Geophysical Research Abstracts
Vol. 13, EGU2011-9407-1, 2011
EGU General Assembly 2011

Determination of Δ17O in stratospheric CO2 using oxygen isotope exchange witch CeO2

Dorota Mrozek and Thomas Röckmann
Poland (dorota.mrozek@gmail.com)

The characterization of the 13C and 18O content of carbon dioxide has played a significant role in the understanding of the global carbon cycle. Most isotope fractionations are mass dependent (MDF) because they arise from differences in chemical and physical properties that are dependent on mass. These processes obey the mass dependent fractionation equation Δ17O = 17O - 0.52 18O = 0. In the atmosphere, almost all atmospheric components show an oxygen isotope anomaly, i.e. Δ17O > 0. Such deviations in 17O from a purely mass-dependent pattern are named mass-independent fractionation (MIF). Also stratospheric CO2 shows mass independent fractionation.

Measurement of both oxygen isotopes in CO2 is not easy because 17O- and 13C- substituted CO2 cannot be distinguished by isotope ratio mass spectrometry. Therefore, CO2 has to be either converted to O2 or the oxygen it contains must be exchanged with oxygen of known isotopic composition. Most of these methods were initially developed as offline analytical techniques. We have established an online measurement system for δ17O in CO2, based on complete oxygen isotope exchange with CeO2 at 650°C (Assonov et al. 2001). Similar to the system by Kawagucci et al (2005), using CuO for exchange, the system allows analysis of 17O on nanomolar quantities of CO2.
The approach involves measurement of CO2 directly, and after isotope exchange. First, CO2 is separated from the main air constituents by gas chromatography. One aliquot is then directly injected into the mass spectrometer, another aliquot is directed through a CeO2 where it is isotopicaly equilibrated with the O2 excess of CeO2 at 650°C. The equilibrated CO2 without anomaly is analyzed on the IRMS.

As a first application, we have determined the isotopic composition of stratospheric CO2 on air samples obtained during the EU project RECONCILE in the Arctic winter/spring season with the high-altitude aircraft Geophysica.