Hydrology and
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Discussions

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Interactive comment on "Retrospective forecasts of the upcoming winter season snow accumulation in the Inn headwaters (European Alps)" *by* Kristian Förster et al.

Anonymous Referee #1

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Summary

In this paper the authors analyze seasonal hydrological hindcasts following a dynamical approach. The hydrological model AWARE is forced with the output from two different GCMs (CFSv2, GloSea5) for the Alpine catchment Inn up to the gauge Kirchbichl. As main predictand the authors chose the snow accumulation, represented by the snow water equivalent, at the end of February with a lead-time of 4 months (forecast initialization in October the preceding year). Additionally this paper assesses the predictive skill of both GCM-based forecast with regard to the anomalies of basin-scale mean temperature and accumulated precipitation depth.

In my opinion, the manuscript fits well into this special issue and its content is relevant for publication in HESS. In particular I like the use of two different GCMs in combination with a water balance model and the analyses of a different hydrological predictand than flow. I recommend this paper to be published after the authors have addressed the following general and specific comments in order to further improve the manuscript.

General comments

Overall, the paper is well written and well organized presenting interesting results. Nevertheless the authors should elaborate the following aspects: To facilitate readability of the manuscript you should explicitly indicate throughout the paper, if you're talking about meteorological seasonal forecast (e.g. used as input for a water balance model) or hydrological seasonal forecasts (output from a water balance model), as both cases are relevant in different parts of the text. I recommend to use the notation of the 4 model experiments (introduced in section 2.4) more consistently throughout the whole paper (including figures), for example clim. forecast should be CF-AWARE.

I suggest re-arranging the validation of the hydrological model: in chapter 2.3 you solely assess the performance of the water balance model with regard to runoff, although the prediction of SWE is the focal point of this study. Therefore I suggest moving the SWE-related evaluation from section 3 (page 7) to section 2.3 and to focus primarily on SWE simulation.

Although you focus on climate model-based seasonal forecast you should add some more background information on the different approaches to create seasonal hydrological forecast (e.g. statistical methods vs. dynamical approaches) in the introduction. Furthermore I miss a better support of literature in the discussion (section 3), e.g. with regard to related studies of the Alpine region, e.g. Fundel, F., Jörg-Hess, S., and Zappa, M.: Monthly hydrometeorological ensemble prediction of streamflow droughts and corresponding drought indices. Hydrol. Earth Syst. Sci., 395-407, doi:10.5194/hess-17-395-2013, 2013 and with regard to the comparison of your skill

measures (e.g. correlation) with other studies, e.g. Kim, H.M. , Webster, P. J., Curry, J. A.: Seasonal prediction skill of ECMWF System 4 and NCEP CFSv2 retrospective forecast for the Northern Hemisphere Winter. Clim Dyn (2012) 39:2957–2973. doi 10.1007/s00382-012-1364-6 or Weisheimer, A., and Palmer, T.N.: On the reliability of seasonal climate forecasts. Journal of The Royal Society Interface 11, Heft 96, S. 20131162–20131162, 2014.

You focused on "hydrological storages instead of instantaneous hydrological fluxes", which you call "a new aspect". For me it is not obvious . . . . . . if you already tried predicting fluxes for the melting season in the Alps? Is SWE indeed better predictable than the resulting flow? and . . . if SWE is a useful information / predictor for the stakeholder you mention (reservoir managers)? Is it as useful as flow forecasts or is it more like a fallback option?

As you evaluate forecast skill for SWE together with areal precipitation and temperature, I think it's necessary to address the interaction of these parameters more explicitly: what is the relative contribution of precipitation compared to temperature on SWE in the Alpine basin at the end of February? I guess you have insights into this interaction, so please share it with the reader of your paper.

Specific comments

I attach the specific comments as supplement.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2017-370/hess-2017-370-RC1-supplement.pdf

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