Hydrol. Earth Syst. Sci. Discuss., 10, C7224–C7226, 2014
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Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Early 21st century climatology of snow cover for the western river basins of the Indus River System" *by* S. Hasson et al.

Anonymous Referee #3

Received and published: 13 January 2014

The authors present an interesting study where they derive a snow cover climatology, estimate snow cover trends and correlate snow cover to a large scale atmospheric mode in the Indus basin using MODIS imagery. This is a very important topic as field measurements in this region are scarce and snow melt plays an important role in the basin hydrology. I think the paper has the potential to be published in HESS after the following major shortcomings have been addressed.

1. I have some concerns about the novelty of the paper. Previous authors have also performed similar analysis in the Indus, which the authors rightfully cite. The authors seemed to have missed

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Discussion Paper

Gurung, D. R. ; Kulkarni, A. V. ; Giriraj, A. ; Aung, K. S. ; Shrestha, B. ; Srinivasan, J. (2011) Changes in seasonal snow cover in Hindu Kush-Himalayan region The Cryosphere Discussions, 5 (2)

which seems important, as they also use a very similar cloud correction procedure. The authors should make clear why their study is considerably different than those previous studies.

2. The cloud correction procedure is straightforward and it seems effective, yet a real independent validation is not performed. The fact that snow cover estimates increase after application of the correction seems to be sufficient reason for the authors to conclude the approach works well. I think it should be tested if significant errors are made in estimating snow cover. One way to do this is to generate a random cloud cover, apply the correction and then validate it against the original image on a pixel basis. This does need to take a lot of time and can be done for a few dates.

3. Figure 3 shows the impact of the cloud filtering. I do not understand legend in the figure and it is not referred to in the text. What is 1MODnMYD, 3SpatialFilered, etc.

4. Correlation with large scale atmospheric modes are tricky to my opinion and care should be taken in assessing the skill. In table 3 the results are shown. I am not sure whether these results are really significant. I would suspect that he correlation would be significant for most basins as they are not far from each other and we are considering a very large scale phenomenon here. For some basins and seasons even the sign of the correlation is opposite. This warrant at least a thorough discussion and also inclusion of literature to other studies that have attempted to derive such relations, such as

Robock, A. (2003). Land surface conditions over Eurasia and Indian summer monsoon rainfall. Journal of Geophysical Research, 108(D4). doi:10.1029/2002JD002286

Shaman, J., & Tziperman, E. (2005). The Effect of ENSO on Tibetan Plateau Snow

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Depth: A Stationary Wave Teleconnection Mechanism and Implications for the South Asian Monsoons. Journal of Climate, 18(12), 2067–2079. doi:10.1175/JCLI3391.1

Immerzeel, W. W., & Bierkens, M. F. P. (2009). Seasonal prediction of monsoon rainfall in three Asian river basins: the importance of snow cover on the Tibetan Plateau. International Journal of Climatology, 30, 1835–1842. doi:10.1002/joc

5. The assessment of the snow cover trends is a key aspect of the study, but nothing is mentioned about the significant of these trends. This is essential. Figure 8 shows those results and I think it is a bit odd to add a boxplot with the elevation distribution of glaciers to this plot.

6. The writing could be more to the point and concise and I find the text for the paper quite long. Also the English should be edited by a native speaker.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 13145, 2013.