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Combined assimilation of reanalyzed SWE and observed streamflow to enhance spring flow forecasts in southern Quebec, Canada

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Incorporation of observed streamflow into different hydrological models has resulted in improved streamflow forecasting in many studies. This approach is currently used by different hydropower companies to maximize hydroelectric production and also to predict and mitigate flood damages. In addition, snow-related model states, such as SWE, snow depth, and snow wetness, also carry important information regarding both timing and volume of spring flow in snow-dominated regions. Consequently, the main objective of this study is to combine assimilation of observed streamflow and reanalyzed SWE to enhance spring flow forecasting. The reanalyzed SWE product investigated is SNODAS.

SNODAS is a snow data assimilation system that improves outputs of a snow model by assimilating observed snow data provided by airborne platforms, satellites, and ground stations and generates snow-related data, such as SWE and snow depth at 1 km resolution. SNODAS is run each day so that the data product is available in near real-time.

In this study, SNODAS SWE data has been assimilated into HYDROTEL, a physically-based distributed hydrological model equipped with a snow module based on a mixed energy budget – degree-day approach, along with observed streamflow during the spring flow season in order to enhance spring flow forecasts. The study site is Au Saumon watershed, located in southern Quebec, Canada. The Au Saumon watershed has an area of 1022 and is predominantly forested. The simulation period is the 2014-2015 water year. Preliminary results show that combined assimilation of SNODAS SWE and observed streamflow improve spring flow predictions, while SWE assimilation has a more delayed impact than streamflow assimilation.

Keywords: Data Assimilation, SNODAS, SWE, Spring Flow Prediction