Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-451-AC3, 2021

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Examining cross-scale influences of forcing resolutions in a hillslope-resolving, integrated hydrologic model" *by* Miguel A. Aguayo et al.

Miguel A. Aguayo et al.

miguel.aguayo@uct.cl

Received and published: 3 February 2021

This response is regarding the broad concerns of referee 2 which revolve around a) the limited details regarding the process representations used; and b) the limited mechanistic description of why the results are as they are.

For the first concern (a) and question associated, what this manuscript intent to show is how combinations of scales can introduce systematic biases within integrated atmospheric and hydrologic modeling through synthetic experiments and independent of how well-calibrated the models are. It is understood that many complex interactions and processes occur in mountain ridges, sublimation, mass loss, etc. However, most

of the LSM lack representation of snow blowing processes that affect, without a doubt, snow-mass in mountain topography and therefore energy and momentum transfer to the atmosphere. In this manuscript, we introduce a methodological framework that works under such model limitations and intends to show how scale "in modeling" might affect predictions using synthetic experiments mixing scales for some specific hydrologic variables like in the OSSEs.

For the second concern (b) and questions associated, we took the forcing from the surface (2 m and 10 m) as required by Parflow-CLM and this is what most modelers usually do. The meteorological downscaling was done physically up to 1km resolution since 3 nested domains were considered in WRF simulations (9,3,1 km). We agree that there are not considerations on cold biases, how windflow is treated, large sublimation losses in 30 m interpolations as the referee mentioned, however, as above mentioned this work was done only under integrated models' capabilities can reach. For this major concern, we will incorporate the caveats of using integrated hydrologic models in the discussion since typically input forcing data (interpolated or not) are often used by modelers, not considering the key processes mentioned by the referee. Regarding reconcile the decision not to downscale any meteorological forcing with running a 30 m hydrological model in alpine terrain, we thought that it would be ideal, however, running WRF at 30 m spatial resolution with hourly outputs for a water year is computational and data storage costly, and it was out of our computational capabilities.

Regarding the major shortcoming of the manuscript, we will give more attention to snowmelt timing, and also incorporating other ways to express the error metrics such as the mentioned Wasserstein metric or others to get a less distracting multi-scale analysis.

In summary, to improve this manuscript we will include the following points based on all suggestions made by the referee, such as:

- Include CLM snow modeling limitations in the discussion.

- Incorporate the interplay of topographic scale and NWP resolution key processes

- Provide results and analysis using observed precipitation data from DCEW to see if WRF precipitation mass estimate is close to observation.

- We will consider the ways of expressing the error metrics such as mentioned Wasserstein metric or others that we will in the next manuscript phase.

- We will ditch all the OSSE terminology that might be potentially confusing. Since we didn't really do an OSSE where we assimilated data, we will adopt some other language like "synthetic experiments" in which we use the ParFlow model as a numerical laboratory where we can examine process interactions under controlled settings.

- Along with every point mentioned above, we will fix all the minor comments.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-451, 2020.