Submitted Abstract

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First Author First Name Last Name	 Thomas (1) Nagler
Submitting Author First Name Last Name	 Thomas Nagler
Correspondence	thomas.nagler@enveo.at
Co-Authors **>> E-Mails will be not listed**	Schwaizer, Gabriele (1); Barella, Riccardo (2); Bueso-Bello, Jose-Luis (3); Cremonese, Eduardo (4); Essery, Richard (5); Hetzenecker, Markus (1); Jonas, Tobias (6); Keuris, Lars (1); Koch, Roland (7); Marin, Carlo (2); Mölg, Nico (1); Notarnicola, Claudia (2); Olefs, Marc (7); Rizzoli, Paola (3); Rott, Helmut (1); Santos, Benedita (2); Strasser, Ulrich (8); Warscher, Michael (8); Fitrzyk, Magdalena (9); Volden, Espen (9)
Organisations	1: ENVEO Environmental Earth Observation IT GmbH 2: Eurac Research 3: German Aerospace Center 4: Agenzia Regionale Protezione Ambiente Valle d'Aosta 5: University of Edinburgh 6: Institute for Snow and Avalanche Research 7: Zentralanstalt für Meteorologie und Geodynamik 8: Universität Innsbruck 9: European Space Agency
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Abstract

The seasonal snow cover is an important resource in mountain regions, the monitoring of which is crucial for water management, snow hydrology, tourism, and natural hazard mitigation. Alpine snow is also an important source of headwater for drainage basins downstream. AlpSnow (2020-2022) is a science activity within ESA's Alpine Regional Initiative, addressing the development of novel Earth Observation techniques and algorithms for the generation of innovative snow products optimized for specific scientific and operational applications. The AlpSnow portfolio includes products on snow extent, snow mass, wetness, albedo, and snow surface grain size.

Algorithm development and validation activities are supported by field activities in five test areas in different Alpine regions. Each test area is equipped with automated stations providing time series of meteorological and snow measurements. These are supplemented by dedicated field activities in order to collect additional snow reference data for validation. In the first phase of the project several candidate algorithms for each snow parameter were selected, implemented, tested, and evaluated. Based on the intercomparisons we selected a set of preferred algorithms which are further optimized for complex topography and diverse surface cover types. Regarding high resolution snow extent, we use an advanced linear multispectral unmixing approach and a new method applying machine learning techniques, both exploiting the spectral capabilities of Sentinel-2 and Landsat. Different algorithms are also tested and evaluated for surface albedo and grain size products. Wet snow extent, snow water equivalent (SWE) and snow depth are derived from synthetic aperture radar (SAR) data. For SWE two approaches are explored. The first is based on the assimilation of EO snow extent into the physical SNOWGRID model of the Austrian meteorological service (ZAMG), the second approach studies the use of repeat-pass SAR interferometry for generating maps of snow accumulation in mountain regions at about hundred meter grid size. This algorithm is tested using L-Band SAR data from the ALOS-2 PALSAR and SAOCOM missions and prepares for the future Copernicus Expansion Mission ROSE-L. For mapping the snow depth during the snowmelt season we investigate the suitability of differencing DEMs from the TanDEM-X mission acquired on snow-free surfaces and over wet snow. The impact of the products will be assessed by six use cases dealing with snow modelling, hydrology, and water management.

We will present results of the experiments dedicated to the selection of retrieval algorithms and report on the properties and performance of the prototype algorithms and products.