



Assimilation of Sentinel-2 Data into a Snowpack Model in the High Atlas of Morocco

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The snow melt from the High Atlas is a critical water resource in Morocco. In spite of its importance, monitoring the spatio-temporal evolution of key snow cover properties like the snow water equivalent remains challenging due to the lack of in situ measurements at high elevation. Since 2015, the Sentinel-2 mission provides high spatial resolution images with a 5 day revisit time, which offers new opportunities to characterize snow cover distribution in mountain regions. Here we present a new data assimilation scheme to estimate the state of the snowpack without in situ data. The model was forced using MERRA-2 data and a particle filter was developed to dynamically reduce the biases in temperature and precipitation using Sentinel-2 observations of the snow cover area. The assimilation scheme was implemented using SnowModel, a distributed energy-balance snowpack model and tested in a pilot catchment in the High Atlas. The study period covers 2015–2016 snow season which corresponds to the first operational year of Sentinel-2A, therefore the full revisit capacity was not yet achieved. Yet, we show that the data assimilation led to a better agreement with independent observations of the snow height at an automatic weather station and the snow cover extent from MODIS. The performance of the data assimilation scheme should benefit from the continuous improvements of MERRA-2 reanalysis and the full revisit capacity of Sentinel-2.

Keywords: snow; semi-arid climate; data assimilation; particle filter; SWE; MERRA-2