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Probabilistic retrospective forecasts of snow accumulation for the upcoming winter season in the Inn headwaters catchment (Austria)

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Seasonal predictions aim at forecasting meteorological quantities for the upcoming months and are analysed as monthly data in many cases due to the uncertainties involved. The skill of seasonal predictions is, however, not distributed homogeneously in space and time. While good model skill measures can be achieved for El Niño and the tropics, the skill of seasonal predictions for Europe is generally lower, which limits the applicability of this kind of predictions. This contribution deals with a systematic analysis of re-forecast data obtained from two coupled atmosphere-ocean climate models (Met Office GloSea5 and NCEP CFSv2). In contrast to some other studies, the focus is on the prediction of hydrologic storages rather than on hydrologic fluxes such as precipitation or runoff. This approach acknowledges the persistence in time of storages which makes predictions more skilful. The study area is the snow- and ice-melt dominated Inn headwaters catchment upstream of Kirchbichl gauging station (9 310 km^2) located in the Austrian Alps. Building on wintertime re-forecasts of the climate models and a subsequent rev-ESP experiment (reverse Ensemble Streamflow Prediction), water balance simulations have been carried out using the Alpine Water balance And Runoff Estimation model (AWARE). Simulations of accumulated runoff depth in the subsequent spring season are compared to observations. This comparison of preliminary results reveals that the ensemble means of computed anomalies of accumulated runoff depth compare well with observations. The model chain GloSea5-AWARE correctly predicted the tendency of anomalies for 9 of 13 years, while the corresponding CFSv2-AWARE simulations result in only 5 of 13 correctly predicted years. The results suggest that some seasonal predictions may be capable of predicting tendencies of hydrologic model storages, although the skill of these predictions is in many cases low in Europe. As the number of correctly predicted winters does not significantly differ from a Bernoulli experiment, further analyses need to be considered. As an outlook for future research, the focus is put on identifying dominant processes that explain the varying model skill in different years.