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Evaluation of high-resolution MetUM and AMPS forecasts of near-surface meteorological variables over Larsen C ice shelf and northern Antarctic Peninsula

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High-resolution weather forecasts are an important tool for understanding the detailed patterns of surface melt on the Larsen C ice shelf (LCIS), Antarctic Peninsula. We investigate the skill of UK Met Office Unified Model (MetUM) and Antarctic Mesoscale Prediction System (AMPS) forecasts with horizontal grid spacing of 4-5 km for a 1 month period during January-February 2011 by comparing near-surface model output to automatic weather station measurements at 5 sites on the LCIS and 3 on the northern Antarctic Peninsula. Forecasts for the range 12-24 h showed a fairly homogeneous performance over the LCIS. The 2 m temperature simulated by AMPS has a correlation with observations of 0.5-0.6 and a systematic cold bias of around -1 degrees centigrade. By comparison, the MetUM had a higher correlation and was less negatively biased. The simulated surface pressure has a correlation of 0.99 and small biases in both models. AMPS yielded better results than the MetUM for 10 m wind speed, being able to capture particularly well synoptically-driven high wind speeds which the MetUM systematically underestimated. Both models struggle to simulate the 10 m wind direction when the wind conditions are highly variable. The simulation of specific humidity by both models was poor. Both models showed a general reduction in performance over the northern Antarctic Peninsula compared to the LCIS. Extending the analysis to consider the 12-36 h forecast range demonstrated a relatively weak dependence of model skill to the length of the forecast. The study focuses particularly on the representation of foehn wind events, which are an important contributor to surface melt over the LCIS, by examining additional $\sim$1 km scale forecasts using the MetUM.