REQUEST FOR A SPECIAL PROJECT 2015–2017

MEMBER STATE: Germany

Principal Investigator[1]: Dr. Florian Harnisch

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Other researchers:

Matthias Sommer, Leonhard Scheck, Martin Weissmann

Project Title:

Convective-scale ensemble data assimilation of humidity- and cloud-related observations

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** _____	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2015	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2015-2017: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2017.)		**2015**	**2016**	**2017**
High Performance Computing Facility	(units)	400.000	400.000	400.000
Data storage capacity (total archive volume)	(gigabytes)	2.000	2.000	2.000

*An electronic copy of this form **must be sent** via e-mail to:* *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date):

30 June 2014

Continue overleaf

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

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Extended abstract

The purpose of this project is to significantly advance the kilometer-scale ensemble data assimilation system (KENDA) that has been developed for the COSMO limited area model of DWD. KENDA aims to improve the forecasts of severe weather events linked to convection by providing improved deterministic and ensemble initial conditions at the convective scales, i.e. at 1-3 km horizontal grid spacing. Previous work for KENDA includes the development of a tool for ensemble-based estimates of the forecast impact of various observations (Sommer and Weissmann 2014) and the assessment of the capability of KENDA to provide appropriate ensemble initial conditions (Harnisch and Keil 2014).

The primary focus of this project is to facilitate the assimilation of different potential high-impact observations for convective-scale NWP that are linked to the initiation and development of convection. The identified observations comprise Global Navigation Satellite System (GNSS) slant and total zenith delay, Meteosat Second Generation (MSG) SEVIRI infrared (IR) humidity channels, and MSG SEVIRI visible (VIS) and near-infrared (NIR) channels. Humidity- and cloud-related remote sensing data provide a temporally and spatially dense data set, which so far is only used to a small extent for convective-scale data assimilation and requires significant further research due to their complexity. In preliminary work, a sufficiently fast forward operator for MSG SEVIRI VIS and NIR channels has been developed (Kostka et al. 2014) and is now applied to assess the appropriate use of such observations in the KENDA system and the forecast impact of such observations.

Further, the project aims to evaluate the impact of different approaches to represent model error in ensemble systems, the relative forecast impact of humidity- and cloud-related observations and the sensitivity of cloud related forecast errors to changes in the initial conditions.

The project will be carried out in the framework of the Data Assimilation Branch of the Hans-Ertel-Centre for Weather Research (HErZ-DA) which exhibits a university research group that is funded by and closely collaborates with DWD. The primary focus of HErZ-DA is the advancement of convective-scale NWP by investigating and developing improved methods for the generation of initial conditions and better ensemble prediction systems.

The investigators are familiar with the ECMWF software and data infrastructure and lateral boundary conditions computed by ECMWF have already been applied in a study investigating ensemble initial conditions (Harnisch and Keil, 2014). Experiments with the KENDA system using the ECMWF infrastructure have been performed already within the **SP ITCONV** (C. Marsigli) and a strong collaboration is envisaged.

References:

Harnisch, F. and C. Keil, 2014. Initial conditions for convective-scale ensemble forecasting provided by ensemble data assimilation. *Mon. Wea. Rev.*, submitted.

Kostka, P. M., M. Weissmann, R. Buras, B. Mayer and O. Stiller, 2014. Observation operator for visible and near-infrared satellite reflectances. *J. Atmos. Oceanic Technol.*, 31, 1216–1233.

Sommer, M. and M. Weissmann, 2014. Observation impact in a convective-scale localized ensemble transform Kalman filter. *Q. J. R. Meteorol. Soc.*, DOI: 10.1002/qj.2343, in press.