Geophysical Research Abstracts
Vol. 15, EGU2013-10634, 2013
EGU General Assembly 2013

Numerical weather forecasting with anelastic model

Damian Wójcik, Marcin Kurowski, Zbigniew Piotrowski, Bogdan Rosa, and Michał Ziemiański
IMGW-PIB, Poland (damian.wojcik@imgw.pl)

Research conducted at Polish Institute of Meteorology and Water Management, National Research Institute, in collaboration with Consortium for Small Scale Modeling (COSMO) are aimed at developing new conservative dynamical core for next generation operational weather prediction model. Within the frames of the project a new prototype model has been developed. The dynamical core of the model is based on anelastic set of equation and numerics adopted from the EULAG model. An employment of EULAG allowed to profit from its desirable conservative properties and numerical robustness confirmed in number of benchmark tests and widely documented in scientific literature. The first stage of the project has been already successfully completed. Its main achievement is a hybrid model capable to compute weather forecast. The model consists of EULAG dynamical core implemented into the software environment of the operational COSMO model and basic COSMO physical parameterizations involving turbulence, friction, radiation, moist processes and surface fluxes (COSMO-EULAG). The presentation shows the case studies comparing results of 24-hour forecasts calculated via the hybrid model with analogous results obtained with the Runge-Kutta dynamical core standard for the COSMO operational applications. The experiments are performed with 2.2 km resolution over Alpine domain of operational MeteoSwiss numerical forecasts. The results demonstrate that the short-term forecasts employing different dynamical cores are qualitatively and quantitatively similar, especially in the middle and upper troposphere. Near the surface the COSMO-EULAG results, while similar to the Runge-Kutta ones, show more small-scale variability. It is seen that the anelastic approximation does not impose measurable adverse affects on the forecast. The presentation shows also results of another class of experiments. They involve 24-hour forecast with COSMO-EULAG over realistic Alpine domain with the horizontal resolutions of 1.1 and 0.55 km, and employing non-filtered orography calculated for every of these resolutions from the SRTM data. The results show a dependence of the forecasted flow structure on the model resolution not only for the surface features but also for the structure of upper level flow and especially structure of the jet stream over Alpine area. The results document also numerical robustness of the COSMO-EULAG dynamical core which for the horizontal resolution of 0.55 km deals with Alpine slopes reaching 56 degrees of inclination.