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The potential of lidar imaging for ecosystem mapping in Glacier Bay National Park, Alaska.

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Data from remotely sensed Earth observation facilitates the mapping and monitoring of remote regions enabling us to improve our understanding of key areas of the Earth System. In particular, the mapping of changes to these systems as a result of recent climate change is important to help assess and predict the impact of these changes, and the implications for the wider Earth System. One of the best-studied regions for the succession in landscape evolution is Glacier Bay National park (GBNP) in Alaska which has experienced rapid glacial retreat over the last 250 years. This study assesses the potential of aircraft-derived lidar data to map a number of catchments in GBNP for the purpose of studying the biogeochemical cycles and ecosystem change in this region. Three catchments were selected for the study, Ice Valley, Stonefly Creek and Wolf Point, representing a range of between 38-133 years since glacial retreat and therefore providing different levels of vegetation succession and vegetation maturity.

The lidar used in this study, an aircraft mounted Riegl LMS-Q240i, operates at 905 nm in the near infrared, scans 30 degrees either side of nadir, and samples 10,000 points per second, resulting in a pixel density of about 1-1.2 points/m with a sample resolution of about 20 cm. On-board waveform processing records alternately records the first and last return from the surface, together with the intensity of the return. The high repetition rate allows the aggregation of data over areas enabling the three-dimensional distribution of the vegetation to be measured, and thus improving the identification of canopy tops. Post-processing of the data is tailored towards the detailed mapping of the riparian system and surrounding environments and in particular, gathering information on the vegetation and potential watershed pathways. Bespoke software is used to extract vegetation cover, slope of ground surface, break in slope etc. This enables regions where the confluence of different surface (and inferred sub-surface) pathways is likely to occur, enabling the targeting of field sites to study the biogeochemical cycling in these remote regions.