



## **Changes in UTLS ozone between the late 1970s and the 1990s deduced from commercial aircraft measurements of GASP and MOZAIC**

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As ozone in the upper troposphere/lower stratosphere (UTLS) acts as a strong greenhouse gas, information on its long-term changes is very valuable. However, whereas the distribution, variability, and temporal changes of ozone in the UTLS have been rather well characterized in the last decade due to a wealth of measurements by ozonesondes, research aircraft campaigns, and sampling from regular commercial aircraft (e.g., MOZAIC), there were much less regular ozonesondes in the previous decades. Thus, only little is known about longer-term ozone changes in the UTLS. To study upper tropospheric and lower stratospheric ozone trends during the last three decades, measurements from the NASA Air Sampling Project (GASP), carried out on flights of commercial B-747 airliners during the period 1975 to 1979, have been evaluated and compared with data from the MOZAIC program (Measurement of Ozone and water vapour by Airbus in-service airCRAFT) that has been in operation since 1994. Potential temperature, potential vorticity and equivalent latitudes, calculated from the 40-year reanalysis data of ECMWF (ERA40), are used to bin the aircraft data with respect to the dynamical tropopause and into the equivalent latitude system to display climatologies of GASP and MOZAIC ozone and differences in-between. In addition to the GASP-MOZAIC comparison, the quality of the GASP ozone data has been verified using balloon data from the late 1970s from Canadian and European ozonesonde stations.

The work performed is part of the EU project RETRO (REanalysis of the TROpo-

spheric chemical composition over the past 40 years). The results presented here are also relevant for comparison with numerical simulations performed in the RETRO project.