Improving water level and soil moisture over peatlands in a global land modeling system

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Surface Water Storage:
Simulated surface soil moisture strongly affected by new model, but reliable soil forcing data: MERRA

Forcing data: MERRA

Simulation Experiments and In Situ Data

Motivation

• How do peatlands react to changing climate?
• Model structures of current global land surface models are not able to reproduce typical hydrological dynamics in peatlands

Objective: Implementation of peatland-specific processes into the GEOS-5 Catchment Land Surface Model (Koster et al. 2000)

Next: Combining satellite observations with land surface modeling over organic-rich regions using data assimilation techniques will provide further improved estimates of geophysical variables in peatlands

Model Structure Adjustments

• Surface Water Storage:
Water pond in microrelief. Water table dependent total specific yield calculated as average of soil and open water specific yields

• Single runoff function replacing original
baseflow and overland flow functions

• Evapotranspiration: Water stress linked to water table depth
• Update of peat hydraulic properties

Simulation Experiments and In Situ Data

• Simulation experiments using different versions of the GEOS-5 Catchment Land Surface Model
• Domain: Northern Hemisphere
• Forcing data: MERRA-2 (corrected precip.)
• No parameter calibration for new model (PCM)
• Comparison with ~ 60 observed multi-year time series (11 clusters) of water table depth (WTD)

Skill Metrics and Time Series

Example 1: Bog in NW Germany
Mild winter, high precipitation, R(PTM)=0.9

Example 2: Bog in Belarus
Long freezing period, R(PTM)=0.6

Conclusions

• New model structure for peatlands results in improved skill metrics (without any parameter calibration)
• Simulated surface soil moisture strongly affected by new model, but reliable soil moisture data lacking for validation

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