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Investigating glacier dynamics using 3D point clouds

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Both the 2D nature and the limited spatial and temporal resolution of the techniques typically used for investigating glacier fronts might be obstructing our understanding of glacier dynamics. The widespread use of 3D survey techniques such as laser scanning and photogrammetry together with the fast development of new algorithms for dealing with massive 3D point clouds and the use of new platforms (Unmanned Aerial Vehicles, airborne, helicopter, ship) are completely changing the way we see, understand and model the cryosphere. Structure-from-Motion (SfM) and advanced computer vision algorithms are progressively replacing classical photogrammetric workflows for the investigation of glacier dynamics using 3D point clouds at very high spatio-temporal detail.

3D datasets derived from a series of time-lapse cameras installed at the front of Store glacier (West Greenland) in summer 2017 will be used to illustrate different approaches for improving our perception, understanding, and modelling of glacier fronts, with emphasis on the following avenues of research: (1) developing new automatic (or semi-automatic) techniques for managing massive point clouds at multiple spatial and temporal scales, (2) investigating of the rapid dynamics of glacier fronts using 4D workflows; (3) computing the deformation field over the glacier front using 3D point cloud comparison and feature tracking techniques; (4) extracting crevasses and other linear features from point clouds; (5) investigating the statistical population of calving events through Magnitude-Frequency laws.

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