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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Subseasonal hydrometeorological ensemble predictions in small-and medium-size mountainous catchments: Benefits of the NWP approach" *by* Samuel Monhart et al.

Anonymous Referee #1

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Review on the paper by Samuel Monhart et al. Subseasonal hydrometeorological ensemble predictions in small- and medium-size mountainous catchments: Benefits of the NWP approach Presented for the review is a paper dedicated to the evaluation of subseasonal streamflow forecasts performance in three mountainous catchments in Switzerland produced by the two approaches. Both approaches involve a regional hydrological process-based model PREVAH to account for the initial conditions in the catchment under consideration and the main concern of the paper is concentrated in the model driving for the forecast lead-times. The first approach is the Ensem-

ble Streamflow Prediction (ESP) framework as described by Day (1985), which uses the historical weather data to force the model for the forecast lead-time resulting in the ensemble of the streamflow hydrographs. The second approach is the Numerical Weather Prediction (NWP) framework that involves a meteorological large-domain model-based 5-member forecasts by the ECMWF IFS to force the hydrological model for the lead-time period. The authors use both the raw and bias-corrected NWP forecasts in terms of meteorological and hydrological forecasting skill. The performance of the forecasting approaches is evaluated both for deterministic and probabilistic properties, e.g. the average characteristics are benchmarked by the MAE, NSE and NSElog criteria and the ensemble spread is evaluated by CRPSS metric, as well as the forecast spread to error ratio; the reliability of the forecasts is further examined by constructing the rank histograms. The overall importance of the study is crucial beyond doubt, as is very well described in the Introduction section – the ensemble forecasting methodology is now employed in many forecasting centers around the globe, yet the mentioned improvement in the NWP systems that hydrological prediction systems may benefit from is achieved mainly in Europe and North America, where the outstanding effort to it is applied. The case study catchments choice matches the research aims very well, as very diverse streamflow generation conditions are within the scope of the study – snowmelt-driven and fast-responding catchments are considered, which are an effort in constructing a well-performing streamflow model, as well as reliable subseasonal forecast, especially for summer and fall rainy periods with short hydrological system memory. Still, the authors show good model evaluation metrics. The main findings in the paper are in different effects of NWP bias-correction on the forecast performance, which vary in terms of variable, space and time, e.g. pre-processing of the input forcing is evaluated for temperature and precipitation apart and combined, and discussed for the three catchments over several seasons. The forecasts performance is evaluated not only for the streamflow but for the snow water equivalent in the catchments, as well, which is very crucial for the understanding of the predictability of snowmelt runoff. The results show the NWP pre-processed temperature forecasts outperforming

the ESP forecasts, which is a crucial finding, as well. There are a few concerns that I would appreciate the authors to enhance in the paper. First is the statement in section 3.2 concerning the minor importance of such variables as relative humidity etc. on the model performance on such timescales. Hence, the authors state that the relative humidity values were taken from the forecasts without any pre-processing. I would not agree with the authors on the minor importance of the relative humidity, as the evaporation rate is highly dependent on the relative humidity, especially within the processes of evaporation from snow. Given that the temperature forecasts are pre-processed, the close relation of the relative humidity and temperature may influence the forecast performance. However, the assessment of this was beyond the scope of the study. In the SWE forecasts verification section 4.3.4 the forecasts are verified against the reference model run instead of the actual observation, yet I would appreciate if the reference model performance could be discussed at least within a few sentences. Another consideration is that the methodology of the SWE assessment should be placed in the corresponding subsection within section 2. Minor technical note: p. 13 l. 1 - "...seasonal meteorological..." must be followed with a noun, which is missing

My overall perception of the paper is that it presents an outstanding scientific effort, which is of critical importance to the modern hydrological forecasting systems research. The motivation is well described, the methods are concise and well referenced, the results are well documented and discussed and a number of very crucial statements on the topic are made. I would recommend minor revisions before the paper can be published.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2018-458/hess-2018-458-RC1-supplement.pdf

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