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Long-term harmonized ozone profiles in the middle atmosphere over Switzerland

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Two decades ago, concentration of ozone-depleting substances in the middle atmosphere started a slow decline as a result of the Montreal Protocol. Since then, stratospheric ozone recovery is expected and has already been observed over some parts of the world, e.g. the Antarctic. Over the mid-latitudes however, the situation is less obvious, and ozone recovery seems to differ depending on the altitude and the geographical area of interest. In view of these uncertainties, there is still a strong need for high-quality and long-term ozone observations and their validation.

Switzerland has a number of stations monitoring ozone using different techniques. In particular, it is the only place in the world with two collocated ground-based ozone microwave radiometers. Located less than 50 km apart, they provide continuous hourly ozone profiles in the middle-atmosphere (~20 to 75 km) since more than 20 years with very few interruptions. Both instrument are part of the Network for the Detection of Atmospheric Composition Change (NDACC) and are regularly used for ozone trend studies or cross validation of satellite observations over Central Europe.

Despite the many studies conducted with these instruments, some anomalous periods and discrepancies in trends were recently identified in their time series. To address these problems, a full harmonization and reprocessing of the data was performed with the aim of obtaining two improved and independent time series. This harmonization affects the calibration of the radiometric measurements, flagging procedures and the retrievals of atmospheric profiles and has now been completed for the last decade.

In this contribution, we present and compare the new harmonized ozone time series for both instruments and highlight the improvements in the ozone retrievals compared to the old data processing. We also perform a comparison of these new data series against measurements from the Microwave Limb Sounder and the Solar Backscatter Ultraviolet Radiometer over Switzerland. As an additional validation, we show some first results of diurnal cycles derived from the new harmonized data series and compare it with model-based diurnal ozone climatology.