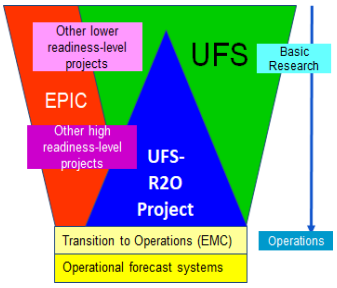
UFS-R2O Project

Accelerating a pathway for community innovations into operational weather and climate modeling systems

https://vlab.noaa.gov/web/ufs-r2o

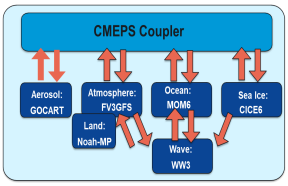
The UFS R2O Project is a NOAA-supported UFS community project, jointly supported by NOAA Operations (NWS) and Research (OAR), to develop three major UFS forecast application systems targeted for operational implementation by 2024.



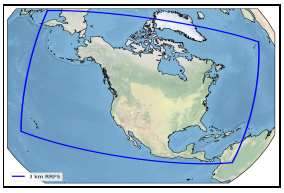
Project Deliverables

Prototypes for GFSv17/GEFSv13:

Merging of the deterministic GFS for medium-range weather (0-16 days) with the ensemble GEFS for subseasonal forecast (17- 45 days):



- A 6-component coupled Earth system model that represents interactions among atmosphere, ocean, sea ice, waves, land and atmospheric composition;
- Advanced physic suites, stochastic parameterizations, aerosol feedbacks;
- 30-year coupled reanalysis and reforecast;

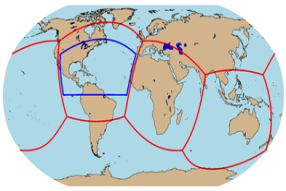


Prototypes of Regional Forecast and Analysis System:

- Rapid Refresh Forecast System (RRFS);
- Three-Dimensional Real-Time Mesoscale Analysis (3DRTMA);

Prototypes of Hurricane Analysis and Forecast System:

- Hurricane Analysis and Forecast System (HAFS) with moving nests following multiple storms;



Project Organization

With over 200 participants from across the Weather Enterprise, including National Weather Service (NWS) National Centers for Environmental Prediction (NCEP), Office of Atmospheric Research (OAR) Laboratories, University Corporation for Atmospheric Research (UCAR), and several Universities. Collaborators follow a single management framework with three co-equal Principal Investigators representing research, operations, and academia (Project Leads: ufs-r2o-leads@noaa.gov; Sponsors: ufs-r2o-sponsors@noaa.gov; Project Engineers: ufs-r2o-engineers@noaa.gov)

Background

The UFS is a community-based, coupled, comprehensive Earth modeling system. This system includes ***computer code***, ***governance rules***, and the ***community*** of individuals composed of researchers, developers and users from NOAA, educational institutions, federal agencies, and the private sector. The UFS is designed to support the weather enterprise and to be the source system for NOAA's operational numerical weather prediction applications.

The goal of the UFS *"is to increase the science-based integrity of the application suite and strive for scientific excellence of the organization as a whole. The UFS will simplify and unify the software suite that supports the UFS applications to address scientific goals, cost goals, and end-user needs."* ***Unified Forecast System (UFS) Strategic Plan: 2021 - 2025****

An essential strategic relationship is represented in the Memorandum of Agreement among the National Center for Atmospheric Research (NCAR), the National Weather Service (NWS), and the Office of Oceanic and Atmospheric Research.

Applications

UFS applications span local to global domains and predictive time scales from sub-hourly to seasonal. Each application has specific forecast target products, a geographical domain, and a specific time horizon. UFS applications provide guidance for global weather at the medium-range time scale, short-range weather for highly resolved regions, hurricanes, with tailored applications for coastal processes, air quality, sub-seasonal and seasonal outlooks, and space weather.

A Unified System

The UFS is a unified system because its applications share a set of agreed-upon scientific components and a set of agreed-upon infrastructures. The scientific components and infrastructures are integrated into a consistent system architecture. The infrastructure is:

- For component model coupling: Earth System Modeling Framework (ESMF) and National Unified Operational Prediction Capability (NUOPC);
- For data assimilation: Joint Effort for Data assimilation Integration (JEDI);
- For atmospheric physics: Common Community Physics Package (CCPP);
- For forecast verification and diagnostics: Model Evaluation Tools (METplus);
- Community data models (CDEPS).