

***Interactive comment on* “Simulation of SEVIRI
infrared channels: a case study from the
Eyjafjallajökull April/May 2010 eruption” by
A. Kylling et al.**

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Overall response to interactive comments from the Referees

We thank the referees for constructive comments to our manuscript. While revising the manuscript, an error in the calculation of the optical properties of the ash particles surfaced. This error led to a factor 3 too large ash absorption optical depth. The correction of this error has drastically improved the agreement between the simulated and measured brightness temperature differences (Figs. 6 and 7). In addition to this

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correction, numerous changes have been made as suggested by the referees. Some of these changes were suggested by two or more of the referees. They are addressed first and referred to in the individual answers to the referees.

1. All three referees have questioned the use of a constant water vapour profile over the whole domain. As mentioned in the manuscript this was done for technical reasons. While revising the manuscript simulations were made with a one-dimensional code that allow the variation of water vapour to be included. Simulations with a fixed water vapour profile and one with water vapour from the ECMWF were compared. Brightness temperature differences in the ± 1.5 K range were found between the two simulations. The 10.8-12.0 μm brightness temperature difference is on average overestimated by 0.2 K using a constant water vapour profile. The impact of using a constant water vapour profile is discussed in the revised manuscript.
2. Referees #2 and #3 questions the use of constant liquid and ice water cloud radii. In the revised manuscript we have adopted the parameterisations used by Bugliaro et al. (2011). The effect of including liquid and ice water cloud parameterisations for the effective radii is readily seen in the revised left panel of Fig. 6. The impact is largest for high ice clouds where a fixed effective radii may overestimate the brightness temperature by up to about 15 K. For brightness temperature differences used for ash discrimination, bottom panel Fig. 7, the difference between using fixed effective radii and the above mentioned parameterisation is small. The paragraph describing the choice of effective radii has been rewritten to reflect the changes in the approach. In addition, the description of the optical properties of ice clouds have been clarified, including the citation of the correct Yang et al. (2005) paper.

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3. Emissivity was set to a fixed value of 1 in the original manuscript. In the revised manuscript the emissivity has been taken from Borbas and Ruston (2010). The use of this emissivity atlas resulted in a decrease of the brightness temperature of about 0.5 K over ocean regions. The largest decrease of 4 K was seen over the Sahara. The use of the emissivity atlas is mentioned in the revised manuscript.
4. Table 1, the text where appropriate, and all relevant figures have been updated to reflect the changes due to the points mentioned above.

Response to interactive comments from Referee #1

Specific comments:

1. The computing time of the Monte Carlo code will depend on the number of scattering events. For the simulations in the manuscript the model was run on a cluster. Typically 10 nodes were used giving a total run time of about two hours for a single channel and scene. As such the model is not applicable for operational use in its present configuration. The computing time is briefly mentioned in the introduction of section 3 in the revised manuscript.
2. The mentioned paragraph on 3-D and 1-D temperature dependence has been clarified.
3. Concerning the use of a constant water vapour profile for the whole domain, please see overall response above.

4. The wording is unfortunate in the manuscript and has been clarified. The density here is, for example, the liquid water content for the water clouds, etc.

Technical comments:

1. “UK Met. Office” changed to “UK Met Office”.
2. “August” changed to “April”.
3. The panels in Fig. 4 are correctly identified in the revised manuscript.
4. See above response.
5. See above response.
6. See above response.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 7783, 2012.

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