EGU21-9601
https://doi.org/10.5194/egusphere-egu21-9601
EGU General Assembly 2021

Simulations of Föhn in Antarctica with WRF for the Antarctic Mesoscale Prediction System AMPS

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We examine the representation of Föhn events across the Antarctic Peninsula Mountains during 2011 as they were observed in measurements by an Automatic Weather Station, and in simulations with the Weather Research and Forecasting Model (WRF) as run for the Antarctic Mesoscale Prediction System (AMPS). On the Larsen Ice Shelf (LIS) in the lee of this mountain range Föhn winds are thought to provide the atmospheric conditions for significant warming over the ice shelf thus leading to the initial firn densification and subsequently providing the melt water for hydrofracturing. This process has led to the dramatic collapse of huge parts of the LIS in 1995 and 2002 respectively.

Measurements obtained at a crest AWS on the Avery Plateau (AV), and the analysis of conditions upstream using the Froude number help to put observations at CP into a wider context. We find that, while the model generally simulates meteorological parameters very well, and shows good skills in capturing the occurrence, frequency and duration of Föhn events realistically, it underestimates the temperature increase and the humidity decrease during the Föhn significantly, and may thus underestimate the contribution of Föhn to driving surface melt on the LIS.

Our results indicate that the misrepresentation of cloud properties and particularly the absence of mixed phase clouds in AMPS, affects the quality of weather simulation under normal conditions to some extent, and to a larger extent the model's capability to simulate the strength of Föhn conditions - and thus their contribution to driving surface melt on the LIS - adequately. Most importantly our data show that Föhn conditions can raise the air temperature to above freezing, and thus trigger melt/sublimation even in winter.