Weekly Report

SCSB/CISESS
Cooperative Research Program Division (CoRP)
STAR/NESDIS
National Oceanic and Atmospheric Administration (NOAA)

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Date of Submission: 9/18/2020

Products and Applications

New Simulated METImage Radiance Data Released by STAR: CISESS/UMD Scientists Xi Shao, Sirish Uprety and Wenhui Wang have been working with METImage, one of the major payloads on EUMETSAT Polar System Second Generation (EPS-SG), which is expected to be launched in 2023. With 20 channels covering the visible, near-infrared, and infrared spectrum and 500 meter spatial resolution, METImage will be the follow-on to the AVHRR on METOP as the primary imaging radiometer in the mid-morning orbit for the next decades, complementing VIIRS in the afternoon orbit on JPSS satellites. To support the Level 2 algorithm and software development at NOAA, a First Principle Physics-based Scene Simulation software has been developed at UMD/CISESS to produce simulated METImage radiance data.

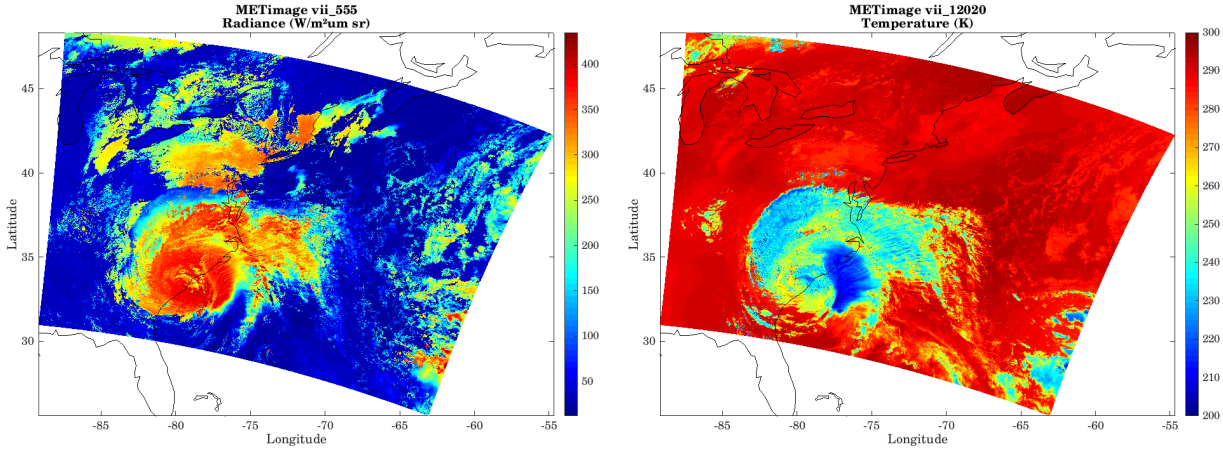


Figure: *Examples showing the simulated Hurricane Florence on Sept. 15, 2018 for the 0.555 µm (visible) and 12.02 µm (thermal infrared) METImage channels.*

The simulated METImage radiance data cover Hurricane Florence on Sept. 15, 2018 with three orbits of 11 visible/near-infrared channels during daytime and 9 infrared channels during day/night-time. The UMD/CISESS simulated METImage radiance will support the METImage-related Level 2 product algorithm/software development and testing efforts at NOAA/STAR.

(*POC: Xi Shao, Sirish Uprety and Wenhui Wang, xi.shao@noaa.gov, Funding: METOP-SG funding from NOAA/STAR and OPPA)*

Publications

Using GOES Satellite Data to Estimate Wildfire Emissions: CISESS Scientists Hyun Cheol Kim and Tianfeng Chai supporting OAR/Air Resources Laboratory (ARL) have a new article published on September 4th in *Atmospheric Chemistry and Physics*. Smoke forecasts have been challenged by high uncertainty in fire emission estimates. These scientists developed an inverse modeling system, the HYSPLIT-based Emissions Inverse Modeling System (HEIMS) for wildfires, that estimates wildfire emissions from the transport and dispersion of smoke plumes as measured by satellite observations. Using NOAA HYSPLIT and GOES Aerosol/Smoke Product (GASP), the system resolves smoke source strength as a function of time and vertical level and outperforms current operational systems.

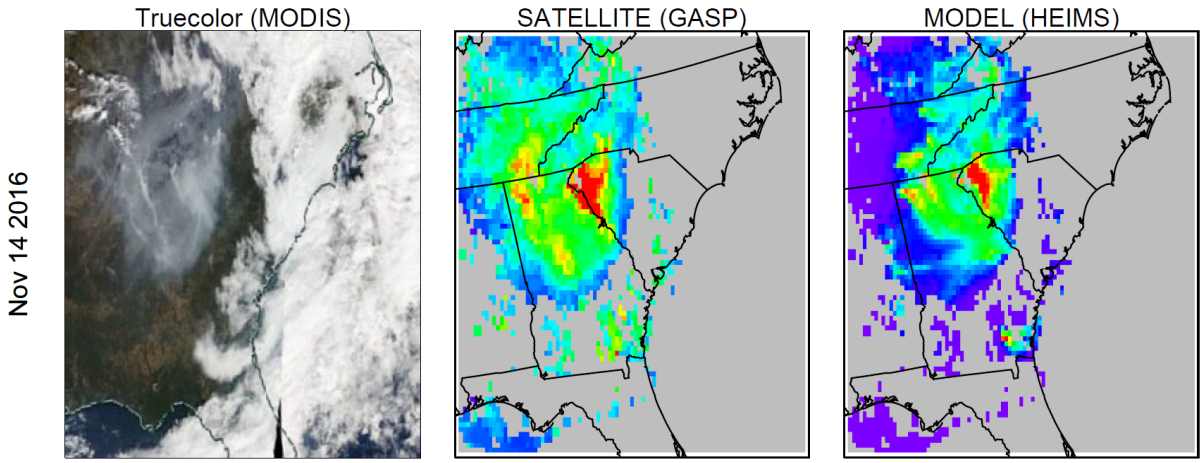


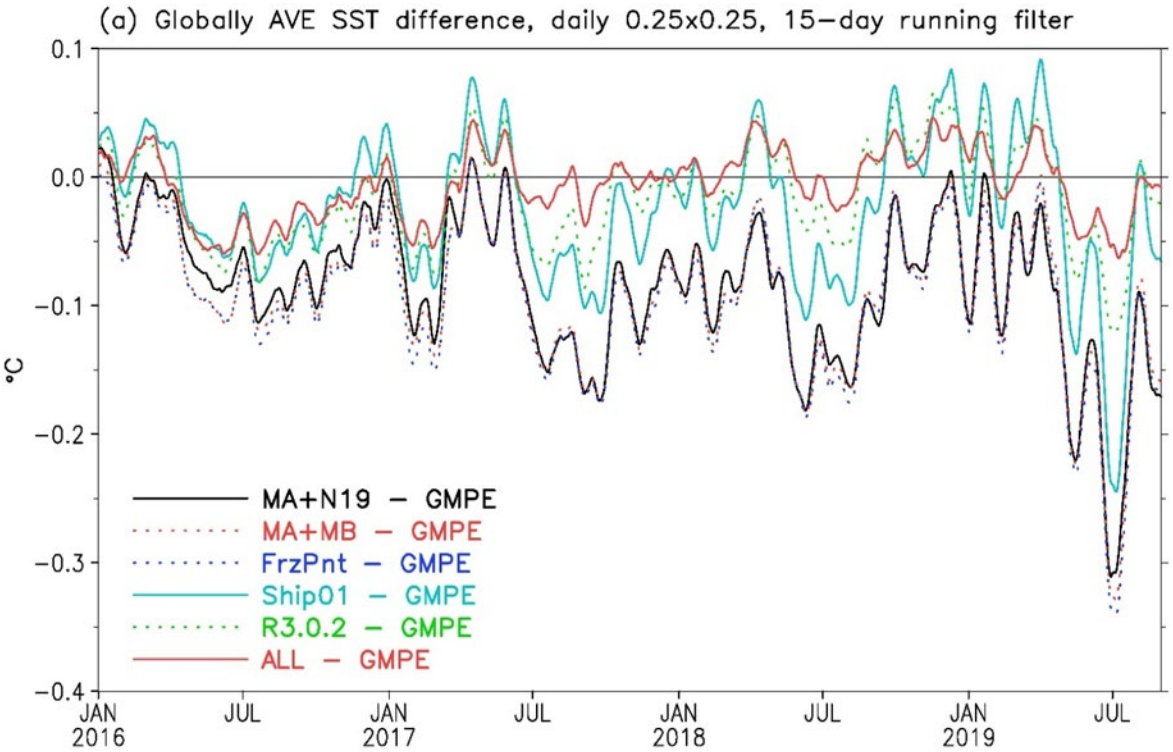
Figure: *A wildfire event in the southeastern U.S. was used to test the HEIMS model. A true color satellite image of the event, the GOES data, and the model data are shown above for 11-14-16.*

Kim, Hyun Cheol, **Tianfeng Chai**, Ariel Stein, and Shobha Kondragunta, 2020: Inverse modeling of fire emissions constrained by smoke plume transport using HYSPLIT dispersion model and geostationary satellite observations. *Atmos. Chem. Phys*., **20**, 10259–10277, https://doi.org/10.5194/acp-20-10259-2020 .

(*POC: Hyun Cheol Kim, hyun.kim@noaa.gov, Funding: ARL)*

Operational Daily OISST Paper to be in *Journal of Climate*: T. Smith has a new paper conditionally accepted for publication. Improvements in the operational daily Optimum Interpolation Sea Surface Temperature (OISST) analysis are documented. These improvements remove most of the problems that had been noted by others, and make several other incremental improvements in the analysis. The figure (from the paper) summarizes overall

improvements after successive changes to OISST, with the final improved analysis indicated by All. Most improvement is from including all *in situ* data for bias adjustments.



Huang, B, C. Liu, V. Banzon, E. Freeman, G. Graham, B. Hankins, **T. Smith**, and H.-M. Zhang, 2020: Improvements of the daily optimum interpolation sea surface temperature (DOISST) version 2.1. (Conditionally accepted for publication in *J. Climate*)

(*POC: Tom Smith, tom.smith@noaa.gov, Funding: PDRA)*

Validation of GOES-16 ABI High Quality Visible and Near-Infrared (VNIR) Imagery: CISESS Scientists Xin Jing, Tung-Chang Liu, Xi Shao, Sirish Uprtey, Bin Zhang, and A. Surjalal Sharma had a conference paper published last month about their CISESS task on calibration and validation of the Advanced Baseline Imager (ABI) on GOES-16. In this paper, radiometric performance of the GOES-16 ABI multiple Visible and Near-Infrared (VNIR) bands are evaluated over the Sonoran Desert by comparing measurements with Suomi National Polar-Orbiting Partnership (S-NPP) Visible Infrared Imaging Radiometer Suite (VIIRS) and Aqua MODIS (Moderate Resolution Imaging Spectroradiometer) equivalent bands. The main challenges for the comparison are the large viewing angle at the Sonoran Desert by ABI (56.34º), a lack of comprehensive BRDF model at such viewing geometry, and angular dependence of atmospheric scattering. To address these issues and to facilitate the comparison, they developed a radiative transfer modeling-based (RTM) method to account for atmospheric effects. The analysis showed that the radiometric biases of the five VNIR channels of GOES-16 ABI are all within 6% in comparison to the matched channels of VIIRS or MODIS after applying the RTM correction. However, some issues concerning reflectance consistency and radiometric bias were found.

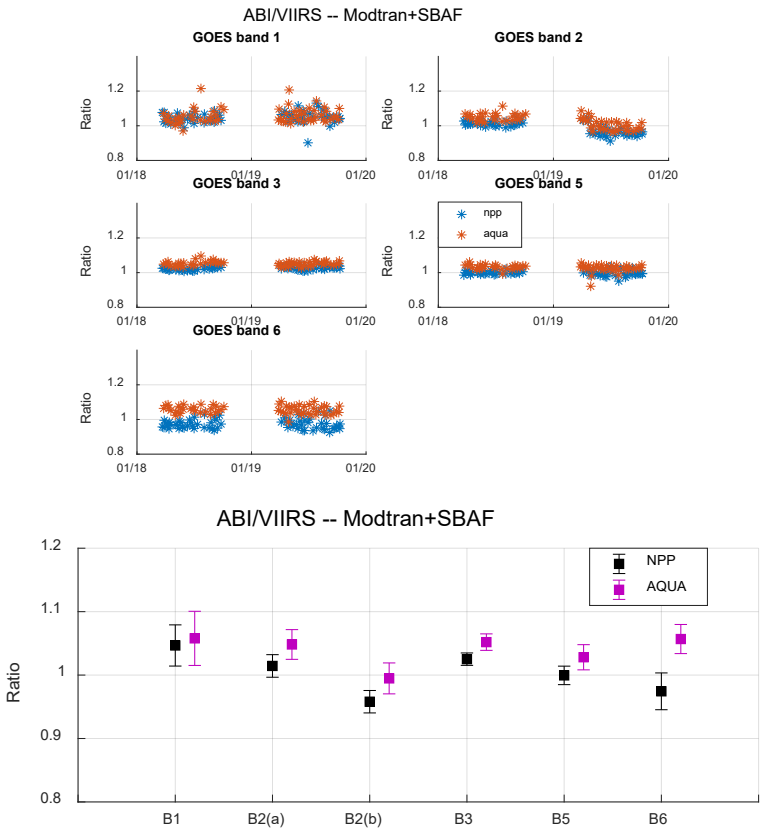


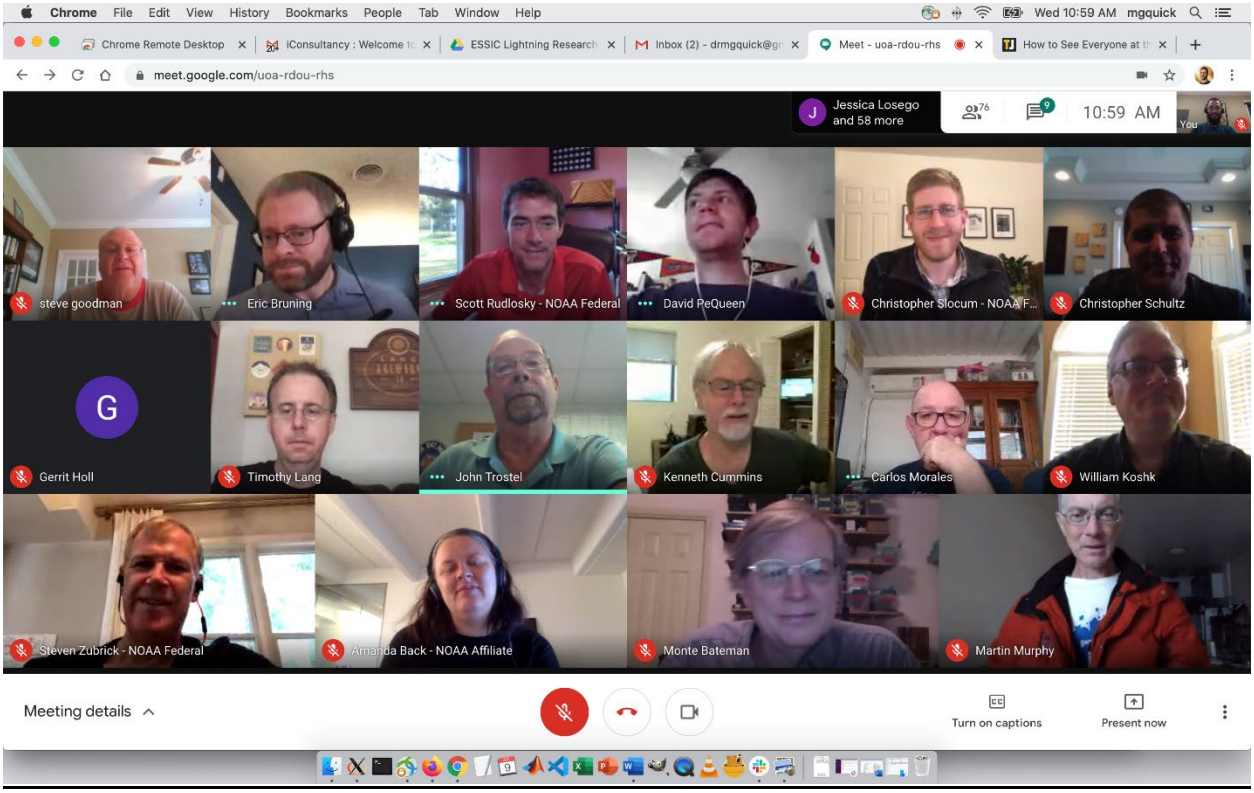
Figure: *(top) Time series of reflectance ratio between GOES-16 ABI and VIIRS and MODIS for five bands. (bottom) Mean reflectance ratio and associated error bar after applying RTM correction method. The cloud/shadow contamination filtering and SBAF factor have been applied.*

Jing, Xin, Tung-Chang Liu, Xi Shao, Sirish Uprety, Bin Zhang, and **A. Surjalal Sharma** , Validation of GOES-16 ABI VNIR channel radiometric performance with NPP VIIRS and AQUA MODIS over the Sonoran Desert", Proc. SPIE 11501, *Earth Observing Systems XXV*, 115011J (20 August 2020); https://doi.org/10.1117/12.2568051.

(*POC: Xin Jing, xinjing@umd.edu, Funding: OPPA/COSMIC-2)*

Workshops, Conferences, and Meetings

2020 Geostationary Lightning Mapper Science Meeting: The UMD lightning team (SCSB: Scott Rudlosky, CISESS:Mason Quick, Jonathan Smith, Joseph Patton and Daile Zhang) organized and presented at the 2020 annual Geostationary Lightning Mapper (GLM) Science Meeting this week (Sep. 8-10). The GLM is a near-infrared optical transient detector on the NOAA GOES-16 and -17 Satellites. Various topics were presented by the team. Scott presented "Initial GLM Climatology and Performance Assessment" and "GLM Data Query Tool." Daile presented "Downscaling of GLM Lightning Observations Using ISS-LIS Data." Jonathan presented "Status of GLM Gridded Products." Joseph presented "GLM Training Overview." Although it was the first time that the meeting went virtual, it was very successful and well attended (~80 participants for each session).



(*POC: Daile Zhang, dlzhang@umd.edu, Funding: GOES-R AWG & GOES-R PGRR)*

Input to Community Meeting on NOAA Satellites: A PowerPoint file was submitted for potential presentation during a user/industry "lean-in" session at the 2020 Community Meeting on NOAA Satellites. The file contains the input from a group of federal and Cooperative Institute employees in support of including passive microwave (MW) instruments in the next generation Geostationary platforms. The group of scientists develop PMW products that are regularly used in NWS weather forecasting. The presentation outlines the significant benefits of GEO MW and how it will revolutionize the applications of MW products in weather forecasting including monitoring of tropical cyclones and severe weather. Existing science and technology also make it feasible for GEO satellites to carry MW instruments that can realize these benefits.

(POC: Huan Meng, Huan.Meng@noaa.gov, Funding: PDRA)

Other

New Project Funded to Improve Combined Satellite and *in situ* SST Analysis: T. Smith, along with J. Carton (UMD) and B. Huang (NCEI), recently received grant funding from the Climate Observations and Monitoring Program to improve combined satellite and *in situ* SST analysis. The work done during the project "could provide an opportunity to communicate the value of your science, as well as value of NOAA programs, to a broader community including your institutional community and the general public".

(*POC: Tom Smith, tom.smith@noaa.gov, Funding: CPO)*