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Regional glacier changes in the Ötztal Alps (Tyrol, Austria) – Results from different remote sensing techniques

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Climate change will pose a variety of challenges in the future, with global sea level rise among the most important ones. Out of all contributions to sea level rise, the contribution from glaciers is the one with the highest uncertainty. This is mainly because only very few and not necessarily representative glaciers are measured regularly. Among others, this limits the validation of extrapolation models.
On a regional scale, remote sensing data offer several possibilities for the mapping and monitoring of glaciers. Especially with the advent of very high resolution data, new possibilities can be exploited. The monitoring of glacier area, the calculation of the geodetic glacier mass balances and the tracking of changes in the seasonal snow and firn bodies of glaciers on a regional scale can not only help to enhance the spatial, but also the temporal coverage of observations.
The Ötztal Alps in Tyrol, Austria have been a research focus for the University of Innsbruck for several decades. Ongoing glaciological field measurements at two reference glaciers (Hintereisferner and Kesselwandferner) and data from different remote sensing techniques provide a valuable basis for a variety of research.
The presented study analyses high-resolution airborne laser scanning (ALS) data, with more than 10 years of annual campaigns on Hintereisferner (2001-2013) and two campaigns covering all of the Ötztal Alps (2006 and 2010) in combination with orthoimages and optical satellite data. Furthermore Pléiades tri-stereo data (2015 and 2016) are available to calculate very high resolution and high quality digital terrain models (DTM). These DTM can be used to extend the time series in combination with the DTM based on ALS data and enable the calculation of the geodetic glacier mass balance for over 150 glaciers within the study area. Furthermore, the optical information (ALS intensity, orthoimages and optical satellite data) is used for surface classification in order to monitor the glacier surfaces. This enables either a monitoring of changes in glacier area or in changes of the extent of firn-bodies on the glaciers.
We will present an overview of glacier changes in the Ötztal Alps during the last 15 years and also discuss the uncertainties in the used remote-sensing techniques as well as the error management. In addition, the potential of extending our investigations to other mountain areas is intended.