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Surface energy balance measurements and modeling on the ice cap of King George Island, West Antarctica

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The Antarctic Peninsula is amongst the fastest warming places on Earth and further temperature increase is to be expected. It has undergone rapid environmental changes in the past decades. Exceptional rates of surface air temperature increases (2.5K in 50 years) are concurrent with retreating glacier fronts, an increase in melt areas, surface lowering and rapid retreat, break-up and disintegration of ice shelves. The South Shetland Islands are located on the northern tip of the Peninsula and are especially vulnerable to climate change due to their maritime climate.

For King George Island we have compiled a unique data set comprising direct measurements of evaporation and sensible heat flux by eddy covariance on the Warszawa Icefield for the austral summers November 2010 to March 2011 and January to February 2012 in combination with a fully equipped automated weather station measuring long- and short-wave radiation components, profiles of temperature, humidity and wind velocities as well as glacier ice temperatures in profile. The combination with the eddy covariance data allows for analysis of variability and seasonality of surface energy balance components on a glacier for an entire year. Repeat measurements of surface lowering at different locations on King George Island are used for analysis of multi-sensor satellite data to identify melt patterns and bare ice areas during summer. In combination with long-term time series of weather data, these data give indication of the sensitivity of the inland ice cap to the ongoing changes.

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