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Earth Surface Dynamics Discussions

# *Interactive comment on* "The hydrological cycle in the high Pamir Mountains: how temperature and seasonal precipitation distribution influence stream flow in the Gunt catchment, Tajikistan" *by* E. Pohl et al.

**Anonymous Referee #2**

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This manuscript describes the implementation of a hydrological model, J2000g in a large (14000 km2) watershed in the Pamirs, and examines the sensitivity of model output to precipitation and temperature input data, as well as model parameters. Simulated discharge hydrographs match reasonably well with observed hydrographs despite the large uncertainty in input data. Overall, the manuscript presents an interesting case study of an application of relatively simple hydrological model to large, data-sparse watershed. This will make a useful contribution to a journal specializing in hydrological modelling. However, I see two fundamental problems that need to be addressed be-



fore the paper is considered for publication in Earth Surface Dynamics. The first is the scope of the work. Although hydrological processes play an important role in earth surface processes, the relevance of this work to "the high quality research on the physical, chemical and biological processes shaping Earth's surface" (from ESurf Aims and Scope) is not clearly demonstrated in the manuscript. I think that the manuscript is a much better fit with Hydrology and Earth System Science than this journal. The second is a more technical, but important issue regarding the treatment of precipitation data. It appears that the authors adjusted precipitation data to fit the model output to observed discharge. I understand the difficulty of obtaining accurate precipitation data in the data-sparse watershed, but I have a hard time accepting the approach. There are a few other technical issues that are listed below. I would encourage the authors to revise the modelling approach, and change the scope of the work so that it will make direct contribution to improved understanding of the processes shaping Earth's surface. Alternatively, the authors could submit their work to a hydrology journal.

Title. The title does not accurately reflect the content of this paper, which is hydrological modelling and model sensitivity analysis. I suggest the title be revised.

Page 1160, Line 23-25. Is this the objective of this paper? If so, I do not think that the manuscript succeeds in meeting the objective. If not, what are the specific objectives?

Page 1161, Line 6. What type of cover and relief are these?

Page 1162, Line 7. What does "orographic barrier" exactly mean in the context of this particular region? Please show Lake Bulunkul in Figure 1.

Page 1163, Line 10. What does "simply and robustly integrated" mean? Please be more explicit.

Page 1164, Line 16. Are you sure about the "wrongly assessed temperatures"? I would think that the difference in degree-day melt factor (TMF) between glacier and non-glacier surfaces is related to the differences in ground heat flux inputs from the

bottom of the snow pack. I would encourage the authors to investigate this issue more carefully.

Page 1165, Line 5-9. Hydraulic properties of coarse sediments covering a large fraction of alpine region is not adequately considered in this modelling approach, which uses "soils" to represent infiltration and retention processes. Or, it is not clearly explained.

Page 1165, Line 16. If I understand correctly, J2000g model does not route water laterally. Does that mean there are no river channels in the model? If so, how is runoff (surface or subsurface) routed to the outlet? Please explain it clearly.

Page 1166, Line 14. What is the typical polygon size or resolution of this database?

Page 1167, Line 12. How was the "field observation" conducted? Was it a casual observation, or a systematic survey of vegetation density and diversity?

Page 1168, Line 9. The value (10^-6 mm/d) is unrealistically small for Quaternary sediments. Was this actually used in the model, or is it a typographical error?

Page 1169, Line 3. Correlation does increase, but there is a major bias between model-derived and field-measured precipitation data.

Page 1169, Line 11. "Correction factors" were applied to precipitation data to match the model results with observed discharge. The correction factor of 1.5 indicates a 50% increase in precipitation. It is hard to justify such a major adjustment of precipitation input. A much more careful consideration should be given to manipulation of precipitation data.

Page 1171, Line 15. These data sets still have very large seasonal biases, even though they may average out over a long time. Please see my comment on Figure A2.

Page 1173, Line 25. Were there any attempts to validate wind speed and relative humidity data? One short season of field campaign will provide a valuable opportunity to examine the data reliability and uncertainty.



Page 1174, Line 5. Were there any attempts to validate sunshine duration? See my comment on wind speed above.

Page 1175, Line 9. Did the authors make any effort to contact the local agency? I would expect engineers to keep some records of reservoir operation. Also, did the authors search for the data on reservoir size, or depth? That will at least give some indication of the effects of reservoirs.

Page 1175, Line 11-12. I would encourage the authors to make a rough estimate of irrigation water use, instead of simply assuming "minimum".

Page 1179, Line 20. In addition to these, TMF and ETR appear to be unrestricted.

Page 1181, Line 24. Please define P_eff.

Table 3. Are the values in bracket average precipitation over the entire watershed? Please clarify.

Figure 1. Please use color scale for elevation. It is difficult to see elevation in gray scale.

Figure 7. Simulated discharge curves appear to be smaller than observed in 2002. Was the spin-up period long enough to equilibrate the storage?

Figure A2. TRMM and APHRO data have a large degree of scatters. APHRO data are particularly troublesome because it have a large negative bias in winter and positive bias in summer. HAR10 have the highest correlation coefficient, but it has a major bias.

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Interactive comment on Earth Surf. Dynam. Discuss., 2, 1155, 2014.