



## **A tropospheric air mass study over the Mid-Northern latitudes deduced from the MOZAIC program: Climatology and "Trends" of O<sub>3</sub>, CO and WV (1994-2009).**

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Taking benefit of the MOZAIC high resolution and sampling frequency measurements on board of commercial aircraft (O<sub>3</sub> and water vapour (WV) since 1994 and CO since 2001) we have delivered the first climatology and inter-annual variability of the tropospheric O<sub>3</sub> column (Zbinden et al., 2006). Nevertheless this result was limited to the troposphere as seen by MOZAIC.

An improvement of the climatology updated has been obtained focussing on O<sub>3</sub>, CO and WV tropospheric contents. In this new climatology delivery our purpose was to estimate the contents in the full tropospheric air mass (Zbinden et al, 2011). We explained the methodology to complete the individual tropospheric profiles when the dynamical tropopause (2pvu) is above the highest MOZAIC observation. The methodology has been validated with both reduced concomitant O<sub>3</sub> sounding from WOUDC (Wallops Island, Hohenpeissenberg and Tateno) and MOZAIC O<sub>3</sub> data set (Eastern USA, Europe and Japan). As we captured 94% to 98% of the tropospheric O<sub>3</sub> on concomitant WOUDC profiles, the successful validation allows the generalization to other MOZAIC sites where no sounding are available. The final tropospheric results are deduced from MOZAIC exclusively which is a major advantage. This methodology will be here shortly presented.

Here, we focus on the tropospheric O<sub>3</sub> and CO "trends" (1994-2009) over Eastern USA, Europe and Japan with also details on the Boundary Layer, Mid and Upper Tropospheric contributions using the fully defined tropospheric profiles. We will also introduce a new definition of the mid tropospheric ceiling instead of a fixed 8km altitude as previously. In that definition the tropopause on individual profiles cannot reside in the monthly mid-troposphere and is pushed into the monthly upper-troposphere. As a consequence, on a monthly basis, the upper-troposphere will be a layer in which the tropopause of individual profiles will oscillate. We found interesting to have an upper troposphere more connected to the tropopause oscillation than to any other layer. This way, the mid-troposphere should be more related to the long range transport and the boundary layer venting effects than previously.

We will show anomalies in the times series to assess: 1/ the O<sub>3</sub> behaviour (still increasing or levelling off?) depending on the site, the season and the layer; 2/ the supposed CO decrease especially over USA and Europe. As the tropospheric O<sub>3</sub> anomalies are well correlated between the three sites till 2001 but not later this could raise a question on the hemispheric mid-tropospheric homogeneity. We will conclude on the quality of these "trends": Do we measure "trends" or still "inter-annual variability" over such time series?