MPAS
Model for Prediction Across Scales

MPAS V6.0 release

MPAS-Atmosphere Version 5.0: 7 January 2017
MPAS-Atmosphere v5.1: 12 May 2017
MPAS-Atmosphere v5.2: 1 August 2017
MPAS-Atmosphere v5.3: 22 March 2018

MPAS-Atmosphere Version 6.0: 17 April 2018

In contrast to WRF, MPAS does not follow a yearly release schedule. Releases in new functionality increments the integer version number. Bugfixes increments the integer to the right of the decimal point.

MPAS V6: New sea-ice core, major upgrades to the ocean and land-ice models (DOE E3SM release). Only minor increments to the atmospheric model.

MPAS
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MPAS – Ongoing Development

- Regional MPAS.
- MPAS and WRF physics unification.
- MPAS-Atmosphere in CESM/CAM.
- Any GPU/accelerator capabilities in MPAS-Atmosphere.
- Mesh generation.
- Open development.

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MPAS – Ongoing Development

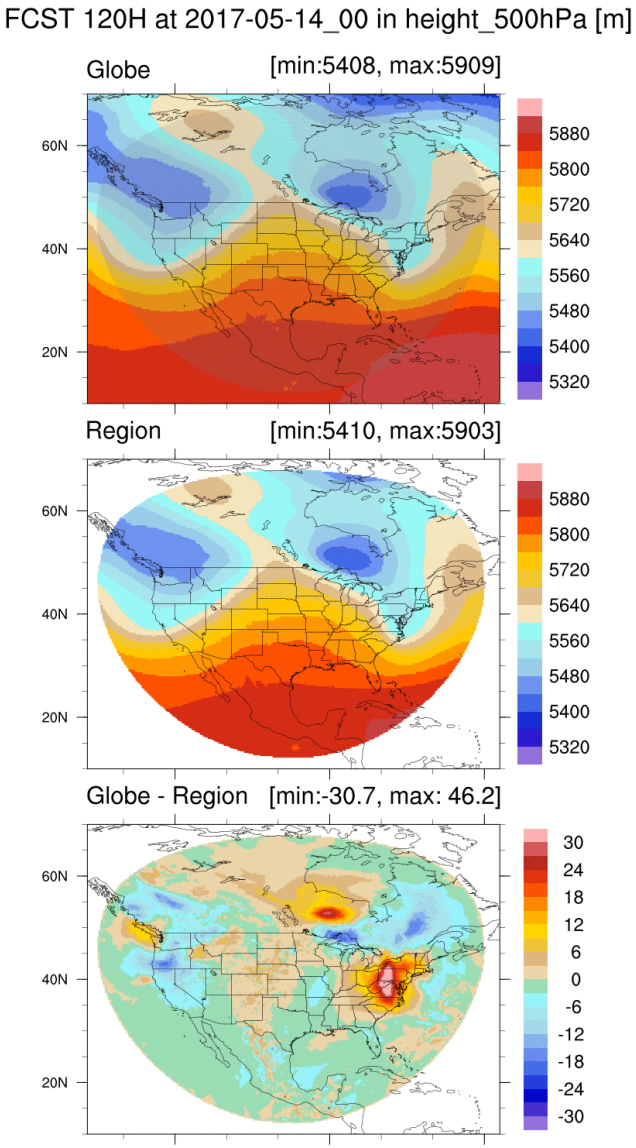
Regional MPAS-Atmosphere

We hope to release the regional version of MPAS-Atmosphere before the next WRF/MPAS workshop i.e. before June 2019.
(core clean-up, SE work on regional utilities)

Regional MPAS can be driven by other MPAS global or regional simulations, by GFS, by CFSR, IFS forecasts, etc.

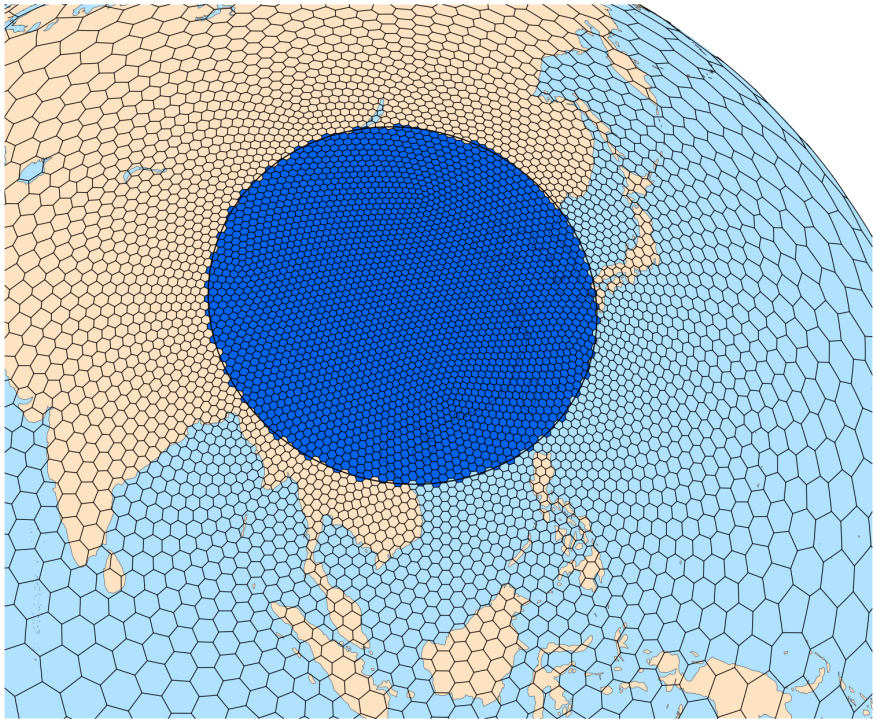
Regional WRF can be driven by global MPAS simulations now.

See the presentation by Michael Duda in the last WRF/MPAS workshop (June 2018)
Progress towards a regional capability in MPAS-Atmosphere.

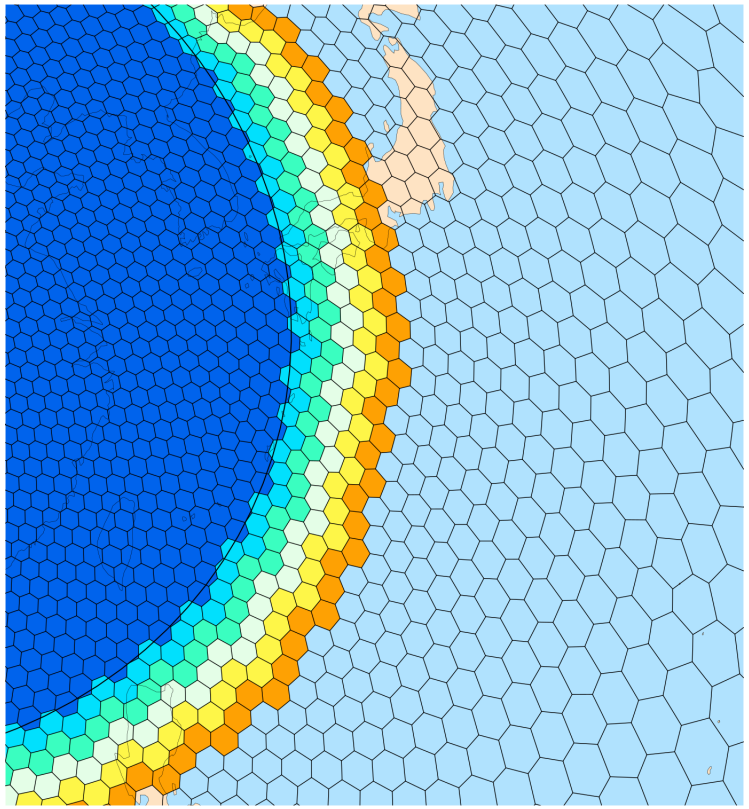


Limited-area meshes in MPAS

Start with a global mesh, identify desired regional domain



Build the relaxation zone



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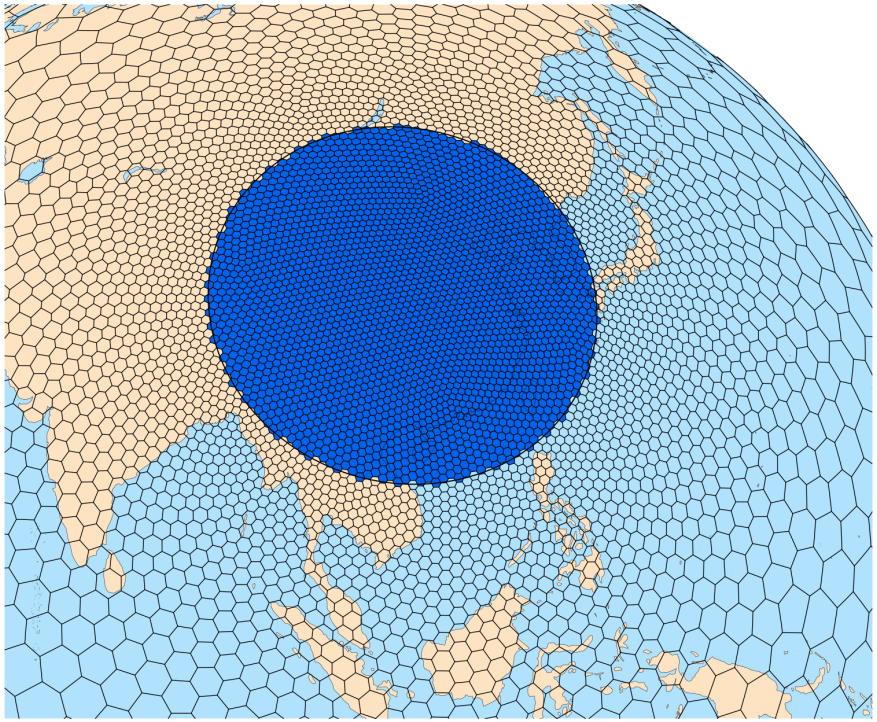
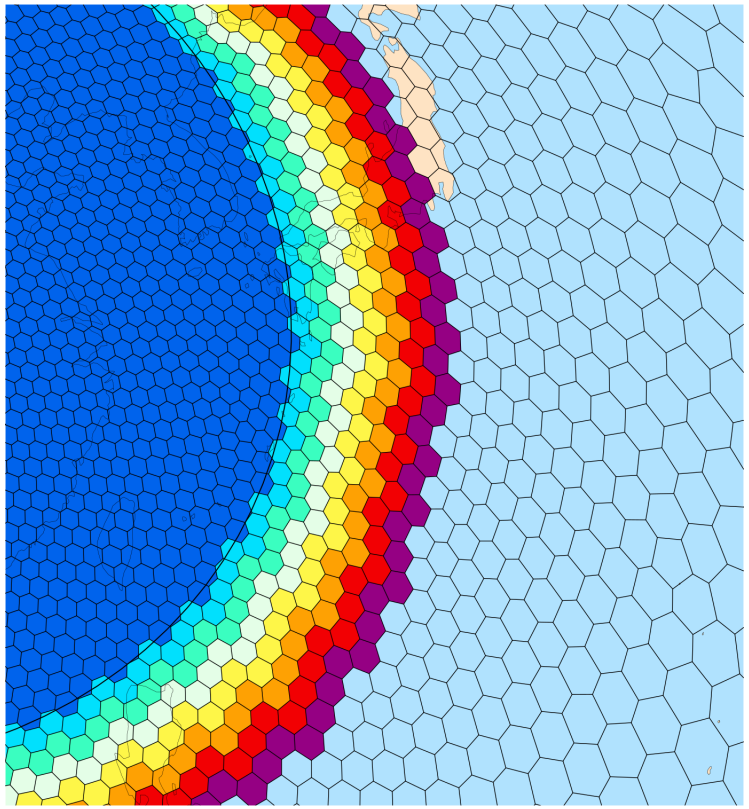
Start with a global mesh, identify desired regional domain

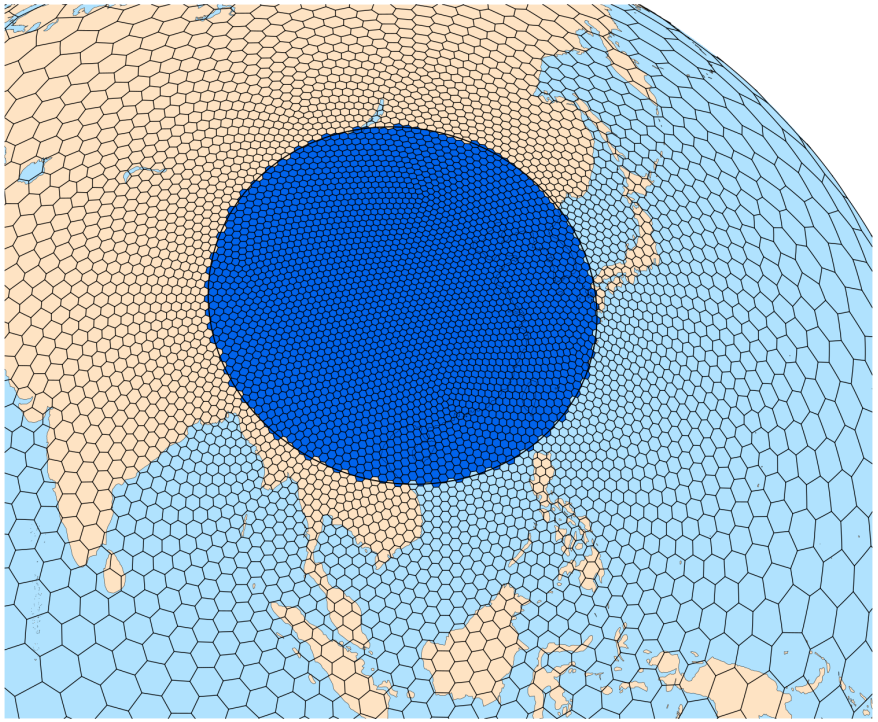


Build the relaxation zone
Build the specified zone

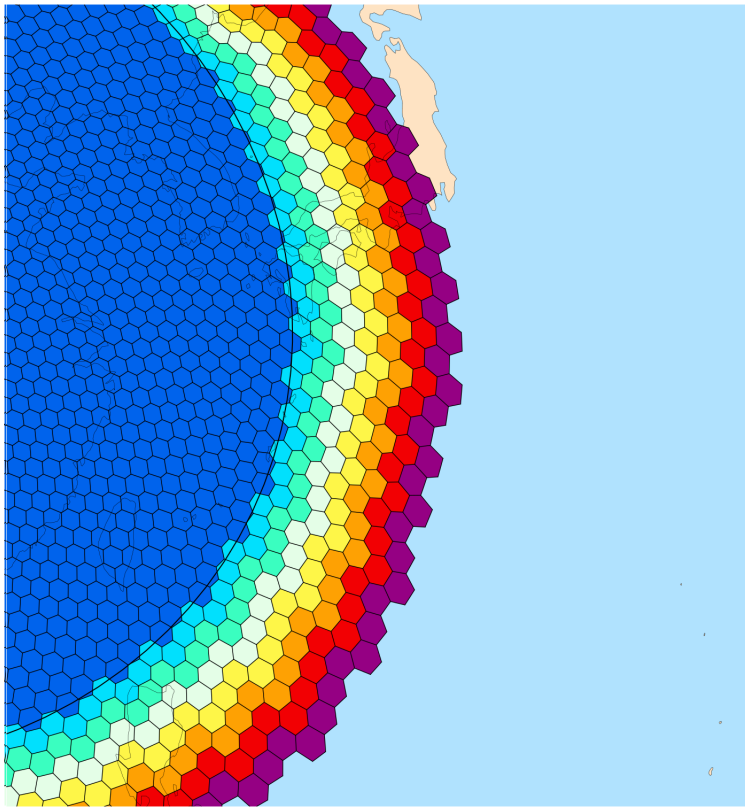


Limited-area meshes in MPAS

Start with a global mesh, identify desired regional domain

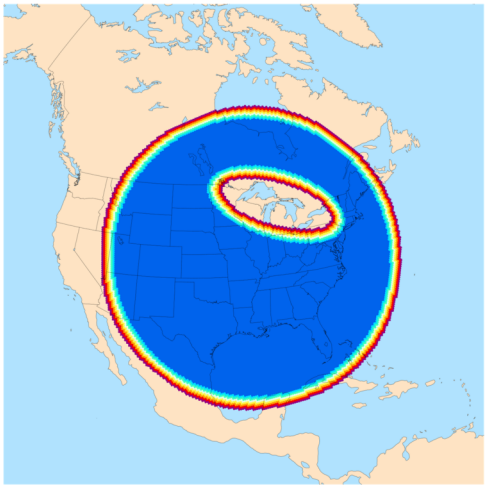


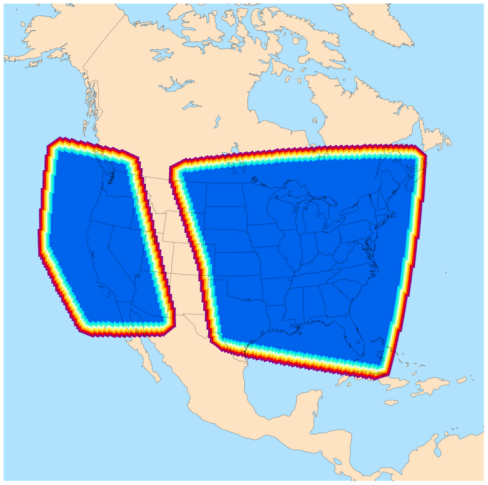
Build the relaxation zone
Build the specified zone
Cut out the remaining global cells

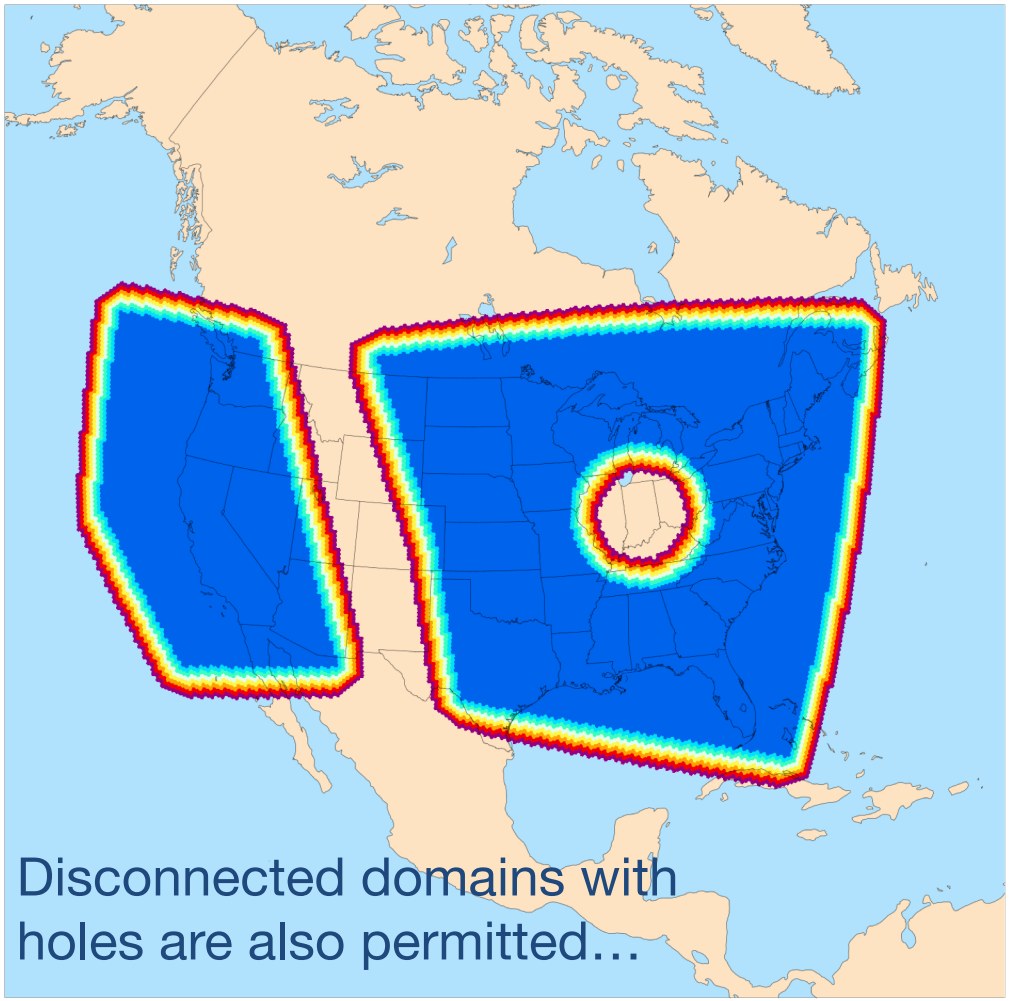


Limited-area meshes in MPAS

With unstructured meshes, the creative user may define exotic simulation domains:







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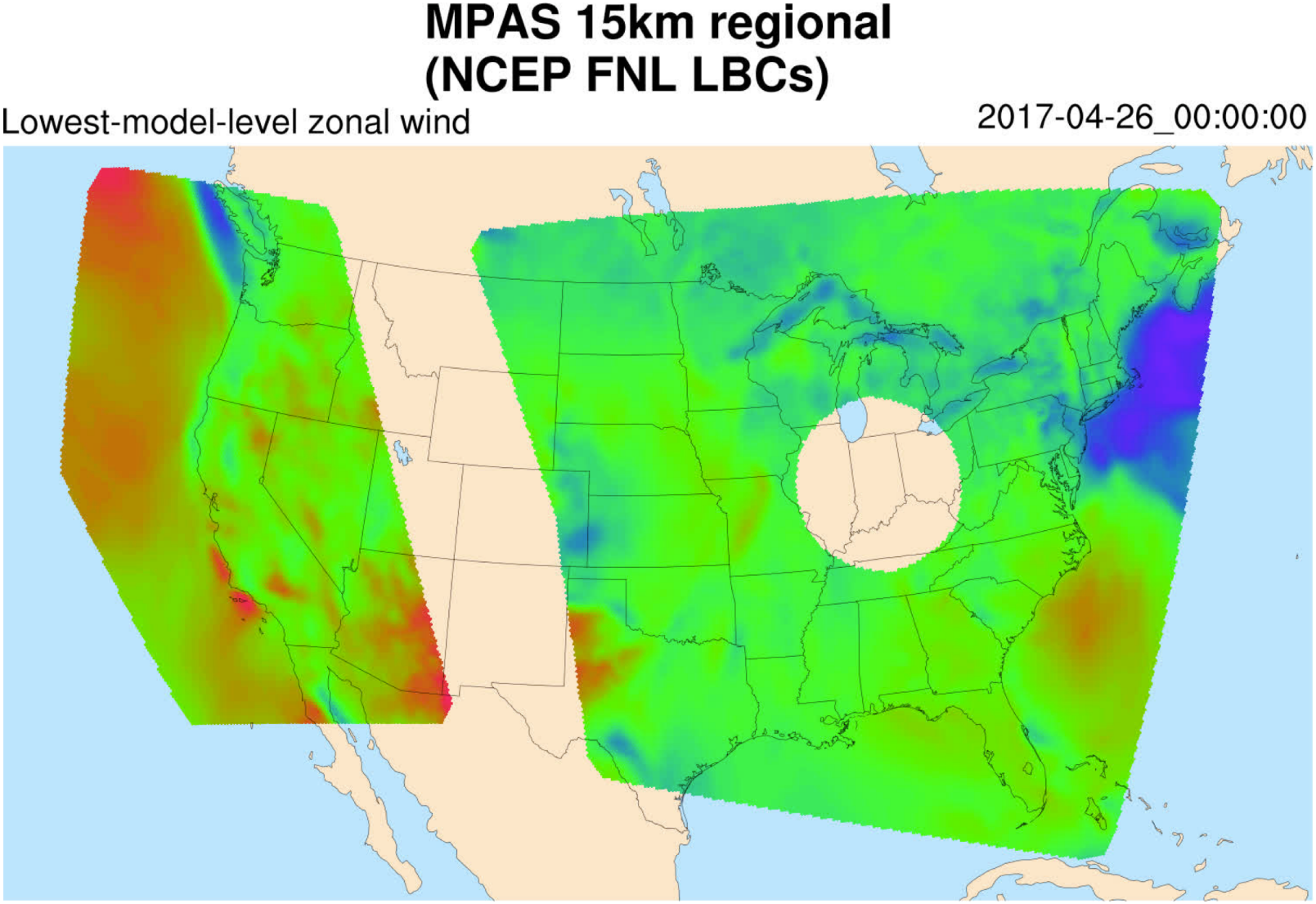

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MPAS – Ongoing Development

MPAS and WRF physics unification

- There are distinct versions of the "same" WRF physics in the WRF and MPAS repositories (i.e. not a single source).
- We are working on physics components that can be shared between MPAS and WRF with no modifications.
- We are going to have a single repository from which we will pull this shared physics for both WRF and MPAS builds.
- We may evolve to sharing a single NCAR repository for WRF/MPAS/CAM physics.

- Longer term – we are developing a Common Physics Framework (CPF) that will replace the physics drivers in NCAR atmospheric models. We expect it will be compatible with NOAA's CCPP (and likely share code).

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MPAS – Ongoing Development

MPAS-Atmosphere in CESM/CAM

Community Earth System Model (CESM)

- MPAS-A Version 4 is an atmospheric dynamical core in CAM
- NWP and climate testing is ongoing
- Coupled model simulations are being performed (w/ocean, ice)
- Physics evaluation for NWP is major focus of early testing

A clean, supportable implementation of MPAS-A into CESM will be engineered later this year. MPAS-A will be a CESM external (like the new CESM ocean core MOM). Builds of MPAS-A in CESM/CAM will pull MPAS-A directly from the MPAS development/release github repository.

The new MPAS-Atmosphere port to CESM is part of the *Singletrack* project to unify atmospheric modeling at NCAR (weather, climate and geospace).

MPAS-Atmosphere will adopt and use the Community Physics Framework (CPF) being developed to access both WRF and CESM/CAM physics.

Regional MPAS-A capabilities should be available in CESM/CAM.

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MPAS – Ongoing Development

GPU/accelerator capabilities in MPAS-Atmosphere

A version of MPAS-A using GPUs through OpenACC directives is being developed.

Participating organizations: The Weather Company, IBM, NCAR, Univ. Wyoming, KISTI, NVIDIA

Questions being addressed in this development:

- Can we achieve significant performance enhancement on GPUs using OpenACC?
- Can we maintain and evolve a single-source code (CPU/GPU) in our development and for release and support to the community?

For further information see the WRF/MPAS workshop talks:

PU developments for the WRF and MPAS Models.
Adie et al, Wednesday morning.

Plans for a GPU-accelerated MPAS-driven forecast system.
Todd Hutchinson et al, Wednesday morning.

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MPAS – Ongoing Development

MPAS mesh generation

Mesh generation utilities are not in the MPAS V6 release.

Mesh generation is expensive (expensive algorithms, parallelization issues, etc). Variable high-resolution meshes can take months to generate with existing utilities.

Recent development efforts suggest we may be able to speed-up our existing algorithms by an order of magnitude or more.

Mesh generation tools will appear in the public MPAS-Tools repository: https://github.com/MPAS-Dev/MPAS-Tools

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MPAS – Ongoing Development

MPAS Github repository

https://github.com/MPAS-Dev/MPAS-Model

As of the MPAS V6 release, the release and development repository have been made public.

Advantages:

- It's easier for everyone to maintain their own branches of MPAS, since they can incrementally integrate changes to the main (single) code base.
- It simplifies the process for community members to contribute changes. Contributions should be developed under git, and pull requests made.
- If more people are able to see pull requests as they are made, there's a higher likelihood that bugs or oversights can be caught earlier.

However…

- We need a contributors' guide to set expectations for contributing to the project.
- Open development doesn't guarantee any pull request made to the project will be approved.
- We can't support development code to the community.
- Anyone wishing to develop a new capability (e.g., a physics scheme) in private will need to manage a small amount of complexity in pushing code between different git repositories (private and public).

WRF and CESM are not public, but they will likely become public in the near future.