

DETAILED COMMENTS for AMTD Manuscript ID

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”Impact of meteorological clouds on satellite detection and retrieval of volcanic ash during the Eyjafjallajkull 2010 and Grmsvtn 2011 eruptions: a modelling study”

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The manuscript details studies of retrieving volcanic-ash loading in the presence of clouds, using a combination of synthetic and SEVIRI radiances.

Using infrared channels to detect and mitigate atmospheric dust and volcanic ash is now becoming routine for hyperspectral atmospheric sounders such as AIRS and IASI (and the newer CrIS); the experience gained can be cross-applied between SEVIRI and the sounders, with the caveat of broader SEVIRI channels ($\simeq 150 \text{ cm}^{-1}$), compared to the other instruments ($\simeq 1 \text{ cm}^{-1}$).

I assume the authors are using Channels 6 and 7 (shown in eg http://nwpsaf.eu/downloads/rtcoef_rttov11/ir_srf/rtcoef_msg.3_seviri-ir_ysrf.html); one sees the response of Ch 6 begins to tail off in the 1000 cm^{-1} region, where dust absorption is close to its peak. This must affect the threshold detection of dust by SEVIRI, compared to the higher spectral resolution sounders, leading to the smaller ($\simeq 20\%$) rates under low-ash loading.

Presently many dust detection/volcanic ash detections and retrievals with hyperspectral sounders assume dust filling the FOV; this current paper goes some way to exposing the realistic problems of the dual presence of ash and clouds, though the hyperspectral sounders have more channels and hence are more effectively able to mitigate dust/ash and clouds.

The paper is well written, as the the authors have explained their methodology in detail. As such, the paper can be shortened and a few figures removed. For example Figure 15 could be removed; in its place a table summarizing eg the detection efficiency could be inserted. In addition, the authors should remind the reader that their studies are equally applicable to atmospheric dust.

The paper has no outstanding issues and can be published after some minor corrections.

1 Comments

- Abstract, could be shortened.
- Pg 11306, line 11 : Not sure what the authors mean by "experimental methods"; are they referring to having an ice/water cloud together with suspended ash particles, in a laboratory situation? Perhaps they should re-phrase this as "realistic atmospheric conditions"
- Pg 11306, line 15 and Pg 11307, line 27 : there is not much scattering in the thermal IR. Can the authors explain why they needed to do a 3d radiative transfer simulation?
- Pg 11308, line 15-20 : Could the authors relate dust loading (eg 0.2 g/m²) to aerosol optical depth (eg 1 g/m² = x OD at 0.55 um)
- Pg 11309, line 12 : The volcanic events were in April/May so the WV profile should be average between subarctic summer and winter? Actually it is not obvious why could the authors not use the ECMWF WV model fields?
- Pg 11309, line 21 : Not sure I understand why there is such a small standard deviation of 0.25 K; looks like your simulations captured the dynamic range of 220 K (when clouds present) to 290 K (low dust/cloud loading). I believe you mean the std.dev of the BT10.8 - BT12.0 simulations?
- Pg 11311 : The OEM retrieval description is adequate; however it could be supplemented with a simple RT equation? Since the authors only parametrize BT10.8, BT12.0 in terms of surface temperature, ash/cloud amount and ash/cloud height, are they effectively assuming eg

$$R = \epsilon R_0 e^{-\tau/\sec(\theta)} + B(ash)(1 - e^{-\tau/\sec(\theta)})$$

Else there are slight lower altitude emission effects, especially at 12 um (since there is WV continuum absorption, though one could argue this is negligible at low wv amount of April/May in Europe); in addition there are competing cloud effects as well.

- Pg 11312, line 26 : in addition there are time-mismatch between the ECMWF model fields and SEVIRI observations.
- Pg 11315, Line 5 : diurnal variation due to surface effects?

- Pg 11315 : Possibly the broadband SEVIRI detectors mean only "higher" ash loading can be detected. Again, a conversion from ash loading → OD would be helpful.
- Pg 11316, Line 1 : As mentioned earlier, using subarctic summer WV profile for April/May simulations maybe incorrect, though you do discuss this on pg 11320, Lines 20-28. Perhaps rearrange this discussion so it comes earlier?