

## ***Interactive comment on* “Estimation of future glaciation and runoff in the Tanimas basin, Eastern Pamirs” by W. Hagg et al.**

### **Anonymous Referee #1**

Received and published: 15 February 2011

General comments: This paper is a valuable contribution to the very important water issue in the Eastern Pamir region. It represents state-of-the art (considering data sparsity) methods to address a significant scientific challenge, the scenario-based estimation of water resources in the region. The paper is concise, well written and complete, despite minor technical issues (see technical corrections). In the discussion part, two aspects should be improved (see specific comments).

Specific comments: The HBV-ETH calibration was performed for a two-years time series of observed daily discharge recordings (85/86-86/87). The calibration parameters were used to model runoff for a 2050 scenario horizon with distinctive reduced glacier area. In the conclusion section, a discussion should be added that includes the fact that temporal regionalization of calibration parameters includes the assumption that the

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hydrological system behaviour remains unchanged. Obviously, it does not; it should be at least mentioned that a certain portion of uncertainty is due to that effect, in addition to what is explained for the climate model uncertainty (mainly in terms of precipitation). A similar consideration should be described concerning the shift of ELA per degree Celsius temperature change. Secondly, it should be stated clearly that the results do not represent predictions, but scenario-based estimates. It is shown that reduction of glacier area is mostly compensated by intensified melt in smaller areas. This arises the important question where and when the glacier melt contribution to streamflow will recede. A discussion of this should be added in the conclusion section.

Technical corrections: p. 1508, line 1: indicate the size of the catchment p. 1508, line 8: which two different time periods, specify exactly p. 1509, line 1: better "glacier volume changes" (singular) p. 1509, line 18: better "high Alpine" than "high-alpine" p. 1509, line 25: better "glacier melt" (two words): snowmelt and icemelt, but glacier melt p. 1510, line 4: better "glacier melt" (two words) p. 1510, line 7: better "glacier melt" (two words) p. 1510, line 9: better skip "Theoretically" (they would suffer not only theoretically!) p. 1510, line 20: better "data availability" than "data coverage" p. 1510, line 22: better "limited data requirements" than "limited requirement for data" p. 1510, line 23: better "by use of" than "through the use of" p. 1511, line 4: better "robustness" and not in combination with "performance" which can be understood in various ways p. 1510, line 23-26: this sentence is somewhat unclear: who/what conserves, which results? p. 1512, in general: specify exactly which catchment is investigated in Your study, its size, altitudinal extent, and glacier coverage. This does not really become clear in this section p. 1512, line 6: better "originates from" than "is formed in" p. 1512, line 7: better "highly arid" than "strongly arid" p. 1512, line 17: is this runoff the annual mean? p. 1512, line 19: better "corresponding to" than "which corresponds" p. 1512, line 27: "suggests" instead of "suggested" p. 1513, line 1: better "meteorological conditions" than "meteorology" p. 1513, line 5: better "occur" than "fall" p. 1513, line 8: better "for runoff formation" than "in runoff formation" p. 1513, line 22: describe in a sentence or two here how precipitation changes in the corresponding scenarios. Skip

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comma after the brackets p. 1513, line 22: not Table 1, but Table 2 p. 1514, line 1-4: this sentence is too general. Skip "if it is not applied in a proper way", and specify exactly what the restrictions of numerical modelling are p. 1514, line 6: "modelling" instead of "modeling" p. 1515, line 2: "Alpine" instead of "alpine" p. 1515, line 15: not the period is based on ... , but the data p. 1515, line : better "and had to be updated" p. 1515, line 23: better "is the nearest glacier for which the required data is available" p. 1516, line 15: better "at ETH" p. 1516, line 17: better "the snow and glacier subroutine" p. 1516, line 18: better "elevation bands" p. 1516, line 26: better "solid precipitation" than "snow" p. 1517, line 1: better "undercatch" p. 1517, line 2: better "elevation band" p. 1517, line 10: better "snow water equivalent" p. 1517, line 21: better "In the end, the three outflows are summed up to represent total runoff" p. 1518, line 5-6: better " ... period, some 10-20 years after the available hydrometeorological data." p. 1519, line 6: " ... for this gauge": specify exactly which gauge You mean p. 1519, line 12: " ... this optimization procedure": what kind of "optimization" was applied? If not described here, better skip "optimization" p. 1519, line 16: better "glacier melt" p. 1519, line 22-24: specify how parameters are constrained p. 1520, line 1-3: for which period? p. 1520, line 10-12: Table 1? You probably mean Table 2 p. 1520, line 15: You mean Table 3? p. 1520, line 22: "compared to", not "compared with" p. 1521, line 3: You mean Table 4? p. 1521, line 5: better "elevation-distributed" and "higher areas" (instead of "reaches") p. 1521, line 6: skip " ... if the same total area loss is assumed" p. 1521, line 11-13: better don't believe, but argue p. 1521, line 15: You mean Table 5? p. 1521, line 16-17: better "modelling", check entire text for consistency p. 1521, line 20: which Table? p. 1522, line 7: again, better "robustness", since performance is interpreted in many different ways p. 1523, line 4-5: no! Better: " ... power of the approach to provide scenario estimates" Table 2: better " ... seasonal precipitation shift ... " Table 3: provide unit in the caption, and catchment/gauge Table 4: provide catchment/gauge Table 5: provide catchment/gauge Fig. 1: a map with topography would be nice Fig. 2: provide catchment Fig. 3: provide catchment Fig. 5: indicate that this is the calibration period Fig. 6: provide catchment/gauge

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Good luck, well done!

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 1507, 2011.

**HESD**

8, C118–C121, 2011

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