Geophysical Research Abstracts
Vol. 14, EGU2012-8879, 2012
EGU General Assembly 2012


# The impact of soil moisture variability on seasonal convective precipitation simulations via the soil-boundary layer interaction.

S. Khodayar, N. Kalthoff, and G. Schädler
Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany (samiro.khodayar@kit.edu)

It is known that besides forcing by synoptic-scale processes, the boundary layer conditions often play a key role for the initiation of convective precipitation. The evolution and conditions of the boundary layer depend considerably on the transformation of the available energy at the Earth's surface into sensible and latent heat fluxes.
The soil moisture (SM), besides other factors such as the vegetation coverage, land use and soil type, is one of the main factors governing this energy transformation. Additionally, the availability of humidity in the atmosphere is controlled by a number of processes including land surface processes, which in turn are strongly influenced by spatially variable fields of SM. Thus, an accurate specification of the SM distribution is a critical requirement in the representation of land and surface processes in forecast and climate models. Moreover, soil-atmosphere interactions, in particular, the SM-precipitation feedback, are highly relevant for numerical weather prediction and seasonal forecasting. Despite being a long-standing topic in research, different studies present inconclusive results showing some evidence for positive, negative, and no feedbacks depending on region and investigated period, model characteristics and resolution.
Reliable data sets for validation or initialization of model simulations are frequently not at one's disposal; especially the SM is currently one of the least assessed quantities with almost no data from operational monitoring networks available.

In summer 2007, the field campaign 'Convective and Orographically-induced Precipitation Study' (COPS) was performed in south-western Germany and eastern France. During COPS an innovative measurement approach using a very high number of different SM sensors was introduced. Each station was equipped with sensors at three different depths (5, 20 and 50cm) simultaneously measuring SM and soil temperature. The COPS data set, which provided suitable observations for model validation, in combination with seasonal climate simulations with the Consortium for Small-Scale modelling (COSMO) model in his climate version (CCLM) were used to investigate the seasonal climatology of the investigation area, as well as the interactions between the soil and the atmosphere in the complex orographic region of western Germany and eastern France. The impact of realistic model initialization with SM measurements from COPS on convective precipitation will be discussed. Additionally, the impact of the prescribed soil type distribution on seasonal climate simulations will be demonstrated.
The combination of dense observations with CCLM simulations permitted a rigorous analysis of the water transfer process chain from SM and fluxes to convective initiation and precipitation.