# Estimating the thickness of ice deposits at Martian mid-latitudes

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**12.11 2014**

**Abstract**
High resolution images of the surface of Mars have shown that several types of Martian deposits in the 30-55 degree latitude band have detailed flow patterns consistent with the flow of ice. In addition, radar properties of the deposits strongly suggest that they consist of nearly-pure near-surface water ice. It is believed that the deposits are remnants of ice from a previous 'ice age', which have been protected from sublimation for millions of years by a thin layer of dust.

In order to estimate the amount of ice in five selected areas, the ice thickness was estimated by interpolating under the ice using a polynomial and trapeze method. The interpolated bed elevation was then compared to available SHARAD radargrams from NASA's Mars Reconnaissance Orbiter to estimate the uncertainty of the method.

The bed topography was also estimated using two 2D flow models; the first was based on the perfect plasticity approximation and the second was a more general model based on Glen's flow law. The yield stress, the specific mass balance, and the creep parameter were all estimated using a Monte Carlo inverse algorithm, and were compared to the normal range of values for glaciers on Earth. The volume of ice was calculated in all five areas, and a volume/area relation was found. The total volume of ice in the areas was estimated to be 3892 km^3 using the non-linear model and 4188 km^3 using the plastic model. The mean thickness of the deposits was estimated to be around 198-213 metres.

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