



From an 'ice-see' perspective: The current use, potential and limitations of Structure-from-Motion photogrammetry for cryospheric applications

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Structure-from-Motion with Multi-View Stereo (SfM-MVS) methods are rapidly becoming the tool of choice for geoscientists who require a relatively low-cost and viable alternative to traditional surveying technologies for characterising the form and short-term evolution of Earth surface landforms and landscapes. Uptake of SfM-MVS methods by workers in the cryospheric science community has been particularly rapid. The choice to use SfM-MVS has many logistical benefits which promote its adoption in remote glacial environments, namely the requirement for little more than a digital camera and proprietary or open-source software for topographic reconstruction, and a surveyed network of ground control to transform the resultant 3D models into a real-world co-ordinate system, if desired. Optionally, a dedicated aerial photography platform (e.g. kite, blimp, multicopter or fixed-wing UAV) may be used for initial photograph acquisition, which can facilitate glacier-scale observation and analysis. To date, cryospheric applications of SfM-MVS have included: the monitoring of glacier, moraine, and rock glacier movement; the evolution of ice cliffs on debris-covered glaciers; the reconstruction of ice-marginal or deglaciated topography; patch- and moraine-scale sedimentological characterisation; and the characterisation of glacier surfaces to monitor supraglacial drainage development or to inform energy balance modelling. This contribution will showcase existing applications and original data and discuss exciting potential opportunities and current limitations of the SfM-MVS method for the cryospheric sciences.