

This paper describes an information content analysis of gas and aerosol retrieval from SWIR and TIR bands. SWIR observations are more sensitive to CO₂ and CH₄ near the surface, but less sensitive to the vertical profiles than TIR observations. A synergy use of these bands is expected to complement one another. Also, optical path modification due to aerosol scattering is one of the major error sources for total-column retrieval from SWIR observations. Therefore, I think the topic of this paper is relevant for AMT. However, there are several concerns; the configurations of analyses are not clear due to the insufficient description; authors made a comments about a satellite mission specification, but the number of considered configuration looks insufficient to make a general conclusion; etc. The major revision is needed before the publication. Followings are the specific comments.

1. Introduction

Earlier paper by Christi and Stephens (2004, JGR, D04316) should be cited.

2. p.8438, l.13-14

Please add "Band 1/2/3/4" in the text.

3. p.8443, l.5

where $\mathbf{S}_{a,i} \Rightarrow$ where $\sigma_{a,i}$?

4. p.8443, l.13

where $\mathbf{S}_{m,i} \Rightarrow$ where $\sigma_{m,i}$?

5. SNR of TANSO-FTS (p.8443, l.15)

A simple description of "a signal to noise ratio of about 300" might lead a misunderstanding to readers. According to Kuze et al. (2009), requirement of SNR larger than 300 is defined under the condition of solar zenith angle of 30 degree and surface albedo of 0.3. It is better to add explanation.

Kuze et al. (2012, AMT) said there are two dominant noise sources for TANSO-FTS; (1) the detector and its electronics noise and (2) the shot noise. The former noise looks dominant because darker (brighter) surface gives lower (higher) SNR (e.g., Fig. 6 of Yoshida et al. 2011).

6. Surface reflectance (p.8444, l.11)

a) There is no descriptions about surface reflectance/emissivity in section 5. Are

surface emissivities (reflectance) of 1/0.98/0.98/0.95 (0/0.02/0.02/0.05) for Bands 4/3/2/1 used in the analysis of section 5 ? If so, the reflectances for SWIR bands are too low (see comment 5). Only water surface has such a low reflectance at SWIR bands, however, TANSO-FTS observes sun-glint region to avoid low SNR measurements over the dark water surface.

b) Many earlier papers discuss about the interaction between aerosol and surface reflectance in the total-column retrieval from SWIR observations (e.g., Butz et al. 2009, Appl. Opt.). Additional analyses with several values of surface reflectance should be made.

7. p.8444, l.12

$(p_e) \Rightarrow (p_s)$?

8. p.8444, l.15

$(P_{Cmol}) \Rightarrow (p_{Cmol})$?

9. p.8445, l.7

"atmospheric column concentrations" \Rightarrow "profiles"

10. p.8445, l.9, p.8451, l.12-14

Yoshida et al. (2011) used Bands 1 and 2 of TANSO-FTS. Band 3 was only used for cirrus screening.

11. Configuration of the analysis

To avoid the misunderstandings, please clarify following points for each case.

a) Retrieved parameters and non-retrieved parameters. It is not clear that CO₂, CH₄, and H₂O are retrieved simultaneously or independently. Also, typical simultaneously retrieved parameter of surface reflectance and temperature are included in the retrieved parameter or not.

b) Used bands and non-used bands. It is not clear that Band 1 is used in section 5.1 and 5.2 or not.

c) Vertical gridding. Many literatures show US standard profile with 1-km resolution; 21 vertical levels from the surface to 20 km. Which boundaries do you used ? Further, vertical grid of Figs. 2 and 4 looks different with that of Figs. 3 and 5. Please clarify.

d) Solar zenith angle and viewing angle.

12. p.8445, l.14

What is "the vertical DOFs" ? Eq. (3) gives a single scalar value regardless the number of retrieved parameters.

13. Figs. 3 and 5

Although a large uncertainty on the prior state vector is applied, error reduction by SWIR bands seems to be too small. Please add detail explanations about this. According to Eq. (5), $\mathbf{S}_x \approx \mathbf{S}_a$ indicates that the spectrum error is larger than Jacobian. It may be helpful to add figures of Jacobian and spectrum error for typical vertical grid.

14. Fig. 6

Add solar zenith angle, viewing angle, and surface reflectance in the figure caption.

15. Fig. 7

According to Figs. 2 and 4, DOFs of H₂O column by Band 4 only/All Bands analyses are expected to be greater than about 6. Why is the maximum DOFs unity ?

16. Satellite mission specification

If you want to mention about a satellite mission specifications, it is better to show a frequency distribution of aerosol optical thickness. Of course, the retrieval results have large errors when optical thickness is large, but such cases are limited. Do not make a conclusion based on a limited specific case.

17. "column"

In some cases, the word "column" seems to indicate "partial-column", not "total-column". To avoid confusion, please clarify. Be care that DOFs just shows the number of independent parameters obtainable from the measurement and do not show the vertical sensitivity.