

ISSUE 04

UFS INSIGHTS

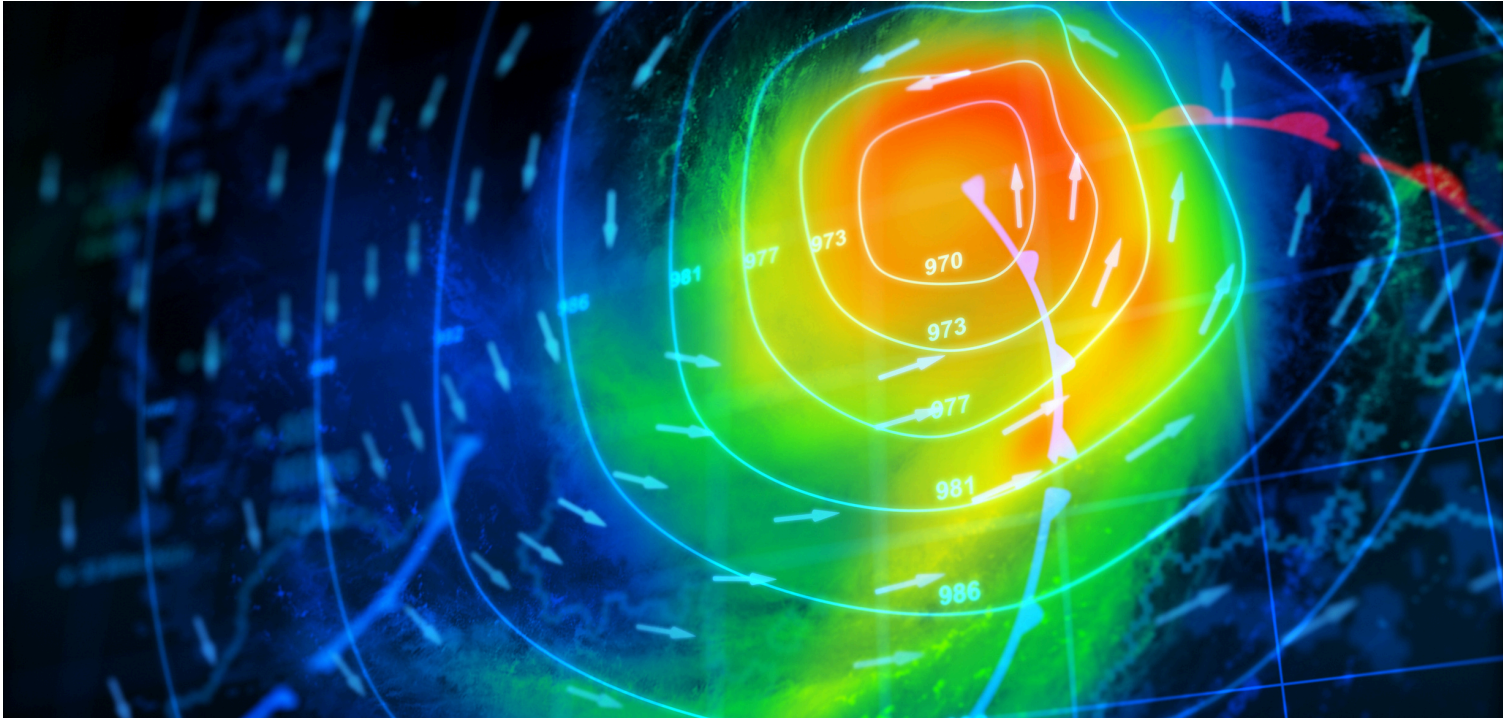
SEPTEMBER 2024



A UFS Collaboration
Powered by **EPIC**



OUR MISSION



The Unified Forecast System

While we cannot control the weather, we can understand how to better predict it. That's where the Unified Forecast System (UFS) comes in. The UFS is an Earth System Modeling framework developed by a community of scientists and engineers who come together to produce cutting-edge science components and software infrastructure to enhance the numerical weather prediction systems that can be used by the Weather Enterprise. The UFS includes multiple applications that span local to global scales and offer sub-hourly to seasonal predictions. These applications package together elements such as preprocessing and postprocessing tools, numerical models, data assimilation, and verification and validation packages.



[Explore the UFS website](#)

Earth Prediction Innovation Center (EPIC)

NOAA's EPIC program fosters the work being done by the UFS by nurturing a collaborative weather community. EPIC offers an environment for the growth of next-generation models, management of cloud-ready code, community engagement and user support, a pipeline for research and model transition to operations, end-to-end testing for UFS applications, and expanded support for NOAA's Earth system models.

[Explore the EPIC website](#)



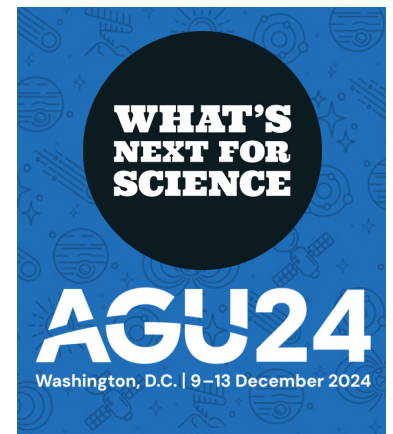
UPCOMING EVENTS



AGU Annual Meeting 2024 – What’s Next for Science December 9-13, 2024, Washington, D.C. / online

EPIC and the UFS will take part in the American Geophysical Union (AGU) Annual Meeting this December in Washington, D.C. and online. AGU is one of the most influential events for Earth and space sciences with an expected audience of over 25,000 people from more than 100 countries. Conveners from the National Center for Atmospheric Research and the Developmental Testbed Center are hosting an Atmospheric Sciences session on model development entitled “Improving Representation of Processes in Earth System Models for Weather and Climate to Address Systematic Biases.”

[AGU Annual Meeting website](#)



AMS Annual Meeting 2025 January 12-16, 2025, New Orleans / online

The next American Meteorological Society (AMS) Annual Meeting will take place in January 2025, and EPIC and the UFS will be there! The [Fourth Symposium on Community Modeling and Innovation](#) is part of this event and provides an opportunity to share information about innovations and recent developments that advance community Earth system modeling capabilities. Stay tuned for a session on “Improving Representation of Processes in Earth System Models for Weather and Climate to Address Systematic Biases.”

[AMS Annual Meeting website](#)



Be Part of UIFCW 2025!

Want to work with us to plan the Unifying Innovations in Forecasting Capabilities Workshop (UIFCW) 2025? This year’s [UIFCW24](#) was a great success, and EPIC and the UFS are hoping to build upon that foundation for the summer of 2025. The team is looking to ensure a range of voices in the room that represent the community’s diverse interests. [Sign up](#) to join the planning committee. We will start meeting by early 2025.

[Sign up here](#)



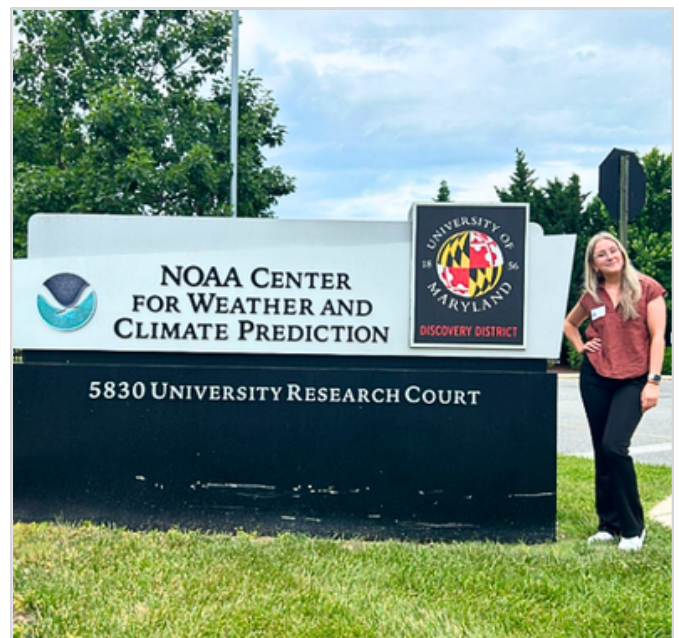
UFS Innovators

This section shines a spotlight on those who help push the boundaries of the UFS. These people put the "innovation" in "Earth Prediction Innovation Center." While not all who are featured are directly part of the EPIC program, they are integral members of the UFS community. Their efforts and contributions help drive the program's success.



UFS Continues to Engage with the Next Generation

Samantha Lang, a meteorology student at North Carolina State University, spent nine weeks at NOAA headquarters as part of a 2024 William M. Lapenta internship. As Student Ambassador for the UFS, she conducted a student survey to help improve the UFS Student Engagement Plan. Samantha also attended the third annual UICFW in July where she presented her own research and took part in a focus group directed towards academia in the UFS community.



Giving Students Wings

Three doctoral fellows, who were selected for the inaugural class of the [WINGS Dissertation Fellowship](#) in 2023, have been working on ground-breaking research with the UFS. They are Shreyas Dhavale, Emily Faber, and Joseph Knisely. Learn more about their ongoing research below.

How Monsoons Form

Shreyas Dhavale, a Ph.D. student at North Carolina State University, is using the UFS to improve operational forecasts of the Indian Summer Monsoon. The timing and strength of the monsoon onset has an immense humanitarian and agricultural impact, affecting both the populous coastal areas and the more agricultural regions of southwestern India. Beyond this, Dhavale notes that “The research is important to me [because] I [was] born and brought up in Mumbai, India and observed the onset of monsoon every year since my childhood.”



[More details](#)



Improving Climate Models

Over the last two years, Emily Faber, a Ph.D. student in atmospheric physics at the University of Maryland, Baltimore County (UMBC), painstakingly replicated part of a NASA climate model on UMBC computing systems. She compared the model’s predictions to on-the-ground data, found major differences in wind speed, and is helping to refine the model so it more accurately reflects reality. A publication on her results is under review, and the findings have significant implications for global climate modeling and forecasting.

[Full story](#)

Advancing Tropical Cyclone Predictions

Generating accurate numerical predictions for tropical cyclones is one of the most challenging problems in weather forecasting. These storms are among the most powerful and destructive extreme weather events on Earth, causing over \$1.3 trillion in damages and around 7,000 deaths in the U.S. since 1980. WINGS Fellow Joseph Knisely, a Ph.D. student at the University of Maryland, College Park, is looking into how new data assimilation techniques can improve tropical cyclone forecasting.

[Read more](#)

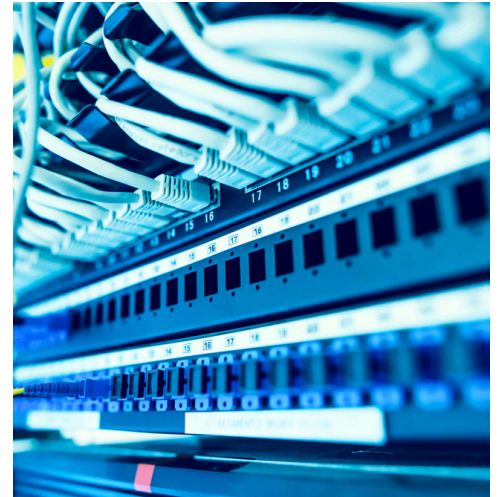


NEWS AND INSIGHTS

EPIC and GMU Overcoming High-Performance Computing Challenges

Kris Booker of EPIC's Platform Team has collaborated with Ben Cash of George Mason University (GMU) to test a proof of concept for running the UFS Weather Model on academic high-performance computing (HPC) platforms. This project aims to address one of the many challenges in the UFS community: the barrier to entry posed by complicated UFS software library requirements in academic HPC environments. In its early stages, EPIC, GMU, and UFS partners continue to refine the work.

[More information](#)



Students Given Boost at UIFCW 2024

This year, the EPIC program office in partnership with the [University Corporation for Atmospheric Research | Cooperative Programs for the Advancement of Earth System Science](#) offered thirteen travel grants to enable students to attend the [Unifying Innovations in Forecasting Capabilities Workshop 2024 \(UIFCW24\)](#) in Jackson, Mississippi from July 22 to 26, 2024. The grant gave students with limited access to funding the opportunity to attend the annual workshop in person. Over 40 students applied for the grant from the U.S. Thirteen were selected to come to Jackson, representing 11 U.S. universities. Seventy percent of applicants were graduate students, and the rest were a mix of undergraduates, post docs, and early career professionals.

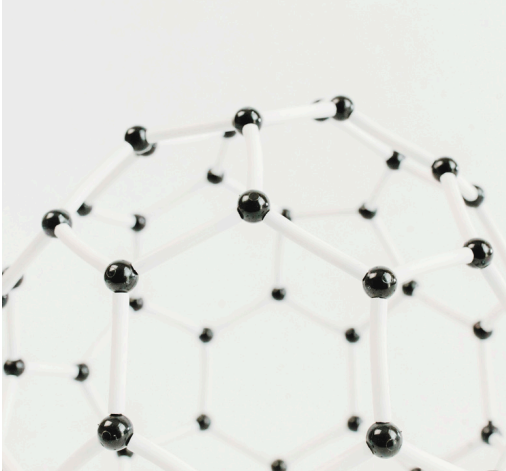
[Read more](#)

Alycia Triplett, a second-year Ph.D. student from Howard University, attended the workshop and shared her experience. At the time, Triplett was an intern at [NOAA's Global Systems Laboratory \(GSL\)](#) and was also a member of the UIFCW24 Planning Committee.



Students attending UIFCW had the opportunity to visit the Jackson Weather Forecast Office.

NEWS AND INSIGHTS



The Common Community Physics Package: Fostering Collaborative Development in Physical Parameterizations and Suites

The Developmental Testbed Center (DTC) recently announced [the public release](#) of v7.0.0 of the Common Community Physics Package (CCPP). This release contains the CCPP Physics, a library of physical parameterizations; the CCPP Framework, an infrastructure that connects the physics to host models; and the CCPP Single-Column Model (SCM), a simple host model that employs the CCPP Physics and CCPP Framework.

[More information and access to the code](#)

A [new article](#) in the Bulletin of the American Meteorological Society provides an overview of the CCPP and how it is being used in two leading modeling systems. The CCPP is part of the UFS and is included in the operational Hurricane Analysis and Forecast System. It is slated for use in all upcoming NOAA global and limited-area UFS applications for operations.

[Publication](#)

JEDI SkyLab Achieves Near-Real-Time Data Assimilation Functionality

JEDI SkyLab can now conduct experiments with newly-published data, adding near-real-time data assimilation, including with UFS backgrounds, to its suite of accomplishments. This allows quick evaluation of the impact of new instruments or commercial data in a real-world context before they are added — or discarded — from operational systems like the UFS. Being able to integrate new sensors incredibly fast and run experiments with the latest data will be instrumental in improving accuracy for future weather and climate forecasting in the UFS.

[Article](#)



NOAA and India Create Life-Saving Tropical Cyclone Forecast Model for Nation of a Billion

A 12-year collaboration between NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) and the Indian Ministry of Earth Sciences is growing ever stronger. A recently-renewed Implementing Arrangement will continue to boost the development of a tropical cyclone numerical weather prediction system for the Indian Seas. The agreement fosters joint research to improve tropical cyclone forecasts as well as a commitment to augment the newest severe weather model — the Indian Ocean-Land Atmosphere model — throughout its years of use.

[More information](#)



NEWS AND INSIGHTS



Spotlight on UIFCW 2024

EPIC and the UFS hosted the third annual Unifying Innovations in Forecasting Capabilities Workshop (UIFCW) from July 22 to 26, 2024 at Jackson State University (JSU). Held over five days at the JSU Student Center, UIFCW24 built on the momentum of past events, and, for the first time, was held at a Historically Black College and University (HBCU) and NOAA Cooperative Science Center (CSC). The workshop was accessible online, enabling broader participation through livestreaming and Slack.

The theme of this year's workshop was "Collaborative Progress in Earth System Modeling." Talks covered updates to the UFS, the latest Earth system research findings, and discussions of challenges, successes, and plans for future progress. Sessions were designed to encourage an open exchange of ideas among participants, with adequate time for dialogue and questions. This year, discussions highlighted the modeling community's need to nurture a sense of community, build stronger collaborations within the Weather Enterprise, and better connect federal research to the broader modeling community.

Nearly 700 people registered, and the planning committee received 170 abstracts for talks and poster sessions. Additionally, three training workshops took place the morning before the conference opened. Highlights of UIFCW24 included a session on Google's GraphCast AI model that drew over 180 people, reflecting the growing interest in artificial intelligence (AI) and machine learning; a keynote talk by Michael Morgan, Assistant Secretary of Commerce for Environmental Observation and Prediction; a roundtable discussion on community modeling; and exploration of the future of modeling and data assimilation.

[Explore the UIFCW talks](#)



NEWS AND INSIGHTS



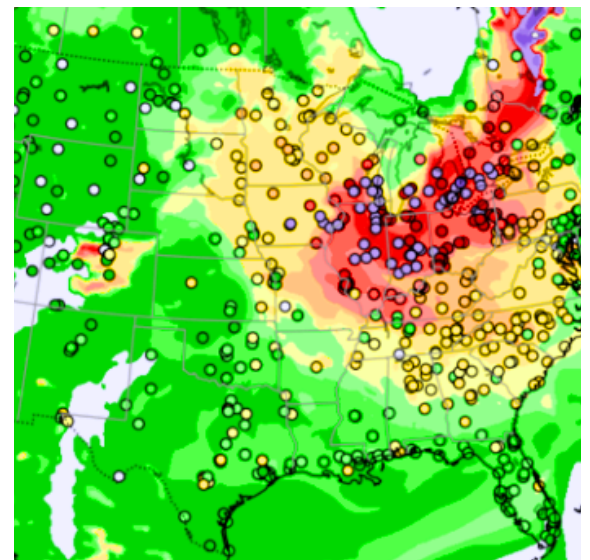
Equipping the Next Generation of Hurricane Model Scientists

The Hurricane Forecast Improvement Program and the NOAA Center for Atmospheric Science and Meteorology (NCAS-M) recently hosted their first Summer Colloquium at the NOAA Center for Weather and Climate Prediction in College Park, MD. Jointly organized by NCAS-M, the NOAA Environmental Modeling Center (EMC), and NOAA AOML, the colloquium was attended by graduate, doctoral, and postdoctoral students from Minority Serving Institutions (MSIs), HBCUs, and other universities. The event catered to students and researchers interested in gaining experience with the Hurricane Analysis and Forecast System (HAFS) model and its various facets. It marks a significant milestone for the next generation of model scientists; it was the first of its kind specifically aimed at developing NOAA's future capacity and leadership in numerical weather prediction, modeling, and data assimilation among students from MSIs.

[Read more](#)

Bridges to Operations: New UFS Air Quality Model is Operational

An advanced regional air quality modeling system (AQM) has been developed within the UFS framework to enhance how fire emissions are represented and to improve air quality predictions. The project is a collaboration between the Environmental Modeling Center (EMC) at the National Centers for Environmental Prediction (NCEP), the Air Resources Laboratory, the Global Systems Laboratory (GSL), the Physical Sciences Laboratory (PSL), and the Chemical Sciences Laboratory under NOAA's Office of Oceanic and Atmospheric Research (OAR). NCEP implemented the UFS-AQM online system as an operational model (AQMv7), replacing the previous operational model (AQMv6) based on the Global Forecast System (GFS)-CMAQ offline system. It has since been ported to the CAPP framework to support UFS-based applications.



[More details](#)

NEWS AND INSIGHTS



Coastal Coupling Community of Practice Roadmap

The Coastal Coupling Community of Practice (CC CoP) [roadmap](#) is now available. The CC CoP was founded in 2019 to advance predictive capabilities in the coastal zone, and is part of NOAA's National Weather Service. The roadmap was finalized at the end of July, and meetings on four CC CoP initiatives began in August. The initiatives are: total water level; ecosystems and water quality; bathymetric data; and communications, education, and training.

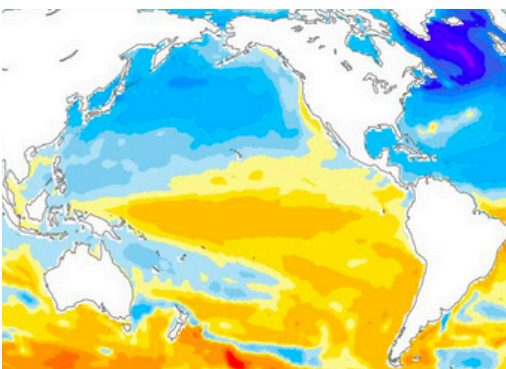
[Roadmap](#)

Tropical Variability in the UFS

Earlier this year, Dr. Lisa Bengtsson and Dr. Maria Gehne of NOAA PSL gave a UFS webinar on the forthcoming GFSv17/GEFSv13, which will be the first global forecast application to become operational under the UFS infrastructure. This is also the first version of the GFS that is a fully coupled Earth system model with atmosphere, ocean, waves, land, and sea-ice component models. Development of this system has been a collaborative effort involving NOAA and the broader numerical weather prediction community. The GFSv17 offers new tropical diagnostic capabilities and innovations in cumulus convection parameterization. The system also accounts for the role that convection and ocean coupling play in driving tropical variability in the UFS.

[Talk and slides](#)

[Paper on Common Community Physics Package](#)



Seasonal Prediction with the UFS

Philip Pegion and colleagues at NOAA PSL, NOAA AOML, and the Cooperative Institute for Research in Environmental Sciences at the University of Colorado Boulder have been working to develop a UFS Seasonal Forecast Application. Early development has been centered around a low-resolution (1-degree) version. In his recent talk, Pegion discussed initial results from the team's climate simulations and seasonal forecast runs, which highlight progress and the need for active stochastic physics to reflect El Niño variability.

[Talk and slides](#)

NEWS AND INSIGHTS

UFS Unified Workflow Resources

Looking for help with UFS workflows or need tips to streamline your processes? The UFS Unified Workflow Team has you covered with regular updates they hope will make your work easier. Check out the new [UW Tools](#) page on the EPIC website and subscribe to their [blog posts on GitHub](#) for the latest insights, how-tos, and answers to common questions. Your questions and feedback are always welcome. Let the team know how they can support your UFS journey!

[Unified Workflow Tools](#)



Embracing Artificial Intelligence in Weather Prediction

EPIC is working with NOAA's Artificial Intelligence for Numerical Weather Prediction Applications (AI4NWP) Working Group to integrate machine learning (ML) and artificial intelligence (AI) into weather prediction and modeling. Specifically, the program is providing support for NOAA's Machine Learning Operations (MLOps) framework, boosting community access and engagement, and ensuring that the latest advances are available to researchers.

EPIC is working to establish a public-facing, open-source GitHub repository with documentation for global AI models that will help developers and researchers integrate and advance AI-driven modeling techniques. EPIC is also helping to ensure that the models maintain specific standards and reliability for operational deployment.

[Learn more](#)

RESOURCES

Explore the UFS Webinar Series

UFS hosts a [webinar series](#) in collaboration with the National Weather Service [Science and Technology Integration-Modeling Program Office](#). Talks share advances in science and technology in all aspects of the UFS, in both research and operational settings. We welcome speakers from the modeling community.

[Webinar recordings](#)

[Subscribe to webinar announcements](#)

[Recommend a speaker or topic](#)

UFS Code + EPIC Support

Each UFS application, model, or component has its own code repository on GitHub, and each repository includes a wiki, question forums, and bug reporting. EPIC provides user support for many UFS repositories. To request new UFS features or enhancements, post a request on the *ufs-community* GitHub Discussions page under [Enhancement](#). Check out our [GitHub Registration and Posting Guidelines](#) to get started on GitHub, or [learn more below about the repositories we support!](#)

[Code + Support](#)

Questions? Email us at: support.epic@noaa.gov

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