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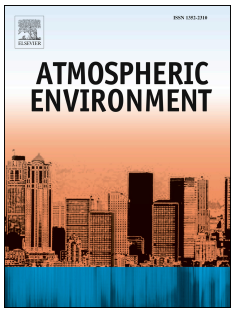


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PII: S1352-2310(17)30453-3

DOI: 10.1016/j.atmosenv.2017.07.012

Reference: AEA 15426

To appear in: *Atmospheric Environment*

Received Date: 10 February 2017

Revised Date: 27 June 2017

Accepted Date: 4 July 2017

Please cite this article as: Crawford, J., Cohen, D.D., Stelcer, E., Atanacio, A.J., Long term fine aerosols at the Cape Grim global baseline station: 1998 to 2016, *Atmospheric Environment* (2017), doi: 10.1016/j.atmosenv.2017.07.012.

# Long term fine aerosols at the Cape Grim Global Baseline Station: 1998 to 2016.

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**Abstract:**
Fine aerosol measurements have been undertaken at the Cape Grim global baseline station since 1992. Ion beam analysis techniques were then used to determine the elemental composition of the samples from which source fingerprints can be determined. In this study six source fingerprints were identified to contribute to the measurements of $PM_{2.5}$ at Cape Grim (from 1998 to 2016); fresh sea salt (57%), secondary sulfate and nitrates (14%), smoke (13%), aged sea salt (the product of NaCl reactions with $SO_2$; 12%), soil dust (2.4%) and industrial metals (1.5%). Back trajectory analysis showed that local Tasmanian sources of soil dust contributed to the high soil dust measurements. High measurements of secondary aerosols were recorded when air masses were arriving from the Australian mainland, in the direction of the Victorian power stations.

When air masses were arriving from the baseline sector, the maximum concentration of aged sea salt was 1.3 $\mu g/m^3$, compared to overall maximum of 4.9 $\mu g/m^3$. For secondary sulfates and nitrates the maximum concentrations were 2.5 and 7.5 $\mu g/m^3$ from the baseline sector and overall, respectively. While measurements at Cape Grim can be affected from long range transport from mainland Australia and some local Tasmanian sources, the average concentrations of anthropogenic sources are still considerably lower than those measured at more populated areas. For example, at Lucas Heights (located south-west of the Sydney central business district, with little local sources) the average concentrations of secondary sulfates/nitrates and aged sea air were 1.4 and 1.0 $\mu g/m^3$, respectively; compared to average concentrations of 0.8 and 0.6 $\mu g/m^3$, at Cape Grim. The average concentrations of smoke were compatible at the two sites. The impact of primary aerosols from vehicle exhaust at Cape Grim was limited and no corresponding fingerprint was resolved.

**Keywords:** Aerosols, Positive Matrix Factorisation, Cape Grim, Baseline

## 1 Introduction

Atmospheric particulate matter (PM) acts as cloud condensation nuclei, can scatter and absorb radiation and can have an impact on human health (Heintzenberg, 1985; Bansah et al., 2016, and references therein). As such, measurement of PM has been an integral part of observations at baseline stations (Heintzenberg, 1985) which have been established for the purpose of monitoring of background air pollution (WMO, 1978). Measurements of PM at baseline stations can vary from atmospheric condensation nucleus (CN) concentration, cloud condensation nucleus (CCN)

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