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UNLOCKING THE TIME-CAPSULE OF HISTORIC AERIAL PHOTOGRAPHY TO MEASURE VOLUME CHANGES IN ANTARCTIC PENINSULA GLACIERS OVER A FIFTY-YEAR PERIOD.

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The regional climate of the Antarctic Peninsula is known to be warming. Recent studies show substantial changes in Antarctic Peninsula glaciers which may be related to climate change, but there is very little detailed, quantitative information about changes in their volume over time.

Historic aerial photographs are time capsules of information about the glacier surface at their time of exposure, which cannot now be measured in the field. Photogrammetry using historic photographs is now the only way to reconstruct past changes in surface elevation and hence calculate volume change for Antarctic Peninsula glaciers. Some glaciers have photographic coverage at five dates over more than fifty years.

Accurate photogrammetry from these photographs is hindered by having to use paper prints and missing calibration metadata. The photography was often flown for regional reconnaissance and is difficult to use for photogrammetry on individual glaciers. Adequate ground-surveyed control information is difficult to acquire.

This study assesses the achievable accuracy for measurements of glacier surface elevation changes over time from the historic aerial photography available for the Antarctic Peninsula. Moider Glacier on Pourquoi Pas Island, which has aerial photography coverage from 1947, 1957, 1989, 1991 and 2005 is used as an example.

The study presents a strategy for maximising difficult-to-use historic photographs and overcoming the lack of ground control by linking the old photographs to new, high-accuracy photogrammetry from GPS-supported aerial photography. Secondly it assesses the effect on measurement accuracy of approximating missing calibration metadata and using paper-prints rather than the original negatives.

The results show that metre-level accuracy measurements of glacier surface elevation can be achieved with new GPS-supported aerial photography. Accuracy of a few metres can still be achieved for historic photographs with incomplete calibration data and using paper-prints. The photogrammetric errors may not be significant compared to the change signal over the fifty-year period for glaciers in the region.