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Hydrology and Earth System Sciences Discussions

Interactive comment on "On the spatio-temporal analysis of hydrological droughts from global hydrological models" *by* G. A. Corzo Perez et al.

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Summary

The manuscript presents a spatio-temporal analysis of droughts using subsurface runoff simulated by the WaterGAP model. The model was forced the recently developed WATCH forcing dataset. The authors present a global scale analysis. In addition, a spatial-pattern recognition algorithm is used to cluster continuous regions experiencing drought in a particular instant. The work is well documented, and presents an important assessment of drought conditions. However, there are several scientific aspects that should be further addressed by the authors.

Comments:

1) Simulated and analysed time period

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Interactive Discussion

Discussion Paper

Why the simulations are only analysed since 1963? From the introduction it was expect an analysis from 1958 to 2001. Furthermore, the continuous drought analyses were only performed for the period 1976-2001. The results presented in the manuscript would benefit if the entire period would have been analysed. This would also be interesting for the readers, since it would present the feasibility of the recently developed WATCH forcing dataset for drought applications. However, this is not necessary if the authors justify that it would not bring and added value for the present analysis.

2) Drought identification threshold and daily time scale

a) The authors refer a range between 70 to 95 percentiles as considered reasonable. The 80 percentile was chosen. Were other thresholds tested? In this point, an uncertainty analysis of the threshold definition would be very interesting. How does the threshold definition impact on the number of events, and average drought duration? A very simple assessment could be performed by replicating the results in figure 7a with different thresholds.

b) Hisdal et al (2001) applied a running mean of 11-days to streamflow observations with the following argument: "There are two main problems associated with the use of daily time series: mutually dependent droughts and minor droughts. During a prolonged dry period it is often observed that the flow exceeds the threshold level in a short period of time, thereby dividing a large drought into a number of droughts that are mutually dependent. A consistent definition of drought events should include some kind of criterion for pooling successive events in order to define an independent sequence of drought". This should be also applied to the subsurface runoff. This would filter the high values of the number of drought events displayed in figure 6a.

c) The authors found that "the number of spatial drought events seem to be consequent with the global area in drought"(pag 633- figure 7b vs figure 9b). However, this could be due to the binary decision of drought/no drought (threshold) on a cell plus the pattern recognition that splits two regions if they have 1 neighbour with no drought (see fig.

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5b - cluster c1 and c3 are separated by 1 cell – 50 km). It could be possible that two regions with an area of 50000 km2 (20 cells) each, would be separated by only 1 cell (in a specific day). This topic should be further addressed by the authors in the discussion.

3) Hydro-climatic regions

The authors state that drought events do not follow hydroclimatic classification (pag 633, and it is clearly represented in figures 6d and 9d). Nevertheless, the authors present an analysis of the percentage of drought areas calculated over the two hydro climatic regions, this is inconsistent. Therefore, the analysis over the hydro climatic regions (fig. 8) should be removed. A possibility would be to use other regions adding a justification for the selection.

Pag: 631: “at the beginning of 1963.” Should be “at the beginning of 1976”

Hisdal, H., Stahl, K., Tallaksen, L. M., and Demuth, S.: Have streamflow droughts in Europe become more severe or frequent?, Int. J. Climatol., 21, 317–333, 2001.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 619, 2011.