



Earth System Research Laboratory (ESRL)

Global Systems Division (GSD)

Putting tools in the hands of users

Making a Difference in Weather and Climate Prediction



ESRL/GSD Develops New Weather and Seasonal Prediction Model – The FIM

A new computational design for a global icosahedral model has been developed at the Global Systems Division of NOAA’s Earth System Research Laboratory (ESRL). GSD collaborated with the Environmental Modeling Center at the National Centers for Environmental Prediction (NCEP) and other divisions of ESRL to research, develop, and test this “Flow-Following – Finite Volume Icosahedral Model”, known as the FIM.

What is an Icosahedron?

The FIM is based on the principle of a solid 20-sided geometric figure known as an icosahedron. The FIM coordinate system consists of a large number of hexagonal cells (with 12 embedded pentagons).

Flow-Following Coordinates Reduce Nonphysical Errors

The FIM’s name originates from the fact that it is a finite-volume icosahedral model that solves shallow-water flow in combination with a flow-following vertical coordinate whose surfaces move freely according to airflow. These coordinate surfaces aloft are defined by a constant potential temperature, making it flow-following. This coordinate system allows for a reduction of nonphysical errors in the model.

Unique Grid Cell Shapes Allow Conservative Finite-Volume Numerics

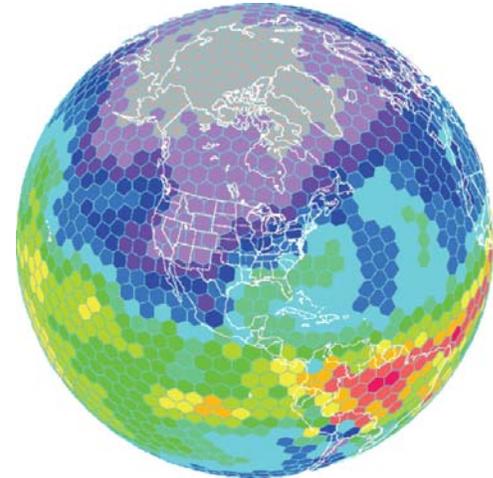
This new grid-point model, in a sense, “molds” over the globe providing quasi-uniform coverage with minimal regional variation. The variations can be kept minimal due to the shape of the grid cells. The FIM is particularly suitable for finite-volume numerics whose conservative operators can be easily approximated as line integrals along cell boundaries.

Potentially Produces More Accurate Numerical Weather Predictions

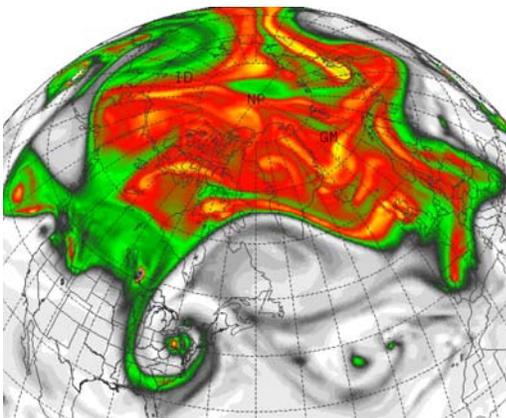
The FIM runs real-time weather forecasts twice daily as part of a verification process proposed by NCEP. These runs and other research have proven that the desirable “conservativeness” of the model can potentially result in better overall numerical predictions.

The FIM Meets NOAA’s Mission Goal

ESRL’s efforts to improve local, regional, and global weather and climate prediction models enhance NOAA’s customers’ preparedness for responding to hazardous weather-, climate-, and water-related conditions. These efforts are also applied to improving medium-range weather prediction and responding to intra-seasonal climate prediction needs.



An icosahedral grid, such as the FIM, is the most uniformly distributed geodesic grid suitable for weather and climate models. The FIM is run at resolutions from 60 km down to 15 km and 10 km.



Above, the FIM is used to predict Superstorm Sandy’s and intensity at landfall. Shown in the figure is potential temperature at the dynamic tropopause.

On The Web

www.esrl.noaa.gov/gsd/

or

fim.noaa.gov

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