

## Multi-source based determination of snow distribution in a semi-arid headwater catchment of northern Mongolia

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Knowledge of the snow cover dynamics in mountains of the semi-arid regions on Earth is essential for an improved understanding of the hydrological regime and for human water supply in a water scarce environment. In the semi-arid Sugnugur headwater catchment (in the Khentii Mountains, northern Mongolia), a spatial analysis of seasonal snow cover duration (SCD) was achieved on a 30 m grid by integrating the spatial resolution of Landsat-7, Landsat-8 and Sentinel-2A images with the daily temporal resolution of MODIS snow products (2000-2017). Validation was achieved using in situ measurements from winter field campaigns and spatially distributed surface temperature recordings. We found a mean increase of SCD with altitude at approximately +6 days/100m. However, no altitude-dependent changes in snow depth could be observed during the field campaigns. The southern exposed valley slopes are either snow free or covered by intermittent snow throughout the winter months due to high sublimation rates and prevailing wind. The estimated mean SCD ranges from 124 in the lower parts of the catchment to 226 days on the mountain peaks, with a mean underestimation of 12-13 days. Snow onset and melt dates exhibited large inter-annual variability, but no significant trend in the seasonal SCD was evident. Our method supports the better quantification of snow melt rates and thus water availability in this semi-arid environment. It can be applied to high-resolution snow mapping in similar mountainous regions.