

São Paulo, December, 2015.

ACP

Dear Sirs,

The manuscript “Impact of vehicular emissions on the formation of fine particles in the Sao Paulo Metropolitan Area: A numerical study with the WRF-Chem model” was first submitted on 23 Jan 2015. The reviewers pointed out many important questions during the time it was open for suggestions and comments. We tried to answer all the questions and the manuscript was re-written and re-submitted. We would like to thank the reviewers for the comments as this version was improved substantially. We try to answer the last questions that were presented by the reviewers. Regarding some specific comments of the reviewers:

The reviewer suggested the presentation of the model evaluation by the analysis of a base case simulation. This was done with the inclusion in the analysis of more statistical index to evaluate the model performance: in addition to the correlation coefficient (R), mean bias (MB), root mean square error UB ($RMSE_{UB}$), it was calculated the mean fractional bias (MFB) and mean fractional error (MFE). The comparisons between simulated and measured parameters for different air quality stations as well as additional tables and figures related to these comparisons are presented in the supplementary material. The simulations for wind, temperature, humidity and air quality parameters are compared to the measured data.

Another important point that is discussed by the reviewer is the consideration in the modelling of only the mobile sources. It is an important point that is more discussed in this new version of the manuscript. We totally agree that a base case simulation should include all possible emissions sources. It is, however, worthwhile to mention that in southeastern Brazil's metropolitan areas, mainly in the São Paulo Metropolitan Area (SPMA), most of the energy is used by the transportation sector. According to official emission inventory provided by the Sao Paulo State Environmental Agency (CETESB, 2013) 80% of NO_x, 97% of CO, and 87% of VOC are emitted by the vehicular fleet, being most of NO_x associated to diesel combustion and most of CO and VOC from gasohol and ethanol combustion (CETESB, 2013). Previous studies applying Receptor Models to trace-elements, performed by the Laboratório de Análise dos Processos Atmosféricos (LAPAt) of the Atmospheric Sciences Department, showed that only 13% of the fine particles mass (PM_{2.5}) in São Paulo is associated to the emission by the industrial process (oil burning and secondary aerosol) (Andrade et al., 2012). The fine particles are composed mostly by carbonaceous aerosols, 60% organic compounds and 20% Black Carbon according to studies performed in São Paulo in tunnels measurements described by (Brito et al., 2013; Pérez-Martínez et al., 2014). In addition, it is also important to remind that the present study focuses especially on the potential formation of secondary particles from the primary emission of gases coming from on-road vehicles (the Guenther biogenic emissions module was chosen to minimize the impact of vegetation). For these reasons, we suggest that the consideration of two simulation scenarios: the first, a base case simulation (Case_0) including emissions of gases and aerosols from nature and on-road vehicles; and the second (Case_1) seems to the first but with no aerosol particles emission, could be a direct and suitable way to

assess the impact of vehicular emissions on the potential formation of secondary aerosols.

References

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