Project: **937**

Project title: **Influence of land-use transformations on local and regional climate in Germany**

Principal investigator: **Merja Toelle**

Allocation period: **2019-01-01 to 2019-12-31**

Project overview

The main objective of this work is to better understand the land-atmosphere interactions and the associated uncertainties. This project aims to improve the understanding of the mid European energy and water cycle, with emphasis on extreme events by modelling and analysing the atmosphere-land system especially over Germany. The mid European region has large discrepancies in future climate change projections due to water-limited and energy-limited areas at the same latitude. Therefore, it is important to understand how land use change influence the climate in the mid-European region.

Range of planned work from the scientific view

Results from the conducted simulations during the granted computing time year of 2018 (see report) will be translated to a set-up of simulations with the regional climate model COSMO-CLM_5-0-9 for the request year of 2019. The previous work helped to optimize the set-up, and to achieve the goals with a minimum of extensive simulations.

Direct downscaling experiments with the best evaluated configuration will be performed using ERA-Interim forcing over a reduced EURO-CORDEX domain from 1979 to 2015. This simulation serves as a control simulation to which land use change studies will be compared to. Before simulations with different land surface data sets will be performed and evaluated, idealized test cased (forestland or grassland) will be performed at convection-permitting scale. Idealized land cover simulations help to estimate the maximal impact. Comparing coarse resolution simulations (see report) with convection-permitting simulations help to elucidate changes in processes. Comparing idealized land cover simulations with the control simulation allow to analyse changes in cloud development and convection initiation among others.

Therefore, we plan the following simulations:

- Long-term CCLM simulation at convection-permitting scale over a reduced EURO-CORDEX domain from 1979 to 2015 with current land cover.

- Long-term CCLM simulation at convection-permitting scale over a reduced EURO-CORDEX domain from 1979 to 2015 with idealized land covers (forestland and grassland).

- Long-term CCLM simulations at convection-permitting scale over a reduced EURO-CORDEX domain from 1979 to 2015 with different land surface data sets.

- First simulation of CCLM at convection-permitting scale over a reduced EURO-CORDEX domain based on RCP8.5 with current land cover.

Particular suitability to solve the problem with help of HLRE-3

The COSMO-CLM is installed at the DKRZ in Hamburg. The DKRZ has a long record on conducting simulations with the CCLM with high quality. The COSMO-CLM is applicable with the resources at the DKRZ. With that, the simulations with the relative high horizontal resolution are conducted on mistral with passable time. Collaboration exists between different modelling institutions. To warrant comparability the high performance computer center should be the same.

Required computing time and amount of storage space

Table 1: „Downscaling" and experiments with COSMO-CLM_5-0-9:

Experiments	Description	Model	Simulation years	Node hours

		resolution		
COSMO-CLM control	Present climate	0.0275°	ERA-Interim 1979-2015	64.000
COSMO-CLM forestland	Present climate	0.0275	ERA-Interim 1979-2015	64.000
COSMO-CLM grassland	Present climate	0.0275°	ERA-Interim 1979-2015	64.000
COSMO-CLM Landsurfac1	Present climate	0.0275	ERA-Interim 1979-2015	64.000
COSMO-CLM Landsurface2	Present climate	0.0275	ERA-Interim 1979-2015	64.000
COSMO-CLM Landsurface3	Present climate	0.0275	ERA-Interim 1979-2015	64.000
Sum				384.000

Storage:

We store hourly/daily values of high resolution simulations and request:

Lustr work [TB]: 89
HPSS arch [TB]: 40
HPSS doku [GB]: 30

Additional value compared to other projects

This project does dynamical downscaling to very local scales and is unique compared to other projects.