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Dry and wet snow analysis in Alpine regions using Radarsat-2 full polarimetry data. Comparison with in situ measurements.

Dr. Jean-Pierre Dedieu (1), Julien Mathieu (2), Nikola Besic (3), Yves Durand (4), and Frédéric Gottardi (5)

(1) CNRS - LTHE, LTHE, GRENOBLE, France (jean-pierre.dedieu@ujf-grenoble.fr, 33 476635887), (2) Phelma, INP Grenoble, France, (3) Gipsa-Lab, INP Grenoble, France, (4) CEN-Météo-France, Grenoble, France, (5) EDF-DTG, Grenoble, France

This study is focused on the advantages of RADARSAT-2 sensor in fully polarimetric mode at C-band for snow properties retrieval: liquid water content of wet snow, depth and water equivalent of dry snow.
Standard Quad Polarisation is used as the Radarsat-2 imaging mode: nominal swath width 25 km, ground resolution 5m (fine) with the incidence angle of 40°. Descending orbits (05:42 am) were planned to coincide with field measurements at 10 representative sites, reinforced with automatic snow stations data. The project was run for three winters (2009-2011, 10 images) over an instrumented river basin located in the French Alps (N 44°.15' / E 7°.15'). One summer image was acquired for SAR reference under snow free conditions (land cover).The targeted mountainous area "Grandes Rousses - Oisans" is characterized by a strong topography, causing shadowing and layover effects.
All polarimetric decompositions are performed by applying the "PolSARPro" ESA/IETR software on the SAR data in slant range, in order to preserve the phase information. The SAR local incidence angle values for each of the sites and the ground plane re-projection of the polarimetric results are obtained using the "NEST" ESA Toolbox, with a fine 25m-DEM. A snow metamorphism model ("Crocus") is used for calibration of the local sites measurements at the massif scale.
In this study, we are comparing two particular polarimetric incoherent target decompositions: decomposition on four standard mechanisms by Yamaguchi and H/alpha algebraic decomposition by Cloude and Pottier. The focus is set on the temporal evolution of the obtained polarimetric parameters versus the simultaneous measurements of the snow pack properties (stratigraphy).
In case of both decompositions we notice a satisfactory correlation of the particular polarimetric parameters with the liquid water content (LWC) measured at the snow surface in wet conditions. On the other hand, the correlation of the H/alpha decomposition parameters with snow depth and snow water equivalent (SWE) occurs only in the case of dry snow layers.