

Interactive comment on “Quantifying present and future glacier melt-water contribution to runoff in a Central Himalayan river basin” by M. Prasch et al.

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Prasch et al (2012) provide a useful quantification of future glacier melt-water contribution to a Himalayan watershed. The paper is well written and the model approach well conceived. The paper requires additional details on the modeling results and validation. Part of the validation should come from comparison to several previous studies, noted in detailed suggestions. The conclusion that “Thus, the contribution of ice-melt to total runoff will almost remain stable until 2080” when the glaciers are largely gone according to the study, is not reasonable in light of the fact that glacier area extent available for melt would have been reduced approximately 80% (Figure 8), which would require a nearly 8 fold increase in melt rate per unit area.

4560-24: More details on observed glacier change in the region, note Li et al. (2011)
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and Caiping et al (2010).

4561-2: Quantify the seasonal monsoon precipitation.

4561-11: Break into two sentences, do not start paragraph with “However”. Cyclic and anti-cyclic glacier runoff versus the overall hydrograph should be introduced here.

4564-23: How is ice thickness determined?

4565-22: What is the threshold at which this transition occurs in your model at several time steps?

4566-2: The output balance gradient, mass balance change with elevation, should be illustrated with a figure. How does the output compare to Caidong and Sorteberg (2010) who modeled mass balance of Xibu Glacier in the study region?

4568-15: What has been the recent ELA and is the modeled accurately? The ELA is an important validation point that can and has been assessed from satellite imagery.

4570-15: The observation that as glacier area is lost glacier runoff does not decline during the study period is not realistic. Why did this happen? In other studies in several different settings where glacier area has been reduced by more than 20%, glacier runoff has already been observed to be in decline. This is because glacier runoff is a product of glacier melt rate and glacier area, a 20% loss in area means a 20% increase in melt rate is needed. This is plausible but this becomes implausible as glacier area is reduced by larger percentages forcing an even higher melt rate increase, from a glacier with a higher mean elevation. A doubling of melt rate has not been observed in the ablation zone of any existing alpine glacier. Here by 2080 Figure 8 indicates an 80% loss in volume, area loss would not be far off that, thus an 8 fold increase in melt is required. Such an increase is not supported in examination of the balance gradient of glaciers from cool to their warmest years.

4571-10: The cyclic and anti-cyclic behavior is well described here. This should be moved to 4561-11. This is a key measure to gauge the hydrograph response against.

Thayyen and Gergan (2010) Figure 3 provides a good representation of cyclic versus anti-cyclic hydrographs in the Himalaya. How does your output in Figure 12 match these hydrographs?

4571-25: How has the snowline shifted in the spring, such as May? How do the results compare to Kulkarni et al (2007)? They noted the importance of snowline recession and that spring snowline extent change is key.

4574:1: The conclusion is too long? A lack of conciseness will prevent a reader from focusing on a few succinct key points. Why is this first paragraph in the conclusion and not earlier? Ice thickness for example, how is this approximation made? This is not something that should be left or the conclusion.

References:

Caidong, C., Sorteberg, A.: Modelled mass balance of Xibu glacier, Tibetan Plateau: sensitivity to Climate change. *J. Glaciology*, 56, 235-248, 2010.

Caiping, Z., Wenbin, Y., Liang, W. Shiyin, L.: Glacier changes from a new inventory, Nianchu river basin, Tibetan Plateau. *Annals Glaciology*, 50(53), 87-92, 2009.

Kulkarni, A. V., Bahuguna, I. M., Rathore, B. P., Singh, S. K., Randhawa, S. S., Sood, R. K. and Dhar, S.: Glacial retreat in Himalaya using Indian Remote Sensing satellite data. *Curr. Sci.*, 92, 69–74, 2007.

Li, Z. et al.: Climate and glacier change in southwestern China during the past several decades. *Environ. Res. Lett.* 6, doi:10.1088/1748-9326/6/4/045404, 2011.

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