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Atmospheric Measurement Techniques Discussions

Interactive comment on "Volcanic ash detection and retrievals from MODIS data by means of Neural Networks" *by* M. Picchiani et al.

Anonymous Referee #2

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Review: amt-2011-47 Volcanic Ash Detection and Retrievals from MODIS Data by means of Neural Networks M. Picchiani, M. Chini, S. Corradini, L. Merucci, P. Sellitto, F. Del Frate, and S. Stramondo

This paper describes application of neural network (NN) technique to detection and quantification of volcanic ash plumes from Etna volcano. The TIR measurements from MODIS satellite instrument are used to train and validate NN performance. To my knowledge this is first demonstration of NN technique to volcanic ash detection and column mass retrieval. The NN technique is compared with the established BDT technique applied to the same MODIS measurements. The subject is suitable for AMT and should be published after revisions and correction outlined below.

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Discussion Paper

General comments:

English language should be improved throughout the manuscript.

More “user-friendly” description of the NN technique would make the paper more interesting for a broader audience. From the practical point of view, the main question is whether the NN technique can be used by other researches (e.g., volcanologists, meteorologists) to study ash emissions from different volcanoes? Is the NN software publicly available and can it be customized for use with other satellite instruments and volcanic clouds?

The confident ash detection using NN technique was demonstrated for plumes in the near vicinity of volcano (p.8). Can the NN technique be improved to track long-range transport of volcanic ash clouds, not attached to the volcano?

The success criteria are that NN agrees with the operational BTD technique. How independent is NN technique from the operational BTD technique? Can NN technique detect ash where BTD fails detection or provide false detection?

Can the NN technique trained on this particular volcano be applied to a different volcano/eruptions? Such demonstration would broaden the application of the method.

More general test for NN method would be using completely independent satellite ash measurements from different instrument (e.g., Aura/OMI UV Aerosol Index data).

I suggest validation of the technique on dense dust clouds.

"specific comments":

I do not agree with the statement that current operational ash detection techniques are “so time consuming to prevent its utilization”: SEVIRI ash retrievals during Eyjafjal eruption were available in near real time.

Current satellite hyperspectral IR measurements (e.g., IASI) allow advanced ash height retrievals, particle composition, etc. Can NN scheme be trained to retrieve additional

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parameters (e.g. ash height)?

Technical corrections: 1. Ttile: . . . [from] -> using MODIS data ? Abstract: 18-22 : these sentences should move to introduction 25 MODIS [on board which satellite?] 27 ash [column?] mass 31-32 “confusion matrix” – not clear

Introduction 9 loss of power [and in extreme cases] failure . . . 17 explain acronym: BTD 18-21: reword sentence 29-30 Do not agree that traditional physics based retrievals are time consuming. Look up tables can be pre-computed allowing NRT traditional ash retrievals (e.g., BTD, UV Aerosol Index)

p3 7 “incorporate a priori knowledge and realistic physical constraints”, while on line 2 “independence from a priori constrains “ is claimed. Does training dataset plays a role of an a priori constraint in traditional inversion methods? 19 replace “phenomenon” -> cloud 21 quasi - > near 27 “morning overpass” – why the second night overpass is not considered?

p4 5 [Mt. Etna] is the largest and . . . 8 specify which gases ? 20. remove word “description” 21. Description -> Difference 25 what is “negative ash detection”? Change to “missing ash clods”. P5. 19 I wonder if more recent measurements of the ash refractive index exist, they should be quoted. Same for Etna mass density. 27 accordingly => according

p6 section 4.1 is too short. Expand or merge with section 4. 11. “most effective channels” – explain 3 channel selection. Are other MODIS channels not useful for ash detection? 13. Provide center wavelengths for MODIS channels used. 23-33. Understanding section 5 requires prior reading of all cited references, which limits its audience. I suggest shifting the focus to a more “user friendly” description of the NN model for a broader audience (e.g., volcanologists) and how it should be trained for volcanic ash detection? Is NN software publicly available? If so, how it can be customized and trained for different eruptions ? 33 remove “it”

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p7 23 This latter .. -> The latter 32 remove “off”

p9 16 different NN topologies – explain 19 “. . . all the MODIS” - remove “the” 22 “false positive ash detection” -> false ash detection 23 “of the ash . . . “ -> to the ash 28 Can BTD ash signal far from volcano be real? P10 3 “Confusion matrices” – clarify 5 “K coefficient parameters” - explain 13. “is the same of the ash detection” –> is similar to the ash detection

31.” always major..” -> always larger

33. remove “it”

P11

25 “development” -> processing 29 remove “the”

p18 Table 3 is missing

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 2567, 2011.