Ny-Alesund O3S-DQA Homogenization Report

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1 Ny-Alesund Metadata Timeseries

Ny-Alesund ozonesonde time series starts in 1992-01. Ozonesonde data were downloaded from the NDACC server and DQA homogenization is processed by RMI. Relevant metadata values are extracted from the header of ames data files and from the files provided by the station PI. Background (iB2) and pump flow (PF) rate values are missing for 1997. For missing values, the median of the relevant value is used. The temperature (TLab), humidity (RHLab) and pressure (PLab) values of the laboratory are used for humidity correction. When one of these measurements is missing, climatological averages are calculated for each month and these values are used for the missing relevant metadata. TLab, PLab and ULab are used for pump flow rate moisture correction. iB2 is used for background correction. Related plots are shown in 1 - 5.

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.
7. Radiosonde changes: RS80 radiosonde correction is tested but not applied yet.

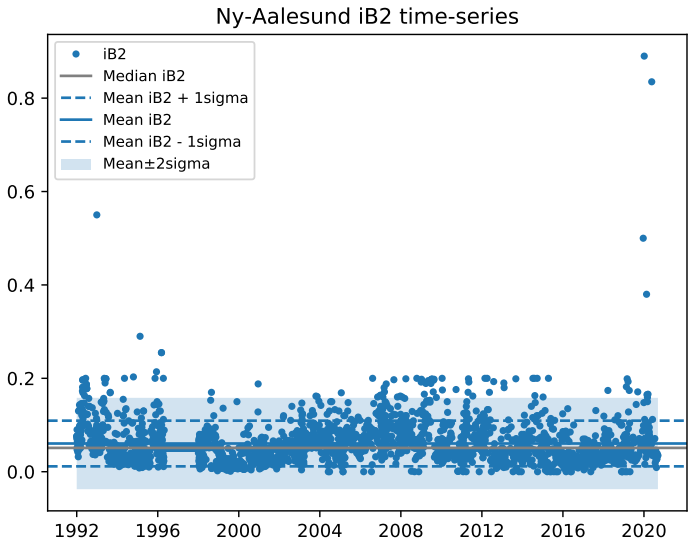

Figure 1: Ny-Alesund iB2 timeseries

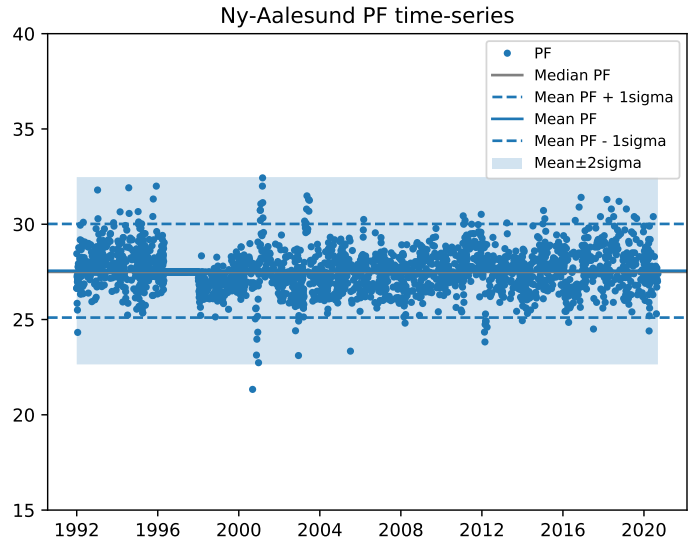

Figure 2: Ny-Alesund pump flow rate timeseries

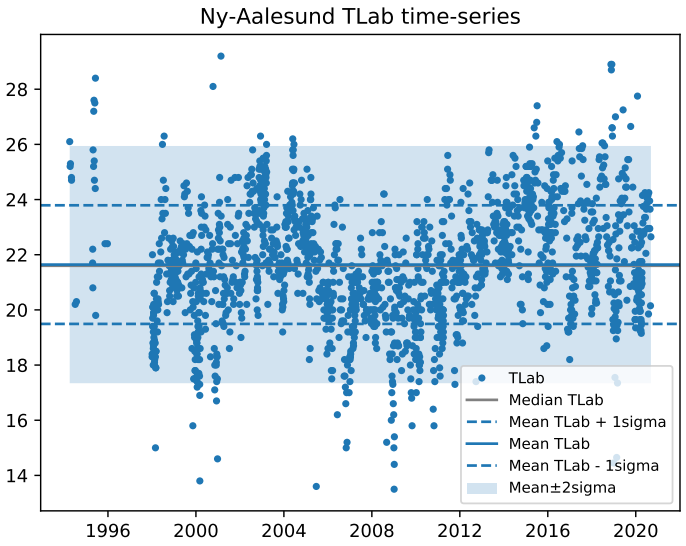

Figure 3: Ny-Alesund laboratory temperature timeseries

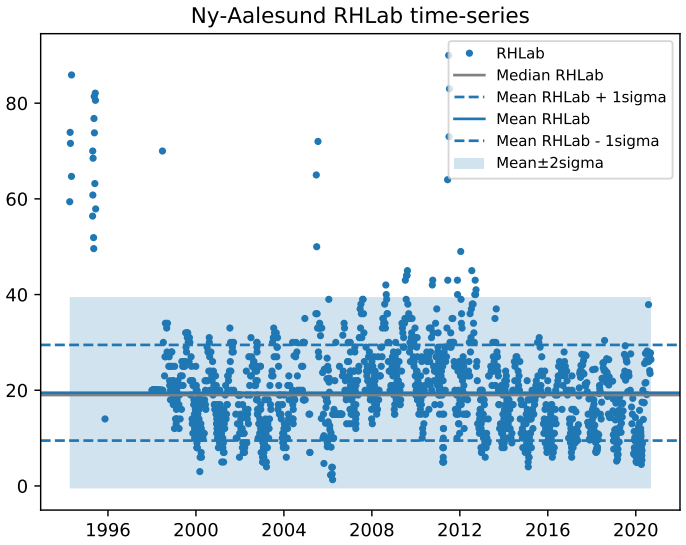

Figure 4: Ny-Alesund laboratory humidity timeseries

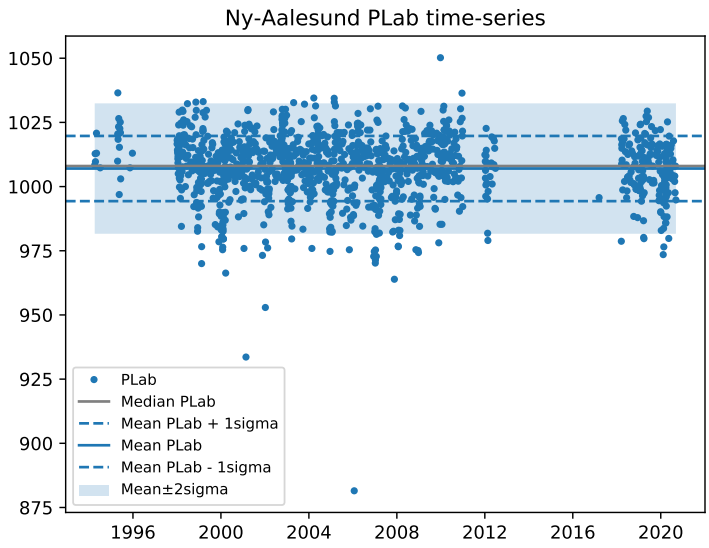

Figure 5: Ny-Alesund laboratory humidity timeseries

O3S-DQA corrections are applied to the raw current measured by ECC's. The raw current values are determined from converting partial ozone values available in the NDACC files to ECC current for the pre-2017 and are available in ames files starting from 2017 and onwards.

The pump temperature values, pump flow rate and background values (iB2) are needed to obtain the raw current values. The corrections applied to calculate ozone partial pressure values in NDACC files, are un-corrected to get the raw ECC current values. These corrections, applied in the Vaisala software, are: pressure dependent background correction for SPC sondes and pump flow efficiency correction.The pump flow efficiency correction table used at this stage is slightly different than the table used for O3S-DQA pump efficiency corrections. The correction applied for uncorrecting NDACC pump flow efficiency can be seen in Ozone Sounding with Vaisala Radiosonde RS41 User's Guide M211486EN, page 74 and the correction table used for O3S-DQA can be seen in O3S-DQA Activity: Guide Lines for Homogenization of Ozone Sonde Data (Version 2.0) at page 34. The Ozone partial values values from the PI station are shown as 'NDACC' and all DQA corrections are denoted by 'DQA' in the rest of the report.

2.0.1 Conversion efficiency

No absorption efficiency and stoichiometry correction are needed since 3ml of cathode solution and SPC $1.0\% - 1.0$B probes are used throughout the time

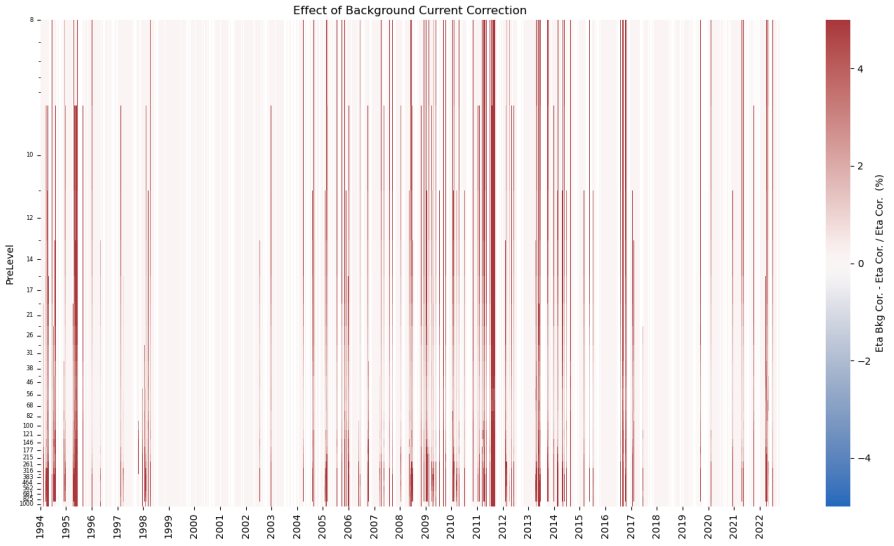

Figure 6: Background current correction

series.

2.0.2 Background current

The effect of background correction on Ny-Alesund data, using iB2, is shown in Figure 6. If I_B exceeds $I_{B,\mathrm{Mean}} + 2\sigma_{IB}$, then I_B should be replaced by a more representative climatic value $I_{B,\mathrm{Mean}}$, but with a larger uncertainty $2\sigma_{IB}$, Figure 1.

2.0.3 Pump temperature measurement

The truest pump temperature correction is applied according to Eq.13 in the O3S-DQA Guidelines. Until 1996-12 SPC-5A sondes, and onwards SPC-6A sondes have been launched. These periods need different corrections and the effects are shown in Figure 7.

2.0.4 Pump flow rate (moistening effect)

This correction, Eq.15 of the O3S-DQA Guidelines, is applied and shown in Fig 8. Details of the values used for this correction are described in Sec 1.

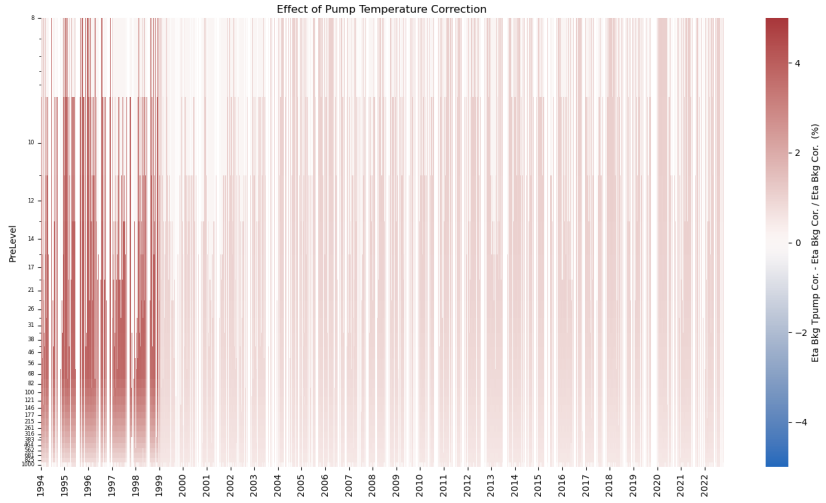

Figure 7: Pump temperature correction

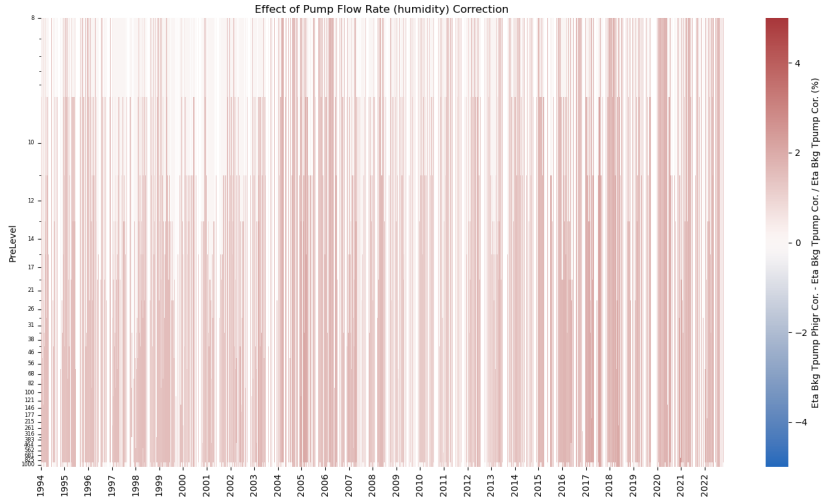

Figure 8: Pump flow rate correction applied

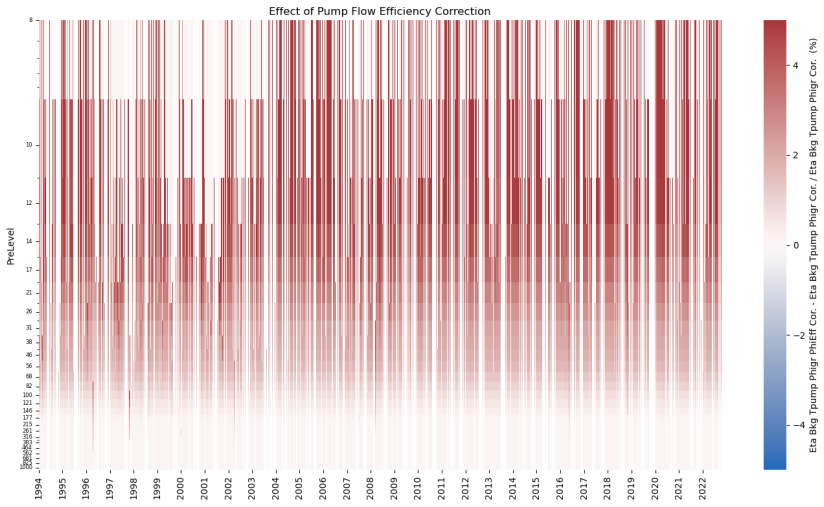

Figure 9: Pump flow rate correction applied

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 9. The effect of this correction is shown in Fig 9.

The effect of all DQA corrections with respect to no correction (Raw PO3) is shown in Fig 10 and comparison of DQA corrected and NDACC O3 values is shown in Fig 11.

2.0.6 Radiosonde correction

RS80 radiosonde correction is applied to correct the pressure offset difference. This correction is not included in the DQA corrections, it is only applied to see its effect. The effect of RS80 correction is shown in Fig 12.

3 Comparison plots to AURA MLS v04

The homogenized and non-homogenized Ny-Alesund data is compared with AURA-MLS data using v04. The NDACC, DQA-homogenized O3 data sets are compared and shown in figures between 13 and 14.

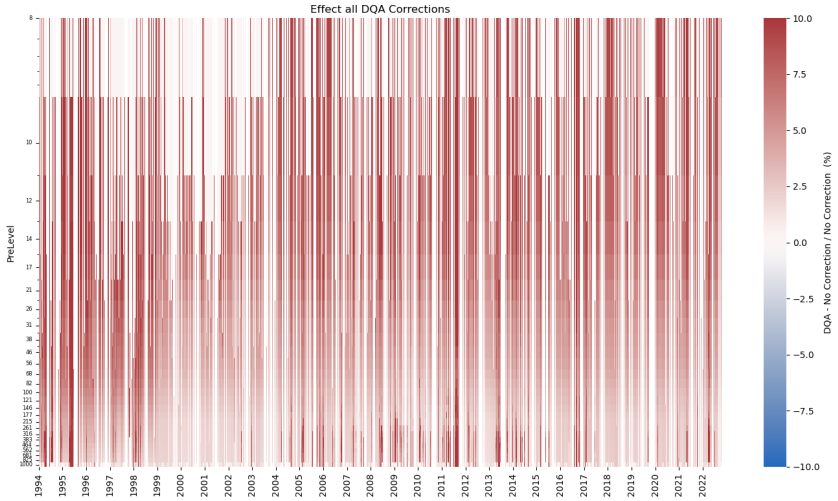

Figure 10: Effect of all DQA corrections

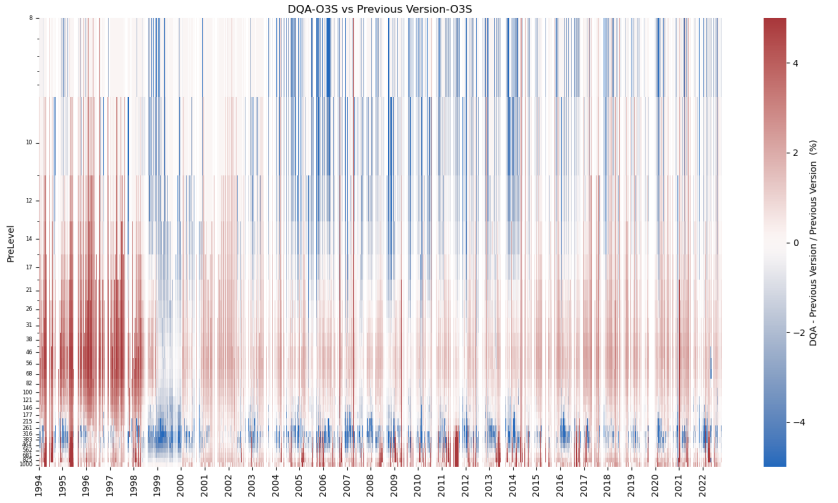

Figure 11: Comparison of DQA and NDACC O3S values

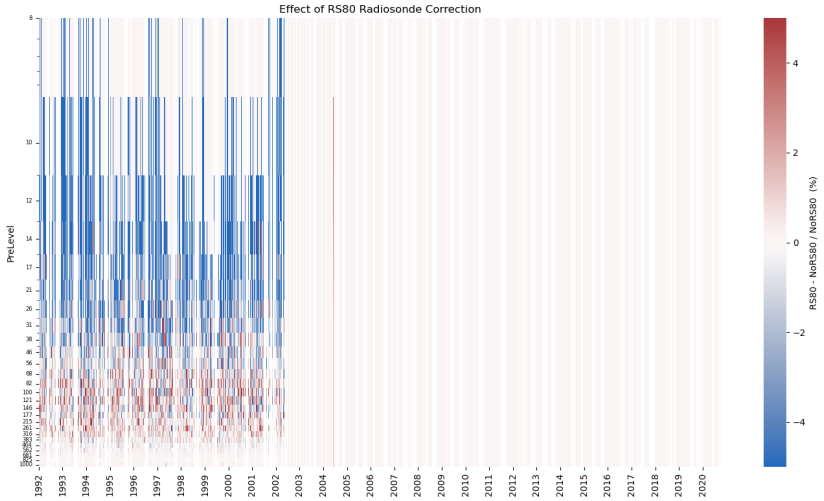

Figure 12: RS80 correction applied

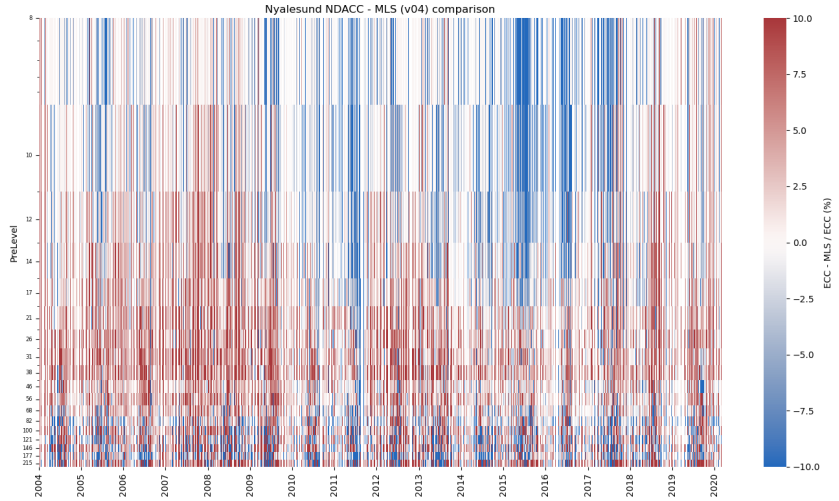

Figure 13: NDACC Ny-Alesund O3S vs AURA MLS v04

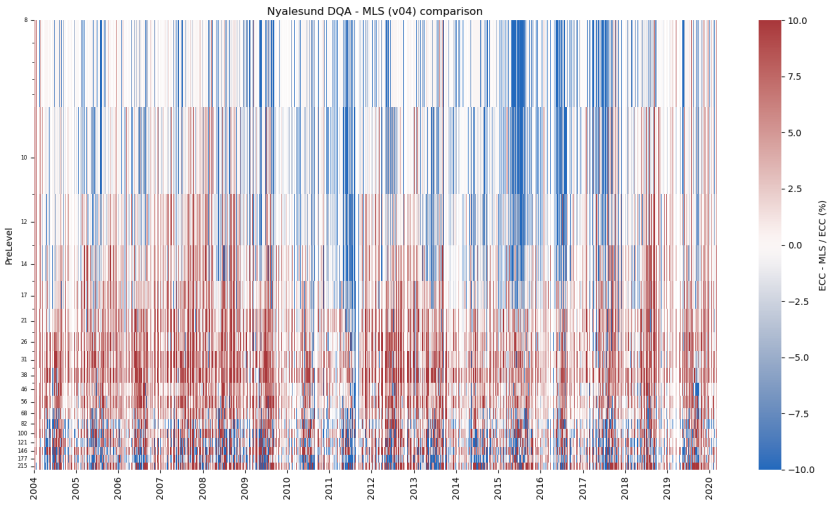

Figure 14: DQA Ny-Alesund O3S vs AURA MLS v04

4 Total Ozone and Total Ozone Normalization Factors

Total Ozone Normalization (TON) factors have been calculated with and without DQA corrections. TON factors are extracted from taking the ratio of TO values from sonde to the TO values given by satellites. TO from the sonde is integrated until burst pressure (max. 10hPa) and the residuals, calculated from climatological means, are added. The corresponding plots are shown in Fig.15 and Fig.16.

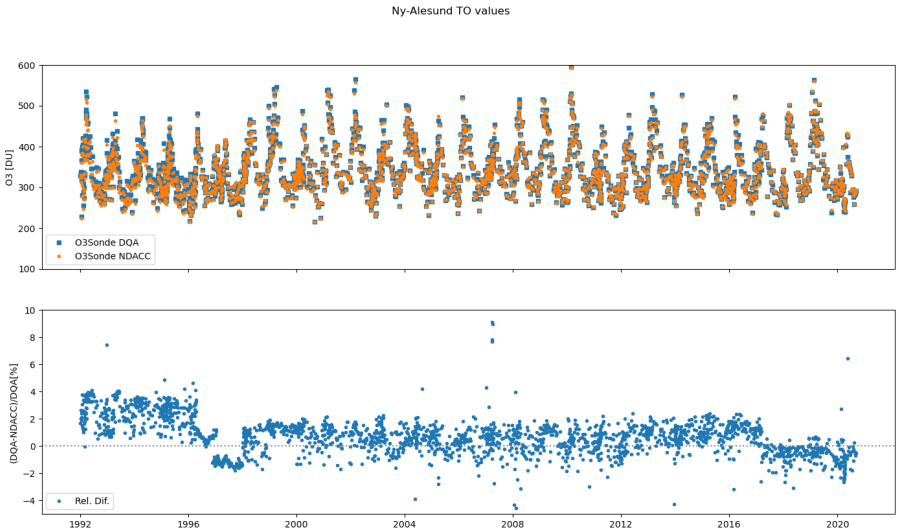

Figure 15: TO values calculated with NDACC and DQA corrected ozonesonde data

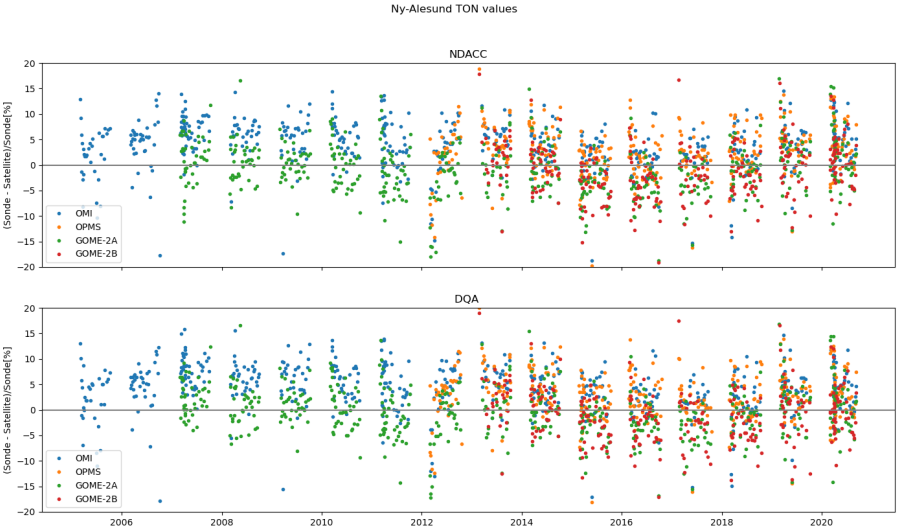

Figure 16: Relative differences of TON values with respect to satellite data calculated with NDACC and DQA corrected ozonesonde data