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Atmospheric Measurement Techniques Discussions

Interactive comment on "Volcanic ash detection with infrared limb sounding: MIPAS observations and radiative transfer simulations" *by* S. Griessbach et al.

Anonymous Referee #1

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General Comments

I thought that this was a good paper which develops the volcanic ash "reverse absorption" technique to be applicable to limb sounders such-as MIPAS. The authors use the Puyehue-Cardon Caulle eruption in 2011 to evaluate a detection threshold. A series of theoretical sensitivity experiments are conducted with ice, ash and sulphate aerosol refractive index data to evaluated the detection threshold. This provides a useful technique to detect and gain height information that will be useful when new limb instruments are launched to complement the information from nadir sounders.

I would recommend publication following the minor revisions highlighted in the sections below.

Specific comments

(1) pg 9941, line 2: the interest for climate work is emphasised but no mention is made for the impact on aviation. As this method provides information on the ash altitude it would provide useful additional information for volcanic ash advisory centres. A sentence should be added with a suitable reference to detail the impact of ash on aviation. This point could also be added when discussing the ash altitude evaluations.

(2) pg 9942, line 9: The authors say that this is "for infrared limb measurements so far no method has been reported that specifically allows for volcanic ash detection", however there is a recent paper which detects volcanic ash using MIPAS data (Grainger et al, 2013). I recommend removing the above sentence and other comments related to this.

(3) pg 9945, line 18: the authors use the Volz 1973 refractive index data for volcanic dust. Why has this dataset been used? Why have other refractive index data not been considered? Is the Volz 1973 composition similar and comparable with the Puyehue-Cardon Caulle ash emitted in 2011?

(4) pg 9946, line 16: the particle size distribution has a constant width of 1.6 why was this value chosen? How sensitive is the detection to significant changes in this value?

(5) pg 9948, line 10: 12.2 km seems a very specific height and I couldn't find this information from the web link given. Perhaps "around 12 km" is more appropriate.

(6) pg 9950, line 19: the authors state that we expect to find volcanic ash in this region and give references. If the MIPAS detection was compared (in figure 7) to a SEVIRI disc (ash product or ash/dust rgb available from eumetsat) or a composition of MODIS or IASI images this would provide more compelling evidence to support the conclusion that MIPAS has successfully detected volcanic ash.

(7) Could the authors include some statistics on the number of false alarms and failed detection of volcanic ash.

(8) Could the authors include some details on the geolocation of the Tangent point. As accurately locating where the ash is located is vital for aviation.

(9) Fig 1, Fig 6, Fig 8, Fig 9, fig 10, Fig 13 are difficult to interpret because of the grayscale used. These would be much clearer if they were in colour.

(10) Fig 2: Why is 3.7 at the top of the legend rather than in the order set below it? Please change or add an explanation to the figure 2 caption.

Technical corrections

(1) pg 9940, line 2: change “troposphere” to “the troposphere” and “stratosphere” to “the stratosphere”.

(2) pg 9941, line 8: reword sentence beginning “Especially” to something like: “Infrared emission measurements are especially useful as they provide day and night observations”.

(3) pg 9941, line 11: add Prata 1989a as well to the Prata reference.

(4) pg 9941, line 13: add e.g. before Barton et al. as the list of papers provided is not an exhaustive list.

(5) pg 9941, line 19 to 25: this sentence is too long and hard to follow, consider rewording and breaking in several smaller sentences.

(6) pg 9942, line 1: replace “to detect” with “the detection of”

(7) pg 9942, line 1: remove “Consecutively” because its unnecessary

(8) pg 9942, line 12: change “in particular MIPAS” to “using MIPAS data” and remove the comma.

(9) pg 9944, line 4: change “index i” to “index i, respectively”

(10) pg 9945, line 3: change “works” to “work”

(11) pg 9946, line 24: change “equal 5” to “equal to 5”

(12) pg 9950, line 13: “This does not change the result” at all or significantly?

(13) pg 9951, line 26: remove first and and replace with comma

(14) pg 9952, line 10: change first sentence to “Wen and Rose (1994) found a stronger sensitivity on the size distribution than the refractive index for volcanic ash therefore the microphysical properties are restricted to one refractive index dataset per particle type and the particle size distribution is varied.”

(15) pg 9954, line 7: change “equal 6” to “equal to 6”

(16) pg 9958, line 11: change strongest for largest

(17) pg 9958, line 11: change “yr of Mt.” to “years, Mt.”

(18) pg 9958, line 17: change oxidated to oxidised.

(19) pg 9958, line 18: change over to in

(20) pg 9958, line 26: remove last sentence and add “giving confidence in our ash detection methodology” to the end of the previous line.

(21) pg 9958, line 28: remove the before sulphuric acid.

(22) pg 9958, line 29: replace having with have.

(23) pg 9959, line 16: change from to using.

(24) pg 9959, line 25: add shown after eruption.

(25) pg 9960, line 10: change “also is” to “is also”

(26) pg 9960, line 11: smoke? Can you be more specific, black carbon forest fires?

(27) pg 9962, line 10: change “to estimate the layer bottom altitude” to “the layer bottom

altitude to be estimated”

(28) pg 9962, line 24: change sentence beginning “These windows” to something like “These window channels can be used to discriminate ash and meteorological cloud because of the spectral gradient produced by different particulates.”

(29) pg 9963, line 21 sentence beginning “We found” needs re-wording.

(30) Fig 7: consider making the black dots smaller for clarity. Change text from “with volcanic ash detections” to “where volcanic ash was detected”

(31) Fig 8: define th in caption or change “tangent altitudes” to “tangent heights (th)”

References: Grainger, R. G., et al. "Measuring Volcanic Plume and Ash Properties from Space." Remote-sensing of Volcanoes and Volcanic Processes: Integrating Observation and Modelling, edited by: Pyle, DM, Mather, TA, and Biggs, J., The Geological Society Special Publication 380 (2013).

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 9939, 2013.