Weekly Report – May 30, 2025

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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HIGHLIGHTS FOR NESDIS LEADERSHIP

Use-Inspired Science

CISESS Scientist Participates in the 2025 Hazardous Weather Testbed Exercise

The 2025 Hazardous Weather Testbed was held last week and in attendance (virtual) as an observer representing the NOAA/NWS Operations Proving Ground was CISESS Scientist Javier Villegas Bravo. While NWS forecasters were assessing live weather on the Advanced Weather Interactive Processing System-II, three satellite products in active use by the forecasters were evaluated. The products were GREMLIN, a GOES-R derived simulated reflectivity field that uses machine learning to map passive imagery to Multi-Radar/Multi-Sensor System composite reflectivity; OCTANE, a suite of products derived from GOES imagery to diagnose cloud-top divergence, cloud-top cooling, and cloud-top wind speed and direction; and ProbSevere Lightning Cast, a tool that maps GOES Advanced Baseline Imager imagery to Geostationary Lightning Mapper flashes in the next 60 minutes using machine learning to give probability contours of lightning forecasted in the next 60 minutes. These products were shown to be especially useful in radar-sparse regions of the U.S. and over the open ocean in radar-denial trials over the course of the week, especially in the absence of mesoscale analyses, crucial to diagnosing convection.

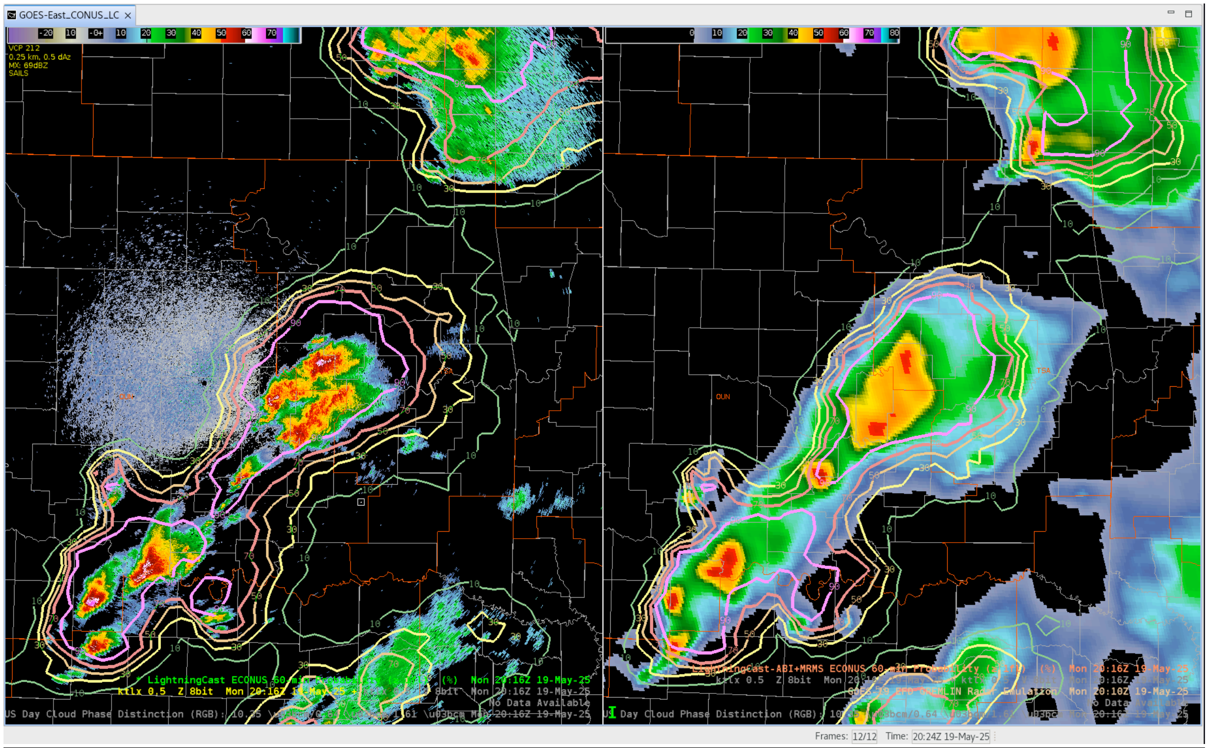

Figure. Contours showing the probability of severe lightning: output from (left) the NEXRAD radar and (right) GREMLIN.

(Javier Villegas Bravo, CISESS, vllgsbr2@umd.edu; Funding: GOES-R PGRR)

PUBLICATIONS

Detecting Convective Rainfall from Satellite Sensors

Hong, Yulan, and **Veljko Petkovic**, 2025: Perspectives on convective rainfall from passive and active microwave sensors. *J. Geophys. Res. – Atmos.*, 130, e2024JD043005, https://doi.org/10.1029/2024JD043005.

Summary: CISESS Scientists Yulan Hong and Veljko Petkovic assess how well passive and active microwave sensors can discriminate between shallow and deep convective rainfall under different meteorological conditions in their recent publication in the *Journal of Atmospheric Science – Atmospheres*. Data compared are from the active dual-frequency precipitation radar onboard NASA's Global Precipitation Measurement Mission (GPM) observatory (KuPR), the passive GPM Microwave Imager (GMI), and the NOAA Multi-Radar Multi-Sensor System that serves as ground validation for the GPM (GV-MRMS), providing gauge-corrected radar precipitation products. Knowing the rainfall type is critical to retrieving accurate rainfall rates, but challenges remain in determining rainfall type from spaceborne instruments. Intercomparisons were made over the contiguous U.S. from April 2014 to December 2022 using GMI, KuPR, and GV-MRMS products and over the globe from April 2014 to June 2023 for GMI and KuPR observations only. Hong and Petkovic found that KuPR convective volume fraction estimates agree the best with those from GV-MMRS. They also report that better agreement in convective rain detection between KuPR, GMI, and GV-MRMS happens under deep convection environmental conditions. Poor agreement is seen under conditions less favorable for deep convection. In terms of trends, KuPR has an overall stronger decreasing trend in both the rain rate and convective rain occurrence frequency, especially along the Intertropical Convergence Zone (ITCZ), for the warm-rain scenario (storm tops below the freezing height). For the cold-rain scenario (storm tops above the freezing height), KuPR and GMI show similar trends when it comes to convective rain occurrence frequency and convective and total rain rates, i.e., decreasing trends over the Pacific ITCZ and eastern Pacific Ocean and increasing trends over the west Pacific Ocean warm pool area and Atlantic ITCZ. They conclude that rain type information from either of the satellite precipitation products can be used for deep convection systems with confidence but not so for shallow cloud systems.

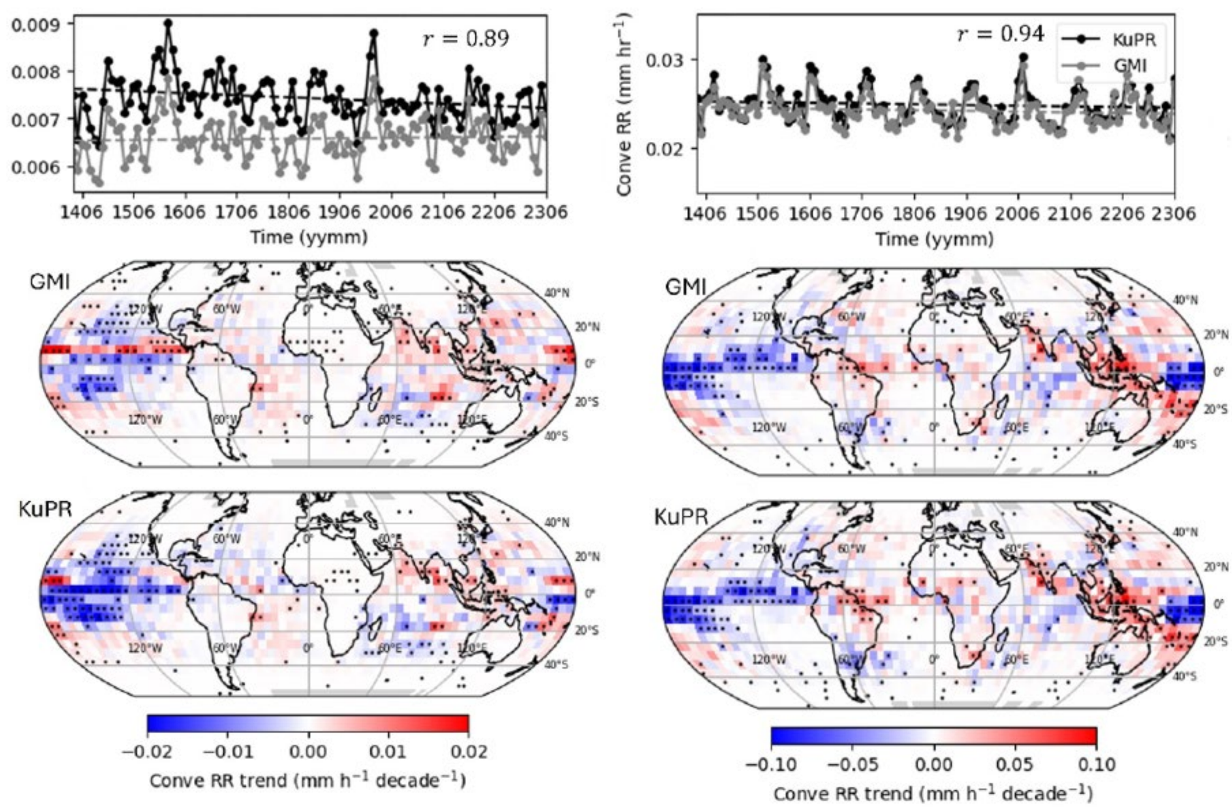

Figure. (Top) Linear trends for convective rainfall under warm-rain (left) and cold-rain (right) conditions. Black and gray symbols represent results for KuPR and GMI, respectively. (Middle and bottom) Spatial distributions of GMI and KuPR trends, respectively. Black dots indicate statistical significance at the 95% confidence level. Light gray indicates no rain data sample.

(Yulan Hong, CISESS, yhong126@umd.edu, Funding: DACS, JSTAR, METOP-SG; Veljko Petkovic, CISESS, veljko@umd.edu, Funding: JSTAR, JSTAR GCOM, METOP-SG)
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