

# Lauder O3S-DQA Homogenization Report

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## 1 Lauder Metadata timeseries

Lauder data is provided by the station PI and processed by KMI. The timeseries starts at 1986/08. There are missing metadata which are temperature (TLab) and humidity (ULab) of the laboratory before 2014-02-12. For the missing TLab and ULab values, climatological means are calculated for each month and these values are used for the corresponding missing metadata. For the pressure value of the laboratory a fixed value 970.2 hPa is used.

## 2 O3S corrections

The recommended and applied O3S-DQA corrections are summarized below.

1. Conversion efficiency
2. Background current
3. Pump temperature measurement
4. Pump flow rate, moistening effect
5. Pump flow efficiency at low pressures
6. Total ozone normalization: in O3S-DQA guide this correction factor is recommended to be added in the data-set, but the normalization factor is applied.

The O3S-DQA corrections are applied to the raw current measured by the ECC's. The raw current values are provided by the station PI. The ozone partial pressure values converted from raw current without applying any correction are denoted as 'Raw' or 'No correction', the O3 values taken from station PI are denoted by 'NIWA' and the ozone partial values that have all the DQA corrections are denoted by 'DQA' in the rest of the manuscript.

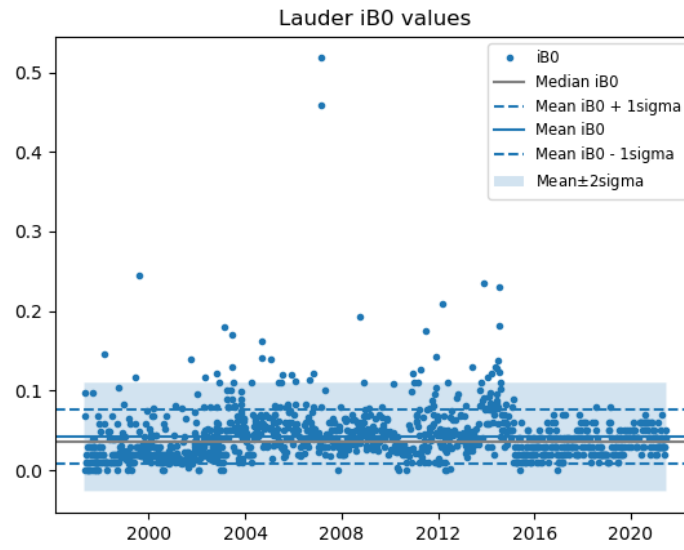


Figure 1: Lauder iB0 timeseries

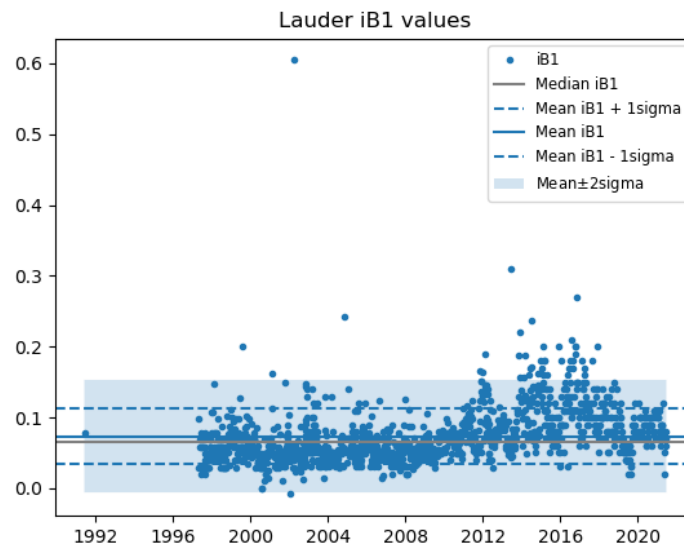


Figure 2: Lauder iB1 timeseries

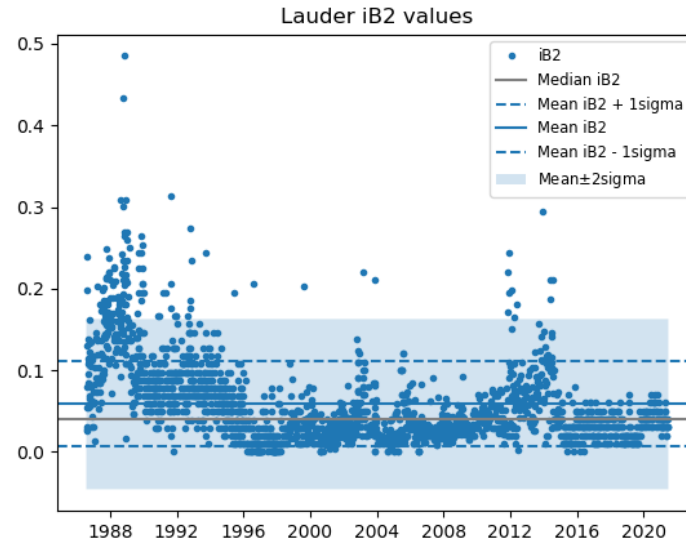


Figure 3: Lauder iB2 timeseries

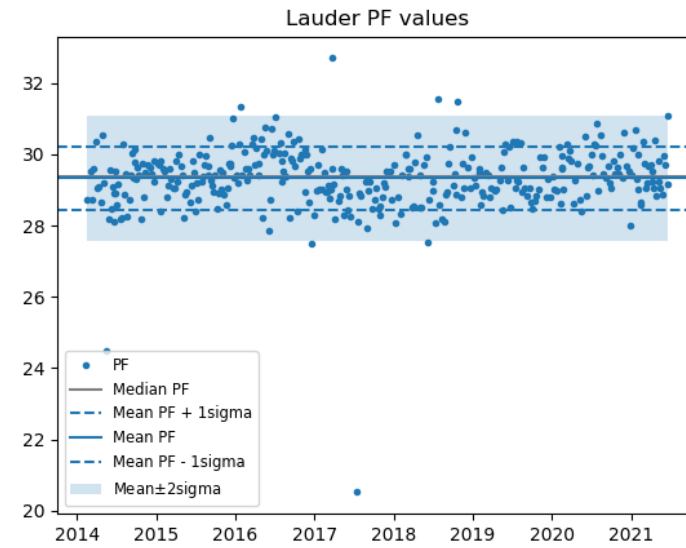


Figure 4: Lauder pump flow rate timeseries

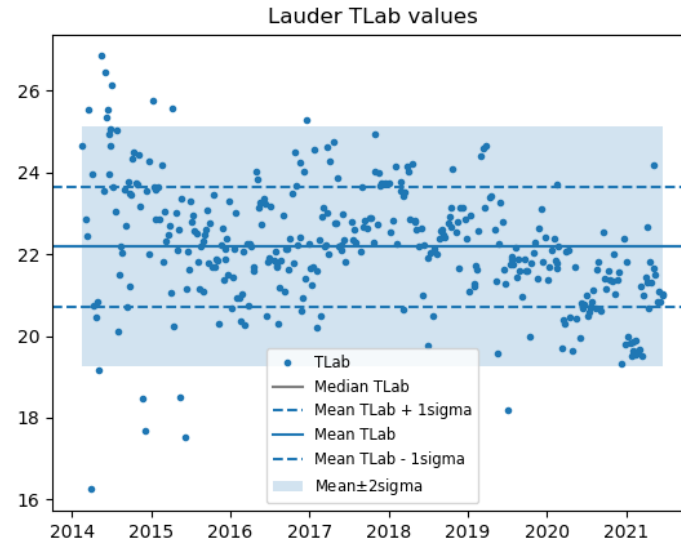


Figure 5: Lauder laboratory temperature timeseries

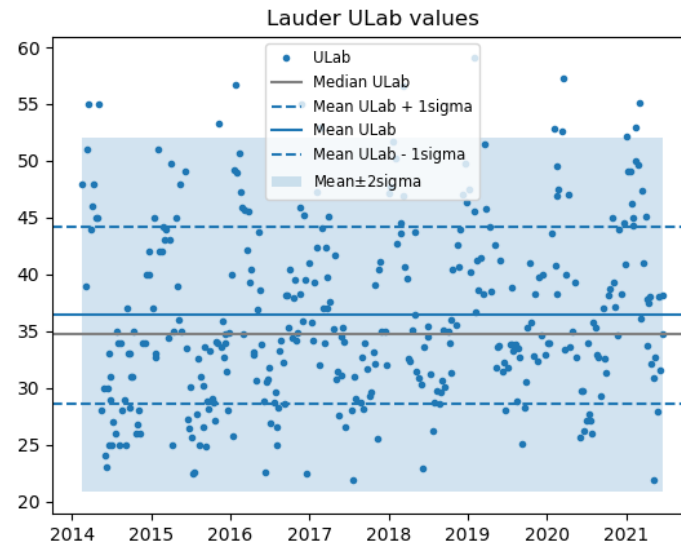


Figure 6: Lauder laboratory humidity timeseries

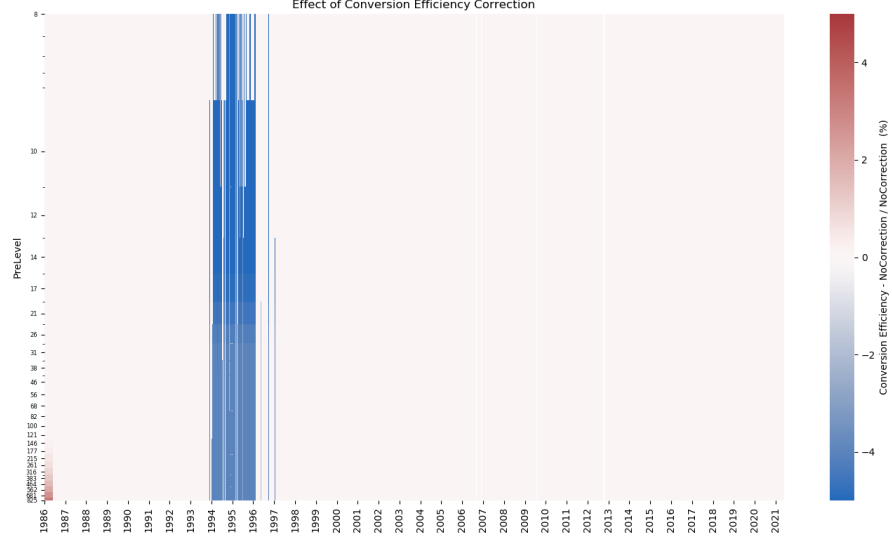


Figure 7: Conversion efficiency correction

### 2.0.1 Conversion efficiency

The stoichiometry correction is relevant for 1986 where 2.5ml is used for cathode solution, and ENSCI sondes were launched with 1.0%-1.0%B solution strength. The effect of the conversion efficiency is shown in Fig 7

### 2.0.2 Background current

Background correction, using iB2, applied Lauder data is shown in Fig 8. If  $I_B$  exceeds  $I_{B,Mean} + 2\sigma_{IB}$  then  $I_B$ , it should be replaced by the more representative climatological value of  $I_{B,Mean}$ , however with larger uncertainty of  $2\sigma_{IB}$ . Therefore to the  $I_B$  values falling above  $I_{B,Mean} + 2\sigma_{IB}$  in Fig 3, the background correction is applied. For the mean and standard deviations of the iB2 values, 2 different period is considered. As it can be seen in Fig 3, iB2 values are larger for the period before 1996 and smaller for the period after 1996. Therefore the mean and corresponding standard deviations are calculated and applied separately in these 2 periods.

### 2.0.3 Pump temperature measurement

Truest pump temperature correction is applied according to Eq.13 of the O3S-DQA Guidelines. Until 1989 SPC-4A sondes, from 1989 till 1994 SPC-5A and from 1994 EnSci sondes where the pump temperature measurement being

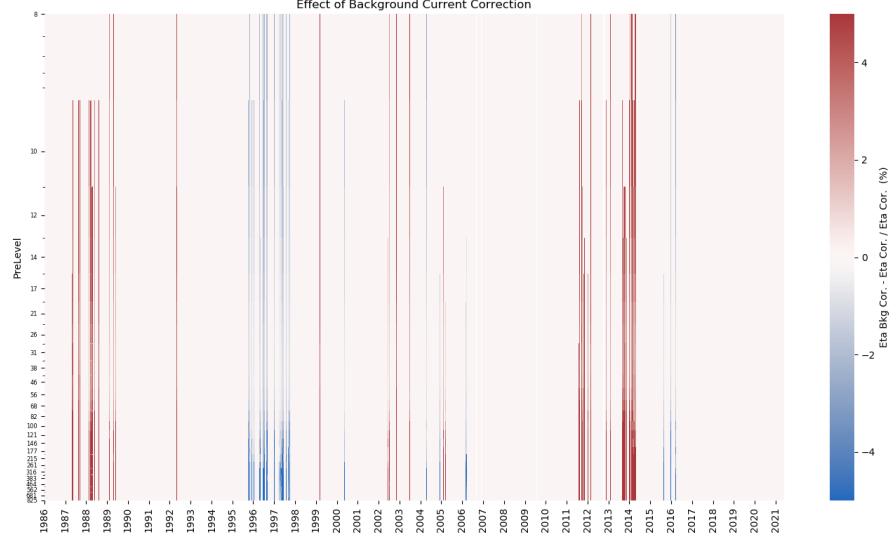


Figure 8: Background current correction

inside the pump were launched. These periods need different corrections and their effects are shown in Fig 9.

#### 2.0.4 Pump flow rate (moistening effect)

This correction, Eq.15 of the O3S-DQA Guidelines, is applied and shown in Fig 10. The details of the values used for correction is explained in Sec 1.

#### 2.0.5 Pump flow efficiency

This correction, Eq.22 of the O3S-DQA Guidelines, is applied using Table 6 of the O3S-DQA Guidelines and shown in Fig 11. The interpolation of the correction factors are made using the pressure. This method gives the same result as doing the interpolation using the logarithm of pressure and polynomial fit with an error of less than 0.03%. The effect of this correction is shown in Fig 11.

The effect of all DQA correction with respect to no correction is shown in Fig 12 and the comparison of DQA corrected and WOUDC O3S values is shown in Fig 13.

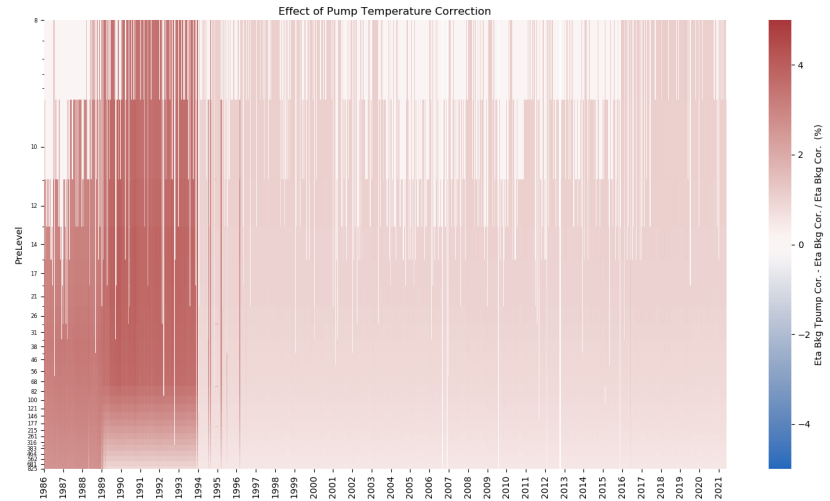


Figure 9: Pump temperature correction

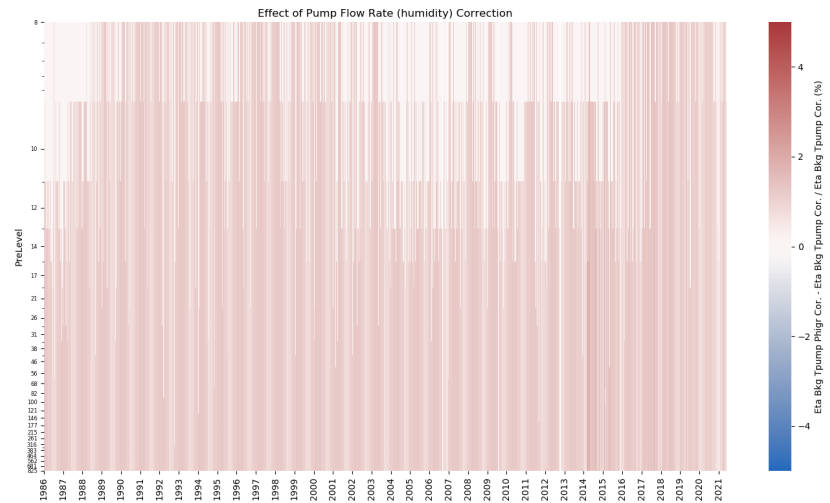


Figure 10: Pump flow rate correction applied

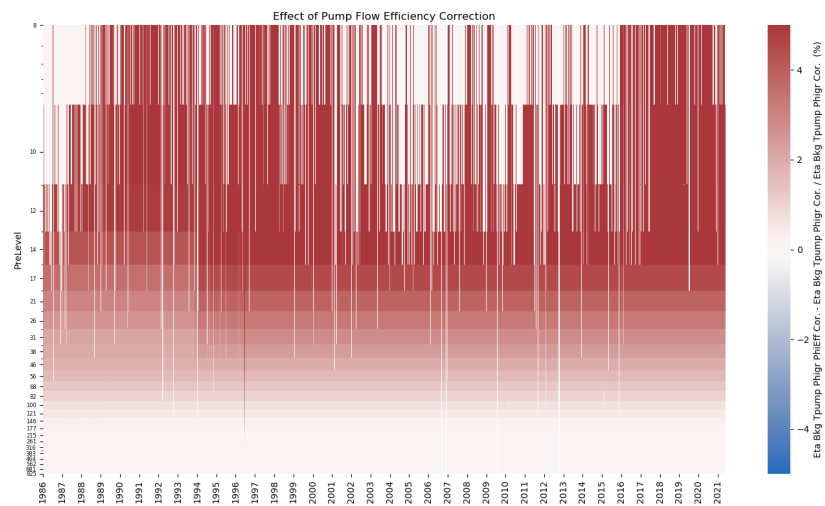


Figure 11: Pump flow rate correction applied

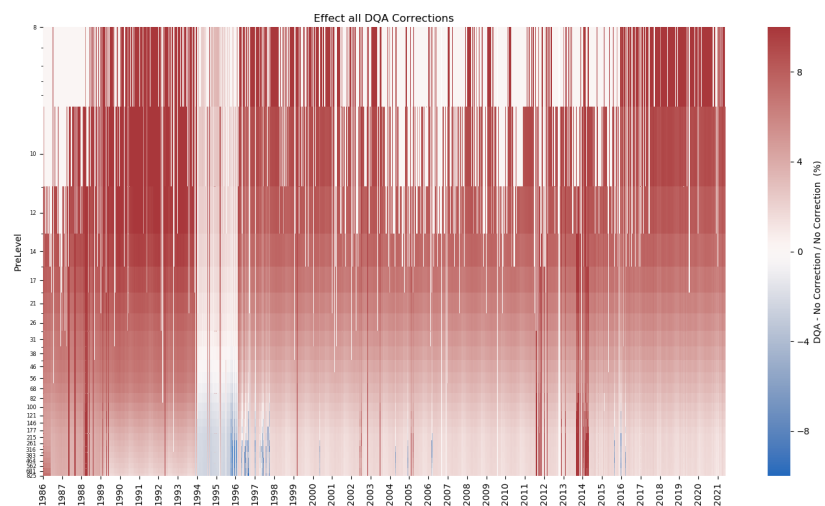


Figure 12: Effect of all DQA corrections



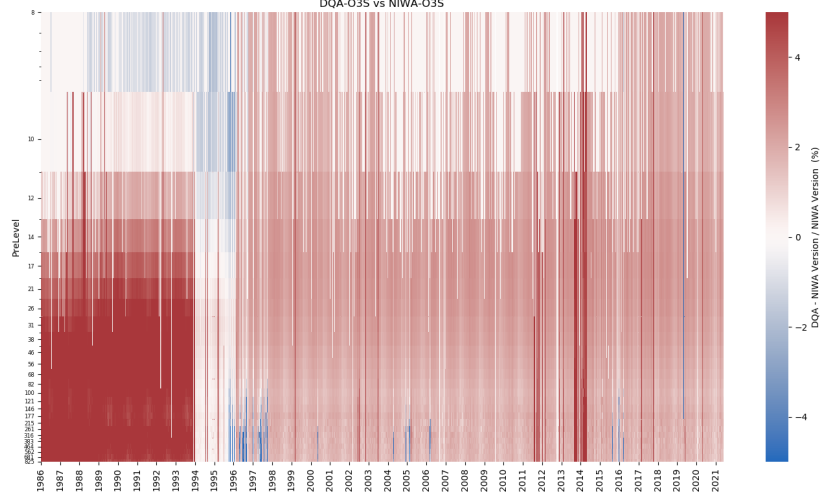


Figure 13: Comparison of DQA and NIWA O3S values

### 3 Total Ozone Normalization before and after homogenization.

The Total Ozone Normalization (TON) factors have been calculated with and without DQA corrections. For the TON the ratio of the TO from ECC to the TO from the Dobson is taken. For the TO from the sonde, the TO is integrated until 10hPa and the residuals, calculated from climatological means, are added. The corresponding plots are shown in Fig.14 and Fig.16.

### 4 Comparison plots to AURA MLS v04

The homogenized and non-homogenized Lauder data is compared with AURA-MLS data using v04. The not-corrected, DQA homogenized and NIWA O3S data sets are compared and shown in figures between 17 and 19.

### 5 RS80 Radiosonde Corrcetion

The RS80 correction is applied to the Lauder time series between 1989 and 2007. The effect of the RS80 correction on TON factors and the comparison of DQA-homogenized Lauder data with RS80 correction are shown in Fig 20 and 22.

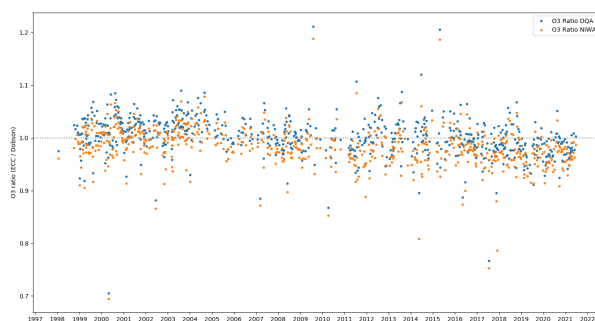


Figure 14: Comparison of NIWA and DQA TON values

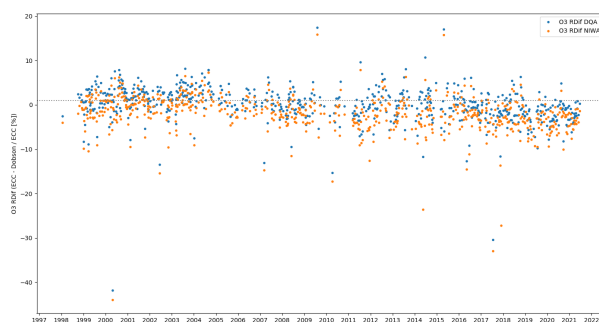


Figure 15: Comparison of NIWA and DQA RDif values

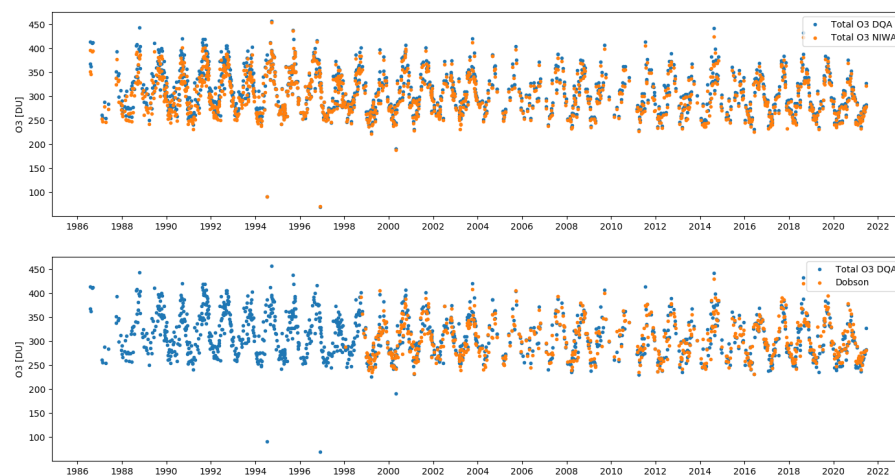


Figure 16: Comparison of DQA and Raw TO and TON values

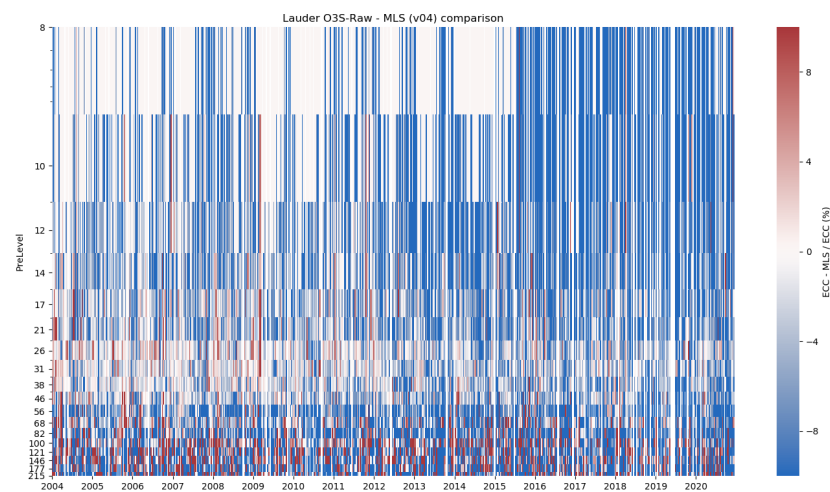


Figure 17: No correction O3S Lauder vs AURA MLS v04

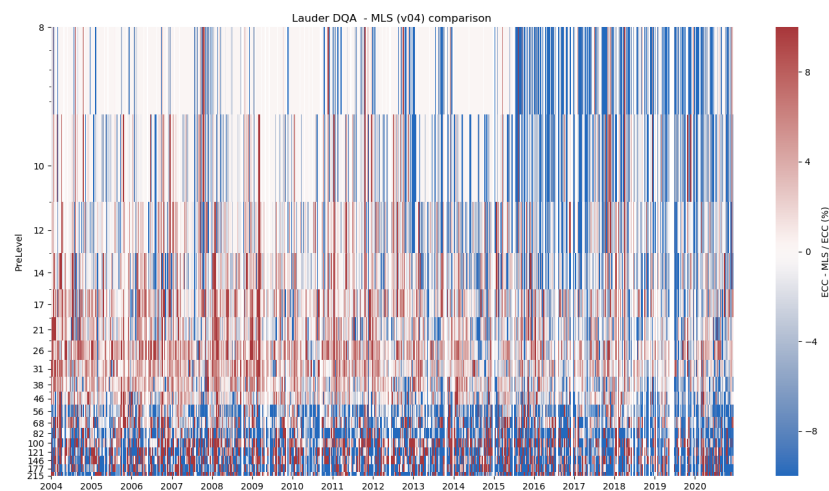


Figure 18: DQA Lauder O3S vs AURA MLS v04

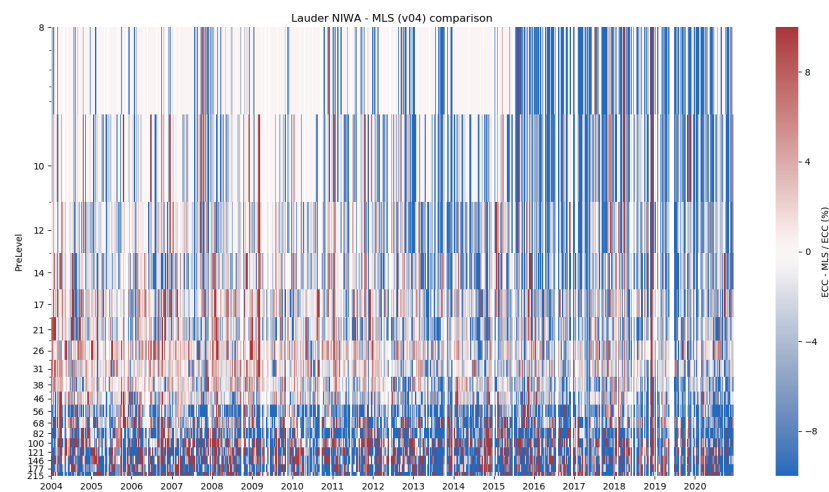


Figure 19: NIWA Lauder O3S vs AURA MLS v04

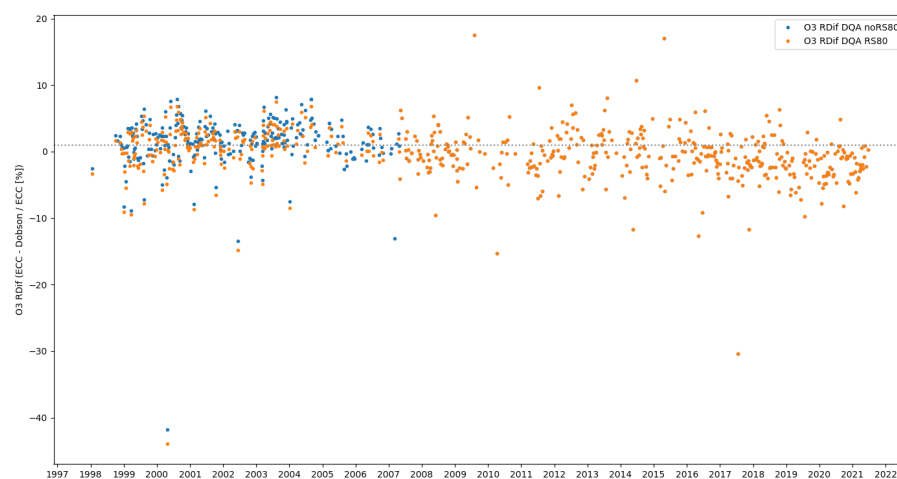


Figure 20: Comparison of DQA corrected RDif values with and without RS80 correction

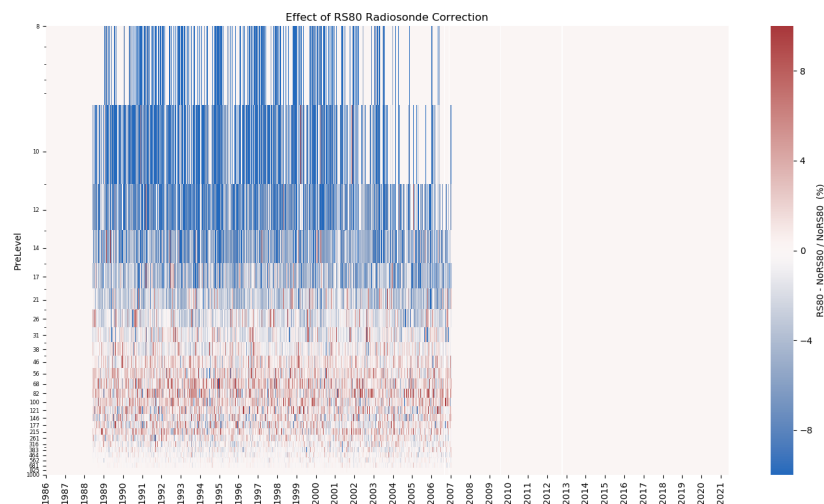


Figure 21: Effect of RS80 correction

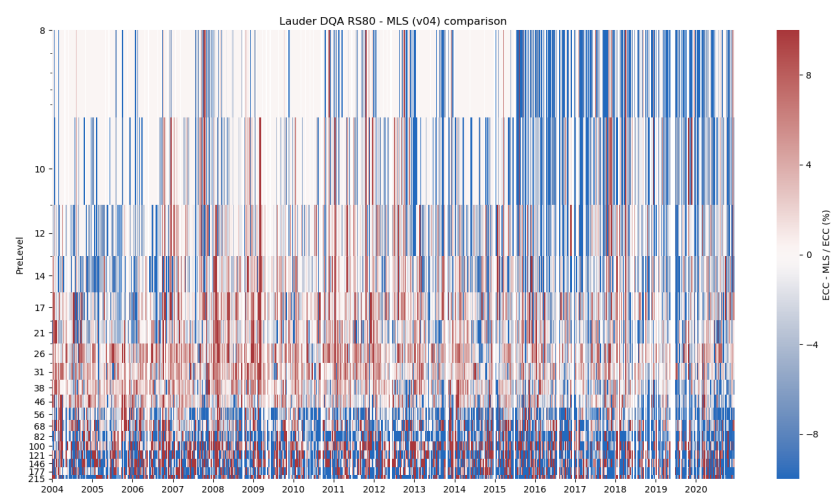


Figure 22: DQA Lauder O3S with RS80 correction vs AURA MLS v04

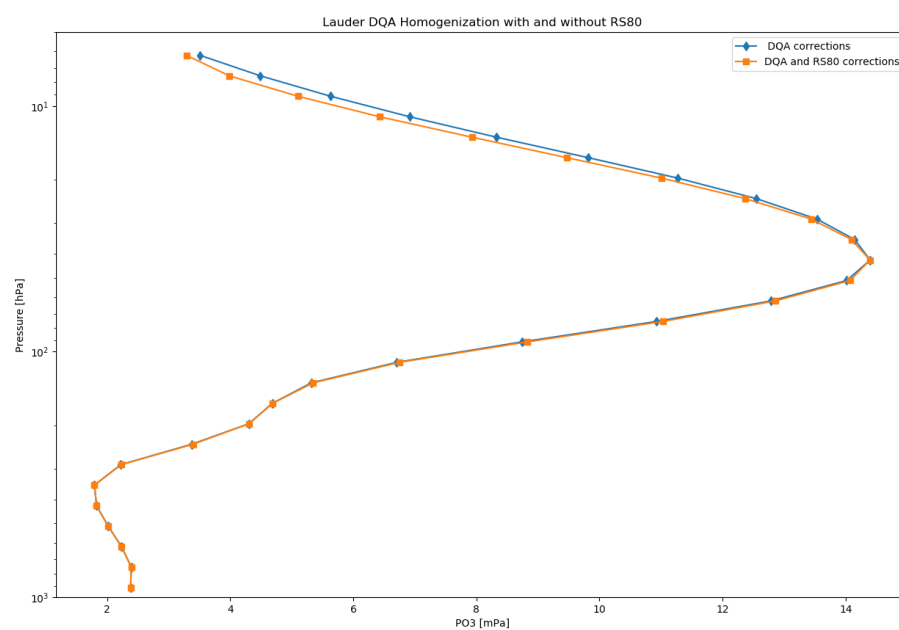


Figure 23: Ozone profile of DQA Lauder time-series with RS80 and without RS80 correction

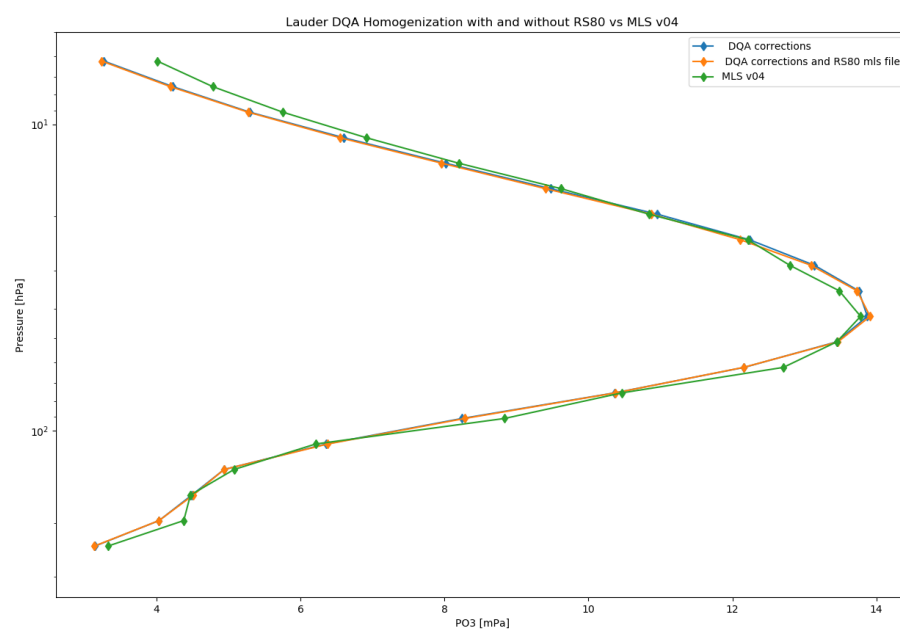


Figure 24: Ozone profile of DQA Lauder (MLS time range) with RS80 and without RS80 correction