

Usefulness of Terrestrial Laser Scanning for Survey of Dynamics of Frontal Zone of Hansbreen - Svalbard Tidewater Glacier

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SUMMARY

Hansbreen is one of the most investigated glacier in Arctic which is ending down into the Hornsund Fjord (tidewater glacier). These kind of glaciers play an important role in global sea level rise by production of icebergs. Precise studies of glacier flow and simultaneously the ice-cliff position changes are necessary for calculation of calving flux (volume of iceberg production). Survey of glacier flow velocity close to its end is difficult and very laborious by classical photogrammetric methods. Acquisition of airborne and satellite images in polar regions are strongly weather depend and accuracy of results are not satisfactory when the feature tracking or even the time parallax methods are used (if applicable). That why terrestrial laser scanning survey method was used to obtain high accuracy survey of glacier flow velocity, the calving flux and the range of the glacier front. This technology give us opportunity to acquisition data from the range up to 6 km with high resolution and without need to place additional marks on the glacier surface. That method is very profitable for tidewater glaciers which are one of the most difficult objects for precise monitoring of processes on their calving fronts. Up to now the research of glaciers dynamic were obtain by classical survey methods (tachymetry, GPS and terrestrial photogrammetry). Terrestrial laser scanning used for medium size grounded tidewater glacier in Svalbard seems to be an ideal tool for short period and inter annual monitoring of dynamic processes on its frontal zone. Repeated terrestrial laser scanning enable to obtain high accuracy data on change of position of particular features on glacier surface (usually crevasses) for calculation of glacier surface velocity field. Having the same data with an interval of e.g. two weeks it is possible to calculate tension rate in the badly crevassed area very close to the frontal ice cliff (not accessible for precise GPS survey). Tension rate is important for studies of mechanism of calving processes. Repeated scanning of the ice cliff is giving precise data on front position changes with a chance for distinguishing the most active parts in ice berg production. The paper describe methodology of survey of dynamics of frontal zone of glacier by using terrestrial laser scanning technology. Long range scanner Riegl LPM-321 were used and two series of scanner registration were conduct: one year period for surface and two weeks period for front during summer glacier activity. These data give us homogeneous distribution of laser points representing glacier surface. The results and analyses of that measurements will allow to assess the usefulness of chosen survey method.

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