

EVDC, PGN

Pandora 59s1, MaunaLoaHI TotNO2, 20180623 - 20200111

Upgrade to QA dataset 005
(LuftBlick Report 2020003)

	Name	Company
prepared by	Moritz Müller	LuftBlick
	Martin Tiefengraber	LuftBlick
	Alexander Cede	LuftBlick
	Manuel Gebetsberger	LuftBlick

28th February

Acronyms and Abbreviations

AMF	Air Mass Factor
EVDC	ESA Atmospheric Data Validation Center
QA	Quality Assured
QF	Quality flag
RD	Rapid Delivery
SC	Slant Column
TotNO ₂	Direct Sun Total Column NO ₂

1 Introduction

This document is a data release note about the QA dataset version 005 for direct sun total column NO₂ (TotNO₂) of Pandora 59s1, located at Mauna Loa. It replaces the RD dataset version 004 which has been available on the EVDC till 20200226. The data between 20180623 and 20200211 are QA data since 20200227. In this release note we compare the QA data (QF = 0), processed with BlickP v1.7, retrieval code nvs1 against the RD data (QF = 10), processed with BlickP v1.7, retrieval code nvs1. The QA and RD datasets have been processed with a different calibration, which is the focus of this release note. It explains the main difference with regard to TotNO₂ values. The RD data which has been on EVDC till 20200226, has been processed with BlickP v1.5 with retrieval code nvs0. Due to the different flagging of the nvs1 compared to nvs0, outliers have been removed, which is not the focus in this release note. The processing versions BlickP v1.5 and BlickP v1.7 are compared in report [1] and the difference of the retrieval codes nvs0 and nvs1 is analyzed in report [2]. Both reports are available on <https://www.pandonia-global-network.org/home/documents/release-notes/>.

1.1 Applicable Documents

- [1] LuftBlick. Blick Software Suite Processor Release Note, LuftBlick Report 2019010: Version 1.7, 2019.
- [2] LuftBlick. Blick Software Suite Retrieval Release Note, LuftBlick Report 2020001: nvs1, 2020.

1.2 Reference Documents

- [3] J. Herman, A. Cede, E. Spinei, G. Mount, M. Tzortziou, and N. Abuhassan. NO₂ column amounts from ground-based Pandora and MFDOAS spectrometers using the direct-sun DOAS technique: Intercomparisons and application to OMI validation. *Journal of Geophysical Research (Atmospheres)*, 114:D13307, July 2009. doi: 10.1029/2009JD011848.

2 Summary

The difference between the data comes from an updated calibration, more precisely a change in the direct sun NO₂ SC amount in the reference spectrum. More information about this topic can be found in [3]. This is why the datasets have also been compared regarding the AMF in section 4. The median difference between the two datasets regarding TotNO₂ is 0.012DU (figure 1) which is quite significant since it is more than 10% of the QA dataset. Especially for low AMF's the QA dataset is showing higher values as the RD dataset (figure 4), e.g. 0.10DU for AMF's between 1.0 and 1.1 for QA data versus 0.083DU for RD data. This is of course connected to a different daily TotNO₂ cycle, outlined in figure 6. Note that version 005 is still using the current v1.7 direct sun retrieval, i.e. it does not optimize the effective NO₂ layer height and effective NO₂ temperature in the algorithm, which we know can both have a significant relative influence on the total columns, especially at remote sites.

3 Overall Comparison of RD and QA dataset

3.1 Total values

The median of the QA data (96816 measurements) is 0.098DU and the median of the RD data is 0.086DU (96702 measurements).

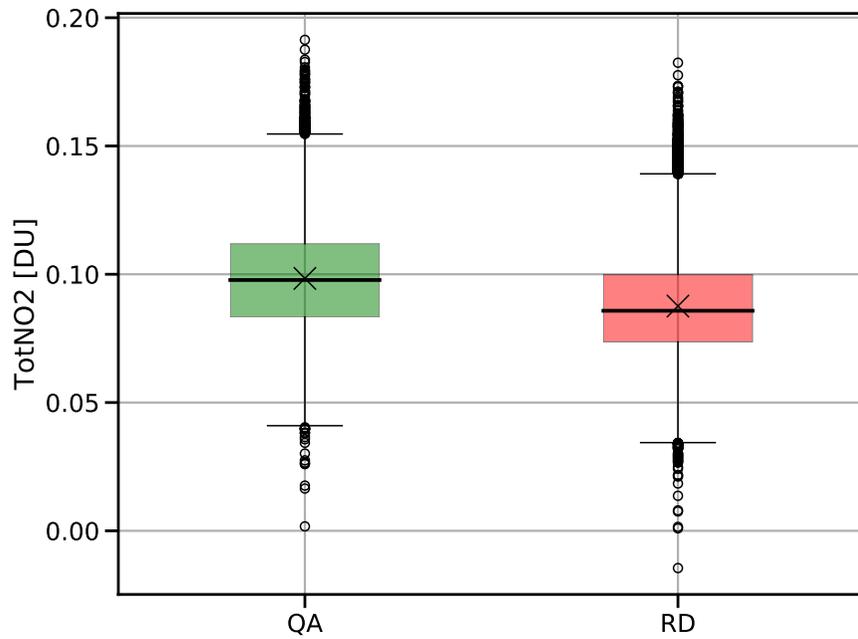


Figure 1: Boxplots of the two datasets. The mean is the black cross, median the thick horizontal line, thin horizontal lines show the Q5 and Q95 and the circles show outliers.

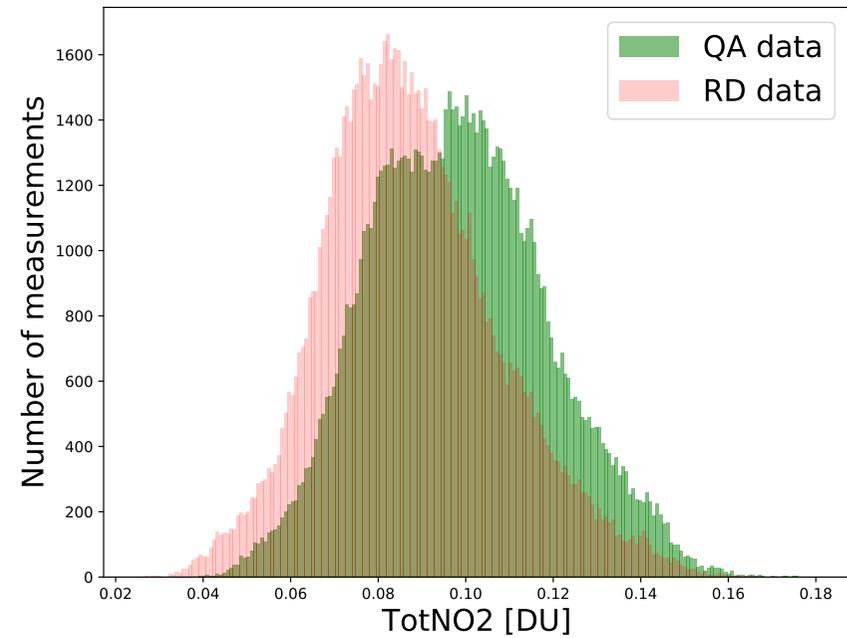


Figure 2: Histogram for the two datasets.

3.2 Differences

In order to show the difference of the RD and QA data, the datasets have been reduced to the same amount of datapoints, i.e. to the 96816 measurements of the QA data to guarantee just quality flags 0 and 10 and measurements have been taken at the same time. The median of the QA dataset is higher by 0.012DU.

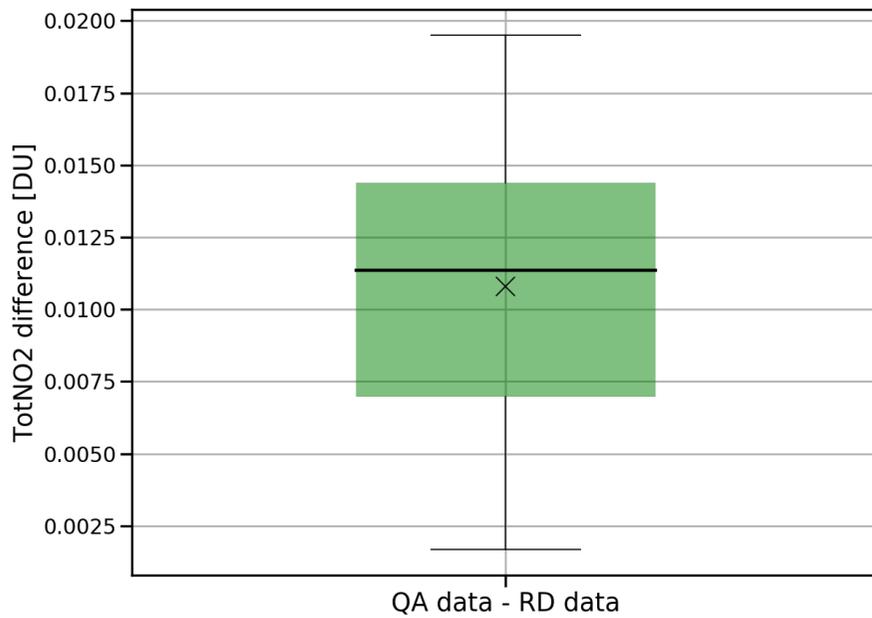


Figure 3: Boxplot of the difference of the two datasets, explanation as in figure 1.

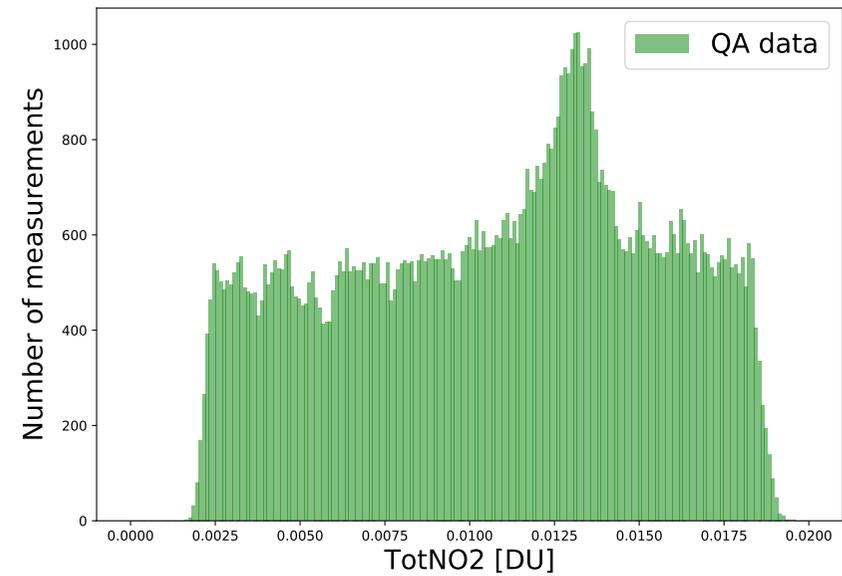


Figure 4: Histogram of the differences of the two datasets.

4 AMF dependent difference

As mentioned in the introduction, the only difference of the QA dataset is a different value in the direct sun NO_2 SC of the reference, which means an AMF dependent difference. This is shown in figure 5, where we can see a higher difference in the TotNO_2 for lower AMF's, e.g. a difference of 0.017DU for AMF's between 1 and 1.1.

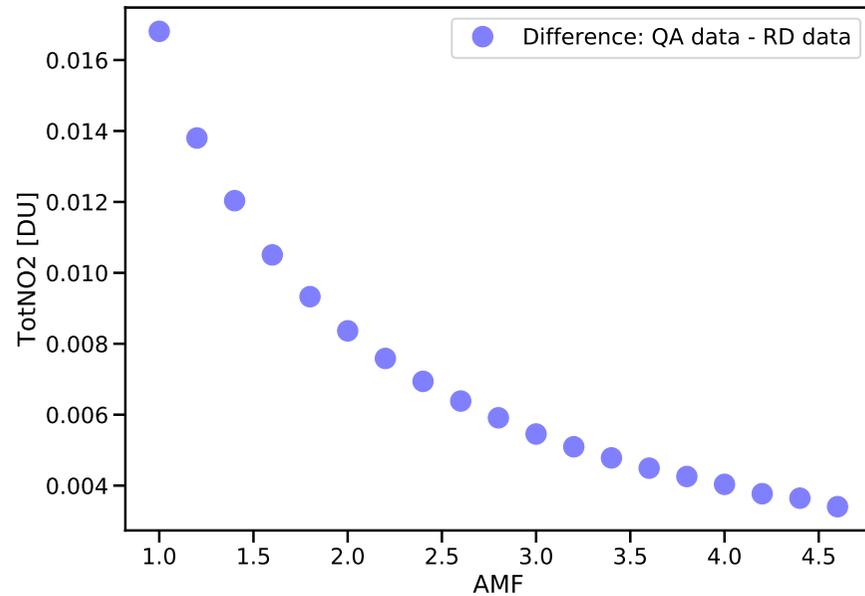


Figure 5: TotNO_2 differences binned in AMF groups with AMF steps of 0.1.

Another interesting difference is the daily pattern, which is of course related to the AMF dependency. The daily TotNO_2 distribution with hourly averages of May and June 2019 is shown. Until midday there is a much flatter TotNO_2 increase for the RD dataset, whereas the QA data is increasing more linear during the day.

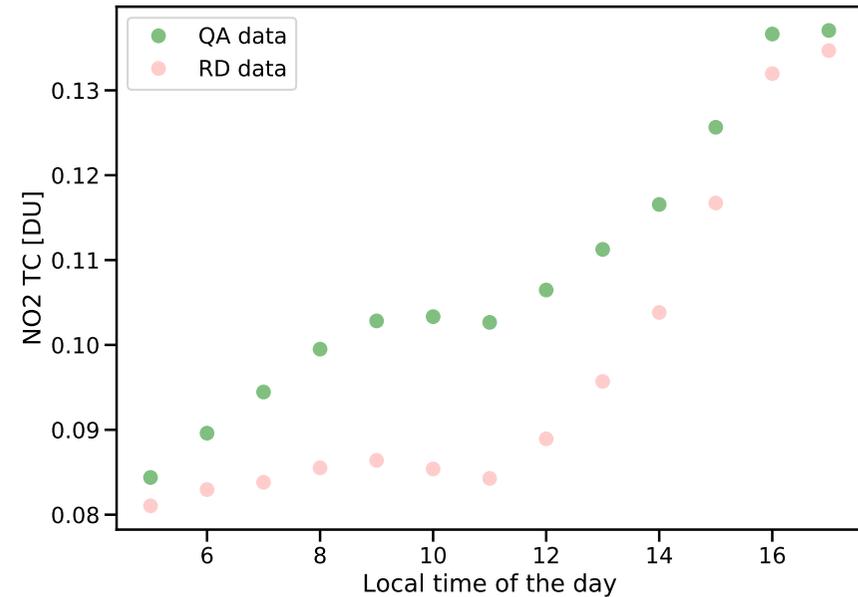


Figure 6: Average daily pattern in May/June 2019.