Geophysical Research Abstracts
Vol. 16, EGU2014-15829, 2014
EGU General Assembly 2014

Comparisons between satellite-derived datasets of stratospheric NO_y species: using a photochemical model to account for diurnal variations

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The ACE-FTS (Atmospheric Chemistry Experiment – Fourier Transform Spectrometer) instrument on the Canadian satellite SCISAT, which has been in operation now for over 10 years, has the capability of deriving stratospheric profiles of many of the NO_y ($NO + NO_2 + NO_3 + 2\times N_2O_5 + HNO_3 + HNO_4 + ClONO_2 + BrONO_2$) species. However, as a solar occultation instrument, opportunities for ACE-FTS and another given satellite instrument to observe a common air mass, can be rather limited. In the case of comparing species that exhibit significant diurnal variation, finding "coincident" measurements can be even more difficult. In order for the measurements to be considered common-volume, the required difference between measurement times can be limitingly small. In this study, for each ACE-FTS measurement, we use a photochemical box model to simulate the diurnal variations of different NO_y species over that day. The ACE-FTS NO_y profiles are then scaled to the local times of coincident measurements from different satellite instruments—GOMOS, MIPAS, MLS, OSIRIS, POAM III, SAGE III, SCIAMACHY, and SMR. This allows for a much larger number of coincidences to be utilized. This study will discuss the advantages and limitations of this technique, as well as the results from comparing NO, NO_2, N_2O_5, HNO_3, and $ClONO_2$ between ACE-FTS and other atmospheric limb sounders.