Seminar on Physics and Chemistry
of the Atmosphere
12.07.2019, SoSe 2019, IUP Bremen

GHG in the Tropics
Tropospheric ozone anomalies during El Nino
and
CO2 retrieval from high resolution NDACC

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Abstract

First Part
El Nino and the Southern Oscillation (ENSO), the largest inter-annual, bimodal natural weather fluctuation, has been subject of study for decades, yet there is still a lot to learn about it. This is especially true for extreme events. During 2015 and 2016 the latest extreme event occurred, after almost 20 years. One of the special aspects of ENSO extreme events are the strong tropospheric ozone anomalies caused by changes in dynamical processes, meteorological anomalies, changes in wildfires and stratosphere-troposphere exchange (STE) that transport, produce and remove atmospheric species.
This study focuses on the last two extreme ENSO events' (1997/1998 and 2015/2016) ozone anomalies, comparing them and finding the cause for the tropospheric ozone anomalies and the difference between them. It is observed that both El Nino events increased the tropospheric O3 over the Pacific warm pool by 10-12 DU, and decrease over the Pacific ocean around 10-20 DU. But it is also shown that the 2015 El Nino had distributed positive O3 anomalies (5-10 DU) extending over the Indian and Atlantic ocean, Africa and South America with especially high anomalies for November. The observed tropospheric ozone anomalies used here were measured using the satellite based data from the instruments: GOME/ERS-2 (1995-2003), SCIAMACHY/Envisat (2002-2012), and GOME-2/MerOpA (2007-present) and retrieved using the Deep Convective Cloud (CCD) method in the tropics to obtain a good estimation of the mean Tropical Tropospheric Ozone Columns (TTCO). For the interpretation of the results, data from _re emissions from the Global Fire Emissions Database version 4 (GFED4s), along with some model output from the LAMOS group of the IUP at the University of Bremen was used to isolate the contribution of several sources and transport.

Second Part
CO_2 in the Amazon is not being largely monitored with ground based remote sensing. There are three stations where NDACC measurements where conducted, Porto Velho, Manaos and Paramaribo, key regions for the carbon cycle. My goal was to create a retrieval for CO_2 using NDACC mid infrared spectra. For that I used data from Ny-Alesund. While TCCON started its operation in 2004, high resolution NDACC spectra are available in Ny-Alesund since the early 1990s and in situ fask data.

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Therefore, Ny-Alesund data was optimal to test the retrieval given the available data for comparison. We selected the spectral window in the region between 4780 cm^{-1} and 4800 cm^{-1} and used the ggg2014 TCCON retrieval package for the xCO_2 retrieval. In this region the averaging kernels indicate a high sensitivity to the troposphere. The daily means of the xCO_2 mole fractions of the high resolution NDACC spectra are compared to the standard TCCON retrieval and in situ data. We have tested this approach for spectra from Ny-Alesund and show first results of the comparison.