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Using WEED to simulate the global wetland distribution in a ESM

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Lakes and wetlands are an important land surface feature. In terms of hydrology, they regulate river discharge, mitigate flood events and constitute a significant surface water storage. Considering physical processes, they link the surface water and energy balances by altering the separation of incoming energy into sensible and latent heat fluxes. Finally, they impact biogeochemical processes and may act as carbon sinks or sources. 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 dynamical behavior into these models. Besides an improved representation of geophysical feedbacks between wetlands, land surface and atmosphere, a dynamical wetland scheme could also provide estimates of soil wetness as input for biogeochemical models, which are used to compute 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 overestimates wetland extent in the Tropics which might be related to the MPI-HM's simplified potential evapotranspiration computation.

In order to overcome this limitation, 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. First simulations with JSBACH-WEED show results similar to the MPI-HM simulations. As the next step, the scheme is modified to account for energy cycle relevant issues such as the dynamical alteration of surface albedo as well as the allocation of appropriate thermal properties to the wetlands. In our presentation, we will give an overview on the functionality of the WEED scheme and the effect of wetlands in coupled land-atmosphere simulations.