FVM: a nonhydrostatic finite-volume dynamical core for the ECMWF Integrated Forecasting System

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Abstract:

Over the next decade, many aspects of ECMWF's Integrated Forecasting System (IFS) may need to change in light of the efficiency of higher-resolution global forecasts called for by ECMWF's long- term strategy. The dynamical core lies at the heart of the model infrastructure. It numerically solves the fundamental governing equations, which take the form of physical conservation laws describing the resolved atmospheric dynamics. The dynamical core is coupled to parametrizations of subgrid- scale physical atmospheric processes and to models of other Earth system components. The current IFS dynamical core depends on the spectral-transform method to solve the governing equations. ECMWF is continuing to develop this dynamical core, which also includes a nonhydrostatic option, to make it as computationally efficient as possible. For added flexibility, it is also developing a new, nonhydrostatic dynamical core which uses the finite-volume method. This 'Finite-Volume Module' (FVM) has been shown to perform well compared to the current dynamical core in benchmark tests, and it holds the promise of greater computational efficiency for global nonhydrostatic forecasts at very high resolution run on future exascale high-performance computing facilities.

Reference

Kühnlein, C., W. Deconinck, R. Klein, S. Malardel, Z.P. Piotrowski, P.K. Smolarkiewicz, J. Szmelter, N.P. Wedi, 2019: FVM 1.0: a nonhydrostatic finite-volume dynamical core formulation for the IFS, *Geosci. Model Dev.*, **12**, 651-676, https://doi.org/10.5194/gmd-12-651-2019