

Seabed topography beneath Larsen C Ice Shelf from seismic soundings

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Seismic reflection soundings of ice thickness and seabed depth were acquired on the Larsen C Ice Shelf in the austral summer of 2012-13. Over 100 sites at 3, 5 or 10 km spacing along 10 lines were recorded, from the Churchill Peninsula in the north to the Joerg Peninsula in the south, and also towards the ice front. Sites were selected using a bathymetry model derived from the inversion of IceBridge gravity data, which indicated key regions where sub-shelf oceanic circulation may be restricted. The seismic velocity profile in the upper 100 m of firn and ice was derived from shallow refraction surveys at a number of locations. Temperatures measured previously within the ice and water column were used to define the seismic velocity profile through the remainder of the ice column and also the sub-shelf cavity. Uncertainties in ice and water cavity thickness are in general <10 m. Compared with the seismic measurements, the root-mean-square error in the gravimetrically derived bathymetry at the seismic sites is 162 m. The derived seismic bathymetry profiles indicate that a number of significant topographic features of the seabed, which could potentially inhibit oceanic circulation beneath the ice shelf and are present in the gravity inversion model, are not observed. The discrepancies between the gravity inversion results and the seismic bathymetry are attributed to the assumption of uniform geology in the inversion process and the sparsity of IceBridge flight lines. These results will be used to improve existing sub-shelf ocean circulation models. Results indicate that care must be taken when using bathymetry models derived by the inversion of free-air gravity anomalies. The bathymetry results presented here will be used to improve existing sub-shelf ocean circulation models.