Sodankyla O3S-DQA Homogenization Report

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1 Sodankyla Metadata timeseries

Sodankyla ozonesonde data time-series exist in 2 different servers, NILU and NDACC. NDACC time series covers a longer time period, therefore data from NDACC is used for the homogenization of the Sodankyla data. The NDACC files starts from 1991-11-20, but there are no background values until 1994-10-12. As a consequence the homogenization of the timeseries only starts from 1994-10-12.

There are also missing metadata which are pump flow rate (PF) before 1997-01-07, temperature (TLab) before 1998-11-11, pressure (PLab) before 1997-01-07, humidity (ULab) beofre 1998-11-11 of the laboratory. For the missing PF values, the climatological mean of the period where SPC sondes were used (soundings before before 2004-01-01). For the TLab, ULab and PLab the climatological means are calculated for each month and these values are used for the missing metadata.

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 added in the data-set, but this is not extracted yet.
7. Radiosonde changes: RS80 radiosonde correction is tested but not applied yet.

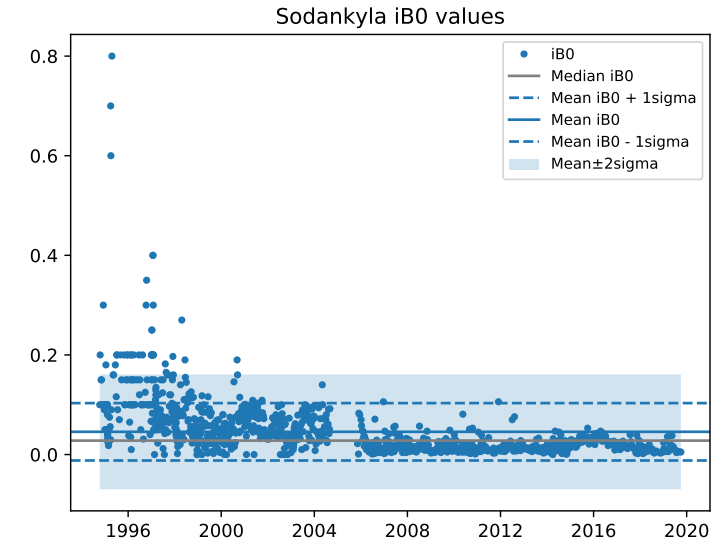

Figure 1: Sodankyla iB0 timeseries

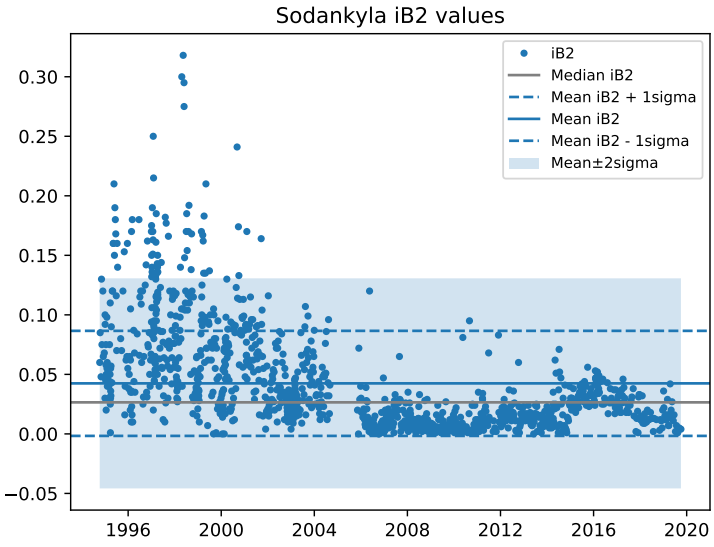

Figure 2: Sodankyla iB1 timeseries

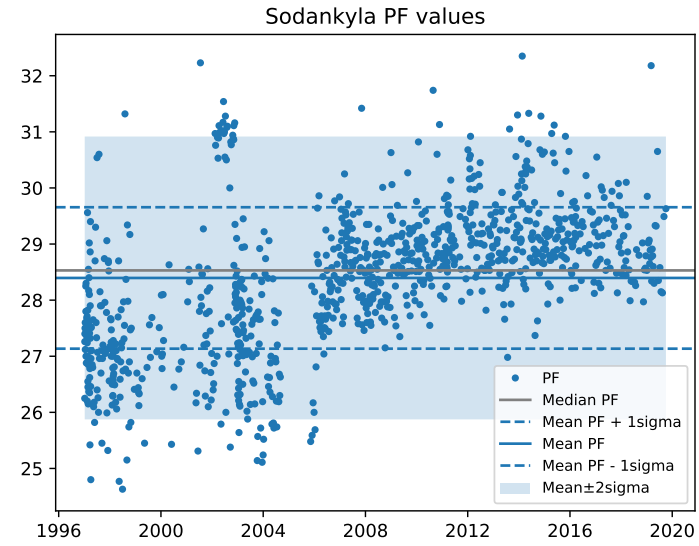

Figure 3: Sodankyla pump flow rate timeseries

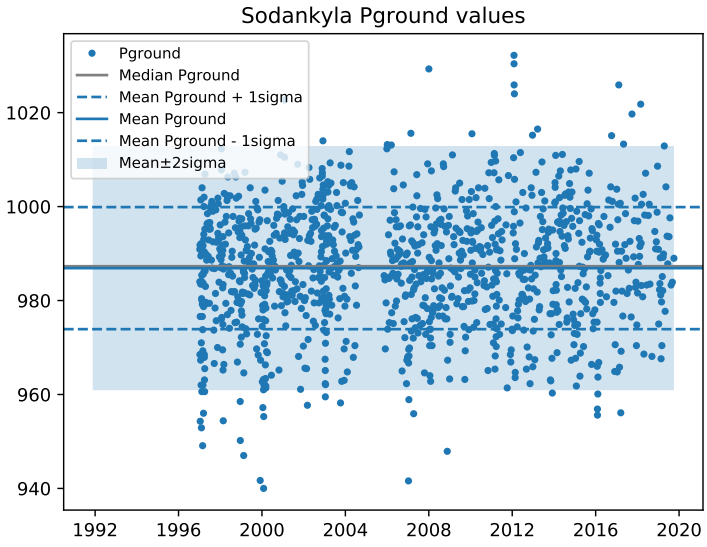

Figure 4: Sodankyla laboratory pressure timeseries

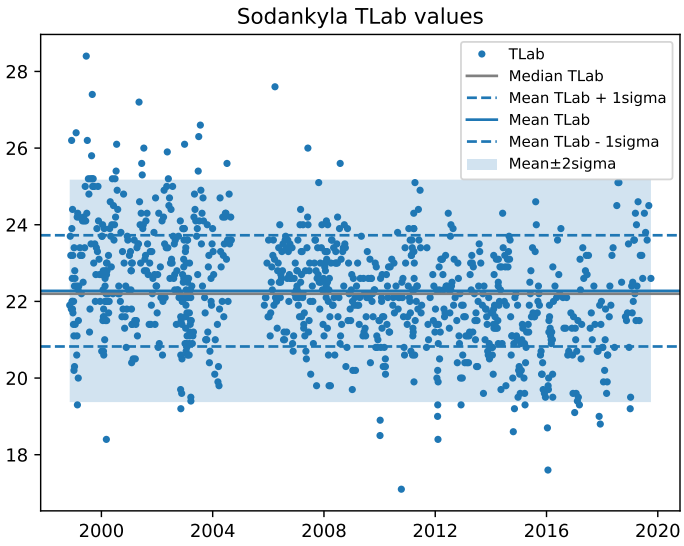

Figure 5: Sodankyla laboratory temperature timeseries

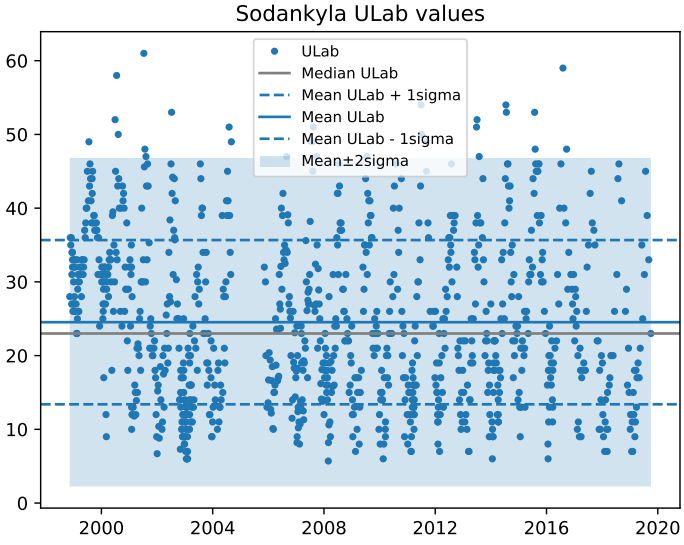

Figure 6: Sodankyla laboratory humidity timeseries

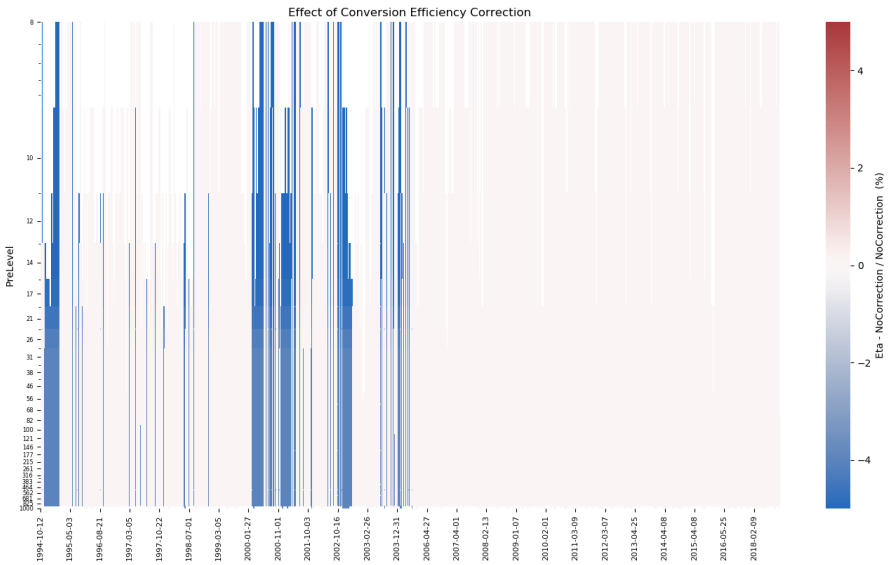

Figure 7: Conversion efficiency correction applied

2.0.1 Conversion efficiency

The stoichiometry correction is needed if not a sonde manufacturer and solution concentration among the recommended ones are launched. The recommended combinations are ENSCI $0.5\% - 0.5B$ and SPC $1.0\% - 1.0B$. There are launches of ENSCI $1.0\% - 1.0B$ that the stoichiometry correction is applied. The effect of the conversion correction is shown in Fig 7.

2.0.2 Background current

Background correction applied Sodankyla data is shown in Fig 9. If I_B exceeds $I_{B,\text{Mean}} + 2\sigma_{IB}$ then I_B, it should be replaced by the more representative climatological value of $I_{B,\text{Mean}}$, however with larger uncertainty of $2\sigma_{IB}$. For the background correction the mean of I_B is calculated in the range of $I_B < 0.1$. Therefore to the I_B values falling above $I_{B,\text{Mean}} + 2\sigma_{IB}$ in Fig 8, the background correction is applied.

This effect can be seen in Fig 9.

2.0.3 Pump temperature measurement

Truest pump temperature correction is applied according to Eq.13 of the O3S-DQA Guidelines. At 1998-12-01 the pump location changed from in the box to in the pump. Therefore Case-III correction is applied to SPC-5A sondes

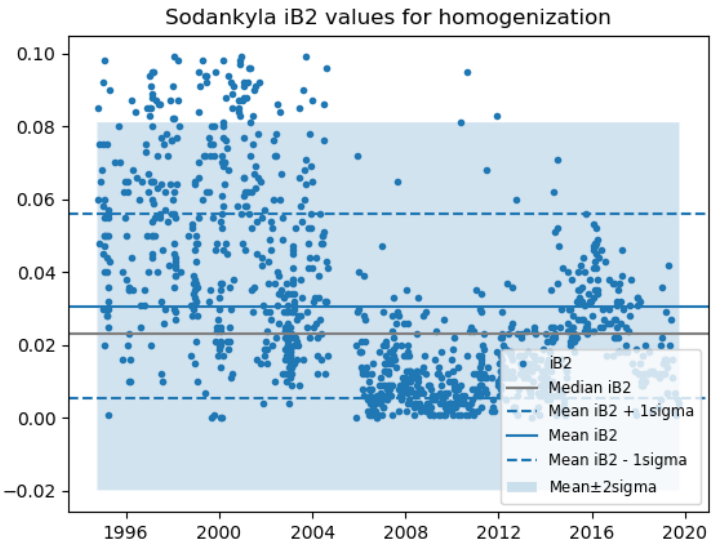

Figure 8: Background current correction applied

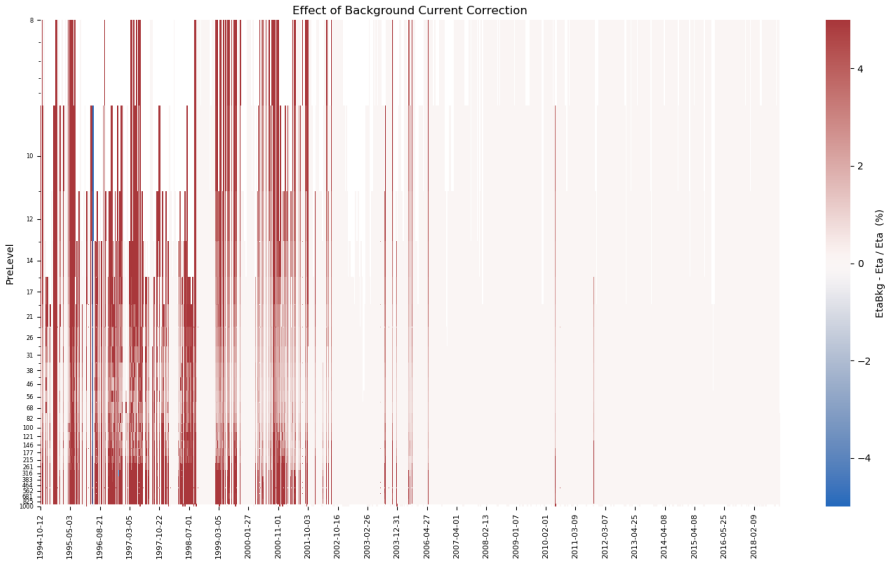

Figure 9: Background current correction range

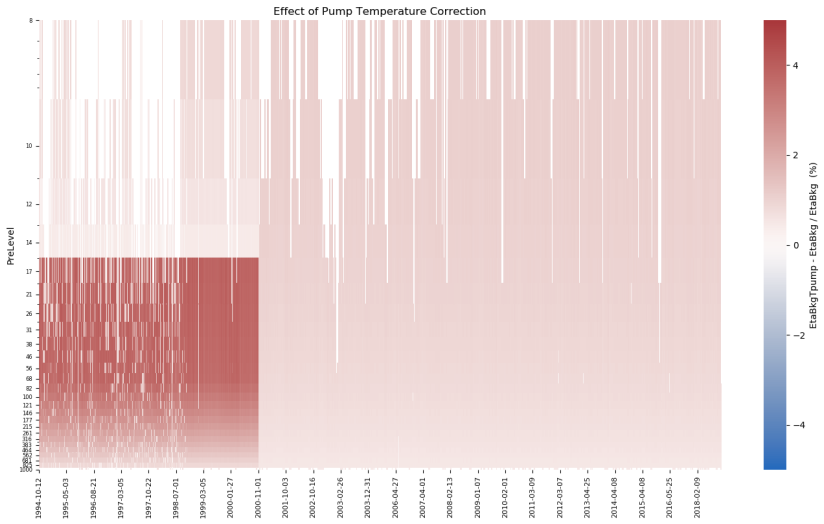

Figure 10: Pump temperature correction applied

and case-V correction to SPC-6A and Z sondes. The effect of the temperature correction is shown in Fig 10.

2.0.4 Pump flow rate (moistening effect)

This correction, Eq.15 of the O3S-DQA Guidelines, is applied and shown in Fig 11. 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 12. The interpolation of the correction factors are made using 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 12.

2.0.6 Radiosonde correction

This correction (give a reference to the paper) is applied to correct the pressure offset difference. It's uncertainity is not implemented in the total uncertainity of the ozone partial pressure. The effect of RS80 correction is shown in Fig 13.

The effect of all DQA correction with respect to no correction is shown in Fig 14 and the comparison of DQA corrected and NDACC O3S values is shown in Fig 15.

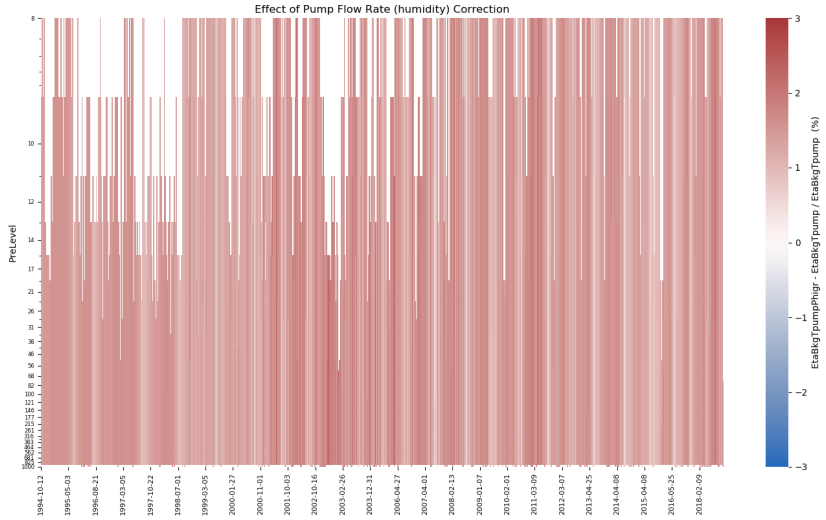

Figure 11: Pump flow rate correction applied

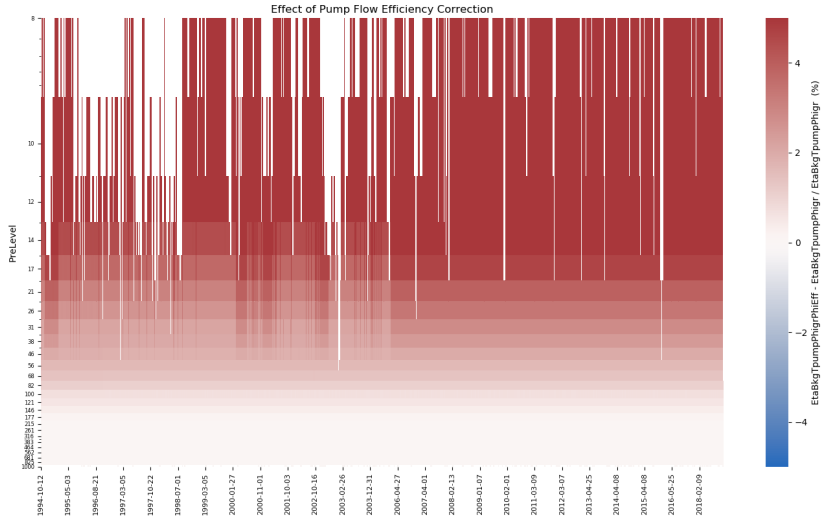

Figure 12: Pump flow rate correction applied

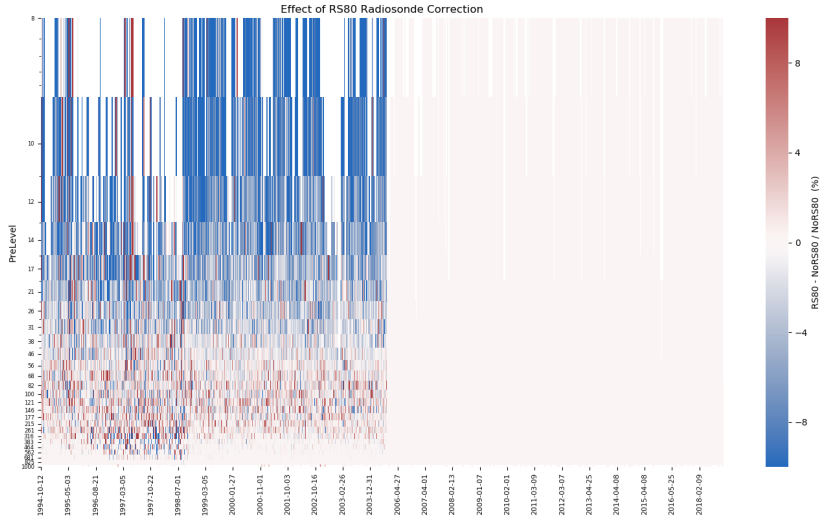

Figure 13: RS80 correction applied

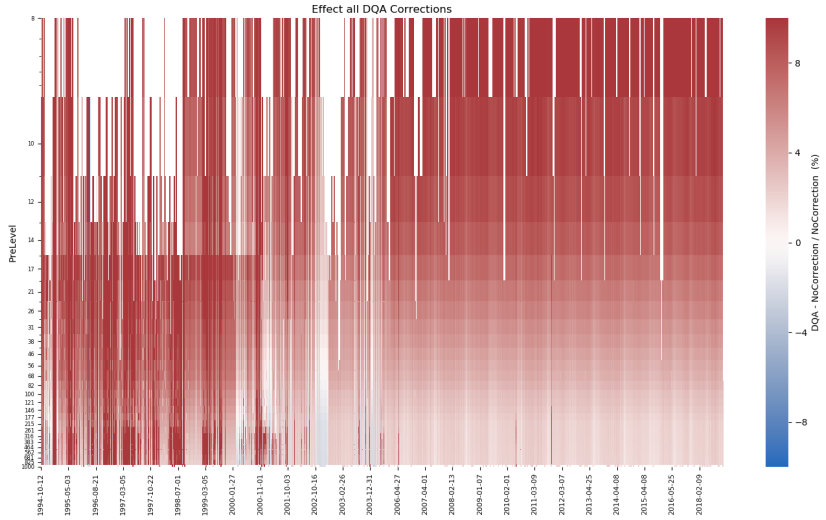

Figure 14: Effect of all DQA corrections

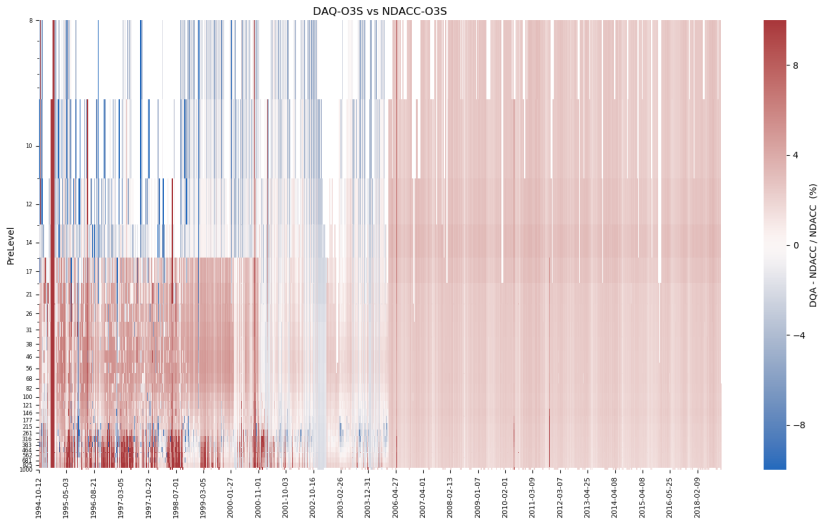

Figure 15: Comparison of DQA and NDACC O3S values

3 Comparison plots to AURA MLS v04 and v05

The homogenized and non-homogenized Sodankyla data is compared with AURA-MLS data using v04 and v05. Among these two a some difference can be seen in the pressure levels between 45 and 215 hPa. This difference is due to the differences in the AURA MLS data. The not-corrected, homogenized and NDACC O3S data sets are compared and shown in figures between 16 and 19.

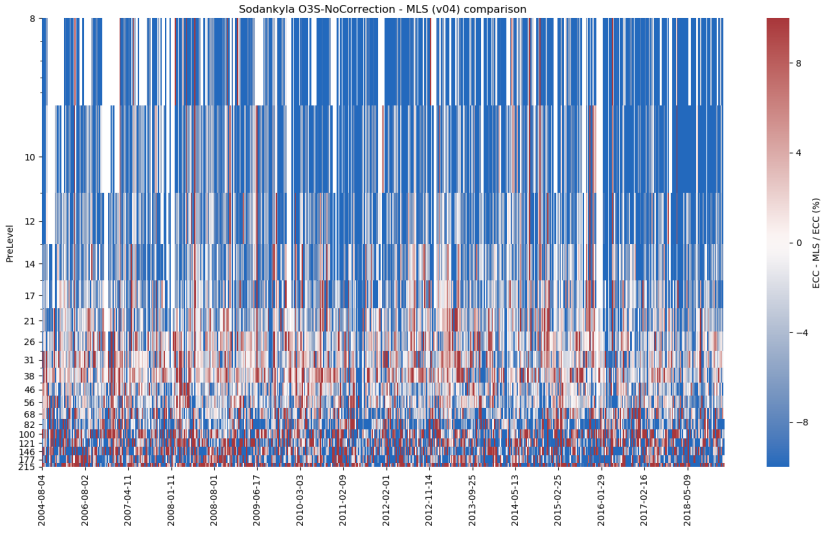

Figure 16: No Corrected Sodankyla O3S vs AURA MLS v04

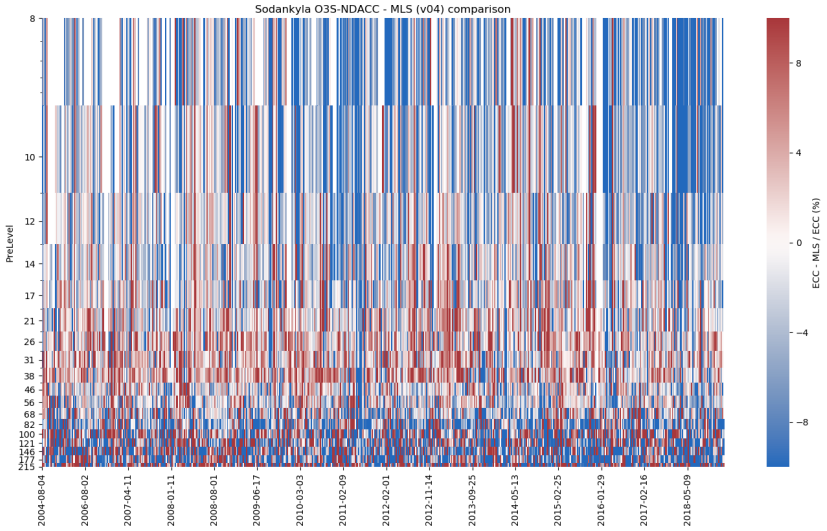

Figure 17: Sodankyla NDACC vs AURA MLS v04

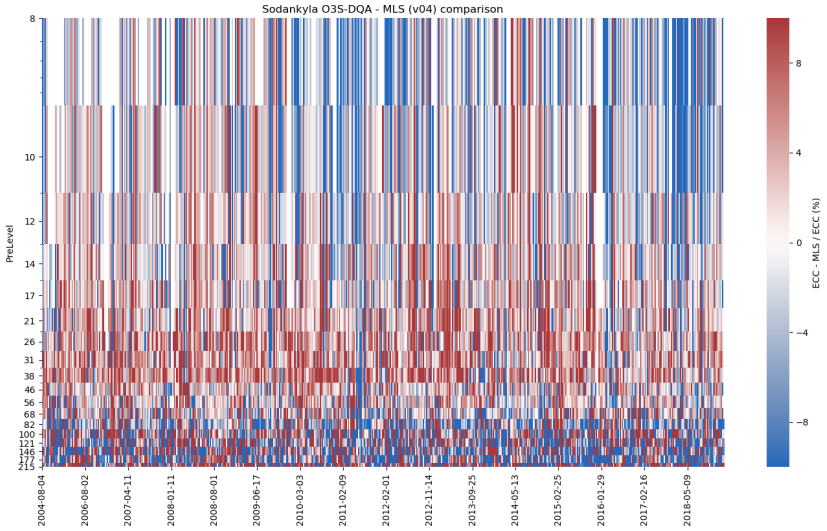

Figure 18: DQA-O3S Sodankyla vs AURA MLS v04

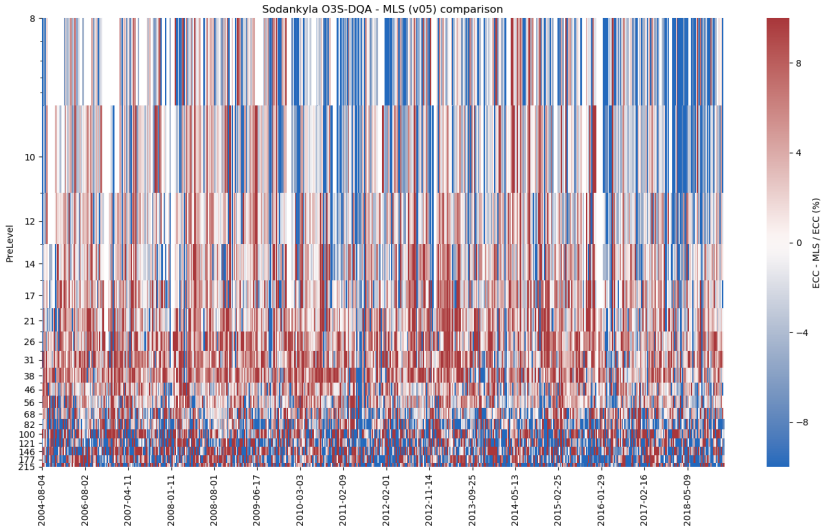

Figure 19: DQA-O3S Sodankyla vs AURA MLS v05