Geophysical Research Abstracts
Vol. 15, EGU2013-8788, 2013
EGU General Assembly 2013

Multi-scale analysis of N2O, O_3 and HNO_3 high resolution measurements in the middle atmosphere

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Small-scale turbulent processes are still poorly understood and paramaterized in numerical models. The aim of this work is to evaluate the vertical turbulent diffusivity in the stratosphere and its variability as a function of altitude, latitude and season. To evaluate the turbulent diffusivity it is relevant to calculate tracer profiles roughness.
Based on measurements obtained over the last decade by the SPIRALE spectrometer balloon borne instrument (9 flights), we calculate the profile roughness of N2O, HNO_3, and O_3 in the stratosphere for different geophysical conditions and seasons at mid-latitudes, in tropics, and in polar region. SPIRALE is a spectrometer with six tunable laser diodes for in situ measurements of trace gas species from the upper troposphere to the middle stratosphere ($\sim$34 km height). This instrument provides concentration of several trace gas species with a very high vertical resolution of $\sim$5 m. SPIRALE has flown in tropical region (Teresina, 5.0°S/42.5°W, Brasil), at mid-latitudes (Aire sur l'Adour, 43.5°N/0.2°W; Gap, 44.3°N/6.0°E, France) and in Arctic region (Esrange, 67.5°N/21.0°E).
In addition, using the high vertical resolution of the measurements, we performed multi-scale analysis using wavelet decomposition in order to investigate the scale interactions and characterize the stratospheric dynamical state for each flight. We will show the preliminary results obtained and discuss on the link between roughness obtained and turbulent diffusion coefficient variability in the stratosphere.