Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., author comment AC2
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Reply on RC2

Elisa Ragno et al.

Author comment on "Applying non-parametric Bayesian networks to estimate maximum daily river discharge: potential and challenges" by Elisa Ragno et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-229-AC2, 2021

We first would like to thank the Reviewer for taking the time to review this work in detail. Below, we addressed the comments in the same order as received.

1. We are a bit surprised by this comment as the information mentioned in the comments are already included in the abstract, following the same order mentioned by the reviewer:

Problem at hand: Few applications of Non-Parametric Bayesian Networks (NPBNs) for river discharge generations are implemented. (Line 2)

Objective: Explore here the potential of NPBNs to reproduce catchment-scale hydrological dynamics. (Lines 2-3)

Methods: 3 different Nonparametric Bayesian Networks (Unsaturated Network (UN-1) and Saturated Network (SN-1) with only hydro-meteorological variables and trained on one catchment; Saturated Network with hydro-meteorological variables and catchment properties (SN-C) and trained on all the catchments. (Lines 4-8)

However, we highly appreciate the Reviewer's comment and we will revise and reformulate the abstract to better highlight and clarify the problem, objective, and method of the study.

2. The main objective of this study is to explore and test the potential of Non-Parametric Bayesian Network (NPBN) to reproduce river discharge given its several potential advantages (Lines 44-49), e.g., the uncertainty quantification is embedded in the model, all the variables can be inferred via conditioning on the remaining variables, knowledge on the relationship between variables can be imposed a priori, information from different catchments can contribute to improve inference, and the computational time is limited. Hence, the significance of the study lies in the appraisal of this specific method rather than in a comparison of regional/national patterns of streamflow. The selection of the study basins, as dictated by the necessity of having a consistent and complete dataset of large number of catchments from diverse climate, then served as actual means to test the method using a large sample of study basins characterized by different environmental conditions. However, the main objective of this paper remains to test NPBNs for their suitability as tools/methods to estimate river discharge. We appreciate the comment of the Reviewer and we recognise the necessity to clarify the main objective of the study in the revised version of the manuscript.

3. As discussed in our response to the previous comment, the main objective of this study is to explore the potential of Non-Parametric Bayesian Network to reproduce river discharge. This was an a-priori decision based on the potential advantages of this method. In the introduction, we provided an overview of methods used in hydrology for generation of river discharge values and we divided these methods into process-based models and process-agnostic models. However, following the Reviewer's comment, we will add information regarding previous studies evaluating river discharge at a monthly scale. We will address it in the revised manuscript.

4. We thank the Reviewer for this comment and we will further clarify in the revised version of the manuscript that the key point of the paper is to investigate the applicability of a fully probabilistic process-agnostic approach to predict river discharge generation. Given its several potential advantages, such as the uncertainty quantification embedded in the model (see line 44-49 for details), we decided to test whether this type of probabilistic model, frequently used in other disciplines for risk and reliability assessment, could be implemented also for generating samples of river discharge. While investigating its suitability for river discharge characterization, we identified some benefits (e.g., embedded uncertainty quantification) and challenges (e.g., Gaussian assumption for bivariate dependence) and we reported them in the Discussion section to incentivize further studies.

5. Following the suggestion of the reviewer, we will improve the quality of the figures in the revised version of the manuscript. At the same time, it is not very clear to us which aspects of the figures need improvement, e.g., resolution, colour codes, legends, content presented.

6. We agree with the Reviewer's comment and, in the discussion section, we will better highlight the key points of discussion. Besides, we will revise the conclusion sections to include a comparison with other methods, following other comments.

7. We thank the reviewer for the suggestion. We will do a thorough grammar check to minimize the amount of placed articles in the revised manuscript.

We thank the reviewer for the specific comments. We will address them in the revised manuscript.

In this study, the Bayesian networks represent the numerical model used to determine the joint probability distribution of the hydro-meteorological variables and catchment characteristics and then infer from it river discharge. We will replace models with networks to avoid confusion. Thanks for the suggestion.

L2 will be modified as followed: "However, few hydrological applications implementing NPBNs can be found in the literature."

P1 L2: noted

P1 L4: noted

P1 L4: noted

P1 L6: SN-C is the name given to the network used to estimate river discharge using also information from the characteristic of the catchments. We will clarify this in the revised version.

P1 L6: noted

P1 L8: noted

P1 L10: noted

P1 L14: noted

P1 L15: noted

P1 L15: noted

P1 L16: noted

We appreciate the Reviewer’s suggestion and will pay extra attention in the revision of the manuscript to avoid grammar and typing errors.