Profiling sources of airborne particulate matter at a background site in Gothenburg region

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Keywords: $PM_{2.5}$, Long range transport, Local combustion
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Background sites are considered to be ideal in providing useful information regarding the trends of natural and anthropogenic sources of airborne particulate matter (PM). Hence a study was carried out to identify the sources contributing to airborne PM at a background site in the Gothenburg region. The site, Råö, is located along the Swedish west coast and approximately 35 km south of the city of Gothenburg. Particulate matter with a diameter of less than 2.5µm ($PM_{2.5}$) were sampled from 1st of October to 23rd of November, 2014, and analyzed for mass concentration, black carbon (BC), and trace elements. The said samples were part of long term sampling by the IVL Swedish Environmental Research Institute AB who uses an automatic sampler that consists of eight PModel S10 impactors.

The average $PM_{2.5}$ concentration was 5.7 ± 4 µg m^{-3}. Black carbon (BC) had the highest average concentration of all the identified species. It accounted for 4.9 % of the total $PM_{2.5}$ mass whereas other detected trace elements; S, Cl, K, Ca, Fe, Ni, Cu, Zn, Br and Pb accounted for 6.9 %. The unidentified components were assumed to be organic matter, nitrates, aluminosilicates and oxides of both the detected and undetected elements.

A Positive Matrix Factorization (PMF) analysis identified four source factors that contribute to $PM_{2.5}$ at the background site (Figure 1). These sources were identified as traffic emission, local combustion, long range transport, and industry emissions in agreement with an earlier study by Molnár *et al* (2014). Local combustion and long range transport were the main sources and contributed approximately 77 % of the measured $PM_{2.5}$. The contribution from long range transport was traced to sources in Eastern Europe and the North Sea region (Figure 2). From this study, it can be concluded that the background areas are influenced by their own unique sources of PM in addition to the long transportation of PM from regional sources.

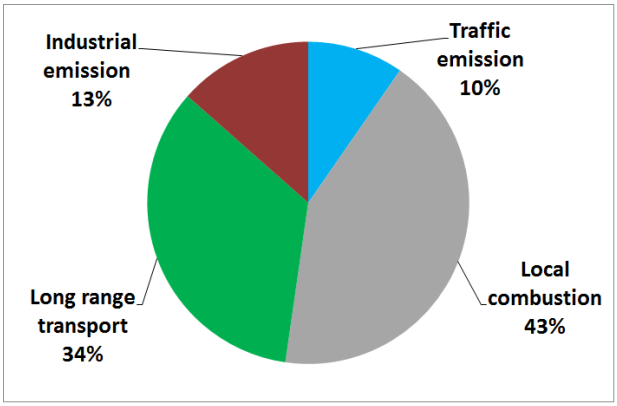

Figure 1. Source factors for airborne particulate matter in the Gothenburg region identified using PMF analysis.

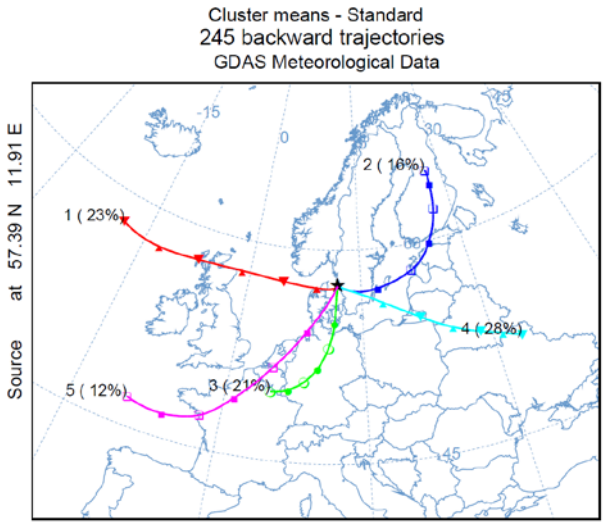

Figure 2. Clustered back trajectories showing the prevalent origin of air masses arriving in Gothenburg in the months of October and November, 2014.

This work was supported by the Swedish Research Council Formas

Molnár P., Johannesson S. and Quass, U. (2014). *Aerosol Air Qual. Res.* **14**:725-733, 2014.