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Sensitivity of glacier melt and equilibrium line altitude on the Antarctic Peninsula to climatic change

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The South Shetland Islands are located at the northern tip of the Antarctic Peninsula (AP) which is among the fastest warming regions on Earth. Surface air temperature increases ($\sim$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 variability 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. Five 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. Glaciological measurements and literature review suggest a change of more than 150m in 15 yr's. Analysis of area changes in accumulation zone to the total glacier area are used to define a tipping point where the negative trends in glacier mass balance is becoming irreversible.