

The Nonhydrostatic Icosahedral Model

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ESRL is developing a new global finite-volume Nonhydrostatic Icosahedral Model, named the NIM, for earth system modeling, and weather and climate prediction. The model uses innovations in model formulation similar to those of the hydrostatic Flow-following Icosahedral Model (FIM) developed by ESRL and now being tested for future use by the National Weather Service as part of their operational global prediction ensemble. Innovations from the FIM used in the NIM include:

- * A local coordinate system remapped to a plane for each grid point,
- * Grid points in a linear horizontal loop that allow any horizontal point sequence,
- * Flux Corrected Transport formulated based on the high-order (3rd Order) Adams-Bashforth scheme to maintain conservative positive definite transport,
- * All differentials evaluated as line integrals around the cells,
- * Strict conservation of passive tracers to the round-off limit, and
- * Computational design to allow for scalability to hundreds of thousands of processors.

The FIM and NIM models use finite-volume techniques pioneered by S. J. Lin of GFDL. The NIM will use the vertically Lagrangian coordinate system developed by Lin. It will use the Earth System Modeling Framework and be part of a modeling system being developed by ESRL, GFDL and AOML. Numerical design goals of the NIM include the development of Piecewise Parabolic third order differencing and Vandermonde polynomials allowing high order approximations of local variables in the horizontal, and a Lagrangian Riemann Solver for vertical differencing. NIM will have the capability to run globally at kilometer scale resolution, which would allow convective macro-phenomena like the Madden-Julien Oscillation to be explicitly predicted. Other important properties include the high conservation needed for earth system modeling of chemistry and aerosols.

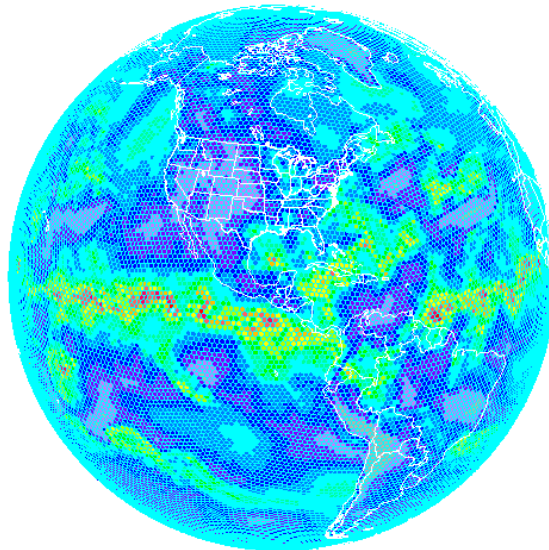


Figure 1. Shows FIM 24-h forecast integrated cloud water superimposed on icosahedral grid.