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Atmospheric Measurement Techniques Discussions

Interactive comment on "Ash and ice clouds during the Mt. Kelud Feb 2014 eruption as interpreted from IASI and AVHRR/3 observations" *by* Arve Kylling

Anonymous Referee #1

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General comments:

In this paper, the Mt. Kelud volcanic eruption cloud of February 2014 has been analyzed by using AVHRR/3 and IASI measurements. In particular, the different capabilities of the two instruments to detect volcanic ash have been discussed and the effect of the ice cloud presence analyzed. The results show that the hyperspectral IASI gives increased sensitivity to the presence of volcanic ash compared to the multispectral AVHRR/3. The comparison between the IASI measured spectra and the modelled spectra, suggest the presence of both ash and ice clouds in the scene. The ice cloud presence reduce the ash needed to reproduce the IASI spectra of a factor of 14 compared with the 'ash only' scene.

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Discussion paper

The paper is well written and interesting. However, some clarifications should be introduced to improve the paper comprehension.

Specific comments:

p.1, “Introduction”: Clarify if the ice cloud origin is volcanic. If yes, discuss briefly the ice formation mechanism and introduce the corresponding bibliography (ex.: Rose et al., 2nd Int. Conf. on Volcanic Ash and Aviation Safety, 2004; Durant et al., JGR, 2008).

p.2, r.27: Mt. Kelud is placed near the Equator and, in this region, the water vapour columnar abundance is in general high. As shown by different authors (Prata and Grant, Q. J. R. Meteorol. Soc. 2001; Corradini et al., 2008), the water vapour radiative signal can counteract, and in some cases delete, the ash signal. Could, the atmospheric water vapour, be the reason why the AVHRR/3 system is not able to detect the volcanic ash on 15 February? Has the author applied a correction to take into account of this effect?

p.2, r.28: Which is the time of acquisition of the 15 February AVHRR/3 image? Why an interval (0229-0235 UTC) has been inserted, instead of a single time (as for the 14 February image for example)? Is, this scene, the combination of two images? Please clarify.

p.3, Figure 1: Substitute “plot” with “panel”.

p3., r.15-16: What it is not so clear to me is why the 1097.25 cm-1 channel is considered. This channel is “little affected” by the SO2 (as stated by the author). If the aim is to avoid the SO2 influence, why a channel outside the SO2 signature has not been considered? For example a channel around 1070 cm-1.

p.3, r.18-19; p.4, r.1-2: The simulations realized to compute BTDI for different SO2 amounts, give the values of -0.31, -0.99 and -0.47 for 0.13, 10 and 100 DU respectively. Why the BTDI values are not monotonic (growing the SO2 amounts)?

p.4, Figure 2: Substitute “plot” with “panel”.

p.3, r.15: Insert “,” between “channel” and “radiative”.

p4., r.4-6: This sentence is not clear to me. What does it mean that “using the 1097.25 cm−1 channel instead of the 1168.25 cm-1 channel implies that the wavelength dependence of the refractive index of water ice may have an effect”? The refractive index is higher (which part?) at 1097.25 cm−1 instead of 1168.25 cm-1? Could you plot the real and imaginary parts of the refractive index for this wavelength range? Moreover, also the water droplets should have the same effect, then also these clouds could affect the volcanic ash cloud detection.

p.4, r.8-12: Being 1.5 K the BTDI threshold over which the pixels are certainly affected by the presence of volcanic ash, the volcanic ash area extent, shown in Figure 1 and 2 (right panel), represent a sort of ‘minimum’ area affected by volcanic ash. ‘Minimum’ because if the ice content is greater than 0.1g/cm3, the BTDI threshold should be lower, than more pixels could satisfy the condition. Is it correct? Please clarify.

p.5, Caption of Figure 3: Insert the description of the two dashed vertical lines.

p.5, Caption of Table 1: Delete “.” after “BT4-BT5”. The BTDA values are in column 8. Insert the “reff” definition.

p.6, r.10: Which surface temperature has been used for the simulations of the IASI spectra?

p.9, r.3: The “magenta” line seems “green” in Figure 5 right plot.

p.9, r. 19-20: From Figure 4, left plot: the BT spectra increase above 1200 cm-1 only for Ash (A). For Ash (B) and Ash (C) it decrease.

p.10, Figure 6: The brown lines can be confused with the red lines. Could you change the color from brown to green?

p.11, r.7: Could you please insert comments on the results shown in Figure 8 and 9? In particular emphasizing the differences between the two days.

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