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Simulation of dynamical wetland extent using a global hydrological model

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Wetland methane emissions are suspected to play a significant role during climate change events. However, it is difficult to represent wetlands explicitly in global climate simulations. While some climate models exist, which try to simulate such wetland-climate interactions, most of them simply assume a static wetland distribution. Thus, the climate forcing cannot alter the extent or distribution of wetlands in these simulations. Therefore these simulations neglect the feedbacks of changes in wetland extent on climate. In order to close this gap a dynamical wetland extent scheme has been developed. This scheme is able to solve the wetland water balance on a global scale and adapt the wetlands' surface area according to net water gain or loss. The intensity of this area change is related to the topographical slope distribution within the respective model grid cells.

The dynamical wetland extent scheme is embedded into the global Hydrology Model (MPI-HM) of the Max Planck Institute for Meteorology. In a first simulation for recent climate the model produced a realistic, although partially overestimated, distribution of today's lake and wetland distribution. The scheme successfully identifies wetlands in the northern part of North America, northern Europe and Siberia. Furthermore it simulates intensive wetland occurrence in the Amazon and Congo River basins. Especially on the northern hemisphere, simulated wetlands show pronounced seasonal variations in extent and water depth with minima in late winter and maxima in autumn.

The simulated river discharge reacts very sensitive to changes in the wetland distribution of river catchments. An increase of wetland fraction leads to a delay in peak flow as well as a decrease in overall discharge. This behavior is consistent with observations.

Currently an intensive validation of simulated wetlands is conducted for recent and mid-Holocene climate forcing. In our presentation we will provide basic information about the scheme itself and show results from the validation.