Interactive comment on “Preflight Calibration of the Chinese Environmental Trace Gases Monitoring Instrument(EMI)” by MinJie Zhao et al.

We would like to thank you for the insightful comments. Our responses to the comments are given below.

General comments:
The paper by Zhao et al. reports on the preflight calibration of the Chines Environmental Trace Gases Monitoring Instrument (EMI). Wavelength calibration of the instrument, a thermal vacuum test to investigate the impact of in-orbit conditions on the whole system and the radiometric calibration are described in detail and results are shown. Furthermore, the expected signal-to-noise ratio for each channel has been estimated using model calculations.

This review refers to the modified manuscript submitted by the authors on June 30. The manuscript is in general clearly written and I recommend it for publication in AMT. However, the authors should consider following comments and recommendations.

(1) Section on performance requirements: The authors should give some information on what these requirements based on. I recommend putting the information either in a table or in proper sentences. Please add this section after the general instrument description.

Response:

Large spectral range from 240 nm to 710 nm combined with high spectral resolution(0.3 nm to 0.5 nm) of the EMI enables the measurement of several trace gases(e.g., NO2, O3, SO2, BrO, HCHO) as well as aerosol, see table 2. To achieve a high retrieval precision, a high SNR is required for the scattered radiance from the UV to the VIS.

Table 2. EMI data products.

Product Name	Wavelength Band/nm
O3	300-345(UV1,UV2)
SO2	305-330(UV1,UV2)
NO2	425-500(VIS1)
BrO	344-360(UV2)
HCHO	335-360(UV2)
Aerosol	UV2,VIS1,VIS2

(2) Instrument description: I'm wondering, why the expected spatial resolution in the Visible is smaller than in the UV since the expected intensity should be larger.

Response:

CCD for the Visible has 576 pixels in the spatial range, each pixel measuring $22.5 \times 22.5\, um^2$. CCD for the UV has 1032 pixels in the spatial range, each pixel measuring $13 \times 13\, um^2$. Calibration results show that:

- Spatial resolution in the Visible is 12km on electronic binning of 4, and is 48km on electronic binning of 16.
- Spatial resolution in the UV is 8km on electronic binning of 4, and is 48km on electronic binning of 24.

(3) Thermal vacuum test: I'm wondering about the relatively small temperature range investigated in this study. Is this really something to expect in reality?

Response:

The in-orbit results showed that temperature stability is better than 0.1K. Actually, the temperature investigated in this study has been applied to EMI after launch.

(4) Radiance calibration, Dark signal: The authors stated, that the spectrometer in the Visible has temperature control and changes of the CCD are therefore not an issue. Again, the question: Is this true under real in-orbit conditions e.g. when the system comes from the dark to the illuminated part of the orbit?

Response:

An investigation done after launch shows that the temperature stability is better than 0.1K over one orbit. This temperature variation over the orbit leads to very small change of the background signal.

(5) SNR (do not use an acronym in the caption): Table 8 and also some sentences concerning the SNR should move from the Conclusions section to the SNR section. In general, I'm a bit unsettled that the assumption of an albedo of 0.3 in the SNR simulations is useful. For most of the relevant scenes the albedo is much lower!

Response:

a) Table 8 and the sentences concerning the SNR have been moved from the Conclusions section to the SNR section.

b) The SNR at albedo of 0.3 is typical SNR of the EMI. SNR at other albedo can be obtained from the typical SNR by equation(16) in the paper:

$$SNR = SNR_{simulation} \cdot \sqrt{\frac{R}{R_{simulation}}}$$

Minor corrections

• Line 11, please change to launch date

Changed (date:2018.05.09)

• Line 25f: Check sentence for clarity

Modified.

• Line 29f: Check citations - I recommend to use following publications instead:

Burrows et al.: The global ozone monitoring experiment (GOME): Mission concept and first scientific results, 1999

Bovensmann et al.: SCIAMACHY: Mission objectives and measurement modes, 1999

Levelt et al., The Ozone Monitoring Instrument, 2006

Changed

• Line 96: travels instead of travel

Corrected

• Line 145: …considered as a Gaussian-type function …

Corrected

• Line 155: … and the accuracy of the FWHM ..

Corrected

• Line 161f: A mercury argon lamp is used as light source for EMI …

Corrected

• Figures 5 and 6: What is NTC??

Corrected (NTC: No Temperature control)

• Line 207: … are presented ...

Corrected

• Line 224: Write solar calibration mode (SCM) in caption

Corrected

• Line 279: Table missing?

Added

• Line 308: about 0,5% per what??

Updated.

• Line 316, Figure 8: … for … instead of … under …

Corrected

• Line 332: … check sentence for clarity …

Modified.

• Line 346f: Check numbers given here!!

Corrected

• Line 358: Based …

Corrected

• Line 429f: … have been discussed elsewhere …

Corrected

• Line 450: … are recorded …

Corrected

• Line 467f: .. of the SNR … and check sentence for clarity

Modified.

• Line 470f: I'm not sure, what the authors would like to point out here.

Modified

• Line 472: The simulation of the … in the UV2, … channels are …

Corrected

• Line 473: … of channel UV1 …

Corrected

• L481f: Numbers given here are different to numbers in Table 8!

Response: The numbers in L481f are obtained by the radiance at an albedo of 0.3 and solar zenith of 60 °. The numbers in table 8 are obtained by the radiance of 1.27/10.89 $\mu W / cm^2 / sr / nm$