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Surface ozone in the Southern Hemisphere: 20 years of data from a site with a unique setting in El Tololo, Chile

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S1: Comparison between TECO 49 (DMC) and TE49C (Empa)

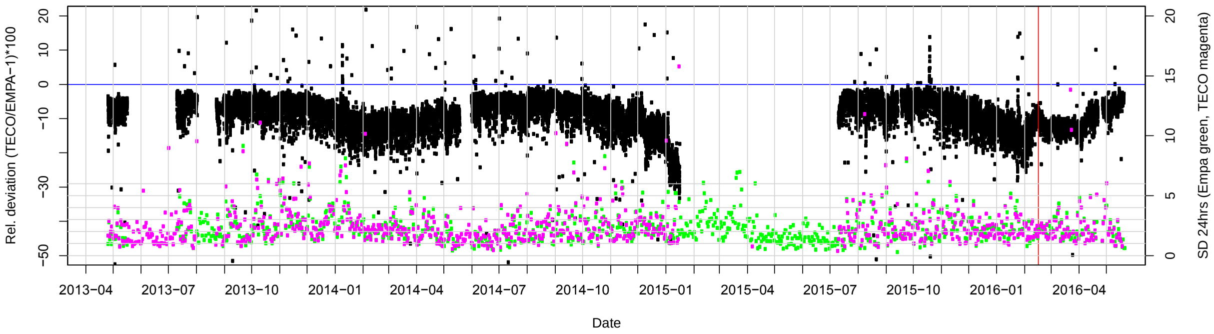


Fig. S1: Relative deviation of ozone measurements between TECO 49 and TE49C. Negative values (below blue line) show higher values measured with TE49C. Coloured points illustrate the 1-day standard deviation of measurements done either with the TECO 49 (magenta) or TE49C (green). Red line shows the time when the inlet tubing of the TECO 49 was replaced.

Since late April 2013, ozone at TLL has been measured in parallel with the TECO 49 from DMC and with the TE49C installed by Empa. Already in the beginning, a slight offset of 8-10% was noticed (equivalent to 2-3 ppb during average conditions at TLL). A more in-depth analysis revealed an annual cycle of the relative deviation ranging between 5 and 15% (equivalent to around 2 and 4 ppb), where the TECO 49 device always measured less ozone than the TE49C.

From mid-January 2015 to mid-June 2015, a series of failures interrupted the measurements of the TECO 49.

In late January 2016, the inlet tubing of the TECO 49 inlet was replaced, as it was speculated that the low readings were due to ozone losses at the inner surfaces of the aged (and possi-bly slightly soiled) tubing. No change in the differences could be observed after the change of the inlet tubing indicating that the aging of the tubing did not cause the losses and pro-gressively growing losses over the years are unlikely. Presumably, the small systematic offset is due to different inlet heights above ground and the different exposure of the intakes. The intake of the inlet for the TECO 49 is 2 m above ground whole the TE49C intake is at 5 m above ground.

S2: Filtering example

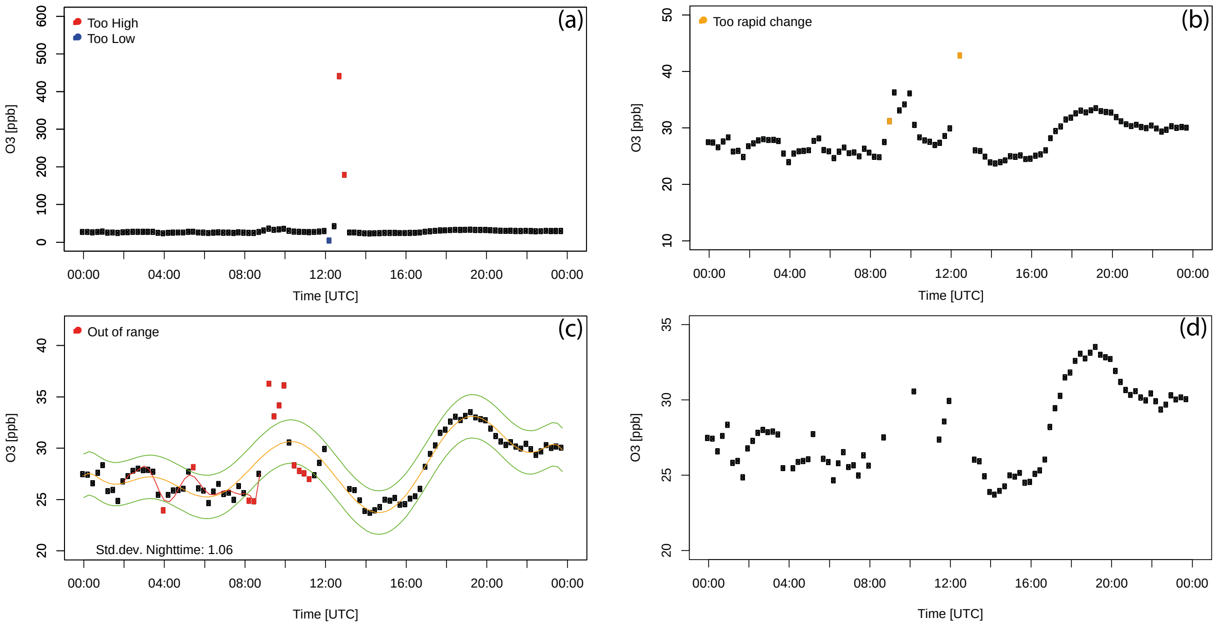


Fig. S2: Example of a typical filtering sequence, using original TECO 49 data from El Tololo between January 10th 2015 and January 11th 2015, UTC times. In a to d, the different steps are illustrated: a) Filtering out too high (red) and too low values (blue), b) Filtering too rapid changes (orange), c) Filtering out values exceeding twice the standard deviation (green curve, red points) computed over the polynomial fit during nighttime (23 to 6 LT, red curve), d) Final result.

S3: Additional figures

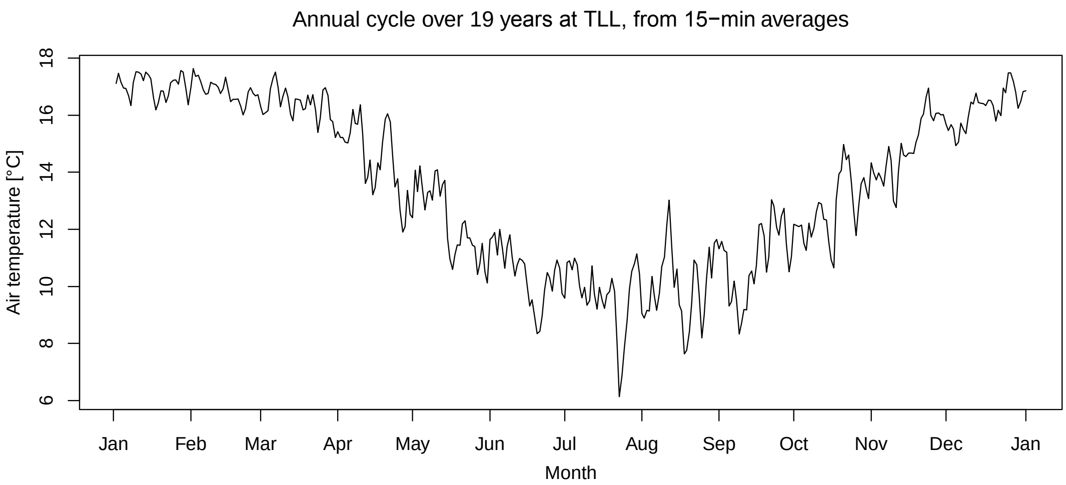


Fig. S3: Seasonal cycle of temperature over one year, computed as average over 19 years.

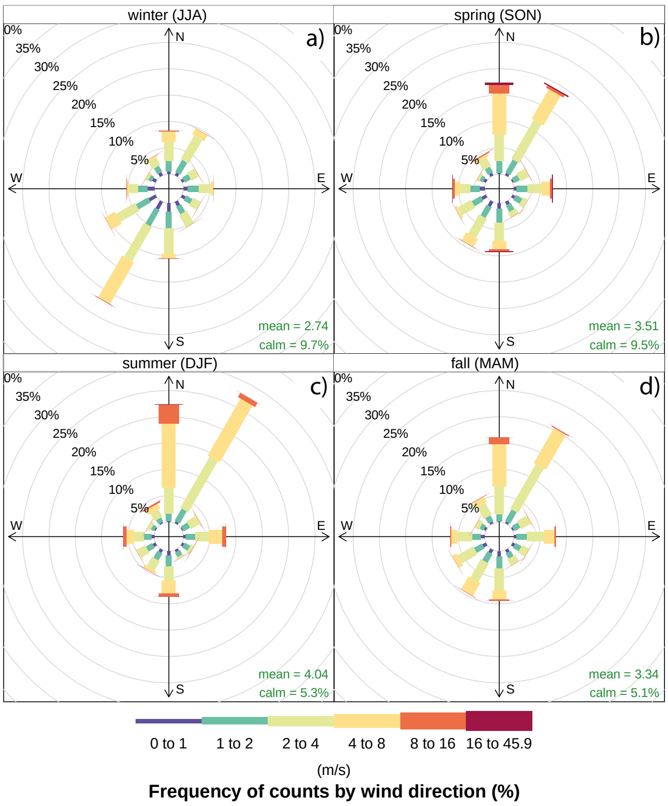


Fig. S4 Wind climatology 1995-2014 at El Tololo (DMC) for four seasons: (a) winter, (b) spring, (c) summer, (d) fall

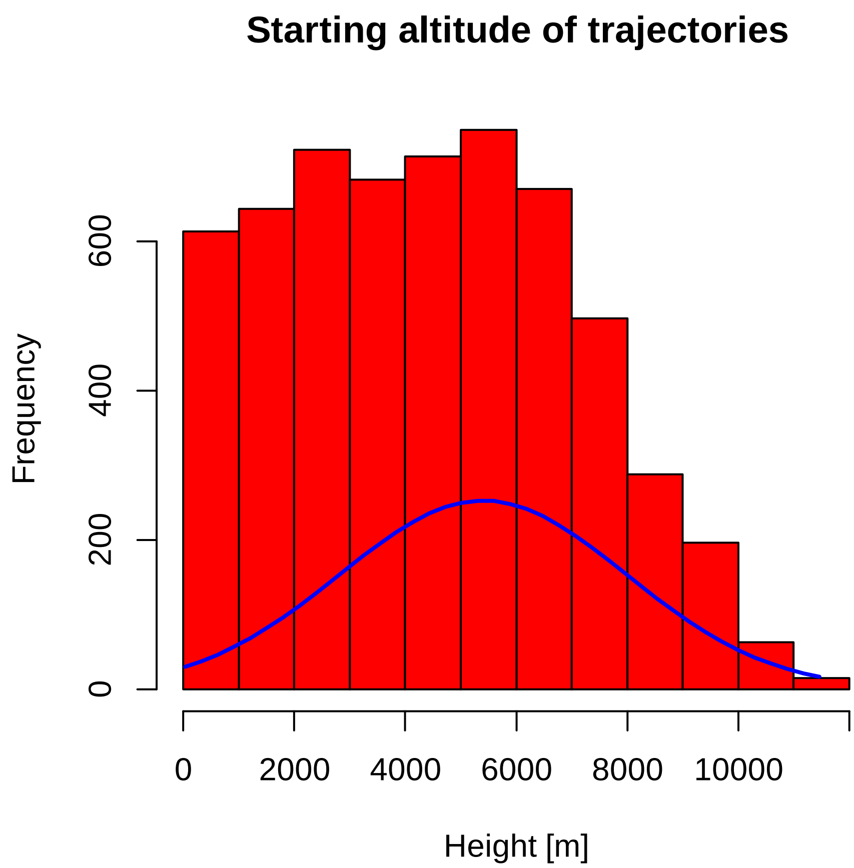
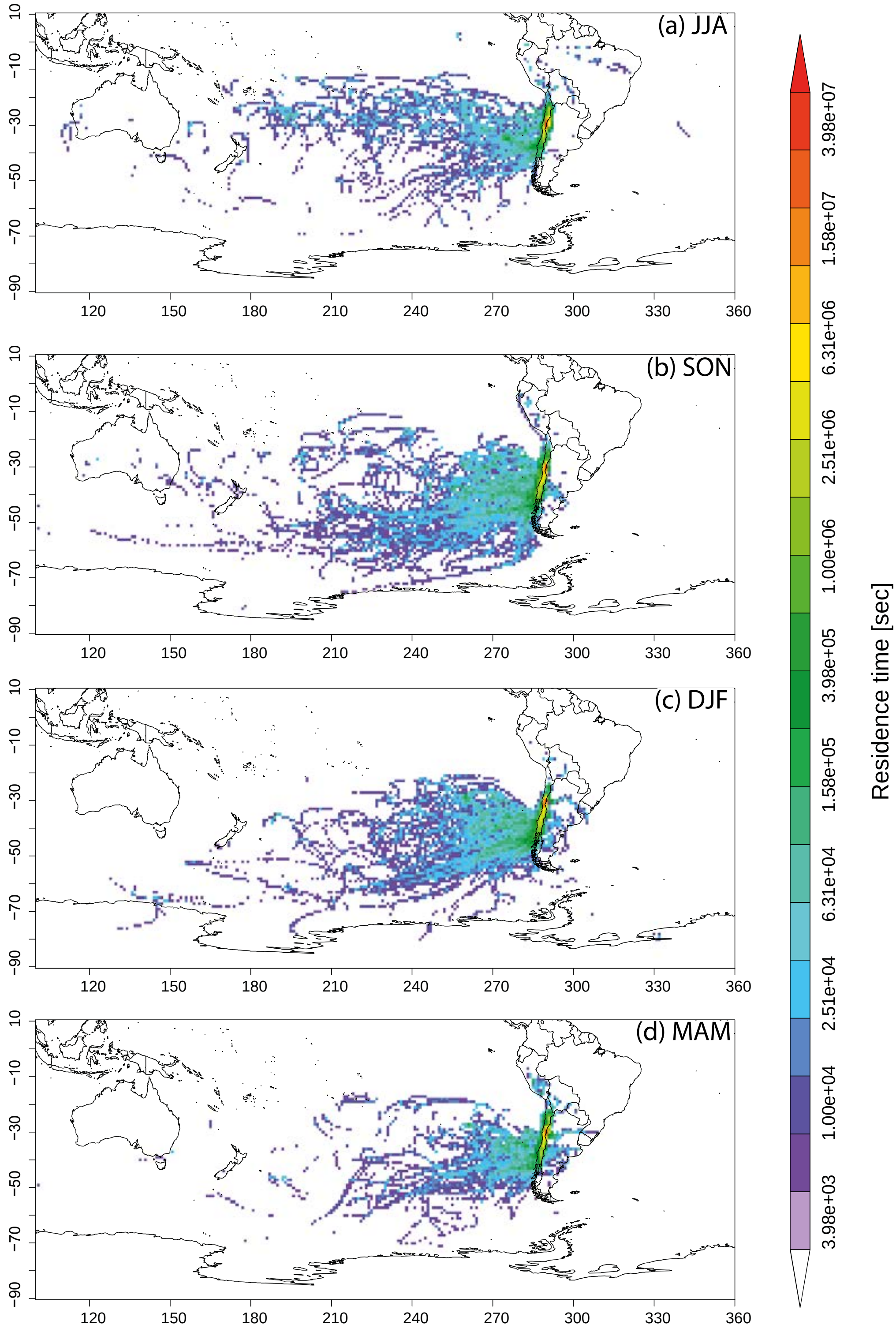


Fig. S5: Starting altitude distribution of the trajectories reaching TLL at a height of 370m.



Figs. S6: FLEXTRA trajectory footprint from April 2013- December 2015, origin: TLL, 370m above model topography. Colour indicates the total residence time of air parcels, summed up over the time period. a) JJA, b) SON, c) DJF, d) MAM.

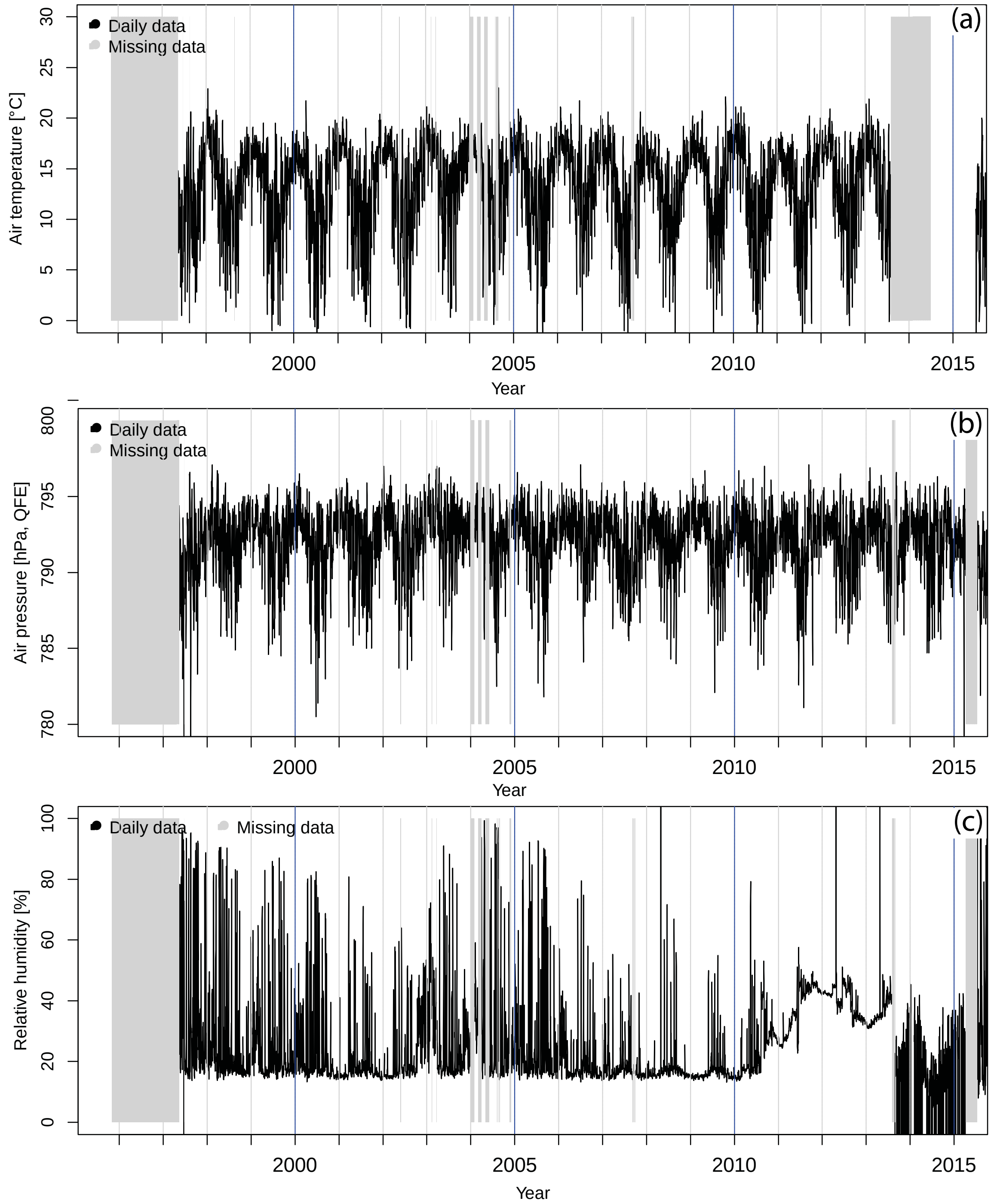


Fig. S7: Time series of a) air temperature, b) ambient pressure and c) relative humidity. Not available data is marked with grey lines.

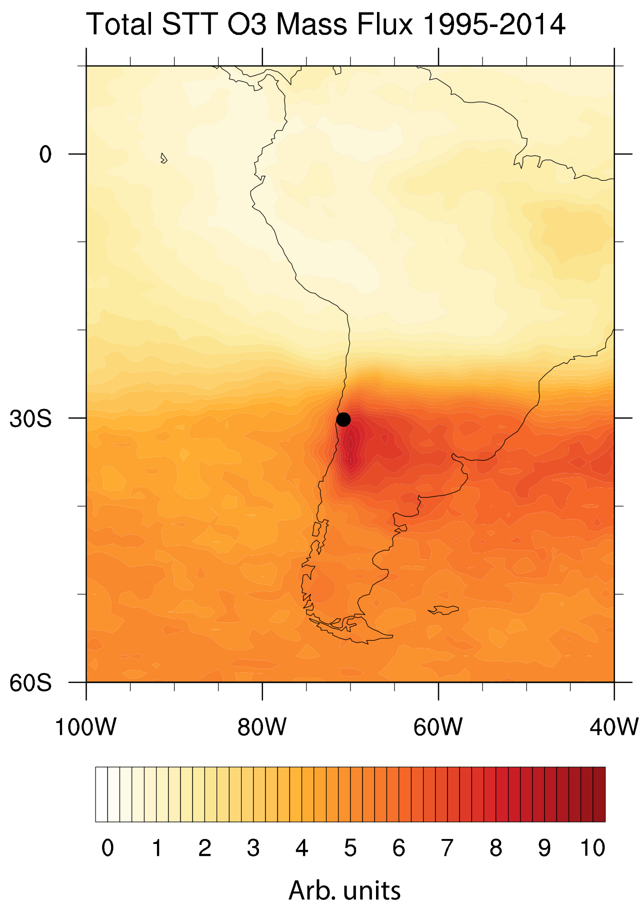


Fig. S8: Ozone Mass flux from the Stratosphere into the PBL, averaged from 1995 to 2014.

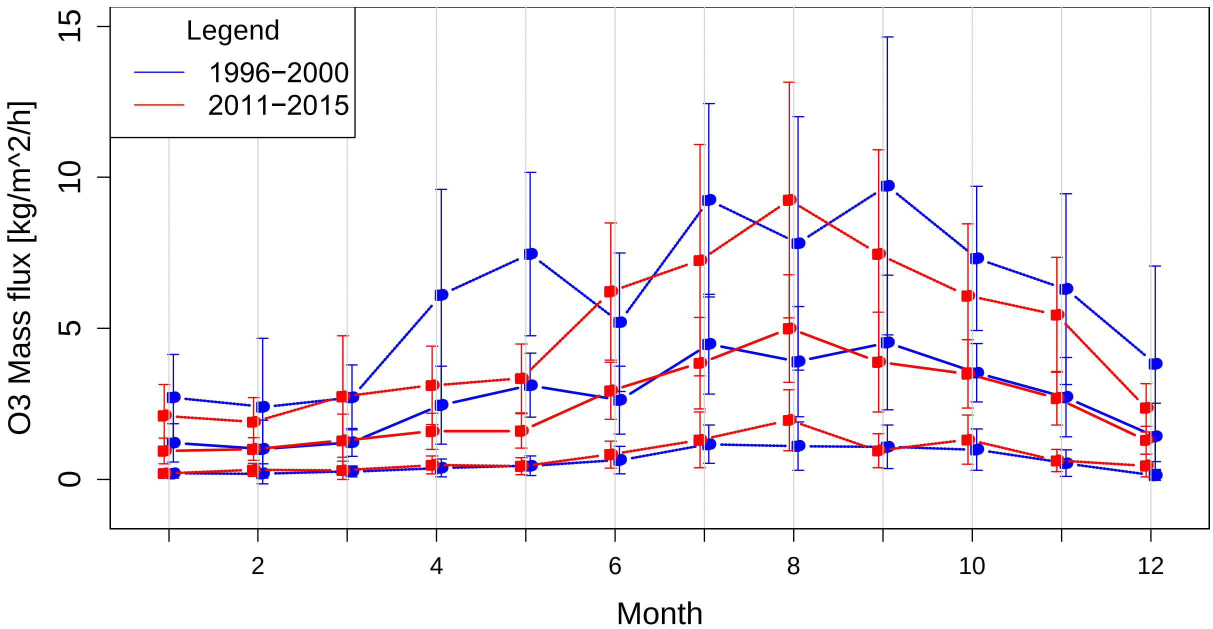


Fig. S9: Mean annual ozone STE mass flux cycle (1995-2000 and 2010-2015) showing mean, upper 95th percentile and lower 5th percentile.

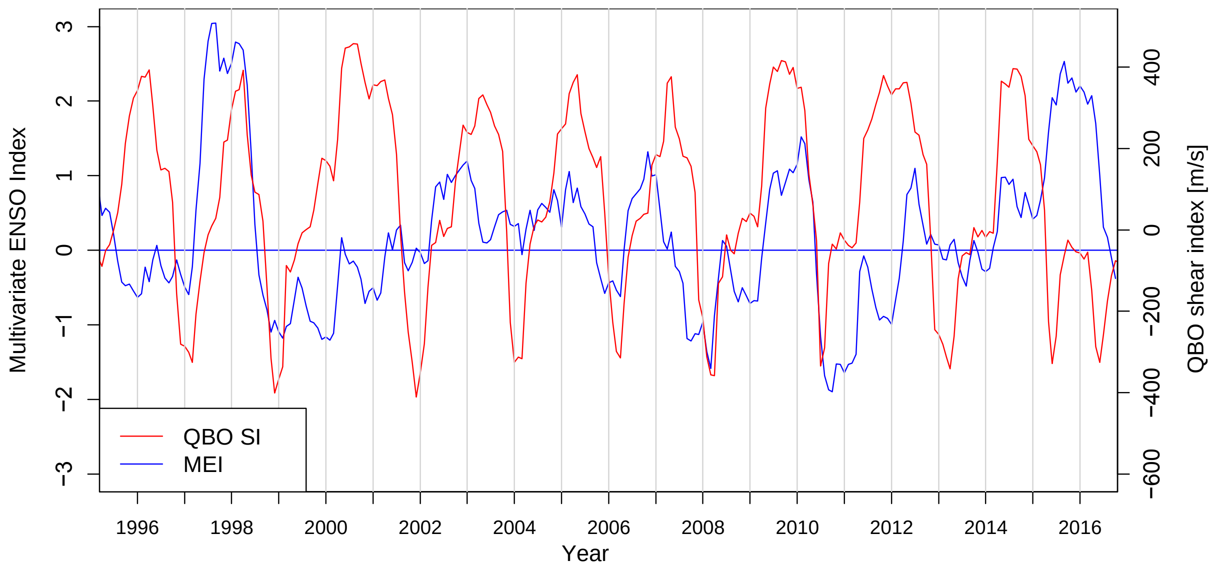


Fig. S10: QBO shear index (zonal wind at 50hPa-zonal wind at 25hPa) and MEI for the entire analysis period.

Table S 1: List of documented extended data gaps and their reasons.

Start of gap	End of gap	Reason
09.07.1999	14.07.1999	Power outage, no UPS available
09.12.1999	17.12.1999	Repainting of the measurement hut, data flagged.
12.08.2000	25.08.2000	Power outage, no UPS available
27.09.2001	10.10.2001	Internal pump failed
24.05.2002	04.04.2003	Internal pump failed, equipment is sent to DMC and repaired
21.10.2006	31.03.2007	Equipment is sent to Argentina for performance assessment (WCC-Empa)
03.09.2010	02.10.2010	Equipment is shipped to DMC for maintenance
06.08.2013	24.08.2013	Data logger failed
15.01.2015	23.04.2015	Internal pump failed
23.04.2015	19.06.2015	UV lamp failed