

Interactive comment on “Automatic volcanic ash detection from MODIS observations using a back-propagation neural network” by T. M. Gray and R. Bennartz

Anonymous Referee #1

Received and published: 9 September 2015

The detection of volcanic ash plumes is an important scientific task with in particular relevant applications for aviation industry. There are several volcanic ash retrieval algorithms both for geostationary and polar orbiting satellites. Most of these retrievals are based on the split window technique analysing the brightness temperature difference in the range between 10 and 12 microns. Some algorithms use additional bands sensitive to water vapour and sulphur dioxide. The differences in the results between these algorithms are still quite large and there is clearly an ongoing need for research on this topic. This paper assesses these methods by training a neural net using the MODIS instrument.

C2888

The reviewer appreciates that the authors extended the Introduction since the first stage of the review process (usually foreseen for technical corrections) and included a broader discussion of the role of the paper in the context of previous work. The authors included the references recommended by the reviewer. I recommend the paper for publication and would like to highlight two aspects:

- The authors make use of HYSPLIT data which is an interesting and promising approach. - The paper discusses volcanic eruption events which are not heavily exploited by existing studies, in particular compared to papers demonstrating neuronal net ash retrievals on the MODIS instrument.

The paper can be considered as a first demonstration of the described methods only, in particular because both the training dataset and the verification are based on quite a small amount of data (see also specific comments below).

The paper is written well and the authors present useful additional details in the appendix.

Specific comments:

1.) p. 8758, line 1-5: Granules from the three eruptions in the appendix are used to train the neural net while the four eruptions in the paper are events independent of the dataset used for the training of the neural net (if I got it correctly). Maybe one could make this a bit more clearly here (or in section 2.4.1). I would also recommend to move the list of granules used for training from the supplement to the paper (sect. 3 of the supplement could be a table in the paper while additional details could be left in the supplement as it is).

2.) Supplement sect. 3: It should be discussed if it is appropriate to use one neuronal network for both MODIS instruments or if separate neuronal networks for Terra and Aqua are necessary. The instruments may suffer from different biases and degradation effects. Overpass times/observation geometries are also different and it appears that

C2889

this is not taken into account by the presented algorithm.

3.) If the algorithm is dedicated to be used both for day- and nightside, it would be good to demonstrate the applicability for at least one event on the nightside using an eruption independent of the training dataset.

4.) The algorithm clearly shows unreasonable high amount of ash cases at the edges of the granules. Is this effect caused by instrumental effects (e.g. biases in the satellite data) or more likely caused by the neuronal network algorithm (observation angles need to be taken into account in addition?)

5.) p. 8764 line 14-16: This sounds as if it is intended to use the algorithm operationally. I think the results shown in the paper do not yet demonstrate the applicability of the algorithm for operational use, because only 4 cases are shown. It is not clear from the paper how many mismatches are given by the algorithm if applied on a global data set (false ash positives far from eruptions). The sensitivity of the algorithm to transported volcanic ash far from source is not a topic of the paper as well. The paper should be considered more as a demonstration of the general applicability of the described methods.

6.) Fig. 1-4: Please add to the caption if MODIS/Terra or MODIS/Aqua granules are shown. The term "RGB" should be renamed to something like "ASH-RGB", "DUST-RGB" or just "false-color RGB" to make clear on a first look that this image is a composite of BT_D and BT in the TIR rather than a visual image (some readers may not know which wavelengths corresponds to the MODIS bands)

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 8753, 2015.