Hydrol. Earth Syst. Sci. Discuss., 3, S1746–S1751, 2006
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Tradeoffs for the implementation of a process-based catchment model in a poorly gauged, highly glacierized Himalayan headwater" *by* M. Konz et al.

Anonymous Referee #1

Received and published: 22 December 2006

General comments:

The authors address the issue of implementing a process-based model approach (TACD) in a sparsely gauged catchment, particularly glacierized catchment. The ms deals with data pre-processing and modelling approaches aiming to improve process understanding for enhancing water resource assessment in such catchments applying a fully distributed, process-based model.

My major comment on the presented work is that a process-based model was implied in a sparsely gauged catchment. As most of the necessary model parameters

are - unsurprisingly - not available in such catchment I question the need for such implementation as we clearly need simply model approaches being applied in such catchments. I'm not totally convinced by the paper as it stands with regards what the advantage of applying a physically distributed model in a poorly gauged catchment is if the majority of the parameters needs to be assumed or taken from literature values from existing studies and concepts (and hence, not "physically" based in the sense that measured parameters are available). You write on p. 3481 that "since the highly sophisticated original TAC-D model cannot be applied to catchments with only temperature and precipitation data, substantial modifications of the model were necessary". In this case, why not using a more simple model approach? Therefore, in my opinion, prior publication in HESS the authors should address this issue and emphasising what the innovative contribution of such application for modelling hydrological processes in such sparsely gauged catchments and whether it really needs such process-based model.

This leads to my second comment regarding the paper title, which might be rather be "Application of ".

I would also recommend that the manuscript would be strengthens by a thorough review by somebody who has English as their first language.

I do have several comments which I outline below for the authors to consider as part of improving this manuscript prior to publication.

Detailed comments :

1. Introduction:

Generally: Introduction contains partly method description (e.g. p3475 L 13-15, L 23) and results, please focus on background information and how this led to research objectives of this study (also see general comments: why need of application of process-based, distributed model). The introduction contains a lot of information needed, but

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needs restructuring.

P. 3474: L 26: “show gaps due to the harsh climate” could you please clarify/explain and/or modify text?

P. 3475: L 1: Re-formulate text, e.g. “One way to improve water resources assessment is to combine existing field data with adequate modelling approaches”, give reference as well.

P. 3475, 2nd para: Please try give more details why working in such (sparsely gauged) catchments is such a research challenge and of interest for scientific society, relate to existing initiatives; why do we need to increase our process understanding in such catchments?, here reasons could be given why chosen process-based model approach.. So far introduction focuses too much on particular model problems (which might be discussed in method or even discussion section), but not in introduction.

P. 3475, L 26: Don’t just describe these studies (see above) rather mention INSIGHTS of these former studies - if of importance as background for this study. Could you please give more background information about research challenges in pre-processing data to fill data gaps (a big task especially in sparsely gauged catchments) - objective 1; what is research background to delineation of process-based units (objective 2)?

P 3476, L 6: Please try to reformulate objectives to make clear the study is less a “description” but tries to get new insight into

3. Data

3.1. Preparation of input data

P3478, L 15: Comment: Meteorological station is located 1000m below average altitude.

P3479, L9: any reference for this approach? Could you please give more detail, e.g. n and P values, any model performance parameter?

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This equation seems to be crucial to derive necessary temperature values, hence, more information should be given (which, e.g., might allow the readership to assess whether such approach is applicable in their study catchments)

P3479, L 10: terminology “coefficient” within this equation- please check and clarify.

P3479, L 19 onwards: I must admit I’m not convinced (as it’s written so far in the msg) about the data processing of the precipitation data. Firstly, I would suggest restructuring of the text as a number of important issues regarding this pre-processing are discussed on P3482 (section 4.1), but surely fit rather in section 3.1. Just few points: how is spatial variability in precipitation considered (particularly in such montane catchments with such range in elevation), as mentioned above: station is located even 1000 m.a.s.l below MEAN elevation. You discuss this partly in section 4.1. but it has to be incorporated already in the procedure of filling missing data.

P3480, L 15 onwards: What is meant by “maps with topographic information”? Did you digitised contour lines? Did you use DTM, what kind of, how was DTM corrected? Again, you mention DTM later in section 4.4., but section 3 is your “data” section, so all information about which data, data availability, correction, pre-processing has to be here, as it is necessary to be able to assess the value and quality of the applied data.

3.2 Hydrological and

P3481, L. 6/7: please give n and P values in equation.

4. The modelling approach

P 3481, L23: TAC-D, see L 13: be consistent in whole manuscript

P3482, L 5 onwards: see comments above, parts of this section should be discussed in section 3 as its not the modelling itself, but already data preparation for later modelling (rather: some issues have to be considered within modelling (as done by the authors) BUT also during data preparation and correction).

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P. 3485: a) The major advantage of applying TAC-D as fully distributed model seems to be the spatial delineation of the process-based units. If this delineation is the reason for applying this model within this study (see my major, general comments) then I think the derivation of these units should be explained in more detail.

b) Using “topography and landuse, aerial photographs and a DEM as well as experiences” can’t surely allow such delineation. What means “experiences”? Are there any insight into runoff sources (if so - how gained?) or flowpaths (if so -how gained?), which would be necessary to derive “process-based” spatial units of runoff generation. I also think the term HRU is wrongly used in this context (as in HRU more physically based processes are considered). Was there any information about hydrochemistry available (I assume, not)?

c) The typology as it stands does not define “dominating runoff generation processes”. What are the dominating runoff generating processes? So far what follows is simply a description of assumed (and applied) storage routines.

5. Model application

I would suggest to merge section modelling approach and model application

P. 3487, L 4 “quite tricky” not appropriate terminology in scientific journal

P. 3487, L 7: Comment: parameter equifinality

6. Simulation results

I think it would be important to show the hydrographs (measured, simulation as well), as its well known that good model performance values do not necessarily mean good model results (need of visual performance assessment).

7. Discussion

P. 3489, L. 3: into methods?

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P. 3489, L. 10: into results?

P. 3491/3492: I'm not convinced which insight was gained and whether improvement of model results by applying the spatially distributed modelling (especially considering the lack of spatially distributed input data).

P. 3493, L. 19: you should show the hydrographs before such conclusion can be drawn.

I think whole discussion section needs to be revised after consideration of detailed comments above.

8. Conclusion

P. 3495, L. 16: if "basic" process knowledge, why application of fully distributed, process-based model?

P. 3495, L. 21: in which way "clear improvement"?, which "previous model efforts"?

Figures:

Fig. 1: symbols are difficult to see Fig 2: I could not distinguish between type 3 and 4

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 3473, 2006.