Weekly Report – July 03, 2025

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

Submitted by: Maureen Cribb
Email: mcribb@umd.edu
Phone: 301-405-9344

Date of Submission: 03 July 2025

TRAVEL AND MEETING REPORTS

CISESS Participation at the Living Planet Symposium

The triennial Living Planet Symposium is a major international conference focused on Earth observation, organized by the European Space Agency. It serves as a platform for leading scientists, researchers, and industry professionals to discuss the latest advancements in Earth science, applications of satellite data, and the role of space-based technology in addressing environmental and societal challenges. CISESS Scientist Christopher Buchhaupt and his graduate research assistant from the University of Maryland's Department of Atmospheric and Oceanic Science, Pittayuth Yoosiri, participated in this year's symposium held from 22–27 June in Vienna, Austria. In his oral presentation titled "Novel Sea-State Observations from Synthetic Aperture Radar Altimetry - Steps Taken and the Road Ahead", Buchhaupt demonstrated how newly developed algorithms for retracking unfocused synthetic aperture radar altimetry signals enable the estimation of a broader set of wave parameters, highlighting the retrieval of vertical wave motion variability and mean line-of-sight wave velocity and outlining future directions to extend this capability to an even wider set of estimable sea-state parameters. These advancements contribute to more robust and detailed satellite-based observations of ocean dynamics, with direct benefits for coastal engineering, weather forecasting, maritime safety, and the optimization of shipping routes. Yoosiri presented a poster titled "An Evaluation of Sea Level Estimation from Surface Water and Ocean Topography (SWOT) Ka-band Radar Interferometer (KaRIn) Altimetry in the Southern Chesapeake Bay", illustrating the SWOT KaRIn altimeter's potential to increase sea level data coverage in near-coast environments, regions where radar altimeters have traditionally struggled to make valid measurements. SWOT measurements hold great potential as a spaceborne source of sea-level measurements, even in regions with complex coastal geometry, improving sea-level records for coastal settlements and infrastructure.

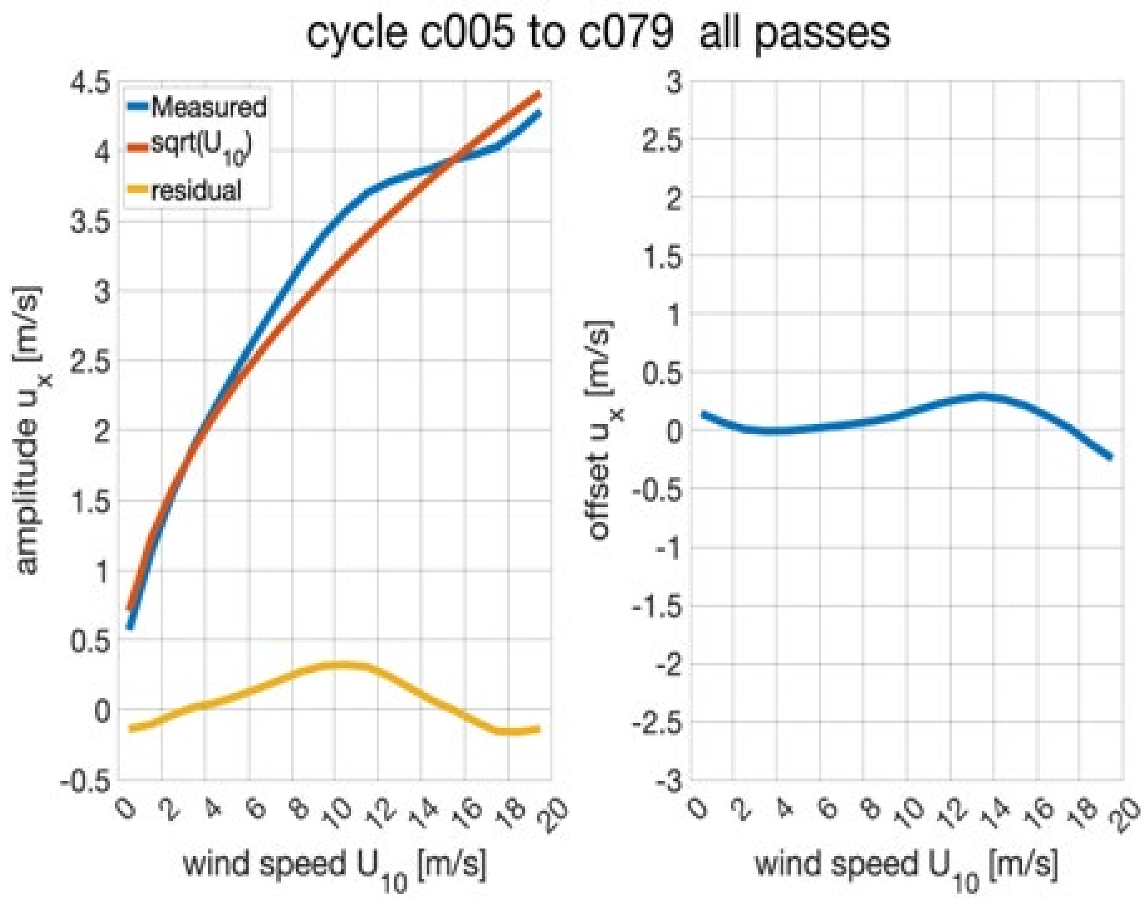

Figure. Mean line-of-sight velocity u_x parameters best fitting directional wind speeds U_{10} from ERA5. The fitting function is defined as $u_x = amplitude \cdot cos(wind_{direction}) + offset$. The left plot provides the best fitting amplitude while the right plot gives the offset. Both parameters are given in meters per second. The latest algorithms described by Buchhaupt can estimate nearly offset-free mean line-of-sight wave velocities (u_x) with respect to directional wind speeds from the ERA5 model.

(Christopher Buchhaupt, CISESS, cbuchhau@umd.edu, Funding: Jason)

PUBLICATIONS

Promising Results from Commercial CubeSat Data Assimilation
Citation: Miller, William, Yong Chen, Shu-peng Ho, and **Xi Shao**, 2025: Exploring the value of Spire GNSS radio occultation bending angle assimilation for improving HWRF model forecasts of Atlantic hurricane intensity. *Wea. Forecasting*, **40**(6), 809–827, https://doi.org/10.1175/WAF-D-24-0092.1.
Summary: Radio Occultation (RO) is a method of obtaining atmospheric profiles of temperature and humidity from simple space-based radio signals, most often found in global positioning and

navigation satellites. The advantage of these profiles is their high vertical resolution and their near-global coverage. NOAA already feeds RO data from the COSMIC-2 constellation into its numerical weather models but is now evaluating whether purchasing such data from commercial satellite providers might be useful and cost-effective. This article is about a CISESS study to assess the use of the observations from Spire's constellation of 30 CubeSats in NOAA's hurricane forecasting model. William Miller and Xi Shao, along with their NOAA colleagues, ran deletion tests (also known as Observation System Experiments–OSEs), which compared the results model runs with no RO data assimilation (control), with just COSMIC-2, and with both COSMIC-2 and Spire data. They selected four hurricanes from 2022 to simulate with these different observational inputs (see figure). They found that the inclusion of the Spire data did offer meaningful improvements to the numerical weather model's tropical cyclone forecasts. The new RO data reduced the short-term forecast errors in lower-tropospheric specific humidity and temperature. This was due to its more accurate observations and lower number of quality control rejections at 2.5–3.5 km height layers. It also mitigated the model bias for cyclone overintensification at longer forecast lead times by reducing errors in minimum pressure during the 24- to 36-hour forecast window. In these instances, the effects were statistically significant.

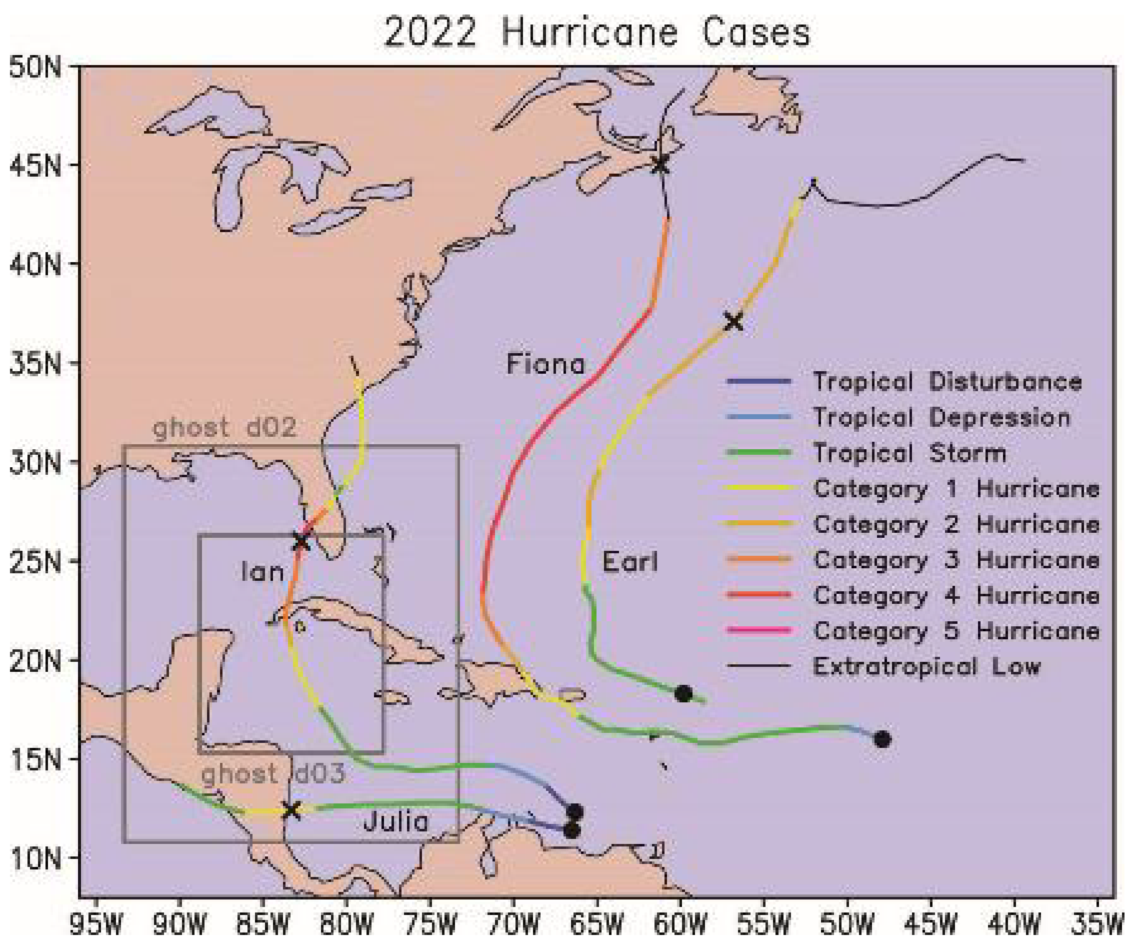

Figure: Observed tracks of the four 2022 Atlantic hurricanes selected for the HWRF forecast experiments, with colors indicating the stage of TC development at the time.

(William Miller, CISESS, william.miller@noaa.gov, Funding: COSMIC-2; Xi Shao, CISESS, xshao@umd.edu, Funding: COSMIC2, JSTAR & STAR)

A Useful Algorithm for Examining the Water Quality of the Chesapeake Bay (and Elsewhere)
Citation: Son, Seunghyun, Nikolay P. Nezlin, and Veronica P. Lance, 2025: Assessing water clarity in the Chesapeake Bay using satellite-derived Secchi disk depth. *Int. J. Appl. Earth Obs. Geoinf.*, **140**, 104574, https://doi.org/10.1016/j.jag.2025.104574.
Summary: A way to gauge the "dirtiness" of a water body is by measuring the Secchi disk depth (SDD), which is done by lowering a black-and-white disk into the water and noting the depth at which it disappears. Although straightforward and inexpensive, this method is labor intensive, providing only spatiotemporally limited information. Another way of assessing water quality is by analyzing reflectance information from Earth-observing satellites using a recently improved semi-analytical SDD algorithm, applicable on a global scale. In their recent paper, CISESS Scientist Seunghyun Son and colleagues evaluate how well this model works when applied to the optically complex Chesapeake Bay (CB) using Moderate Resolution Imaging Spectroradiometer (MODIS, 2002–2022) and Visible Infrared Imaging Radiometer Suite (VIIRS, 2012–2023) data. In terms of the spatial distribution of SDD across the CB, SDDs are shallower in the northern CB and deeper in the central and lower parts of the CB. They also find unsurprising seasonal and interannual variations in SDD. Overall, satellite-retrieved SSD agree well with in-situ measurements of SDD, lending credence to the use of this SDD algorithm with these satellite data and other ocean-color satellite data to assess the water quality of turbid coastal and inland water bodies globally.

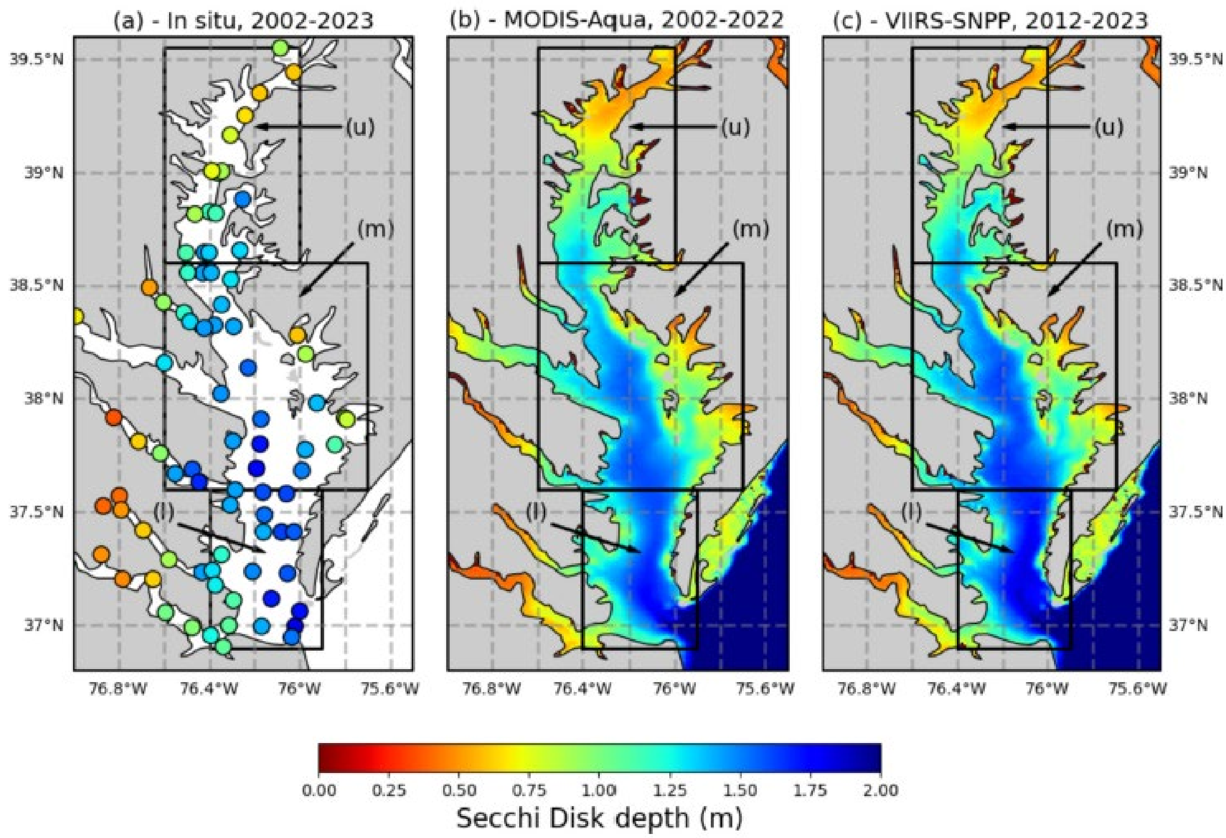

Figure. Mean SDDs in the CB: (a) in-situ measurements and climatology SDD composites of (b) MODIS on the Aqua platform and (c) VIIRS on the Suomi National Polar-orbiting Partnership platform.

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

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