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# The performance of TLS in monitoring periglacial and glacial processes: comprehensive view of case studies in the Austrian Alps.

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Monitoring periglacial and glacial processes is a crucial task in observing the ongoing global warming as a result of climate change in high mountain areas. The project ALPCHANGE – Climate change and impacts in Southern Austrian Alpine Regions (www.alpchange.at) – comprises 4 test sites for terrestrial laserscanning (using Riegl long range laserscanner LPM-2k) such as Pasterze glacier (glacial, beginning in 2001, 8 data sets), Gössnitzkees (glacial, beginning in 2000, 9 data sets), Hinteres Langtalkar (periglacial, beginning in 2000, 9 data sets) and Fallbichl (periglacial, beginning in 2008). In September 2008 an airborne LiDAR (Light detection and ranging) campaign was carried out in all test sites for comparison to terrestrial data. Data acquisition in very remote areas such as Gössnitzkees and Hinteres Langtalkar were affected by partly insufficient power supply due to long acquisition time due to e.g. changing weather conditions.

At Pasterze glacier especially meteorological conditions downgraded the quality of acquired data. Wrong distances are partly measured due to varying temperatures in different air packages covering the glacier. Reason for that is a large difference in elevation of appr. 300m from the scanner´s position to the scanning area as well as an unfavourable scanning angle of 15 – 45°. We used up to 10 reflective traffic signs placed on the glacier surface, independently positioned with DGPS and geodetic surveys, to validate measurement data and correct the digital terrain model (DTM).

At all test sites it turned to be crucial that non moving areas such as bedrock are within the scanning sector. Changing conditions (e.g. scanner horizontation, atmospheric influences) always need independent data for orientation and validation.