Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-194-RC1, 2020

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "A Tri-Approach for Diagnosing Gridded Precipitation Datasets for Watershed Glacio-Hydrological Simulation in Mountain Regions" *by* Muhammad Shafeeque and Luo Yi

Anonymous Referee #1

Received and published: 24 July 2020

General

The paper presents a model study on the Indus basin, in which different precipitation reanalysis products and observations are used to classify the hydrological behavior of the basin. The precipitation product used are either reanalysis or interpolated gridded observation data. The authors propose a tri-faceted approach consisting of statistical analysis, physical diagnosis, and practical simulation.

The study constitutes a contribution toward the modeling of effects of precipitation prod-

Printer-friendly version

Discussion paper

ucts on the simulated water balance of the Upper Indus basin, a major source of water for the Indus irrigation system. Inferences are made on the ice mass balance, a topic of high relevance for climate impact analysis in this strongly glacierized system. Depending on products used the UIB turns out to be either a gaining or a losing glacial mass system. However, the approach does not provide any clues on how to assess, which one of the reproduced behavior is closer to reality. As such it provides mainly suggestions on how to correct individual GPDs to match observed outflows, while making unverifiable inferences on ice mass accumulation/depletion.

Introduction

The introduction and other parts of the paper do not mention previous published work by Reggiani et al. (2017) and Reggiani and Rientjes (2015) which is concerned with the basin and compares precipitation reanalysis products for the area of interest. The study also contains a basic water balance analysis for the Indus used to infer on the ice mass balance by specifying the individual terms of the mass balance equation. Reggiani et al 2016 provide an uncertainty analysis for the Shigar subbasin based on a Bayesian analysis of multiple precipitation products.

General comments

Overall it is not clearly explained, what the authors want to demonstrate. Different precipitation products can show very different precipitation depths, while temperatures are generally more consistent among products. For example, Reggiani and Rientjes (2015) have already shown inconsistencies between reanalysis data and the TRMM as well as CRU data, whereby the latter two heavily underestimate precipitation, leading to different water balance results and conclusions of the ice mass balance when applied to the UIB.

The use of a tri-approach as proposed here does not give more insights than just using one of the three.

Spatial precipitation products are information, that is inherently error-affected. To draw different conclusions on the water balance using individual products is an interesting exercise, but the ultimate scope unclear. What is the goal of finding out that using one product the catchment turns out to be “leaky” (i.e. it stores water through glacier mass increase) and with the other product the catchment becomes “gaining” (i.e. releases water by glacial melt) and then concluding that corrections to GPDs need to be made accordingly? This does not give any insights into what is actually happening within the basin.

In my view, the real advantage of having multiple products is their mutual combination and exploitation of informative content as a “package”. This point has not been addressed at all by the authors.

The products or the hydrological signals derived using these products must be conditioned on available ground information (flows, precipitation, snow area extent etc.), and on this basis a selection made about which products is superior, by attributing it more importance vs other, less informative ones. If done properly, the conditioning should remove bias and reduce the uncertainty given the ensemble of products.

I personally see the present study as a collection of GPD applications, that lead to a qualitative classification of GPD products, but do give improved insights into glacio-hydrological behavior or clues on an improved structure of spatial hydrological model forcing.

References

Reggiani, P., G. Coccia and B. Mukhopadhyay (2016). Predictive uncertainty estimation on a precipitation and temperature reanalysis ensemble in Shigar basin, Central Karakoram, Water, 8, 263, DOI:10.3390/w8060263.

Reggiani, P. and T.H.M. Rientjes (2015). A reflection on the long-term water balance of the Upper Indus Basin, Hydrology Research, 46(3), 446-462,

DOI:10.2166/nh.2014.060.

Reggiani, P., B. Mukhopadhyay, T.H.M. Rientjes and A. Khan (2017). A joint analysis of river runoff and meteorological forcing in the Karakoram, Upper Indus Basin: Implications for water availability at Tarbela Reservoir, Hydrological Processes, 31: 409-430, DOI:10.1002/hyp.11038.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-194, 2020.

Printer-friendly version

Discussion paper