

## ***Interactive comment on “South Asia river flow projections and their implications for water resources” by C. Mathison et al.***

### **Anonymous Referee #1**

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#### General comments

In this manuscript, Mathison et al first evaluate the simulations of present day river flows of the Indus, Ganges, Brahmaputra calculated by a selection of GCM-RCMs. They compare them with sparse observations and a benchmark simulation with ERA-interim-RCM simulations. The authors find that the GCM-RCM simulations are in line with observations with respect to the timing of maximum river flows, but typically overestimate the amount of maximum river flow. The authors attribute this overestimation to positive rainfall bias and a lack of abstraction in the model. Second, Mathison et al. evaluate changes in river flows as projected by the same GCM-RCM combinations. The simulations show an increase in mean annual river flows for some locations, but no changes in the seasonality of flow.

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The objective of this manuscript was twofold. First, to understand the riverflows in the RCM and to see how useful they are for understanding the changes in water resources for South Asia, and second to understand the effect of projected changes in river flow might mean for water resources across the Himalayas. The authors have made a major effort in running the GCM-RCM combinations and performing all the analysis but in my opinion, both objectives are not fully met. In the introduction, the manuscript need better articulation of the research gap that is going to be addressed. Further, it needs a better scientific embedding by comparing/discussing the streamflow simulations done with the GCM-RCMs here with streamflow simulations done with hydrological models, and explaining the added value of the RCMs. It should also be explained why only two simulations (with one RCM) are used here. That makes the conclusions about expected trends in future streamflow weak, as the climate scenarios for this region are very uncertain. I would expect at least a discussion of results as compared to other studies that project future streamflow for this region.

Further, I think that the article could be much better if the writing would be done more concisely. The authors often use long sentences, there is a lot of repetition and I had difficulties with focussing while reading the manuscript. I think the article needs a better story line and can be much shorter.

#### Specific comments

Abstract is much too long. It should be focused on research gap/question and objective, method, results and one or two sentences about conclusions. Around 250 words should be the target length (as some journals even have that as a limit).

P. 5792. R 14. Both of these are changing..., in which direction? Could you be more precise?

P.5792. r 23. Immerzeel et al... Could you be more precise? Why could upstream water supply decrease? Where? Is there a difference between the three rivers?

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P5793. R 5. The aim of this analysis is not logical after the first few paragraphs of the introduction. Could you explain what research gap you try to address with this objective? What are 'these simulations', they are not mentioned before? Can you also explain why you want to do this analysis with the runoff generated by RCM's, rather than hydrological models? Can you also explain which projections of future river flows have already been performed in this regions, and what you add by this analysis?

P 5793 r12 and further. In order to avoid too much repetition and make the manuscript more readable, you should consider deleting this part of the introduction, as it is a summary of the methods that should not be presented here yet.

P5793. R14. Why was only part of the Highnoon ensemble used and not the full ensemble?

P.5794. It seems more logical to start with a description of the model you use. Specifically, there needs to be an explanation of the parameterizations of runoff generating processes and the routing, because that might also explain partly explain the overestimation in streamflow peaks that you observe later.

P. 5797 r. 5. Which climate scenario do you use? Can you convince the reader that only two simulations is enough to capture the range of uncertainty similar to the whole AR4 ensemble?

P.5797. r 11. If the ERA interim-RCM run is used as a benchmark, it doesn't help in understanding the usefulness of RCMs in understanding streamflow in this region. It is unclear to me why this run is added, and why is used as a benchmark.

P. 5798 r27. Do you use 0.5 degree resolution for the routing the 0.25degree runoff? Please clarify.

P5800. R 21. Can you explain why ERA-interim is considered to do better? I miss a justification for using ERA-int-RCM as a benchmark.

P.5003. r 1-5. It is unclear to me why you add 1.5 SD around the simulations to represent the variability, because it can be derived from the simulated time series themselves. I have the impression it should be drawn around the observations?

P5807. There is a lot of overlap between the caption and the description of the figures in the text.

Figures 3-5. Difference between ECHAM5 and ERAint is very difficult to see in my print, it would be better to choose another color.

Fig 3. Could you somewhere plot the outlines of the river basins? Eg. In fig 1 or 2?

Fig4. Could you show daily values here? (or a 30day running mean)

Fig 5. Smoothed average over how many years?

Fig9 and 10 are difficult to interpret, and I find the caption unclear. What does each dot stand for? It would also be better to keep the y axis the same for easy comparison.

Technical corrections

P 5795 r 22. Himachal Pradesh typo

p. 5797 r 16 finest resolution CLIMATE modelling available...

p. 5800 r 12. Although... (new sentence).

p. 5808 r 26. Variability. Although... (new sentence).

P. 5813 r 5 extractions (Biemans et al, 2013), these are....

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 5789, 2015.