Natural Hazards
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Discussions

Interactive comment on "Oil/gas pre-treatment plants and air quality hazards: PM$_1$ measurements in Agri Valley (southern Italy)" *by* S. Trippetta et al.

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On behalf of all co-Authors, I wish to thank the Reviewer for the interesting remarks and the suggesting issues aiming at improving the proposed study. The revised version of the manuscript will be corrected following all the specific comments and suggestions. Responses to the Reviewer's comments, along with the acceptance of the proposed changes, are detailed below:

General comments

This work deals with the source apportionment of PM1 measurements in an area 2.5 km away from an oil/gas pre-treatment plant, an issue of high research interest. It is also appropriate to be included in the special issue 'New observing strategies for mon-

itoring natural and technological hazards: the case-study of the Agri valley, Southern Italy'. The paper is generally well written and suggests an appropriate methodology, without though applying state of the art statistical techniques. Results are well presented through high quality figures/tables, but human health and environmental implications are not adequately discussed. Furthermore, some methodological issues limit the value of the article's results. Also, the title of the article could be considered misleading since its first words refer to the plant emissions, while measurement did not take place in the plant's surrounding. I would therefore recommend several clarifications to be made to improve the paper.

Authors' response: We have followed the Reviewer's suggestions. In particular, regarding the title, we have rephrased it as follows: PM1 measurements in a site close to an oil/gas pre-treatment plant (Agri Valley - southern Italy): a preliminary study.

Specific comments

1. Introduction 'Moreover, the results obtained, besides contributing to improve the knowledge of the PM1 composition, could be also useful to address other type of studies (e.g., epidemiological studies)': Contribution of the article as discussed in the introduction is inappropriate as concerns the reference to the epidemiological studies. A sample of only 30 daily measurements distributed in a specific month may not be enough to support any epidemiological study. The authors should comment on the limitations of their study regarding the sample size, the period of time and seasonal distribution. Why this period/season was selected for such an analysis? Also, the European Directives establish specific air quality standards which further apply over differing periods of time because the observed health impacts associated with the various pollutants occur over different exposure times. I would also suggest a discussion for the need/proposal for long-term measurements so that an extensive study of the impact and the seasonal effect can be made. A reference to specific epidemiological studies regarding the PM1 concentration thresholds and their impact on human health could be useful for the reader to better understand the importance of the results from

the hazardous point of view.

Authors' response: We have followed the Reviewer's suggestion and we have partially revised the introduction to better contextualize the study proposed. We also have underlined that the study presents a preliminary characterization of PM1 in Agri Valley that will be improved when long-term measurements of both PM1 concentrations and chemical composition will be available. As to the period discussed, it was chosen since the PM1 chemical composition was available for this period only. Regarding the latter Reviewer's remark, to the best of our knowledge, no PM1 concentration thresholds related to health effects have been reported in literature. At present, there are no limit values for this PM fraction nor guideline values have been set by any known international agency, including the World Health Organization (WHO). This absence of thresholds/standards for PM1 is due to the scarcity of information on this metric. In fact, it is not monitored on regular basis yet and the consequence is the inadequacy of current scientific data that could support the identification of health/environmental-based thresholds/standard values.

2. Introduction: 'PM1 can penetrate more deeply into the human respiratory and circulation systems carrying harmful chemical species inside the human body (Mohiuddinet al., 2014)': The specific paper is not an epidemiological one and includes a one sentence comment, saying that 'respirable particles in the size range of PM2.5 and PM1 are particularly hazardous as they can be transported deep into the alveolar region of the lungs and the bloodstream' and does not compare between PMs. Please refer to specific epidemiological studies and outcomes. The same comment applies to the next reference, Dubey et al., 2012.

Authors' response: We have followed the Reviewer's suggestions. In particular, we have revised the indicated sentences and the related references.

3. Materials and methodologies/2.1 Study area 'Therefore, it could give rise to a wide range of environmental and especially human health impacts due to its presence in an

area where several small towns (from 1700 to 5400 inhabitants) are settled' Which are the environmental implications of the PM1 emissions? To complete the discussion the authors should refer to established impacts on the environment.

Authors' response: We have followed the Reviewer's suggestion. In particular, we have briefly referred to PM environmental impacts in the introduction section.

4. Weekday–weekend variation of the PM1 and trace element concentrations: 'As to S, the variation observed should be related to a change in the emissions of the COVA plant which is expected to be the main source of sulfur compounds' Does the plant's operation differ between weekend and weekdays and if yes how this influences the analysis?

Authors' response: In theory, the COVA plant's operations should not vary between weekend and weekdays but the amount of the oil/gas treated should be subject to day to day variations with a consequent change in the COVA emissions of sulfur compounds in atmosphere. Having said this and by considering that the COVA plant is expected to be the main source of sulfur compounds in the area under study, we can only suppose that, in the short period under study, the amount of the oil/gas treated was somehow reduced during weekends justifying the variation observed in the S concentrations.

5. PCA: PCA is an appropriate statistical technique. To my knowledge, though, Positive Matrix Factorization (PMF) is considered today the 'state of the art' technique for the specific analysis, because it manages to resolve the PCA limitations, as JRC reports (http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/7956/1/reqno_jrc52754 However, in this case the sample of 30 measurements is not adequate for PMF. This confirms the methodological limitations mentioned before, which should be discussed in the article.

Authors' response: We thank the Reviewer for the remark. At the same time, we would like to highlight that the Principal Component Analysis (PCA) is a methodology widely

chosen to identify particulate matter (PM) source types even now (see for example, Kara et al., 2014; Revuelta et al., 2014; Zhai et al., 2014; Zhou et al., 2014). This choice is mainly operated on the base of the aim of the study. In the present work, we would preliminary identify the main PM1 sources in the area under study so we consider the PCA a suitable methodology for the scope and, as a consequence, we applied it to the PM1 data. Cited references Kara, M., Dumanoglu, Y., Altiok, H., Elbir, T., b Odabasi, M., and Bayram, A.: Seasonal and spatial variations of atmospheric trace elemental deposition in the Aliaga industrial region, Turkey, Atmospheric Research, 149, 204–216, 2014. Revuelta, M.A., McIntosh, G., Pey, J., Pérez, N., Querol, X., Alastuey, A.: Partitioning of magnetic particles in PM10, PM2.5 and PM1 aerosols in the urban atmosphere of Barcelona (Spain), Environmental Pollution, 188, 109-117, 2014. Zhai, Y., Liu, X., Chen, H., Xu, B., Zhu, L., Li, C., and Zeng, G.: Source identification and potential ecological risk assessment of heavy metals in PM2.5 from Changsha, Science of The Total Environment, 493, 109–115, 2014. Zhou, S., Yuan, Q., Li, W., Lu, Y., Zhang, Y., Wang, W.: Trace metals in atmospheric fine particles in one industrial urban city: Spatial variations, sources, and health implications, Journal of Environmental Sciences, 26, 205–213, 2014.

6. Conclusions: Conclusions do not discuss the human health and environmental implications, as mentioned also in the previous specific comments of the present review. Argumentation for the significance/usefulness of the results, the originality of the paper, the specific contributions and the possible future plans related to the study are currently inadequate.

Authors' response: We have followed the Reviewer's suggestion and we have revised the conclusion section.

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