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

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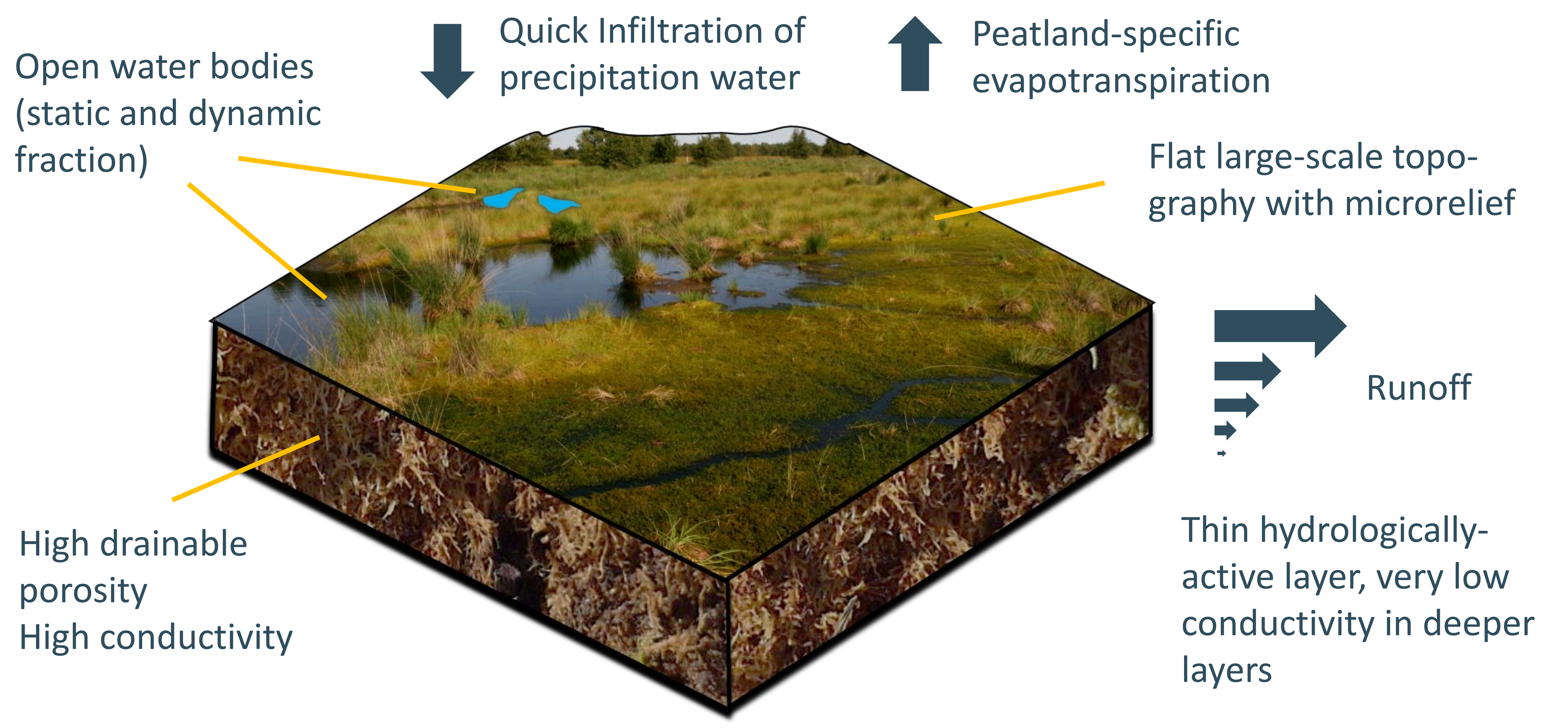
Motivation

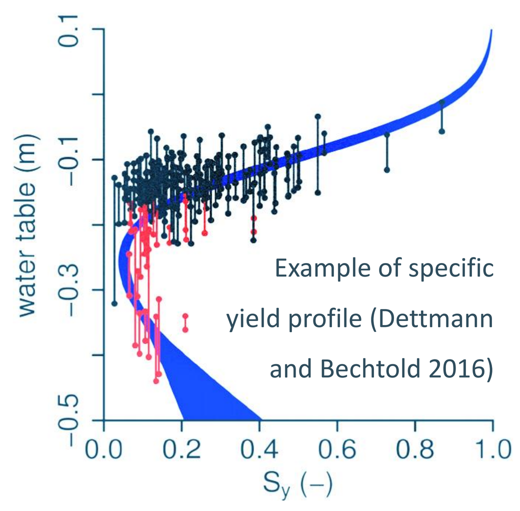
- How do peatlands react to changing climate?
- Model structures of current global land surface models are not able to reproduce typical hydrological dynamics in peatlands
- **Objective: Implementation of peatland-specific processes into the GEOS-5 Catchment Land Surface Model** (Koster et al. 2000)
- 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

Peatland characteristics (rain-fed type)



Model Structure Adjustments

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

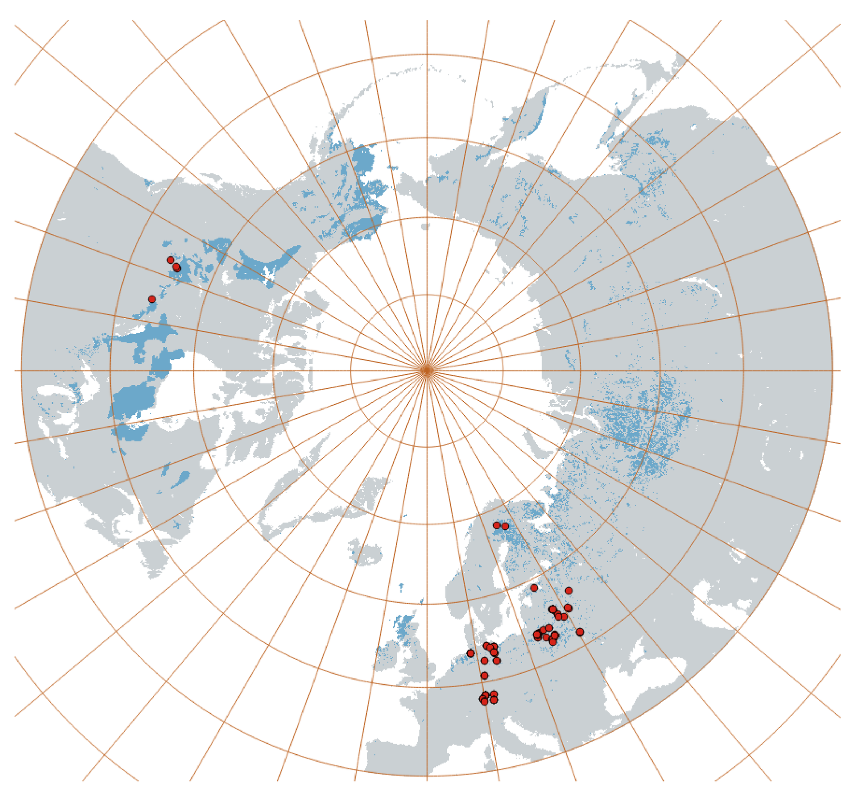


- Single runoff function replacing original baseflow and overland flow functions
- Evapotranspiration: Water stress linked to water table depth
- Update of peat hydraulic properties

Simulation Experiments and In Situ Data

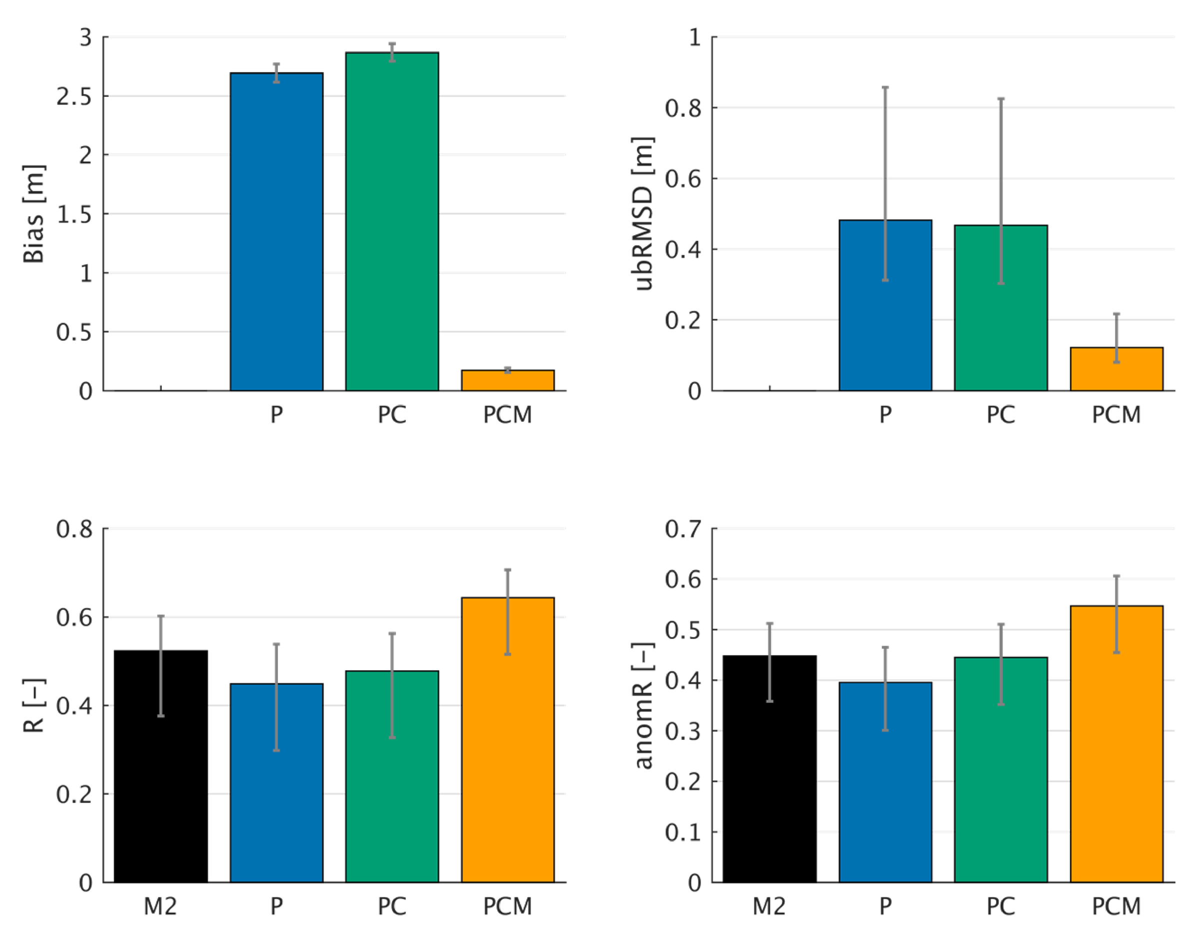
- Simulation experiments using different versions of the GEOS-5 Catchment Land Surface Model
- Domain: Northern Hemisphere
- Forcing data: MERRA-2 (corrected precip.)
- No parameter calibration for new model (PCM)
- Comparison with ~ 60 observed multi-year time series (11 clusters) of water table depth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

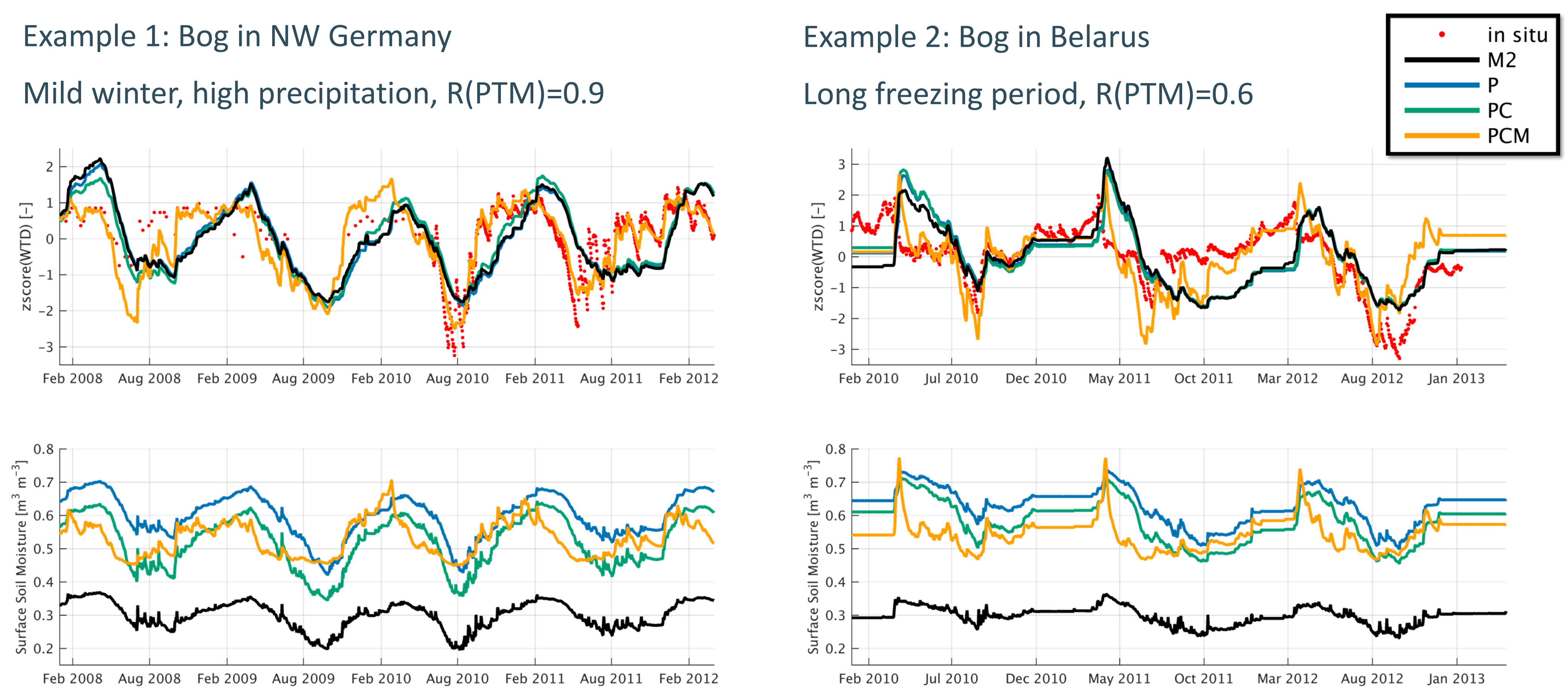
Experiment	M2	P	PC	PCM
Description	Operational **M**erra-**2**, only mineral soils	Revised soil input including **P**eat class (De Lannoy et al. 2015)	**P**eat class + Refined Topography and **C**atchment delineation	**P**eat class + Refined **C**atchments + New **M**odel Structure
Resolution	2/3° x 1/2°	EASEv2 M09	5' x 5'	5' x 5'



Peatlands (light blue) of the Northern Hemisphere, red dots = in situ data

Skill Metrics and Time Series





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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