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Comparison of ozone measurements of MOZAIC with ozonesondes based on backward trajectory analysis

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Ozone is one of the key trace constituents in the Earth's atmosphere and plays essential roles in the chemical and radiation balance of the both the troposphere and stratosphere. Due to the temperature structure of the atmosphere, changes of concentrations of ozone near the tropopause region have largest impact on radiative forcing. The processes affecting ozone at UTLS (Upper Troposphere/Lower Stratosphere) are very complex and documentation of ozone (and its changes) is therefore of crucial importance particularly due to the fact that present day numerical simulations still need to simplify many of the relevant processes.

Ozone concentrations at UTLS are strongly variable in time and space. Regular aircraft, e.g., provide continuous measurements of trace gas concentrations with an excellent spatial and temporal resolution, mostly in the 9-12km altitude since this is their cruise altitude. Another widely-used in-situ measurement method offering a high vertical resolution at UTLS is through the use of ozone soundings. The measurement principle is based on the reaction of ozone with potassium iodide in aqueous solution. There are three main designs (Brewer Mast, electrochemical concentrations cell (ECC), the carbon iodine cell type) of ozonesondes but in this study we focus only on the ECC type which is used by most stations nowadays since they are less sensitive to preparation procedures and manufacturing aspects than the two others. However, inter-comparison studies at the environmental chamber at Forschungszentrum Jülich have shown that the performance of ECC sondes is highly influenced by sensor type, sensing solution, inappropriate data processing and preparation procedures. In addition, it is known that procedures have changed at some sites which then require a homogenization of their measurements.

In this study we use the 1 minute averaged ozone measurements of MOZAIC (Measurements of OZone, water vapour, carbon monoxide and nitrogen oxides by in-service AIrbus aircraft) data to assess and check the agreement between selected European ECC soundings sites and MOZAIC ozone measurements – the two major data sources for measured ozone concentrations at UTLS altitude. The dynamical tropopause at 2PVU, obtained from fields of ERAINTERIM realanalysis data sets and interpolated onto MOZAIC and sondes flight tracks, is used to discriminate between UT and LS air masses. The ozone data are then assigned to potential temperature differences from the local tropopause. 3 days backward trajectories using the model LAGRANTO are applied in order to select appropriate measurements for comparison and to improve criteria of similarity of data.

It is planned to use the results to check the success of a possible homogenization of soundings records which is required when changing sensor type or sensing solution.