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Overview of O3 and CO interannual variabilities and trends based on MOZAIC data.

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The MOZAIC program (http://mozaic.aero.obs-mip.fr) measures O3 and thermodynamical parameters since August 1994 along with CO since December 2001, on board 5 commercial aircraft operated by European airlines. Thus, most of the sampling data have been recorded at northern mid-latitudes, between 9 and 12 km altitude, in the upper troposphere – lower stratosphere (UTLS). To better assess the O3 distribution and its seasonal and regional behavior, measurements have been referenced to the tropopause altitude. The tropopause is defined as being a transition zone 30 hPa thick centered on the surface PV=2 pvu. Two other layers are defined on either side of the tropopause to encompass all the cruise levels of the MOZAIC flights, as fully described in Thouret et al., (2006). Then, we have access to the upper tropospheric and lower stratospheric O3 and CO distributions independently of any ozone threshold and regardless of the seasonal variations of the tropopause. We will present a climatology of O3 and CO in the UTLS for different regions of the northern hemisphere, from Western US to Japan, via North Atlantic and Europe. We aim to further assess their interannual variability and "trends". The first analysis presented in Thouret et al., (2006) showed an increase of O3 of about 1%/year between 1994 and 2003 in both the UT and the LS over a large North Atlantic area. This time period was actually characterized by the so-called (positive) anomaly 1998-1999. Later on, Koumoutsaris et al., (2008) have shown the role of the strong El-Nino event in 1997 in this positive ozone anomaly observed at hemispheric scale. In this present study, thanks to a longer time series now available (up to mid 2009), we go a step further. We will show that recent data in the UT actually reveal a levelling off of O3 since 2000 over the US and Europe while it is still increasing over Asia. On the other hand, UT CO distributions actually show a significant decrease over US and Europe while they show an increase and a strong interannual variability over Asia partly linked to the intensity of boreal fires. Such anomalies have a quasi global (northern hemispheric scale) impact (Elguindi et al., 2010).

References:

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