Weekly Report – December 12, 2025

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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SOCIAL MEDIA AND BLOG POSTS

Winter Makes an Early Appearance

The first week of December ushered in a dump of snow across central and eastern U.S, describes CISESS Scientist Christopher Smith, GOES-R Satellite Liaison for the National Weather Service Weather Prediction Center and Ocean Prediction Center in his latest blog post. The low pressure system made its way to the Eastern Seaboard before sweeping over the Canadian Maritimes and heading out to sea, intensifying to hurricane-force levels in the north Atlantic. Snow totals of around 6 inches across central U.S. and up to 12 inches in upstate New York were reported.

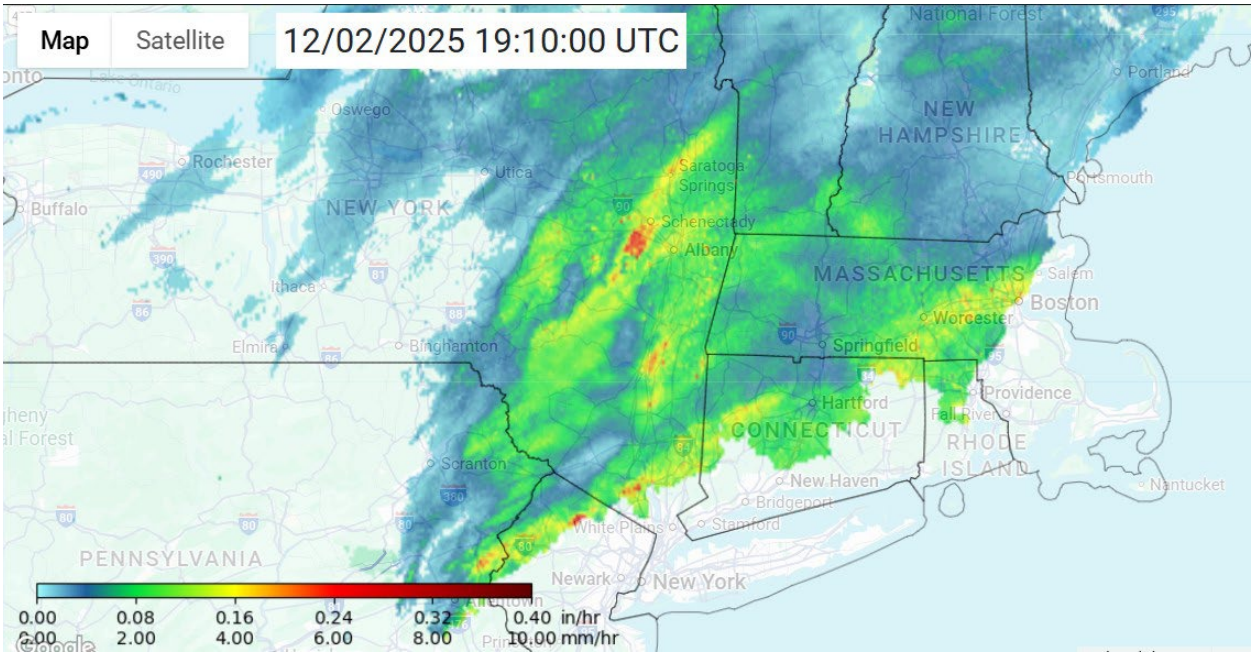


Figure: NESDIS snowfall rate product valid at 1910 UTC 02 December 2025. Red areas indicate snowfall rates of 2.4 inches per hour.

(Christopher Smith, CISESS, csmith70@umd.edu; Funding: GOES-R PGRR)

PUBLICATIONS

Using Machine Learning to Estimate Chlorophyll-a in the Chesapeake Bay

Citation: Nezlin, Nikolay P., **SeungHyun Son**, Salem I. Salem, and Michael E. Ondrusek, 2025: Chlorophyll-*a* in the Chesapeake Bay estimated by extra-trees machine learning modeling. *Remote Sens.*, **17**(13), 2151, https://doi.org/10.3390/rs17132151.

Summary: Colored dissolved organic matter and suspended sediments in coastal waters make it difficult to estimate chlorophyll-a (*Chl-a*), a critical indicator of water quality, in these waters from space. In their paper published in the journal *Remote Sensing*, CISESS Scientist SeungHyun Son and colleagues introduce a machine-learning approach applied to the Chesapeake Bay, one of the largest estuaries in the United States and an optically complex marine environment at that. The authors opted to use the computationally efficient Extra-Trees machine-learning model to predict *Chl-a* in the Bay from ocean color satellite imagery collected by the Moderate Resolution Imaging Spectroradiometer onboard the Aqua platform (MODIS-Aqua) and the Visible Infrared Imaging Radiometer Suite on the Suomi National Polar-orbiting Partnership (VIIRS-SNPP) platform. In-situ surface measurements of *Chl-a* synchronized to satellite imagery, used in model training and testing, were obtained from the Sea-viewing Wide Field-of-view Sensor Bio-optical Archive and Storage System database and from the DataHub of the Chesapeake Bay Program. They report that long-term *Chl-a* composites generated from the MODIS-Aqua (> 20 years) and VIIRS-SNPP (> 10 years) datasets and in-situ measurements agree well in terms of spatiotemporal patterns, suggesting that their model is reliable. They also note that freshwater inflow from the Susquehanna River is a key driver of *Chl-a* distribution in the Chesapeake Bay.

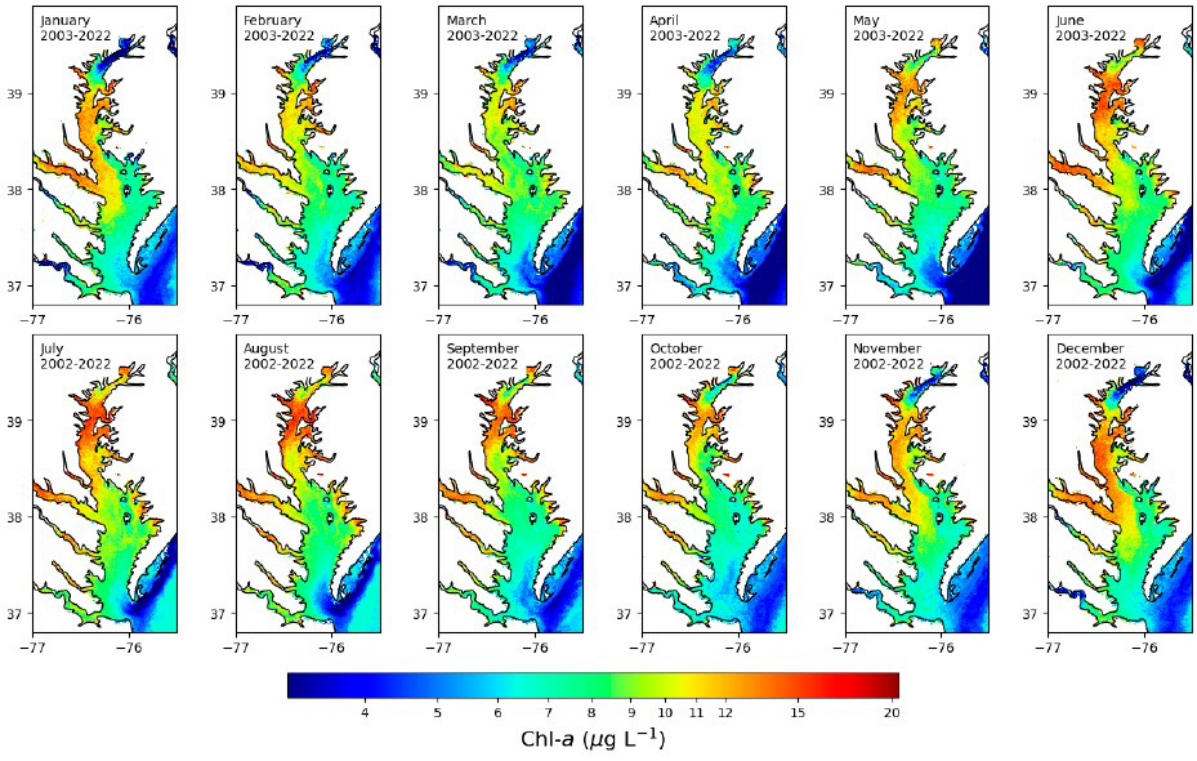


Figure: Spatial distributions of Chl-a typical for each month averaged over the entire period of satellite observations in the Chesapeake Bay predicted using the Extra-Trees machine learning model from MODIS-Aqua-retrieved reflectances.

(SeungHyun Son, CISESS, shson@umd.edu; Funding: ORS)

OTHER

Seed Grant Mid-Term Report: *Development of High-resolution Satellite Soil Moisture Retrievals Through Integrating GNSS-Reflectometry Observations*

The goal of this project led by CISESS Scientist Jifu Yin is to develop high-resolution satellite soil moisture (SM) retrievals by integrating Global Navigation Satellite System (GNSS)-Reflectometry (GNSS-R) L-band observations from GNSS missions, namely, the Cyclone Global Navigation Satellite System (CYGNSS) and SPIRE. Yin reports that the first half year of this project was spent comparing reflectivity and signal-to-noise-ratio observations from CYGNSS and SPIRE observations, developing a machine-learning model for retrieving CYGNSS SM observations at a 9-km spatial resolution, and collecting and processing P-band Radiometer Inferred Soil Moisture airborne-based brightness temperature (T_b) observations and ground SM observations in layers from 0-5 cm down to 35-40 cm soil depth. Also, a journal article was submitted to the journal *IEEE Transactions on Geoscience and Remote Sensing*, describing how to generate reliable SM data from GNSS-R and highlighting the significant potential of fusing data from multiple satellite constellations to achieve near-global coverage in the future. Another article is about to be submitted, showing that P-band T_bs agree the best with SM observations in comparison with L-band T_bs.

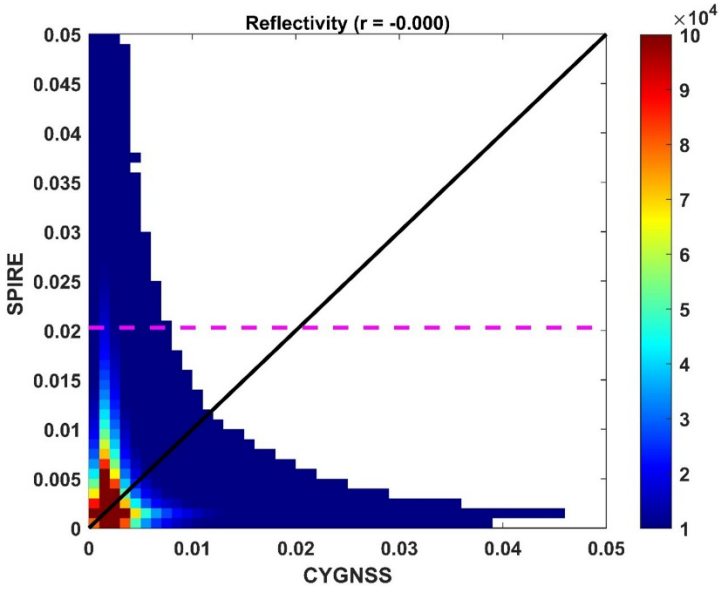
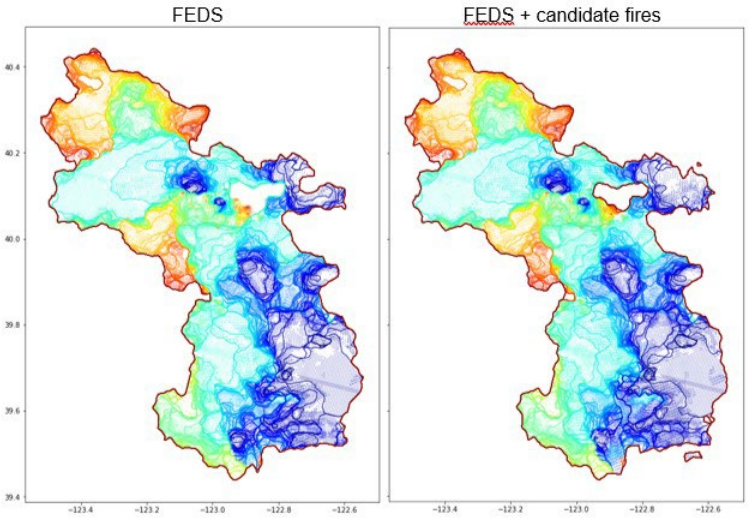


Figure: Scatter density plot of daily CYGNSS and SPIRE reflectivity observations at the pixel level over the 37°S–37°N latitudinal band from January 25 to June 10, 2024. One-to-one (black) and linear regression (pink) lines are shown. The weak correlation coefficient indicates the tremendous differences between CYGNSS and SPIRE observations. This suggests that CYGNSS- and SPIRE-based SM retrieval algorithms should be developed separately before creating a combined CubeSat product.

(Jifu Yin, CISESS, jifu.yin@noaa.gov; Funding: IIJA, JSTAR GCOM & LEO)

Related UMD Work: Using VIIRS Information to Improve Wildfire Tracking in the Western U.S.



Monitoring wildfires from space has limitations, such as smoke and cloud obscuration and the omission of small or low-intensity fires. Fire detection algorithms using information from the Visible Infrared Imaging Radiometer Suites (VIIRS) onboard the Suomi National Polar-orbiting Partnership satellite and the NOAA-20 satellite label pixels as active fire pixels or potential, i.e., candidate, fire pixels. In a paper published in the journal *Remote Sensing of Environment*, Earth System Science Interdisciplinary Center scientists Shane Coffield and Tempest McCabe and colleagues developed an approach that uses Level-2 quality assurance information to improve fire tracking. For more information, see https://essic.umd.edu/improving-wildfire-tracking-with-satellite-detection/. (Summarized by Maureen Cribb, mcribb@umd.edu, Task I)

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