A31C-1714 Assessment of Finite-Volume Transport Schemes on Cubed-Sphere Grids and an Accurate Alternative for Divergent Winds

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🕐 08:30 - 12:20
📍 *Hall B-C (Poster Hall) (Convention Center)*

Abstract

The cubed-sphere finite-volume dynamical core (FV3), developed by GFDL-NOAA, is widely used as a basis for atmospheric models worldwide. Central to FV3 is its finite-volume approach for solving horizontal dynamics on Lagrangian surfaces, which applies transport finite-volume fluxes for different variables, thereby assigning a critical role to the transport scheme in the solver. This work re-evaluates the FV3 transport scheme with the goal of enhancing its accuracy, particularly in scenarios involving divergent winds. We propose modifications to the FV3 transport scheme that significantly improve its accuracy, as demonstrated through numerical experiments. Unlike the first-order accuracy of the original FV3 scheme under divergent winds, our modified scheme achieves second-order accuracy. Under divergence-free wind conditions, both schemes perform at a second-order accuracy level, with our proposed scheme exhibiting slightly superior accuracy. Moreover, our enhancements entail minimal additional computational overhead and can be easily implemented within existing codes. In summary, our proposed modifications offer substantial improvements in accuracy, especially in the presence of divergent winds typical in certain atmospheric phenomena, while maintaining computational efficiency.

First Author

S

Luan Santos

Cooperative Institute for Modeling the Earth System, Atmospheric and Oceanic Sciences program, Princeton University

Geophysical Fluid Dynamics Laboratory

Authors

M

Joseph Mouallem

Cooperative Institute for Modeling the Earth System, Princeton University

NOAA/Geophysical Fluid Dynamics Laboratory

P

Pedro Peixoto

Universidade de São Paulo

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