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Hydrology and Earth System Sciences
Discussions

# *Interactive comment on* "Anthropogenic and catchment characteristic signatures in the water quality of Swiss rivers: a quantitative assessment" *by* Martina Botter et al.

**Anonymous Referee #2**

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Anthropogenic and catchment characteristic signatures in the water quality of Swiss rivers: a quantitative assessment Martina Botter, Paolo Burlando, Simone Fatichi Several recent papers studied long-term series of water quality and discharge aiming to generalize behaviors of selected solutes across catchments in order to infer anthropogenic and catchment characteristic influences. This study provides some more results on Alpine streams. The authors analyzed geogenic solutes, chloride, nitrogen, phosphorus and organic carbon species, monitored by the Swiss National River and Survey Program for 11 Swiss rivers with a temporal resolution of 14 days as composite sampling (sampling represent an integration of the preceding 14 days) for more than 10 years. The analysis of basic statistics, seasonality, temporal trends and concentration-



discharge behavior revealed impacts of human activities for some catchments. However, the influence of catchment characteristics is much less evident. This is probably due to the small number of analyzed catchments and to their area range which is very bi-modal (one group with catchment area around 5000 to 30 000 km$^2$ vs. 2 small catchments with area < 1km$^2$) which do not help having a more quantitative spatial analysis. The manuscript needs to better explain the relation between temporal metrics and spatial characteristics. Another way of analyzing the results could be to consider the variation of these relationships along nested catchments (Rhein, Rhone, Aare). The manuscript has a relatively good structure, but the results could be presented in a more factual way, in order to better distinguish them from the discussion. The conclusion needs to highlight the new findings of this work. Database and study sites The authors do not present very well the database (numbers of data/years for each site and element, screening, discussion about the difference between composite sampling and grab sampling, representativeness of metrics calculated from composite sampling, especially for small catchments). It is not clear either whether all the calculated temporal metrics are based on mean bi-monthly concentration and discharge data time series. If this is the case, the authors need to discuss how this sampling design impacts the analysis of the temporal metrics (especially concentration-discharge relationships). Catchment characteristics are not very well presented. Figure 1 could be reworked to present land use/land cover. Colors for catchment could be replaced by contour lines. For example, authors defined three categories of catchments according to their morphology and geographical locations (lines 148) but it is not clear why only these criteria. It seems that these regions are homogenous also for land use, lithology and climate? Hence, do they belong to the same hydro-ecoregion? It might help to see on figure 1 or in table 1 theses three categories (how many catchments for each category) to link them to geology, landuse/land cover. Table 1. Please use km$^2$ as unit for catchment size, and specific discharge (l s-1 km-2) for discharge, also in figures (ex. Figure S5,) in order to allow catchment comparisons. ID=VW on table 1 but ID=WM on figure 1. Is it the same catchment? Temporal metrics: it is not very clear what is the aim of each indicator, especially for the seasonality and C-Q relationship. Index of “seasonal” variability: the numerator of the equation could be reformulated to take into account that it performs a sum of deviations for different catchments belonging to the specific “topographic” class. It is consistent for all “topographic” classes with only 3 to 4 catchments in a category ? Figure 5. How hydrological regimes were defined? The method is not presented in chapter 3. What is the link with Figure 6 (index of seasonal concentration variability), and with figure S2 ? Concentration-discharge relationship. Please define why you calculate integral “b” exponent and truncated “b” exponent, b50sup, b50inf. Figure 2 and Figure 10 can be merged, indicating that you use the conceptual diagram of C-Q relationships proposed by Moatar et al, 2017 and test it for Swiss rivers (mean altitudes > 1000 m, mean rainfall 1000 - 2000 mm/y). You can also compare with other recent papers (ex. Diamond, Cohen, 2017 for coastal Plain Rivers in Florida) In the split-hydrograph method, separate concentration-discharge relationships are described for below and above median discharge, Q50 is the median of daily discharge. Are your C-Q diagrams (Figure 9, 10) realized from mean bi-monthly concentration with mean bi-monthly discharge? It would be the reason why only 29% of the catchment-solute combinations have different behaviors between low- and high-flow conditions. Or perhaps, it is a characteristic of alpine rivers where dilutions and exports of elements are the major behaviors. While biogeochemical and retention removal processes at low flows are not very significant. Or perhaps, Q50 is not the appropriate discharge percentile break-point? Figure 8. What site? Figure 6. A, B, C not defined in section 3.2 Figure 10. define grey areas

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