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Atmos. Chem. Phys., 7, 887-897, 2007

www.atmos-chem-phys.net/7/887/2007/

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Application of absolute principal component analysis to size distribution data: identification of particle origins

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Abstract. Absolute principal component analysis can be applied, with suitable modifications, to atmospheric aerosol size distribution measurements. This method quickly and conveniently reduces the dimensionality of a data set. The resulting representation of the data is much simpler, but preserves virtually all the information present in the original measurements. Here we demonstrate how to combine the simplified size distribution data with trace gas measurements and meteorological data to determine the origins of the measured particulate matter using absolute principal component analysis. We have applied the analysis to four different sets of field measurements that were conducted at three sites in southern Ontario. Several common factors were observed at all the sites; these were identified as photochemically produced secondary aerosol particles, regional pollutants (including accumulation mode aerosol particles), and trace gas variations associated with boundary layer dynamics. Each site also exhibited a factor associated specifically with that site: local industrial emissions in Hamilton (urban site), processed nucleation mode particles at Simcoe (polluted rural site), and transported fine particles at Egbert (downwind from Toronto).

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