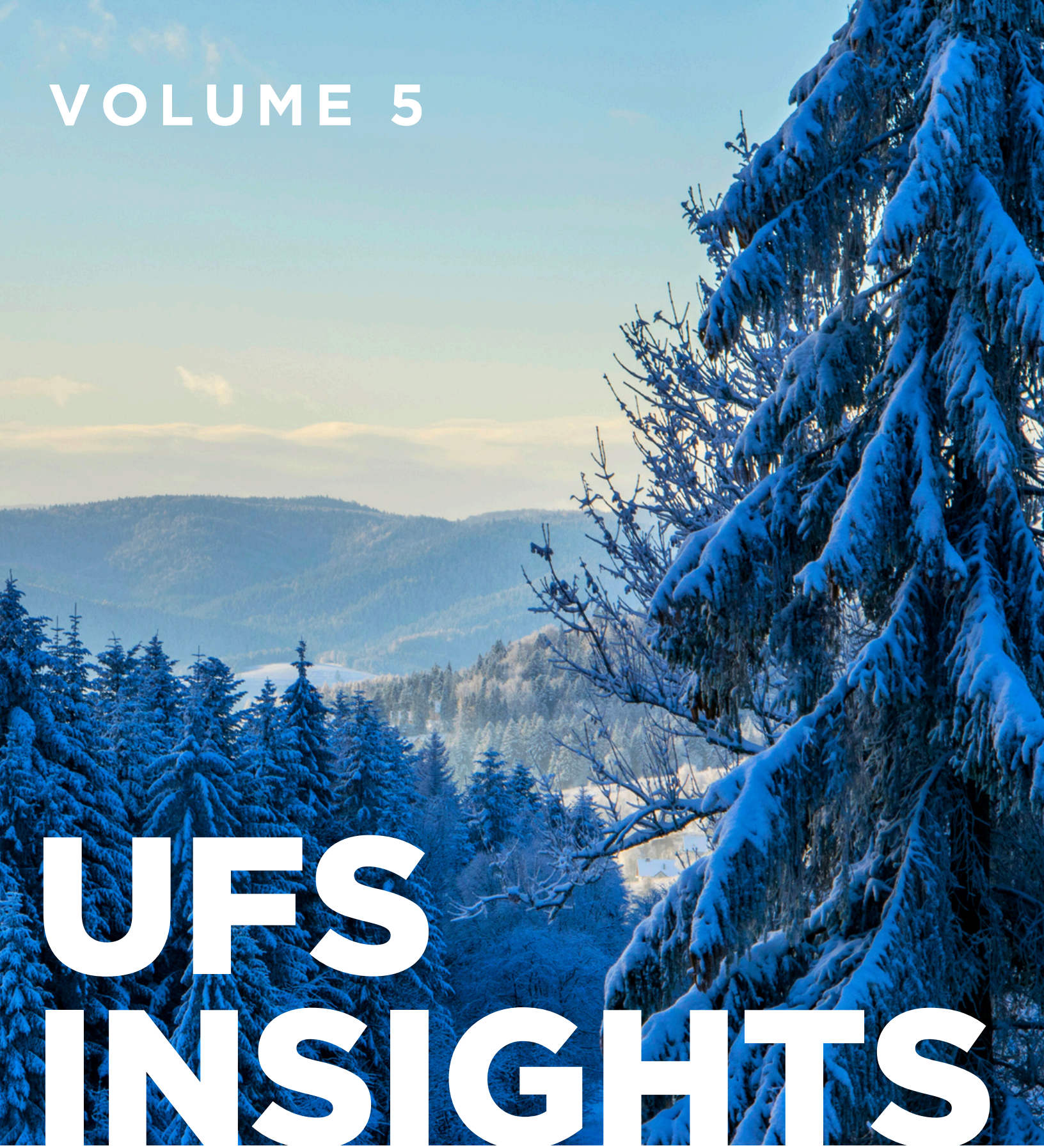
VOLUME 5



UFS INSIGHTS

DECEMBER 2024

A UFS Collaboration
Powered by EPIC

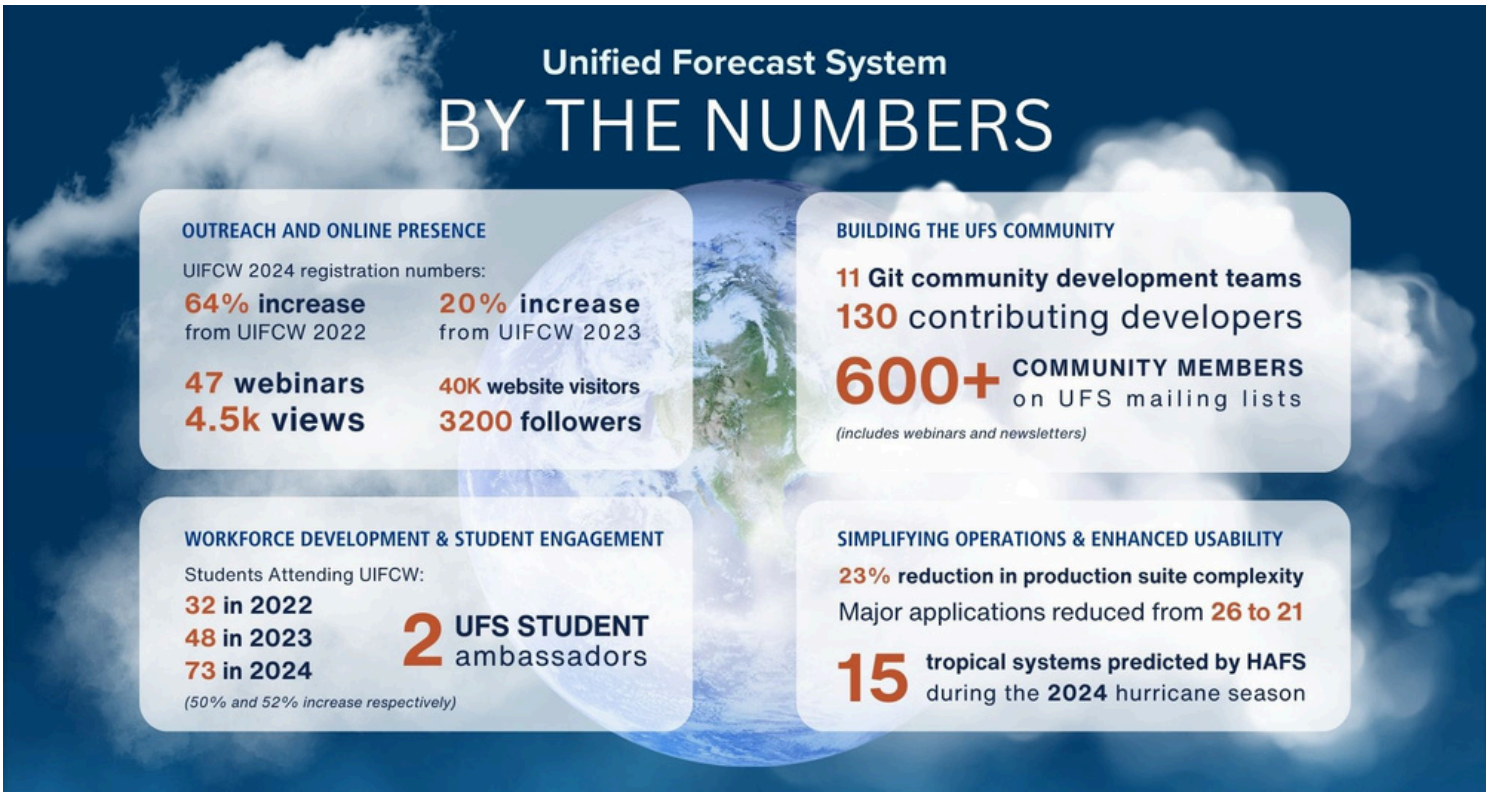
OUR MISSION

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 scientific 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.

UFS
UNIFIED FORECAST SYSTEM

[Explore the UFS website]

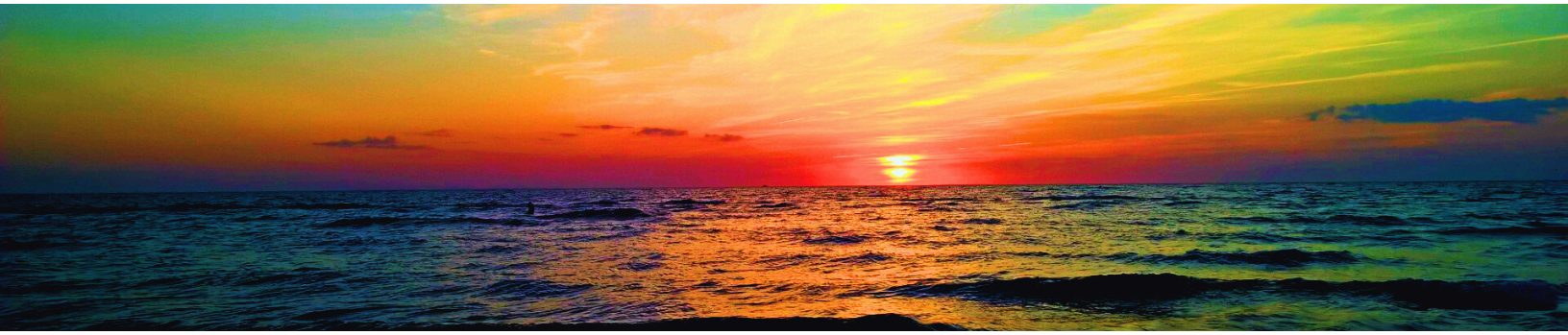


Earth Prediction Innovation Center (EPIC)

NOAA's EPIC program supports a collaborative Earth system modeling community, centered around the Unified Forecast System (UFS). EPIC provides an environment for the development 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 community will take part in the American Geophysical Union (AGU) Annual Meeting this December in Washington, D.C., and online. The AGU Annual Meeting 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. Registration is now open.

Poster Session
Community Modeling and Open Innovation to Advance Earth Prediction Systems
by Jose-Henrique Alves, Hendrik Tolman, and Neil Jacobs

Topics in this session will include discussions on the motivation and process by which the community can work together to explore, validate, and integrate all aspects important to advancing weather and climate prediction.

More information

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

EPIC will join the UFS community at the 105th AMS Annual Meeting from January 12-16, 2025, in New Orleans and online. As part of the UFS community, EPIC will showcase its latest contributions through presentations highlighting advancements in Earth system modeling and collaborative innovation.

The Fourth Symposium on Community Modeling and Innovation
The Fourth Symposium on Community Modeling and Innovation will also take place during AMS. This symposium features sessions and discussions focused on enhancing Earth system modeling and fostering community collaboration. Explore EPIC's content and the symposium agenda at the links below. The Fourth Symposium on Community Modeling and Innovation is an opportunity to share information about innovations and recent developments that advance community Earth system model capabilities. Topics reflect upon the motivation and processes by which the community can work together to explore, validate, and integrate advances in weather and climate prediction frameworks. Presenters from public, private, and academic sectors are encouraged to discuss how community modeling initiatives can contribute to improving weather and climate forecasting products and services.

Fourth Symposium on Community Modeling and Innovation

More information

UPCOMING EVENTS

As part of the UFS community, EPIC is excited to showcase its contributions at the upcoming AGU and AMS conferences. Find a list of EPIC abstracts being featured at these events below.

Advancing Atmospheric River Prediction: Development and Implementation of a High-Resolution Forecasting Framework
Anil Kumar at AGU

EPIC Systems Architecture: Enabling Rapid Innovation
Kristopher Booker at AMS/AGU

Computational Benchmark Performance and Portability of the NOAA Unified Forecast System Model Infrastructure
Jong Kim at AGU

Empowering Forecasting Innovation Through EPIC Community Engagement and User Support
Aaron Jones at AMS/AGU

Ensemble-Based Data Assimilation and Forecasts Using a Single Coupled JEDI/UFS Application
Mark Potts at AGU

UFS Application Workflow Convergence - Developing a Clear Path to Operations for the Community
Keven Blackman at AGU

Using NOAA-EPIC Containers to Build and Run UFS Applications on Any System
Mark Potts at AMS

Running UFS Global-workflow on AWS, Azure and Google Cloud
Wei Huang at AMS

Status of Test Case Integration into UFS Weather Model and Applications
Cameron Book at AMS

EPIC/UFS Community Support for Earth System Modeling
Gillian Petro at AMS

The Earth Prediction Innovation Center - an Overview of the EPIC Contract
Keven Blackman at AMS

Porting of the Global-Workflow to Gaea-C5
D. Alex Burrows at AMS

Unified Forecast System (UFS) Noah-MP Land Data Assimilation Release and Community Support
Jong Kim at AMS

Be Part of UIFCW 2025!

Want to work with us to plan the Unifying Innovations in Forecasting Capabilities Workshop (UIFCW) 2025? UIFCW 2024 was a great success, and EPIC and the UFS Community are hoping to continue that success next summer. The team is always looking for more Planning Committee members to represent the community's diverse interests. Sign up to join the planning committee today!

Sign up here

UIFCW
A UFS Collaboration Powered by EPIC

UFS Innovators

We want to shine the spotlight and recognize 'UFS Innovators.' These are the individuals who truly put the 'innovation' in Earth Prediction Innovation Center. While not all featured innovators are directly part of the EPIC program, they are integral members of the UFS community. Their efforts and contributions are what drive the program's success. These dedicated professionals are instrumental in advancing the UFS, constantly pushing boundaries to enhance its capabilities.

Tara Jensen

Tara Jensen passed away in early September after a year-long battle with cancer. Tara was the motivating force behind the METplus verification package, where she effectively led with energy and vision such that METplus continues to gain broad usage across the national and international numerical weather prediction and Earth system modeling communities. She was always positive, kind, and inclusive and made a safe space for everyone. A feature on Tara is included in the Developmental Testbed Center (DTC) Newsletter, which we encourage the UFS community to read.

UFS INNOVATORS

Alison Gregory is the Community Engagement Specialist for the Unified Forecast System (UFS). In this role, she is responsible for coordinating the UFS's community engagement efforts.

What drew you to working with the UFS?

I have a degree in atmospheric and oceanic science, so I've always had a passion for Earth and environmental sciences. I have also spent a lot of my career as a social scientist working with communities to improve engagement and understand localized needs. Our nation's forecast system plays a significant role in the safety and livelihood of our communities. Since the Unified Forecast System (UFS) is open-source, it's hard to identify who is working on the code and what their needs are; that's where I can help. I was excited for the opportunity to help this community prioritize their goals and increase their reach. The UFS provides the opportunity for anyone to improve our nation's forecasting system, which can positively impact communities across the US.

What UFS projects are you working on at present?

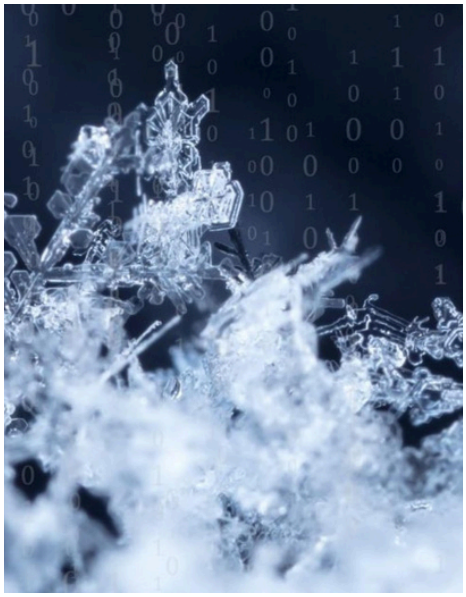
I am working on three projects related to the UFS. First, I support broad engagement efforts by chairing the UFS Communication and Outreach Working Group. This group works with the EPIC program office and various stakeholders to ensure information about the UFS is being shared with the public and continually incorporating diverse perspectives. Another project I'm working on is a UFS Academic Engagement Strategy. Students in the Earth system sciences are the future of our nation's modeling efforts and the UFS, so we need to ensure that we're setting them up for success. Finally, I am using social science best practices to help UFS leadership and existing community members better understand how to work effectively as a team, create success metrics, and strategize for the future.

Tell us more about the value of bringing together social and environmental science.

Environmental science touches all aspects of society. From forecasting our daily weather, to projecting large scale hurricanes, flooding, and wildfires; there is no way to uncouple environmental science and the human experience. Not only does our modeling work impact our local communities, we need data scientists, specialists, and researchers working on these modeling platforms to further improve our nation's forecast system. Using social science tools can assist us in all aspects of our modeling efforts. I am looking forward to teaching others in this space about social science tools and finding new ways to broadly support Earth system sciences.

NEWS AND INSIGHTS

New Release: UFS Land Data Assimilation (DA) System v2.0.0



Discover the latest updates to the UFS Land Data Assimilation (DA) System, enhancing DA for improved weather forecasting. This release includes key features like an updated workflow that better conforms to National Centers for Environmental Prediction (NCEP) Central Operations Implementation Standards; integration of the Unified Workflow (UW) Tools open-source Python package to perform standard numerical weather prediction (NWP) workflow tasks; and validation of analysis outputs using both the CTest framework and the baseline regression test. Also included is UFS Weather Model Noah-MP land surface component support, and new baseline test case with data atmospheric forcing, expanding the system's accessibility for researchers on various platforms.

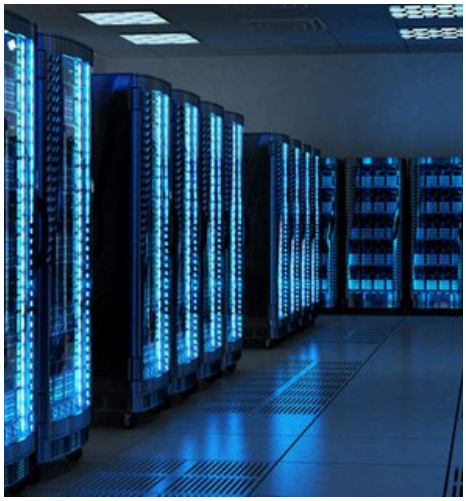
Read the full article to learn more about the new features, improvements, and how you can access the Land DA System v2.0.0.

Improved Representation of Land Processes Key to Precipitation Extremes: Integration of LM4 in the UFS

Check out how the integration of the Geophysical Fluid Dynamics Laboratory (GFDL) Land Model LM4.0 into the Unified Forecast System (UFS) is enhancing the ability to predict precipitation extremes. This research captures key land-atmosphere interactions that improve predictability on subseasonal to seasonal timescales. LM4.0 provides advanced tools for tackling the challenges of a changing water cycle.

Read the full article

Advancing NOAA's Weather and Climate Forecasting with GFSv17/GEFSv13/SFSv1 Physics Suite Under the UFS Framework

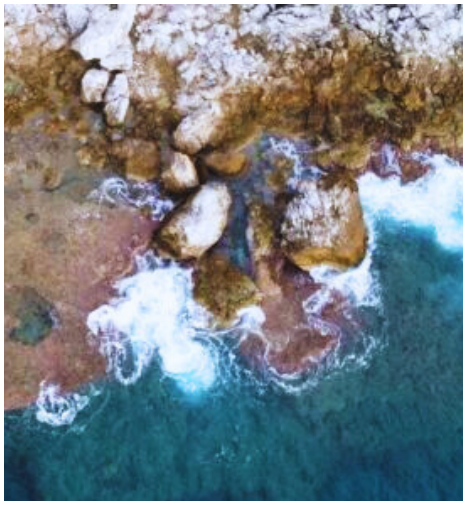


The Unified Forecast System (UFS) is improving forecasts for extreme weather through the development of the GFSv17/GEFSv13 physics suite. This includes improvements in atmospheric physics, land modeling, and coupled components to enhance accuracy across timescales. Updates address biases in tropical variability, precipitation, and surface conditions, while unifying physics across global and regional models. These advancements are helping pave the way for NOAA's next-generation operational Earth system models.

UFS article

NEWS AND INSIGHTS

Collaboration Through a Common Infrastructure and Best Engineering Practices Expedites UFS Coastal App Development



In under a year, NOAA National Ocean Service (NOS), EPIC, National Center for Atmospheric Research (NCAR), and others established the UFS Coastal App, integrating key ocean, wave, and weather models to support coastal forecasting. Leveraging Unified Workflow Tools and CI/CD pipelines, this project streamlined development, allowing for efficient testing and faster integration of model components. The success of this effort highlights the power of coordinated engineering practices and open-source tools to advance coastal prediction capabilities for U.S. communities.

Read full article

New Training Resources: Building and Running the Containerized Global-Workflow

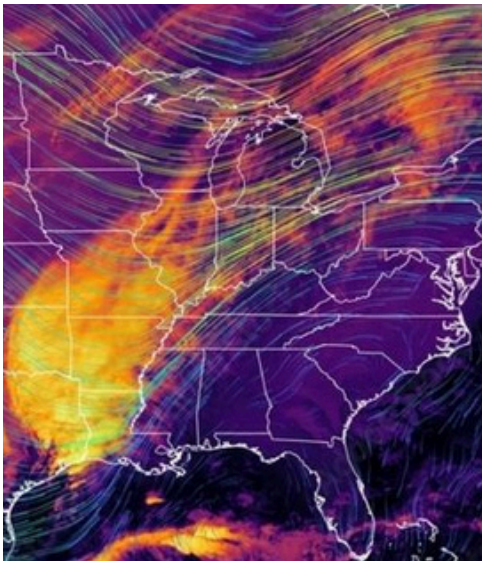
Discover how to build and run the Global Workflow on any Linux system using the latest container based on spack-stack v1.8.0. This guide simplifies setting up forecast-only tasks and is perfect for both seasoned researchers and newcomers to UFS applications. Dive into weather modeling with ease!

Get started

Raytheon Annual Engineering Award for Outstanding Use of Engineering Methods and Processes: NOAA Earth Prediction Innovation Center (EPIC)

Congratulations to the Raytheon members of the EPIC team for receiving the 2024 Raytheon Annual Engineering Award for Outstanding Use of Engineering Methods and Processes! While this award specifically honors Raytheon members, it reflects the collective effort and collaboration of the entire UFS community. This achievement was only possible thanks to shared innovation and partnership across the UFS. Well done to everyone who contributed!

NEWS AND INSIGHTS



UFS Replay Dataset Released

The UFS Replay Dataset has just been released and is now available on the NOAA Physical Sciences Laboratory (PSL) site! This dataset supports the UFS community with components for atmosphere, land, ocean, ice, and waves. Here are some highlights you can explore further on the original page:

- Atmosphere: Temperature, humidity, winds, and more, replayed to ERA5.
- Ocean: Temperature, salinity, and currents, replayed to ORAS5.
- Land: Snow depth and cover assimilated from Global Historical Climatology Network (GHCN) and Ice Mapping System (IMS) datasets.
- Ice: Sea ice variables adjusted using Sea-ice Ocean and Coupled Analysis (SOCA).
- Wave: Modeled with WaveWatch III.

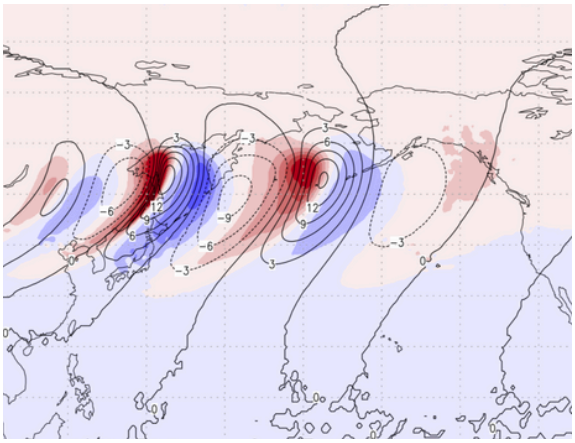
Learn more about this new release and its applications for Earth system modeling

View the documentation

ESMF 8.7.0 Release is Now Available

The latest Earth System Modeling Framework (ESMF) release (v8.7.0) introduces 16 new features and 6 bug fixes, including enhancements to time management, regridding, and support for model coupling across different programming languages. These changes improve route handling capabilities, streamline workflows, and enhance the performance of UFS applications.

Find the release notes



HSD Capability Announcement

The NOAA Earth Prediction Innovation Center has introduced two new test cases for the UFS Weather Model: an idealized dry baroclinic wave case and a July 2020 Convective Available Potential Energy (CAPE) case, both in atmosphere-only configurations. These tests are part of a new developmental framework that allows users to evaluate model changes and supports hierarchical system development within the UFS. The tests are easy to run on Tier-1 platforms and containers, with detailed instructions available in the updated UFS WM User's Guide.

Read more

NEWS AND INSIGHTS

Bridging the Gap Between Model Developers and End Users: The 2024 NOAA Air Quality Forecasters Focus Group Workshop

The NOAA/NWS National Air Quality Forecast Capability (NAQFC) program hosted the annual Air Quality Forecasters' Focus Group Workshop in College Park, MD, on October 9-10, 2024. The NAQFC develops and implements operational air quality (AQ) prediction models, including the recently implemented UFS AQM online system. A primary function of the UFS AQM is to provide AQ forecast guidance for forecasters employed by local and state agencies. The purpose of the workshop is to review forecaster assessments of the strengths and weaknesses of the AQ model guidance, examine current model development and research initiatives, and use forecaster feedback to identify gaps and/or misalignment between model performance, current Research and Development (R&D) initiatives, and forecasters' needs. More information on workshop outcomes, along with the presentations, can be found on the Workshop Website.

Updates to the Unified Forecast System Cumulus Convection Parameterization Scheme Between GFSv16 and GFSv17

Learn about updates to the Unified Forecast System between GFSv16 and the upcoming GFSv17, the first global forecast model operational under this new infrastructure. The study introduces innovations like stochastic processes, 3D sub-grid organizational effects, and a new prognostic closure to address systemic biases. These changes improve predictions in tropical temperature and humidity, Convective Available Potential Energy (CAPE) forecasts, U.S. precipitation, and tropical variability. Explore how these modifications affect weather forecasting and the challenges in developing convection parameterizations for both coupled and uncoupled models.

Read more

WINGS Fellowship

Applications are open for the second cohort of the WINGS Ph.D. Dissertation Fellowship, hosted by NOAA's Weather Program Office and UCAR's Cooperative Programs for the Advancement of Earth System Science (CPAESS). This fellowship is designed for Ph.D. candidates to focus their dissertation research on an area of scientific importance for the broader Weather, Water, and Climate Enterprise. This year, the fellowship will be focused on the EPIC and Joint Technology Transfer Initiative (JTTI) program missions. Fellows will be funded for two years as UCAR employees and will have the opportunity to gain insights into their field, integrate into the workforce, and contribute to forecast model development for both research and National Weather Service operations.

Learn more about the benefits and how to apply

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.

Featured Webinar

Emily Faber, a WINGS fellow and Ph.D. candidate in Atmospheric Physics at the University of Maryland, Baltimore County (UMBC) speaks about improving dust emission models. Watch her recent webinar and learn more about her work.

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

NEW! Stochastic Physics Get Code page

Additionally, EPIC would like to announce that the Unified Forecast System Community has a new email address for inquiries and communication: ufs.community@noaa.gov

Suggest a Newsletter Topic

Make your voice heard by contributing to our next newsletter. We welcome ideas for future topics.

Submit your newsletter topic

Get Involved

Join our community! Whether you're a seasoned academic, interested student, or complete newbie, EPIC has something for you.

Sign up for the UFS mailing list

Stay Connected

We'd love to connect — it's at the heart of what we do. Send us questions at support.epic@noaa.gov or stay in touch via our feedback page.