

## ***Interactive comment on “Simultaneous observations by sky radiometer and MAX-DOAS for characterization of biomass burning plumes in central Thailand in January–April 2016” by Hitoshi Irie et al.***

### **Anonymous Referee #1**

Received and published: 11 October 2018

#### - General Comments

This manuscript analyzed valuable measurements of trace gases and aerosols including biomass burning events at Phimai, Thailand using Sky-radiometer and MAX-DOAS. However, the descriptions of retrievals and analysis are not clear at least to me. This manuscript is also lack of completeness by depending on other references, even for some essential information. Therefore, I do not fully agree with their major conclusions of this manuscript yet. Hence, I recommend judging this manuscript after major revisions below.

C1

#### - Major Comments

Pages 5-6 As this manuscript mainly analyzes collocated retrievals of largely varying absorbing aerosols and trace gases, they need to elaborate how they implemented the aerosol properties for trace gas retrievals. According to their prior papers (Irie et al., 2008a, 2011), They fixed aerosol single scattering albedo as 0.95 for all wavelengths, which can propagate nonnegligible systematic biases in the trace gas retrievals. For example, if they used HCHO fitting window as 335-360 nm (Hoque et al., 2018), the SSA values at this wavelength can be differ by up to  $\sim 0.15$  compared to the Sky-net retrievals (Figure 1). It might have large effect on analysis throughout this manuscript (e.g., Figures 1, 2, 4). If the authors utilized collocated aerosol properties from Sky radiometer for trace gas retrieval, please describe those. If not, at least they need to analyze error estimation of trace gas retrievals due to the biases of SSA between Sky radiometer retrievals and assumption.

Page 7, lines 20 - 24 This paragraph includes one of the main conclusions of this manuscript. They insist that aerosols in BB plumes are absorptive by suggesting high AAOD values at 340 nm. However, monochromatic AAOD is not a straightforward parameter to represent absorption ‘property’, since it is function of absorption (SSA) and amount (AOD). As the authors already have SSA retrievals, and I don’t think AAOD is prior to SSA for the analysis. Therefore, I recommend to additionally focus on spectral SSA retrievals of BB aerosols to clearly show their absorption properties (e.g., like figure 3, for several BB aerosol events).

Page 7, lines 24-25 HCHO is well correlated to the BB in this manuscript. However, it might not be true at different place and time where/when there are other major sources of HCHO (High concentration of HCHO does not mean there is BB event nearby at any place and time). Thus, authors need to carefully state this sentence, which is one of the major conclusions, with specific time and location throughout the manuscript (e.g., BB is the major sources of HCHO at this time and location, with reference if available).

C2

- Specific Comments

Page 3, lines 25-28 Please add radiometric calibration method and accuracy for sky-scan (diffuse sky) measurements of Sky radiometer.

Page 6, lines 7-9 Please describe oversampling, typical SNR for the trace gas retrieval.

Page 6, lines 10-12 Please add more description of information content (e.g., degrees of freedom) of HCHO, CHOCHO, NO<sub>2</sub> profile retrievals.

Page 6 Please add table or description of fitting windows, cross section database (including their reference) of each species.

Page 7, lines 9-10 Please insert a sentence that describes why RGF is important for atmospheric chemistry.

Page 7, lines 10-12 This sentence is not clear to me. Do you mean this? : 'HCHO was chosen as a standard tracers of BB, since it has the longest lifetime among the three potential BB-originating trace gases investigated here (i.e., HCHO, CHOCHO, and NO<sub>2</sub>).' If so, please suggest their typical lifetime (with references) to clarify this sentence.

Page 7, lines 12-13 Please suggest statistics (e.g., correlation coefficient, RMSE)

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