Weekly Report – August 15, 2025

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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TRAVEL AND MEETING REPORTS

Hong Presents at the 2025 IEEE IGARSS

NOAA NESDIS and University of Maryland's (UMD's) CISESS produces an operational snowfall rate (SFR) product from a constellation of polar-orbiting satellites. On 8 August at the 2025 IEEE International Geoscience and Remote Sensing Symposium in Brisbane, Australia, CISESS Scientist Yulan Hong, in her in-person talk titled "A Machine Learning-Enhanced Satellite Snowfall Rate Product and Its Application in Nowcasting", introduced the audience to this product. The retrieval algorithm combines one-dimensional variational data assimilation physical modeling with machine learning. SFR retrievals are enhanced with improved representations of snow microphysics and optical physics. U.S. National Weather Service (NWS) forecaster feedback has overwhelmingly indicated that the product is useful for their nowcasting operations. Through a collaboration between NOAA, UMD, NASA, and the Geographic Information Network of Alaska, the SFR product has been made available to all U.S. NWS Weather Forecast Offices. The SFR website features near real-time SFR images for several regions, with low latency and functionality to support nowcasting.

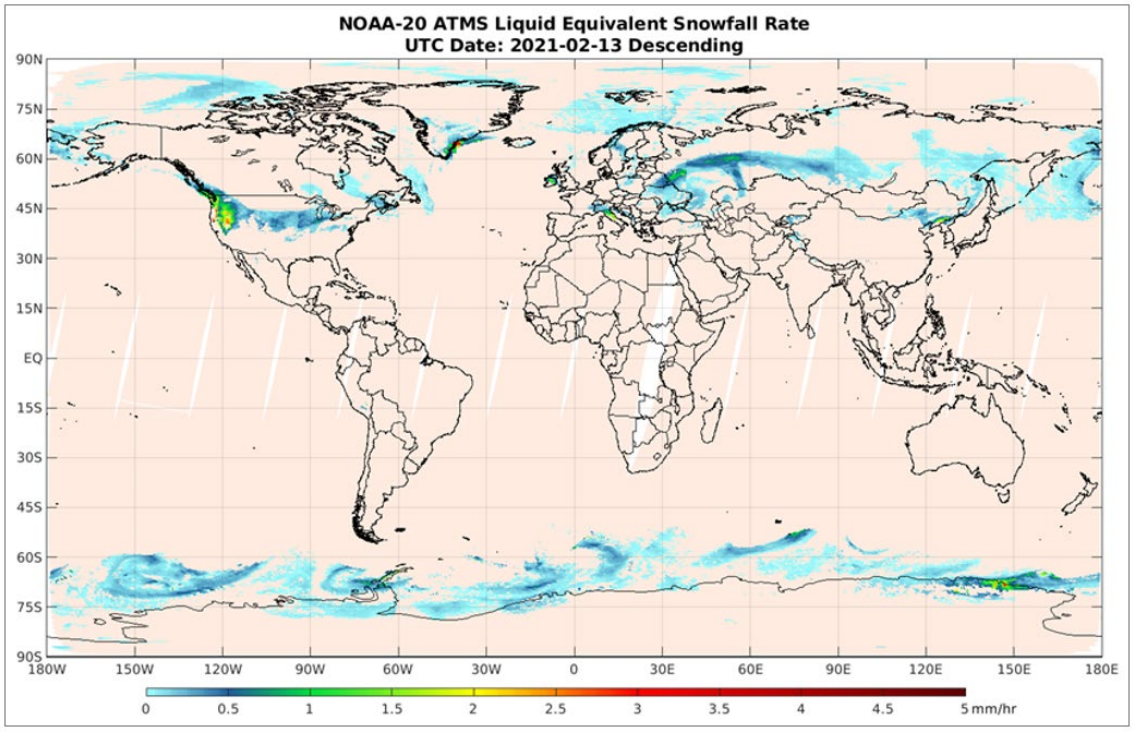

Figure. Example of the SRF product retrieved from the NOAA-12 Advanced Technology Microwave Sounder (ATM) on 13 February 2021.

(Yulan Hong, CISESS, yhong126@umd.edu, Funding: DACS, JSTAR, LEO & METOP-SG)

Wang Presents at the SPIE Optics + Photonics 2025 Conference

CISESS Scientist Wenhui Wang gave a talk on 5 August at the SPIE Optics + Photonics 2025 Conference that took place in San Diego, CA, presenting the results of an inter-comparison of S-NPP/NOAA-20/NOAA-21 Visible Infrared Imaging Radiometer Suite (VIIRS) thermal emissive bands (TEBs) I4 and I5's long-term on-orbit saturation radiances using an updated methodology. Data from these bands are widely used for active fire, fire radiative power, and thermal anomaly applications. Wang reported that, overall, S-NPP I4 and I5 have higher saturation radiances than NOAA-20 and NOAA-21, mostly due to on-orbit degradations, and that S-NPP I5 detector level saturation radiances have increased by 2–5 K after 13 years on-orbit due to responsivity degradations. Moreover, the I5 radiance limit used in the NOAA operational processing and reprocessing are suboptimal for S-NPP (especially in recent years) and NOAA-21 during its early mission (launch to 3 March 2023) and can be improved. Results from this study help improve the quality of VIIRS TEB sensor data record products and help better understand the differences in the downstream active fire and thermal anomaly products.

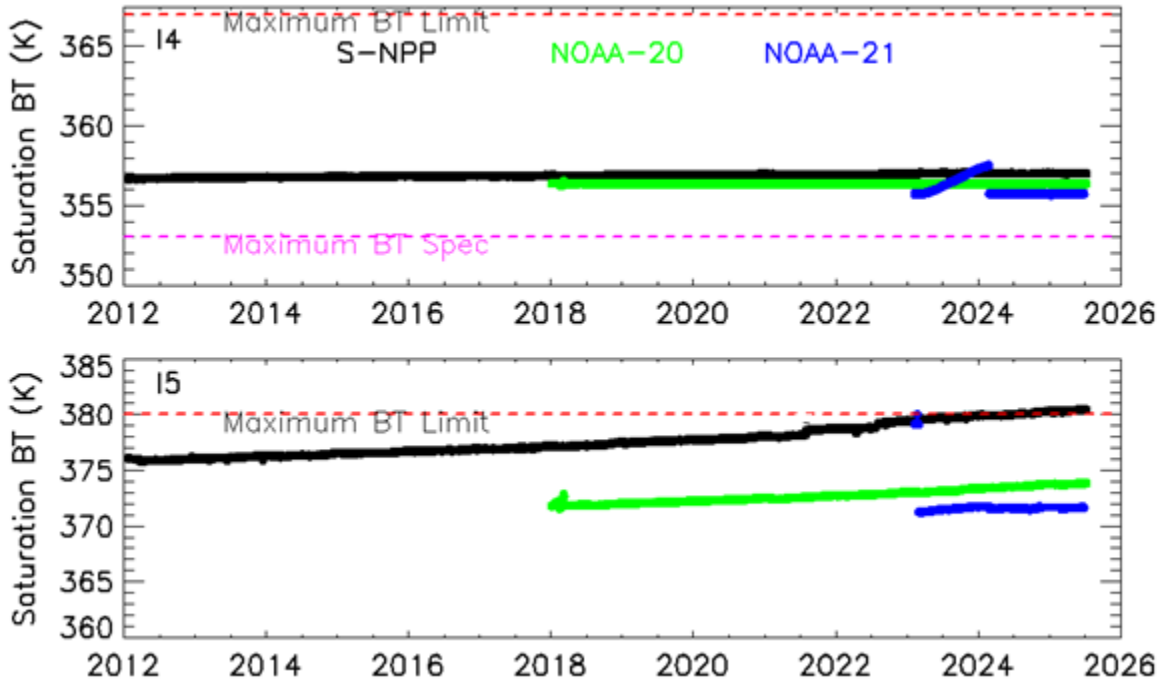

Figure. Time series of estimated S-NPP, NOAA-20, and NOAA-21 VIIRS bands I4 (top) and I5 (bottom) on-orbit saturation radiances at nadir (from launch to June 2025).

(Wenhui Wang, CISESS, whwang1@umd.edu, Funding: JSTAR & STAR)

TRAINING AND EDUCATION

NOAA Lapenta Summer Internship Research: Wildfire Identification in Active Fire Products Using Satellite-Derived Variables and Random Forest

Under the mentorship of CISESS Scientists Jingjing Peng and Yunyue Yu, Alexander Xie, a junior undergraduate student at the University of Maryland-College Park pursuing a B.Sc. in Computer Science, investigated distinguishing wildfires from other fire types (e.g., agricultural burns or industrial flares) in the Visible Infrared Imaging Radiometer Suite (VIIRS) Active Fire product using satellite-derived variables and a Random Forest classification model. This refinement will enhance the value of VIIRS fire data for disaster response, air quality assessment, and land management. Key features, such as fire radiative power, changes in albedo and normalized difference vegetation index, land cover, and detection confidence, were analyzed and used as input for training and testing. The model, trained on data across the contiguous U.S. (CONUS) from 2012–2024, demonstrated strong performance through confusion matrix and receiver operating characteristic analysis. The model was applied to recent data to identify wildfire from other fire types. Future work includes improving validation and expanding the model's generalizability beyond the CONUS region.

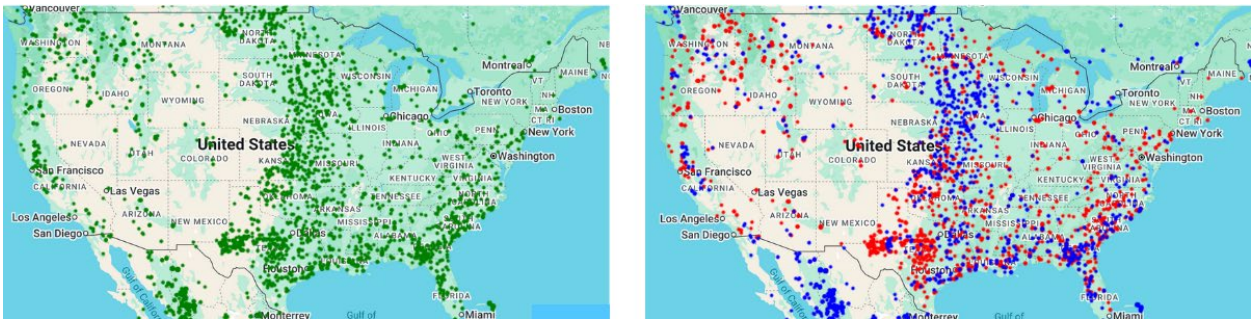

Figure. Application of the new model. (Left) Green dots show all active fires that were detected by VIIRS across the CONUS for the period 1–7 May 2025. (Right) The wildfire classifier developed by Alexander can distinguish between wildfires (red dots) and non-wildfire types (blue dots).

(Jingjing Peng, CISESS, jingjing.peng@noaa.gov, Funding: DACS, GOES-R AWG, JSTAR & METOP-SG; Yunyue Yu, CISESS, yunyue.yu@noaa.gov, Funding: DACS, GOES-R AWG, JSTAR & METOP-SG)

PUBLICATIONS

A New Ocean Heat Content Algorithm May Improve Tropical Cyclone Intensity Forecasts
Citation: Lavin, Paige D., Deirdre A. Byrne, Lewis J. Gramer, and **David S. Trossman**, 2025: Evaluating tropical cyclone intensity forecasts from HAFS using satellite-derived ocean profiles.

Wea. Forecasting, https://doi.org/10.1175/WAF-D-24-0172.1, in press. Early online release: 08 July 2025

Summary: The heat content and stratification of the upper ocean influence the strengthening of tropical cyclones, natural hazards to coastal communities once they reach land. However, it is difficult to forecast TC intensification, especially rapid intensification, which is linked to ocean heat content (OHC). CISESS Scientists Paige Lavin and David Trossman, along with colleagues from NOAA/NESDIS, the University of Miami, and the NOAA/OAR Atlantic and Oceanographic and Meteorological Laboratory, present a new NOAA Next Generation Enterprise (NGE) OHC algorithm that provides daily upper ocean temperature/salinity and OHC information at a high horizontal resolution, meant to replace the currently operational NOAA NESDIS Satellite OHC Suite (SOHCS) product. The NGE OHC algorithm involves historical ocean profile measurements, sea-level anomaly data from the Radar Altimeter Database System, and satellite-derived sea surface temperature and salinity. They examine how well this new algorithm performs through comparisons with the SOHCS product and the operational ocean-atmosphere coupled Hurricane Analysis and Forecast System (HAFS) for hurricane case studies in the Gulf and the Caribbean Sea. Overall, the authors report that the NGE OHC generally outperforms the SOHCS and HAFS products for the case studies examined, suggesting that this new algorithm could be useful for improving HAFS ocean data assimilation. They also propose looking into how information from the NGE OHC algorithm could be used to forecast the intensity and extent of coral bleaching events.

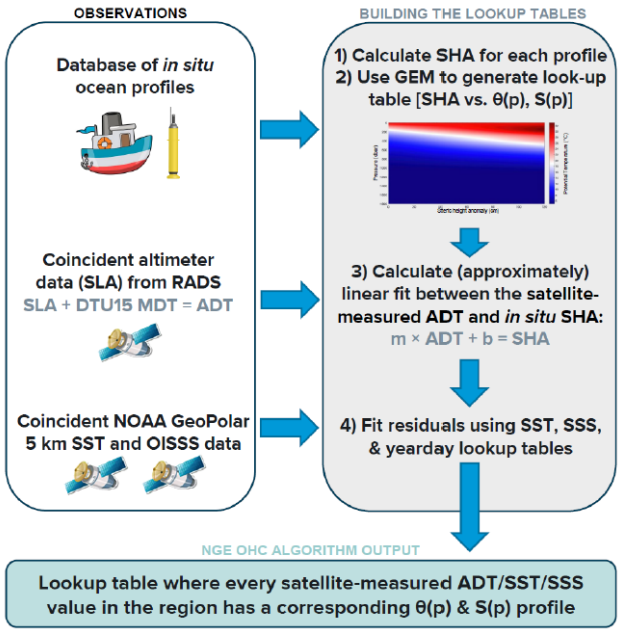

Figure. Summary of the NGE OHC algorithm. SLA = sea level anomaly; RADS = Radar Altimeter Database System; DTU15 MDT = Technical University of Denmark version 15 mean dynamic topography; ADT = absolute dynamic topography; SST = sea surface temperature; OISSS = Multi-Mission Optimally Interpolated Sea Surface Salinity; SHA = steric height anomaly; GEM = Geostrophic Empirical Mode; SSS = sea surface salinity; ϑ(p) = ocean temperature as a function of pressure; S(p) = ocean salinity as a function of pressure.

(Paige Lavin, CISESS, paige.lavin@noaa.gov, Funding: Jason & ORS; David S. Trossman, CISESS, trossman@umd.edu, Funding: AOML, Jason & ORS)

(Maureen Cribb, CISESS, mcribb@umd.edu, Funding: CISESS Task I)