EGU2020-432
https://doi.org/10.5194/egusphere-egu2020-432
EGU General Assembly 2020

A Seasonally Varying Phenology for High Resolution Simulations with the COSMO-CLM Model

Eva Nowatzki[1], Jan-Peter Schulz[2], Jean-Marie Bettems[3], Jürg Luterbacher[1], and Merja Tölle[1]
[1]Department of Geography, Climatology, Climate Dynamics and Climate Change, Justus-Liebig University Giessen, Giessen, Germany (eva.nowatzki@geogr.uni-giessen.de)
[2]Deutscher Wetterdienst (DWD, German Meteorological Service), Offenbach, Germany
[3]MeteoSwiss, Zurich, Switzerland

The energy and water cycle of the regional climate is influenced by the phenological development of the vegetation through albedo, sensible and latent heat flux changes. This influences near surface temperature, precipitation and ultimately the boundary layer structure. The phenological stages in turn depend on temperature, day length, water availability and net primary productivity variations. Therefore, vegetation should play an important role in climate simulations. The current implementation of the seasonal vegetation development in the regional climate model COSMO-CLM (CCLM, COSMO 5.0 clm15), represented in the model by the leaf area index (LAI), the root depth or plant coverage, assumes a static, annually recurring cycle. In reality, it varies from year to year depending on the environmental conditions. In particular, the phenology will change with climate change modifying the environment. In this study, we implement the approach of Knorr et al. (2010) to improve the representation of the phenology in CCLM with 3 km horizontal resolution by temperature, day length and water availability. Here, the tuning parameters of the growth rate for grass is adapted from Schulz et al. (2015). Convection-permitting single column simulations are performed over the Lindenberg Meteorological Observatory, the FACE measuring site at Linden close to Gießen, and the TR32 measuring site at Selhausen close to Jülich in Germany. Comparisons of LAI results with observations show significantly improved correlations compared to simulations with the standard phenology over the period from 1999 to 2015. The reaction of the LAI due to years with extreme warm winter and spring or years with extreme dry summer is improved as well. A warmer beginning of the year causes an earlier start of the growing season, whereas a drier summer reduces the LAI due to water limitation. It is also shown, that lower LAI values lead to decreases of latent heat fluxes in the model. The mean amount of strong precipitation events (> 20 mm) is closer to the observations with the new phenology compared to the standard phenology. Further seasonally varying phenology for different plant functional types and its net primary productivity will be implemented in future work.

Ackowledgement:

Computational resources were made available by the German Climate Computing Center (DKRZ)

through support from the Federal Ministry of Education and Research in Germany (BMBF). We acknowledge the funding of the German Research Foundation (DFG) through grant nr. 401857120.

Literature:

Knorr, W. et al., 2010. Carbon cycle data assimilation with a generic phenology model. Journal of Geophysical Research: Biogeosciences, 115(G4).

Schulz, J.-P., Vogel, G. & Ahrens, B., 2015. A new leaf phenology for the land surface scheme TERRA of the COSMO atmospheric model. COSMO Newsletter No. 15, p.21-29.