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

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 microlrelief. Water table dependent 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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