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Use of near real-time cloud-free MODIS snow cover data from DLR's Global SnowPack for the early forecast of extreme hydrological events

Sebastian Roessler and Andreas Dietz
German Remote Sensing Data Center, Land Surface Dynamics, Germany (sebastian.roessler@dlr.de)

The MODIS sensor on the NOAA Terra satellite has been providing daily information on global snow cover with a nominal spatial resolution of 500 m since February 2000. Since July 2022, this sensor is also located on NOAA's Aqua Satellite in orbit. The daily snow cover product of both platforms constitutes the basis for the DLR Global SnowPack (GSP) processor.

In the course of the GSP processing, the daily data of both MODIS sensors are merged and data gaps (e.g., clouds or polar night) are interpolated over 3 days. From a digital elevation model, the snow height (elevation above which only snow occurs), as well as the snow-free height (elevation below which no snow occurs) are determined. Heights above or below these thresholds are filled accordingly. Finally, remaining gaps are gradually filled by the values of preceding days. Since the year 2022, the daily cloud free GSP data has been made available in near real time (3 days delay due to the preprocessing of the NSIDC) via the GeoService Portal of the Earth Observation Center (EOC).

The rapid provision of the information on global snow coverage allows completely new applications of time-critical questions. These include hydrological estimates to what extent the snow conditions in the catchment area influence the drainage behavior. In addition to the satellite data, meteorological and hydrological data of the past 20 years are used to estimate the impact of a changing snow cover on the runoff. In the course of climate change, a delayed onset of snow cover and an earlier snowmelt is likely. Warmer winters also increase the risk of Rain-on-Snow events, which cause a strong increase in the outflow and have more dramatic ecological effects.

We will present results for selected river catchment areas with a special focus on hydrological extreme events (droughts and floods), and when their occurrence has been shown early in the development of seasonal snow coverage. Our goal is to provide an automatic early warning system based on near real time GSP for large river catchments with nival-influenced drainage regimes.