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Development of a dynamical wetland extent scheme

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Wetlands interact strongly with the water cycle on the land surface. They increase evapotranspiration, store water and therefore regulate river discharge. Currently, most global hydrology and climate models regard wetland extent and properties as constant in time. However, to study interactions between wetlands and different states of climate it is necessary to implement wetlands with dynamic behaviour into those models. Beside an improved representation of geophysical feedbacks of wetlands, the dynamical wetland scheme can also provide input for biogeochemical models, which calculate methane production in wetlands.

For the development of the dynamical wetland extent scheme, the hydrology model (MPI-HM) of the Max-Planck-Institute for Meteorology was used as a testbed. It consists of a vertical water balance model and a river routing scheme. The MPI-HM works on a global scale at 0.5° resolution. The model was modified to account for the special aspects of the water balance in wetlands. These also include lateral water inflow and outflow which are calculated using the river routing scheme. High resolution topography data are then used to translate changes in the water balance into changes in wetland extent. This is based on a statistical approach which estimates the distribution of slope within the gridcells of the model.

Although the model development is not yet completed, first test simulations were conducted in order to judge the performance of the dynamical wetland scheme. The spatial distribution of simulated wetlands is mainly concentrated on North America and the regions around the Amazon and Congo river. Additionally wetlands were generated in northern Europe and Siberia. The simulated wetlands are generally shallow (0.1 - 1 m) and show strong seasonal variations in their depth and extent. While the agreement to observations is high in North America, wetland extent is underestimated in Siberia.

Additionally a strong influence of wetland extent on the simulated river discharge can be seen. For all investigated river basins the peak flow is decreased and delayed compared to baseline river flow simulations without any wetlands. This behavior is confirmed by most of the published wetland hydrology studies.

In our presentation the model mechanics will be introduced and first results from initial simulations will be shown.