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Drought monitoring and propagation using indicators derived from global water resources reanalysis data

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The recent development of a global water resources reanalysis dataset within the context of the EartH_2Observe project, comprising of an ensemble of hydrological and land-surface models forced by global meteorological reanalysis datasets, allows deriving a consistent set of drought indicators of meteorological, agricultural and hydrological drought. The advantage of the global approach of these reanalysis datasets is their spatial consistency and period of record, allowing comparison of indicators established across regions with different hydro-climatological characteristics, and with different levels of data availability such as is the case in many transboundary basins. This allows monitoring drought at the global level, as well providing insight into how drought propagation differs depending on hydro-climatology. However, differences in structure and parameterisation of the models contained in the reanalysis result in variability in the derived drought indices.

We explore the variability of the drought indicators representing meteorological (SPI-n, SPEI-n), agricultural/soil moisture (ETDI), and hydrological (SRI-n, SSFI-n) drought. Where groundwater is also included in the global models, we include an indicator representing groundwater drought (SGI-n). Drought propagation is explored both spatially for selected drought events, as well as temporally at point locations sampled to represent different hydro-climatological conditions. Where sufficient data is available, comparison is made to indices based on observed data (from e.g. WMO, GRDC).

Results show that while the spread between the results of the global models is appreciable, the derived drought indicators are more consistent, both between models, and to drought indicators calculated using available observed data. Patterns of drought propagation reflect largely what can be expected in the different hydro-climatological conditions. Identification of drought periods using the global model data compares well to drought periods identified using observed data, though at smaller spatial scales correlations between observed and model derived hydrological drought indicators tends to deteriorate for some of the models. Overall results show that the global scale water resources reanalysis dataset can provide useful information on drought identification and propagation.