

## ***Interactive comment on “Prediction of future hydrological regimes in poorly gauged high altitude basins: the case study of the upper Indus, Pakistan” by D. Bocchiola et al.***

### **Anonymous Referee #1**

Received and published: 1 June 2011

This work presents hydrologic modeling results for changes of climate and glacier coverage in a data limited catchment in the Hindu Kush, Karakoram, and Himalaya (HKH) region. As this work is submitted as part of a special issue on prediction in ungauged basins (PUB) work, the methods put forward and modeling carried out are appropriate. The authors have done a nice job highlighting some of the potential limitations of this pure modeling work. This is important from a PUB perspective. There are a few general comments that I urge the authors to address and/or consider as this paper moves towards publication.

Reading through the paper, there is no real issue with the assumptions made and approaches adopted. However, in the discussion (around Pg 3769) some flags start to go up for me. My concern is that the work presented has been put into a context of another study (Akhtar et al., 2008) in a nearby region with conflicting results. The discussion around this point loses some rigor (e.g., Ln 5, Pg 3769 “Eventually, we may state that our results here broadly speaking agree with their findings”) and needs to be better presented. Further, and more importantly, it appears that one of the main strengths of the approach presented in this current study (particularly from a PUB perspective) is that the approach is “simple enough that portability to catchments nearby should be reasonably practicable”(Ln 16, Pg 3769). Bringing this all together: Why not port the modeling results to the catchments considered in Akhtar et al. (2008)? This seems like a good PUB exercise that the authors could reasonable undertake.

Along similar lines, it is difficult to assess the appropriateness of the hydrological modeling (Ln 17-20, Pg 3755) put forward. Previously, it appears that the modeling has been published in national journal (Groppelli et al., 2011b) and is currently under review in another international journal (Groppelli et al., 2011c). The relative ‘newness’ of this model is interesting as it is being used in a difficult application (i.e., a data limited PUB environment). A new model in an ungauged system almost seems like a ‘double-blind’ experiment. Perhaps a parallel study in a nearby system (e.g., the catchments from Akhtar et al., 2008) where more information and/or orthogonal modeling results are available could help.

Lastly, the choice of future projections of daily flows into the years 2050 through 2059 is interesting. What is the motivation behind that choice? Would it have made more sense to try to overlap somewhat with the other studies done in the region where analysis was carried out from 2071 through 2100? Also, presenting the daily discharge dynamics for these future predictions might be a bit unnecessary. The climate projections do not give any real estimate regarding daily values. I would not have expected to see much more presented than annual discharge changes and long term trends for the future

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scenarios. This would still deliver the main message regarding ice coverage influence and (perhaps) drive home important limitations regarding expectations around PUB.

In addition to the above general comments, the following is a list of minor/detailed/editorial comments to be address or corrected:

Ln 9-10, Pg 3745: change “contribution in the scientific available” to “contributions in the available scientific”

Ln 12, Pg 3746: The sentence starting with “In view of . . .” needs rewritten.

Ln 3, Pg 3747: Here and everywhere, you have already presented an abbreviation for Hindukush-Karakoram-Himalaya as HKH.

Ln 22, Pg 3747: change “In facts” to “In fact”. This error occurs in several locations. Please check thoroughly.

Ln 10, Pg 3748: change “area” to “areas”

Ln 13, Pg 3748: change “albeit” to “although”

Ln 17, Pg 3748: change “Nor the” to “Nor are the” and delete the “are” later in the sentence.

Ln 17, Pg 3749: change “are” to “is”

Ln 1, Pg 3750: You have not defined BWK yet

Ln 22, Pg 3751: This “yes/no” confuses me. Could you present this better?

Ln 24, Pg 3755: change “are considered two mechanism of flow formation” to “two mechanisms of flow formation are considered”

Ln 17, Pg 3758: the statement “discharge under this form is only available to us” makes is sound like you were the only people with access to this data. I think you mean that there is no other data available. Consider rewriting.

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Ln 19, Pg 3758: Do you mean “piece wise” instead of “path wise”?

Ln 20, Pg 3759: change to “(at a monthly scale we saw little sensitivity)”. That is you should add the parenthesis.

Ln 17, Pg 3763: change “more complicate” to “a more complicated”

Ln 24, Pg 3764: again, “In facts” to “In fact”

Ln 18, Pg 3765: change “here projected” to “projected here”

Ln 19, Pg 3765: change “cumulated” to “accumulated”?

Ln 21, Pg 3765: change “provide” to “provides”

Ln 22, Pg 3765: change “so” to “thus”?

Ln 23, Pg 3765: change “no more permanent” to “no longer permanent”?

Ln 24, Pg 3765: delete “alone”

Ln 25, Pg 3765: delete “here”

Ln 7, Pg 3766: change “what” to “what is”

Ln 9, Pg 3766: the phrase “down wasting up the an area” sounds strange. Rewrite?

Ln 17, Pg 3766: change “worst drought spells” to “worsening drought spells”?

Ln 21, Pg 3766: change “model” to “models”

Ln 23 Pg 3766: change “in practice unavailable” to “in practice than available”

Ln 28, Pg 3766: change “a least” to “some”?

Ln 29, Pg 3766: delete “least”?

Ln 4, Pg 3767: Do you mean “noise” or rather “uncertainty”?

Ln 19, Pg 3767: “soil retemption”? I guess this should be “soil retention”?

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Ln 20, Pg 3767: change “were” to “where”

Ln 24, Pg 3767: delete “henceforth”

Ln 18, Pg 3768: delete “As reported in the introduction”

Ln 27, Pg 3768: change “consistently” to “consistent”

Ln 3, Pg 3769: change “highest” to “higher”

Ln 22, Pg 3769: again “retemption”?

Table 1: There is a strange line of text at the bottom of this table. Perhaps editorial error?

All Tables and Figures: the abbreviations are not introduced such that the reader can understand them. It took me very long to understand the CO implied control runs.

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