The Global-to-Regional Data Assimilation System for the ICON Model

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Abstract

The Icosahedral Non-Hydrostatic (ICON) Model and its Ensemble Data Assimilation Systems EnVAR+LETKF are developed by an international consortium with Deutscher Wetterdienst (DWD), the Max-Planck-Institute for Meteorology (MPI), the German Climate Computing Center (DKRZ), the Karlsruhe Institute of Technology (KIT), the COSMO Consortium (Germany, Russia, Switzerland, Italy, Romania, Poland, Greece and Israel) and the Center for Climate Systems Modeling (C2SM).

Globally, an ensemble data assimilation system based on an ensemble-variational system (EnVAR) in combination with a Localized Ensemble Transform Kalman Filter (LETKF) is used for the 13 km global deterministic ICON and the 40 km ensemble prediction system (ICON-EPS) with 40 members. The models are run with a two-way nested 6.5 km resolution area ICON-EU over Europe, where the ICON-EU-EPS has 20 km resolution. The analysis is carried out every 3 hours. Operationally, the full LETKF ensemble analysis is coupled to the high-resolution EnVAR analysis by relaxation of the ensemble mean to the deterministic analysis.

The convective-scale ICON-D2-EPS is run on 2 km resolution with 40 members. The operational system employs the LETKF with an additional deterministic analysis for the deterministic run, where the Kalman matrix of the LETKF is employed. Regional analysis is carried out every hour. Rapid Update Cycle analyses and forecasts hourly are under preparation within the SINFONY project in combination with Nowcasting.

For ICON-D2 we also develop an EnVAR, which can use any of the available ICON-EPS (global, mesoscale and convective-scale) as input for its covariance estimator. The system is portable and can be employed for regional data assimilation anywhere on the globe.

Keywords: Ensemble Data Assimilation, EnVAR, LETKF, ICON Model, Global, Mesoscale, Convective, scale Data Assimilation, Particle Filters

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