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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "PM_{10} measurements in urban settlements after lava fountain episodes at Mt Etna, Italy: pilot test to assess volcanic ash hazard on human health" *by* D. Andronico and P. Del Carlo

Anonymous Referee #3

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General Comments Many thanks for asking me to review Andronico & Del Carlo's manuscript on PM10 measurements near Mt Etna. The need for this sort of research and analysis is clear but this particular manuscript does not deliver results in a scientifically robust way so it is hard to draw any conclusions from this study.

It is the second time that I have seen this manuscript, given that it was submitted to another journal previously, and it is clear that the authors have not been able to address the major issues with this paper, except to imply in the Discussion that this is seen as

a pilot study. The authors attempt to correlate increases in airborne particulate with the November 2011 eruption of Etna. The premise for the manuscript is sound but the short duration of air quality measurements using the TSI DustTrak make the manuscript of poor scientific quality.

Specific Comments 1) The authors only measured PM10 for between 10-16 minutes at each of three locations (during two time periods). With this duration, it is not possible to draw statistically meaningful results from the data. Ten minutes of measurements result in only ten data points as the DustTrak was set to record only once per minute. The authors should have measured for 24 hours at each location, in order to compare with EU standards. If this was not possible, then at least four hours of measurement is necessary in order to collect sufficient data to smooth out the effects of factors affecting background concentrations (e.g., variations in traffic flow). It is also not clear why the authors were not consistent in the duration of their measurement (ranging between 10 and 16 minutes). 2) For unknown reasons, the authors chose to take measurements using the DustTrak at varying distances above ground level (1m, 80cm, 40cm) at the different locations. The instrument should have been set up at a standard level, using a tripod, so that data were directly comparable amongst sites. In addition, the DustTrak should have been set up at a height relevant to human exposure e.g., 1.5m, which is considered the 'breathing zone' for adults. Instead, all heights used are relevant to children/toddlers (1m and 80 cm) or are so low as to not be relevant to human exposure (40 cm). The amount of material suspended by vehicles changes rapidly with height above ground (Horwell et al. 2003) so the use of different heights unfortunately renders the data incomparable amongst sites. At heights for adult exposures, one would expect the readings to have been substantially lower than those observed here. 3) The authors do not present data on vehicle counts during this time so it is not possible to smooth the data according to factors affecting the background concentrations (vehicles would have been generating PM10). Also, collection of these data would have allowed quantification of traffic levels rather than generalised statements regarding traffic. 4) As the authors only had one instrument, data were not collected simultaneously amongst

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sites and, therefore, comparison is further complicated due to the likely changes in particulate concentrations as the day progressed. 5) Measurements in November and December were made on different week days (Tuesday and Thursday). Could local variables affect traffic counts on these days?

Due to these factors, the Discussion contains several statements which are greatly overstated given the data. For example: "... our study shows that the presence of fine grained tephra in the ground may be highly hazardous in terms of PM10 concentrations in the air when not quickly removed."

The final sentence of the abstract also greatly exaggerates the interpretation of the findings; just because there is PM10 in the air does not mean that there will be health problems. Ash clearance from the ground is expensive and disruptive so further evidence of health impacts would be required before this recommendation should be made. I suggest toning down this part of the abstract, especially as the authors only measured PM10 and not smaller fractions which are more likely to be hazardous.

Unfortunately, the submitted manuscript does not present scientifically important results. The authors only measured PM10 for between 10-16 minutes at each of three locations – a total of less than 1.5 hours' work - from which it is impossible to draw meaningful conclusions. The data give an indication that PM10 was significantly raised on 11 November, but I suggest that the authors take these data and use them to plan a further study during the next ashfall event. If they have only one DustTrak, I suggest they use just one location but set up the DustTrak as soon as possible during/after the event and leave it running for several days to show the inevitable decay of airborne dust concentrations over time (and how this varies according to weather conditions promoting dampening or re-suspension of deposits).

Technical Corrections 1) Page 3927, line 5 – The definition of PM4 and PM10 is incorrect (coarse particles of 4-10 μm diameter). PM10 is all particles sub-10 μm diameter and PM4 is all particles sub-4 μm diameter. 2) Page 3927, line 22 – please can the

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authors define what they mean by light, relatively heavy and serious fallout? 3) P3928, line 5 – please replace morphoscopic with morphological. 4) P3930, line 24 – the sampling name convention is confusing, using PM1, 2 and 3, which have been previously described in the text to mean 'particulate matter sub-x μm diameter'. This is very confusing. In the next line, please replace 'weight for m2' with 'mass per m2' to correct the English. 5) SEM data are not presented in the Results but are mentioned in the Methods. 6) For health, the aspect ratio of the particles could have been measured to give quantitative data on particle shape (and therefore the presence, or otherwise, of fibrous particulate). 7) P3934, line 4. The heading here is confusing – what pilot test are they referring to? It is possible they are meaning that the entire study was a pilot but this is not clear and the discussion refers to the December readings too, not just the November ones. 8) P3934, line 6 – replace 'tephra in' with 'tephra on'. 9) P3934, line 12 - Data from December are described as being 'significantly different' from November. Were any statistical tests conducted? They are not presented anywhere. Again, I don't believe that these data would be meaningful anyway after 10 minutes of measurement. They should not use this phrase. 10) P3936, line 25 – Conclusions. Why might there be a quasi-permanent cloud at 2-3m from ground? This is not based on any data and is not discussed in the earlier sections so should be removed.

References Horwell CJ, Sparks RSJ, Brewer TS, Llewellin EW, Williamson BJ (2003) The characterisation of respirable volcanic ash from the Soufriere Hills Volcano, Montserrat, with implications for health hazard. Bulletin of Volcanology 65:346-362

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