

Interactive comment on “Tracking microphysical variations in emissions from Karymsky volcano using MISR multi-angle imagery, and implications for volcano geologic interpretation” by Verity J. B. Flower and Ralph A. Kahn

Anonymous Referee #2

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General Comments

The paper presents MISR data that are used, in combination with the MODIS thermal alerts, to investigate volcanic plumes from Karymsky volcano between 2000 and 2017. MISR retrievals showed 2-4 km high volcanic plumes having different particle types. From their analysis, the authors identified two eruptive cycles, producing plumes mainly composed by sulfate prior to 2010 and plumes with varying fraction of absorption particles after 2011. The analysis of MISR data is well written but, before the publication, the volcanological interpretation should be improved and validated with other data.

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Specific points

1. A detail description of volcanic setting and eruptions for the Karymsky volcano is lacking. The authors should cite other papers and go in depth on some works that could improve their understanding on typical volcanic activity (e.g. Johnson et al., 1998; Ozerov et al., 2003). In the 1.1. Karymsky volcano chapter, the authors should add a table which includes the eruptive events with their main features.

2. Volcanological interpretation is not well supported. Authors should improve the eruption description during MISR observations in chapter 4. It is not very clear what is the eruption style that MISR is detecting (e.g. ash emission, Strombolian activity, lava flow emissions). Although MISR is able to distinguish volcanic ash plumes from degassing/water vapor plumes, data shown in the paper are not able to define the eruption style. Furthermore, the classification among Strombolian or Vulcanian eruptions cannot be done only on the base of the column height or duration of the eruptive event. Finally, the differences among the eruption periods should be again supported by other data, mainly due to the small coverage of the MISR sensor (about 4%).

3. Authors state that MISR was able to detect particle fallout, physical aggregation, chemical evolution only qualitatively but they should clarify how they reached this objective point to point. To validate MISR data and their interpretations they could improve the analysis of MODIS data applying well known algorithms as the Brightness Temperature Difference (BTD) technique (Wen and Rose, 1994).

4. Volcanic plumes are strongly affected by atmospheric fields. The maximum distance reached by volcanic particles, for example, could depend on the wind speed and, mainly for this reason, I suggest to insert a new figure which includes wind profiles for each event retrieved by MISR.

Technical corrections

Replace the title ‘Tracking microphysical variations in emissions from Karymsky vol-

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cano using MISR multi-angle imagery, and implications for volcano geologic interpretation' with 'Tracking microphysical variations in emissions from Karymsky volcano using MISR multi-angle imagery, and implications for volcanological interpretation'

P1L15. Clarify the sentence. What do the authors mean for 'high volcanic surface manifestation'?

P1L16. Add the size.

P1L22. See specific points about the interpretation in terms of activity cycles.

P3L10. The authors state that MISR has the potential to distinguish the emission from (a) ash explosions, (b) pulsatory degassing, (c) gas jetting, and (d) explosive activity. May the authors identify those emissions for each MISR data shown in this paper?

P3L12-13. Delete this sentence. See specific points.

P3L18-20. This is in general true at the same atmospheric conditions. I suggest to delete this sentence.

P4L17. Explain 'derive proxy particles type'.

P5L3. Define SSA.

P5L13. Add the period.

P5L15. Add how the size, shape and absorption are retrieved by the MISR RA.

P5L20. Add the size retrieved by MISR for large, medium and small particles.

P8L15-17. Due the very few MISR observation rate (about 4%), this sentence is not well supported.

P9L14. Add the distance from the volcanic vent.

P10. Replace 'geological' with 'volcanological' in the sub-chapter 4.2.

P10L10. Improve the description of the eruptive phases.

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P10L24. I wonder if the shift from effusive to explosive activity is given only by the amount of ash in the atmosphere without taking into account the amount of sulfate/water that could be also high for both activities. May the authors add some references?

P11L2-5. Clarify this sentence.

P11L11. Fig. 4c is lacking.

P11L18. The hypothesis of pyroclastic flows should be justified by published papers or news from web-sites.

P11L26. Is MISR able to distinguish among sulfate or water vapor plumes?

P12L16-17. Clarify.

P12L21-22. Clarify.

P12L25. What is 'volcano's geologic evolution' for?

P12L28. The eruption style cannot be derived from MISR data analysis. See specific points.

P12L32. Add the classes.

P13L10-11. I wonder if this analysis is affected by the small percentage of MISR data respect to the eruptions happened in the same period.

P13L14. See specific comments on eruptive cycles.

P13L18-19. Are MISR data able to discriminate those processes? How?

References

Johnson, J.B., Lees, J.M., Gordeev, E.I. (1998), Degassing Explosions at Karymsky Volcano, Kamchatka, Geophysical Research Letters, DOI: 10.1029/1998GL900102.
Ozerov, A., Ispolatov, I., Lees, J.(2003), Modeling Strombolian eruptions of Karymsky

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volcano, Kamchatka, Russia, *Journal of Volcanology and Geothermal Research* 122, 265-280. Wen, S., and W. I. Rose (1994), Retrieval of sizes and total masses of particles in volcanic clouds using AVHRR bands 4 and 5, *J. Geophys. Res.*, 99, 5421–5431, doi:10.1029/93JD03340.

Figures

Figure 1 is not cited in the text.

Figure 2, 3 and 4. Add the scale in km.

Figure 7. Add the scale at the bottom of figures. In Fig. 7 B, the plume height of 7 km reached far from the volcanic vent is higher than the height above the vent. Why?

Table 1. Improve the eruption description.

I suggest to move the plots from the supplementary material to the paper and, moreover, add the plots 'height versus distance from the volcanic vent' as retrieved by the MINX software. Finally, the column heights reported in the paper should be above sea level.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2017-868>, 2017.