Blick Software Suite

nvs1

Retrieval Code Release Note
(LuftBlick Report 2020001)

20th January 2020

	Name	**Company**
prepared by	Manuel Gebetsberger	LuftBlick
	Martin Tiefengraber	LuftBlick
	Alexander Cede	LuftBlick

1 Release overview

General	
Operational from	December 2019
Predecessor code	nvs0
Retrieval setup	
Observation mode	Direct sun
Algorithm type	Real time direct sun algorithm, version 1
Optical filter in place	Diffuser
Assumed effective layer height	7.2 km
Reference	Synthetic reference spectrum calibrated with MLE
Wavelength window	400 to 440 nm
Order of smoothing polynomial	4
Order of offset polynomial	0
Order of wavelength change polynomial	1
Fitted gases	NO_2 at 254.5 K from *Vandaele et al.* [3], O_3 at 225.0 K from *Serdyuchenko et al.* [2]
Fitted gas temperatures	None
Ring	Not fitted
Molecular scattering	Subtracted before fitting
Noise	Included in fitting
L1 correction steps applied	All but wavelength correction
Quality limits (highest, moderate)	
Uncertainty limits	0.0048 DU, 0.0133 DU
AMF limits	7, 14
wrms limits	0.00093, 0.00195
Wavelength shift limits	0.2 nm, 0.5 nm
L1 quality limits	Standard

2 Major changes

'nvs1' is replacing the operational direct sun NO_2 retrieval code 'nvs0'. There is no change in the retrieval setup itself, wherefore the numerical values are identical. A change was made in the quality limits of 2 quality indicators, which leads to a new quality flagging (QF) and clustering into high, medium and low data quality. The affected quality indicators are:

- Weighted root mean squared error based on measured uncertainty (wrms): QF is evaluated at the processing level L2Fit.

- Vertical column uncertainty based on measured uncertainty (VCU): QF is evaluated at the processing level L2.

Table 1: Changed quality limits for wrms and VCU

Parameter/limit	nvs0	nvs1
wrms / high	2e-3	9.3e-4
wrms / medium	5e-3	1.95e-3
VCU / high	3e-2	4.8e-3
VCU / medium	5e-2	1.33e-2

Both limits are defined in the quality codes of the latest processing setups file which is needed for processing nvs1 locally, and available under `https://www.pandonia-global-network.org/home/documents/software/`.

3 Impact on data

The main impact of nvs1 is a reduction of high quality data (L2 quality flag 0,10). An example is shown in Figure 1, where individual outliers are visible until the end of August 2019 (top figure). From September 2019, the instrument had known pointing issues around noon, leading to a wrong air mass factor calculation. Consequently, unrealistic total column NO_2 values close to, and below zero occured more frequently.

These special pointing cases are clearly visible in the quality indicators, which are untypically increasing during the period with pointing issues (see *Gebetsberger et al.* [1]). The original limits of nvs0 where insensitive in capturing such events. The new quality limits are clearly flagging these data properly (Figure 1 top, bottom).

The approach to derive nvs1 thresholds as reported in Table 1, are described in *Gebetsberger et al.* [1] Section 5.1.

4 Applicable Documents

[1] M. Gebetsberger, A. Cede, and M. Tiefengraber. Fiducial Reference Measurements for Air Quality, LuftBlick Report 2019008: TN on Data Quality Flagging Generic Procedure Evolution, 2019.

5 Reference Documents

[2] A. Serdyuchenko, V. Gorshelev, M. Weber, W. Chehade, and J. P. Burrows. High spectral resolution ozone absorption cross-sections - Part 2: Temperature dependence. *Atmospheric Measurement Techniques Discussions*, 6:6613–6643, July 2013. doi: 10.5194/amtd-6-6613-2013.

[3] A. C. Vandaele, C. Hermans, P. C. Simon, M. Carleer, R. Colin, S. Fally, M. F. Mérienne, A. Jenouvrier, and B. Coquart. Measurements of the NO_2 absorption cross-section from 42,000 cm^{-1} to 10,000 cm^{-1} (238-1000 nm) at 220 K and 294 K. *Journal of Quantitative Spectroscopy and Radiative Transfer*, 59:171–184, May 1998. doi: 10.1016/S0022-4073(97)00168-4.
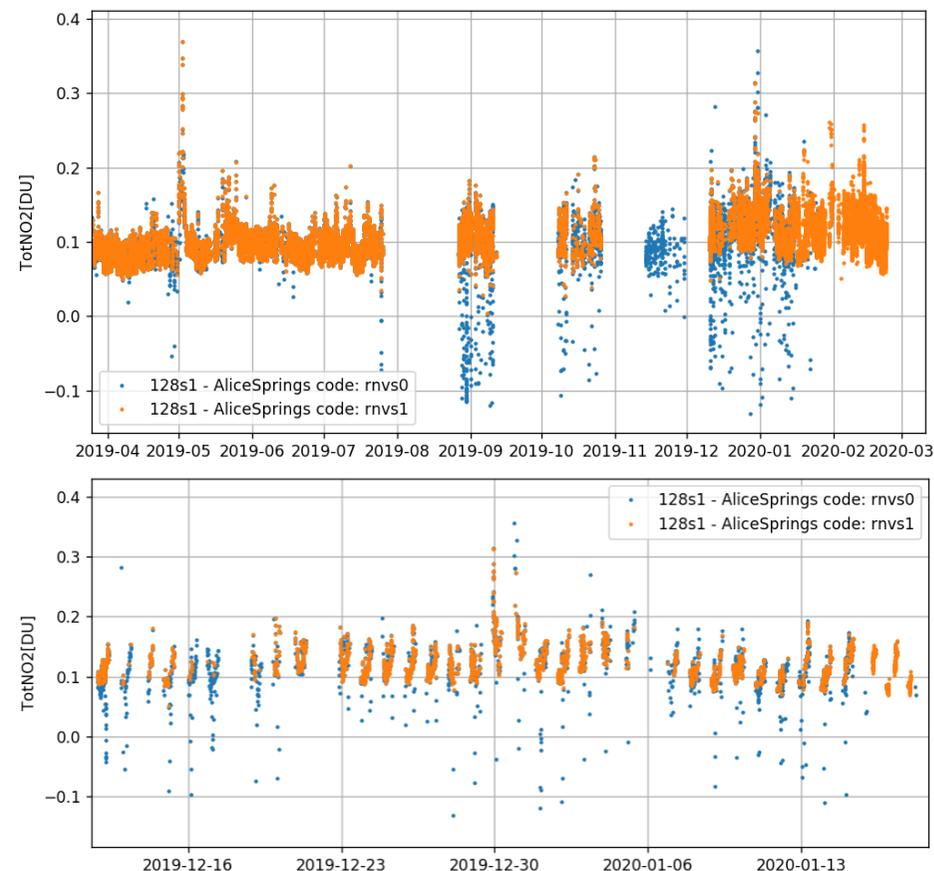

Figure 1: NO_2 total columns for AliceSprings in Dobson units (DU) using only high quality data, shown for nvs0 (blue) or nvs1 (orange).