Summary of Technical Details

Model Properties

General

Language

Release Date

Native Data Format of IO Data

Parallelization Approach

Dynamical Core

Dycore Generic class

Prognostic variables (moist setup with water vapor)

Specifics on spatial discretizations (keywords)

Specifics on temporal discretizations (keywords)

Temporal discretization (generic class)

Type of horizontal discretization

Type of vertical coordinate

Type of vertical discretization

equation_set

Tracer Advection Scheme

Tracer Advection Generic class

Tracer Advection: Type of horizontal discretization

Tracer Advection: Type of vertical discretization

tracer advection: Specifics on spatial discretizations (keywords)

tracer advection: Specifics on temporal discretizations (keywords)

Computational Grid and Grid Staggering

Additional grid design choices

Base computational grid

Grid projection

Horizontal grid staggering

Option for variable-resolution grid

Vertical grid staggering

Time Steps

Model nomenclature for approximate 1x1 degree grid spacing (110 km x 110 km)

Typical dynamics time step (in s) for approximate 1x1 degree spacing (110 km x 110 km)

Typical physics time step (in s) for approximate 1x1 degree grid spacing (110 km x 110 km)

Typical tracer advection time step (in s) for approximate 1x1 degree grid spacing (110 km x 110 km)

Conservation and Fixers (Horizontal and Vertical)

A-posteriori fixers

Built-in conservation property

Dissipation Mechanisms (Horizontal and Vertical)

Explicitly added dissipation mechanisms

Implicit (numerical) dissipation mechanisms

List of all dissipation coefficients

Coupling the Dynamical Core to Moist Physics

Physics-Dynamics coupling strategy

format: edited by R.B.Rood 20160302

MPAS-MMM

Fortran and C
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NetCDF
MPI (MPAS V4.0 release); MPI and OpenMP (development branch)

Eulerian finite volume

scalar mass (moisture, etc)

Runge Kutta, third order

timesplit HE-VI integration
finite volume and finite difference on a C-grid Voronoi mesh
hybrid terrain following height coordinate
finite volume/finite difference
shallow-atmosphere, fully compressible nonhydrostatic, spherical

Eulerian

finite volume

finite volume

hybrid coordinate, Lorenz staggering

Arakawa C-grid

Lorenz C-grid

120 km mesh: 40962 cells

between 600 and 720 seconds, configuration dependent

physics dependent

between 600 and 720 seconds, configuration dependent

mass of dry air
density-weighted potential temperature
tracer mass

2D constant hyperviscosity filter, 2D horizontal 4th-order divergence damping, 3D divergence damping, gravity-wave absorbing layer (Raleigh damping on w).

FCT for monotonic or positive definite scalar transport - configuration dependent.

see the MPAS-Atmosphere Users Guide

configuration and physics dependent