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Atmospheric Measurement Techniques Discussions

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 #2

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1. This paper aims to assess the ability to identify volcanic ash plumes and assess co-incident SO2 concentrations by training a neural net on four thermal IR metrics provided by MODIS. This is a valuable pursuit, given the global nature of MODIS observations and the well-known relationships between volcanic plume properties and the thermal IR bands used. Some additional work assessing more quantitatively the uncertainties in the MODIS training data, and maybe also the HySplit runs, would add considerable value to this study (see Notes 4 and 5 below).

2. P2, lines 20-23. Just some perspective on this point: Although CO2 concentrations might be reduced due to ocean fertilization, this also depends heavily on the degree to

which the iron in the ash is soluble, and on whether iron is the limiting nutrient in the water. Volcanoes can also be CO2 sources.

3. P2, lines 26-28. Again for perspective, it is possible that even the much larger number of smaller volcanic eruptions could have a cumulative climate effect by adding sulfate to the stratosphere (e.g., Solomon et al., Science 333, p.866, 2011).

4. P3, lines 22-23. It might be worth mentioning the estimated uncertainty in the ash concentration derived from HySplit. I'd expect HySplit to produce reasonable indication of ash plume location, but maybe not as good a constraint on concentration. Actually, I think you are mainly using ash location from HySplit in this study. Also, more could be reported about the data used to characterize the eruption occurrences for initializing the HySplit runs. (I do see that some qualitative discussion of the uncertainties in the plume characterization applied to HySplit is given toward the end of the Discussion section.)

5. P5, lines 28-29. For this technique to be generally useful, the uncertainties in the MODIS-derived volcanic ash discrimination used to train the neural net need to also be assessed. One way might be to compare the results with those from MISR, which has information about aerosol type based on differences in ash vs. sulfate particle size and shape. Such analysis is presented for a series of Mt. Etna eruptions by Scollo et al. (JGR 117, doi:10.1029/2011JD016625). SO2 discrimination could be validated using the uv detections from the OMI instrument (e.g., Yang et al., JGR 112, doi:10.1029/2007JD008825). MODIS also has an ice-detection channel at 1.38 microns that might be helpful here.

6. P6, line 18; Figures 1-4. You might explain the color scales associated with the right-side images in Figures 1-4. Also, it might be helpful to the make the ash and SO2-rich-ash detections more visible in Figure 1; if there are essentially no detections, then perhaps the caption could say so, so the reader doesn't struggle to find the signals in these plots.

7. P7, lines 23-27. In Figure 3, the ash detection (upper right panel) seems clearer than the SO2 detection (lower right panel), yet the discussion here seems to suggest the opposite.

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