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Geoscientific Model Development Discussions
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Interactive comment on "FORHYCS v1.0: A spatially distributed model combining hydrology and forest dynamics" *by* Matthias J. R. Speich et al.

Anonymous Referee #2

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The article presents how a modified version of hydrological model, PREVAH, is coupled with a forest landscape model, TreeMig, that makes the distributed ecohydrological model, FORHYCS. The FORHYCS is applied in a mountainous catchment to illustrate the coupling effect on hydrology and forest structure along with a series of climate change experiment.

The authors did a great job collaborating on all the information from various sources and made up a good modeling concept. My main concern about the research is, this study area is not an ideal watershed for doing the experiments. Since we are talking about coupling a forest model with a hydrological model, we better have a catchment

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Discussion paper

that is covered with forest. The five subcatchments of Navizence, have ~30% forested area in Chippis (but no streamflow data) and ~15% forested area in Vissoie. The other three catchments have negligible fraction of forested area. That might be part of the reason that we don't see much hydrograph difference between uncoupled and coupled runs even in the most forested catchment Vissoie. In fact the uncoupled-coupled streamflow differences are smaller in the other less forested catchments.

It would be great if authors could acquire downscaled meteorological data from latest climate modeling scenarios and test the FORHYC with those time series data. It's not that the delta method (e.g. ±degrees and/or precipitation) isn't scientifically sound, but the climate modeling data provides more variation and insight to the change of climate.

Specific comments P1L12-13: give names of the two new metrics.

P2L22: what aspects of mountainous regions are sensitive to what type of global change?

P8L7: explain AI, is it the stand leaf area?

P9L3: define EDI, is it Evaporative Demand Index?

P10L5: again, define fDS.

P14L7: forest minimum stomatal resistance at 180 s m-1 seems to be at the lower end of what has been reported. The stomatal/canopy resistance could be one of the most influential parameters when it comes to estimating transpiration (not sure about this PREVAH model). Why is a single number resistance superior to the previous "minimum canopy resistance for each land cover class"? In any case, the number needs to be justified according to the region and species being applied in this particular study.

P22L9-23: I've got confused by the streamflow simulations. How was the model calibrated to generate these KGE scores? I assume the PREVAH/FORHYCS were "tuned" to their best performance before the series of experiment. It seems three modeling runs generated model efficiencies that vary from catchment to catchment. Would some

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other combinations of parameterization make the results look differently?

P23-Figure 5: I'd suggest giving PREVAH a solid light grey line to make it easier to read the difference between FORHYCS00 and FORHYCS11 (which matters more).

P26L8-20: labels from different simulations need to be unified. For example, Succ_TM_BEK is BEK in the Figure 8?

P33L3-15: looks like a large part of the reason that uncoupled and coupled modeling runs were making rather subtle differences is, the catchment areas are not forested enough for the forest model to pass signals back to the hydrology module. If we look at the hydrologic modeling performance for catchments, Vissoie has more vegetated areas (other than Chippis, which has no observations), thus has the lowest KGE score. The other three catchments, none with meaningful forest fraction, perform much better without interplay with the forests.

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