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Is the positive mass balance of north-eastern Antarctic Peninsula glaciers persistent after 2015?

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Over the second half of 20th century, the Antarctic Peninsula (AP) has experienced rapid warming that was shifted to a prominent cooling between 2000 and 2014. Consequently, positive surface mass-balance was reported on several land-terminating glaciers in the northern AP and James Ross Island (JRI) during this period. However, the year 2016 was the warmest in records from the Mendel Station, situated on the northern coast of JRI. Mean annual air temperature was about 3 ˚C higher than the 2005–2014 average at this site. In this contribution, we tried to examine whether JRI glaciers could respond to climate variability in such a short time. We analysed annual mass balance changes of four dominant land-based glaciers in the northern part of JRI. Davies Dome is an ice dome, which has an area of ∼6.5 km^2 and lay in the altitude range 0–514 m a.s.l. Whisky Glacier is a north-facing valley glacier with an area of ∼2.4 km^2 ranging from 215 to 520 m a.s.l. Triangular Glacier is a southwest-facing glacier with an area of 0.6 km^2 ranging from 107 to 302 m a.s.l. San Jose Glacier is a south-facing piedmont glacier rejuvenated from the above lying Lachman Crags Dome and covers an area of 0.6 km^2 between 138 and 310 m a.s.l.

The surface mass-balance changes were estimated based on ablation stakes and differential GNSS measurements, which were carried out over last two years (2015/16–2016/17). The ablation stake height was measured from the top of the upright stakes to the glacier surface with 0.01-m resolution. In addition, surface elevation changes were determined for this period and compared with digital elevation models (DEMs) created from available TanDEM-X scenes. The annual surface mass-balance was negative for the most of investigated glaciers in the 2015–17 period. One of the highest negative mass-balance was found for Whisky Glacier in 2015–16. The positive mass-balance of these glaciers between 2010 and 2015 has been replaced by mass loss since 2016. Our results indicate high sensitivity of small JRI glaciers to temperature fluctuation and ongoing glacier retreat in this region is to be expected with rising atmospheric temperatures.

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