REQUEST FOR A SPECIAL PROJECT 2013–2015

MEMBER STATE: GERMANY

Principal Investigator[1]: Leonhard Gantner, Norbert Kalthoff

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Project Title: Convection-permitting ensemble simulations for West Africa based on different soil moisture fields

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SPDELM**	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2012	
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)	350 K	200 K	n/a
Data storage capacity (total archive volume) (gigabytes)	800	800	n/a

*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): 20.04.2012

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.

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Extended abstract

In West Africa convective systems contribute substantially to the annual rainfall. Their rainfall, however, is highly variable in space as well as in time and it is difficult to forecast. Recent research shows that land-atmosphere feedbacks are playing an important role for the life-cycle and physics of convective systems in the region of West Africa, where gradients of soil moisture are common (e.g. Gantner and Kalthoff, 2010).

Significant uncertainty is associated with determining initial soil moisture for a numerical model. For example, satellite measurements of soil moisture can show a quite remarkable discrepancy from in situ data and initial fields of soil moisture can vary quite a lot in different forecast models. We expect also uncertainty concerning the feedback of soil moisture with different representations of convection due to different members of the Ensemble Prediction System (EPS).

As the quality of a single forecast may be low, we will develop an ensemble system and use it for our research purposes. One aim is to determine the uncertainty in the forecast of precipitation given by the uncertainty of soil moisture. We want to avoid problems connected with parameterization of deep convection; therefore we use a convection-permitting horizontal resolution. For initial and boundary values we will use members of the EPS from ECMWF, with the Ensemble Data Assimilation (EDA) as initial conditions for improved skill in the tropics. Members will be selected with clustering methods. To use different initial fields of soil moisture will be one of the main focuses of our work.

Some working steps:

- Adapt the COSMO model for use in tropical regions and test clustering methods COSMO-LEPS (Molteni et al., 2001), EOF based (Harr et al., 2008) for the West African region and the short lead time, adapt them if necessary.

- Run SVAT model TERRA of COSMO in standalone mode forced with observed parameters like precipitation and radiation from satellite and ECMWF model data e.g. temperature and pressure. Learn about behaviour of soil moisture and temperature in the model and its climatology. Provide data for matching of satellite soil moisture.

- Test different model-based and satellite-derived soil moistures fields for suitability to use in the ensemble. Rerun ECMWF EDA and EPS for interesting cases e.g. during the AMMA period, therefore we need the requested computing time. This task can only be done on ECMWF computers.

Gantner, L., and N. Kalthoff, 2010: Sensitivity of a modelled life cycle of a mesoscale convective system to soil conditions over West Africa. Quart. J. Roy. Meteor. Soc., 136 (s1), 471-482.

Harr, P.A, D. Anwender and S.C. Jones, 2008: Predictability associated with the downstream impacts of the extratropical transition of tropical cyclones: Methodology and a case study of Typhoon Nabi (2005). Mon. Wea. Rev. 136, 3205-3225

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.