REQUEST FOR ADDITIONAL RESOURCES IN THE CURRENT YEAR FOR AN EXISTING SPECIAL PROJECT

MEMBER STATE: Germany

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Project title: The role of soil moisture and surface- and subsurface water flows on predictability of convection

Project account: **SPDEARNA**

Additional computer resources requested for	**2016**
High Performance Computing Facility (units)	5 000 000
Data storage capacity (total) (Gbytes)	1500

Continue overleaf

[1] The Principal Investigator is the contact person for this Special Project

Technical reasons and scientific justifications why additional resources are needed

One goal of this project (http://www.w2w.meteo.physik.uni-muenchen.de/research_areas/a5/index.html) is to produce soil moisture data for Germany and West Africa using the hydrologically enhanced version of the Weather Research and Forecasting (WRF) model, i.e WRF-Hydro. Such WRF-Hydro simulations are planned to be conducted for mutli-year periods in order to account for the full range of hydrological processes potentially playing a role on land-atmosphere feedback mechanisms and convection initiation. In the framework of the DFG (German Research Foundation) Collaborative Research Center 165/1 “Wave to Weather” (W2W, http://www.w2w.meteo.physik.uni-muenchen.de/), these soil moisture data will allow to investigate the role of soil moisture, surface and subsurface water flows on convective precipitation predictability. Technically, these WRF-Hydro derived soil moisture data are used to enhance the initial condition of NWP runs with WRF, WRF-Hydro and COSMO. The potential role of soil moisture-related processes on precipitation is currently assessed with water budgets and water tracking. The potential of a stochastic parameterization to account for these soil moisture effects will be addresses by implementing the stochastic parameterization from COSMO in WRF.

It was originally planned to run WRF-Hydro for Germany for a multi-year period with a horizontal grid of 300x300 points at 5 km resolution and 35 vertical levels for the atmosphere, and a horizontal grid of 1500x1500 points at 1 km resolution with four soil layers for the terrestrial hydrology. Such a setup was considered to require 85 000 SBU for a one-year simulation, although no test on the machine had been done to verify this at the time the proposal was written.

In order to facilitate the collaboration with other projects of W2W investigating the effect of surface variability on convective precipitation with COSMO-DE, it has been decided to run WRF-Hydro with a setup closer to that of COSMO-DE, a rotated pole grid of 550x550 points at 2.8 km resolution and 50 vertical levels for the atmosphere, and a horizontal grid of 5500x5500 points at 280 m resolution with four soil layers for the terrestrial hydrology. This setup was not originally planned because the technique to construct the hydrological grid, including the river network, on a rotated pole grid was not known by the members of this project at that time. However, this setup is much more computational demanding, since it requires 1 600 000 SBU for a one-year simulation.

Test simulations for Germany for the year 2008 have been conducted on the ForHLR1 machine at the Karlsruhe Institute of Technology. First results suggest that the effect of enhanced soil moisture initial condition and additionally resolved surface and subsurface water flows on model variability is weak. It is foreseen that the enhanced treatment of soil moisture plays a larger role in drier areas, like West Africa. It is therefore hypothesized that WRF-Hydro could make a significant difference in the results for Germany during the heat wave episode of 2015, which is by the way an additional source of collaboration with other projects of W2W focusing on heat waves. Also, there is a potential source of case-studies related to the W2W field campaign in September-October 2016 (http://w2w.meteo.physik.uni-muenchen.de/cca/campaign-data/index.html). Therefore it has been chosen to use the ECMWF computing resource for producing WRF-Hydro-derived soil moisture data for 2015 and 2016. A WRF-Hydro simulation initialized in January 2014 and forced with operational analyses is currently running for this purpose. So far, half a year is available. In order to prolong this simulation to the end of 2016, this would require 2.5 x 1 600 000 = 4 000 000 SBU. An additional 1 000 000 SBU is added to the additional computer resource request in order to cover past and future testing.