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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieval of SO_2 from thermal infrared satellite measurements: correction procedures for the effects of volcanic ash" *by* S. Corradini et al.

Anonymous Referee #1

Received and published: 24 March 2009

General:

The paper presents a method to correct for the influence of ash on retrievals of SO_2 from mid-IR nadir sounding spectrometers. The manuscript is well structured and written. The results clearly demonstrate the necessity for such a correction, since otherwise the SO_2 abundances would be largely overestimated. The method is demonstrated for the example of MODIS and SEVIRI observations of an eruption of Mt. Etna. My main comment concerns the explanation of the differing results obtained by the two instruments and the lack of discussion of further possible error sources.

Specific:

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Interactive Discussion
Discussion Paper

p.308, l.16...: 'The effect of ash at 7.3 μm is much less important and the radiance percentage difference results are always less than 3% for all the simulations considered.'

Can you explain why ash has so little effect at 7.3 μm compared to 8.7 μm? Do you consider the same altitude profile for SO_2 as for ash (boxcar from 4-5km) or is SO_2 also present at higher altitudes? Has ash a stronger absorption at 8.7 μm and how strong does this depend on the chosen composition of the ash?

p.309, l.16: Eq. (1)

Why are the relative radiance differences (squared) minimized instead of the square of the absolute radiance differences? The reason might be the definition of the channel weight w_j. Can you define this more clearly in the text?

p.311, l.5:

Which width of the log-normal distribution has been used?

p.311, l.5:

What was the reason to use andesite refractive index? How strong is the influence of the refractive index on the results for the example case?

p.316, l.7...:

The passage should be re-worded to make clear that the water vapour influence is the major reason for the differences between both channels.

p.318, l.18: 'This can be explained considering that SEVIRI has a higher NEΔT (i.e. lower sensitivity), and smaller ground pixel resolution than the MODIS instrument.'

The explanations given for the large differences between the two instruments do not convince me:

I don't think that a higher spectral noise (NEΔT) can explain this: first, why should a higher noise lead to generally lower values for aerosol mass and SO_2? I would

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anticipate a larger standard deviation in the results but not generally a systematic bias. Second, as stated by the authors earlier in the text, the noise of SEVIRI is even lower than that of MODIS in the 7.3 μm channel.

Thus, I think it would be necessary to perform a quantitative estimation of the error induced by the spectral noise on the SO_2 retrieval.

The smaller ground pixel resolution of SEVIRI is given as another explanation. I don't understand why this should reduce the retrieved values, especially the mean value for the whole plume. Could you explain this in more detail?

I think it is also necessary to discuss further possible reasons for the observed systematic differences. Therefore, at least in the conclusions further systematic possible error sources for the SO_2 retrieval should be discussed.

Technical:

p.317, l.16, p.320, l.17

criteria -> criterion

Figs. 6 and 12

The colour scales for the aerosol optical thickness should be made equal.

Interactive comment on Atmos. Meas. Tech. Discuss., 2, 303, 2009.