Deriving ice thickness from ice-freeboard measurements by satellites is based on the hydrostatic equilibrium assumption and estimations for densities of ice, water, and sea level height. Ice-thickness measurements from air and ground using radar can be used for the validation of satellite derived ice thickness provided the density of snow and ice is known. This method might be hindered if saline ice is present at the bottom of the ice shelf or in case of brine layer intrusions near the ice shelf front.

Electromagnetic induction sounding presents a method to effectively measure the thickness of sea ice. In 2009, we used a helicopter-borne instrument (EM bird) to measure freeboard and total ice thickness in the McMurdo Sound area. We present results of the measurements over the ice shelf, which contains layers of saline ice and brine layer intrusions. In some parts a ground penetrating radar system was used for additional ice thickness measurements, and for detecting the transition depth between fresh water ice and saline ice.

The EM-bird was capable to measure ice-shelf thicknesses of up to 50m. Freeboard and ice thickness yielded varying mean ice densities between 800 and 910 kg m\(^{-3}\), which could be related to ice-shelf morphology. Using this information, satellite altimetry was used to obtain ice shelf thickness. Despite the limitations of the used system, we conclude that the chosen method is feasible for obtaining improved ice-thickness values for ice shelves and can be used in the validation of satellite measurements.