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Monitoring of land-based glaciers on James Ross Island, Antarctic Peninsula

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Antarctic Peninsula has been considered one of the most rapidly warming parts of our planet during the second half of the 20^{th} century. Therefore, James Ross Island located near the northern tip of the Antarctic Peninsula, represents a unique place to study the sensitivity of glacier systems to regional atmospheric warming. Since 2006, an integrated multidisciplinary study of glaciers and terrestrial ecosystems has been carried out in the northern part of Ulu Peninsula, James Ross Island. In this contribution, glacier monitoring network consisting of four dominant land-based glaciers at the Ulu Peninsula is presented. Davies Dome (DD) is an ice dome, which originates on the surface of a flat volcanic mesa at >400 m a.s.l. and terminates as a single 700 m wide outlet in Whisky Bay. In 2006, Davies Dome had an area of 6.5 km^2 and lay in the altitude range 0-514 m a.s.l. Whisky Glacier (WG) is a cold-based land-terminating valley glacier, which is surrounded by an extensive area of debris-covered ice. WG covered an area of 2.4 km^2 and ranged from 215 to 520 m a.s.l. Triangular Glacier (TG) is a southwest-facing land-terminating glacier with an area of 0.6 km^2 ranging from 302 to 107 m a.s.l. with well-developed ice-cored terminal moraine. San Jose Glacier (SJG) is a south-facing land-terminating piedmont glacier rejuvenated from the above lying Lachman Crags Dome (∼640 m a.s.l.). SJG covers an area of 0.6 km^2 and extends between 138 and 310 m a.s.l. Moreover, monitoring network consists of five automatic weather stations (AWS) placed in the central and marginal parts of the selected glaciers. Each AWS was equipped with the EMS33 air temperature and humidity probes placed inside the radiation shields. Apart from that, additional instruments, e.g. albedometer, propeller anemometer, snow depth sensors were installed on the central part of DD and WG. Since 2009, annual mass balance measurements have been realized on the DD, WG and TG glaciers. In 2010, ice thickness and glacier bed elevations of DD and WG were surveyed using ground-penetrating radar. The results of glaciological measurements over the period 2009-2014 reveal mostly positive annual mass balance on DD and WG except for the glaciological year 2011-2012 when net accumulation was recorded in the uppermost part of both glaciers. Spatial variability in annual mass balance is larger on DD where snow distribution and net accumulation is strongly determined by meteorological conditions. By contrast, interannual changes in spatial pattern of net balance are reduced on WG due to the topographic control of snow accumulation.

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