Geophysical Research Abstracts
Vol. 18, EGU2016-11856, 2016
EGU General Assembly 2016

A new high-precision technique for measurement of N2O concentration in polar ice cores with small amount of samples

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Nitrous oxide, one of the major greenhouse gases, has about 300 times higher GWP for 100 years, although its mixing ratio is a thousand time less than that of CO_2. Since N2O has important roles in biogeochemical nitrogen cycles, atmospheric ozone destruction, and long term scale climate feedback, it is crucial to comprehend the underlying mechanisms that lead changes in global inventories of greenhouse gases in the past. Because previous data from ice core studies have large uncertainty of 5 ppbv with relatively low temporal resolutions, they are not sufficient for interpreting centennial to multi-centennial variations. Here we present a new high-precision technique for measuring N2O concentration of ancient air occluded in ice cores. We use a wet extraction method (melting-refreezing method) to extract gas from the ice core, and GC-ECD to determine N2O concentration. The optimized setting for GC-ECD permits high sensitivity for N2O, and minimizes volume of ice core sample that is requisite to get reliable results. Here we present preliminary results that we obtained from 15 $\sim$ 20 g of ice core samples. The values for solubility correction is measured by an additional melting-refreezing process. The amount of correction is about 3 ppbv for 329.88 ppbv N2O standard gas air (calibrated from NOAA) with an uncertainty of $<$ 1 ppbv. We also compare the results with those from a dry extraction method for validation, and present preliminary results from Styx ice core, Antarctica. The updated results will be presented at the meeting.