REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: Germany

Principal Investigator[1]: George Craig

Affiliation: Ludwig-Maximilians-Universität München

Address: Theresienstraße 37
80333 München
Germany

E-mail: George.craig@lmu.de and tobias.selz@lmu.de

Other researchers:

Tobias Selz, Christian Keil

Project Title:

Large-scale and local control of severe weather: towards adaptive ensemble forecasting

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** DEADEN	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2011	
Would you accept support for 1 year only, if necessary?	YES ☐	NO ☐

Computer resources required for 2013-2015: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2015.)	**2013**	**2014**	**2015**
High Performance Computing Facility (units)	300,000	x	x
Data storage capacity (total archive volume) (gigabytes)	500	x	x

*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): 26.04.2012

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.

Principal Investigator: George Craig

Project Title: Large-scale and local control of severe weather: towards adaptive ensemble forecasting

Extended abstract

(identical to the abstract of the original application)

High impact weather is often associated with small-scale substructures in larger-scale weather systems. Heavy precipitation or intense wind gusts associated with convection or frontal cyclones are partially controlled by the synoptic flow, and partly by local orographic features or small-scale dynamical processes. Predictability,
or forecast uncertainty, of these events are influenced by all scales, but in different ways in different meteorological situations.

Small-scale variability can be represented by stochastic parameterizations in an ensemble forecast set-up. These include the variability of a convective ensemble, which can be assessed by using a stochastic convective parameterization. Unresolved variability in the boundary layer can be represented by introducing random perturbations. Sources of large-scale variability are well represented by global ensemble forecasts such as the ECMWF Ensemble Prediction System (EPS).

The aim of the project is to assess the relative importance of these sources of forecast uncertainty and to develop the concept of an adaptive ensemble forecasting system that allocates the limited time and computing resources in an optimal way between ensemble members that reflect synoptic-scale uncertainty, those that reflect unresolved small-scale processes, and additional nested models to give very high resolution in the target region.

To account for uncertainties associated with the large-scale flow, the model system will be based on the ECMWF EPS used in combination with the COSMO-LEPS clustering (Molteni et al. 2001). providing boundary and initial conditions to the COSMO model (Steppeler at al. 2003). The COSMO-model is run with a medium resolution (~7 km grid-spacing) with the Plant-Craig stochastic parametrization for convection (Plant and Craig, 2008). Within the medium-resolution COSMO grid, we will embed a COSMO grid with 2.8 km grid-spacing on which simulations with stochastic boundary layer perturbations will be run.

ECMWF computing resources are requested to rerun the ECMWF EPS and the COSMO-LEPS clustering algorithm for selected cases, and to run part of the COSMO model experiments. This work is carried out in the framework of the Deutsche Forschungsgemeinschaft (DFG) Research Group PANDOWAE (Predictability and Dynamics of Weather Systems in the Atlantic-European Sector, see:
www.pandowae.de) that aims to contribute to the improvement of the quality of high-impact weather (HIW) forecast. This Group represents a strong German contribution to the "World Weather Research Programme" THORPEX of the World Meteorological Organisation WMO.

The principal investigator, George Craig will be assisted by Pieter Groenemeijer and Christian Keil who has experience with the ECMWF computing infrastructure, being principal investigator of the Special Project "Ensemble modelling for the improvement of short range quantitative precipitation forecasts" (DEEQPF).

Molteni, F., R. Buizza, C. Marsigli, A. Montani, F. Nerozzi, and T. Paccagnella, 2001: A strategy for high-resolution ensemble prediction. Part I: definition of representative members and global-model experiments. Quart. J. Roy. Meteor. Soc., 127, 2069-2094.

Steppeler, J., G. Doms, U. Schättler, H. W. Bitzer, A. Gassmann, U. Damrath and G. Gregoric, 2003: Meso-gamma scale forecasts using the nonhydrostatic model LM. Meteorol. Atmos. Phys., 82, 75-96.

Plant, R. S. and G.C. Craig, 2008: A stochastic parameterization for deep convection based on equilibrium statistics, J. Atm. Sci., 65,
87-105.