Weekly Report – July 11, 2025

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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HIGHLIGHTS FOR NESDIS LEADERSHIP

Data and Information

Mapping the Extent of the Devastating July 4 Texas Flash Flood Event

The July 2025 flood event in Texas Hill Country, fueled by remnants of Tropical Storm Barry, resulted in, to date, 120 fatalities, including 28 children at riverside camps, the deadliest U.S. inland flood since 1976. The Flash Flood Alley's landscape features narrow valleys with thin, clay-rich soils overlying fractured limestone bedrock. This geology forces **>70% of rainfall** to become surface runoff (minimal infiltration). Valleys like the Guadalupe River basin constrict floodwaters and accelerate flow velocities. Even moderate rain can trigger rapid rises. Two hundred and fifty-four mm of rainfall fell in three hours, midnight July 3–4 at Hunt (500% of the July average), exceeding a 1,000-year recurrence interval. On 4 July, the Guadalupe River rose 8 m in 45 minutes, overwhelming Camp Mystic (152 m from the channel). The unique atmospheric-topographic nexus enabled rapid runoff amplification. It was cloudy on 4 July, and the Visible Infrared Imaging Radiometer Suite (VIIRS) daily 375-m floodwater product was unable to provide usable flood inundation information. CISESS Scientist Qingyuan Zhang and the NOAA STAR Flood team have been working to order synthetic aperture radar (SAR) images and produce SAR flood inundation products. One Sentinel-1 image on 4 July was acquired and processed, and the NOAA STAR Flood team produced a SAR flood inundation map based on this image (see figure). The 4 July SAR map captured some flood inundated areas. All flood products are delivered to the RealEarth platform at the Space Science and Engineering Center at the University of Wisconsin-Madison for public use.

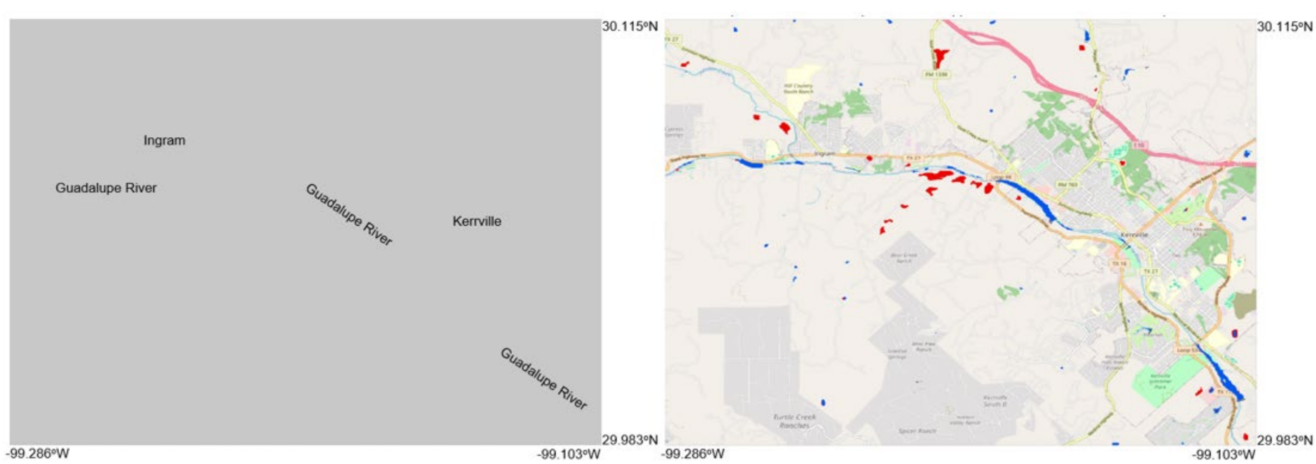

Figure. Two images showing the same geographical area. (Left) VIIRS 375-m daily floodwater extent product on 4 July 2025, with the locations of the Guadalupe River and the towns of Ingram and Kerrville superimposed. Cloudy conditions were in place so no flood inundation information was available, hence the gray background. (Right) The SAR flood inundation map on 4 July 2025, showing some flooded areas (in red).

(Qingyuan Zhang, CISESS, qyzhang@umd.edu, Funding: IIJA & IRA)

TRAVEL AND MEETING REPORTS

Fang Pays a Visit to Earth Networks in Germantown

On 2 July 2025, CISESS Scientist Guangyang Fang visited the Earth Networks in Germantown, MD, to upgrade the Raspberry Pi camera system used for lightning observations (see figure, left image). The Raspberry Pi operating system was updated to the latest version, and the existing recording script was replaced with the new Boltcam application, which includes remote live streaming capabilities. During the visit, Fang also assisted in deploying a slow antenna (see figure, right image) that was developed by Dr. Jeff Lapierre, the point of contact at Earth Networks. A slow antenna is a specialized sensor designed to detect slow (low-frequency) electric field changes in the atmosphere, which are typically associated with lightning discharge and other transient electromagnetic events. Earth Networks is a recognized industry leader in lightning monitoring, mapping, and detection. This visiting activity is part of an ongoing collaboration between UMD/ESSIC and Earth Networks. The two teams will share data, including video footage of lightning strikes captured during the summer thunderstorm season, as well as data from the Earth Networks Total Lightning Network.

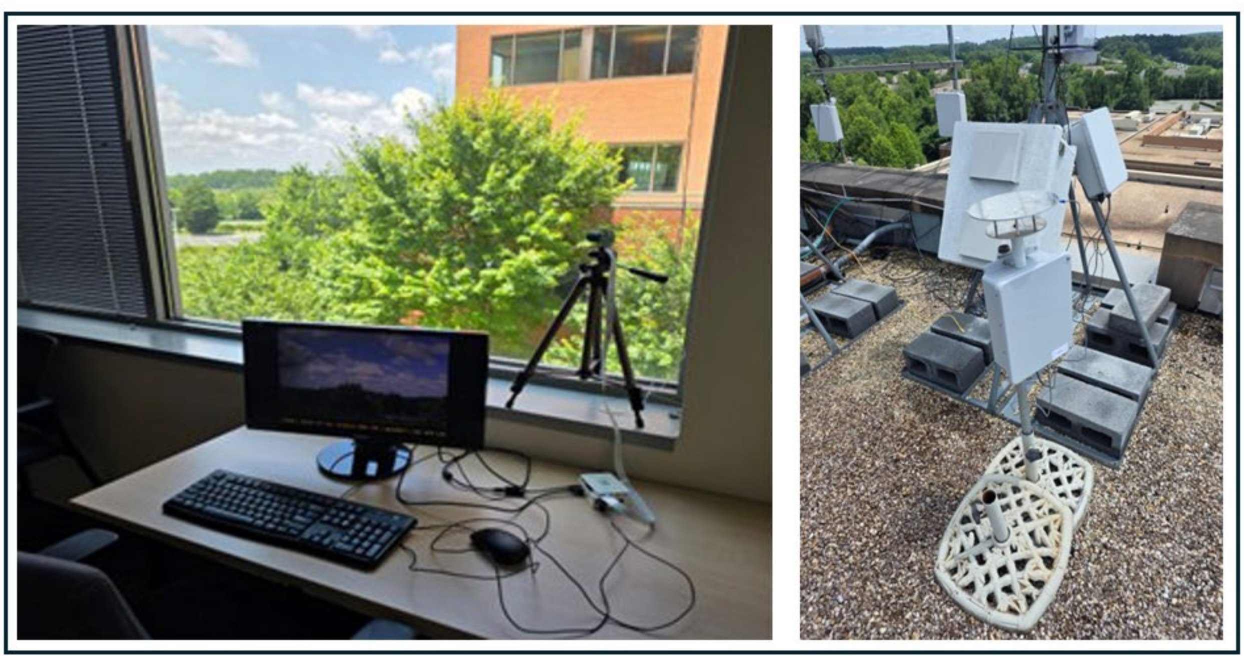

Figure. (Left) Updated Raspberry Pi camera for lightning observations of UMD/ESSIC at Earth Networks in Germantown, MD. (Right) Slow antenna developed by Jeff Lapierre from Earth Networks.

(Guangyang Fang, CISESS, gfang@umd.edu, Funding: GEO-XO, GOES-R AWG & GOES-R PGRR)

PUBLICATIONS

Introducing a High-resolution Atlas of U.S. Offshore Wind Profiles
Citation: Frech, James, Korak Saha, **Paige D. Lavin**, Huai-Min Zhang, James Reagan, and Brandon Fung, 2025: A new gridded offshore wind profile product for US coasts using machine learning and satellite observations. *Wind Energ. Sci.*, **10**, 1077–1099, https://doi.org/10.5194/wes-10-1077-2025.
Summary: The U.S. offshore wind energy industry is a growing endeavor. As such, stakeholders in this industry need information about winds from the ocean surface up to wind turbine hub heights of ~100 m to 200 m in the case of larger wind turbines. Accurate wind speed observations within the rotor layer of wind turbines are scarce, with sparsely spaced coastal meteorological towers, as well as site-specific sodars and lidars, the only sources of information. Using satellite-based products, with their high spatiotemporal coverage, offers a way of developing detailed wind speed profile gridded datasets for practical use by stakeholders. In a paper published in the journal *Wind Energy Science*, CISESS Scientists James Frech and Paige Lavin and colleagues use random forest regression (RFR), a machine-learning technique, to accurately estimate offshore wind speed profiles on a 0.25° grid at a six-hour resolution from 1987 to the present. Their methodology is applicable to the coastal regions of the contiguous U.S. and Hawaiʻi and uses satellite-derived surface wind speeds from the NOAA NCEI Blended Seawinds version 2.0 product as input. They report that their RFR model has the advantage of requiring fewer input variables and outperforms traditional methods when it comes to estimating wind speeds at wind turbine hub heights in the presence of high vertical wind shear and low-level jets (LLJs). In future work, among other things, they plan to find a way to predict the wind speed gradient inversion of an LLJ, a current limitation of their model. The final product generated by the model, NOAAOffshoreWindProfiles-USA, will be archived with NCEI for public access.

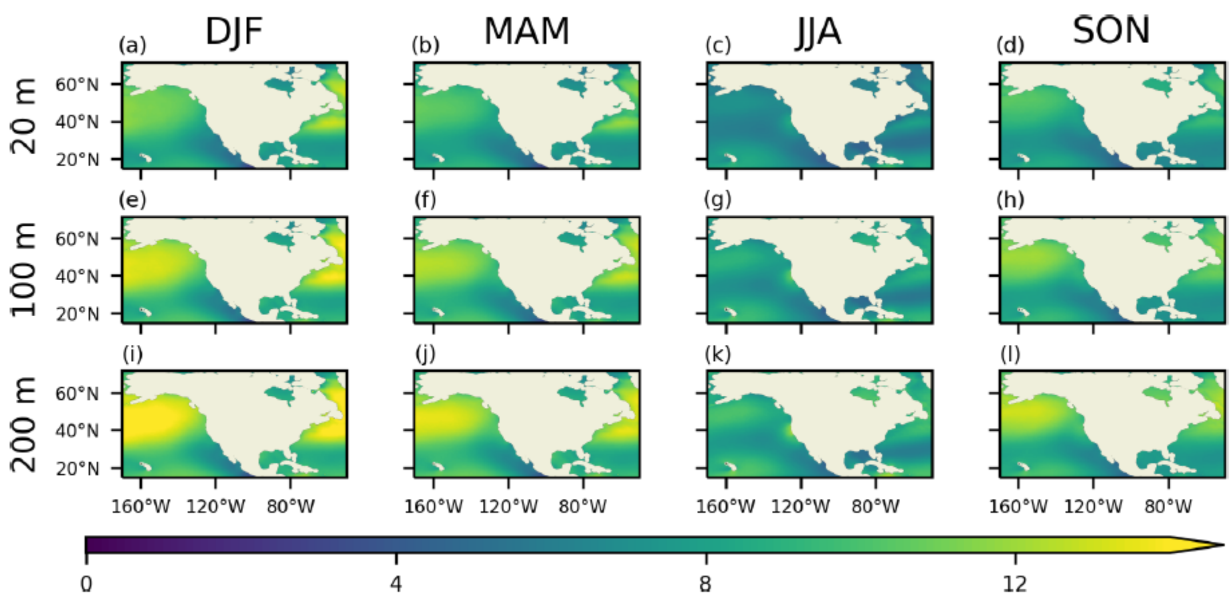

Figure. Seasonal climatologies (1987–2022) for wind profiles extrapolated from NOAAOffshoreWindProfiles-USA (unit: m s^{-1}) at (a-d) 20, (e-h) 100, and (i-l) 200 m. DJF: December, January, February; MAM: March, April, May; JJA: June, July, August; SON: September, October, November.

(James Frech, CISESS, james.frech@noaa.gov, Funding: NCEI; Paige Lavin, CISESS, paige.lavin@noaa.gov, Funding: Jason & ORS)

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