

## **Response to Referee 3, N. Le Vine**

The paper considers uncertainty in hydrological signatures due to errors/uncertainties in rainfall and discharge time series: 1) point measurement, spatial interpolation and equipment malfunctioning errors for rainfall (no systematic errors), and 2) uncertainty in stage-discharge relation (no stage time series uncertainty). MCMC sampling is employed to estimate signature uncertainties based on the time series uncertainty. The findings illustrate individual and combined contributions of the above rainfall and discharge uncertainties to the extent of signature uncertainty; and show that each uncertainty source, except for the rainfall point measurement uncertainty, contributes to a sizable signature uncertainty (for the selected signatures).

The paper is well thought-through and addresses an existing gap in uncertainty assessment for hydrological time series and its propagation into hydrological signatures. One important aspect that, in my opinion, the authors need to acknowledge and discuss is that the 'posterior' distribution of the rating curves is not strictly a statistical distribution, since the Voting Point likelihood it is based on is not a formal statistical likelihood. This has implications on the use of the MCMC sampling method as well as on the interpretation of the corresponding signature values as draws from probabilistic distributions.

**Response: We thank Nataliya Le Vine for the review and the positive comments about our paper. We will clarify the section in the end of the introduction (P4237, line 13-23) and include a section in the discussion about the choice of uncertainty estimation methods, including a comment on the use of formal/informal likelihoods. Here, we will also refer to the further motivation for the choice and development of the Voting Point likelihood found in the technical note where the Voting Point method was first presented (McMillan and Westerberg, 2015, as referred in the paper).**

Further, I would suggest specifying in the title which hydrological signature uncertainty is considered in the manuscript, as there are other uncertainty sources, e.g. due to the time period selection, due to regionalization in ungauged basins.

**Response: We appreciate the suggestion, but prefer to keep the more simple title of the paper, as it would become rather complex to specify exactly which uncertainty sources are considered. See the new Table described in the response to Referee 1, Alberto Viglione, for a summary of uncertainty sources to assist the reader.**