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Hydrology and Earth System Sciences Discussions

Interactive comment on "Evaluation of drought indices at interannual to climate change timescales: a case study over the Amazon and Mississippi river basins" *by* E. Joetzjer et al.

Anonymous Referee #2

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This paper discusses a set of drought metrics for two large river basins and how they change under future climate scenarios.

The objective of this paper needs to be more carefully defined and explicitly addressed. For example, one objective is to assess whether the different drought metrics identify the same events and how the severity of the different events compare. This is done using both observation and model data to see whether the model has comparable characteristics to the observations. Another one may be to assess whether these different metrics identify the same events under climate change.

Drought evolves following a general pattern: first there is some type of meteorological drought, then possibly agricultural drought then hydrological drought. These different types of drought manifest over different time scales and have specific and different impacts on society. This paper also evaluates the ability of the three meteorological drought metrics to detect hydrological drought (says in abstract). Why do we want to use meteorological drought metrics to detect hydrological drought? Surely we can use a direct metric of hydrological drought (e.g. the SRI) to detect these events? Are we interested in determining whether a meteorological drought metric can be used as a proxy for hydrological drought in basins where there are no streamflow measurements? Hydrological drought lags behind meteorological drought. Therefore a meteorological drought metric could be used as a predictor for hydrological drought – this is alluded to in the introduction but not directly addressed in this paper. The relationship between meteorological and hydrological drought will change in a changing climate (for example because of the CO2 fertilization effect) and therefore the ability of meteorological drought to predict hydrological drought will change.

Comments

1. Were factors such as changing stomatal resistance under increased atmospheric CO2 included when calculating the potential evapotranspiration using the climate change scenario (Bell et al., 2011)? This is important in a climate change scenario. 2. Why is annual data used – a monthly anomaly from climatology would provide a greater sampling size and would help diagnose time lags between the different drought indices. 3. Why is the SRI12 used as a 'benchmark' (back to query over objectives)? 4. Figure 2 – the whole period 1850 to 2100 is used. Do the correlations change between the beginning and the end of this time period? Under climate change changes in the the land surface processes are impacting runoff as well as precipitation. What are the skill scores for the future scenarios? 5. Soil moisture is not discussed at all but is also a possible drought metric and this should at least be noted.

Bell, Victoria A., Nicola Gedney, Alison L. Kay, Roderick N. B. Smith, Richard G. Jones,

Robert J. Moore, 2011: Estimating Potential Evaporation from Vegetated Surfaces for Water Management Impact Assessments Using Climate Model Output. J. Hydrometeor, 12, 1127–1136. doi: http://dx.doi.org/10.1175/2011JHM1379.1

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13231, 2012.