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This interesting manuscript uses an impressive data collection to estimate the amount of precipitation in the upper Indus Basin, as a key for a better quantification of the available water resources. The authors conclude that currently used precipitation estimates yield a gross underestimation of actual precipitation. Given the virtual absence of ground-based precipitation estimates at high altitudes, this work is obviously of prime importance. I am not an expert for this region, but I get from the presented discussion that it is currently not even entirely clear whether runoff in this region is fed by positive net glacier melt or not.

Thanks for the positive feedback and our detailed responses are listed below in bold. Regarding your last comment we note that glacier melt is a key contributor to runoff in the upper Indus [*Immerzeel et al.*, 2013; *Lutz et al.*, 2014]**, however overall there may a stable or slight positive glacier mass balance during the last decade** [*Gardelle et al.*, 2013]**. This does however not imply that glacier melt is negligible; it merely shows that the accumulation is larger than the melt. The glacier melt is not in the water balance equation (Eq. 2) because the melt equates the precipitation when the mass balance is 0 and it is thus accounted for.**

What triggered the present comment on this paper was

i) the overall impression that the used methods and results are presented in such a condensed way that I cannot entirely follow what has been done,

In the revised version we will address this and elaborate further on the details of our methodology.

ii) the absence of a summary of the order of magnitudes and of the uncertainties of the water balance terms,

We will include a water balance analysis including estimated uncertainties to the extent possible in the revised version to substantiate our findings. This is a good suggestion.

iii) the fact that the paper does not mention groundwater. Groundwater is absent from the water balance equation (eq. 2). This might of course be justified for the region / studied period but is nevertheless surprising.

> **We have assumed that over the observed period from 2003 until 2007 there is no net loss or gain of groundwater in the upper Indus basin. We do acknowledge that groundwater may play an important role in the hydrology. A study in the Himalaya in Nepal shows that fractured basement aquifers play an important role. They fill during the monsoon and they purge in the post-monsoon thus causing a natural delay in runoff** [*Andermann et al.,* 2012]**. However this does not imply significant net gains or losses over multiple year periods, which is what we consider. In the revised manuscript we will add a discussion related to role of groundwater and the potential additional uncertainty it may cause.**

The very condensed presentation of the methodology reads well but I would suggest to add some details (or supplementary material).

Point taken and we will elaborate the methodology in the revised manuscript. Some first responses to your queries can be found below.

I do for example not understand how the best precipitation field has been selected among all generated fields (there seems to be some form of optimization, on which criterion?).

There is no optimization within the 10000 realizations. What we present in Figure 5 is the ensemble average precipitation field based on the 10,000 simulations. Each simulation differs due to slightly different parameterization of the key processes in the model simulation (parameter ranges can be found in Table 1). This provides us with the uncertainty of the obtained precipitation field, where the standard deviation (measure of uncertainty) of those 10,000 simulations is shown in panel C.

Also e.g. in the sentence “. By running a multiple regression analysis after optimizing the PGs we quantify the contribution of each parameter to the total uncertainty.” I do not really know what has been done.

We randomly vary 5 parameters (HREF, HMAX, DDFd, DDFdg, TS) 10,000 times. For each glacier and for each parameter combination we optimize the PG such that the total accumulation for a glacier minus the total melt is equal to the mass balance. Once we have 10,000 combinations of parameters and associated PGs we ran a multi-variate linear regression analysis to determine relative contribution of each parameter to the spread in the PG, this is what is shown in Figure 6. The sum of the relative weights per region is 1. We will further clarify this.

What is the total uncertainty?

We define the total uncertainty as the standard deviation of the 10,000 simulations, which are based on the random variation of 5 key parameters as outlined in paragraph 2.3.

Why do the degree-day factors explain the PGs ("We take into account uncertainty in the following key parameters (HREF, HMAX, DDFd, DDFdg, TS) for the PG")?
The degree-day factors determine the melt and the total amount of melt determines how much precipitation is required to sustain the observed mass balance. The total amount of precipitation is controlled by the PG.

On what are the PG-fields conditioned in "geostatistical conditional simulation"?
They are conditioned on the PGs determined for each glacier (separately for each of the 10,000 parameter combinations). The continuous PG fields are then obtained by using a variogram to spatially interpolate these PGs, were they are conditioned by the obtained PG at the glaciers.

What do you mean with a standardized semi-variogram.? The same functional type everywhere?
This meas that the sill is 1 and that we use the same variogram for the PGs associated with each of the 10,000 parameter combinations but scale the sill of the variogram with the variance of the PGs associated with each parameter combination drawn.

Finally: would it be possible to summarize the different estimates of the water balance terms for the different sub-regions, how they are estimated and the order of magnitude of their uncertainty? Are there areas where the uncertainty of precipitation and mass balance is in the order of magnitude of the uncertainty of evaporation, transpiration and groundwater storage change (which would make any inference impossible to my view)? A comment on the order of magnitude of the observed runoff uncertainty could perhaps complete the picture

We will include this analysis in the revised manuscript for the different regions.