

## Review of Manuscript

### 'How can expert knowledge increase the realism of conceptual hydrological models? A case study in the Swiss Pre-Alps '

by M. Antonetti and M. Zappa

Dear Editor, dear Authors,

I have reviewed the aforementioned work. My conclusions and comments are as follows:

#### 1. Scope

The article is within the scope of HESS.

#### 2. Summary

The authors evaluate the influence of several choices in an event-based, conceptual hydrological modeling exercise in mesoscale (up to 445 km<sup>2</sup>) catchments. This includes choices on rainfall input, initial conditions, dominant runoff process mapping and model parameterization strategy. For the former three, the choices can be ranked according to an expert-based, prior assumption of 'quality', the latter distinguishes a 'bottom-up' and a 'top-down' approach. Comparison of rainfall-runoff simulations of many combined realizations of the above choices with discharge observations reveal that i) the most complex (assumed most informative) process maps did only slightly outperform the simpler versions, ii) the bottom-up and top-down approaches differed only for short events, slightly in favor of the bottom-up approach, iii) the effect of forcing quality was hard to interpret due to compensation effects and iv) the top-down approach seems to be more robust and bottom-up tends to overconfidence.

#### 3. Overall ranking

The work is ranked 'Minor revision'.

#### 4. Evaluation

The study is well-designed, clearly reported, the conclusions are supported by the data and results. So just a few comments from my side:

- Title: The study has a strong focus on the concept of dominant runoff processes; in fact all of the experiments include DRP –based choices. This should be reflected in the title. E.g. 'How can expert knowledge increase the realism of conceptual hydrological models? A case study based on the concept of dominant runoff processes in the Swiss Alps.
- P3L3: applied instead of solved (or 'used as constraints')
- P4L31 pp: The connection between the text, Table 2 and Figure 3 should be improved:
  - Reverse the order of a), b) and c) in Fig 3 to match the order of Table 2
  - In Fig 3, add some textual info of the meaning of the RT's (e.g. column 3 of Table 2)
  - Add some more explanation about the maps in Fig 3 to the text (e.g. what is the raw resolution of the maps)
- P5L20 and P25 Table 2: It is not entirely clear to me how the mapping from 9 → 5 and 12 → 5 types was done.
- P6 section 2.2.1: So PREVAH was used to initialize SSM. How was SUZ initialized?
- P7 section 2.3.1: How was GS1H determined?
- P7L12: Can you explain in more detail the optimization against generalized response curves?

- P7 section 2.3.2: How was the routing parameter chosen for the top-down approach? Same as for bottom-up?
- P11L6: overestimate instead of underestimate
- P11L23: Can you explain 'interaction' in this context?

Yours sincerely,

Uwe Ehret