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A comparative study on new technologies for mapping glaciers and snow fields

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Glaciers with their enormous impact on the local water supply, economy, power generation and alpine eco system are influenced heavily by climate variations such as changes in temperature and precipitation. Airborne Laser Scanning (ALS also abbreviated as LiDAR) systems are capable to acquire topographic data on glaciers and snowfields to analyze and model their behavior due to the climate change. Because of the high point repetition rate, Riegl Laserscanners have proved to be an efficient instrument for mapping glaciers and snowfields with a high point density. In rough terrain data acquisition can become a complex task especially when the limiting factor is the operating flight altitude. The effects of range ambiguities have to be considered carefully during flight planning by choosing a flight altitude assuring that all measurements stay within a single “multiple-time-around” (MTA) zone. Since the launch of the new Riegl long range airborne laserscanner the operating flight altitude of up to 10.000 ft while scanning with a 100 kHz pulse repetition rate opened a new perspective for mountainous airborne laser scanning of glaciers and snowfields. To compare a conventional Riegl Laser Scanner LMS-Q680i with the new long range scanner LMS-Q780 the Dachstein Glacier with a height between 2300 and 2700 meter above sea level in the center of the Austrian Alps has been scanned, processed and analyzed for both LiDAR systems. A simultaneous data acquisition was not possible because of the different flying altitude but it was possible to acquire the data at the same day to avoid significant changes in the surface topography. A special focus was set on crucial parameters like point density and backscattering behavior on snow and ice surfaces which directly correlate with the capability to derive accurate and high resolution models for the subsequent glacier monitoring. The operative advantages have been compared and conclude this study.