An MPAS App with Unified Workflow Tools

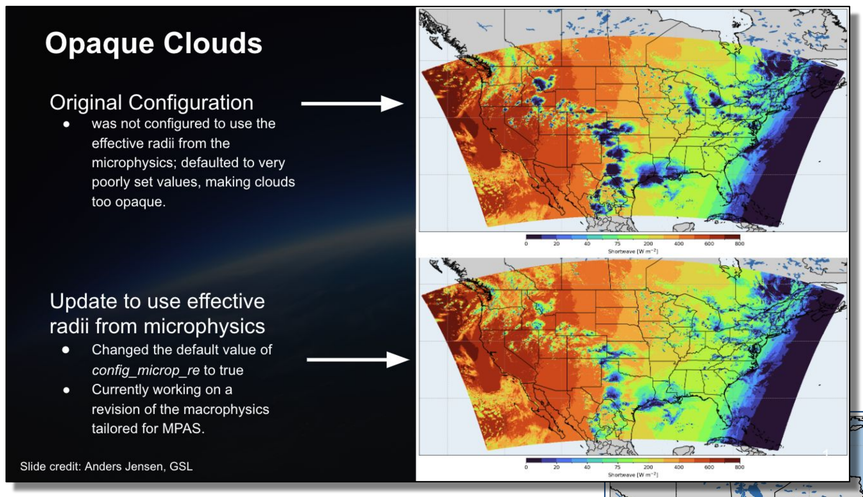
Janet Derrico, Emily Carpenter, Christina Holt
CIRES/NOAA GSL

MPAS Application

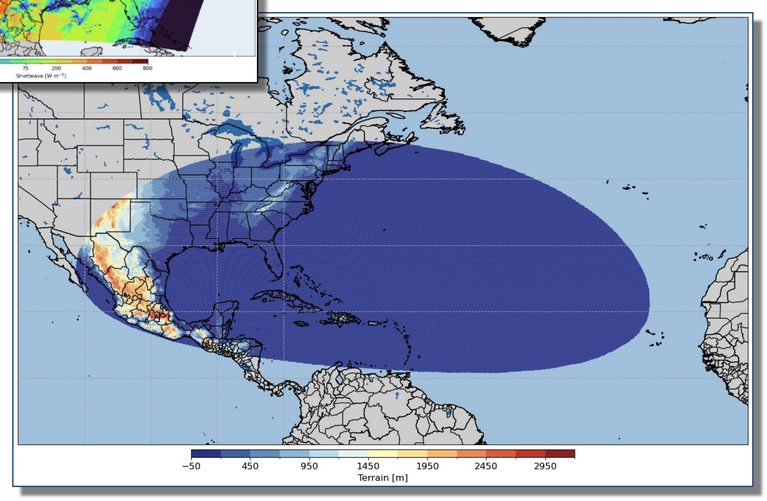
The Rapid Refresh Forecast System (RRFS) development teams recommend transitioning to the MPAS dynamical core to address biases in storm intensity and rainfall associated with the FV3 dynamical core. NOAA GSL scientists are now rigorously testing the MPAS model, aided by a bespoke MPAS application developed in collaboration with the UFS Unified Workflow (UW) team. Leveraging expertise of those who came before us from NCAR, NSSL, and GSL, this application features a portable build system that utilizes spack-stack-installed modules for libraries and packages used in building the developmental codes. The MPAS App installs Miniconda to support the Python environments needed for codes that configure and run a workflow with Rocoto.

This solution aims to provide NOAA GSL researchers with a user-friendly environment for advancing MPAS-related research while broader UFS integration plans are finalized. Ultimately, the goal is to incorporate the MPAS dycore into the ufs-weather-model and include MPAS as a supported choice in the UFS Short Range Weather App. The experience gained from the GSL MPAS App will directly inform the development of the UFS SRW App, ensuring seamless integration and shared functionality across both platforms. The MPAS App will be used for GSL's contributed experiments in the 2024 Hurricane Forecast Improvement Program (HFIP).

The MPAS App contains a build system and the Unified Workflow Framework for configuring and running experiments.

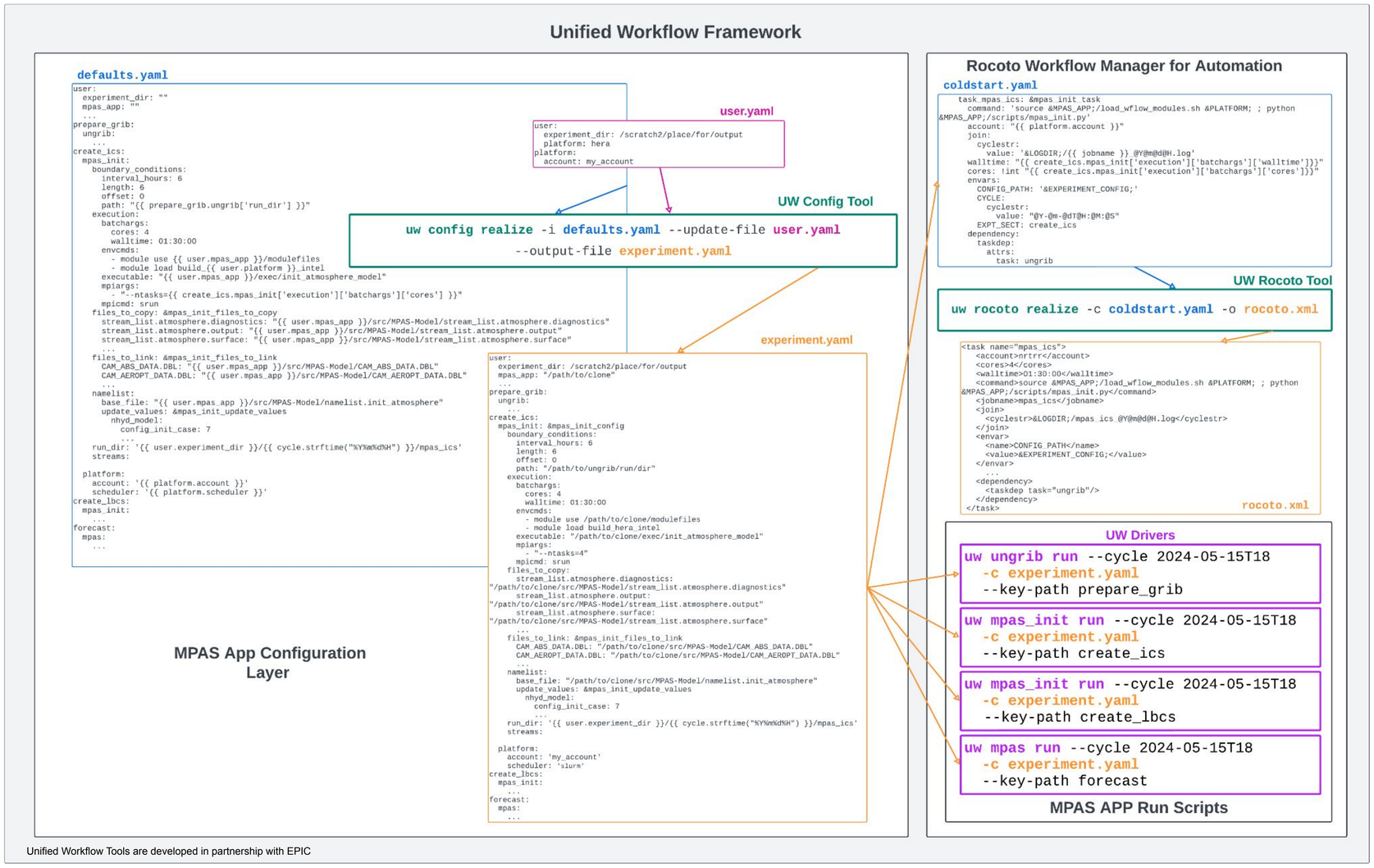


HFIP 2024: A 3-km tilted-oval Atlantic domain which sidesteps most of the severe terrain at the lateral boundaries and includes adequate upstream fetch



Benefits of the MPAS App:

- All scientists start with the same codes
- Changes to code are tracked via Git and changes to experiments via YAML configs
- Drastically reduces lines of code we're responsible for–one config file handles input for all steps of model
- Easily portable to other platforms



Unified Workflow Tools are developed in partnership with EPIC

Unified Workflow (UW)

UW Tools is a versatile Python package that provides a command-line interface and a Python API containing two types of utilities: generic tools that streamline the configuration process and **UW Drivers** responsible for running of computational codes common to workflow tasks within the UFS.

UW defines a consistent **YAML-based control language** that configures tools including to compare unordered namelist files with mixed-case keys, render templates, and even create the Rocoto workflow manager's XML workflow definition file.

Drivers are designed for a specific program and are responsible for:

- Preparing run directories by staging data files
- Defining a component's resource requirements
- Executing a program, either directly or by submitting a job to a batch system
- Validating their config file against a schema

Historically, each NWP application has created bespoke scripts to drive its workflows, leading to duplication of effort and incompatibility across UFS applications. The UW vision is to unify these disparate configuration layers into a single, cohesive framework that interfaces with existing workflows and workflow managers. The aim is to alleviate common pain points, provide the tools necessary to create a concise and efficient runtime environment, flatten the learning curve to get what you need out of an app, and empower scientists to realize their experiments exactly as they envision them.

Contacts
MPAS App: Janet Derrico (janet.m.derrico@noaa.gov)
UW Tools: Christina Holt (christina.holt@noaa.gov)
UW Tools: Emily Carpenter (emily.l.carpenter@noaa.gov)

`mpas-app` github:

`uwtools` github:

This research was supported in part by NOAA cooperative agreement NA22OAR4320151, an FY22 WPO JTTI award, the OCIO Software Engineering for Novel Architectures program, and the EPIC Contract.