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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The effects of climatic anomalies on low flows in Switzerland" *by* Marius G. Floriancic et al.

Anonymous Referee #4

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General comments:

In this paper, the authors assess to what extend precipitation and PET anomalies trigger summer low flow events in Switzerland. The assessment employs Spearman correlations between low flow magnitude and climate anomalies in P and PET aggregated over varying lead times before the peak of the low flow event. The correlations are overall weak, but still indicate that most low flows arise from the compound effects of precipitation and PET anomalies, with longer and larger anomalies related to more extreme low flow events, as one would expect. The assessment of lead times before the peak of the event is not new (e.g. Fangmann and Haberlandt, 2019 on a monthly time scale), but indeed appropriate to assess the genesis of events.

While the paper is generally easy to follow, the paper appears to suffer from weakly

formulated research question and consequently from a limited scope of the study. The results remain superficial and do not provide sufficiently new insights in low flow generation in Switzerland. I therefore cannot recommend the paper for publication in its present form. I will provide detailed feedback below, which I hope to be useful for the authors for further elaborating the paper.

Science question

Science questions (or hypotheses) of this paper (Line 73-75) are formulated in a way that everybody would immediately agree: There is little doubt that low flows will typically occur after anomalous weather conditions, and that most extreme low flows will be associated with the most extreme weather conditions. This leads directly into a quite superficial analysis and weak conclusions. I urge the authors to sharpen the science questions and, accordingly, the study design, in order to gain more significant insights in how precipitation and evaporation together generate low flow events in Switzerland. I agree with Referee 2 that the focus of the paper should be much more on the interplay of the two meteorological drivers. And their relative importance for events with different time of occurrence within the summer/fall low flow season.

Methods

The paper also suffers from weakly defined analyses. The methods section does not provide all necessary methodological details; they pop-up in a mixed results and discussion section. This makes analysis rather ad-hoc and hampers a well-structured assessment of the research question. I strongly advocate organizing the paper into clearly separated methods, results and discussion sections to foster a transparent, in-depth assessment.

In the following I review the used methods found in the results section.

In Section 3.2, the purpose of this "first correlation analysis" is not clearly defined (ref. also to the vague section title). The section assesses the correlation of 30-

day-anomalies. For what purpose the time window has been chosen, and what may analysing 30 days before the event tell us has not been indicated.

Section 3.4 Duration of climatic anomalies – The analysis of durations of anomalies before the peak of the event is largely depending on very short interruptions of the climate anomaly that have no effect on streamflows. Some pooling would be necessary to filter out disturbances in this type of analysis. The second analysis based on various time windows is more robust, and the most insightful analysis of the study.

Section 3.5 The role of winter precipitation is not a pertinent research question, it is well-known that in an Alpine environment it is rather snow-storage than accumulated precipitation that shapes summer low flow with respect to timing and magnitude. Analysing winter precipitation (instead of snow storage and snow melt) has not the potential to lead new insights in the low flow generation process in Switzerland.

Specific comments:

L 41: It is not either climate, or catchment, but the combined effect of meteorological drivers and catchment functioning that determines streamflow. L68: Contradiction to "the effects of evapotranspiration on low-flow occurrence and magnitude have received relatively little study" (two paragraphs above)

L72 Sentence does not make much sense.

L73 ff: Please revise hypothesis (better formulate them as science question(s) and objectives of the study. Avoid duplication of the overall aim into one objective (currently objective a).

L114: One sentence methodology, apart from the definition of the anomaly measures, is definitely too short.

Section 3.1: This is prior knowledge and should go into the introduction

L222: Statement is not true. What the cited papers say is that large parts of Europe

were affected by the drought events of 2003 and 2015. But papers also show how different timing and magnitude of events were across Europe.

L226: ditto

L239: Citation needed. What do you mean by erratic?

L285: No, snowpack is not the same as precipitation sum, snowmelt is precipitation redistributed over time.

L300 ff: “if SWE is important, we expect to see stronger correlations between winter precipitation and summer low flows at higher elevations – see my previous comment (L222). The following analyses are wrongly motivated and results overinterpreted.

L327: Remove sentence, as the paper does not represent a novel methodological framework

References:

Fangmann, A. and Haberlandt, U.: Statistical approaches for assessment of climate change impacts on low flows: temporal aspects, Hydrology and Earth System Sciences 23 (2019), 23, 447–463, 2019.

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