

Interactive comment on “Level 1 algorithms for TANSO on GOSAT: processing and on-orbit calibrations” by A. Kuze et al.

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<Response to Referee #1> We thank the reviewer for carefully reading our manuscript and for providing constructive and positive comments. We address the comments below.

(our responses in bold and red in supplement file).

<Response to the general comment> We asked a native speaker, who is familiar with FTS technology, to edit our manuscript.

<Corrections> (1) Abstract: page 2960, line 12 "...not mentioned, here in this paper" -> "...not discussed in this paper" or "not subject of this paper" A: We have modified.

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(2) Overview, page 2961, line 15: introduce acronym: Kongsberg Satellite Services (KSAT) A: We have introduced "Kongsberg Satellite Services AS (KSAT)".

(3) Overview, page 2961, line 24: "the camera was ... installed to check alignment on board." This is rather diffuse. - Alignment of what? A: We have modified as follows. "to check on-orbit alignment between the actual viewing position and the calculated value from the resolver angles of the pointing mirror."

(4) GOSAT operation, page 2963, line 6: "In addition to the official GOSAT level2 product provided by NIES, several working groups have derived XCO₂ and XCH₄ from TANSO level 1 data using own processors (refs...)." A: We have corrected as follows. "In addition to the standard GOSAT level2 product provided by NIES, several working groups have derived XCO₂ and XCH₄ from TANSO level 1 data using own processors."

(5) GOSAT operation, page 2963, line 9: "... has been measured from space for the first time ..." A: We have modified.

(6) GOSAT operation, page 2963, line 21: "to avoid the performance degradation" omit "the" A: We have omitted.

(7) Section 2.1: It would be useful for the reader to closer associate the list of steps S / T with Fig. 3. I find it difficult to bring the listed step sequence in correspondence with the data processing flow shown in Fig. 3. A: We have modified the figure 3 and add steps in the figure as follows.(please find the supplement) We also modified the TIR procedure for better understanding.

(8) Section 2.1, page 2966, line 6 "correction of spike noise detection..." line 16 "correction of spike noises" perhaps one should say "correction of spike noise events..." A: We have modified as follows. "correction of spike noise events"

(9) Section 2.2.1 line 16: "Even though there have been no cosmic rays detected since the launch, the high energy particles also create spikes." - sorry, I am not sure to understand what you want to express. A: We have corrected as follows. "The high energy

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particles also create spikes. Fortunately, there have been no cosmic rays detected since the launch."

(10) Section 2.2.2, page 2968, line 2 omit "a later" A: We have omitted.

(11) Section 2.2.2, page 2968, line 4 omit "the" A: We have omitted.

(12) Section 2.2.2, page 2968, line 24 "In the former version of V130.130 an ADC nonlinearity correction was implemented. However, the resulting level 1b products suffered from large artifacts." A: We have modified as follows. "In the former version of V130.130 an ADC non-linearity correction was implemented. However in the case of low input cases, the resulting Level 1B products suffered from large artifacts."

(13) Section 2.2.2, page 2968, line 26: "... have the possible small bias"? Do you mean "...show a low bias"? A: We have modified as follows. "low bias."

(14) Section 2.2.3: Correction of the two micro-vibrations. It seems remarkable to me that these modulations are so pure that the correction works as described. Any minor variation of scan speed during the recording of the ifg would distort the local phase of these oscillations. Perhaps the correction method via the out of band artifact spectra is mainly sensitive for the speed instability near the IFG center burst? A: Yes. Your understanding is correct. Generally speaking, the on-orbit mechanical environment is very quiet. The only vibration source detectable is the earth sensor motion at 244 Hz. The FTS mechanism is very sensitive to the oscillation at its resonant frequency of 325Hz. We have to care only two oscillations. Random vibration is very small. So local-oscillations are negligible. We have added "Except for these two oscillations, the on-orbit mechanical environment is very quiet".

(15) Section 2.2.4, page 2969, line 26 "The interferogram sampling interval has to be smaller than" A: We have modified as follows. "Interferogram sampling interval has to be smaller than half wavelength of the signal."

(16) Section 2.2.5, page 2971, line 5 "the actual on-orbit interval ... decreases by 25

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nm from ZPD to maximum OPD" A: We have modified as follows. "The actual on-orbit interval decreases by 25 nm from ZPD to maximum OPD."

(17) Section 2.2.6, page 2971, line 18 "Apart from the high gain Band 1 all bands use Butterworth filters ..." A: We have modified as follows. "Apart from the high gain Band 1 all bands use Butterworth filters, which have flat response. The feedback capacitance changes result in the cut-off position only".

(18) Section 2.2.7, page 2972, line 8 "using a 2nd order polynomial" A: We have modified.

(19) Section 2.2.7, page 2972, line 11 "under stable conditions" A: We have modified.

(20) Section 2.2.7, page 2972, line 24 "modeled as function of time" A: We have modified.

(21) Section 2.3.1, page 2973, line 11 "when the input scene flux and radiation are balanced" ?? A: We have modified as follows. "On the other hand, for the TIR band, scene flux from the ground and atmosphere is close to the back ground radiation and it can be difficult to detect ZPD position as the positive signal of input scene flux is cancelled by the negative signal of the radiation from the optics."

(22) Section 2.3.1, page 2974, line 1 + 3 "a quality (warning) flag", "with an assumption" -> "assuming" A: We have modified.

(23) Section 2.3.2, page 2974, line 10 ff: I understand what you mean, but the following sentences should be reworded. Comment: It is known that for a reliable phase reconstruction one has to use a low res IFG. But in addition to this, a numerical apodization should be applied on the low-res IFG. Please detail which apodization function is used. A: We have reworded. "The phase is corrected such that imaginary spectra become noise level. It is known that for a reliable phase reconstruction one has to use low resolution spectra. At strong absorbed lines, it is difficult to distinguish the imaginary spectra from the noise. If we correct the phase of fully absorbed lines with high spec-

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tral resolution, sometimes the phase is over-corrected. Imaginary part become much lower than noise level and the artificial part is created. Therefore the moderate spectral resolution of the phase retrieval, which is much wider than single absorption lines, has to be selected with Gaussian apodization.”

(24) Section 2.3.2, page 2974, line 17 "the complex radiometric calibration and the phase correction is performed simultaneously." A: We have modified as follows. "For TIR data processing, the complex radiometric calibration and the phase correction are performed simultaneously."

(25) Section 2.5 , page 2975: have the acronyms DS, BB been introduced? A: Yes. DS (deep space) and BB (black body) is introduced in page 2967 line 1 and page 2965 line 21, respectively.

(26) Section 3.3.3, page 2985, line 9 "have a common wave number shift" or "have the same wave number shift" (Comment: I would expect the same spectral abscissa calibration factor for all bands, not the same shift?) A: Thank you very much for your comment. Your comment is correct. We have modified as follows"Because all the bands have the same spectral calibration factors,"

(27) Section 3.4, page 2986, line 10 "...and an example is shown..." A: We have modified.

(28) Section 4.1.1, page 2990, line 9: "...dark level is a function of..." A: We have modified.

(29) Section 4.1.2, page 2990, line 15 "the integrating sphere has angular distribution..." I assume you intend to state "uneven angular distribution" or "deviates from the Lambertian emitter" A: We have added "uneven".

(30) The ordinate title of Fig. 6 b seems corrupted A: We have replaced the Fig. 6 b with the clearer one. (Please find the supplement).

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Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/5/C1377/2012/amtd-5-C1377-2012-supplement.pdf>

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 2959, 2012.

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