A snow cover climatology for the European Alps derived from AVHRR data

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To understand long-term changes and interactions in Alpine snow cover, the data acquired by the Advanced Very High Resolution Radiometer (AVHRR) sensors mounted onboard the National Oceanic and Atmospheric Association (NOAA) and Meteorological Operational satellite (MetOp) platforms is of particular interest: Even though newer generation sensors have become available, the AVHRR instrument offers the longest record of visible satellite imagery on a daily basis. This historical data record therefore represents a unique comprehensive source of snow cover information. However, the main difficulty lies in the appropriate raw data processing, which is considered a key requirement to access the full potential of the archived data.

We present a space-borne 1-km snow extent climatology for the Alpine region derived from historical 1-km AVHRR data over the period 1985-2011. This includes the generation of a set of cloud-free satellite snow products by means of a cloud gap-filling technique as well as a spatial representation of the snow cover dynamics in the European Alps over the last 27 years. Snow parameters such as snow onset day, snow cover duration (SCD), melt-out date (SCMD) and the snow cover area percentage (SCA) are employed to analyze the spatiotemporal snow cover variability of snow cover over the last three decades. Results suggest significant trends toward a shorter SCD at lower elevations in the southern regions of the European Alps. However, our results do not show any significant trends in the monthly mean SCA over the last 27 years. This is in agreement with other research findings and may indicate a deceleration of the decreasing snow trend in the Alpine region.

This data set represents robust EO-based information that provides spatially and temporally comprehensive snow information for use in related research fields. It potentially facilitates the integration of SCA into suitable modelling systems to better parametrize cryospheric processes and their interactions. Furthermore, the data set may support phenological investigations in explaining alterations in vegetation dynamics. Future projects aim at expanding the timeseries to whole Europe and validating the record and derived parameters at the continental scale.