Master thesis by Charlotte Ditlevsen

Electrical Conductivity Measurements (ECM) of Greenland Ice Cores

Abstract

The study presented in this thesis is a new calibration found by the relationship between acidity and conductivity, based on electric conductivity measurements (ECM) on three Greenland ice cores. Sulphate distribution based on the values calculated from the new calibration, are also in focus. Five volcanic eruptions were specifically selected to be measured to produce the calibration but it was only in NGRIP that all five of them were measured only three in GRIP and Dye-3 were measured due to insufficient amount of ice preserved. The eruptions measured are Krakatoa (1883), Tambora (1815), Laki (1783), Unknown (1257) and Unknown (9305 B.C.). All eruptions are well known which makes it possible to compare the new data with previously measured and published data. The measurements were performed on a new ECM setup where a calibration was produced by finding the relationship between sulphate and the newly measured ECM current over the volcanic eruptions. The sulphate values used for the calibration were old measurements done on ion-chromatography (IC) in 5 cm intervals.

The study shows that three parameters control the reproducibility of the measurements: the overall core quality, temperature and polarization. Six out of the eleven measurements on the five eruptions were done on firn, which turned out to be less stable measurements and possibly somewhat destructive regarding the calibration.

The new calibration gave a linear relationship between sulphate and current, which is different from any published calibrations. The reason for this is assumed to be due to complications associated with some of the measurements used and/or the change in direct use of sulphate instead of H+, which have been used for all other calibrations. The sulphate distribution was found by the calibration function and the deposition values of each eruption in all cores. The values showed that there was a favouring of distribution in central Greenland at the GRIP core followed by NGRIP and last Dye-3. However this is questioned by the over all quality of the measurements done on Dye-3 and the comparison between the values produced here and others.

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