EGU2014-2885: Impact of meteorological forcing datasets on regional scale water fluxes and drought characteristics over Germany

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1. Introduction

Accurate representation of regional-scale water fluxes is crucial for hydrological assessments of societally relevant events such as droughts. Hydrologic models are now commonly used to derive gridded estimates of land surface water budgets (e.g., soil moisture, evapotranspiration, and runoff), in the absence of long-term observations. Consequently, the skill of such models depends on, among other things, the quality of their driving data sets, particularly the choice of meteorological forcing data.

2. Research Objectives

- To provide an assessment of regional-scale water fluxes and states over Germany since 1950 using a well-established mesoscale hydrologic model (mHM[2, 1]).

- To analyze uncertainties in the representation of hydrologic fluxes and large-scale drought characteristics based on the choice of meteorological forcing data.

3. Model Set-up

A long-term hydrologic simulation was carried out with mHM using the forcing data based on (a) the publicly free E-OBS data set and (b) the gridded product of over 5500 rainfall gauges and 1100 weather stations, operated by the German Weather Service (DWD).

Hydrologic components of mHM
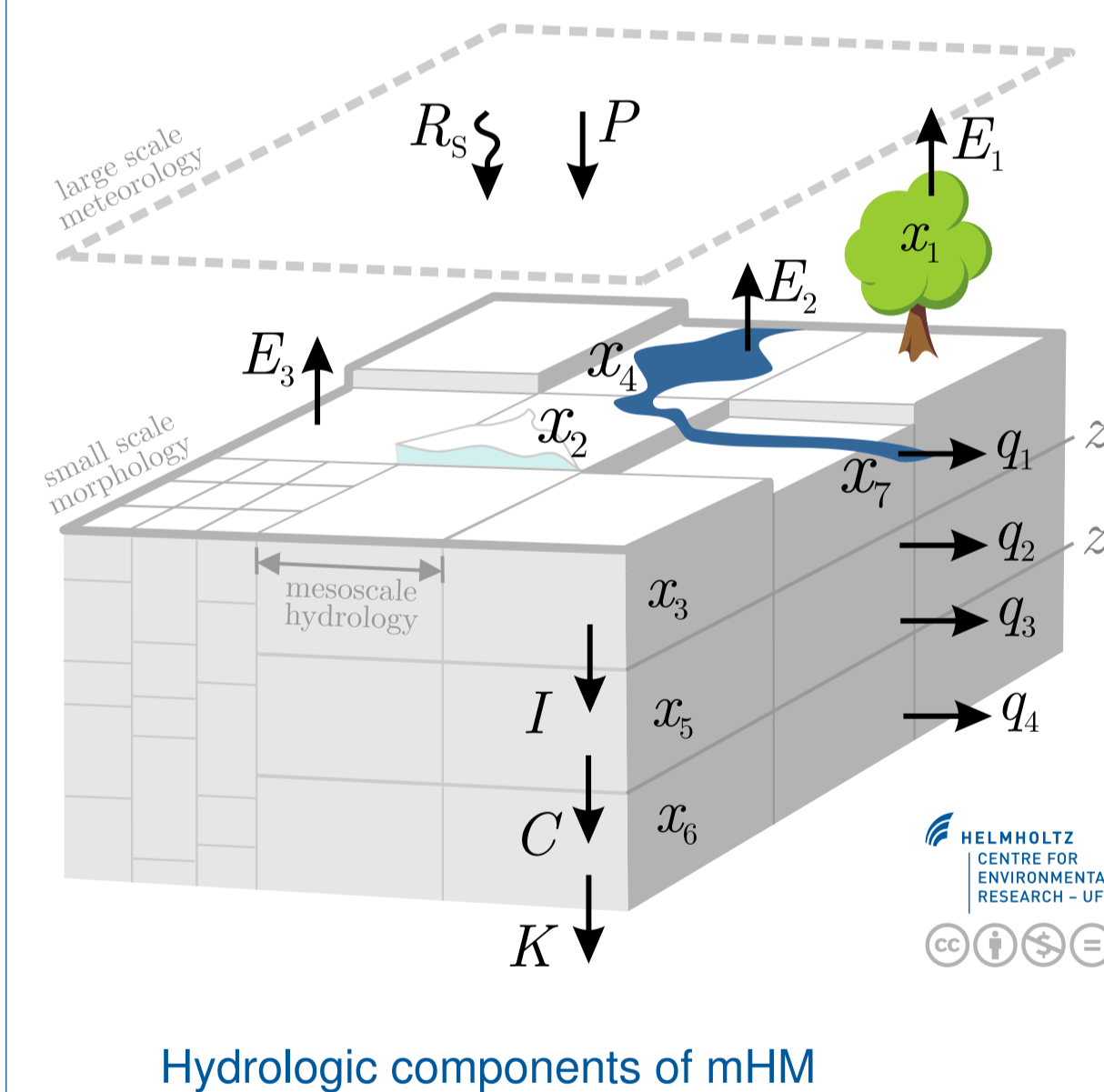
Model set-up configuration

Modeling domain	= Germany
Modeling period	= 1951-2012
Spatial resolution	= $(0.25° \times 0.25°)$
Temporal resolution	= Daily
Meteo. datasets	= E-OBS & DWD
Soil properties	= BÜK 1000
Land cover scenes	= CORINE
Geology	= HÜK 200

## 4. Agricultural Drought: Soil Moisture Index (SMI) [3]

Monthly estimates of simulated root-zone soil moisture were transformed to their respective quantiles to derive the soil moisture index (SMI) for drought identification.
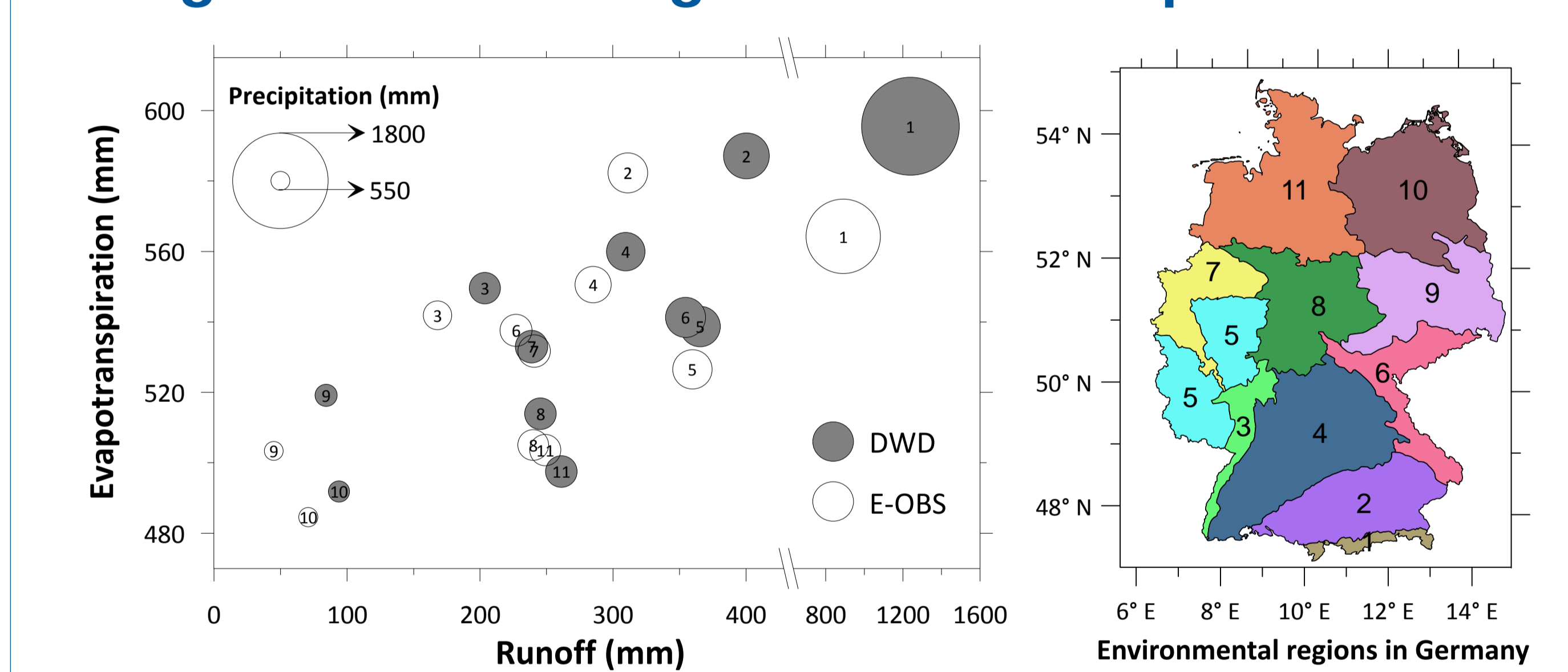
Drought Severity Classification

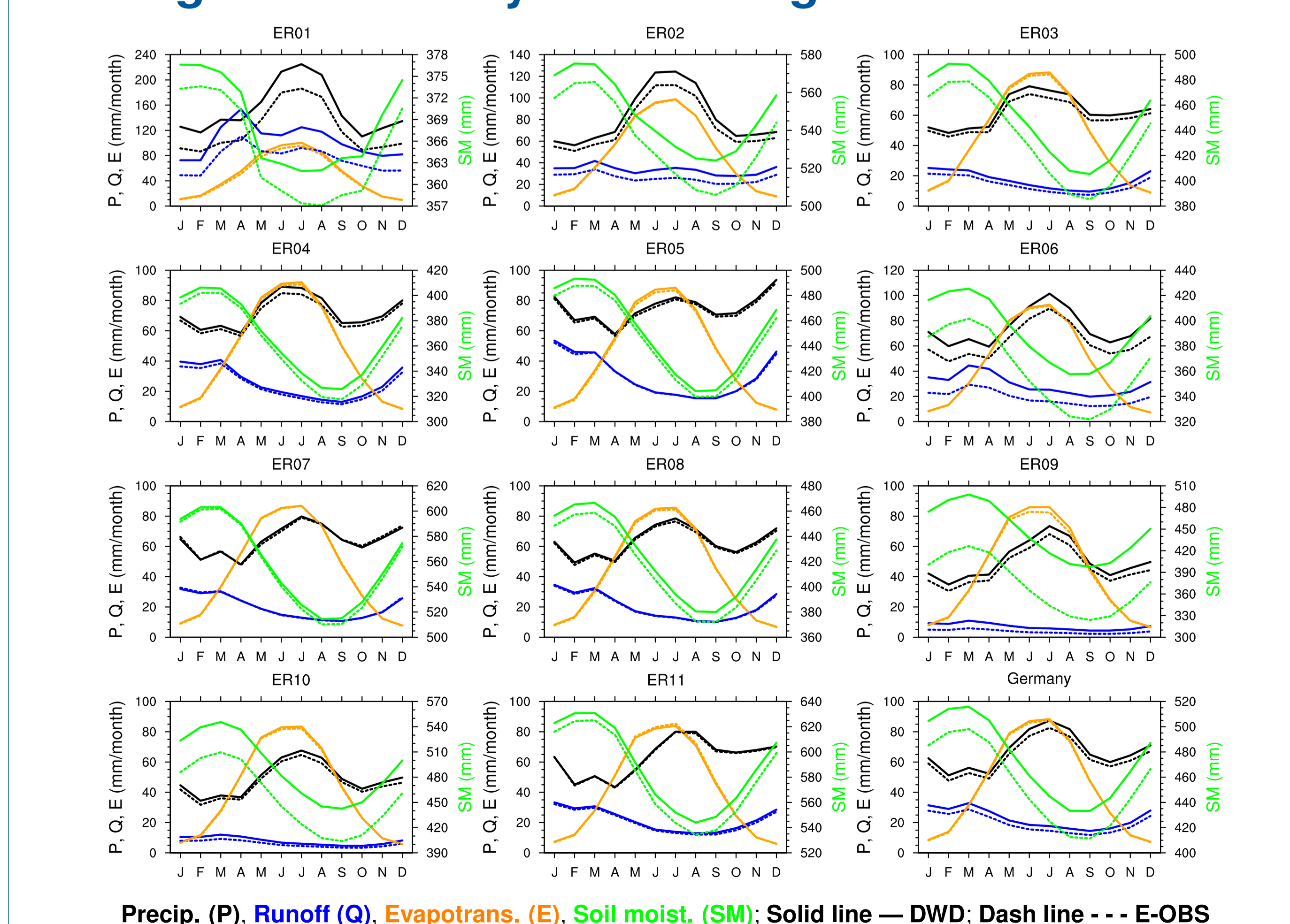|	
D0: Abnormally dry	$0.20 < SMI \leq 0.30$
D1: Moderate drought	$0.10 < SMI \leq 0.20$
D2: Severe drought	$0.05 < SMI \leq 0.10$
D3: Extreme drought	$0.02 < SMI \leq 0.05$
D4: Exceptional drought	$SMI \leq 0.02$
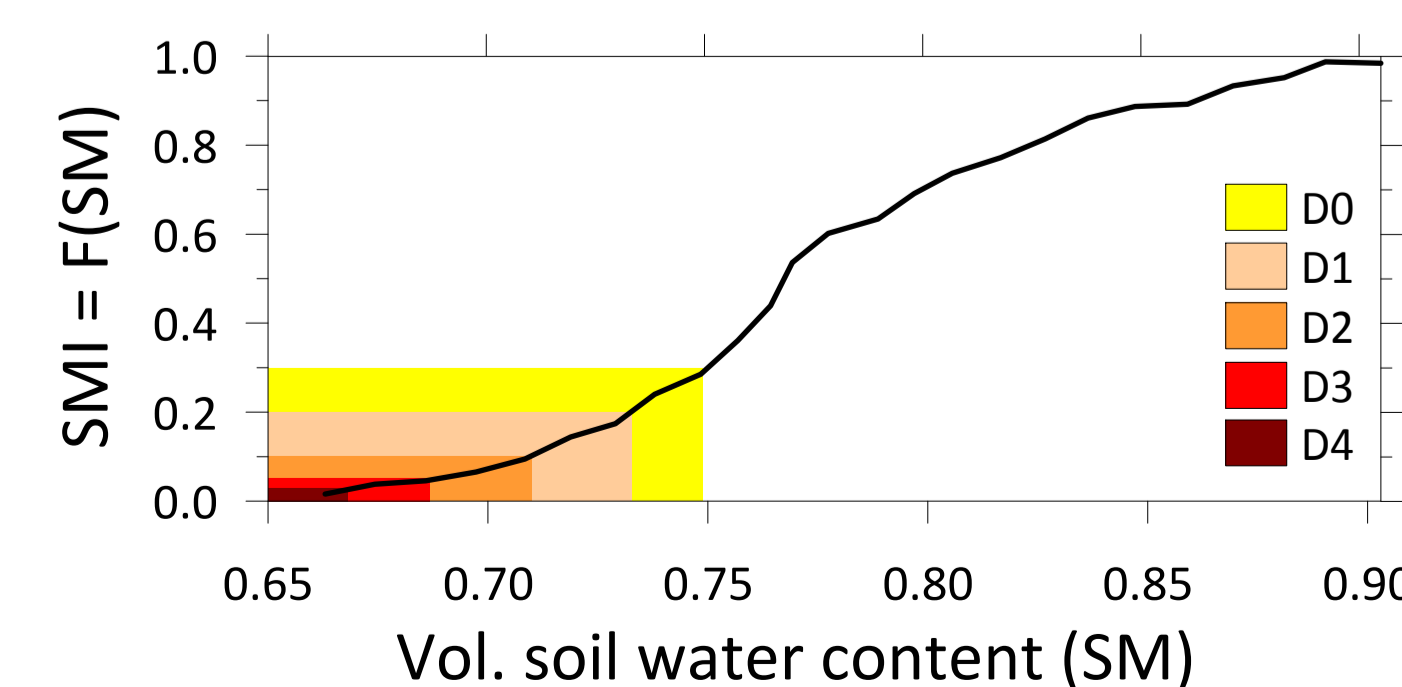
5. Long-term Annual Water Budgets
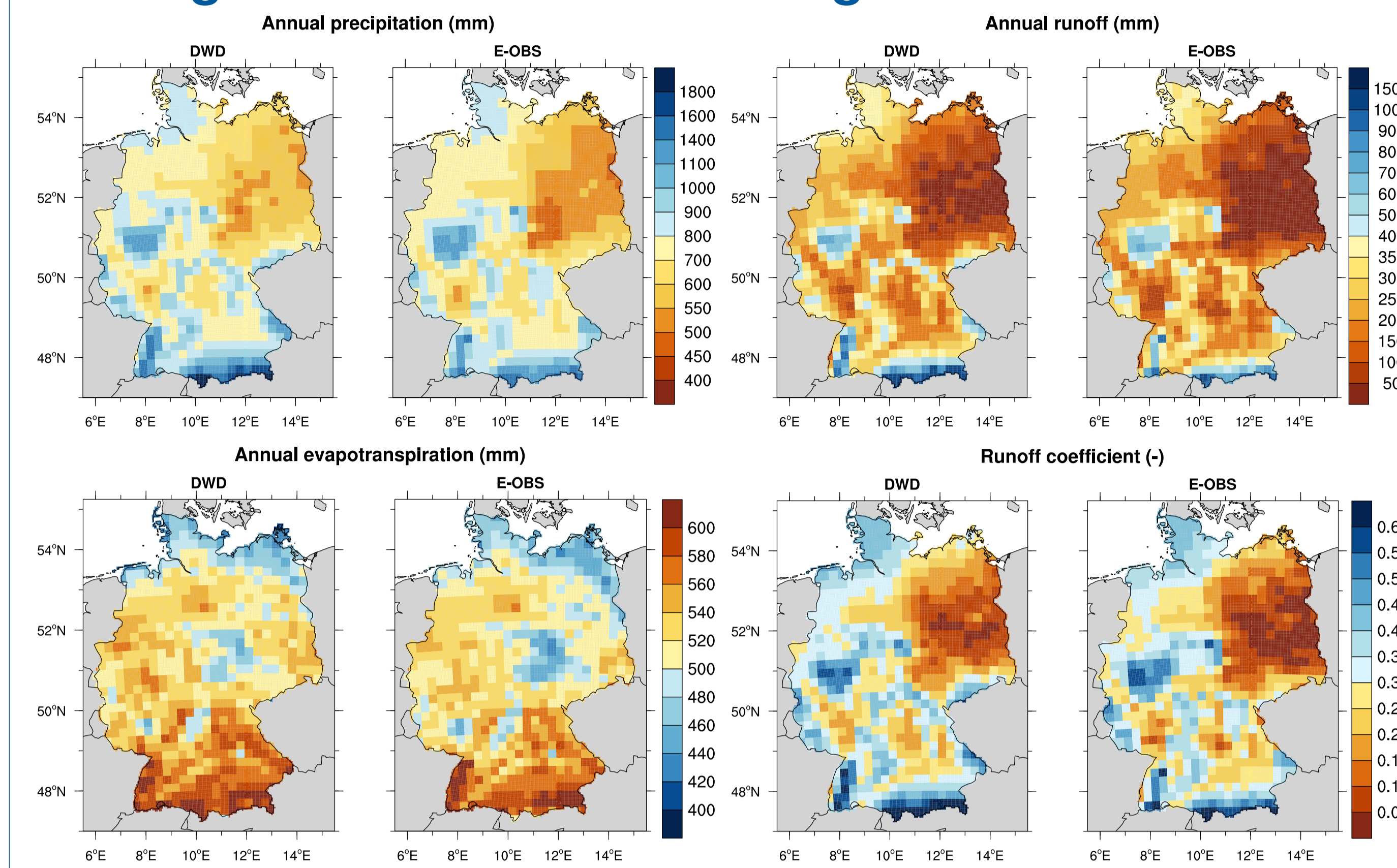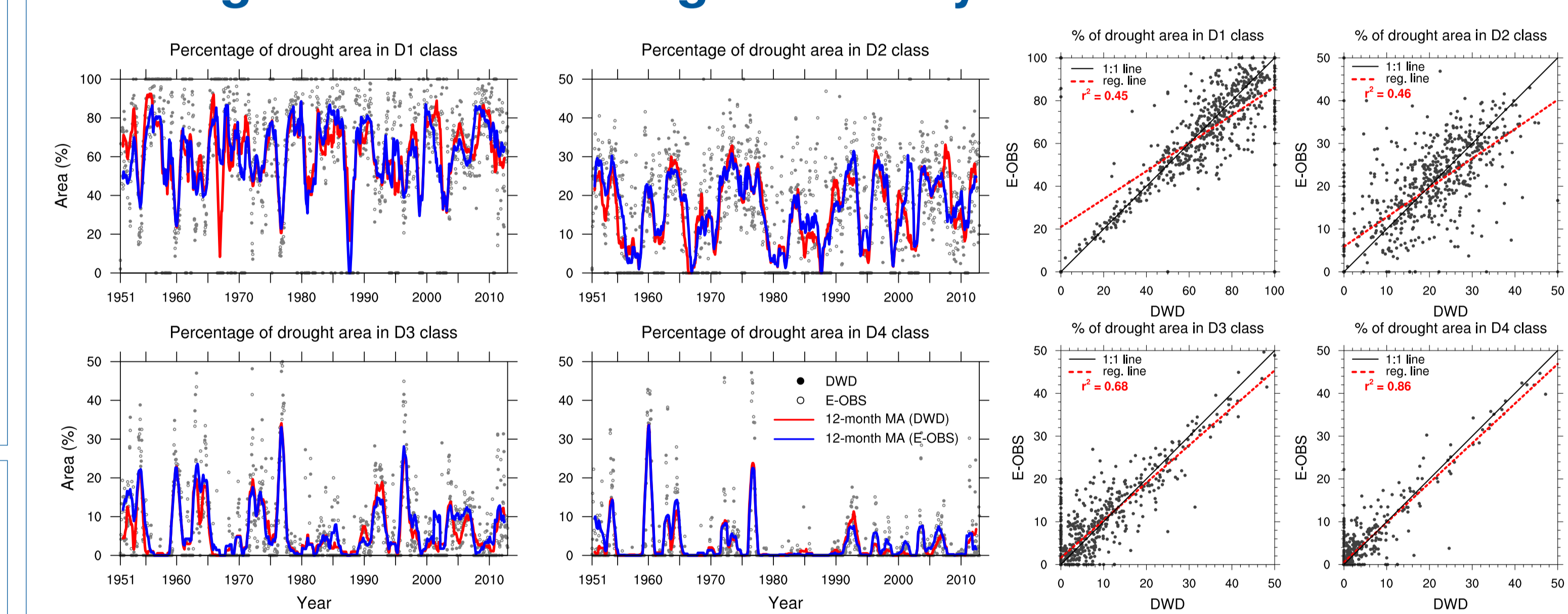

6. Regional Partitioning of Annual Precipitation

7. Long-term Monthly Water Budgets

Precip. (P), Runoff (Q), Evapotrans. (E), Soil moist. (SM); Solid line — DWD; Dash line - - - E-OBS

8. Agricultural Drought Characteristics

D0: Abnormally dry	D3: Extreme drought
D1: Moderate drought	D4: Exceptional drought
D2: Severe drought	
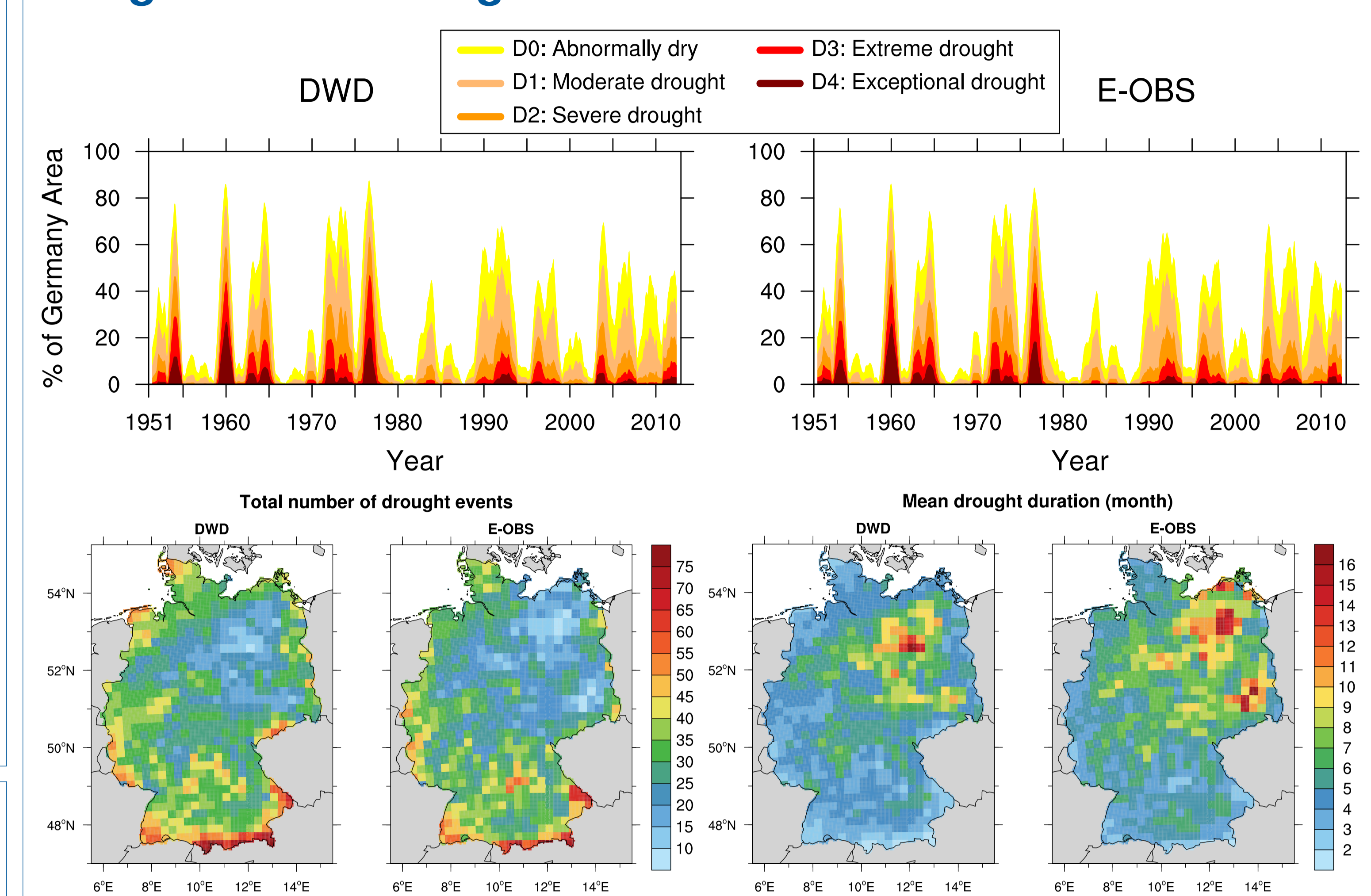
9. Disagreement on Drought Severity Class

10. Conclusions

- Simulated water fluxes and states with the DWD and the E-OBS meteorological data sets showed regional differences, particularly in the northeast and the alpine parts of Germany.

- Two sets of simulations exhibited substantial differences for drought classification despite having nearly the same areal coverage for historical drought events.

[1] R. Kumar, L. Samaniego, and S. Attinger, "Implications of distributed hydrologic model parameterization on water fluxes at multiple scales and locations," *Water Resour. Res.*, vol. 49, 2013.

[2] L. Samaniego, R. Kumar, and S. Attinger, "Multiscale parameter regionalization of a grid-based hydrologic model at the mesoscale," *Water Resour. Res.*, vol. 46, 2010.

[3] L. Samaniego, R. Kumar, and M. Zink, "Implications of Parameter Uncertainty on Soil Moisture Drought Analysis in Germany," *J. Hydrometeor.*, vol. 14, pp. 47–68, 2013.

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