MPAS in NOAA and UFS

- **Standalone MPAS with physics suites used in NOAA configurations**
  - NSSL has demonstrated 3km CONUS MPAS forecasts for 2.5+ years
    - RRFS/HRRR initial conditions/physics suites (and NSSL MP variant)
    - Evaluated in HWT SFE and informed RRFSv2 officenote “whitepaper”
    - Developing 3km MPAS-based WoFS
  - GSL has invested in MPAS development and testing over last 2 years
    - All development publicly available in the UFS fork of MPAS
    - 3 km CONUS variants for MPAS release/physics/DA testing
      - RRFS initial condition with updated physics evaluated in HWT
      - Physics in UFS-community MPAS fork and GWD in NCAR MPAS
      - Hourly cycling with JEDI using 3 DEnVer
    - 3 km vs 3.5 km CONUS MPAS meshes
    - 15 km fixed global and 15-to-3 km variable MPAS meshes (over NA)
    - 1 km sub-CONUS MPAS mesh for fireweather applications

MPAS in NOAA and UFS

- **Use of MPAS in the UFS (steps completed towards integration)**
  - Generalization of UFS atmospheric component (FV3ATM → UFSATM)
    - Fork of the MPAS model created in the ufs-community space of GitHub
    - Cmake filelists for including/building MPAS in UFSATM created
    - Stub atmospheric driver for the MPAS-based UFSATM created (calls the dynamical core and a mock CCPP-compliant parameterization via the CCPP framework)
    - ESMF grid component to invoke the MPAS-based UFSATM
    - Simplified NUOPC cap was created to run the ESMF Grid Component
  - Generalization of the CCPP Physics
    - Refactoring of parameterizations completed so all schemes can return tendencies and not directly update the model state
    - Stochastic physics pattern generator modified to use with the MPAS grid (only developed for SPPT so far)

MPAS in NOAA and UFS

- **Use of MPAS in the UFS (steps needed for integration)**
  - Initialization/UFSATM driver
    - Complete tests of CCPP parameterizations w/tendencies
    - Code to convert between height/pressure, bottom/top, array shape
    - Variables associated with LBCs need to be initialized/populated (LAM)
  - Physics
    - Transition SPPT-related stochastic physics code in MPAS standalone to the MPAS-UFSATM along with SHUM, SKEB, Cellular Automata
    - Update CCPP Physical Parameterizations (keeping synced across repos)
  - Pre-processing
    - Integrate MPAS preprocessing tools into UFS_UTILS along with RAVE
    - Grid generation tools
  - Post-processing/IO
    - convert_mpas vs MPASSIT - which tools to use and scope of grids?
    - ESMF write grid component - for horizontal interp and asynchronous I/O
    - Inline vs offline UPP - efficiency vs. scope of operational upgrades

MPAS in NOAA and UFS

- **Shared support issues**
  - Personnel – having sufficient dycore expertise (NOAA), having sufficient capacity for NOAA and non-NOAA development/maintenance (NCAR)
  - Code management for MPAS dycore in other hosts including UFS
  - Development needs to facilitate potential future operational implementation that overlap with community applications
  - MPAS performance optimization

MPAS-A in NOAA and the UFS

Questions:

NOAA support for community use of NOAA physics?

- In the MPAS-Atmosphere release
- In the UFS

NSF NCAR support for MPAS-A dynamical core in the UFS

- Operations
- Research and exploratory use