

Change in Elevation of the Antarctic Ice Sheet (1992 - 1995)

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Abstract

At present the best estimates of the rate of mass change of the Antarctic Ice Sheet are based on direct glaciological observations. This evidence is insufficient to say if the Ice Sheet is growing or shrinking, the uncertainty in the rate of mass change being 400 Gt of ice per year. To reduce this uncertainty with satellite altimeter data, the average elevation of the Ice Sheet must be monitored to within an accuracy of 5 cm per year. We have used 3 years of ERS-1 data to create a time series of Antarctic Ice Sheet elevation change maps. The average ice sheet elevation change is then derived from these maps. 30 cm changes in elevation in a few months are common on the spatial scale of Antarctic drainage basins. The echo received at the altimeter is composed of a part scattered from the snow surface and a part scattered from within the volume of the ice sheet. Much of the observed elevation change has been found to be caused by changes in the amount of scattering from the snow surface. A method has been developed to remove from the time series the effect of these temporary changes in surface scattering. The final corrected time series is approaching the 5 cm accuracy required to reduce the uncertainty in the rate of mass change of the Ice Sheet. We estimate that with 5 years of data any long term trend in the mass of the Antarctic Ice Sheet will be detectable.

Keywords: Mass Balance, Antarctica, Radar Altimetry, Ice Sheet