Contribution ID: **67** Type: **Poster presentation**

Dynamical core of the Russian global NWP model: current state and further developments

Currently, the dynamical core of Russian operational global NWP model is the hydrostatic semi-Lagrangian semi-implicit core SLAV20 (Tolstykh et al, GMD 2017). The operational version has the horizontal resolution about 20 km. The new version with 10 km resolution is under testing. The works on increase of parallel efficiency for this new version of SLAV model are presented. The result is 23% elapsed time reduction at 3900 cores.

The development of the next generation non-hydrostatic core for our model is in progress. It will be based on compressible non-hydrostatic equations in height-based terrain-following coordinates. The horizontal grid is gnomonic cubed-sphere with nested regions of higher resolution. Reduced lat-lon grid is also considered. Possible strategies are semi-implicit semi-Lagrangian algorithm, exponential time integration scheme with semi-Lagrangian advection, Runge-Kutta IMEX scheme with Eulerian advection. All these strategies are under testing in shallow-water and vertical slice Euler-equations models.

The results for shallow-water nonlinear system using exponential-Rosenbrock scheme and semi-Lagrangian advection at the cubed sphere are presented and compared with other approaches.

The discretization of the linearized shallow-water equations for reduced latitude-longitude grid with Arakawa C-type variables staggering is considered. The interpolation approach is used to construct spatial discretization. The constraints on the interpolation procedures that ensure mass and total energy conservation are derived. First tests results confirm the accuracy of the scheme and its conservation properties.

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Session Classification: Posters