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# Foehn-induced surface melting of the Larsen C ice shelf, Antarctica

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The Antarctic Peninsula (AP) is a steep, narrow, elongated mountain range, stretching ∼1500km from Drake's Passage in the north, to Ellsworth Land in the south. A number of ice shelves extend from both the west and east coast, and provide a stark contrast to the ∼2000m high mountains. The AP was the fastest warming region on Earth in the late $20^{th}$ century. The disintegration of two east coast ice shelves, Larsen A and B, in 1995 and 2002 respectively, became a symbol for climate change in the Polar Regions. A proposed theory for ice shelf destabilisation is surface melting induced by föhn winds. The föhn winds which flow down the eastern slopes of the AP, are a feature of the interaction of the steep mountain range with the prevailing circumpolar westerlies. This work uses near-surface observations and numerical simulations to study the impacts of the föhn winds on the surface energy balance and surface melt across the Larsen C ice shelf.

Observations from an automatic weather station on Larsen C ice shelf (67.02˚S, 61.5˚W) were ingested into a SEB model to estimate values of the energy balance components, prior to this study. Daily averaged values of all SEB components from 2009-2012 were provided for the project. Annual and seasonal analysis of these components has highlighted the impact of föhn winds on the ice shelf.

The residual energy available for melt is largely due to the increased downwelling shortwave radiation from the cloud-clearing effect during föhn events, and the increased (positive) sensible heat flux. Surface melt is observed up to 100km from the foot of the AP. The frequency and duration of föhn events significantly increases the annual average melt energy. Föhn conditions during austral spring (SON) can lengthen the duration of the melt season, increase the number of melt days, and increase the intensity of surface melt. Surface melt from föhn events is greatest in years with multiple consecutive föhn events in late spring.

Simulation of a spring föhn event using the Weather Research and Forecasting (WRF) model at 1.5km horizontal resolution puts the above results into the wider spatial context of the ice shelf. Assessing the spatial influence of föhn events may provide insight into the mechanism responsible for the northward-propagating rift on Larsen C. Model output reveals a north-south divide in melt potential, with warm, dry föhn air to the north of the ice shelf. A comparison of the case study results and observations from multiple weather stations will also be presented.