EGU21-2554
https://doi.org/10.5194/egusphere-egu21-2554
EGU General Assembly 2021

Sentinel-1 snow depth assimilation improves river discharge simulations in the western Alps

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In many of the world's mountainous regions, river discharge is largely influenced by the seasonal melt of snow. Therefore, accurate information on the amount of water stored as snow is essential for water management and flood forecasting. However, there are large uncertainties in model simulations of snow depth, partly due to uncertain precipitation estimates in mountain regions with complex topography. A study by Lievens et al. (2019) showed the potential of Sentinel-1 (S1) satellite observations to provide snow depth estimates at 1 km spatial and ~weekly temporal resolution in mountain regions. In this study, we assimilated these retrievals into the Noah Multiparameterization (Noah-MP) v3.6 land surface model for the western Alps using an ensemble Kalman filter. The land surface model was coupled to the Hydrological Modeling and Analysis Platform (HyMAP) routing scheme to also provide estimates of river discharge. With S1 data assimilation, the snow depth estimates improved, reducing the bias from 0.23 m to 0.05 m compared to in situ measurements. Preliminary results also show improved discharge simulations mainly in mountain catchments at high elevations that are less prone to regulations (e.g., by dams). This study demonstrates the capability of the S1 snow depth retrievals to improve not only snow depth estimates, but also the estimation of snow melt water contributions to river discharge.