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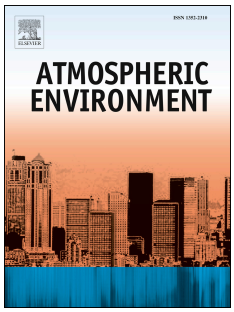

Urban airborne matter in central and southern Chile: Effects of meteorological conditions on fine and coarse particulate matter

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ACCEPTED MANUSCRIPT

Urban airborne matter in central and southern Chile: Effects of meteorological conditions on fine and coarse particulate matter

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Abstract.

Air pollution is one of the major global environmental problems affecting human health and life quality. Many cities of Chile are heavily polluted with $PM_{2.5}$ and PM_{10}, mainly in the cold season, and there is little understanding of how the variation in particle matter differs between cities and how this is affected by the meteorological conditions. The objective of this study was to assess the effect of meteorological variables on respirable particulate matter (PM) of the main cities in the central-south valley of Chile during the cold season (May to August) between 2014 and 2016. We used hourly $PM_{2.5}$ and PM_{coarse} (PM_{10}- $PM_{2.5}$) information along with wind speed, temperature and relative humidity, and other variables derived from meteorological parameters. Generalized additive models (GAMs) were fitted for each of the eight cities selected, covering a latitudinal range of 929km, from Santiago to Osorno. Great variation in PM was found between cities during the cold months, and that variation exhibited a marked latitudinal pattern. Overall, the more northerly cities tended to be less polluted in $PM_{2.5}$ and more polluted in PM_{coarse} than the more southerly cities, and vice versa. The results show that other derived variables from meteorology were better related with PM than the use of traditional daily means. The main variables selected with regard to $PM_{2.5}$ content were mean wind speed and minimum temperature (negative relationship). Otherwise, the main variables selected with regard to PM_{coarse} content were mean wind speed (negative), and the daily range in temperature (positive). Variables derived from relative humidity contributed differently to the models, having a higher effect on PM_{coarse} than $PM_{2.5}$, and exhibiting both negative and positive effects. For the different cities the deviance explained by the GAMs ranged from 37.6 to 79.1% for $PM_{2.5}$ and from 18.5 to 63.7% for PM_{coarse}. The percentage of deviance explained by the models for $PM_{2.5}$ exhibited a latitudinal pattern, which was not observed in PM_{coarse}. This highlights the greater predictability of $PM_{2.5}$ according to meteorological parameters in the cities to the south. Southern cities located spatially close to one another had similar patterns in both the selected variables for the models and the trends. The meteorological factor influencing the cities had a major impact on PM concentrations. The findings of this study may aid understanding of PM variation across the country, in the way of improving forecasting models.

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