Geophysical Research Abstracts
Vol. 13, EGU2011-6917, 2011
EGU General Assembly 2011

An intercomparison study of isotopic ozone profiles from the ACE-FTS and JEM-SMILES instruments.

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Observations of various atmospheric isotopologue species are a valuable source of information, as they can improve our current understanding of the atmosphere. For example, isotopic signatures in atmospheric profiles can be used to investigate atmospheric dynamical processes, while differences in the isotopic composition of atmospheric trace gases can be traced to effects due to their sources and sinks. This study focuses on the intercomparison of two satellite missions that provide measurements of isotopic species. Firstly, the Atmospheric Chemistry Experiment-Fourier Transform Spectrometer (ACE-FTS) aboard the Canadian satellite SCISAT (launched in August 2003) was designed to investigate the composition of the upper troposphere, stratosphere, and mesosphere. ACE-FTS utilises solar occultation to measure temperature and pressure as well as vertical profiles of over thirty different chemical species and isotopologue profiles for; O_3, H_2O, CH_4, N_2O, CO, CO_2 and NO. Global coverage for each species is obtained approximately over one year and with a vertical resolution of typically 3-4 km. Secondly, the Superconducting Sub-Millimeter-wave Limb Emission Sounder (SMILES), onboard the Japanese Experiment Module (JEM) of the International Space Station (ISS) was launched in September 2009 to investigate the middle atmosphere. It is the first space-borne application of superconductor–insulator–superconductor (SIS) heterodyne detector technology. From limb emission measurements, the JEM-SMILES instrument provides vertical profiles of isotopologues of O_3 with a vertical resolution of typically 2.1-3.7 km. Here, we present differences between collocated O_3 isotopologue profiles measured by each instrument, where coincidences are selected by using specific time and distance criteria. Coincidences found during polar winters are filtered with an additional criterion based on scaled potential vorticity values derived from the GEOS-5 analyses, which are interpolated to the time and location of each ACE-FTS and JEM-SMILES profile.