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Hydrology and Earth System Sciences
Discussions

Interactive comment on "An assessment of trends and potential future changes in groundwater-baseflow drought based on catchment response times" *by* Jost Hellwig and Kerstin Stahl

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The paper presents an analysis of baseflow 'to characterize groundwater drought on a catchment scale'. Trends in observed baseflow minima and derived drought descriptors are identified and investigated in the context of 'climatic and catchment controls'. A 'scenario-neutral' approach is adopted to characterise the sensitivity of the drought descriptors to future changes in. The study uses flow data from 338 gauges in headwater catchments across Germany.

General comments

Introduction:

The aims of the study could be set out more clearly in the Introduction. The two following statements 'we use a baseflow approach to characterize groundwater drought on a catchment scale' (p2, l19) and 'Employing a data-based approach, in this study we assess future changes in drought hazard on catchment scale across Germany' (p3, l29) describe what has been done, but there is no unambiguous aim or research question stated in the Introduction.

Study area and data:

Data from 338 gauges on headwater catchments were used in this study. In this context, what constitutes a headwater catchment?

It's not easy to tell from Figure 2, but it is possible that some of the gauges are nested catchments. Is this the case? If so, what biases if any might this introduce into the data? What are the implications of those potential biases for the trend analysis (section 4.2) and the results of the potential future drought hazard assessment (section 4.3)?

Streamflow data for the period 1970-2009 was analysed. Was the data complete? If there was any missing data how was it accounted for in the pre-processing of the data?

The data 'were visually screened for signs of anthropogenic influence' and 'four of the gauges showed spurious changes . . . and were subsequently removed' (p4, l7-8). Please could you justify their exclusion in more detail. What anomalies were present in the data that caused you to exclude the sites?

Why was a 2/3rds fraction used to define mixed catchment (p4, l21)? Is there a citation for this?

Is there any information on the distribution of low permeability superficial deposits across the region? It's not uncommon for such deposits to play an important role in

stream flow generation and so the proportion of such deposits in catchments might be an interesting parameter to investigate in the context of the study, and should at least be commented on, either here or in the Discussion.

Methods:

The justification for the use of Mann-Kendall (MK) test could be more robust. There is a significant literature on the application of this test to hydroclimatic time series. However, it's application to such time series is also contentious when there are underlying auto and cross-correlations present. Consider adding to the justification of use of the z-statistic [also see comment below about identification of significant trends based on MK test].

Results:

Figure 4c is a map of the MK z-statistic indicating the direction and magnitude of the trend in Qb7. However, it is stated that 'according to the MK-Test, 40 out of the 338 catchments show a significant trend in Qb7' (p8, l7). What was the level of significance that was used? Please justify this and link this justification back to the Methods, section3.2?

Discussion:

It is noted in Section 5.1 of the Discussion that 'a baseflow approach does not allow for conclusions on groundwater storage in snow-dominated catchments' (p9, l30). In this context, how do you define snow-dominated catchments, and which if any of the 338 headwater catchments that you have analysed fall into this category? If any of the catchments are 'snow-dominated' should they be excluded from your analysis?

Specific comments

P1, l10: replace reflexion with reflection

P2, l28: resp. is not a normal abbreviation to use in articles like this. If it is and

abbreviation for respectively please re-write [see also p5, l28, p10, l9 and p13, l25]

P9, l9, replace Marchant and Bloomfield (2013) with Bloomfield and Marchant (2013)

P10, l5, delete comma after revealed

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