Wide Area Mapping of Wet Snow Extent With Multiple Spaceborne SAR Sensors

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Mapping wet snow extent with satellite SAR sensors has in the past been significantly constrained by topographic effects on both the geometry and radiometry of the backscatter products used. We present and demonstrate methods that can be applied to strongly reduce the effects on resulting wet snow maps, allowing nearly full seamless coverage where residual effects from fore- vs. backslopes are minimal.

We use data from the Sentinel-1A (S1A), S1B, and Radarsat-2 (RS2) satellites, demonstrating the generation of hybrid snow products based on multiple sources. Unlike some other processing schemes, here data combinations are not restricted to single modes or tracks. We note that accurate geometric and radiometric calibration is a prerequisite for such processing. We first define temporal windows that support ascending/descending combinations given data revisit rates seen in archival data. Next, that temporal window is cycled forward in time merging ascending and descending acquisitions from all available satellites into a time series of composite backscatter images that seamlessly cover large regions. We demonstrate such processing over the entirety of the Alps, as well as coastal British Columbia, and northern Nunavut, Canada. With S1A/S1B combinations, we demonstrate nearly full coverage over the Alps with time windows of 6 days, and consistently full coverage with wider windows. Results generated at medium resolution (~90m) are presented together with higher resolution samples at 10m. We show temporal signatures for VH and VV polarizations, and make use of both channels to generate wet snow maps using difference thresholds with respect to a dry reference image. Further plausibility checks that consider local height and temperature are also incorporated.

For selected time periods, we compare S1-based wet snow classifications with composite MODIS snow products generated over the same temporal window.

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