

# ***Interactive comment on “An adaptation of the CO<sub>2</sub> slicing technique for the Infrared Atmospheric Sounding Interferometer to obtain the height of tropospheric volcanic ash clouds” by Isabelle A. Taylor et al.***

## **Anonymous Referee #3**

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The paper describes the possibility to use the CO<sub>2</sub> slicing established technique to retrieve the top height of tropospheric volcanic ash clouds. The topic is really interesting because the plume altitude is an input of many retrieval scheme and a good estimation of the height is essential to obtain accurate values of ash properties (aerosol optical depth, effective radius, abundance and concentration). The authors adapted and applied the CO<sub>2</sub> slicing method to IASI multispectral measurements. Simulated ash spectra were used to select the most useful channels and to validate the procedure, showing good results. Then the technique was applied to real ash spectra from 2010-

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2011 Eyjafjallajokull and Grimsvotn eruptions and compared with the results obtained from an optimal estimation scheme and with CALIOP measurements. The manuscript is well written and clear, the work is scientifically accurate and correct. I would recommend publication with some minor changes listed below.

#### Specific Comments:

- In the description of simulated ash spectra (section 4.1, page 6, lines 6-7), are specified the AOD, Effective Radius and Cloud Heights ranges used, but no reference about the ash type considered, that is the aerosol optical properties (extinction and absorption coefficient, asymmetry parameter, ecc . . .) used in simulation. Which ash type was used? Andesite? Obsidian? Pumice? Other?

- Why you use different AOD and Effective Radius ranges for channel selection (section 4.1) and simulation results (section 4.2)? AOD=5-15 and Ref=5-10 micron for channel selection, AOD=0.5-15 and Ref=1-10 micron for simulation results. Can you explain better?

- I think it would be very interesting to evaluate the heights obtained from CO<sub>2</sub> slicing as a function of AOD, Ref and cloud top pressures. In fig. 6 (g-i) are shown the frequency for which the CO<sub>2</sub> slicing was unable to return a height value. I suggest to insert 3 similar panel to show the frequency for which the CO<sub>2</sub> slicing returns a good value (for example a value that differ from the truth max +/- 500 meters or +/- 1 km). In this way we could better understand in which conditions the CO<sub>2</sub> slicing is applicable and reliable.

#### Technical Comments:

- Page 4, line 1: transmittance is not radiance, so it can't be "emitted" . . . . I suggest to replace the sentence with: "the atmospheric transmittance at channel  $\nu$  of the layer between the pressure level  $p$  and the instrument (top of atmosphere)".

- Page 5, line 3: "with" instead of "which" ?

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- Page 10, line 6: here you said “4 days” for Grimsvotn eruptions, while in fig. 7 the days are only 3 (20110521 PM, 20110522 AM, 20110522 PM, 20110523 AM).
- Figure 2: the y-label is “Pressure (mbar)” not “Altitude (km)”.
- Figure 3: the x-label of the last two lines is missing (“CO2 Wavenumber (cm-1)”).
- Figure 4: the same as above.

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