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Atmospheric Measurement Techniques Discussions

Interactive comment on "Improving automated global detection of volcanic SO_2 plumes using the Ozone Monitoring Instrument (OMI)" *by* V. J. B. Flower et al.

Anonymous Referee #1

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This paper introduces a new technique for automatically detecting volcanic eruptions using SO2 measurements from satellites. The description of the technique is, for the most part, clear and comprehensive, and the analysis of it effectiveness using SO2 information from the OMI sensor is thorough and the conclusions are sound. The incorporation of this technique as a tool to detect volcanic eruptions will enhance the capability for providing warnings to the general public and to the greater scientific community.

I do have a couple of comments:

1) The Support for Aviation Control Service also monitors SO2 and ash from the Ozone Mapping and Profiler Suite (OMPS) onboard the S-NPP satellite.

2) Although the technique is fully described, I am confused about a few aspects (which may display my ignorance more than anything else). The technique depends on analysis of sensor data in a defined area about a given volcano, either 2x2 or 4x4 degrees, to determine the existence of SO2 above background levels.

2a) The authors indicate that the noise from the larger 4x4 degree box would be an increase over that of the smaller one. That seems counter-intuitive to me. Wouldn't the noise reduce if you use the larger set of measurements available in the larger box?

2b) Since the box drawn around volcanoes is delineated in degrees, the actual areal size of the box used in the analysis changes with latitude. I'm unclear if, or how, changes in the actual areal size of the box affects the technique. For example, wouldn't the calculated noise inside the box change as the size of the box get larger as the latitude increases, and wouldn't that affect the threshold at which the technique was applicable?

In terms of presentation, the paper contains more than a few run-on sentences, many of which become garbled in what they are trying to present:

1) Introduction, second sentence:

"The addition of these particles can result in significant impacts locally as fine particulate matter in the atmosphere can cause significant health problems (Delmelle et al., 2002, Hansell & Oppenheimer, 2004) and impacts to the aviation industry (Miller & Casadevall, 1999; Prata, 2009) in addition to alterations to the radiative transfer rates through the atmosphere on a global scale as seen following the eruption of Mt Pinatubo (Self et al., 1993), in order to mitigate the possible impacts of volcanic eruptions timely warning of events are essential."

This is a run-on sentence, plus the thoughts the authors wish to impart have become garbled and hard, if not impossible, to untangle. The sentence should be broken up into smaller, more easily digestible (and less garbled) ones.

2) Introduction, third sentence is awkward. Instead:

“Since the installation of a global network of ground-based monitoring stations would be both costly and impractical, the use of satellite-based remote sensing data provides the spatial and temporal coverage necessary to facilitate the near-real time (NRT) monitoring of global volcanism (Brenot et al., 2014). “

3) Introduction, fourth sentence is again awkward. Instead:

Existing techniques employ a threshold approach in order to identify volcanic eruptions. This, however limits their capabilities in regards to smaller events and can be susceptible to the effect of high background noise levels.

4) Section 1.1, change sentence starting with “The technique developed by Brenot” to: The technique developed by Brenot et al. (2014) is subject to certain limitations when utilising UV data, including the systematic noise in the data leading to false alerts and the restriction of retrievals to those that assume a SO2 plume altitude in the lower stratosphere (STL).

5) Section 1.1, next sentence, should be a comma after altitude.

6) Section 2.1, remove the semi-colon in the sentence starting with “OMSO2 data currently”

7) Section 2.1. The following sentence is garbled and needs to be rewritten, preferably into smaller sentences:

“The use of one retrieval altitude reduces the need for user input or prior knowledge of the injection altitude of the plume however results in the overestimation of plume mass for features injected above the retrieval altitude therefore this method is for identification and alert purposes as opposed to accurate plume mass calculation.”

8) Section 2.4. The second sentence is again a run-on one and, again, the message becomes garbled:

“Significant differences in measured SO2 mass were found between the samples due to variations in eruption magnitude, background noise levels and SO2 emission strength displayed by the incorporated volcanoes preventing the calculation of a flat emission threshold for the classification of the eruptive events.” And, again, rewriting into two or three smaller sentences is needed.

9) In the third paragraph, c,orrectly should be correctly.

10) Section 4.1.1.

“Two additional alerts were generated as a result of a data gap in the OMI measurements (C10 and 24); this indicates that missing values (characterised by a blank cell to differentiate these from days with data available but no recordable SO2 10 emissions) are likely to be incorrectly classified by the incorporated model as volcanic events and therefore screening of samples for data gaps prior to incorporation into the model is required to prevent the classification of missing values as volcanic events.”

Although the above sentence is understandable, it would help to break it into smaller pieces.

11) Section 4.4

“Where high latitude data were available and incorporated into this trial (Bezymianny, Okmok and Cleveland) correct classification occurred in all but one of those days where data was available (one additional control sample characterised by no available data was misclassified) indicating the robust nature of the M3 pre-processing technique employed, however further investigation is required to accurately assess the capabilities in high latitude regions particularly regarding the influence of persistent cloud cover.”

The above is another run-on sentence, break into smaller ones.

“In order to resolve smaller plumes an instrument with a higher spatial resolution would be required however existing higher resolution instruments sacrifice temporal resolution in order to facilitate the identification of small features and therefore do not provide

the daily coverage necessary in the creation of a global near real time alert system."

Another run-on (and somewhat garbled) sentence, rewrite and break into smaller pieces.

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