A model-based study of foehn effect impacts on the near-surface climate over the Larsen ice shelf at the Antarctic Peninsula

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The role of foehn effects for the near-surface climate in the region of the Larsen Ice Shelf at the Antarctic Peninsula (AP) has been investigated using the regional climate model COSMO-CLM (CCLM) at 5 km (C05) and 15 km (C15) resolution. The model was run for the whole Weddell Sea region for the period 2002-2016 with nesting in ERA-Interim reanalyses. Sea ice concentrations were taken from microwave satellite measurements and were updated daily to allow for a close-to-reality hindcast. Model results are compared to available AWS data. Comparison between CCLM and ERA-Interim for the AP region show that katabatic winds are higher over the slopes, which leads also to higher temperatures. Foehn events were detected from C15/05 simulations 2002-2015 using objective criteria for changes in wind, temperature and humidity. Only foehn events exceeding 6h were considered, the longest event lasted 48h. The climatology for the 2 m-temperature of foehn and non-foehn events for the Larsen ice shelf shows that foehn events cause melting frequently even for spring and autumn. In winter, a few cases with melting during foehn events occur as well. Considering that the recent temperature increase has occurred mainly for autumn, winter and spring, the temperature rise expected for the coming century will probably lead to a large increase in melting events due to foehn also in winter.