3D reference profile in GRAPES_GFS dynamics

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Abstract

The selection of reference profile is critical to the accuracy of the semi-implicit semi-Lagrangian model’s dynamic core. The GRAPES_GFS(Global Regional Assimilation and PrEdiction System, Global Forecast System) developed by the Numerical Prediction Center of China Meteorological Administration is based on the one dimension reference profile, this kind of method is simple and easy to realize, but because of the perturbation of dimensionless pressure and potential temperature is very big, it’s reducing the accuracy of spatial computation, at the same time, due to the large nonlinear terms, the accuracy of time integration is low. This paper takes the major operational center’s method of construction the dynamic core in recent years as a reference, introduced a three dimension reference profile which does not change with time and satisfies the hydrostatic balance into the dynamic core of GRAPES_GFS, So that the reference atmosphere can be as close as possible to the model atmosphere, it’s improving the accuracy of spatial computation and decreasing the nonlinear terms, which improve the accuracy of time integration.

This paper re deduction the process of solving the dynamic equations after introduced the three dimension reference profile, through a number of ideal tests to verify the correctness of theoretical methods and implementation of the code, and shown that the new three dimension reference profile can effectively improve the computational accuracy of the dynamic core.

There will be some discussions focus on the construction of three dimension reference profile based on the real data forecast, and finally we decide to use climate average field. Then through several months forecast to see the actual prediction performance of the new reference profile, and also some result coupled the three dimension reference profile with the new predictor-corrector SISL scheme of the dynamic core.

Key words GRAPES_GFS, Three dimension reference profile, SISL, Linearization, Predictor-corrector SISL scheme