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Ozone trends (1995-2013) in the UTLS as seen by MOZAIC-IAGOS over northern mid-latitudes

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Since 1994, the MOZAIC program has been performing in-situ measurements of ozone and water vapor concentrations from commercial aircraft, thus leading to a wide observing system for the UTLS over northern mid-latitudes. In order to complete the understanding of ozone distribution, CO analysers were added among on board measuring instruments at the end of 2001. From 2011, a new set of instruments combining ozone and CO have been installed in the frame of IAGOS (In-service Aircraft for Global Observing System) to keep going on a long term observing system. Historical MOZAIC data have been recorded until 2014 and are still available in the IAGOS central database (www.iagos.fr). Consistency has been demonstrated (Nedelec et al., 2015). Consequently, a 20-year dataset now allows deriving interannual variability and (multi-)decadal trends. We present ozone time series from 1994 to 2013 over six regions representing northern mid-latitudes, excluding Pacific area. CO times series start in 2002.

We define three pressure ranges relative to the tropopause altitude, dynamically defined as the 2 pvu-isosurface : the Upper Troposphere, the tropopause and the Lower Stratosphere.

We globally observe positive trends of ozone in the UT, more pronounced from 1995 to 2000 (e.g. 1.71 +/- 0.57 ppbv.year-1 over Western Europe) than from 2000 to 2013 (e.g. 0.3 +/- 0.15 ppbv.year-1 over the same region). CO time series show a decreasing tendency (e.g. -1.36 +/- 0.31 ppbv.year-1 over Western Europe) since 2002. However, the latter period shows significant interannual variabilities and anomalies over most regions, in ozone and CO : positive in 2003, negative in 2008-2009 for example. This may suggest a possible impact of the summer heat wave (2003) and an influence of the large-scale CO decrease, likely due to the global financial crisis (2008). We will discuss potential leading processes of such observed variabilities (troposphere-stratosphere coupling, boreal fires, large-scale climate oscillations, ...).