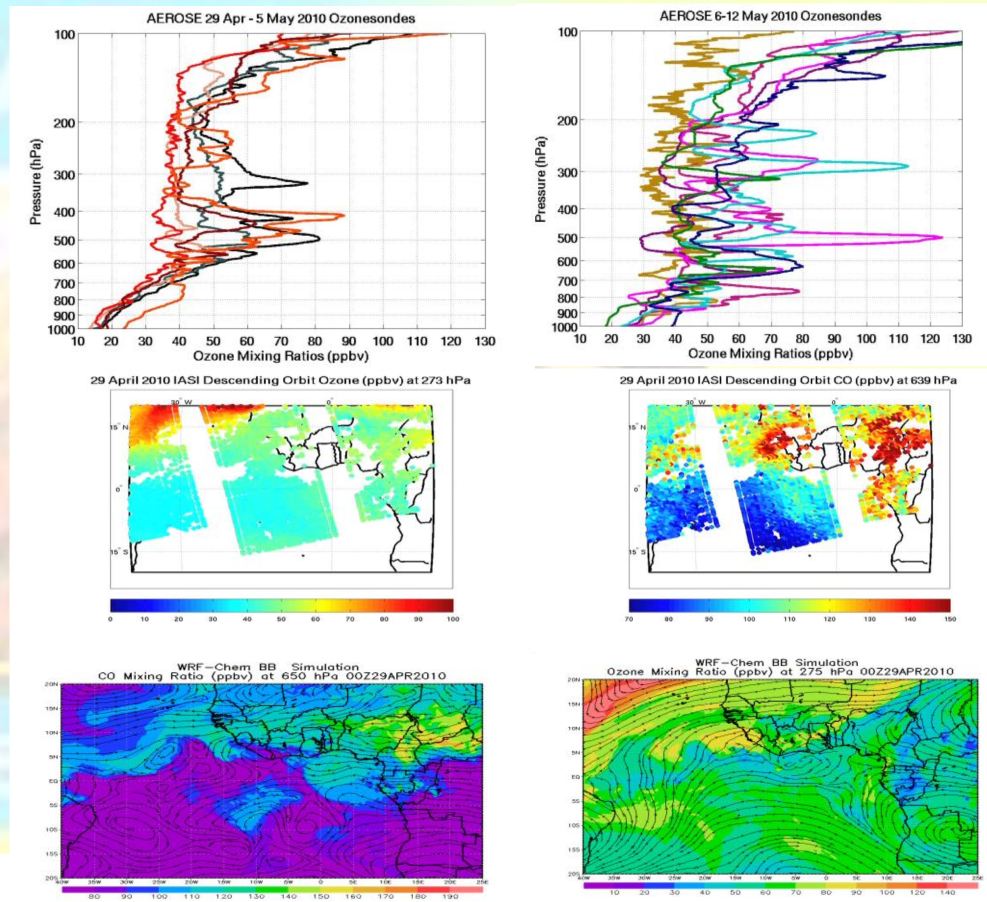
Sample interactive "Bandapp" educational webapp:
http://cimss.ssec.wisc.edu/goes/webapps/bandapp/

Sounder observations and WRF-Chem Model simulations: Impact study on tropospheric ozone increases observed during the 2010 AEROSE Campaign

17th Conference on Atmospheric Chemistry

Jonathan W. Smith, Ph D., National Academies/National Research Council Associateship STAR/SMCD, and Nicholas R. Nalli, Ph D., STAR/SMCD

- IASI and WRF-Chem Model ozone are comparable quantitatively and spatially
  - 110-130 ppbv at 650 across the Sahel of Africa
  - Plumes emerge of the coast of Guinea and Gabon/Cameroon
  - Likely from convective transport
- IASI, AEROSE ozonesonde, and WRF-Chem Model ozone are comparable
  - 50-60 ppbv at 275 hPa across the Sahel early in period then a decrease to 30-40 ppbv



GOES-R AIT: Development of Standard Test Data Sets for Routine Testing

Jonathan Wrotny[1], Z. Zhang[1], S. Sampson[1], W Wolf[2], and W. Straka[3]
[1]IMSG, College Park, MD 20740, USA
[2]NOAA/NESDIS/STAR, College Park, MD 20740 USA
[3]CIMSS, Madison, WI 53706, USA

11th Annual Symposium on New Generation Operational Environmental Satellite Systems

- Regression testing on all GOES-R Level 2 (L2) products is performed weekly to ensure stability of the algorithm code.
  - Currently, test data is limited to a handful of test scenes such that the full science code is not being tested.
  - Lack of code coverage makes it difficult to evaluate impact of code updates.
- New test data sets are being assembled which ensure full code coverage of the GOES-R software.
  - The standard GNU utility 'Gcov' is used to evaluate the code coverage for each test case.
  - The individual GOES-R Algorithm Working Group science teams support the identification of test cases and help identify test data which can trigger hard to reach code decision points.
  - Test cases are selected which maximize code coverage, while attempting to limit the overall number of cases.

```
       -:  653:        ! viewing zenith angle
 9003969:  654:        View_Zen_Ang = SatZen(Elem,Line)
       -:  655:        ! solar zenith angle
 9003969:  656:        Sol_Zen_Ang = SolZen(Elem,Line)
       -:  657:
       -:  658:        !*** does this check need to be done in LZA rather
than VZA?
       -:  659:        !--- check for correct sensor and solar geometry
       -:  660:        !IF (Local_Zen_Ang >= 65.0) THEN
 9003969:  661:        IF (View_Zen_Ang >= 72.0) THEN
   #####:  662:          Num_Pix_Cycle=Num_Pix_Cycle+1
       -:  663:        !*** does this check need to be done in LZA rather
than VZA
       -:  664:          !--- quality flag set for "Local Zenith Angle >= 72.0"
   #####:  665:          Quality_Flag(Elem,Line) = 1
   #####:  666:          CYCLE
       -:  667:        END IF
       -:  668:
```

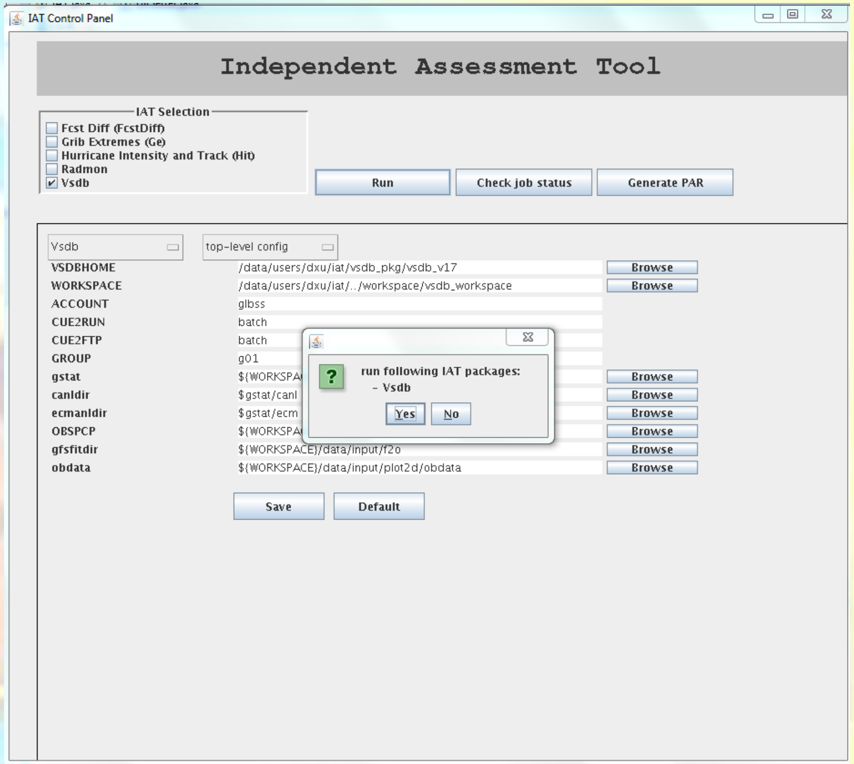
A section of source code for the GOES-R Nighttime Cloud Microphysical Properties algorithm from a 'Gcov' code coverage file generated by running the algorithm with a scene of MSG-SEVIRI data from 0600 UTC on 1/29/2012. The green line show a non-executable line of code; the blue line shows an executable line of code and the number of times (9003969) it was executed; and the red line shows an executable line of code that was not executed.

Development of Independent Assessment Tool (IAT) at NOAA/NESDIS/STAR/JCSDA

Deyong Xu, V. Krishna Kumar, and Sid Boukabara
RTi @ NOAA/NESDIS/STAR/JCSDA

The third Symposium on the Joint Center for Satellite Data Assimilation

- **Development of Independent Assessment Tool (IAT) at NOAA/NESDIS/STAR/JCSDA**
  - Integrate multiple existing validation tools into one place (IAT) and migrate them to various system such as ZEUS.
  - Standardize the configuration of each IAT package, including I/O, utilities, compiler, etc. to facilitate the usage of IAT packages.
  - Develop Java GUI to run these IAT packages to relieve the burden of setting these IAT packages from researchers.



Issues in Developing and Validating Satellite Land Surface Temperature Product

Yunyue Yu, Ivan Csiszar, NOAA/NESDIS/STAR
Yuling Liu, Peng yu, Zhuo Wang, UMD/ESSIC/CICS

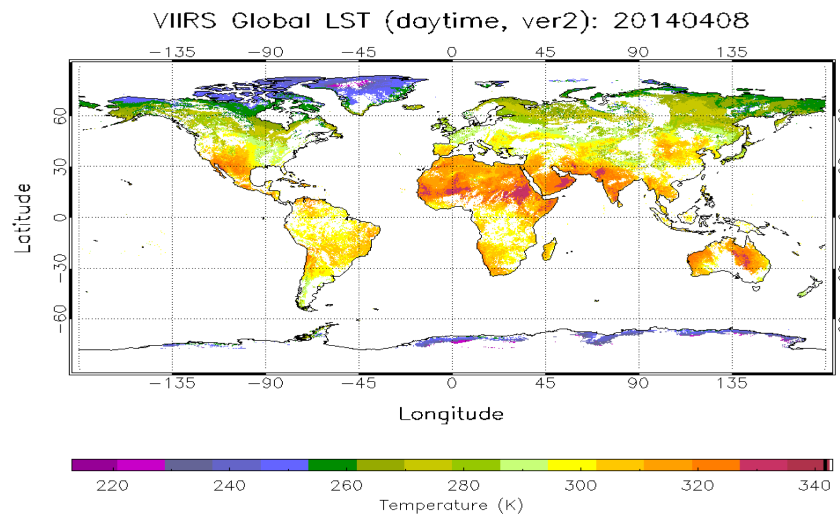
Presentation in the American Meteorological Society's 11th Annual Symposium on New Generation Operational Environmental Satellite Systems

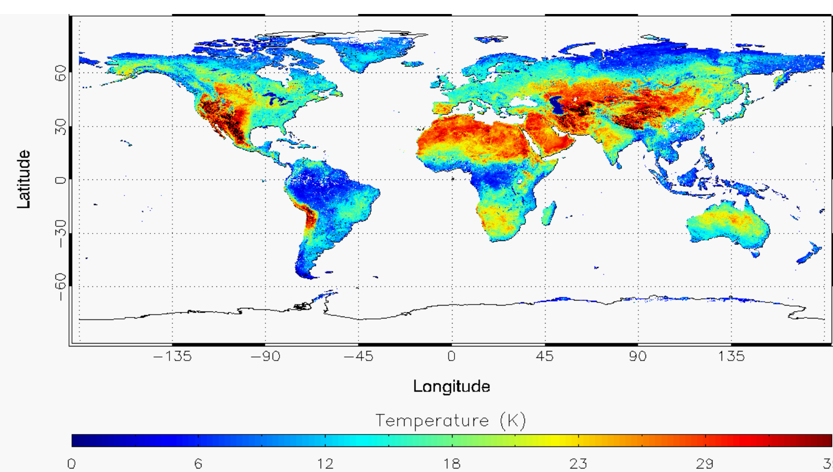
Issues in LST Algorithm Development

- Emissivity sensitivity
- Spatial heterogeneity
- Temporal variation
- Atmospheric difference
- Cloud contamination

Issues in LST Product Validation

– In-situ validation
  - Spatial heterogeneity: spot-pixel difference
  - Temporal variation: time match restriction
  - In-situ LST estimation: data quality, emissivity issue
– Cross-satellite comparison
  - Data gridding: aggregation process
  - Time match
  - BRDF impact





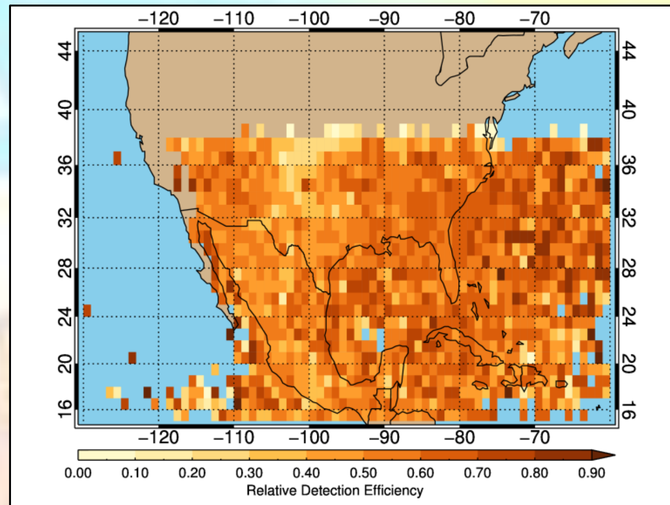
CICS-MD

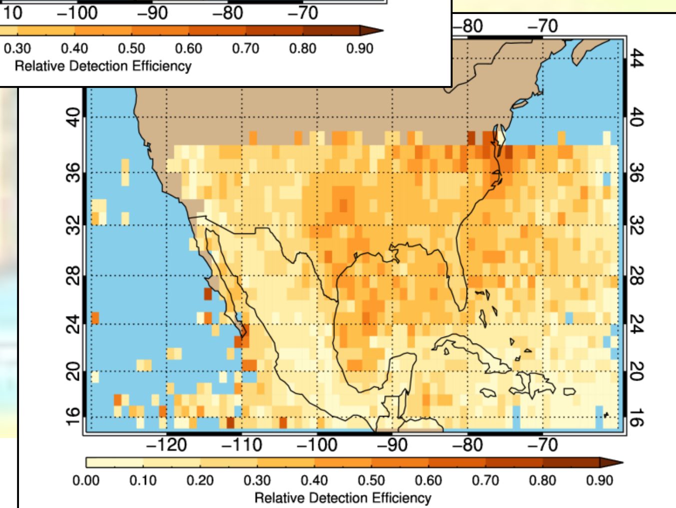
- Bitzer, Phillip
- Casey, Sean
- Chen, Yong (2)
- Folmer, Michael
- Kenney, Melissa (2)
- Liu, Yuling
- Lukens, Katherine
- Moradi, Isaac
- O'Brien, Katherine
- Wang, Likun
- Yang, Wenze
- Yoo, Hyelim

Determination of Detection Efficiency of Lightning Detection Systems using Bayesian Analysis

Phillip Bitzer, Jeff Burchfield, Hugh Christian U. of Alabama in Huntsville

- LIS detects 53% of ENTLN lightning discharges
  - uniform in space and time
- ENTLN detects 6% of LIS lightning discharges globally
  - 27% near North America
- Of all lightning discharges in North America in 2013, LIS detects 81%, ENTLN 41%
- Space based instruments to detect lightning outperform ground based instruments



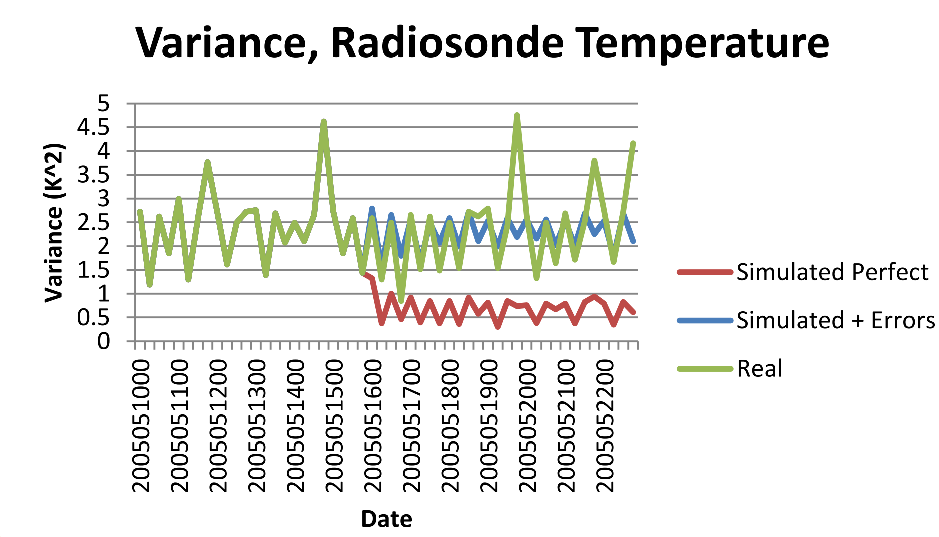


Initial Validation of a New OSSE Capability

Sean PF Casey[1,2,3], Hongli Wang[4,5], Robert Atlas[6], Ross N Hoffman[7], Sid-Ahmed Boukabara[2,3], Yuanfu Xie[5], Zoltan Toth[5], and John S Woollen[2,8]
[1]CICS-MD [2]JCSDA [3]NOAA/NESDIS/STAR [4]CIRA-CSU [5]NOAA/ESRL [6]NOAA/AOML [7]AER [8]NOAA/NCEP/EMC

19th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface

- New GEOS-5 7-km Nature Run (G5NR) different enough from GDAS/GFS to allow for OSSE experiments to be run
  - Lower RMSE noted for mid-range forecasts compared to real observations
  - AC scores similar between real, simulated atmosphere
- New simulated observations with added errors more closely resemble real observations
  - Transition between OSE, OSSE shows non-significant variance differences between real, simulated observations (right)
  - Work ongoing to add reasonable variances to all assimilated observations



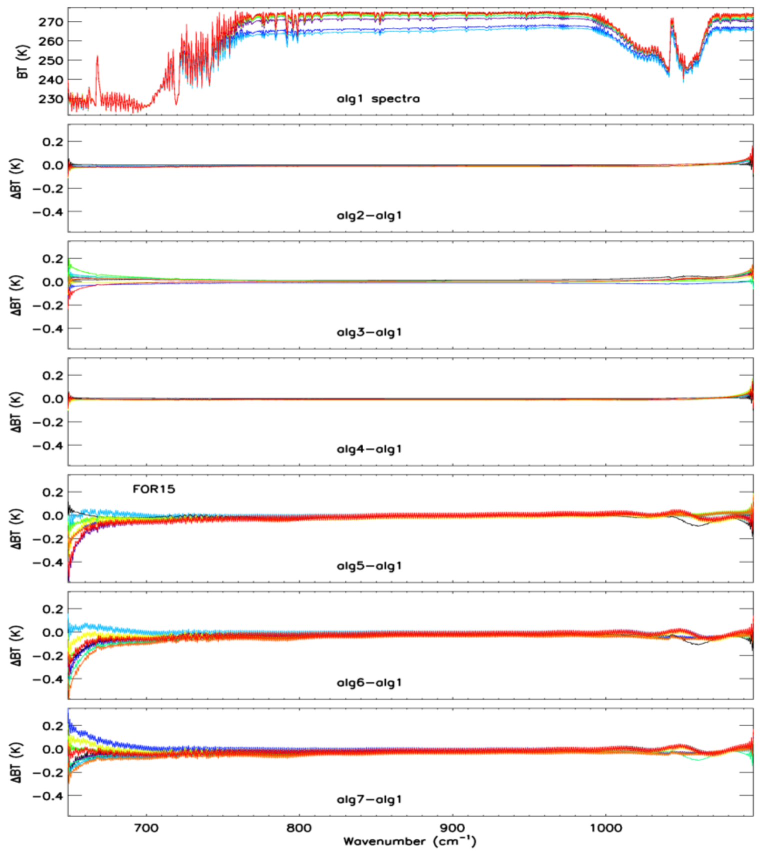
Comparison of Different Calibration Approaches in S-NPP CrIS Full Spectral Resolution Processing

Yong Chen[1], Yong Han[2], Likun Wang[1] , Denis Tremblay[3], Xin Jin[4], Xiaozhen Xiong[4], and Fuzhong Weng[2]
[1]CICS/ESSIC [2]NOAA/NESDIS/STAR [3]Science Data Processing Inc. [4]ERT

- We have implemented different calibration approaches in the CrIS full resolution SDR code in order to study the ringing effect observed in CrIS unapodized spectra and to support to select the best calibration algorithm for J1

- Preliminary results show significant ringing artifacts among different calibration approaches and their order in the calibration process

- The CrIS SDR Science team has been working to improve SDR calibration algorithm to reduce ringing artifacts, and we will implement and test the improved calibration algorithms for J1

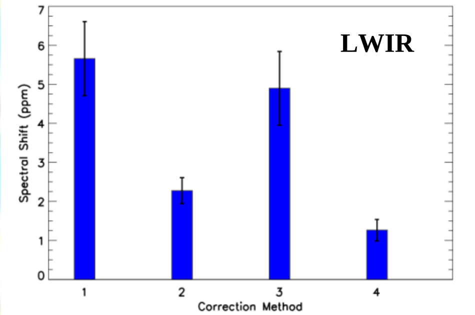


Envelope of Ringing among different Algorithm

Assessment of Hyper-Spectral Infrared Sensors CrIS and IASI Spectral Accuracy Using Community Radiative Transfer Model

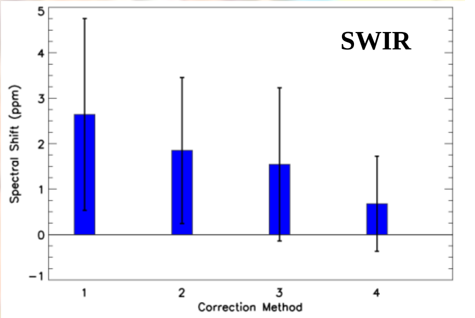
Yong Chen[1], Yong Han[2], and Fuzhong Weng[2]
[1]CICS/ESSIC [2]NOAA/NESDIS/STAR

- In this study, CRTM is used to systematically evaluate the spectral accuracy of CrIS and IASI at different spectral ranges for all three bands
- Based on these results, the best spectral ranges are 710-760 cm^{-1}, 1340-1390 cm^{-1}, and 2310-2370 cm^{-1} for CrIS three bands, respectively
- Results show that increasing the simulated spectral resolution (for example CRTM simulated IASI spectra) then convert to back to the original resolution (IASI2CrIS) can improve the absolute spectral shift uncertainty for CrIS

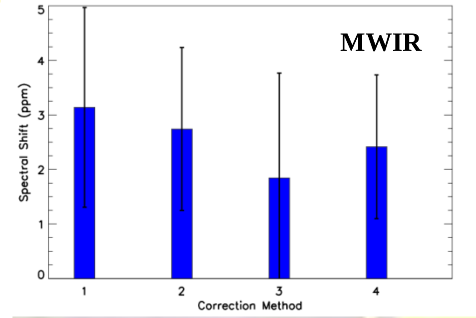


Frequency used: 710-760 cm^{-1}

Correlation Method	
CrIS_apod	1
CrIS_unapod	2
IASI2CrIS_apod	3
IASI2CrIS_unapod	4



Frequency used: 1340-1390 cm^{-1}



Frequency used: 2310-2370 cm^{-1}

Spectral shift between CRTM and Obs. for CrIS full resolution SDR at nadir FOV5

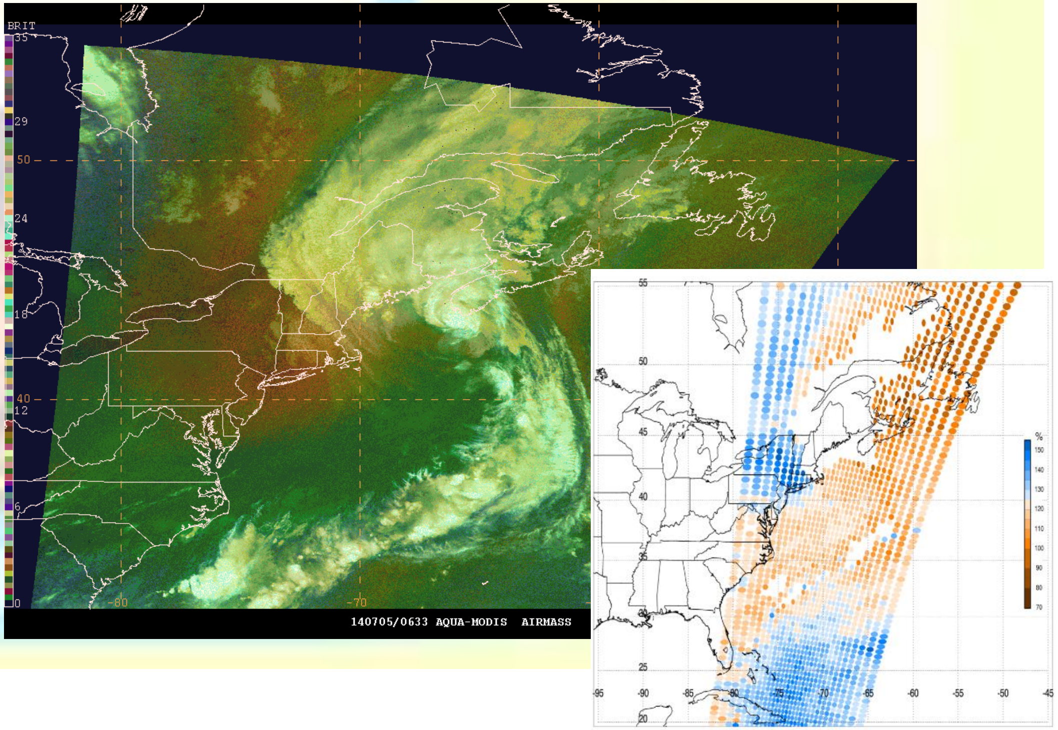
The 'Unusual' Evolution of Hurricane Arthur 2014:

A GOES-R and JPSS Satellite Proving Ground Perspective

Michael J. Folmer (UMD/ESSIC/CICS), John Cangialosi (NHC), Jeffrey Halverson (UMBC), Emily Berndt (SPoRT), Steven Goodman (GOES-R), and Mitch Goldberg (JPSS)

11th Annual Symposium on New Generation Operational Environmental Satellite Systems: Satellite Testbeds and Proving Ground Activities

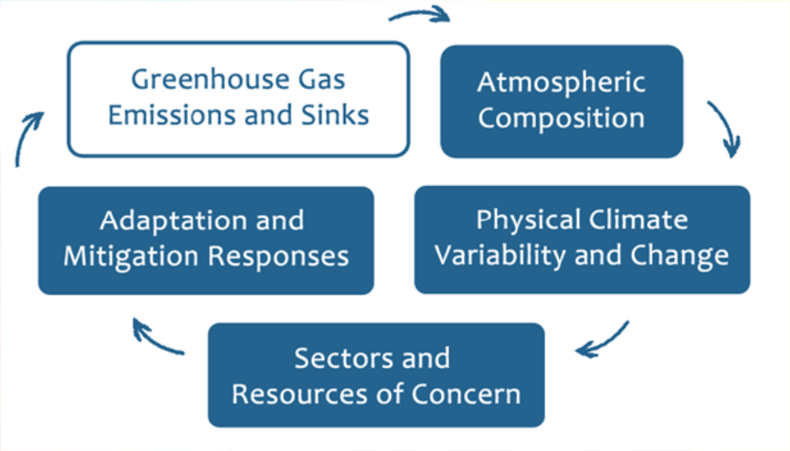
- Multiple GOES-R/JPSS products were available to forecasters to assist in diagnosing the complex evolution of Arthur.
- The RGB Air Mass coupled with the Ozone products revealed the stratospheric intrusion leading to the extratropical transition.



Indicators for the National Climate Assessment (Invited)

Melissa A. Kenney, Ph.D., University of Maryland, Earth System Science Interdisciplinary Center and Cooperative Institute for Climate and Satellites-MD, USGCRP National Climate Indicator System

- A system of physical, ecological, and societal indicators that communicate key aspects of the climate changes, impacts, vulnerabilities, and preparedness
  - Provide meaningful, authoritative climate-relevant measures about the status, rates, and trends of key physical, ecological, and societal variables and values
  - Inform decisions at multiple scales
  - Identify climate-related conditions and impacts
  - Provide analytical tools by which user communities can derive their own indicators for particular purposes

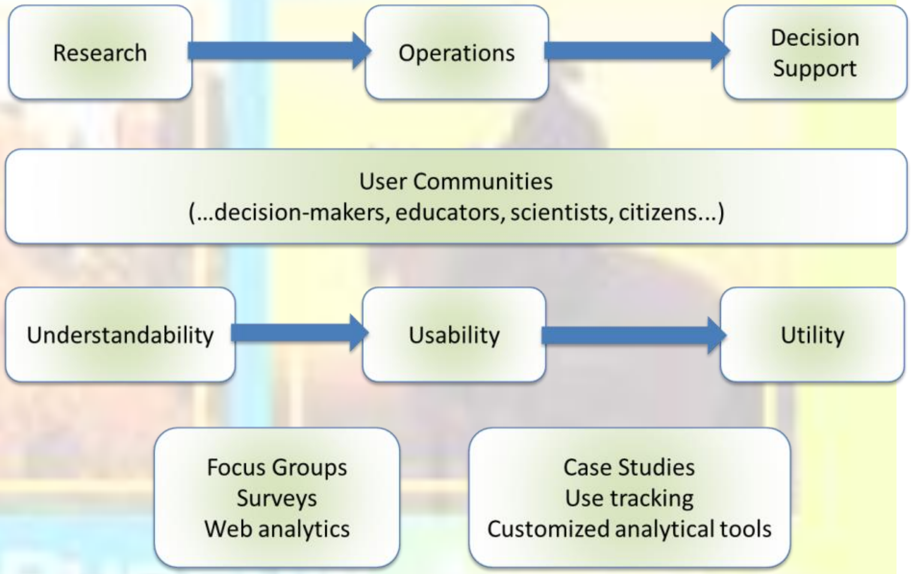


Categories of Indicators: Framework for the National Climate Assessment Indicator System

National Climate Indicators System: Utility of Information of Indicators

Melissa A. Kenney, Ph.D., University of Maryland, Earth System Science Interdisciplinary Center and Cooperative Institute for Climate and Satellites-MD, USGCRP National Climate Indicator System
Ella Clarke, University of Maryland, USGCRP National Climate Indicator System

- Pilot Indicators
  - Indicators that are already developed, scientifically vetted, and proven to be useful
- Iterative user-focused design and development with a variety of user communities in mind
  - Scientific assessments of understandability and usability (e.g. through surveys and focus groups)
  - Scientific assessments of utility (at a later point in the process, e.g. through case studies and evaluation of customized analytical tools developed by users)



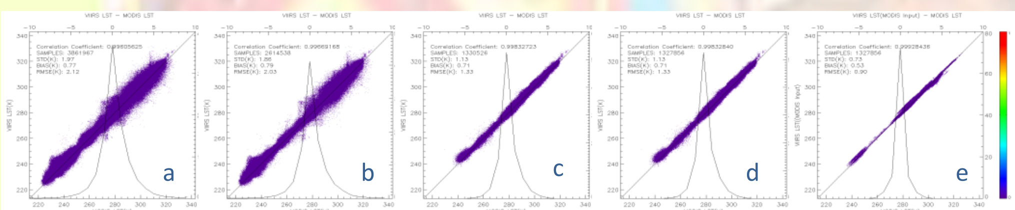
Concerns on cross comparison of satellite land surface temperature retrievals, a case study between VIIRS and MODIS LST product

Yuling Liu[12], Yunyue Yu[2], Peng Yu[12], Zhuo Wang[12]

[1]CICS, University of Maryland, College Park; [2] STAR/NESDIS/NOAA

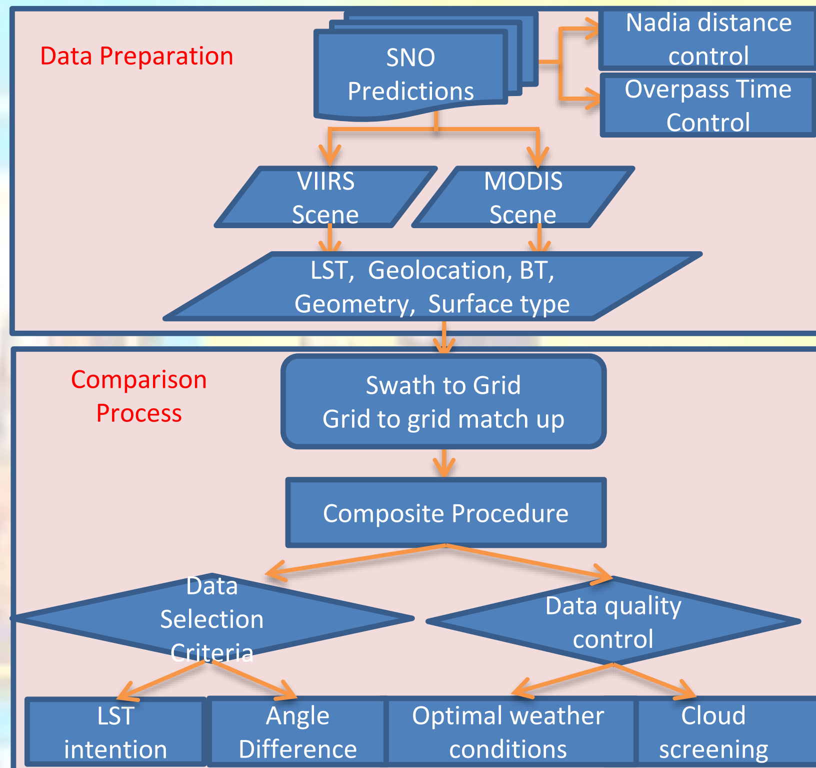
The cross-comparison of LST products from different satellites or sensors is widely used to evaluate one LST product with reference to the other, particularly between heritage satellite products. As the VIIRS LST is expected to replace MODIS LST in the future, the inter-comparison between VIIRS LST and MODIS LST will provide the evaluation of VIIRS LST performance with respect to difference characterization, i.e. spatial pattern, systematic error budget, which may reflect the algorithm difference, limitations or errors. Cautions need to be taken in the whole chain of cross-comparisons, i.e. data selection for comparison, data processing procedures and results analysis. This study will focus on cautions regarding temporal differences, composite process, and angular differences. Some comparison cases are discussed and a guideline is provided for each of them in the cross satellite LST comparison.

- **Cross Comparison at granule Level**

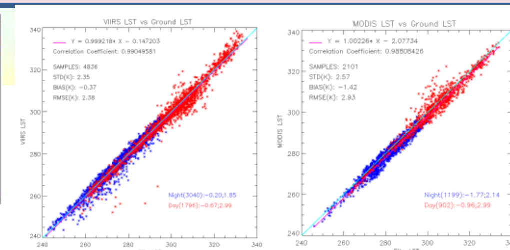


Comparison results from Simultaneous Nadir Overpass (SNO) between VIIRS and AQUA in 2012, 2013 and early 2014 over US, polar and low latitude areas. The matchups are quality controlled using the quality flags in each product.
a) all comparison results under cloud clear condition ; b) based on a, the satellite zenith angle difference between VIIRS and MODIS is constrained within 10 degrees; c) based on a, spatial variation tests are added ; d) based on c, angle difference is added ; e) based on d, VIIRS LST is calculated using MODIS data as input and then compare to MODIS LST

Cross Satellite Comparison Flow Chart



SURFRAD data in US



On the Relation Between North American Winter Precipitation and Storm Tracks

Katherine E. Lukens* and E. Hugo Berbery*
ESSIC/CICS-MD
*University of Maryland, College Park, MD

27th Conference on Climate Variability and Change

- The track density (Fig. 2) from the Lagrangian method highlights the Northern Hemisphere winter storm tracks with greater detail than the traditional Eulerian method (Fig. 1).
  - The Lagrangian track density captures the extensions into the lower latitudes of the Mediterranean and Pacific storm tracks.
- Applying low-level vorticity to the Lagrangian approach allows for storms to be identified earlier in their life cycles.
  - Storm genesis regions are typically small in scale, and only the vorticity field exposes these regions.
  - The Lagrangian genesis density (Fig. 3) highlights regions of cyclogenesis.
- Regressions of the Lagrangian vorticity on surface precipitation (Fig. 4) reveal detailed small-scale features, contrasting regressions using Eulerian variables.

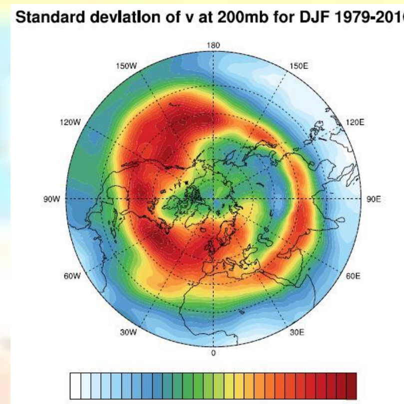


Fig. 1: Eulerian storm track patterns represented as standard deviations of meridional wind at 200 hPa in units of m/s.

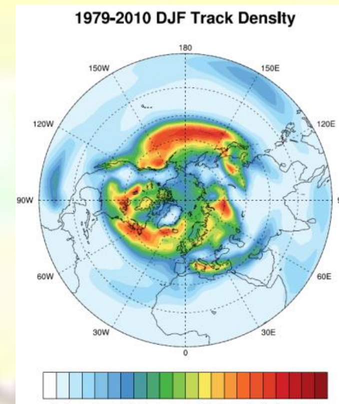


Fig. 2: Lagrangian statistical representations of storm tracks from single estimation points for each track.

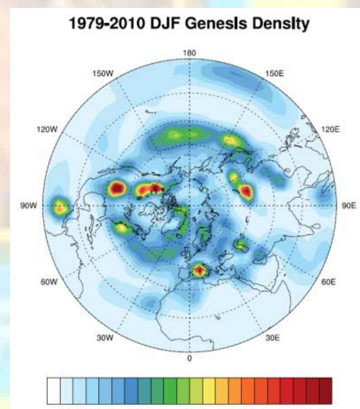


Fig. 3: Lagrangian statistical representations of cyclogenesis from the starting points of each track.

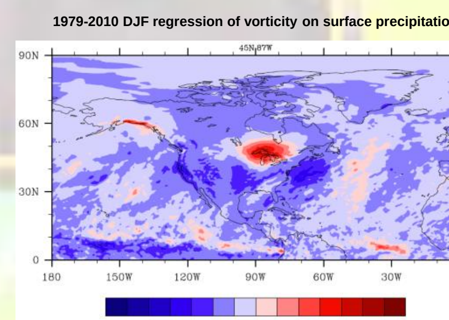
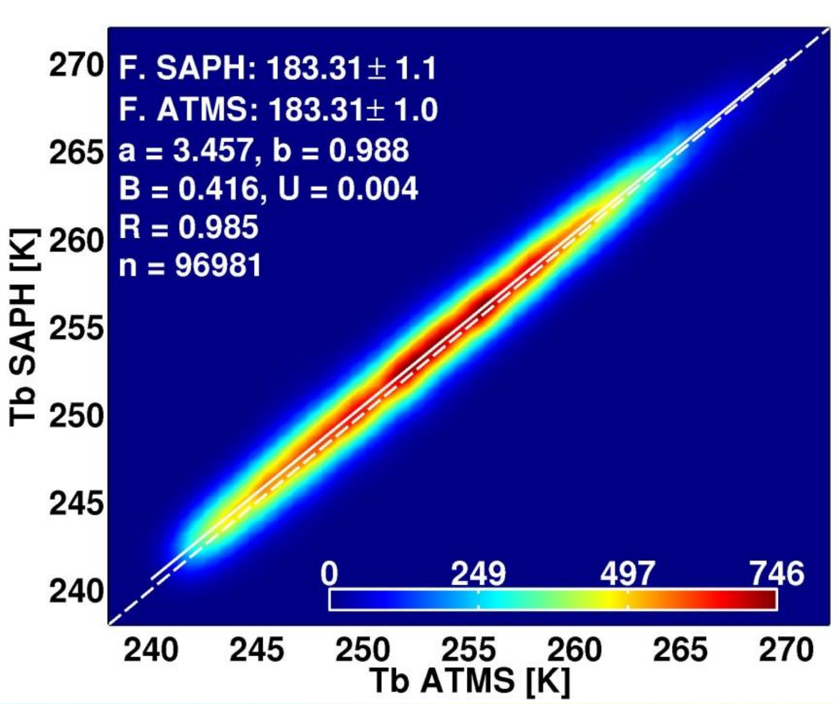


Fig. 4: Regression of Lagrangian filtered vorticity on surface precipitation on lag 0 with a base point of 45°N, 87°W.

Inter-calibration and validation of observations from ATMS and SAPHIR microwave sounders
Isaac Moradi (JCSDA/UMD) and Ralph Ferrao (STAR) – Isaac Moradi (CICS-MD/UMD/JCSDA), Ralph Ferraro (NOAA)

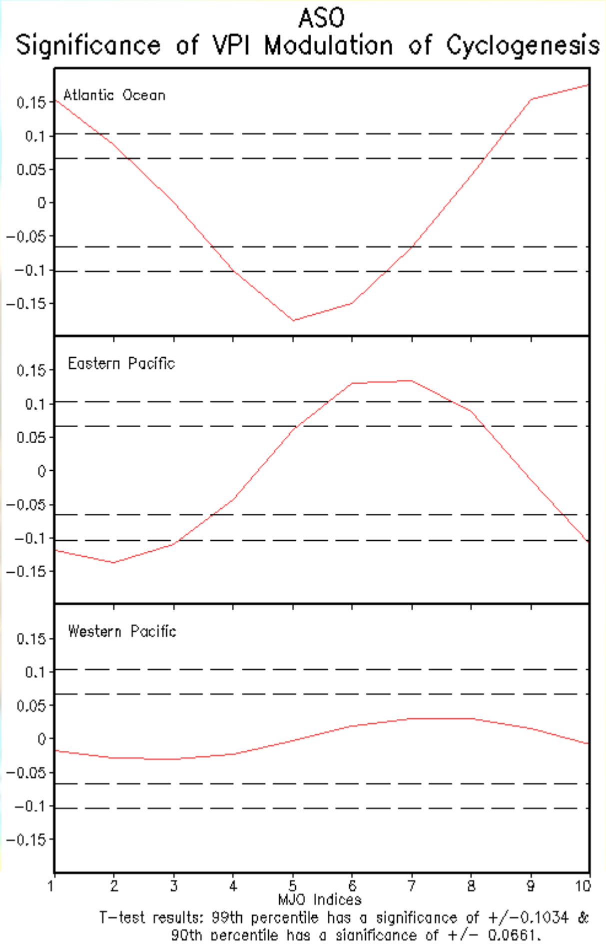
- SAPHIR and ATMS water vapor channels very consistent
- The difference between sonde simulated and observed Tb's were less than 1 K after taking into account sonde biases
- ATMS sounding channels show only a small difference versus GPS-RO simulated Tb's



Toward Using the CPC's MJO Index for Tropical Cyclone Prediction

By: Katherine O'Brien and Crystal Oudit, Advisor: Stephen Baxter, CPC
Climate Prediction Center/CICS-MD

- The CPC derived an MJO index (with 10 indices) using velocity potential.
- Using this index, we noted that the MJO can modulate cyclogenesis in the
  - Atlantic and Eastern Pacific
  - But, NO significance determined for the Western Pacific.
- Results were analyzed further by looking at wind shear and sea level pressure anomalies in each index of the MJO.



Inter-Comparison of Suomi NPP CrIS Radiances with AIRS and IASI toward Infrared Hyperspectral Benchmark Radiance Measurements

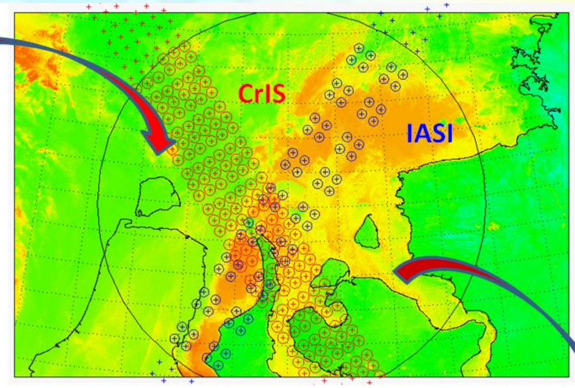
Likun Wang, Yong Han, Xin Jin, Yong Chen, and Denis A. Tremblay

Poster for 20th Conference on Satellite Meteorology and Oceanography

- **Radiometric and spectral consistency of four IR hyperspectral sounders is fundamental for inter-calibration and climate application.**
- **Inter-comparison of CrIS with IASI/Metop-A, IASI/Metop-B, and AIRS have been made for one year's of SNO observations in 2013.**
- **CrIS vs. IASI**
  - **IASI spectra are converted into CrIS spectral grid and the comparison is along CrIS spectral grid.**
  - **CrIS and IASI well agree each other at LWIR and MWIR bands with 0.1-0.2K differences**
- **CrIS vs. AIRS**
  - **CrIS and AIRS are integrated within 25 spectral regions.**
  - **CrIS and AIRS agree each other at LWIR and MWIR bands with the differences of 0.1-0.2 K .**
  - **At SWIR band, the differences is less than 0.3K.**

From Changyong Cao

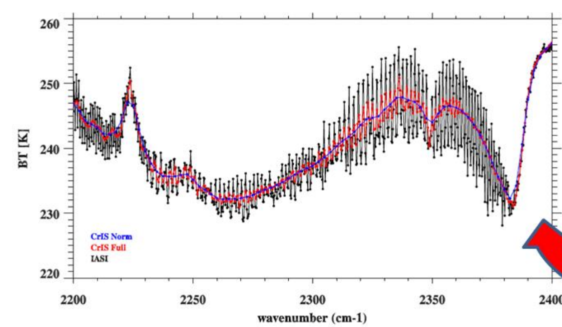
CrIS: Afternoon orbit
IASI : Morning orbit

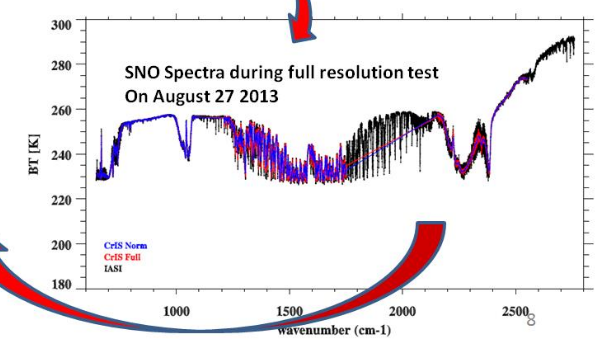


Time Difference: <= 120 Sec

FOV distance difference: <=(12+14)/4.0 km = 6.5 km

Angle Difference: ABS(cos(a1)/cos(a2)-1) <= 0.01



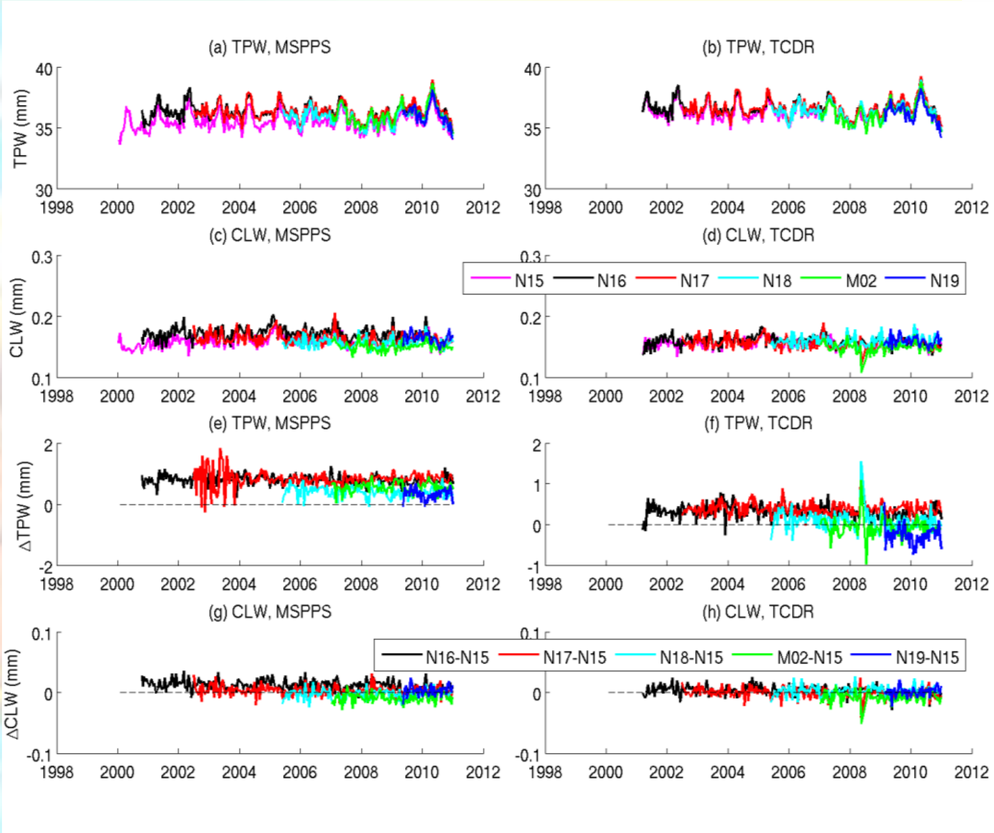


Wang, L, Y, Han, X. Jin, Y. Chen, and D. A. Tremblay, 2014: Inter-Comparison of Suomi NPP CrIS Radiances with AIRS and IASI toward Infrared Hyperspectral Benchmark Radiance Measurements, *Journal of Atmospheric and Oceanic Technology (submitted).*

An Improved Microwave Satellite Data Set for Hydrological and Climate Applications

Wenze Yang (CICS-MD), Huan Meng and Ralph Ferraro (NOAA/NESDIS)

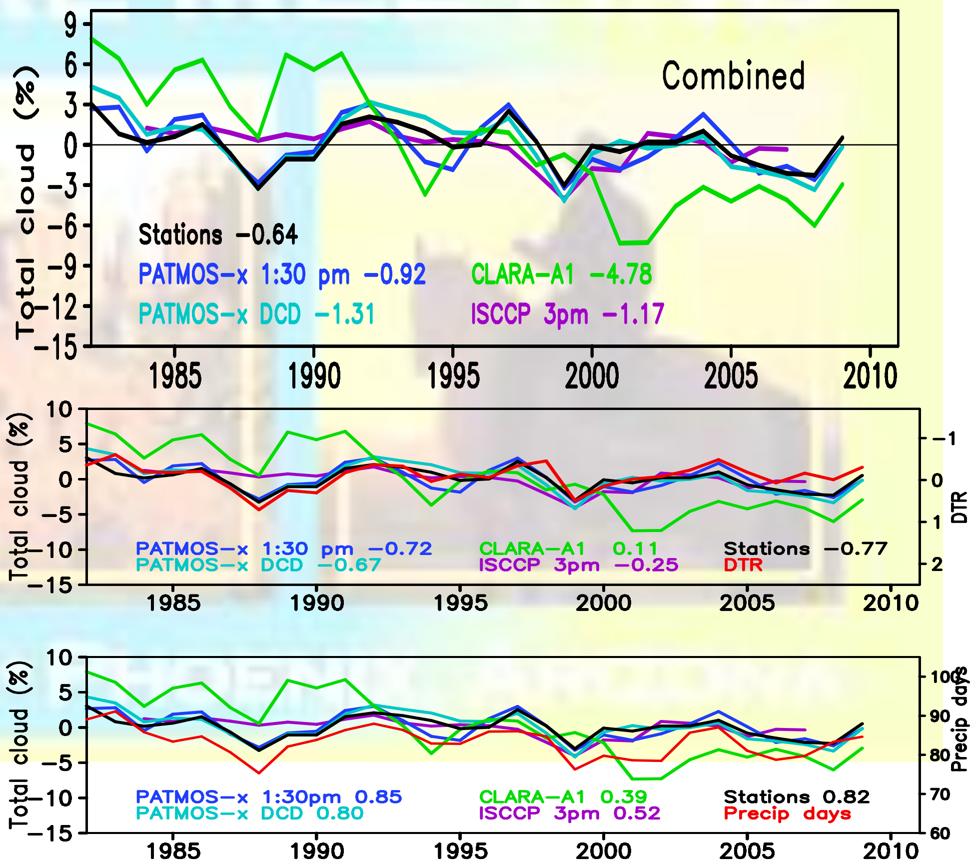
- CDR's for AMSU window channels and hydrological products are vital for the climate community
- Our accomplishments to date include
  - Completed AMSU geolocation
  - Completed AMSU-A scan bias corrections and intersatellite calibration
  - Developed β-FCDR for AMSU-A window channels, which include aforementioned corrections
  - Developed β-TCDR for AMSU-A data sets



Long-term cloud cover trends over the U.S. from ground-based data and satellite products

Hye Lim Yoo[12], Melissa Free[1], Bomin Sun[34]
[1] NOAA Air Resources Laboratory, College Park, MD
[2] Cooperative Institute for Climate and Satellites, University of Maryland, College Park, MD, USA
[3] NOAA/NESDIS/Center for Satellite Applications and Research
[4] I. M. Systems Group Inc., Rockville, MD, USA

- Improvement of surface data
  - Homogeneity-adjusted weather observations reduce trends in US total cloud cover than those in original dataset and increases the agreement between the cloud cover time series and those of physically related climate variables such as DTR and precipitation days.
- Comparison with satellite products
  - Trends for 1984-2007 are all negative in both adjusted-station and satellite products but satellite products are more negative than those from station data.
  - **Overall we find good agreement between inter-annual variability in most of the satellite data and that in our station data, with PATMOS -x products showing the best match and less well with ISCCP.**



CIMSS

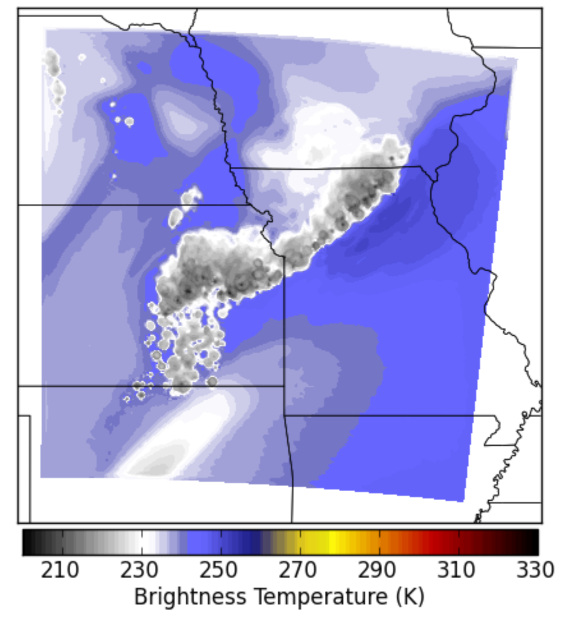
- Cintineo, R.
- Feltz, Michelle
- Gerth, Jordan J.
- Knuteson, Robert
- Letterly, Aaron
- Li, Jinlong
- Li, Jun
- Li, Zhenglong
- Lim, Agnes
- Lindstrom, Scott S.
- Menzel, W. P.
- Mooney, Margaret
- Otkin, Jason
- Strabala, Kathleen I.
- Straka III, William
- Terborg, Amanda M.
- Tobin, David C.
- Walther, Andi
- Wang, Pei
- Wanzong, Steve

Assimilation of GOES-R ABI satellite and WSR-88D radar observations during a convection-resolving Observing System Simulation Experiment

R. Cintineo[1], J. Otkin[1], T. Jones[2], S. Koch[3], L. Wicker[3], and D. Stensrud[4]
[1]UW-CIMSS, [2]OU-CIMMS, [3]NSSL, [4]Penn State Univ.

19th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS)

- Better results from radar reflectivity and radial velocity assimilation than GOES-R ABI assimilation in idealized experiments
  - GOES-R ABI overproduces cloud cover, possibly due to problems with idealized truth simulation
- Ongoing real data experiments producing better results than idealized experiments
  - GOES-R ABI assimilation improves analysis over no assimilation
  - Radar assimilation results still more accurate

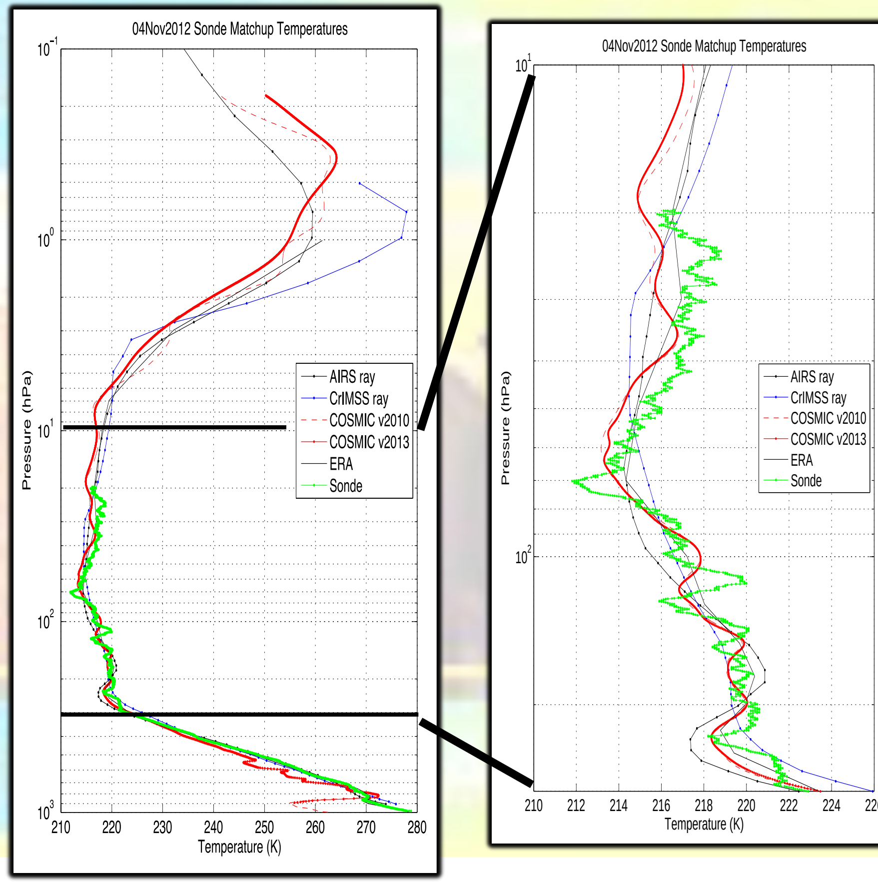


Synthetic GOES-R ABI 6.19 µm observations from the truth simulation

Assessment of Vertical Resolution's Effect in the Intercomparison of Temperature Profiles from Hyperspectral Infrared Sounders and GPS Radio Occultation

Michelle Feltz, Robert Knuteson, and Steve Ackerman
University of Wisconsin-Madison Cooperative Institute for Meteorological Satellite Studies

- Raypath validation method published
  - Sounder AVTP vs GPRO dry temp.
  - Feltz et al. (2014) JGR
  - Example shows four way coincident validation at Madison, WI between AIRS, CrIS, COSMIC, and radiosonde.
- Sounder Inter-comparison
  - AIRS/CrIMSS/IASI Soundings are inter-compared using COSMIC as a common reference.
  - Published in Feltz et al. (2014) AMT
  - Discovered bias errors in COSMIC data leading to UCAR reprocessing (from COSMIC v2010 to v2013).



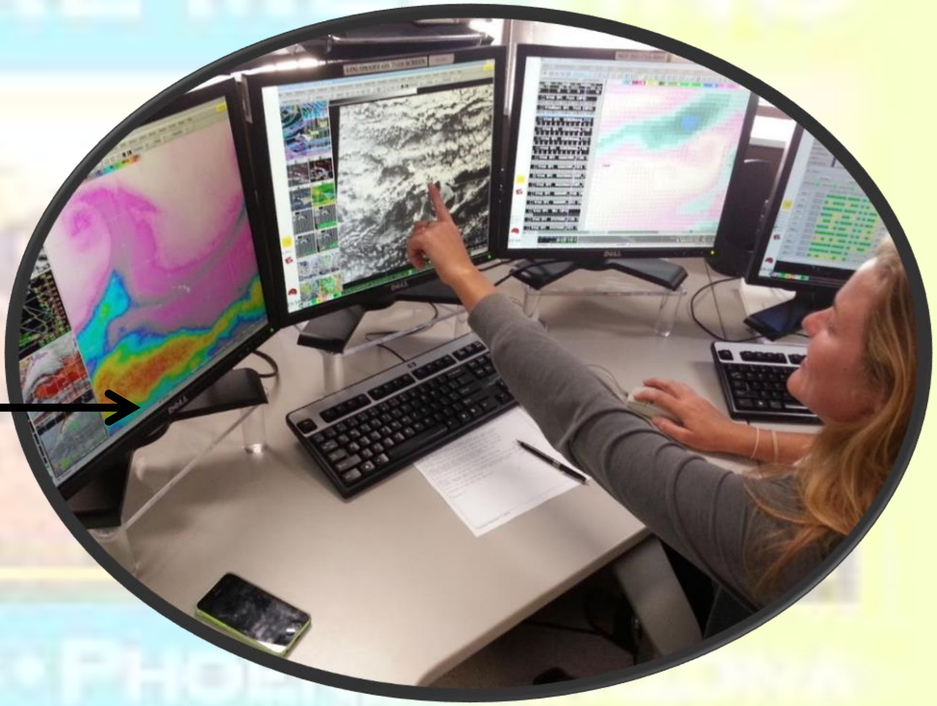
R2-Whoa

Challenges and solutions for executing best practices in transferring NOAA's research to NWS operations

***Jordan J. Gerth**, CIMSS/Univ. of Wisconsin, Madison, WI*

Fifth Conference on Transition of Research to Operations

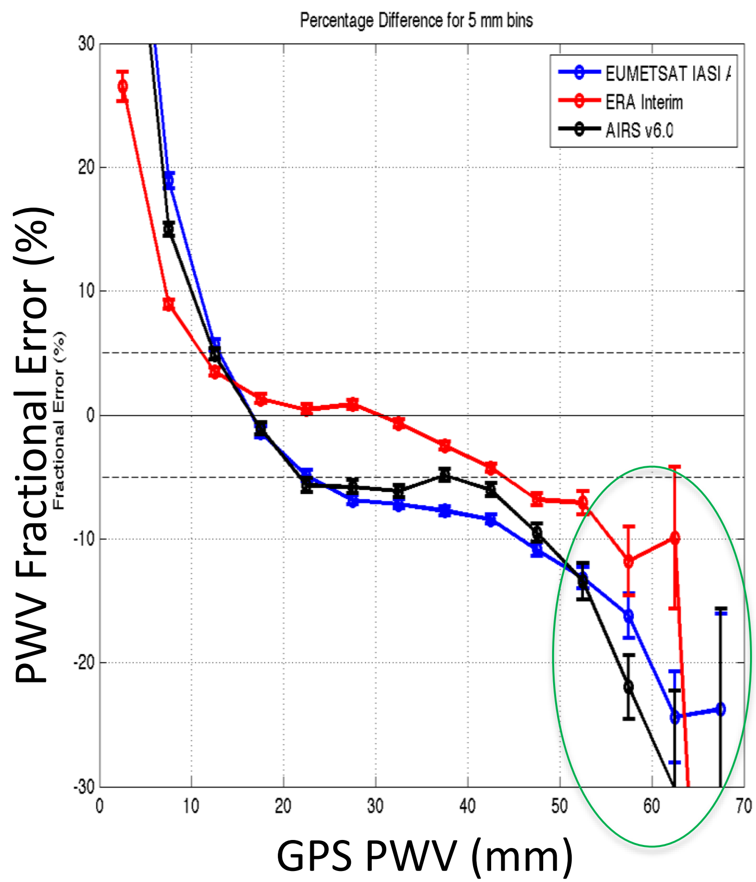
- **Oversight and Strategic Direction**
  - **Appoint a coordinator of activities**
  - **Joint governance**
- **Operational Demonstrations**
  - **Employ satellite liaisons to work with operations**
  - **Hire technical liaisons to develop plug-ins for the Advanced Weather Interactive Processing System (AWIPS)**
- **Research Proposals**
  - **Hold technical interchange meetings with both operational and research participants**
  - **Use proxy and simulated imagery from existing instruments and/or numerical models**



Validation of Level 2 Temperature and Water Vapor Profiles from JPSS and EUMETSAT Operational Polar Satellites using DOE ARM, SuomiNet, and COSMIC Datasets

Robert Knuteson, Michelle Feltz, Jacola Roman, Steve Ackerman, Hank Revercomb, Dave Tobin, Lori Borg, Dan DeSlover, Thomas August*, Tim Hultberg*, Tony Reale+
Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin-Madison, * EUMETSAT, +NOAA

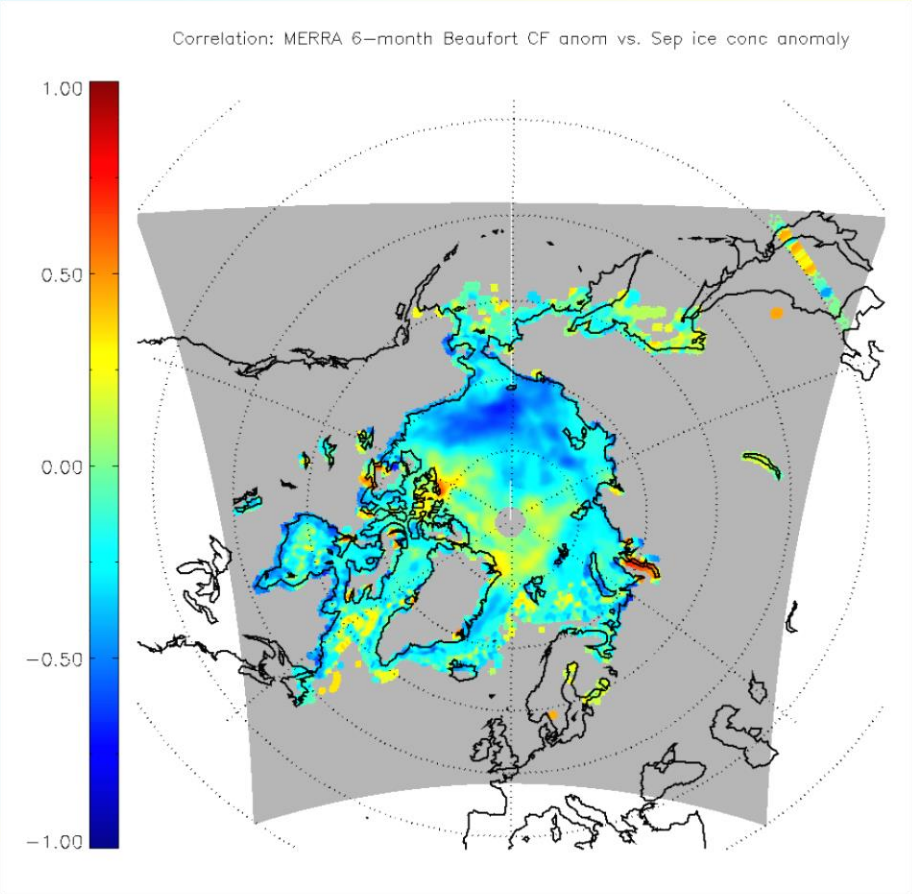
- Sounder Water Vapor Validation
  - ARM site and SuomiNet sites
  - Period 2007 – 2014 (seven years)
  - Product dry bias (-5 to -10 %)
  - Products miss extreme wet events
- Requirement for Climate
  - Detection of Mean PWV trends within 15 years requires better than 3% accuracy as published in Roman et al. (2014), J.Climate.
  - Detection of shift in extreme PWV events requires better than 3% accuracy. (Roman et al, J. Climate, submitted)



Wintertime Cloud Cover on Arctic Sea Ice Variability, Aaron Letterly, UW-Madison CIMSS

27th Conference on Climate Variability and Change

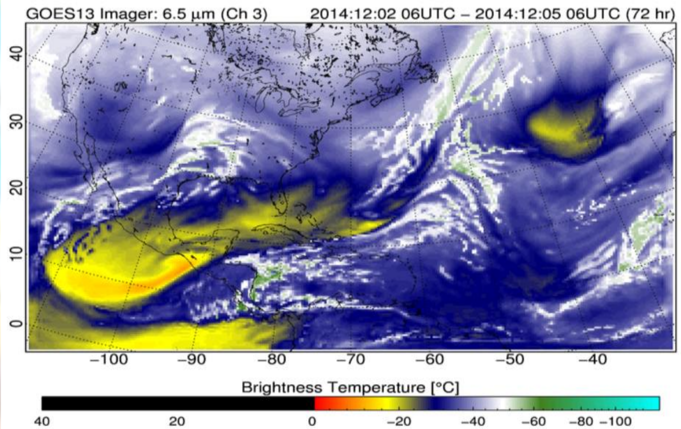
- Winter cloud forcing varies inversely with summer ice concentration
  - Marginal ice areas show high dependency on clouds to refreeze each year
- Cloud forcing over Beaufort Sea serves as indicator for much of Arctic sea ice loss
  - Beaufort Gyre advects ice anomalies from one region to another



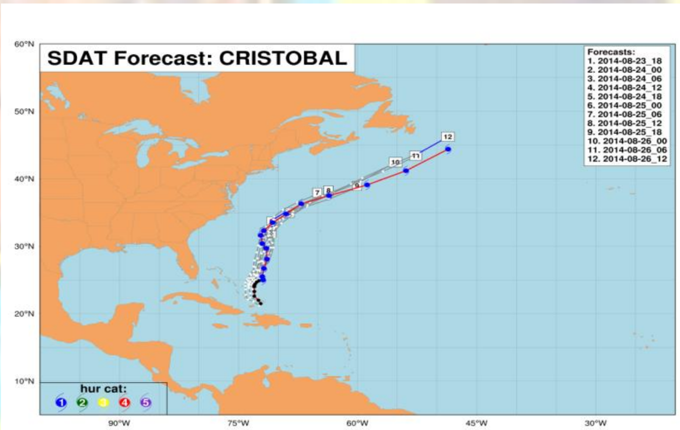
A near real time regional satellite data assimilation system for high impact weather research and application

Jinlong Li@, Jun Li@, Pei Wang@, HyoJin Han@, Tim Schmit&, Mitch Goldberg#, and Steven Goodman*
@CIMSS, &SaTellite Applications and Research (STAR), #JPSS Program Office, *GOES-R Program Office

- A near realtime satellite data assimilation for tropical cyclone (SDAT) system has been developed at CIMSS.
- Researches have been conducted on GOES/GOES-R data impacts, handling clouds for advanced IR sounder radiance assimilation, assimilation strategies, etc.
- The system has been running in near realtime since August 2013. The preliminary validations are encouraging.
- Through joint effort among CIMSS, CIRA and NHC, the CIMSS SDAT products have been delivered since September 2014 in near real-time to the Automated Tropical Cyclone Forecast (ATCF) system that NHC are using now.



Example of simulated 72-hour forecast of GOES 6.5 µm BT image from SDAT webpage.

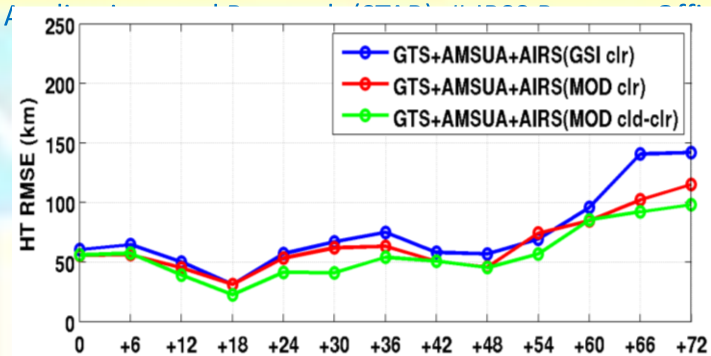


Hurricane Cristobal (2015) forecasts from SDAT system along with observed best track (red line).

Assimilation of thermodynamic information in cloudy regions from advanced IR sounder for tropical cyclone forecasts

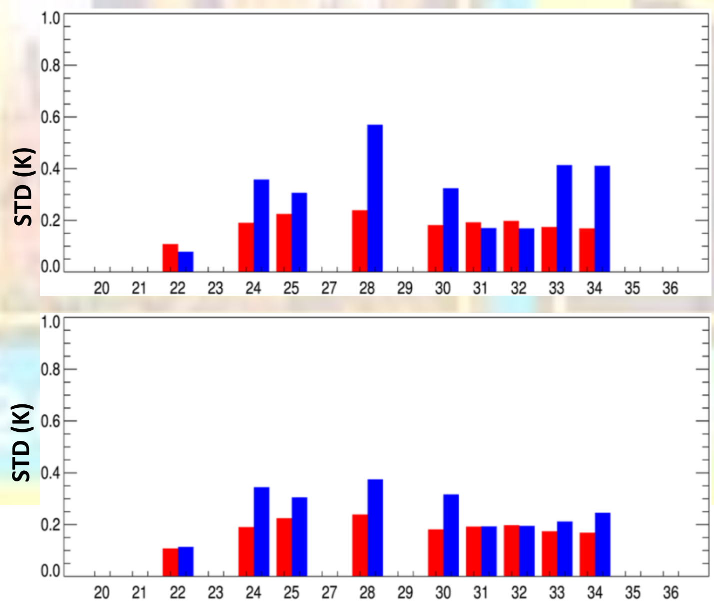
Jun Li@, Mitch Goldberg#, Pei Wang@, Hyo-Jin Han@, Tim Schmit&, Agnes Lim@, Zhenglong Li@, and Jinlong Li@
@CIMSS, &SaTellite A... e

- Combing imager/sounder could improve assimilation of thermodynamic information in cloudy region
  - Imager/IR sounder cloud-clearing is a feasible alterative approach for assimilating thermodynamic information in partially cloudy skies
- At least one H2O (6.7 um) and one CO2 (13.4 um) absorption bands for future VIIRS are needed in order to have high quality CrIS/VIIRS cloud-cleared radiances (CCR) for assimilation



The RMSE of the hurricane track from AIRS (MOD cld-clr) is the smallest among the three experiments for the whole process, especially after the 18-hour forecasts:

(1) AIRS (GSI clr), AIRS radiances from GSI clear detection
(2) AIRS (MOD clr), AIRS raddiances from MODIS clear detection
(3) AIRS (MOD cld-clr), AIRS radiances from MODIS clear detection plus cloud-cleared radiances



The standard deviation (STD) of AIRS cloud-cleared radiances with MODIS 9 bands (red) , MODIS IR window bands only (blue in middle panel, VIIRS like), and MODIS IR window bands plus 1 CO2 and 1 H2O absorption bands (VIIRS like + 1 CO2 + 1 H2O) , compared with MODIS clear radiance observations at 9 spectral bands for Hurricane Sandy (2012) case..

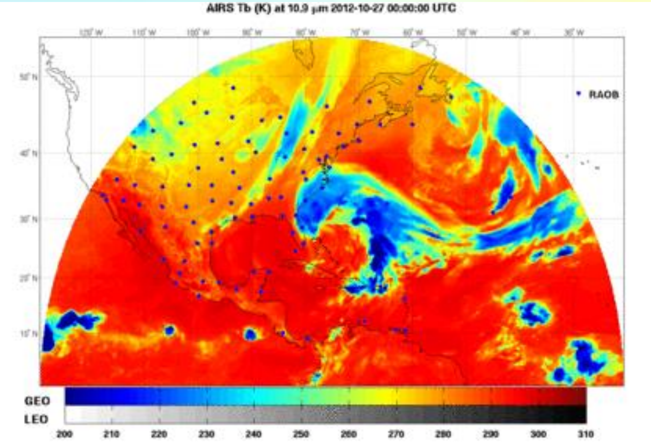
Applications of future GEO advanced IR sounder for high impact weather forecasting – demonstration with regional OSSE

Zhenglong Li[@], Jun Li[@], Feng Zhu[@*], Pei Wang[@*], Agnes Lim[@], Tim Schmit[&], Robert Atlas[#], Ross Hoffman[#]

@CIMSS/SSEC, University of Wisconsin-Madison, * AOS, University of Wisconsin-Madison, &Center for Satellite Applications and Research, NESDIS, NOAA, Madison, %AOML, OAR/NOAA

- Synthetic GEO AIRS observations simulated and validated from ECMWF T1279 NR and G5NR
  - ECMWF T1279
    - Large scale features are reasonably simulated, even for 108-h forecast
    - Small scale features are less reasonable, especially small convective clouds over Amazon River.
    - Ice clouds are too cold
  - G5NR
    - Impact from initialization is not evident after 1 month. May consider free atmosphere.
    - Too many clouds, both high and low clouds; coverage too large
    - Individual convective cells are not well characterized, shape looks artificial
    - Cloud edges are too cold
- Preliminary results show improved impact from GEO AIRS over LEO AIRS on Hurricane Sandy track forecasts
- Positive impacts from
  - Cycling
  - Hyperspectral sounder over current GOES sounder
  - Doubling observational error (retrieval)

Synthetic observations from ECMWF T1279

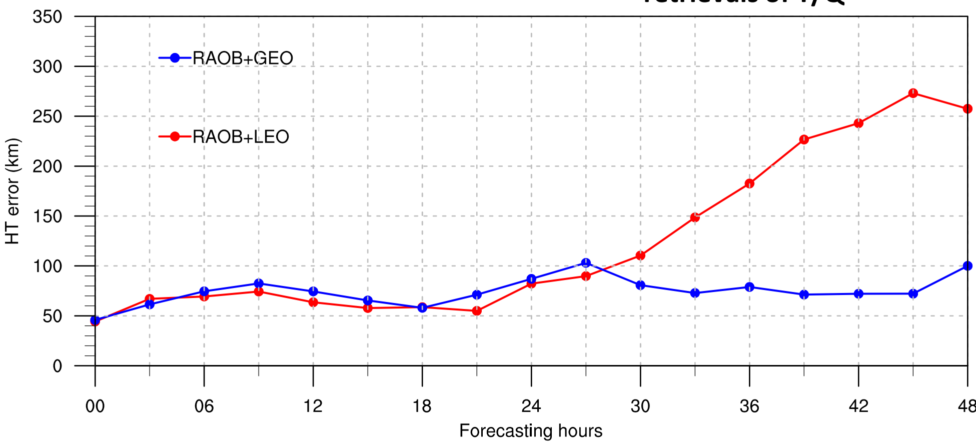


GEO AIRS has more usable observations
- Better coverage
- Better refresh rate

UWRTM: SARTA + cloudy model

RAOB: vertical correlative errors considered

Assimilate sounding retrievals of T/Q



Impact Analysis of LEO Hyperspectral Sensor IFOV size on the next generation NWP model forecast performance

Agnes Lim[1], James Jung[1], Allen Huang[1], Zhenglong Li[1], Jack Woollen[2], Greg Quinn[1], Fred Nagle[1], Jason Otkin[1] and Mitch Goldberg[3]

1. Cooperative Institute for Meteorological Satellite Studies
2. IMSG/NOAA/NCEP/EMC
3. NOAA/JPSS Program Science Office Joint Polar Satellite System National Oceanic and Atmospheric Administration

- 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 – surface observations, rawinsondes, aircraft and GPSRO
- Satellite radiances from current observing system
  - Flying satellites in the simulated atmosphere
  - Orbit simulator developed - Generate sensor geometry use in radiance simulation for any given set of start and end time. See Figure 1 for comparison between real and simulation.
- OSSE Progress in Figure 2

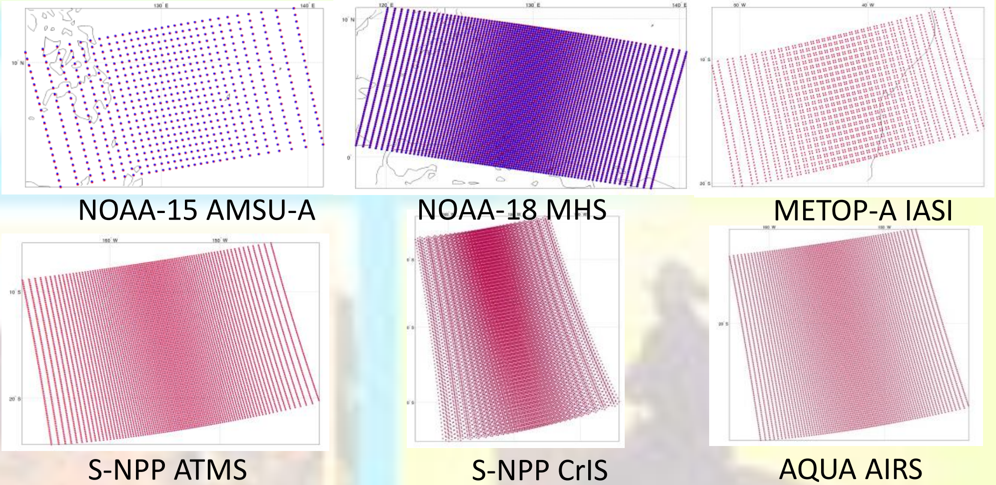


Figure 1 Comparison of Simulated satellite orbits (red) and real satellite orbits (blue) valid for the same start and end time

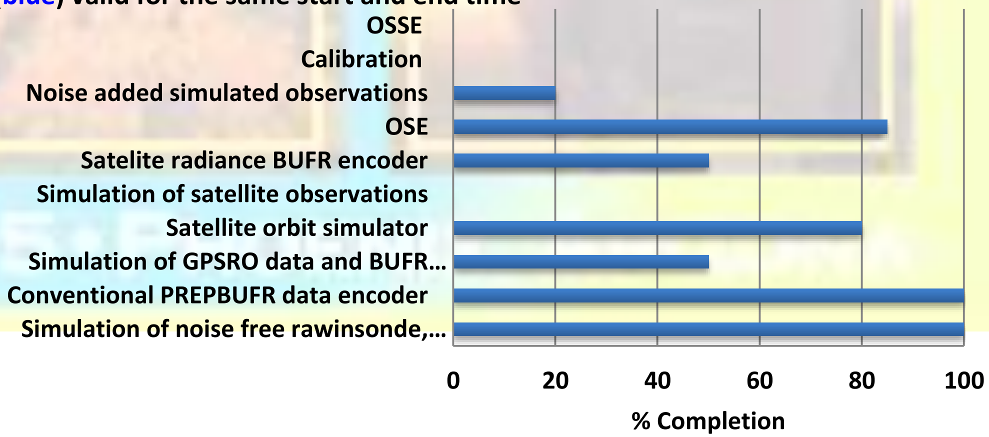
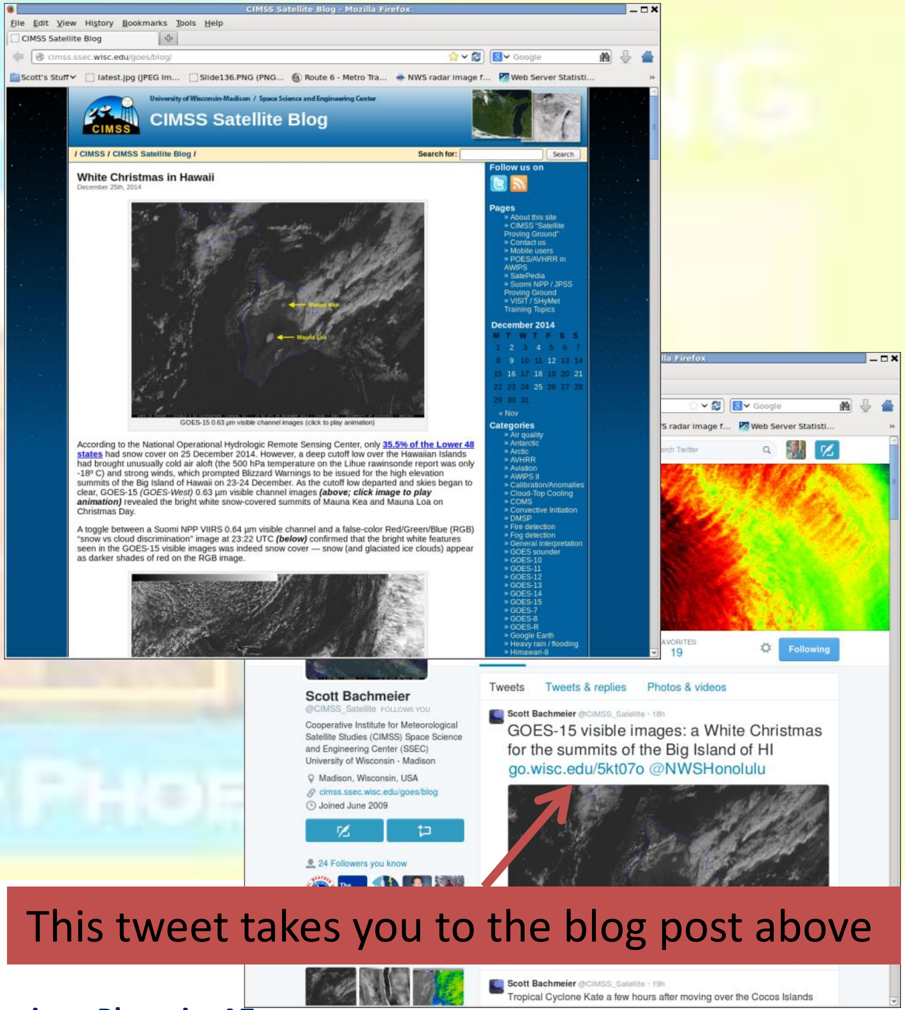


Figure 2 OSSE Progress

The use of Blogs, Twitter and YouTube for outreach at CIMSS

Scott S. Lindstrom and A. Scott Bachmeier

- Blogging aligns with CIMSS' goal of outreach/education
  - Demonstrate the utility of satellite data in understanding the atmosphere
  - Demonstrate the utility of CIMSS-produced Satellite products
- Blogging and Tweeting are complementary
  - Tweet about the presence of a new blog post
  - Tweet if there's not enough information for a full-blown blog post



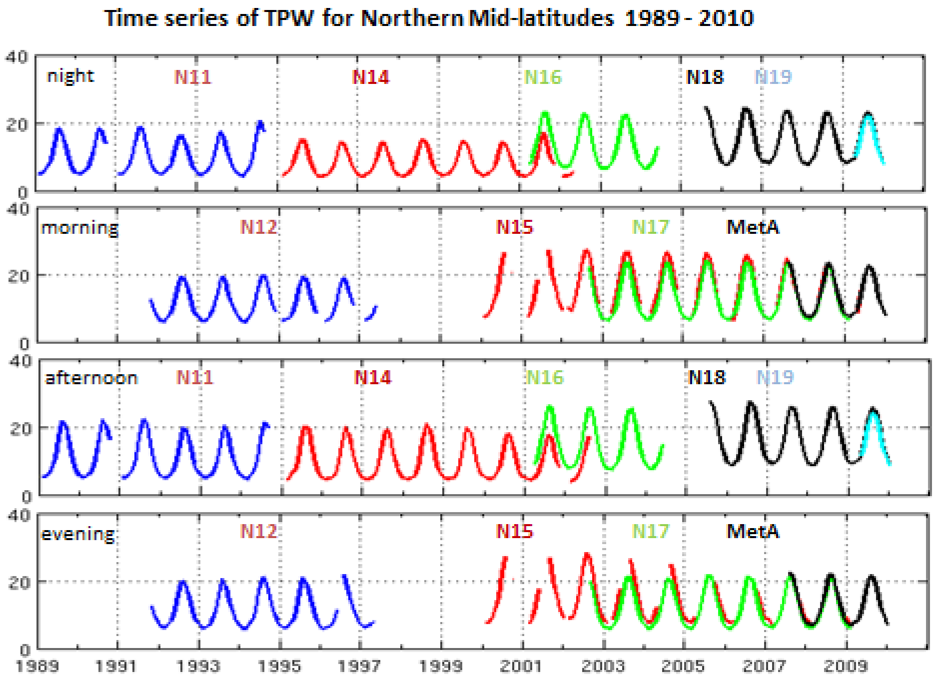
This tweet takes you to the blog post above

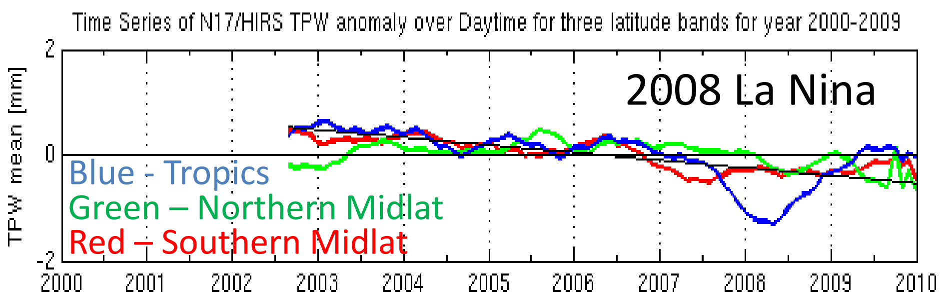
Recalibrating HIRS Sensors to Produce 30 years of Radiance Measurements Useful for Cloud and Moisture Trend Analysis

W. P. Menzel, E. Borbas , R. Frey, C. Cao, R. Chen, N. Bearson, and B. Baum

Session 1B: Satellite Climate Data Records and Applications I

- Recalibration
  - Recalibration using IASI and SNOs offers new opportunity for climate worthy record
- H2O Trends
  - Separation into day before & after noon and night before & after midnight mitigates effects of orbit drift on trends
  - Seasonal TPW cycle is strongest in northern mid-latitudes and weakest in tropics
  - La Nina decrease in tropical TPW evident in all sensor trends





GOES-R Education Proving Ground

Margaret Mooney, *CIMSS/Univ. of Wisconsin, Madison, WI*; and T. J. Schmit and S. Ackerman

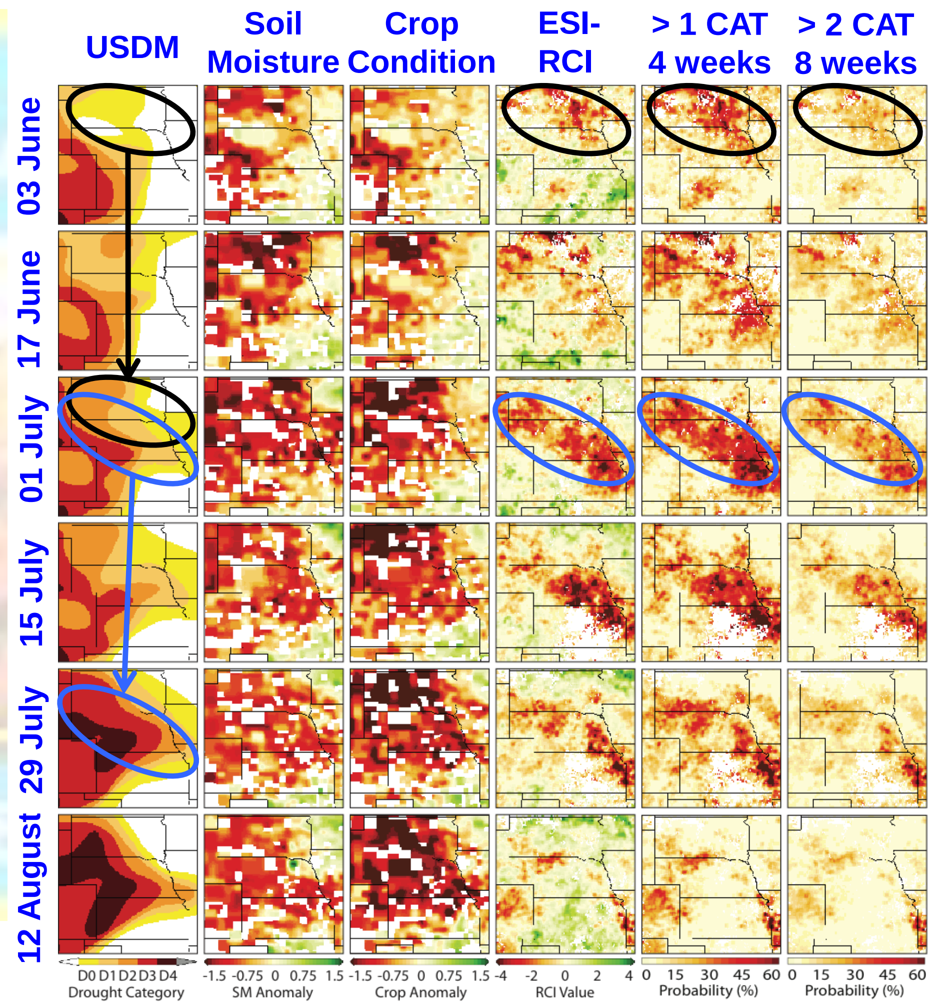
- GOES-R Education Proving Oral Presentation (M. Mooney)
  - https://ams.confex.com/ams/95Annual/webprogram/Paper267662.htmlSub result 2
- SOS video
  - Debuted at AMS 2015
  - Distributed to the entire SOS Network via CIMSS EarthNow Blog (OED grant) http://sphere.ssec.wisc.edu/goes-r/

New 90-second GOES-R video for Science On a Sphere (SOS) shown on NOAA SOS at AMS 2015

Temporal changes in drought indices used to provide early warning of drought development over sub-seasonal time scales

Jason Otkin (UW/CIMSS), Martha Anderson, Chris Hain, and Mark Svoboda

- Use GOES thermal infrared data and a land surface energy balance model to identify areas experiencing moisture stress conditions
- Use changes in the Evaporative Stress Index (ESI) to compute a Rapid Change Index (RCI)
- Compute probabilities of drought development over different time periods based on the RCI value
- Large RCI and probabilities across South Dakota on June 3rd -- drought spread into that region during June
- Elongated area of large drought probabilities on July 1st – drought intensified across the region during July

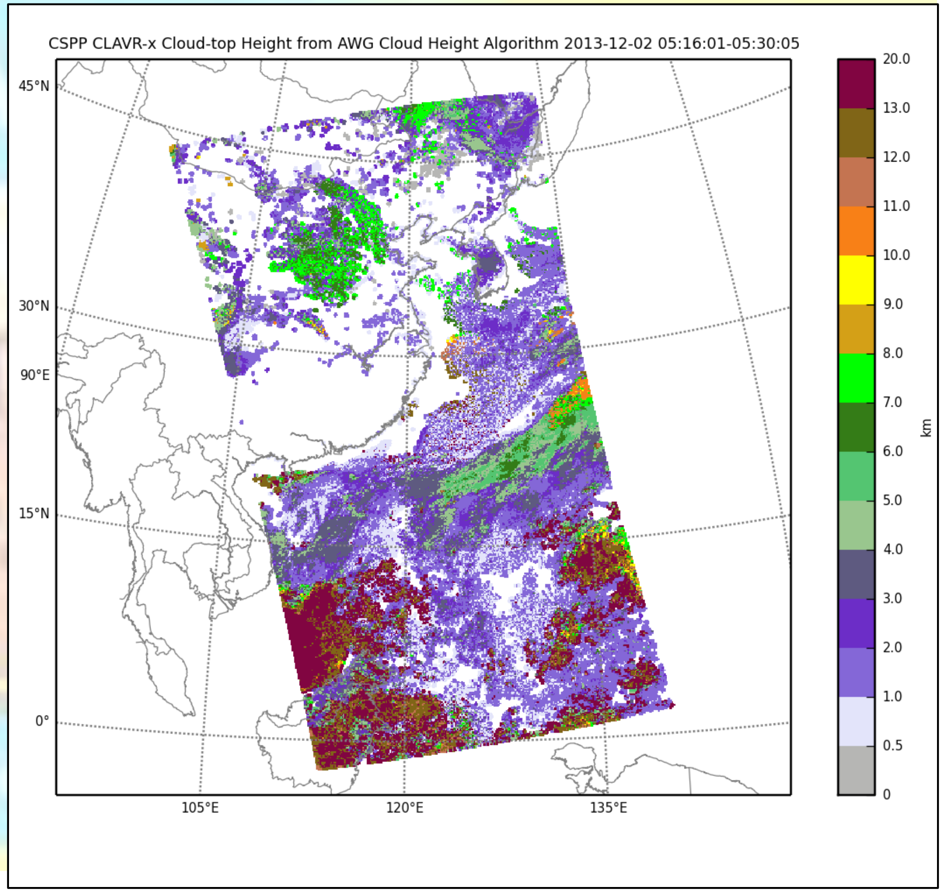


CSPP: Direct Broadcast Software for Operational Environmental Forecasters

Kathleen I. Strabala, CIMSS/SSEC/Univ. of Wisconsin, Madison, WI; and L. E. Gumley, H. L. Huang, D. Hoese, S. Mindock, G. Martin, R. Garcia, J. Gerth, E. Weisz, W. L. Smith Jr., N. Smith and Brad Pierce

AMS Session: Direct broadcast capabilities for polar-orbiting and geostationary satellites

- CSPP Software Facilitating the Use of Polar Orbiter Satellites
  - > 800 CSPP Registrants
  - Users on all 7 Continents
- Suomi-NPP DB data Supports Operational Forecasters
  - US NWS Forecasters
  - US Air Quality Forecasters



CLAVRx used at Taiwan Central Weather Bureau

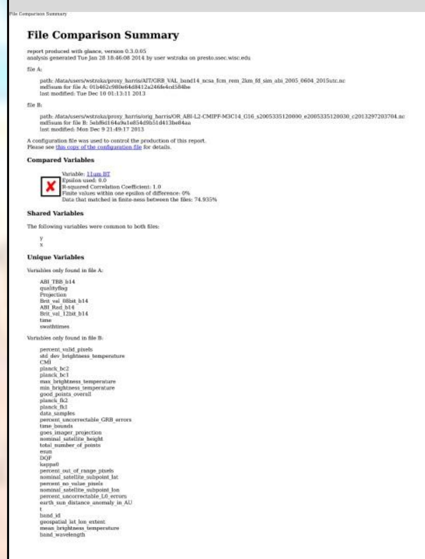
Routine Validation of the GOES-R Multi-Satellite Processing System Framework

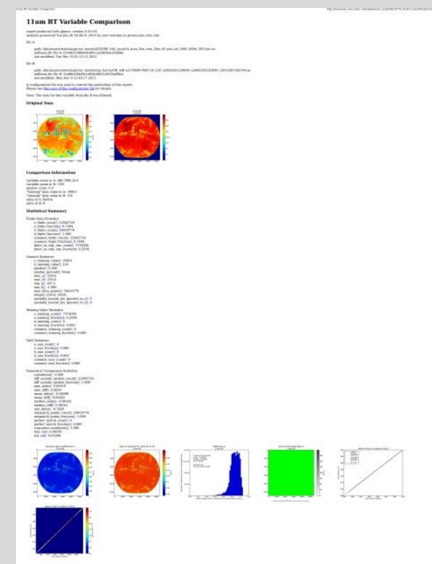
William Straka III[1], S. Sampson[3], R. Kuehn[1], G. Quinn[1], E. Schiffer[1], R. Garcia[1], G. Martin[1], R. Holz[1], T. Yu[3], A. Li[3], R. Rollins[3], W. Wolf[2] and J. Daniels[2]

[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 testing framwork
  - 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
- 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.

Example *Glance* output





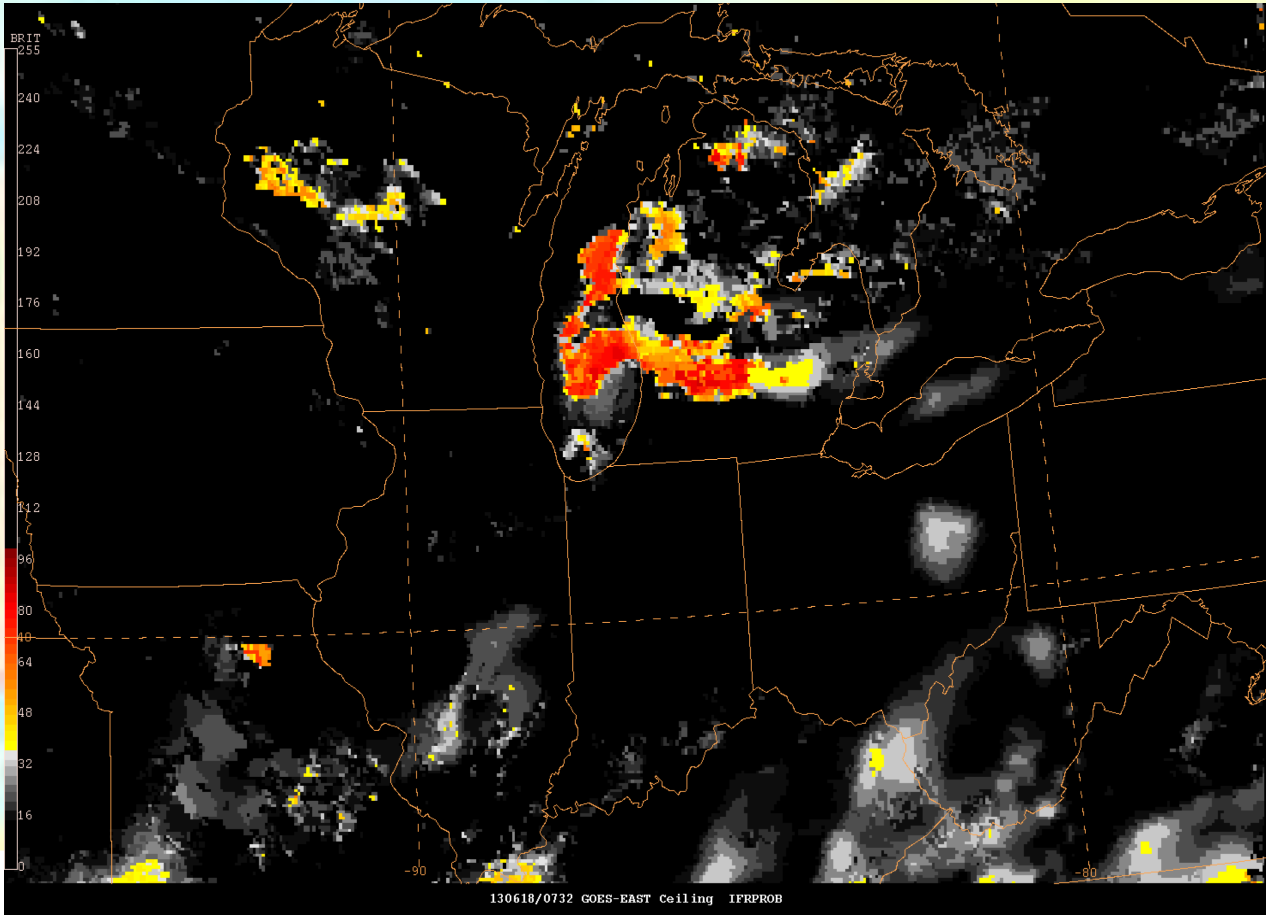
Links can be selected to provide a more detailed report of a given variable, along with the various statistics, such as how many missing pixels were in each file, the correlation between the two datasets, the mean/max/min difference, etc., as well as plots of the area of difference, a histogram of the distribution of the differences and plot of the differences

Advances and innovation in Aviation Forecasting: Using Next Generation Satellite Data at the Air Traffic Control Systems Command Center

Amanda M. Terborg, *CIMSS/Univ. of Wisconsin, Kansas City, MO*; and M. T. Eckert and B. A. Smith

17th Conference on Aviation, Range, and Aerospace Meteorology

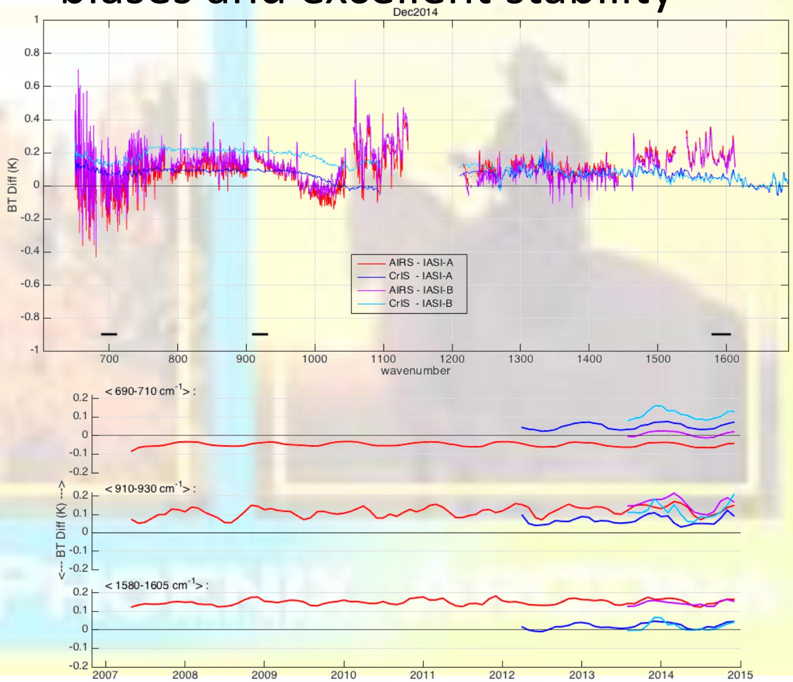
- National Aviation Meteorologists were posted to the FAA Command Center
  - Provide briefings directly to TFMs
  - Real-time TFM met watch responsibilities
- GOES-R products have been tested/utilized in their operations:
  - Fog and Low Stratus
  - NearCast model
  - CI and CTC
  - Simulated Imagery
  - ACHA cloud heights



Suomi-NPP Cross-track Infrared Sounder (CrIS): Radiometric Calibration and Validation, *David C. Tobin, H. Revercomb, R. Knuteson, J. Taylor, L. Borg, D. H. DeSlover, G. Martin, A. Merrelli, and T. Greenwald*, CIMSS/SSEC/UW-Madison

Joint session of the 11th Annual Symposium on New Generation Operational Environmental Satellite Systems and the 20th Conference on Satellite Meteorology and Oceanography

- Radiometric Calibration Uncertainty (RU) of CrIS is very good.
  - Overall, RU is <0.3K (LW), <0.15K (MW), <0.15K (SW)
  - Better than spec by approximately a factor of 4.
- Various post-launch validation analyses confirm these RU estimates
  - Clear sky obs-calc
  - Simultaneous Nadir Overpasses (SNOs)
  - Internal consistency analyses
- Example validation result: SNOs of AIRS, IASI and CrIS should small biases and excellent stability

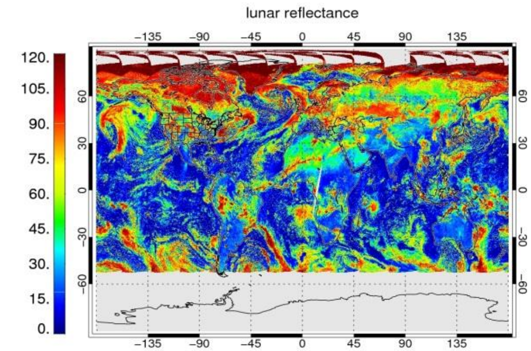


Nighttime Cloud Microphysical Products with the VIIRS DNB

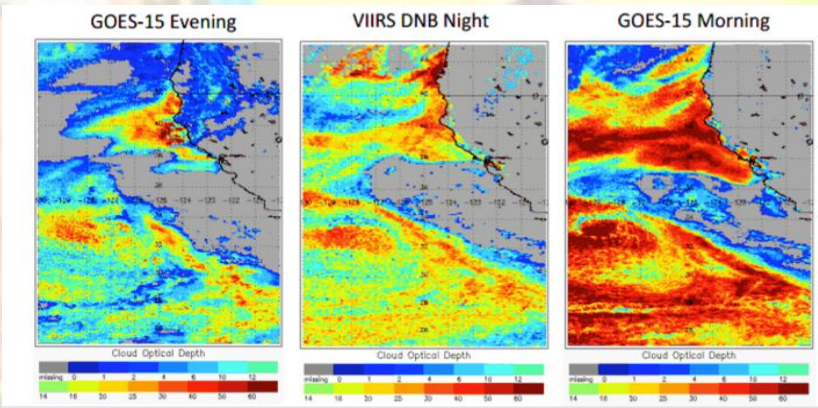
Andi Walther (CIMSS), Steven Miller (CIRA), Andrew Heidinger (NOAA)

HIGHLIGHTS

- Development of a lunar down-welling irradiance predictor which enables us to compute DNB lunar reflectance.
- Development of a new nighttime cloud property retrieval NLCOMP
- NLCOMP closes nighttime observation gap of cloud optical thickness (COD) and effective radius (REF)
- NLCOMP is part of CLAVR-x processing scheme.
- Can be used for derived nighttime products, such as precipitation or icing threat



Left: Global composite of lunar DNB reflectance

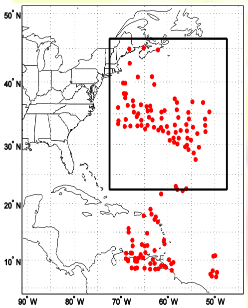


Close the nighttime gap: Left and right image show COD of daytime retrieval. Small inset the state-of-the-art nighttime IR result: no information of thick clouds due to saturation. Middle image shows NLCOMP COD at night.

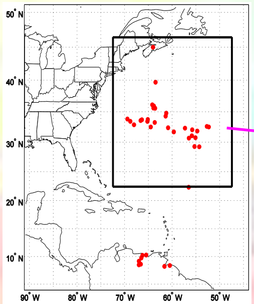
Improving assimilation of advanced IR sounder radiances in NWP with cloud detection from collocated imager cloud mask

Pei Wang[@#], Jun Li[@], Jinlong Li[@], Zhenglong Li[@], Tim Schmit[&], Hyo-Jin Han[@],
@CIMSS, &SaTellite Applications and Research (STAR), # AOS, UW-Madison

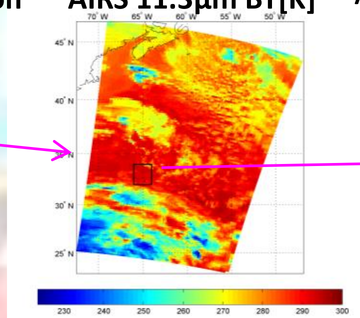
AIRS stand-alone



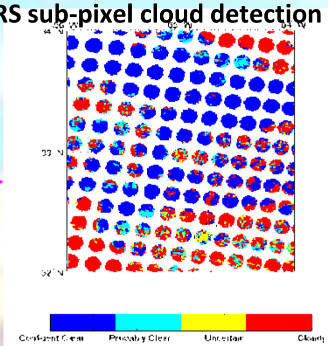
MODIS cloud detection



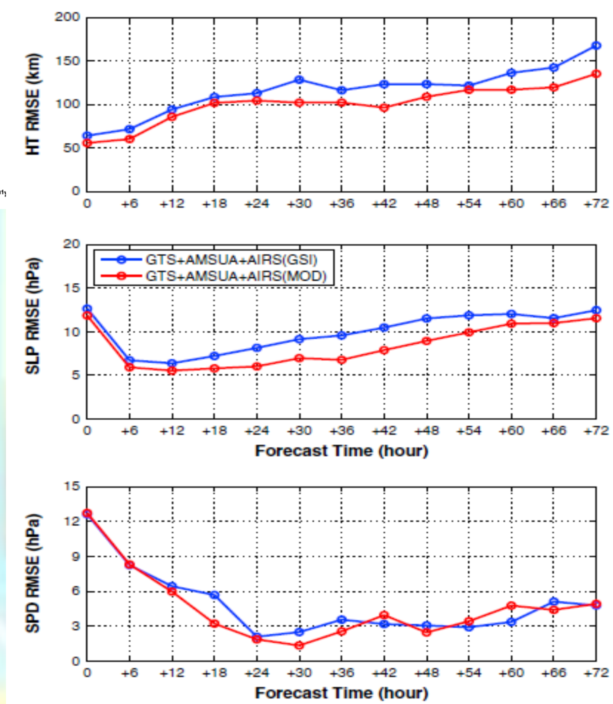
AIRS 11.3µm BT[K]



AIRS sub-pixel cloud detection with MODIS



Hurricane Sandy (2012) forecast RMSE



- AIRS stand-alone cloud detection and AIRS sub-pixel cloud detection with MODIS high spatial resolution cloud mask product are compared
  - There are some mismatched areas that the stand-alone cloud detection failed to reject and assimilated as clear radiances.
  - The stand-alone cloud detection allows more cloud contaminated radiances into GSI, causing a cold bias in temperature field and a wet bias in moisture field.
- The 72 h forecasts of Hurricane Sandy (2012) indicate that both hurricane track and intensity forecasts are improved when the collocated high spatial resolution MODIS cloud mask product is used for the AIRS sub-pixel cloud detection.

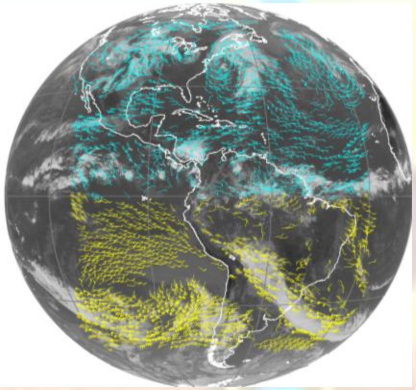
Historical GOES AMV Reprocessing

Steve Wanzong[1], David Santek[1], Christopher Velden[1], Jaime Daniels[2], Dave Stettner[1], Wayne Bresky[3], and Andrew Bailey[3]

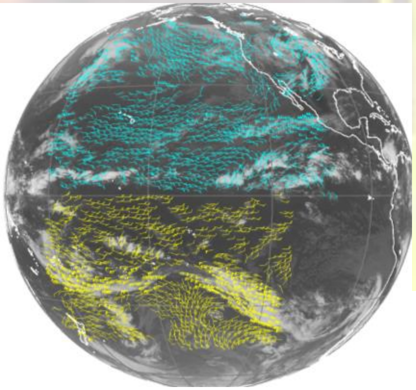
[1] University of Wisconsin – Madison/SSEC/CIMSS
[2] NOAA/NESIS/STAR
[3] IMSG

11th Annual Symposium on New Generation Operational Environmental Satellite Systems

- GOES-East/West AMV Reprocessing
  - Hourly AMVs from 1995 – mid 2013 using current operational NESDIS AMV algorithm
  - AMVs will be used in planned reanalysis efforts by ECMWF, JMA, NASA-GMAO
  - ~ 540,000 AMV datasets generated and available now



GOES East
07 May 2005
1500 UTC



GOES West
07 May 2005
1500 UTC

CIRA

- Chirokova, Galina
- DeMaria, Robert
- Longmore, Scott
- Rogers, Matt
- Schumacher, Andrea (2)
- Szoke, Ed
- Zhu, Tong

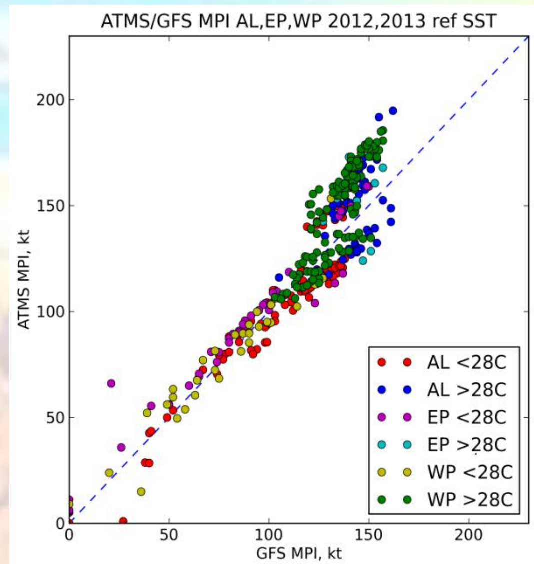
Use of JPSS ATMS-MIRS Retrievals to Improve Tropical Cyclone Intensity Forecasting

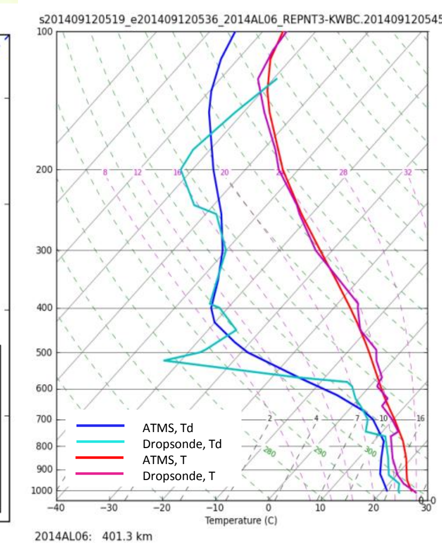
Galina Chirokova[1], Mark DeMaria[2], Robert DeMaria[1], Jack Dostalek[1], and Jack Beven[2]

[1]CIRA/CSU, Fort Collins, CO [2]NOAA/NWS/NCEP/National Hurricane Center, Miami, FL

20th Conference on Satellite Meteorology and Oceanography

- ATMS: more realistic TC structure than AMSU
- ATMS, GFS and dropsonde data are being combined to obtain best T, q sounding and Maximum Potential Intensity (MPI) estimates
- **Real-time ATMS MPI** and ATMS-dropsondes sounding comparison are **available at RAMMB-CIRA TC Real Time page** http://rammb.cira.colostate.edu/products/tc_realtime/
- **Use of ATMS MPI in statistical models:**
  - **LGEM and SHIPS intensity forecast: AL – worse; WP, EP – better in some cases**
  - **Rapid Intensification (RI) forecast is slightly improved for AL, EP, and WP**





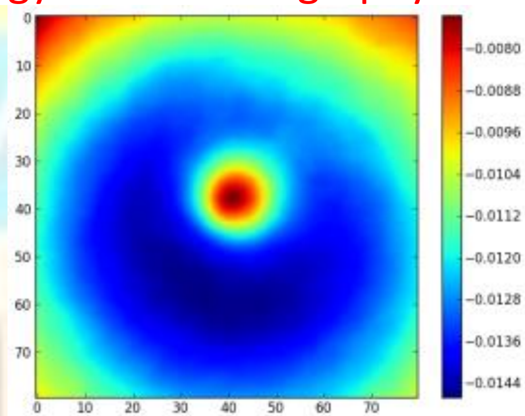
	RI	BS GFS	BS ATMS	BSS A/G	Bias GFS	Bias ATMS	# RII Cases
AL	25 kt	965	958	0.68	1.63	1.44	13
AL	30 kt	724	718	0.70	1.30	1.15	10
AL	35 kt	477	468	1.98	1.26	1.00	6
AL	40 kt	248	244	1.95	1.63	1.37	3
WP	30 kt	1044	996	4.60	0.56	0.61	31

Machine Learning Algorithms for Tropical Cyclone Center Fixing and Eye Detection,

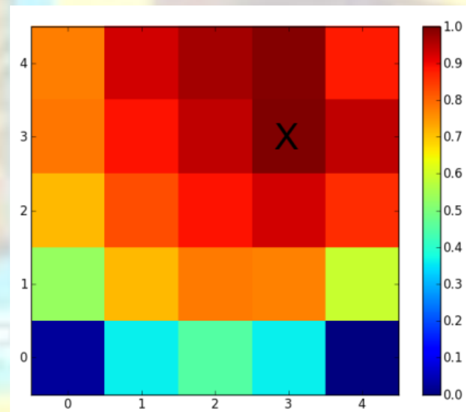
Robert DeMaria[1], Galina Chirokova[1], John Knaff[2], and John Dostalek[1]
(1) CIRA, Colorado State University, Fort Collins, CO
(2) NOAA/NESDIS/StAR, Fort Collins, CO

20th Conference on Satellite Meteorology and Oceanography

- Developed system using Principle Component Analysis(PCA) with Quadratic Discriminant Analysis(QDA) that can detect if an eye is present in IR imagery of tropical cyclones.
  - Average probability of detection: ~78%
  - Further analysis/adding additional data sources may improve accuracy
- Developed system using QDA that can locate a tropical cyclone center in real-time from MIRS microwave retrievals.
  - 11% improvement over baseline of extrapolating from real-time positions
  - May be combined with system described above.



Eigenvector of storm data produced by eye detection system.



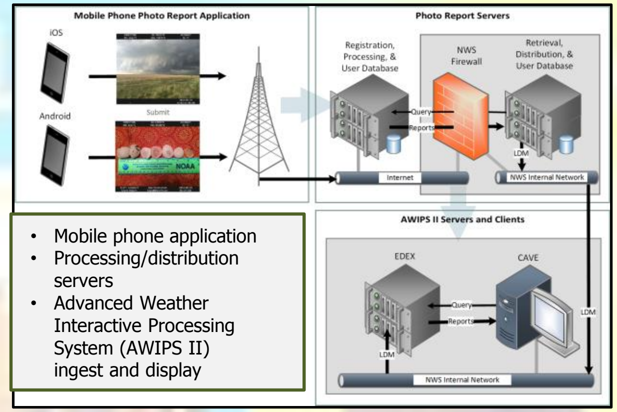
Probability field of possible storm center locations produced by center-fixing system.

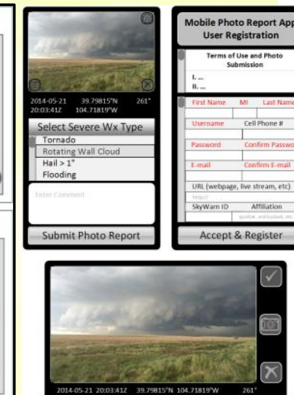
"An Automated Mobile Phone Photo Relay and Display Concept Applicable to Operational Severe Weather Monitoring"

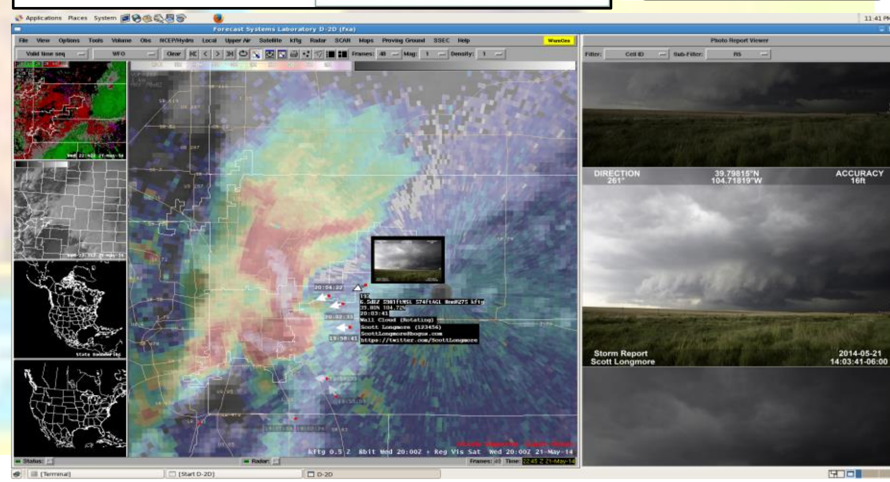
Scott Longmore[1], Steve Miller[1], Dan Bikos[1], Dan Lindsey[2],Ed Szoke[1], Debra Molenar[2], Don Hillger[2], Renate Brummer[1], John Knaff[2]

31st Conference on Environmental Information Processing Technologies Session: Crowdsourcing Data and Data Portals - Part I
Thursday, January 8, 2015: 08:30 AM - 09:45 AM, Phoenix CC, 132AB

- Photo Report (PR) social media interactions with NWS forecasters
  - Liked geo-located PRs
  - Social media has limitations
- Direct PR system concept
  - Mobile phone application
  - Processing/distribution servers
  - Advanced Weather Interactive Processing System (AWIPS II) ingest and display







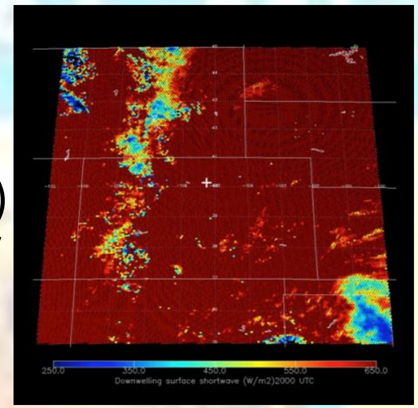
[1]Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, Colorado
[2]NOAA/NESDIS, Regional and Mesoscale Meteorology Branch, Fort Collins, Colorado

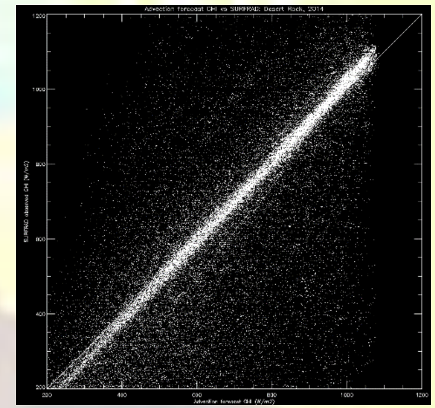
Improvements in Satellite-Derived Short Term Insolation Forecasting: Statistical Comparisons, Challenges for Advection-Based Forecasts, and New Techniques

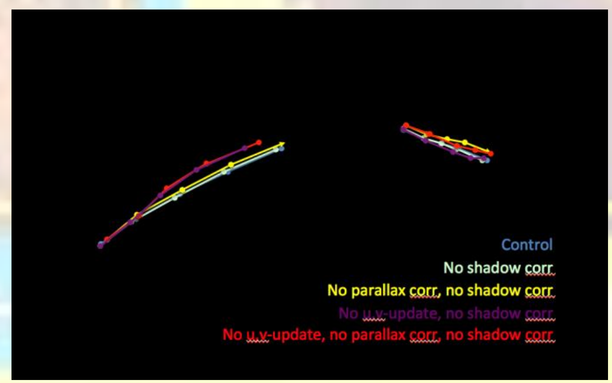
Matt Rogers[1], Steve Miller[1], John Haynes[1], Andrew Heidinger[2], Sue Haupt[3], Manajit Sengupta[4]

Sixth Annual Conference on Weather, Climate, and the New Energy Economy

- NOAA Retrieval algorithm (PATMOS-x) used for development of satellite-derived advection technique to forecast surface GHI
- Results show mean-absolute error (MAE) normalized to clear-sky of approximately 10-20%, validation against SURFRAD sites
- Novel algorithm accounts for parallax errors and cloud height/shadow computation
- Partnering with HRRR and WRF-Solar projects for intercomparison
  - Satellite-derived forecasts may fill the initialization gap from 0-3 hours past initialization time
  - Assimilation of satellite-derived products into WRF-Solar for forecast purposes







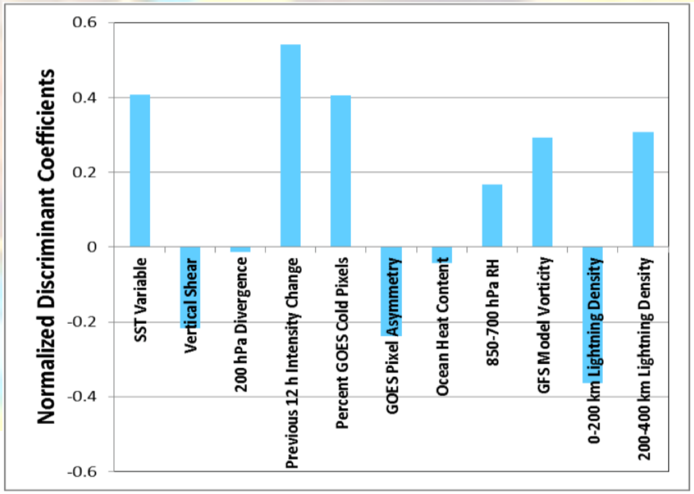
[1]CIRA/CSU, [2]CIMSS/UWisc, [3]NCAR, [4]NREL

Using Total Lightning Data to Improve Real-Time Tropical Cyclone Intensity and Genesis Forecasts

Andrea Schumacher and Robert DeMaria, CIRA/Colorado State Univ., Fort Collins, CO
Mark DeMaria, NOAA/NWS/NHC, Miami, FL

- Lightning data has potential to improve tropical cyclone (TC) rapid intensification (RI) forecasts
  - e.g., DeMaria et al. 2012
  - Used WWLLN lightning data, mostly cloud-to-ground
- In preparation for GOES-R Geostationary Lighting Mapper (GLM), this study examines role of total lightning and RI and TC genesis

- Goal: update statistical TC algorithms to use total lightning data
  - Rapid Intensification Index
  - TC Formation Probability Product

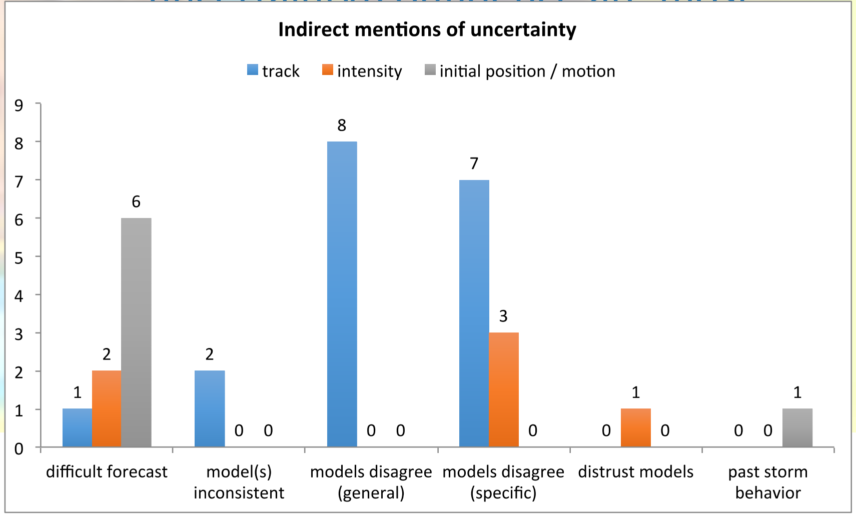


Normalized coefficients for Atlantic experimental RII

Evaluating Subjective Uncertainty Information in National Hurricane Center Tropical Cyclone Discussions

Andrea Schumacher, Olivia Vila and Vanessa Vincente
CIRA/Colorado State Univ., Fort Collins, CO

- Motivation
  - Research shows that public wants forecast uncertainty information, makes better decisions with it
  - Situational forecast uncertainty available in NHC TC Discussions, but not standardized nor verified
- Conducted quantitative content analysis NHC TCDs to examine
  - How often is uncertainty mentioned in TCDs? How is it expressed?
  - Does uncertainty messaging change for different types of forecasts?
  - How does expressed uncertainty/confidence relate to actual forecast errors?
  - What types of evidence are cited (e.g., model spread, synoptic conditions) and how often?
- Preliminary Results
  - Uncertainty mentions >> confidence mentions
  - Direct statements of uncertainty/confidence are most common for intensity and initial conditions
  - Indirect statements of uncertainty/confidence are most

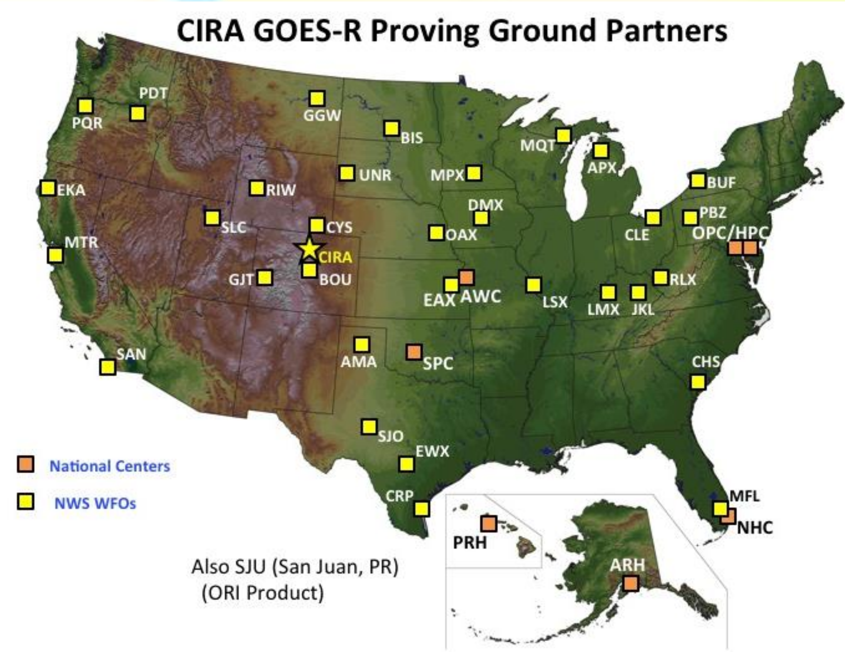


CIRA Proving Ground Activities in Preparation for the GOES-R Era

Ed Szoke[1,2], Dan Bikos[1], Renate Brummer[1], Steve Miller[1], Deb Molenar[3], Bernie Connell[1] and Mark DeMaria[3]

[1]Cooperative Institute for Research in the Atmosphere (CIRA)
[2]NOAA/Earth System Research Laboratory (ESRL)/Global Systems Division (GSD)
[3]NOAA/National Environmental Satellite, Data, and Information Services, Center for Satellite Applications and Research (NESDIS/STAR)

- GOES-R and JPSS products
  - Variety of products developed
  - Demonstrated to WFOs/Centers
- Feedback
  - Feedback has been useful
  - Many forecasters are now more familiar with potential new products



Development and Impact Study of Community Satellite Data Thinning and Representation Optimization Tool

Tong Zhu (CIRA/CSU@NOAA/NESDIS/JCSDA) and Sid Boukabara (NOAA/NESDIS/JCSDA)

- Development of CSTROT
  - Developed a new satellite data thinning tool, CSTROT, with three basic thinning methods (thinning by STD, averaging and skipping), and each one can be combined with target and/or domain regions selections..
  - The thinning function based on the union of selections by different channels to represent atmospheric variations at different levels.
  - Analyzed satellite brightness temperatures STD, and created STD thresholds for 29 GSI currently assimilated sensors in the thinning_std.txt configuration file.
  - Implement CSTROT scheme in GSI system, and performed comparison study. Compared with current GSI 145-km thinning mesh, the new CSTROT thinning can provide more data and more increment of GSI analysis in weather active regions and selected areas..

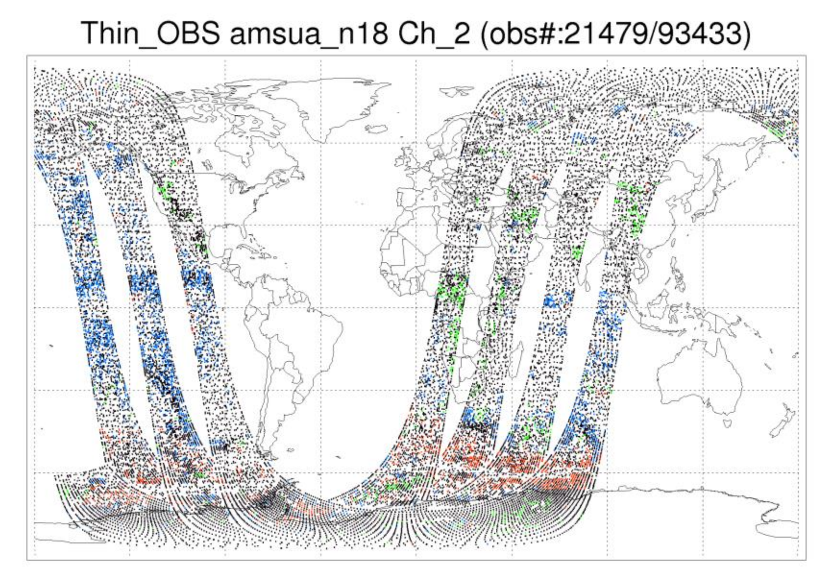


Figure. The observation points selected by CSTROT thinning scheme based on the union of AMSU-A N18 channel 2, 4 and 10 selections. Black points are the same observation points selected by all three channels. Blue, green and red points are the additional observations selected by Ch-2, 4 and 10, respectively

CREST

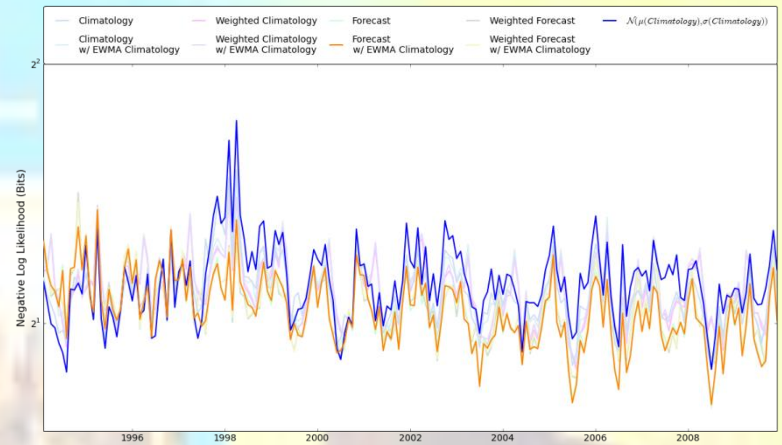
- Aizenman, Hannah
- Bishir, Raymond
- Carroll, Brian
- Daham, Farrah
- Glenn, Equisha
- Hosannah, Nathan
- Hsu, Freddy
- Karimi, Maryam
- Kraatz, S.
- Ramirez-Beltran, Nazario
- St. Pé, Alexandra
- Sullivan, J. T.
- Vant-Hull, Brian
- Wesloh, Daniel

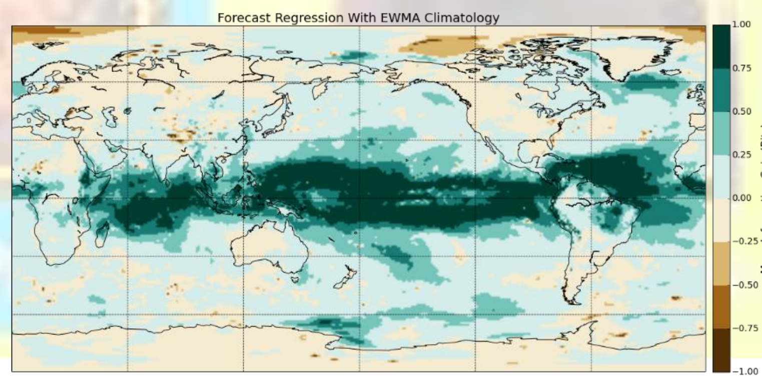
Toolbox for Evaluating Ensembles Using an Information Gain Measure

Hannah Aizenman, Michael Grossberg, Irina Gladkova, Nir Krakauer, CREST/City College of New York

Fifth Symposium on Advances in Modeling and Analysis Using Python

- Climatology variation is a good proxy for model uncertainty
- Combining forecasts and climatology in predictive model improves skill
- Further improve skill on land by incorporating trends:
  - Add new observation to training set (online)
  - computing climatology using exponential moving average





Concurrent Multi-Instrumental Observations Of The Atmospheric Boundary Layer

Raymond Bishir[1], Ivan Valerio[1], Dr. Mark Arend[2], Stephen Neufeld[1], David Melecio-Vazquez[1]

[1]The City College of New York, [2]NOAA CREST / Optical Remote Sensing Lab

ABSTRACT

A mobile Coherent Doppler LIDAR (CDL) system has been developed to measure the vertical wind speed and backscatter signal intensity at distinct heights. The CDL detects line-of-sight field measurements of backscattered atmospheric signals enabling wind to be characterized in time and space, thus providing a representation of the turbulent atmospheric conditions. This lidar technology was utilized to observe meteorological events simultaneously with a separate 1µm Direct Detection LIDAR (DDL) and Microwave Radiometer (MWR). By coordinating multi-instrumental observations of a common weather event, the retrieved profiles of vertical wind speeds, cloud cover heights, relative humidity, and atmospheric temperature can be combined to provide synergistic knowledge about the dynamic temporal evolutions of the Atmospheric Boundary Layer (ABL). It is shown that the measurements for a vertical profile from 100m to 2500m on October 31st, 2014, as observed by the CDL, agrees with the phenomena observed by the MWR and DDL, while also providing additional information undetected by the latter two instruments.

What are Aerosols?

Sources for Aerosols

Aerosols are fine airborne (liquid or solid) particles present in the atmosphere. These particles are detected by the CDL through line-of-sight measurements of backscattered laser light.

Backscatter is an 'echo' made up of reflected of light waves traveling back to their origin.

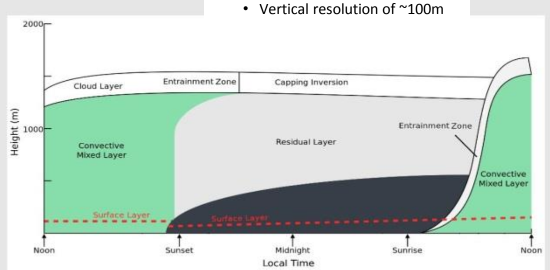
SYSTEM CONFIGURATION AND METHOD

Microwave Radiometer (MWR)

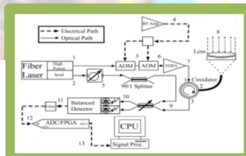
MWR

This remote sensing device measures the vertical profiles of temperature and relative humidity.

- Passive technology
- Scans using RF radiation frequencies between 51 GHz and 59 GHz for temperature profiling and 22 GHz and 30 GHz for water vapor profiling.
- Data is measured near-continuous coverage from the surface to 9800m.
- Vertical resolution of ~100m



The Atmospheric Boundary Layer



CDL Schematic

CDL Mobile Unit

CDL

Coherent Doppler Lidar (CDL)

The CDL utilizes a 1545.2 nm laser to detect line-of-sight backscattered atmospheric signals

- Active remote sensing device
- This lidar detection device operates from a mobile lab
- Measures vertical wind speed and aerosol concentrations

Atmospheric Boundary Layer

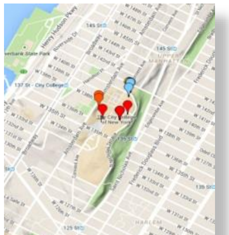
- The ABL is the lowest portion of the atmosphere (≈ 1 to 3 km deep) directly in contact with the Earth's surface
- It is the layer of atmosphere in which we live and is characterized by its responses to diurnal heat fluxes and turbulence production generated by wind shear.

DDL

Direct Detection Lidar (DDL)

The DDL detects intensity of backscattered atmospheric signals @ 355nm, 532nm, and 1064nm wavelengths

- Active remote sensing technology
- Measures Aerosol Concentration, Cloud Top Heights
- Limited availability of data
- Pulse duration of 6 ns, with a repetition rate of 50 Hz



City College NYC Met Net

FUTURE WORK

I. Further develop the CDL system to allow detection of horizontal wind velocity. This can be done through the addition of a rotating top to allow the beam to travel at angles other than the zenith

II. Conduct additional multi-instrument campaigns to obtain a more complete view of ABL dynamics

III. Investigate the potential for developing a framework for coordinated multi-instrument campaigns

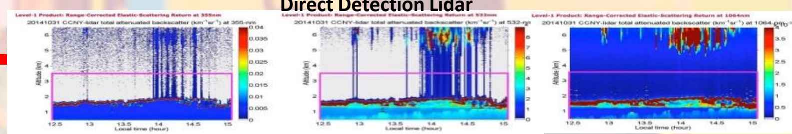
RESULTS AND CONCLUSIONS

- The testing of our system occurred between the hours of 11 AM and 3:30 PM, on October 31st, 2014.
- A consistent picture of the momentum and thermal temporal structure is detected with the mutli-instrument system in place. Starting the **MWR**, the conditions necessary for cloud formation and growth are present in the region near 1500m.
- Relative humidity values remain nearly saturated for the entire time period in question. At the same height, the calculated virtual potential temperature lapse rate ($\partial\vartheta_v/\partial z$) shows that the near-neutral conditions, indicative of mixing, keep the thermal conditions as uniform as possible.
- Looking at the results from the **DDL**, a high aerosol concentration at a height of ~1500m is seen in all three wavelengths. The presence of these aerosols is key to the formation of clouds. The information about the size of the aerosols at the 1500m level is also given by the DDL.
- The rising and sinking motions of these aerosols are then observed with the **CDL**. Below the 1500m level there is significant rising motion (high values for vertical wind speed is proportional to the low intensity of the backscatter). Once at the 1500m level, high aerosol concentratior form due to the low values of the vertical wind speeds.

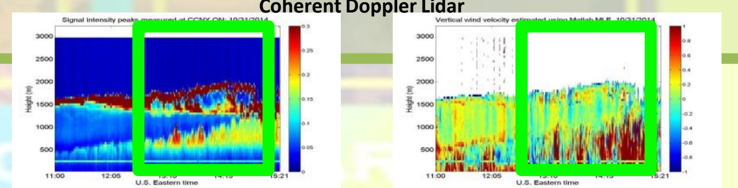
FIGURES AND GRAPHS

CDL DDL

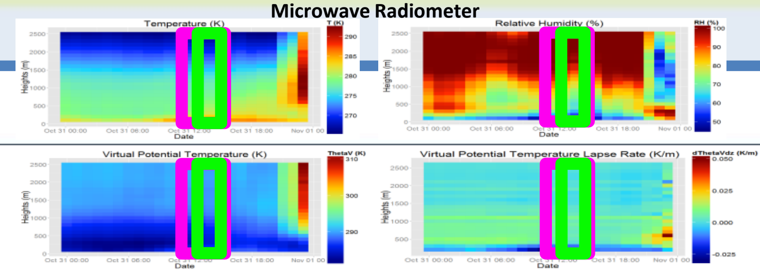
Direct Detection Lidar



Coherent Doppler Lidar



Microwave Radiometer



ACKNOWLEDGEMENTS

1-This project was made possible by the Research Experiences for Undergraduates in Satellite and Ground-Based Remote Sensing at CREST_2 program funded by the National Science Foundation under grant AGS-1062934. Its contents are solely the responsibility of the award recipient and do not necessarily represent the official views of the National Science Foundation.
2-This research is supported by the National Science Foundation's Research Experiences for Undergraduates (NSF REU) Grant No. AGS-1062934 under the leadership of Dr. Reginald Blake, Dr. Janet Liou-Mark, Mr. Chinedu Chukuigwe.
3- The National Oceanic and Atmospheric Administration – Cooperative Remote Sensing Science and Technology Center (NOAA-CREST) for supporting this project. NOAA CREST - Cooperative Agreement No: NA11SEC4810004.
4- The Consortium for Climate Risk in the Urban Northeast (CCRUN), Research Experience for Undergraduates (REU).
5- My irreplaceable mentors for their infinite patience and bottom-less wisdom for the duration of my research under their indelible guidance.

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Dr. David Santoro, "Development of an Eye Safe Coherent Doppler Wind Lidar System" PhD Thesis 2012, City College of New York
Sameh Abdelazim, "Analysis and Implementation of Signal Processing Strategies for a 3-D Doppler Lidar Wind Profiler", PhD Thesis 2012, City College of New York

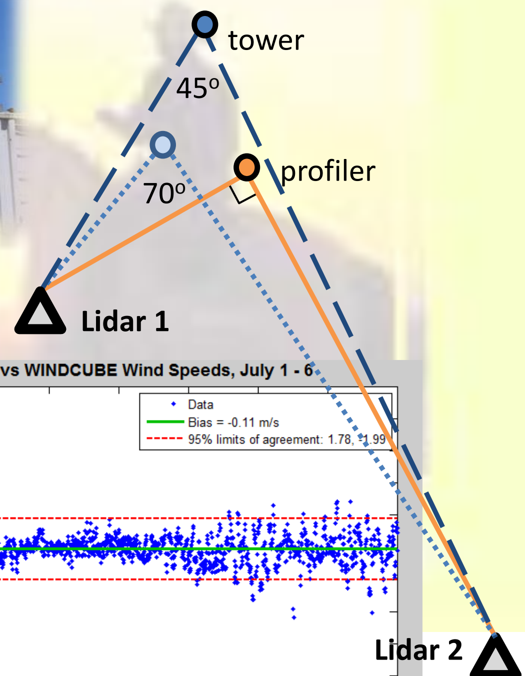
Dual Doppler Lidar Wind Profiling in the Lidar Uncertainty Measurement Experiment (LUMEX)

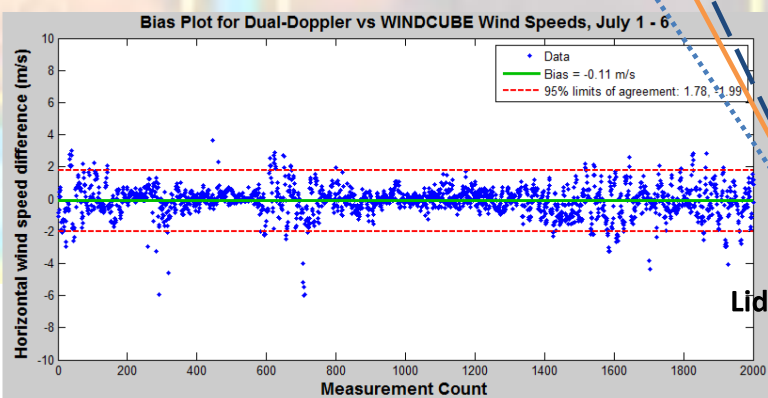
Brian Carroll[1], Aditya Choukulkar[2], Ruben Delgado[3], Graham Antoszewski[1], Scott Sandberg[4], Mike Hardesty[2], Alan Brewer[4], Julie Lundquist[5], Andreas Muschinski[6]

[1]Atmospheric Physics Dept., UMBC; [2]Cooperative Institute for Environmental Sciences, Boulder; [3]Joint Center for Earth Systems Technology, UMBC; [4] Chemical Sciences Division, NOAA, Boulder; [5]University of Colorado Boulder; [6] NorthWest Research Associates, Inc.

7th Symposium on Lidar Atmospheric Applications

- Validation of Dual Doppler Lidar
  - Enhance the ease and accuracy of future wind measurement experiments
- Characterization of Dual Doppler Scan Parameters
  - Intersection angle, dwell time
  - Preferred weather conditions





Determination of the Temporal and Spatial Variability of the Planetary Boundary Layer Height in Maryland from 915-MHz Radar Wind Profiler Measurements

Farrah Daham[1], Scott Rabenhorst[2], Belay Demoz[1,2], Ruben Delgado[2]
[1]UMBC, [2]JCET

2015 AMS Student Conference

- 2013 wind profiler data from Beltsville, Horn Point, and Piney Run used to investigate seasonal diurnal height variation of PBL
  - Day PBLH were on average higher in the summer than winter due to instability in the atmosphere
  - Summer PBLH were on average 0.144, 0.076, and 0.211 km higher than winter PBLH, respectively
- Temporal and spatial variability shown between comparison sites
  - Highest correlation in PBLH, R^2 = 0.984, shown between Beltsville and Horn Point, shortest distance of 55 miles

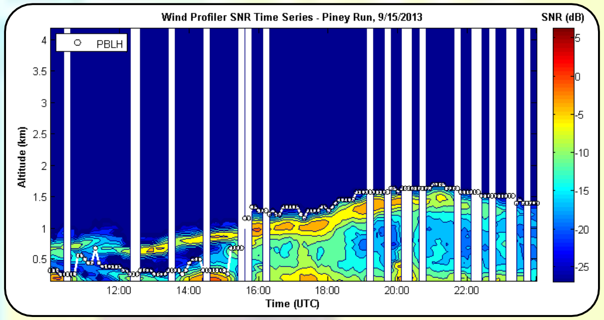


Figure 1. PBLH plotted for summer case study day, Sept 15, in Piney Run

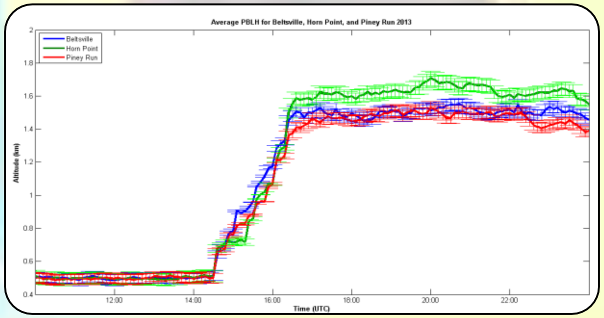


Figure 2. Average 2013 daytime cycle of PBLH for comparison sites with error bars

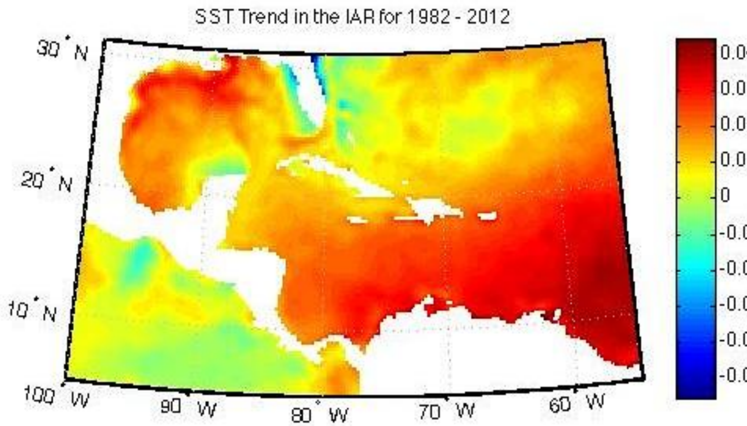
Climate Change Detection in the Intra-Americas Region and Local Implications to Sensitive Eco-systems

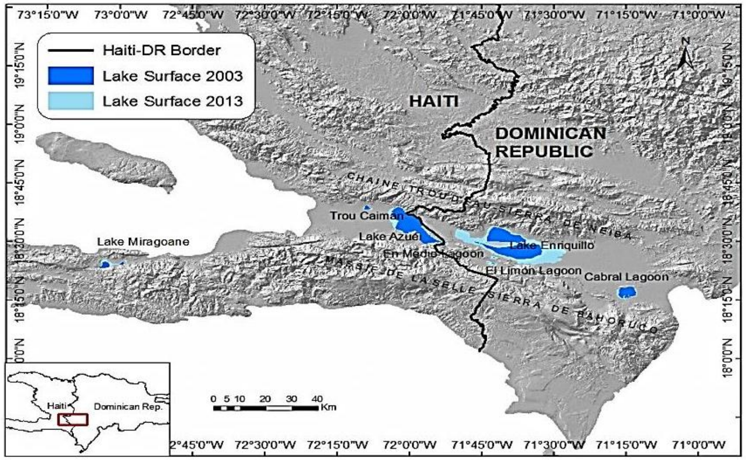
Equisha Glenn
ESES Graduate Initiative
NOAA-CREST

Jorge E. Gonzalez, PhD
Mechanical Engineering Dept., CCNY
NOAA-CREST

Daniel Comarazamy, PhD
NOAA/CREST/NESDIS
STAR/SOCD

- **What:** **A 30-year analysis of high resolution SST data revealed warming trends for the Intra-Americas Region (IAR) during the 1982 – 2012 period.**
  - **SST-Product: NOAA/Optimum interpolated sea surface temperature (OISST) with spatial resolution of 0.25 degrees.**
  - **Observed for annual, monthly, and rainy seasons – with high statistical significance (Top-Left).**
- **Local Implications:** **Water bodies in Hispaniola show a shrinking and expanding pattern since the early 1980s attributed to SST increases (Bottom-Left).**
  - **As of 2013, Lake Enriquillo (DR) is double its minimum size observed in 2004. Lake Azuéi (Haiti) is observed to grow at similar rates.**

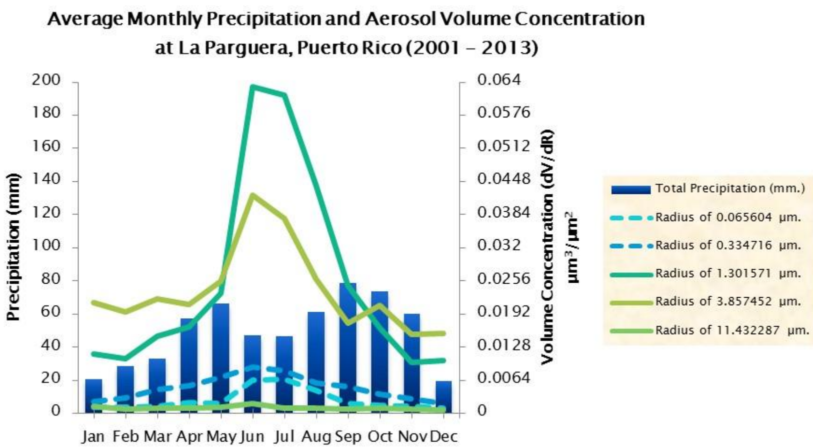




Poster-809/Effects of Aerosol PSD Data Assimilation on Precipitation Prediction in Western Puerto Rico using a Cloud-Resolving Atmospheric Model

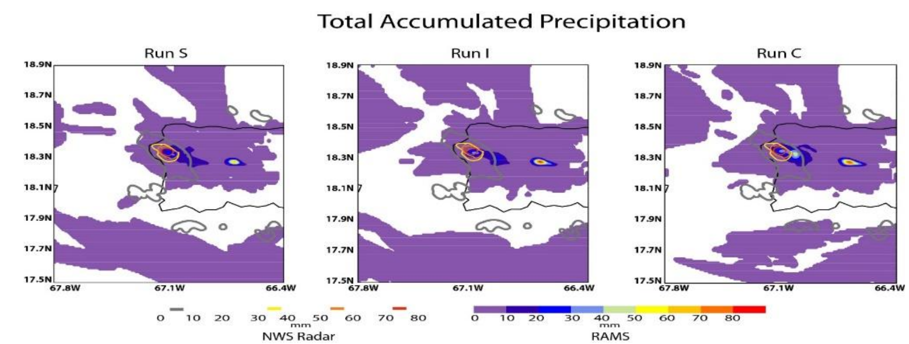
Nathan Hosannah, H. Parsiani, J. E. González, D. Comarazamy, and R. A. Armstrong

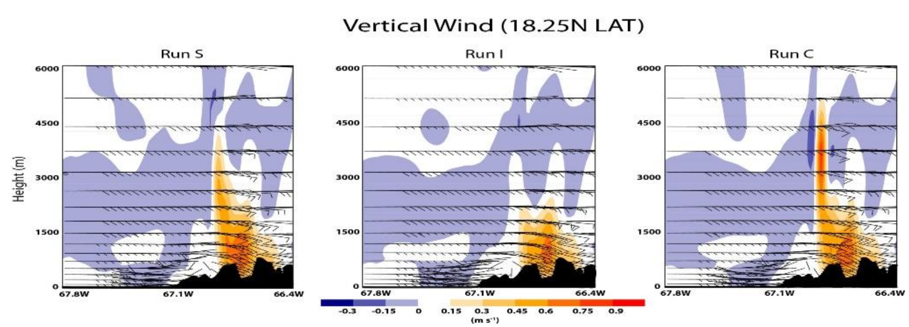
- **Why Puerto Rico-** The distribution of aerosols in the Caribbean atmosphere has been documented to influence precipitation totals (Comarazamy et al.), and spatial precipitation distribution (Fig. below).



- **Modeling (RAMS).** We selected a localized precipitation event (16 June 2013 to simulate 3 different PSD ingestion techniques: **Run S-**Simplified Unimodal PSD with only CCN. **Run I-**Bimodal with both CCN and GCCN. **Run C-**Bimodal vertically varying PSD updated in time.

Results: Radar vs RAMS results indicate that Run C captures the most intense precipitation (near Rincon) more accurately than Runs S and I. Errors in the 3 cases are 68, 57, and 43% respectively. Vertical (shaded) and U x W (barbs) along the 18.25N latitude for Run S, I, and C (Bottom Fig.), showing that 4D ingestion motivates convection, and a main cause for improved prediction.



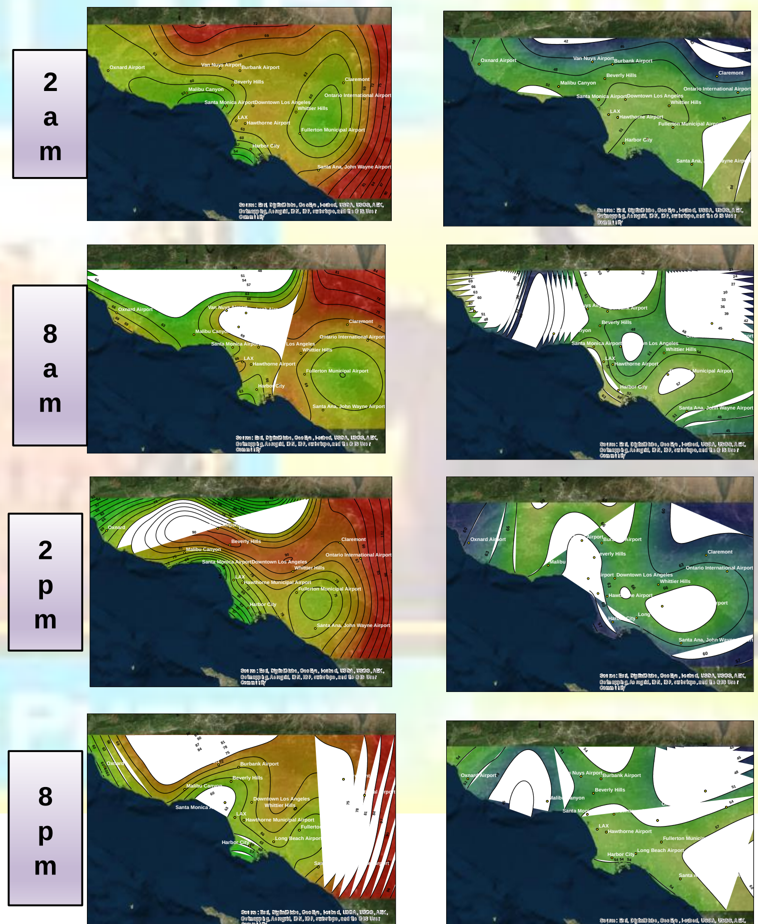


Investigating the Los Angeles Urban Heat Island Using Satellites and Ground Data

Freddy Hsu[1], Tania Torres[1], Pantiwa Jarujareet[1],Steve LaDochy[1], Pedro Ramirez[1], Hengchun Ye[1], Pedro Sequera[2], William Patzert[3]
[1]Department of Geosciences & Environment, California State University, Los Angeles, California
[2]Department of Mechanical Engineering, The City College of New York, CUNY, New York, New York
[3]Jet Propulsion Laboratory, NASA, Pasadena CA

- Major result 1
- Downtown Los Angeles' annual average temperature as well as Los Angeles county population trends are gradually increasing.
- Major result 2
- Summer and winter 2012-2013 maps reveal that the UHI shifts from near the coast at night/early morning to the inland valleys during the afternoons.
- Major result 3
- The diurnal patterns for summer and winter are quite complex, the UHI appears closer to the downtown area in winter throughout the day, while closer to downtown at night and shifting to the inland valleys during the day.
- Major result 4
- Limitations of data availability and models creates inaccuracies in the maps with unrealistic values at the extremes.
- Sub result 1
- LA UHI is too complex to be clearly described with 1 year of data.

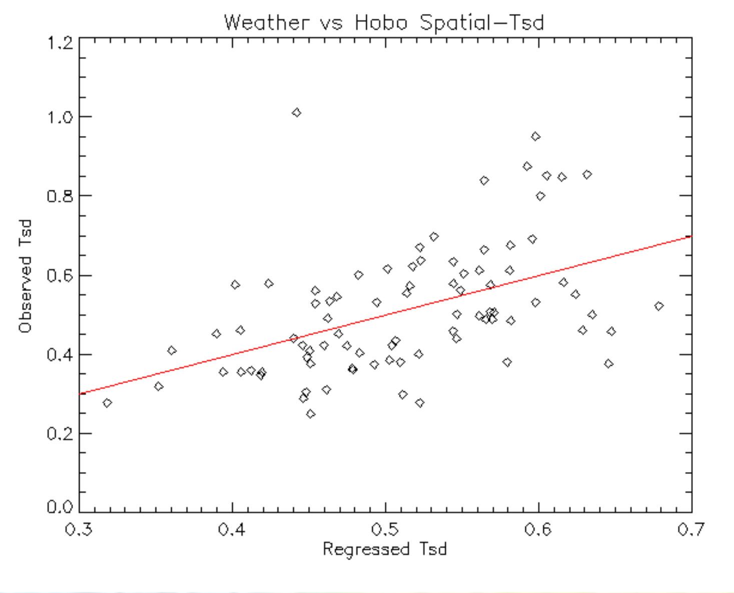
2012-2013 Summer and Winter Heat Island Maps



Impact of Environmental Factors in Variation of Temperature in Respect to Urban Heat Island, Manhattan, New York, *Weather and Corresponding Surface Temperature*

Maryam Karimi, ***Dr. Brian Vant-Hull, Dr. Rouzbeh Nazari, Dr. Reza Khanbilvardi , and Awalou Sossa***
The Graduate Center, CUNY, NOAA Crest Institute, The City College of New York, and Rowan University

- Field campaigns in Manhattan were used to measure spatial temperature variations within an urban setting.
- Amplitude of spatial variation in temperature for each day can be predicted by regression of weather variables.
- Amplitude of spatial variation in temperature is most dependent on Eastward winds and temperature.



Observing river ice through thin clouds (Susquehanna, MODIS-AQUA)

S. Kraatz, R. Khanbilvardi and N. Devineni
NOAA-CREST at the City College of New York (CCNY)

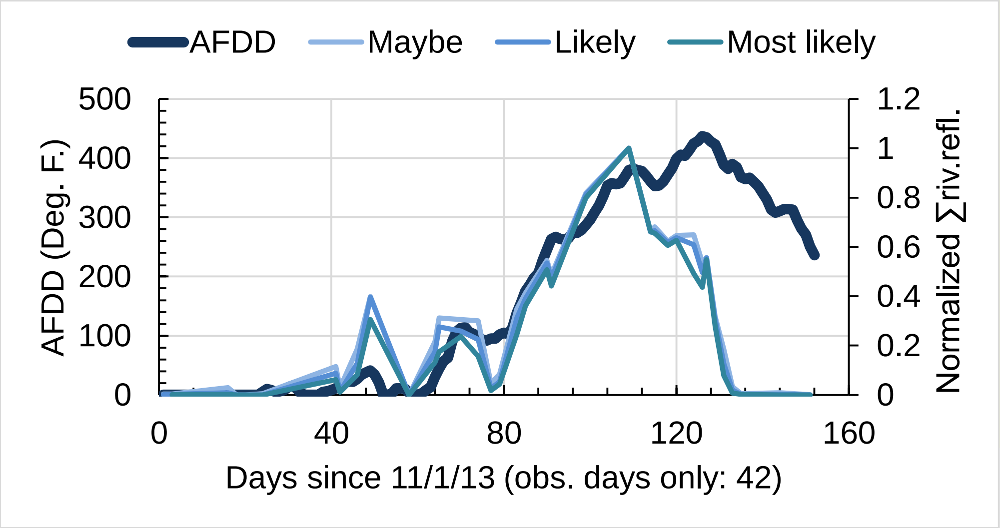
29th Conference on Hydrology: Hydrometeorological Extremes

- Reduced revisit time (right)
  - Cloud masks should not be used: strong bias towards ID as cloud during ice bearing time
  - Use other bands (here, 7)

Days since 11/1/13	Cld. Mask	Algorithm
1-45 (no ice)	9.5 (4.7,26)	7.8 (5.8,9)
46-130 (ice)	5.3 (16,35)	22.9 (3.7,23)
131-171 (no ice)	11.6 (3.5,23)	10.6 (3.9,11)

1.0 unit = data for 1 entire river (eff. revisit [days], #days sth. retrieved)

- High correlation with temperature (AFDD)
  - Captures midwinter thaws
  - Spatial distribution/reflectance changes consistent with ground reports



NOAA STAR CENTER FOR SATELLITE APPLICATIONS AND RESEARCH

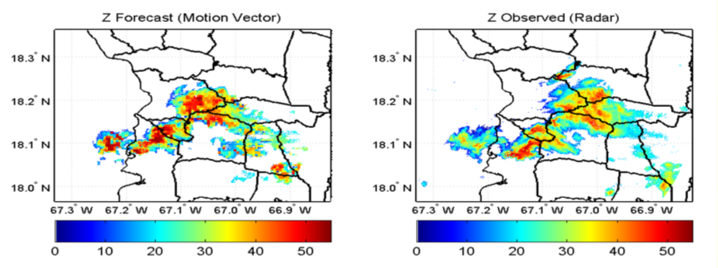
cics-md Cooperative Institute for Climate & Satellites UNIVERSITY OF MARYLAND | CIRA | CUNY NOAA - Cooperative Remote Sensing Science and Technology Center | CIMSS

An Empirical Model of High Spatial and Temporal Resolution for Radar Rainfall Nowcasting

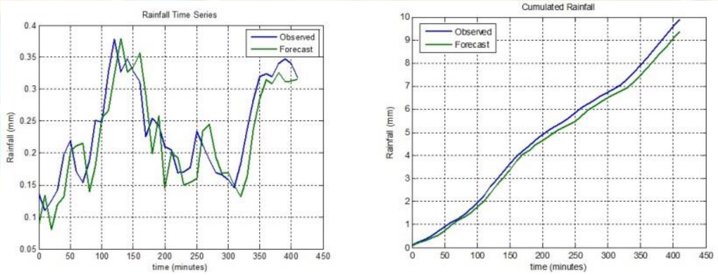
Nazario D. Ramirez-Beltran, Luz Torres Molina, Joan M. Castro, Sandra Cruz-Pol, José G. Colom-Ustáriz and Nathan Hosannah
University of Puerto Rico, P.O. Box 9030, Mayagüez, PR 00681, U.S.A, nazario.ramirez@upr.edu

The 29th Conference on Hydrology

- A short term rainfall prediction algorithm for a convective storm is introduced in this work. The algorithm uses high spatial and temporal resolution (0.06 km and 1 min) of TropiNet radar data to predict the evolving distribution of rainfall rate over western part of Puerto Rico:
  - It is expected that in a short time period (~10 min) a rain cloud behaves approximately as a rigid object and the cloud rain pixels moves in a constant speed and direction. Thus, the most likely future rainfall areas can be estimated by using the advection of centroids of rain cells in consecutive images.
  - The postulated rainfall nowcasting algorithm involves two major tasks: a) predicting the future location of the rain pixels, and b) predicting rainfall rate at each pixel.
- The rainfall process exhibits significant changes in time and space, and it can be characterized as a non-stationary stochastic process..
  - To face the non-stationary characteristic of the process, parameters are estimated at each time and spatial domain
  - The stochastic characteristics of the process are represented by a nonlinear time and spatial lag model, which is an approximation to a stochastic transfer function model
- The left panel shows the rainfall forecast with 10 min as a lead time and the right panel shows observations from TropiNet radar



- Left panel shows the average rainfall for all rain pixels during each time interval (10 minutes). The right panel shows the accumulated precipitation for all rain pixels during 7 hours of a rainfall event that occurred on western part of Puerto Rico on March 28, 2012. The blue line represents the TropiNet data and the green line represents the forecasts at 10 minutes lead time.

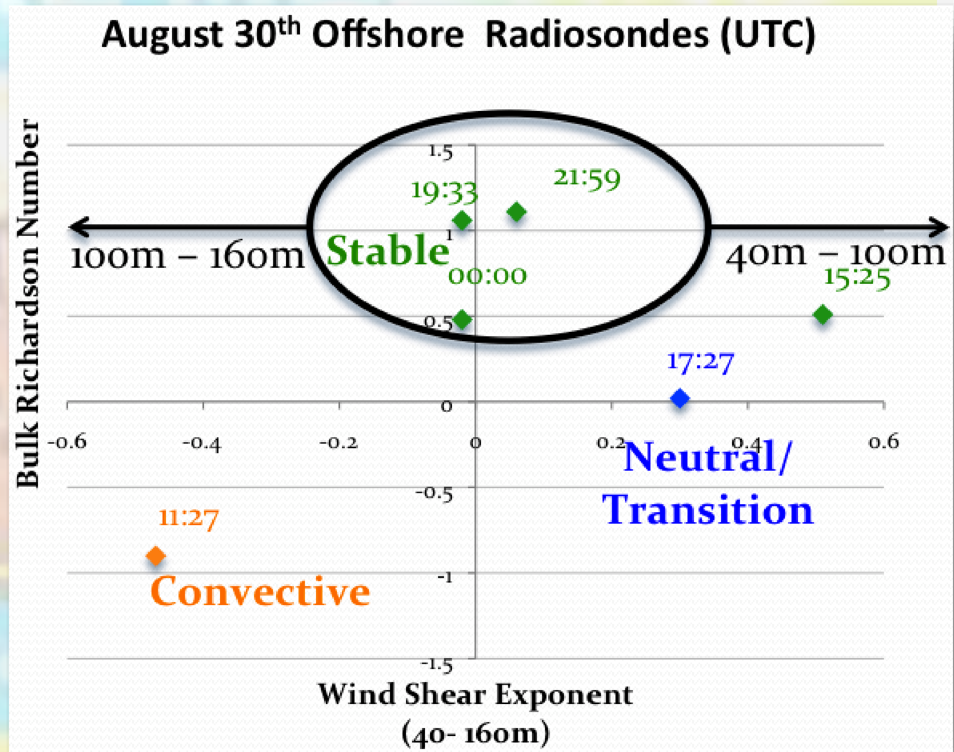


Using Doppler Wind Lidar to Assess Meteorological Controls on Offshore Wind Power Generation

Alexandra St. Pé, Farrah Daham, Daniel Wesloh, Graham Antoszewski, Navid Goudarzi, Scott Rabenhorst, Ruben Delgado
[1]University of Maryland, Baltimore County [2] University of Maryland, College Park [3] Join Center of Earth Systems Technology

Applications of Lidar in the Energy Sector-II

- Evidence suggests a *microscale* meteorology event lead to a localized area of increased stability & low-level wind max within turbine's rotor layer in the MD offshore wind energy area
  - More data-mining and WRF modeling needed to test hypotheses of possible drivers
- Relationship between offshore stability and wind shear depends on section of rotor layer analyzed
  - Given sharp nose of low-level wind max (near 100m), wind shear binned 40m-160m **underestimates** shear
- 46% greater normalized power occurs post initial increase in offshore stability
  - Expected given increased wind speed throughout rotor layer

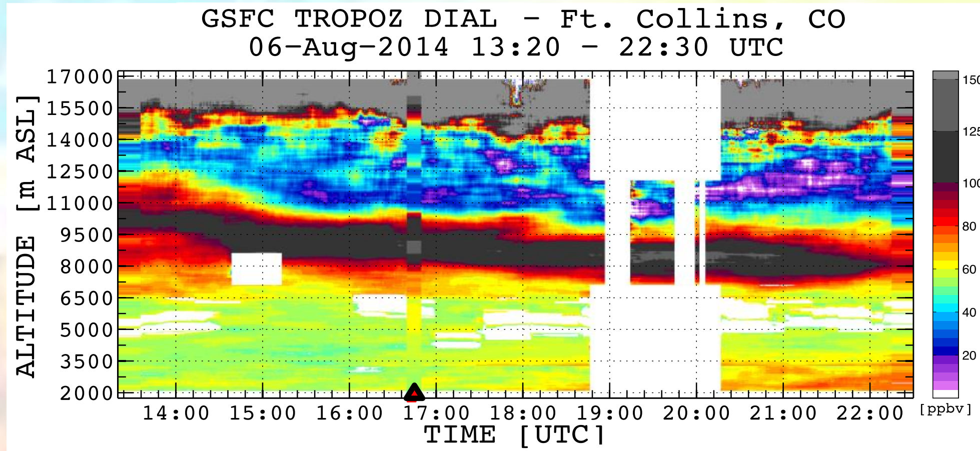


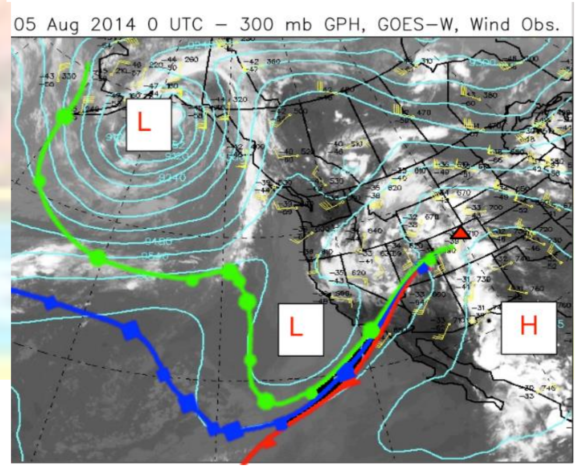
Tropospheric Ozone Enhancement in the Front Range Using the GSFC TROPOZ DIAL During DISCOVER AQ 2014

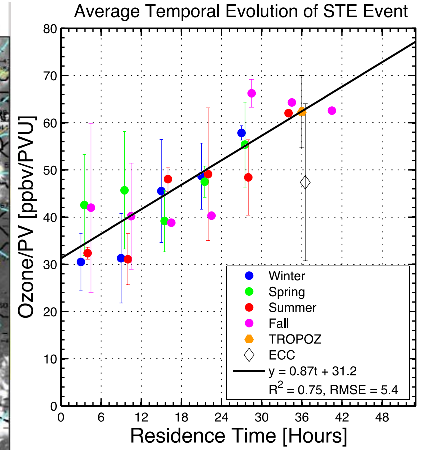
J. T. Sullivan (jsull1@umbc.edu)[1,3], T. J. McGee [2], R. M. Hoff [1,3], L. Twigg[4], and G. Sumnicht[4]
1. Department of Atmospheric Physics, University of Maryland Baltimore County (UMBC), Baltimore, MD.
2. Code 614.0, NASA GSFC, MD. 3. Joint Center for Earth Systems Technology (JCET), MD 4. Science Systems and Applications Inc, MD

Seventh Symposium on Lidar Atmospheric Applications

- A Stratospheric-Tropospheric Exchange Event (STE) was characterized with the GSFC TROPOZ DIAL (top panel)
  - The stratospheric air mass entered the troposphere near California's Pacific Coast
  - It was then advected to the Rocky Mountain region (bottom left)
- A relationship was determined in order to quantify STE residence times and occurrence
  - This implies that most STE events are rather shallow, with most of the stratospheric air dissipating in the upper troposphere over the period of the first 24 hours.







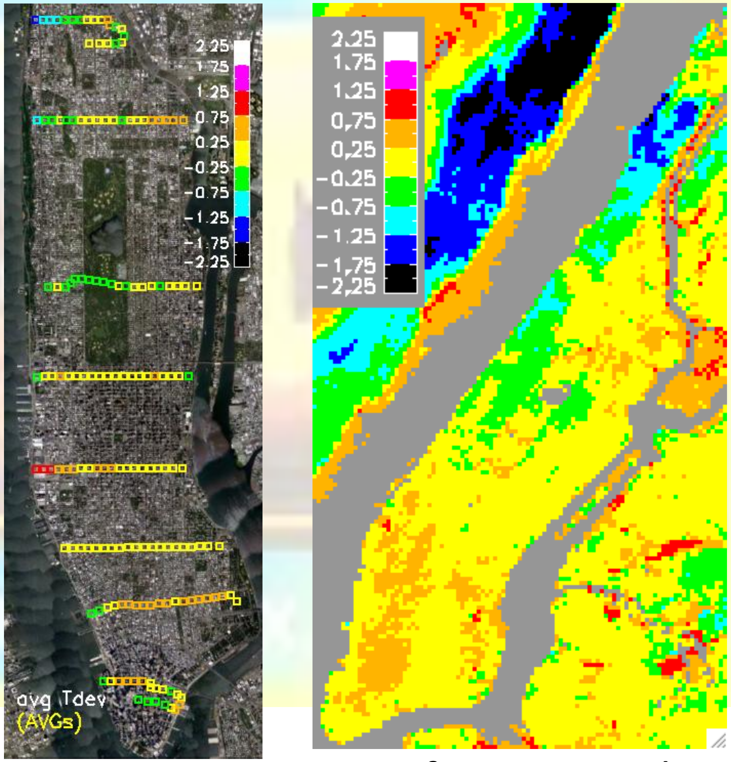
A Simple Statistical Model to Predict Urban Temperature Anomalies

Brian Vant-Hull, Maryam Karimi, Awalou Sossa,
Rouzbey Nazari, Estatio Guiterrez, Reza Khanbilvardi

AMS Annual Meeting, 2015: Conference on Environment and Health

- Surface temperature anomalies are modeled by multivariable linear regression against surface variables such as elevation, vegetation, building geometry;

- The magnitude of the anomalies are modeled by linear regression against weather variables.



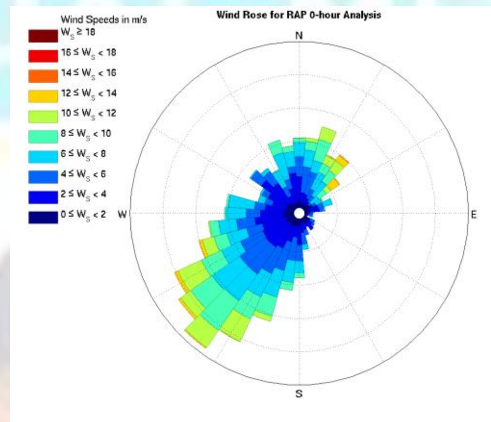
Left: measured
Right: modeled

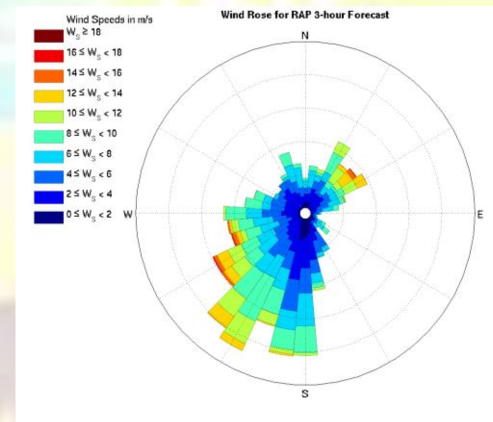
Comparison of RAP Forecast Wind Data with Lidar Measurements in the Maryland Wind Energy Area

Daniel Wesloh[1], Scott Rabenhorst[1], Ruben Delgado[2]
[1] Department of Physics, University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250
[2] Joint Center for Earth Systems Technology, University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250

2015 AMS Student Conference

- Model Forecast winds were consistently slower than Lidar-observed winds
  - Analysis state by 1.5 m/s, on average
  - 3-hour forecast by 0.8 m/s, on average
- High variability in relationship between forecast and observed winds
  - Standard deviation of differences between forecast and observed wind speeds of 2 m/s for the analysis state and 3 m/s for the 3-hour forecast state
  - Both values increase with height





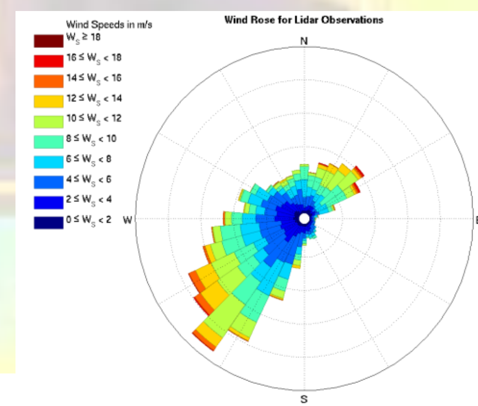


Figure : Clockwise from top right, wind roses for the RAP f00 analysis, the RAP 3-hour forecast, and the lidar observations. Wind data at all heights is combined in these plots.