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Sensitivity of glacier mass balance and equilibrium line altitude to climatic change on King George Island, Antarctic Peninsula.

Ulrike Falk (1,2), Damian Lopez (2,3), Adrian Silva-Busso (4,5)

(1) Climate Lab Geography, Univ. Bremen, Germany (ulrike.falk@gmail.com), (2) ZFL, Univ. Bonn, Germany, (3) Geology and Mineralogy, Univ. Cologne, Germany, (4) Exact and Natural Sciences, University Buenos Aires, Argentina, (5) National Water Institute of Argentina (INA), Buenos Aires, Argentina

The South Shetland Islands are located at the northern tip of the Antarctic Peninsula which is among the fastest warming regions on Earth. Surface air temperature increases (ca. 3 K in 50 years) are concurrent with retreating glacier fronts, an increase in melt areas, ice surface lowering and rapid break-up and disintegration of ice shelves. Observed surface air temperature lapse rates show a high variability during winter months (standard deviations up to $\pm$1.0 K/100 m), and a distinct spatial heterogeneity reflecting the impact of synoptic weather patterns especially during winter glacial mass accumulation periods. The increased mesocyclonic activity during the winter time in the study area results in intensified advection of warm, moist air with high temperatures and rain, and leads to melt conditions on the ice cap, fixating surface air temperatures to the melting point. The impact on winter accumulation results in even more negative mass balance estimates.
Six years of glaciological measurements on mass balance stake transects are used with a glacier melt model to assess changes in melt water input to the coastal waters, glacier surface mass balance and the equilibrium line altitude. The average equilibrium line altitude (ELA) calculated from own glaciological observations for KGI over the time period 2010 – 2015 amounts to ELA=330$\pm$100 m. Published studies suggest rather stable condition slightly negative glacier mass balance until the mid 80's with an ELA of approx. 150 m. The calculated accumulation area ratio suggests rather dramatic changes in extension of the inland ice cap for the South Shetland Islands until an equilibrium with concurrent climate conditions is reached.