Global weather-climate model developments: the present and the future

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Abstract

A general consensus is emerging within the global modeling community that a unified model approach for both weather and climate applications would be highly beneficial scientifically as well as pragmatically (offering huge cost saving by eliminating duplicating development efforts). It is also recognized that in order to substantially reduce uncertainties in climate-change predictions as well as to improve the skill in medium-range weather forecasting (including typhoon/hurricane intensity predictions), cumulus parameterization may have to be replaced with "brute-force" cloud-resolving approaches (e.g., super parameterization and CRM). To achieve these goals within the framework of a unified regional-global weather-climate model, NOAA/GFDL has in its 5-year plan to develop such a super atmosphere model with the following key attributes:

1) Fully non-hydrostatic dynamics without approximation.
2) High-order conservative finite-volume discretization with quasi-uniform grid on the sphere.
3) Configurable as a regional or global model with Adaptive Mesh Refinement (AMR) capability, simultaneously allowing spatial scale from meso-beta (~100 km) to finer than the meso-gamma (< 10 km).
4) Highly scalable on High Performance Parallel computers.
5) Explicit cloud micro-physics keeping the "deep moist convection" as an option.

In this talk, I will discuss various approaches to meet the above goals. A brief review of the finite-volume dynamical core, and its performance within GFDL's coupled atmosphere-ocean-land modeling system, the CM2.1, will be presented.