



Comparison of ablation stake measurements and Airborne Laser Scanning results

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Ablation measurements using ablation stakes are a well-established method in glaciology, which sees a lot of use. However, ablation stakes cannot always be installed and read at a sufficient number of points on a glacier or on multiple glaciers, due to limited personnel and financial capacities or because of inaccessible areas due to dangerous zones (crevasses, rock falls, avalanches) or remote terrain. Furthermore, ablation stakes only enable measurements of surface melt, whereas basal or internal melt processes as well as surface change related to glacier dynamics cannot be measured.

Multi temporal Airborne laser scanning (ALS) can provide high resolution and very accurate topographic information for the whole glacier area, which allows the calculation of the difference in surface height and therefore - if the density profile is known or can be estimated - the determination of the local mass balance, including processes like basal melt at least to a certain degree. To gain a better understanding of the differences between ablation stake readings and differential ALS data at the stake locations, the results of both methods have been compared in detail. At Langenferner, a glacier in the Italian Eastern Alps, where mass balance measurements have been carried out since 2004, three ALS campaigns have been conducted at the end of the hydrological year in 2005, 2010 and 2013. There are about 30 ablation stakes installed at the glacier, which have been read during or very close to the time of the flight campaigns. The ablation measurements are then compared to the surface differences calculated from ALS data at the locations of the ablation stakes. To take the movement of the stakes due to glacier dynamics into account, the position of the stakes has been measured with a differential GPS.