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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessing the benefit of snow data assimilation for runoff modelling in alpine catchments" *by* Nena Griessinger et al.

Anonymous Referee #2

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General Comments

The work of Griessinger et al. assesses the added value (or lack thereof) of a hierarchy of complexities in degree-day snow-models, possibly including SWE data assimilation. This type of models is frequently used in hydrological modelling.

This manuscript is of high value for hydrological modellers in snow-dominated and snow-influenced catchments, and draws important conclusion as to the desirable level of complexity to be chosen depending on the type of catchment concerned (high snow/enduring-snow cover, low snow depth /ephemeral snow). The different model versions used here build a clever set-up to test the impact of different snow-melt parametrizations and of SWE data assimilation within a hydrological model.

However, a few important considerations are missing, which would strengthen the con-

clusions of the paper. These are listed below :

- First, the uncertainty associated with snow depth observation data is never mentioned. As I understand from the manuscript the collected snow depth data were rather punctual and to me, the mentioned 'flatness' of the terrain where they were collected does not guaranty their 'local' representativity. Elaboration on that, and precisions as to the snow depth measurement protocol, would be welcome. An ancillary aspect also regards the hydrological data, which are subject to quite high uncertainties in mountain catchments as a result of frequent shifts in the topography of the river beds. This aspect should at least be discussed.

- Second, in most calibration and validation sets of simulations, M3 outperforms the upper-benchmark, which relies on a calibrated degree-day factorn whereas M3 relies on a constant degree-day factor for all catchments. To me this result is quite counter-intuitive and deserves an explanation.

- Finally, a distinct 'discussion' part could be inserted in the manuscript : Section 4.4 after line 11 could be part of it, as well as elements coming in response to point 2 mentioned above. Optionally, more elements as to the different, converging metrics used could be provided to the reader. The general decrease of (each) model performances with elevation could be commented and interpreted, in link with the quality of the interpolations (/extrapolation) of meteorological data and sometimes snow observations at these altitudes.

Minor Comments

- The last sentence of the abstract overlooks the fact that with altitude, not only the accurate estimation of snowmelt rate gains importance, but also the accurate estimation of SWE, which is one of the hypotheses tested by the paper's set-up.

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