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Greenland CO_2 and δ13C of CO_2 – assigning the contamination

T. Jenk (1), M. Rubino (1,2), D. Etheridge (2), M. Bigler (3), and T. Blunier (1)

(1) Centre for Ice and Climate, University of Copenhagen, Copenhagen, Denmark, (2) CSIRO Marine and Atmospheric Research, Aspendale, Victoria, Australia, (3) Physics Institute, Climate and Environmental Physics and Oeschger Centre for Climate Change Research, University of Bern, Bern, Switzerland

Analysis of air extracted from bubbles of Greenland ice results in considerably higher CO_2 concentrations compared to records from Antarctic sites. This can not be explained by the inter-hemispheric gradient expected for past climatic conditions. Instead, it is attributed to chemical reactions between impurities in the ice, contributing excess CO_2 to the atmospheric signal which was initially trapped in the bubbles. This is consistent with the fact that Greenland ice contains a significantly higher amount of impurities compared to Antarctic ice. Different candidates of CO_2 producing chemical reactions were suggested by previous studies: (i) the acidification of carbonates, (ii) the oxidation of hydrocarbons and (iii) the photodecarboxilation of humic like substances. However, there is no agreement on how much each of the above reactions contributes. This study aims to identify the contribution from organic and inorganic sources to the Greenland CO_2 excess. Compared to previous studies we base our analysis on an increased set of parameters and data points. We discuss data of CO_2 and δ13C-CO_2, both in high (2.5 cm) and low resolution (55 to 110 cm) along with parallel records of chemical impurities from three different sites in Greenland. The samples for the presented high resolution CO_2 and δ13C of CO_2 records were measured on a new set-up at the Centre for Ice and Climate (needle cracker, GC-IRMS).