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Snow depth observations from Sentinel-1 over the Northern Hemisphere mountain ranges

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The snow depth in the world's mountains ranks among the most uncertain variables in hydrology. Estimates from the interpolation of local measurements are unrealistic where they are sparse, atmospheric models poorly estimate snowfall, and current snow remote sensing observations have inherent limitations. Yet, accurate snow depth estimates are critically needed to provide information on the associated water resources. More than a billion people rely on water from snow, most of which originates in the Northern Hemisphere mountain ranges. Here, we demonstrate the unprecedented ability of the Sentinel-1 mission to map ˜weekly snow depth in the Northern Hemisphere mountains at 1-km² resolution. An evaluation with measurements from ˜4,000 sites and reanalysis data demonstrates that the Sentinel-1 observations capture the spatial variability between and within mountain ranges, as well as their inter-annual differences. The latter is showcased with the contrasting snow depths between 2017 and 2018 in the US Sierra Nevada and European Alps. The Sentinel-1 observations offer new opportunities for data assimilation, to improve the initialization of numerical weather, seasonal and climate predictions. The long-term continuity of the ESA and Copernicus Sentinel-1 constellation is a strong asset, offering the frequent and continual observations that are required for monitoring the cryosphere.

Which session would you like to present in?

1. Remote sensing, hydrological modelling and data assimilation

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