Atmospheric
Measurement
Techniques

Open Access

EGU

Discussions

# *Interactive comment on* "Intercomparison of Pandora Stratospheric NO$_2$ Slant Column Product with the NIWA M07 NDACC Standard" *by* Travis N. Knepp et al.

**Anonymous Referee #2**

Received and published: 19 June 2017

Review of the manuscript 'Intercomparison of Pandora Stratospheric NO2 Slant Column Product with the NIWA M07 NDACC Standard' by Travis N. Knepp et al.

The authors present a comparison of NO2 slant columns measured with a Pandora instrument and the NIWA M07 instrument. Both instruments were employed next to each other at Lauder, New Zealand, and made measurements in zenith sky mode for a whole year (Sep 2014 – Sep 2015). The authors retrieved the measured slant columns using their respective native analysis algorithms and they provide a statistical analysis of the data comparison. The overall motivation for this study is to evaluate the Pandora instrument as a potential SAGE-III validation tool for stratospheric NO2 using

the NDACC approved NIWA instrument as a standard to compare with.

I have no major issues that need to be addressed and a list of specific issues is appended below. However, it would be good to see a bit more of a discussion on where the observed differences between both data sets could potentially be arising from, i.e. although for sure a combination of both, what contributions could come from the actual instrument/raw data and/or could be introduced by the two different processing algorithms. E.g. possible differences in the field of view of the instruments are not discussed nor is discussed if there could potentially be important differences in the actual processing routines used for this intercomparison.

Could one contributing factor to the observed seasonal bias between the data sets be caused by seasonal changes in the cloud cover?

Also a brief statement on how the results can be interpreted in light of the recommendations made by NDACC need to be added.

The manuscript is recommended for publication in AMT.

List of specific comments to be addressed:

Page 1, line 1, Abstract: Add comma: 'In September 2014, a ….'

Page 1, line 8, Abstract: Change to '… to vertical column density (VCD) is …. '

Page 2, line 1: delete 'the' before 'stratospheric'

Page 3, lines 13-18 & page 4, lines 2-10: Please add another paragraph to explain in more detail the processing procedure applied to retrieve the NO2 slant columns discussed in the this paper; the same goes for the NIWA data processing and it would certainly be helpful to have a table summarizing the settings used for both instruments, e.g. wavelength interval used for the fit, which cross-section were used, which polynomial, Ring, has an offset correction been applied, are the NO2 and O3 cross-sections Io corrected? This will help to understand the similarities and differences in the data

processing algorithms applied to each of the data sets.

Page 3, lines 19-21: Can you please provide some evidence that shows that the Pandora instrument used here has a high enough light through-put to make sensible measurements at SZA =>90.

Page 4, line 15: replace ')' with ','

Page 4, line 21: should be 'similarly'

Page 4, lines 26/27: If these are SCDs please state so clearly in the text.

Page 5, line 9: ''... the two sites are in phase ....'

Page 7, Figure 2: panel (b): any comments re why the displayed ground-based data is clearly higher? Maybe I missed this somehow but this should be included in the caption and also be discussed in the manuscript text. Also state clearly in the first line of the caption if the OMI NO2 data product is SCD or VCD.

Page 8, line 5: '... the correlations as seen in Fig. 3'

Page 8, line 6: '... where it peaks at ... Within each panel of Fig. 3 the data are color ...'

Page 8, line 6: It would also be helpful to refer here to Table 3 as well.

Page 8, line 13: '... instruments have strikingly ...'

Page 9, Tables 3&4: Last column, close with ')' not ']'

Page 10, Figure 3 caption: Change to '(i.e. red colors represent the upper SZA limit, blue colors represent the lower bounds for each individual panel).'

Page 10, line 1: 'The decrease in correlation ...'

Page 10, line 9: How about something like: 'To better understand the seasonal variability seen within the data sets, the data ...'

C3

Page 10, lines 10-11: This sentence needs to be improved, change to something like: 'Seasonal correlation plots were generated (Fig. 4); they show nearly identical behaviour to the aggregate (Fig. 3) with most of the tailing behaviour being attributed to winter conditions.'

Page 11, line 11: Change to: '... at high SZAs .... or at very low NO2 ...'

Page 11, line 20-22: Can you please address if the observed seasonal dependence can cause issues when using Pandora instruments for satellite validation.

Page 11, line 24: delete '-' between 'NDACC' and 'standard'

Page 11, line 25: replace 'on' with 'using'

Page 11, lines 26-27: Change to: 'We showed that the data obtained using the two instruments and retrieval algorithms were well ..., and that the time of the year had just minimal impact on the comparison. ' However, didn't you just state in the paragraph above that there actually is a seasonal impact??

Page 11, line 30: The tailing effect should be explained when first mentioned.

Page 12, line1: The SZA range where the Pandora instrument may be useful for SAGE-III validation seems rather limited (around 90 deg, possibly as low as 85 deg) – can you please elaborate a bit on if that is realistic with re to known overpass information for suitable sites.

Page 12, line 2: I don't understand the sentence: 'Lower SZAs may not ....'. Can you please explain what you mean here.