Project: **937**

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

Principal investigator: **Merja Toelle**

Report period: **2017-01-01 to 2017-12-31**

The main objective of this work is to better understand the land-atmosphere interactions and 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.

A convection permitting model is required to study the complex interactions between the atmosphere and the land as land management turns out to be more pronounced on that scale as previously thought (Tölle et al. 2014). In this study, we employed the regional climate model COSMO-CLM_5-0-9 (CCLM), based on the non-hydrostatic equations. CCLM uses the lateral boundary conditions from the ERA-Interim reanalysis.

In a first phase a simulation has been performed from 1980 to 2010 using horizontal grid resolution of ~3km. The results show that the diurnal cycle of precipitation can realistically be reproduced by the atmospheric model, even though a dry bias is introduced. Further investigations regard the land-atmosphere fluxes and is still ongoing.

Since we found by further analysis a dry bias of CCLM in the western German region and a wet bias in the German region to the east relative to gridded observations (see Fig. 1), we decided to further investigate in the configuration of the model during the granted computing time year 2017. Therefore, in a second phase configurations are adapted and performances improved. Furthermore, we investigate in weather phenomena by testing three convective events. Here simulations over a short period of time are carried out driven by ERA-Interim. The results show that CCLM is able to reproduce all three convective events in a sufficient manner (Fig. 2-4).

The adaption to a more realistic land surface and another control simulation will be our next steps.

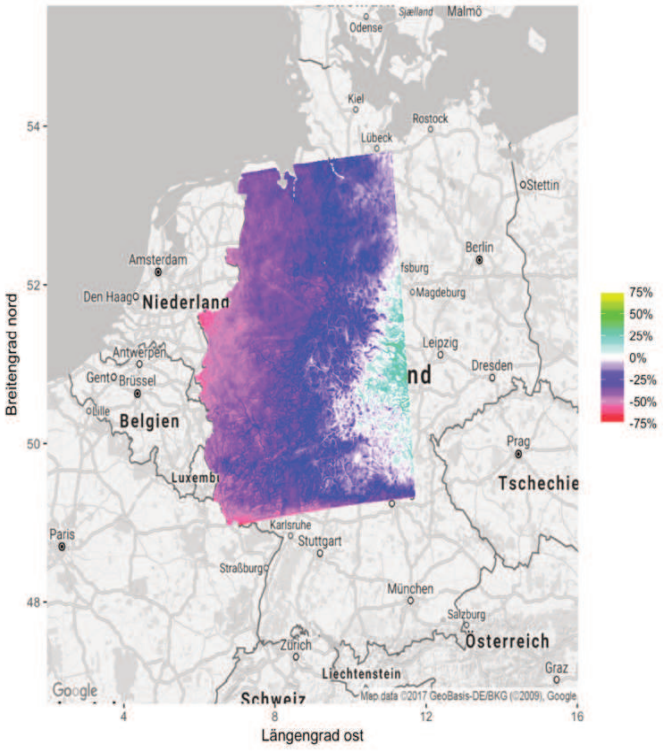

Fig.1: Relative difference as a percentage of COSMO-CLM precipitation relative to HYRAS gridded observational data set over the NW part of Germany in summer.

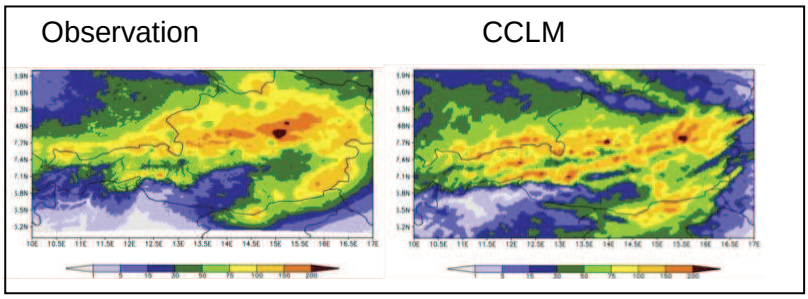

Fig.2: Precipitation distribution of the observation (left) and COSMO-CLM (left) over Austria for 23-28 OCTOBER 2012.

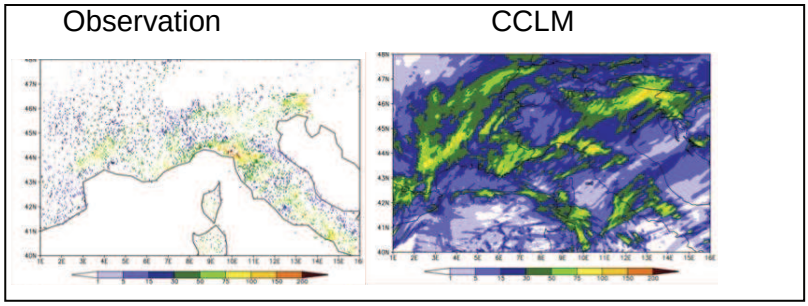

Fig.3: Precipitation distribution of the observation (left) and COSMO-CLM (left) over North Italy for 22-25 June 2009.

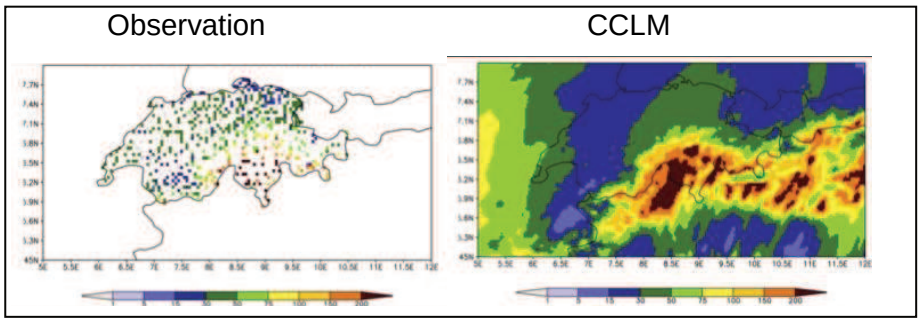

Fig.4: Precipitation distribution of the observation (left) and COSMO-CLM (left) over Swiss for 4-5 November 2014.