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Using WEED to simulate global wetland distribution in a land surface model

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Wetlands interact strongly with the water and energy cycle on the land surface. They increase evapotranspiration and alter the separation of incoming energy into sensible and latent heat fluxes. Additionally, they store water and 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 surface water bodies (thereafter referred to as wetlands) with dynamic behavior into these models. Besides 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.

Recently, a model for the representation of wetland extent dynamics (WEED) was developed as part of the hydrology model (MPI-HM) of the Max-Planck-Institute for Meteorology (MPI-M). The WEED scheme computes wetland extent in agreement with the range of observations for the high northern latitudes. It simulates a realistic seasonal cycle which shows sensitivity to northern snow-melt as well as rainy seasons in the tropics. Furthermore, flood peaks in river discharge are mitigated. However, the WEED scheme strongly overestimates wetland extent in the Tropics which might be related to the MPI-HM's simplified potential evapotranspiration computation.

Currently, the WEED scheme is implemented into the MPI-M's land surface model JSBACH. Thus, not only its effect on water fluxes can be investigated but also its impact on the energy cycle, which is not included in the MPI-HM. Furthermore, it will be possible to analyze the physical effects of wetlands in a coupled land-atmosphere simulation. While its implementation is not yet complete, first simulations with JSBACH-WEED show results similar to the MPI-HM simulations. The next development steps will be focused on energy cycle relevant issues such as the alteration of the surface albedo as well as the allocation of appropriate thermal properties to the wetlands. In our presentation we introduce the WEED scheme and show first results of its validation using a wide range of observations such as the newly available ESA-CCI land cover dataset of surface water bodies.