



Exploring twentieth-century tropical teleconnections using a new daily observational record from Grytviken, South Georgia

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A number of recent studies have suggested that tropical teleconnections have contributed to atmospheric warming across West Antarctica and the Antarctic Peninsula. However, a major limitation for capturing atmosphere-ocean teleconnections is the relatively short length of instrumental records in the mid- to high southern latitudes. Historical records from sub-Antarctic islands offer considerable potential for developing highly-resolved records of change that extend through the 20th century. In 1905, a whaling and meteorological station was established at Grytviken on sub-Antarctic South Georgia in the South Atlantic (54°S, 36°W) providing near-continuous daily observations through to present day. Here we report a new, daily observational record of temperature and precipitation from Grytviken, which we compare to regional datasets and historical reanalysis (including the Twentieth Century Reanalysis; 20CR version 2c). We find an average rate of temperature rise of 0.13°C per decade over the period 1907-2016 ($p < 0.0001$) with most of this increase taking place during the latter half of the 20th century, weighted towards the summer months. A shift towards increasingly warmer daytime extremes commencing from the mid-20th century is also identified, accompanied by warmer night-time temperatures. Analysis of the annual precipitation total shows a strong increasing trend through the 20th century, representing an average increase of ~40 mm per year (though this is superimposed on a highly variable time series), with autumn and winter rainfall dominating this signal. Our analyses suggest a tropical Pacific forcing of pervasive synoptic conditions across the mid to high-latitudes since the mid-20th century, with warmer equatorial surface waters associated with increasing atmospheric temperatures accompanied by stronger westerly airflow and associated warm föhn winds across South Georgia.