

Variation in the Heterogeneous Chemistry of Particulate Matter During the Polarimetric Cloud Analysis and Seeding Test (POLCAST) 2012 Campaign in Grand Forks, North Dakota

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Organic material accounts for a large fraction of particulate matter (PM) in the atmosphere and can have an influence on our climate and on human health. Chemical variation among PM in different environments is a product of different primary emission sources as well as the extent to which secondary oxidation reactions occur. While many natural and anthropogenic primary emission sources have been evaluated in terms of their contribution to the chemical fingerprint of PM studies, the data assessing the contribution of harvesting activities on chemical variance is limited.

In this work we investigate the chemical speciation as well as the organic (OC) and elemental (EC) carbon content of PM filter samples collected in weekly cycles through a seventeen week campaign in Grand Forks, ND. Filter collection began in early summer and extended through the local harvesting season during late summer/early fall. Filter samples were collected in parallel with PM measurements from a scanning mobility particle sizer, tapered-element oscillating microbalance, and a cloud condensation nuclei counter. OC and EC content of all filters samples were determined using a thermal optical analyzer. For chemical speciation of the collected filter samples a thermal desorption/pyrolysis-gas chromatography/mass spectrometry method was deployed. Variations in the abundance of specific chemical markers (i.e., alkanes, alkenes, polycyclic aromatic hydrocarbons and their oxidation products, xylenes, alkylbenzenes, etc.) throughout the campaign were investigated.

Several trends and variations in the abundance of targeted chemical markers were observed. Levoglucosenone, known to be produced from the thermal degradation of cellulose (Lin *et al.*, 2009), was only observed during isolated incidents throughout the

campaign. MODIS backward trajectories show the source of levoglucosenone as wild fires in northwest USA. Carbon Preference Index (CPI) values were determined through the campaign. High biogenic influence (i.e., CPI >>1) was observed during sessions of local biomass harvesting. In addition several other markers of anthropogenic and biogenic activity exhibited fluctuations in abundance throughout the campaign. Variation in the OC mass percentages coincided with large changes in the abundance of the targeted chemical markers, again being a product of anthropogenic and biogenic sources.

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References

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