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Atmospheric Measurement Techniques Discussions

Interactive comment on "Impact of meteorological clouds on satellite detection and retrieval of volcanic ash during the Eyjafjallajökull 2010 and Grímsvötn 2011 eruptions: a modelling study" *by* A. Kylling et al.

Anonymous Referee #3

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In this study a multi-model approach is used to assess the impact of liquid water and ice clouds on traditional "split-window" ash detection and ash cloud property characterization. As has been known for a very long time, meteorological clouds impact the "split-window" satellite measurements, causing some ash to go undetected and some estimates of mass loading to be biased. While this study highlights an important issue, there are a few issues that need to be addressed prior to publication.

Specific issues that should be addressed prior to publication

1. The authors fail to recognize previously published alternatives to the traditional "split-window" approach (see references below) that are not as strongly impacted by underlying meteorological clouds. While I agree that dispersion and transport models should play a role in ash detection, the "split-window" approach has been and continues to be greatly improved upon, mitigating many of the issues highlighted in this paper. The authors are encouraged to recognize these more sophisticated ash detection approaches and indicate that improvements to remote sensing techniques are just as important as merging satellite with models.

Clarisse, L., P. Coheur, F. Prata, J. Hadji-Lazaro, D. Hurtmans, and C. Clerbaux (2013), A unified approach to infrared aerosol remote sensing and type specification, Atmospheric Chemistry and Physics, 13(4), 2195-2221, doi:10.5194/acp-13-2195-2013.

Clarisse, L., F. Prata, J. Lacour, D. Hurtmans, C. Clerbaux, and P. Coheur (2010), A correlation method for volcanic ash detection using hyperspectral infrared measurements, Geophysical Research Letters, 37, doi:10.1029/2010GL044828.

Gangale, G., A. Prata, and L. Clarisse (2010), The infrared spectral signature of volcanic ash determined from high-spectral resolution satellite measurements, Remote Sensing of Environment, 114(2), 414-425, doi:10.1016/j.rse.2009.09.007.

Mackie, S., and M. Watson (2014), Probabilistic detection of volcanic ash using a Bayesian approach, edited, J. Geophys. Res. Atmos, doi:10.1002/2013JD021077.

Pavolonis, M. (2010), Advances in Extracting Cloud Composition Information from Spaceborne Infrared Radiances-A Robust Alternative to Brightness Temperatures. Part I: Theory, Journal of Applied Meteorology and Climatology, 49(9), 1992-2012, doi:10.1175/2010JAMC2433.1.

Pavolonis, M., W. Feltz, A. Heidinger, and G. Gallina (2006), A daytime complement to the reverse absorption technique for improved automated detection of volcanic ash, Journal of Atmospheric and Oceanic Technology, 23(11), 1422-1444,

doi:10.1175/JTECH1926.1.

Pavolonis, M., A. Heidinger, and J. Sieglaff (2013), Automated retrievals of volcanic ash and dust cloud properties from upwelling infrared measurements, Journal of Geophysical Research-Atmospheres, 118(3), 1436-1458, doi:10.1002/jgrd.50173.

2. The authors should document the source of spectrally resolved surface emissivity data used in the radiative transfer simulations.

3. The authors emphasize that the size of the ash cloud detected by the simple "split-window" technique that is rarely used anymore, is greatly underestimated relative to the FLEXPART simulations. This conclusion is severely misleading and should be modified. For instance, in an operational environment, forecasters make heavy use of pattern recognition in addition to the actual value of the "split-window" BTD's. Thus, the area of ash manually derived by a human expert would be much more similar to the FLEXPART results. In other words, the "split-window" BTD is rarely used by itself! The author's really need to add this caveat to the abstract and many body of the paper prior to publication because the amount of ash missed in this study is not consistent with real world results.

4. The commentary on the impact of large viewing angles is incomplete. While it is true that large viewing angles can cause more false alarms in the traditional "split-window" method (large viewing angle false alarms are less problematic in more advanced ash detection methods), large viewing angles can also increase the detection efficiency in practice (see reference below). The authors should modify their discussion accordingly.

Gu, Yingxin, Rose, William I., Schneider, David J., Bluth, Gregg J. S., and Watson, I. M., 2005, Advantageous GOES IR results for ash mapping at high latitudes: Cleveland eruptions 2001: Geophysical Research Letters, v. 32.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 11303, 2014.