Monitoring Wet Snow at High Alpine Glaciers Using Multi-Polarized TerraSAR-X Data

Anna Wendleder (anna.wendleder@dlr.de), Achim Heilig, Andreas Schmitt, Christoph Mayer
German Aerospace Center, Germany

Due to the climate change the hydrological cycle changes globally. For the high Alpine regions a warmer and shorter winter with less precipitation is predicted. Consequently, the glaciers are melting. These parameters lead to more flooding events during the spring time and a low water level in the summer. Snow melt is the greatest contributor to runoff. Only during the summer, ice melt dominates the runoff regime, whereas rain has only a small contribution of the total discharge. For a better prediction of runoff, a better understanding and knowledge of the spatial distribution and temporal change of wet snow and accumulation is needed. In particular satellites equipped with Synthetic Aperture Radars (SAR) have the capacity to provide accurate high resolution information. Due to their all-weather and day and night observation capability they enables a regular mapping and monitoring of wet snow and accumulation occurrences and their temporal variations.

The test site is located in the Rofental (Oetz Valley), Austria, with its glacier Vernagtferner, Gepatschferner, Hintereisferner und Kesselwandferner. The glaciers are located at an altitude between 2800 m and 3700m, but in different expositions. The objective is to analyse the temporal and spatial change of wet snow during the melting season and hence to understand better the superficial melting process. Therefore, the time series of TerraSAR-X stripmap data acquired during the melting season (April – September) in 2016 are analysed. Furthermore, the accumulation area ratio (AAR) for both glaciers Vernagtferner and Hintereisferner are derived. All images are acquired in the dual-cross-polarized mode with the VV and VH channels. The polarimetric information is processed by the help of the Kennaugh Multi-SAR framework. It comprises the Kennaugh Decomposition as well as the temporal change detection using differential Kennaugh elements. The advantage of this framework is that any SAR data independent of its wavelength, orbit geometry, radiometry or acquisition date can be used. The results are compared with optical data acquired with Landsat-7 and with manual measurements.