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Comparison of surface mass balance estimates of the Larsen-C ice shelf from near-surface density measurements and a regional climate model

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The collapse of the Larsen A Ice Shelf in 1995 and the Larsen B Ice Shelf in 2002 have led to concerns over the stability of the larger Larsen C Ice Shelf (LCIS). Although such collapses have little direct effect on sea level, the accompanying reduced buttressing of inshore glaciers led to increased ice discharge and sea-level rise. Both atmospheric and oceanic warming have been hypothesized to be responsible for the recent observed thinning of the LCIS. Here we present a comparison of Surface Mass Balance (SMB) estimates over the last 20 years from RACMO, a regional climate model, and neutron scattering measurements made during Austral Spring 2009 across the LCIS. Preliminary results show that variations in modelled SMB over time is greatest for the inland site and decreases towards the ocean. This agrees with the variability in neutron scattering data except at the site nearest the ice shelf edge, which shows the greatest variability in density with depth. Previous studies have shown that the penetration depth of radar signals is related inversely to snow/firn density and our observations reveal a high degree of spatial variability in the relationship of density with depth over distances of 5 m to 200 km. We use these data to assess the magnitude of the correction for ESA's Cryosat-2 mission, which has the potential to identify subsurface accumulation layers, and to investigate the mechanism responsible for the observed thinning of the LCIS.