Interactive comment on “Retrieval of sulphur dioxide from the infrared atmospheric sounding interferometer (IASI)” by L. Clarisse et al.

Anonymous Referee #3

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This paper describes an SO2 retrieval scheme for space-based infrared sounding instruments such as IASI on MetOp-A, designed for near real-time volcanic cloud measurements. It is a useful contribution that describes the theoretical basis of the algorithm, the applicable range of SO2 columns, the associated errors, and the sensitivity of the retrieval to ash and ice in the volcanic cloud. I can recommend publication after attention to the following mostly minor issues:

P7242, L7: 500 hPa is a pressure level not an altitude; convert to approximate altitude?

P7242, L21-2: list references in chronological order (unless AMT policy dictates otherwise).

P7243, L2: change ‘space’ to ‘satellite’, also on line 4.

P7243, L4: can use ‘IR’ instead of infrared hereafter.

P7243, L13: the wording here suggests that TOMS is still making measurements, but the final TOMS mission ended in 2005.

P7243, L21: change to ‘For an overview of satellite instruments capable of...’.

P7243, L25, 29: for the benefit of non-spectroscopist readers, it might be useful to give wavelengths for the SO2 absorption bands in addition to wavenumbers.

P7244, L7: although it is pointed out later on, it would be worth also stressing here that all IR measurements require thermal contrast between the SO2 plume and the underlying source of radiation.

P7244, L21: ‘...using high spectral resolution instruments...’

P7244, L23: I’m not sure that the time constraints are that significant these days – except when retrievals are required in ‘near real-time’ for hazard mitigation.

P7245, L21: need to explicitly state here that Tc is cloud temperature, and also that Ts is measured brightness temperature.

P7249, L20: there is a very minor discrepancy between the 0.15K error for channel set 1 given here and the 0.14K given in Table 1 as the standard deviation.

P7251, L8: remove parentheses and use ‘quiescent’ or ‘passive’ instead of ‘quiescence’.

P7251, L14: I think ‘uniformly’ should be ‘uniform’ – meaning no spectral dependence in ash absorption across the v3 band? The authors could also comment on the effect of ash composition here.

P7251, L19-20: should be ‘optically thick’. ‘Lower lying thin to medium optically thick’ is a bit of a mouthful – perhaps replace with ‘Low-altitude aerosol layers of low-to-medium
optical thickness...’?
P7251, L21: by ‘close’ I presume you mean just below the SO2 cloud?
P7251, L28: switch to wavelength here is inconsistent with wavenumber used elsewhere.
P7252, L18-19: instead of ‘atmosphere’ I would use ‘UTLS’. There have been some large effusive eruptions that emitted large quantities of SO2 into the lower troposphere.
P7253, L2-4: Full sensor names should be given, if not given earlier, and whether they operate in the UV or IR.
P7253, L15: ‘injection altitude’.
P7253, L24: ‘shear’.
P7254, L17: ‘gridding’.
P7254, L22: use ‘2011’ instead of ‘this year’.

Fig. 2: please also give equivalent altitudes for the pressure levels, for the benefit of volcanologists.

Fig. 5: the parts of this figure overlap a bit and need some adjustment. Also, I think the ‘$\times 10^4$’ on the pressure axis should be ‘$\times 10^2$’

Fig. 9: label the color bars (I presume it is SO2 column in DU). It is also not clear what altitude is assumed for the displayed SO2 columns?

Fig. 11: surely this image shows more than just the ‘maximum observed SO2 columns’ for the 20 May – 30 June 2011 period, as stated in the caption. It seems to be a composite of all IASI SO2 retrievals in this period.

Fig. 12: could dates be provided for each panel in this figure?