**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Monitoring volcanic ash cloud top height through simultaneous retrieval of optical data from polar orbiting and geostationary satellites" *by* K. Zakšek et al.

Anonymous Referee #1

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General comments

In this work the authors present a method to estimate volcanic ash cloud top heights (ACTH) using data from two satellite-based instruments, the geostationary SEVIRI and polar orbiting MODIS instruments. An image matching technique is described and applied to the Eyjafjallajökull eruption in April 2010. Besides of using two separate satellite instruments, the authors suggest two novel ideas: (1) ACTH is based on 'intersection line distance', allowing quality estimation, and (2) the effect of wind is minimized by using interpolation from two consecutive images from SEVIRI.

The review of existing height estimate methods is extensive and clearly points out the

strengths and limitations of different methods. However, the article lacks a quantitative comparison between the suggested new method and most of the existing ones.

The article is moderately well written, and presents an interesting new application of the known stereo height estimate methods. I recommend the article to be published in ACP with slight modifications.

Specific comments

1) Section 2.3: It is not explained how the ACTH is obtained by the absorption techniques. Can the method be briefly described?

2) Section 2.4: It is not mentioned what instruments have been used for obtaining ACTH using trajectories. What is required of these instruments (i.e. in terms of revisit times)? How do the result compare to those obtained by other methods?

3) Section 3: It is not explicitly mentioned which channels of SEVIRI and MODIS are used in the image matching. Does the result depend on the choice of channels? Does the different path length in atmosphere have an effect?

4) Section 3.2: The description of the area-based image matching method (p. 25628-25629) is not very clear and needs clarification. Perhaps a schematic illustration of the method could be presented.

4.1) Specifically, it is not explicitly explained over what range the sums in Eq. (1) are calculated, given that the 'search subset' and 'reference subset' are of different size. Is it implied that in the first image there is a fixed window of the size of the 'moving window' (NC2 x NL2), centered at position C,L, and that the moving window in the second image is compared against this, with different shifts? In other words, is it implied that the 'reference subset' determines the size (NC2 x NL2) of the moving window, and the 'search subset' merely limits the amount of the shift allowed? If the search window size determines the maximum shift (13-7=6 pixels), how is it possible to have shifts of over 10 pixels in Fig. 5?

4.2) Image pyramid method (p. 25629): It remains unclear how the image pyramids are used. Are the mentioned averages (3x3 and 9x9) calculated as moving averages, or are the image data regridded to coarser resolution? Do the mentioned window sizes (7x7 and 13x13) refer to the original resolution? If so, how is it possible to find decent correlations using a 7x7-moving window in a 9x9 averaged grid?

4.3) If the maximum shift is limited in the method, it should be described what is the corresponding maximum ACTH.

5) Section 4: It is not explained how the ash is generally distinguished from meteorological clouds (although BTD is mentioned). Is there an automatic process that can be used, or is the analysis made 'by the user'? In some parts of the discussion it seems that ACTH is confused with CTH; for example, is the data in Fig. 7 for ash contaminated pixels only (as implied in the text), or for all clouds?

6) Section 5: It would be useful to discuss the cloud top wind speeds associated with the interpolation between the two SEVIRI images, and in connection to the column shifts (Fig. 5c).

Technical corrections

p. 25618, L25: 'restricted to their exceptional spatially and temporal availability'; Do you mean 'restricted to their specific spatial and temporal availability' ?

p. 25621, L1: 'Additional inaccuracy brings the instability of the temperature profile near the tropopause'; The sentence is unclear. Do you mean 'Additional inaccuracy is caused by the instability of the temperature profile near the tropopause' ?

p. 25621, L13: 'currently launched'; Do you mean 'recently launched' ?

p. 25622, L21: It is unclear to whom 'They' refers to. Do you mean 'O'Hara and Barnes showed that...' ?

p. 25629, L9: 'generate' -> 'generates'

p. 25631, L7: 'Island' –> 'Iceland'

p. 25631, L26: 'rise' –> 'rises'

p. 25632, L28: 'Spatial distribution of CI...' I suggest rephrasing this sentence.

p. 25636, L20: What is meant by 'manual selection' ? Does this mean that the horizontal parallax is manually estimated from the images?

p. 25637, L1: 'The ACTH error...' I suggest rephrasing this sentence.

p. 25653, Fig. 6: Reference to panel (b) is missing from the caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 25617, 2012.