

## ***Interactive comment on “Hybrid Neural Network – Variational Data Assimilation algorithm to infer river discharges from SWOT-like data” by Kevin Larnier and Jerome Monnier***

### **Anonymous Referee #2**

Received and published: 5 November 2020

This study aims at proposing the hybrid Neural Network (NN) – variational data assimilation algorithm to estimate river discharge from simulated SWOT like data. Such methodological studies are very important and of the scope of the NPG. In addition, investigating the potential benefits of satellites prior to the launches is quite useful to improve satellite missions further. However, I think the present manuscript has some fatal issues that should be solved prior to publication. The authors seemed to investigate the method that would not be applicable to the real ungauged river basins as I elaborate below. I am compelled to suggest this manuscript be rejected.

[Major Issues] 1. As described, the SWOT-based estimation of river discharge is useful

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for ungagged or poorly gauged river basins (P1L14). However, the authors used “too rich” basin information. They used  $dA$  (difference in cross section),  $W$  (river width),  $S$  (slope), and  $A$  (cross section) to estimate  $Q$  (discharge) by NN (P8L166). The physical based models, which were also used to mimic observation data, simulates  $Q$  based on  $dA$ ,  $W$ ,  $S$ , and  $A$  with only one major uncertainty parameter: frictions of river channel. Namely, there is one equation and one uncertain parameter. Solving this problem is too very easy for NN. Consequently, the present experimental setting of NN was very confusing to me. It is usually impossible to use the cross section  $A$  because the cross section under the river surface is unobservable by satellites. The challenge for realistic applications is to estimate  $Q$  without using  $A$ . 2. The authors assumed unrealistic daily SWOT observation data while real satellite revisits 1-4 times per 21 days (P1L22). Consequently, I strongly suggest the authors re-consider experimental design that is applicable to real problems.

[Other Issues] 1. Experimental design is unclear to me. It is better to add a schematic that shows a flow chart of data used in this algorithm. 2. The paper should add more hydrological papers for reference. For example, I found a data-driven estimation of river width from satellite data (Yamazaki et al. 2014). Comparisons to such existing approach would be beneficial to add values of the manuscript.

<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013wr014664>

Interactive comment on Nonlin. Processes Geophys. Discuss., <https://doi.org/10.5194/npg-2020-32>, 2020.

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