Weekly Report – July 18, 2025

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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TRAINING AND EDUCATION

A Great Start to the 2025 CISESS Summer Internship Program

The Summer Internship Program is the hallmark of CISESS educational outreach activities. This year, CISESS has 28 summer interns, including 5 high schoolers, 21 undergraduates, and 2 graduate students, with 28 mentors. Their projects cover a diverse range of innovative research topics, such as “Using a Machine Learning Method to Explore Hyperspectral Infrared Satellite Observations”, “Python-based AI/ML Module Development for Satellite Sensor Radiance Validation and Cloud Identification”, “A Scalable Framework for Estimating Heatwave-Related Mortality Risk”, and “Creating Virtual Reality Tutorials for High School and Undergraduate Geoscience Education”. There was an in-person welcome gathering on 16 June from 2:00-3:00 PM. There were 33 people, including 15 summer interns, in attendance. A social event was held on 11 July from 2:00-3:30 PM. Thirty-seven people, including 14 summer interns, mingled and shared research experiences over pizza, cookies, and refreshing drinks. Upcoming activities include weekly brown bag lunches, featuring informal talks by CISESS scientists, and end-of-summer presentations in August. It is a privilege working with these talented young researchers, and we look forward to hearing the results of their hard work.

Figure: Top Row: CISESS Summer Internship Program welcome gathering on 16 June 2025 (Photo credit: K. Cooney). Bottom: CISESS Summer Intern Party on 11 July 2025 in College Park, MD at the University of Maryland ESSIC Building (not all attendees pictured). Photo credit: M. Baith.

(Kate Cooney, CISESS, kscooney@umd.edu, Funding: CISESS Task I)

TRAVEL AND MEETING REPORTS

Updating the Status of the World Ocean Database

CISESS Scientist Alexey Mishonov attended in person the OCEANS2025 Conference in Brest, France in mid-June, where he gave a talk titled "Monitoring ocean climate with the World Ocean Database". His talk gave an overview of the World Ocean Database (WOD), covering topics such as instrument platforms (which include marine mammals equipped with sensors attached to their bodies) and their evolution since the 1960s and highlighting the leaps and bounds in the number of casts included in the WOD over the years (just under two million casts in the 1974 version of the WOD to ~19 million casts in the current version of the WOD). How these data, for example, temperature, salinity, phosphorus, and silicate at the ocean surface or at different depths or both, provide a picture of the state of the global ocean was also illustrated. Mishonov ended his talk with instructions on how to submit data to the WOD and how to obtain data from the WOD. A paper based on this talk has been accepted for publication in IEEE Xplore.

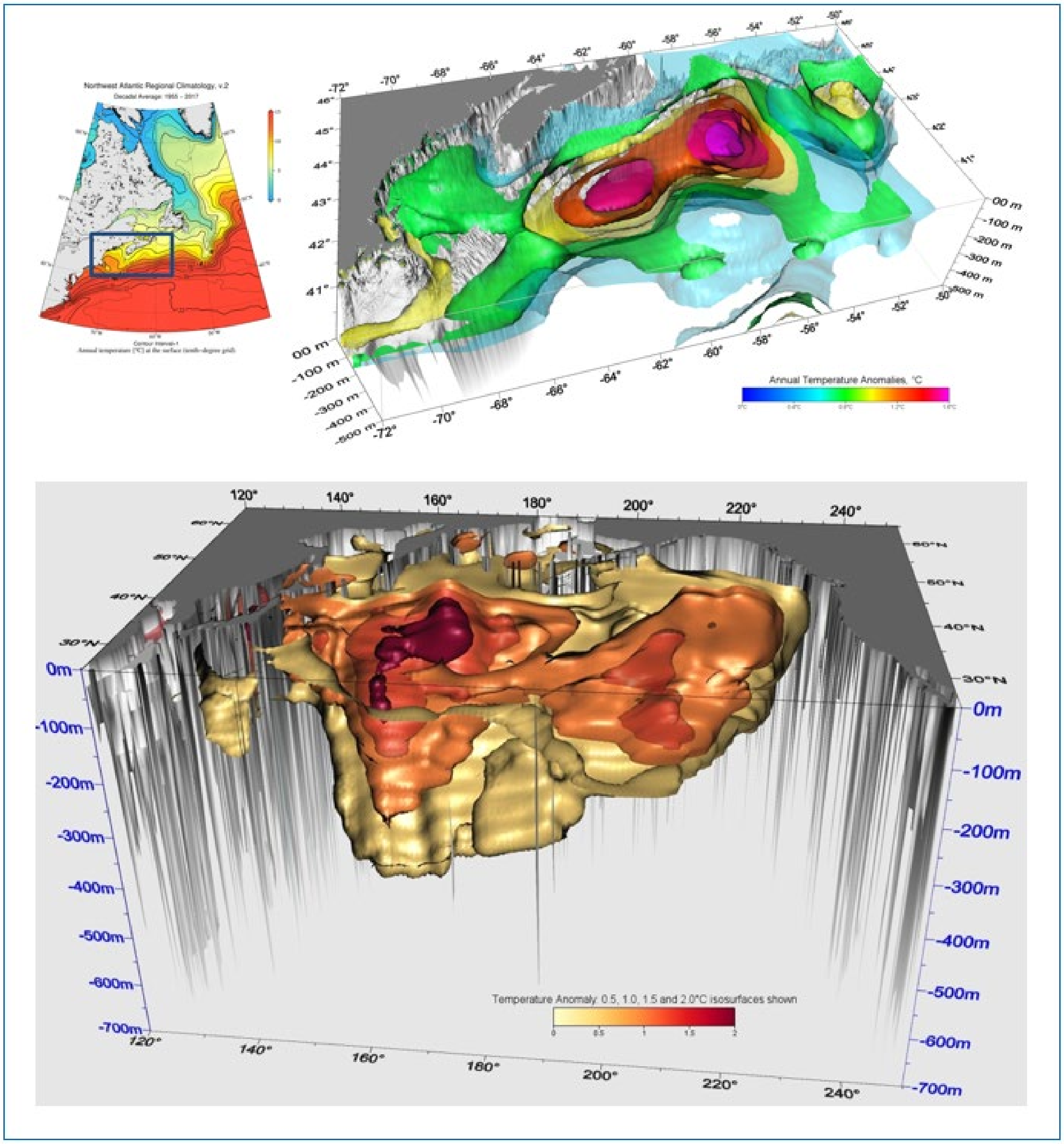

Figure. Applications of the data that are archived in the WOD. Top: 1995–2017 versus 1965–1984 annual temperature anomalies in the Gulf of Maine and the Nova Scotia Shelf (https://doi.org/10.1002/lno.11892). Bottom: 2021 versus 1981–2010 baseline in annual temperature anomalies in the Northern Pacific (https://doi.org/10.1007/s00376-022-1461-3).

(Alexey Mishonov, CISESS, alexey.mishonov@noaa.gov, Funding: NCEI)

PUBLICATIONS

Using Machine Learning to Predict Fire Behaviors

Citation: Hung, Wei-Ting, Barry Baker, **Patrick C. Campbell**, **Youhua Tang**, Ravan Ahmadov, Johana Romero-Alvarez, Haiqin Li, and Jordan Schnell, 2025: Fire intensity and spRead forecAst (FIRA): A machine learning based fire spread prediction model for air quality forecasting application. *GeoHealth,* **9**(3), https://doi.org/10.1029/2024GH001253.

Summary: Operational air quality forecast models estimate smoke emissions from wildfires based on the latest available satellite fire products. However, these models assume that fire characteristics, like location and intensity, do not change over time, an unrealistic assumption. To address this issue, CISESS Scientists Wei-Ting Hung, Patrick C. Campbell, and Youhua Tang and colleagues present a novel machine-learning-based fire-spread model called Fire Intensity and spread forecAst (FIRA) that predicts fire spread and intensity of fire radiative power (FRP) simultaneously in the following hour of a given time point. Model output can also be used to generate multi-hour forecasts. For model training and evaluation purposes, datasets from 2020 over the contiguous U.S. and from the 2024 California Park Fire were used. The authors show that FIRA predictions of fire spread agree well with satellite measurements. However, they point out that FIRA-predicted FRPs are generally underestimated but could be improved by applying scaling factors to FRP values. They note limitations of FIRA, such as problems with predicting nighttime fires and uncertainties due to the training data and underlying assumptions made to filter certain fire types. The authors plan to improve FIRA by refining some assumptions, like the definition of dying fires, and including more input variables that better represent land surface characteristics and fire behaviors. Application of FIRA globally is also under consideration.

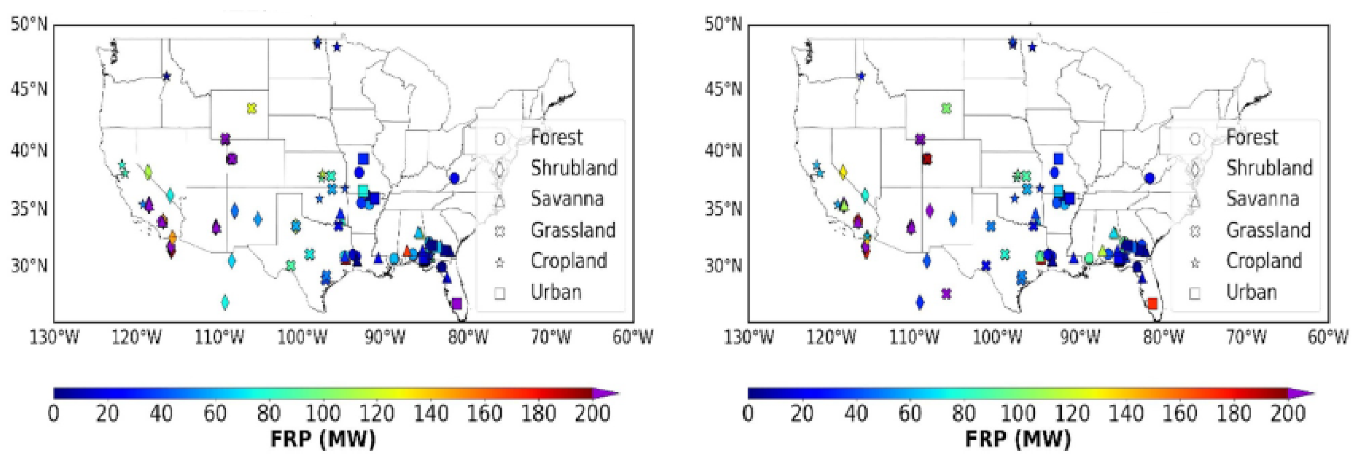

Figure. Example of fire radiative power (FRP; unit: megawatts, MW) from (left) satellite-based Regional ABI and VIIRS fire Emissions estimates and (right) FIRA predictions.

(Wei-Ting Hung, CISESS, whung@gmu.edu, Funding: ARL; Patrick C. Campbell, CISESS, patrick.c.campbell@noaa.gov, Funding: ARL; Youhua Tang, CISESS, youhua.tang@noaa.gov, Funding: ARL)

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