Chemical characterization of time resolved haboob samples from Tempe, AZ
Aurelie Marcotte, Jershon Eagar, Denise Napolitano and Pierre Herckes
Department of Chemistry and Biochemistry, Arizona State University, Tempe, AZ 85287
amarcot@asu.edu

Introduction

During the summer months in Arizona, very intense dust storms, or haboobs, can occur. A haboob formation occurs suddenly when fast moving downdrafts from dissipating thunderstorms hit the ground and, in arid regions, cause the resuspension of dust. This turbulent air mass travels at approximately 30 mph, can be up to 60 miles wide and are an average of 4 000 – 8 000 feet in height. These dust storms can last from minutes to hours and have the potential to alter the aerosol content greatly on short time scales. Understanding haboobs is of great importance in the Phoenix area as they can increase particulate matter (PM) and bring an influx of PM material from other locations. Deposition of PM may alter soil and water chemistry in the affected areas. In this work, we chemically characterize haboobs and their effect on the air quality in the Phoenix area. During the summers of 2013 and 2014, PM_{2.5} and PM_{2.5} aerosol samples were collected on the Arizona State University Tempe Campus. Samples were collected before, during, and after haboobs to determine the time resolved effect of haboobs on PM in the Phoenix area. Samples were analyzed for trace metals by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and soluble iron content by a ferrozine/UV-Vis method.

Experimental

Tisch high volume (1.13 m³ min⁻¹) aerosol samplers were placed on the roof of the Life Sciences A-Wing building at the ASU Tempe Campus. Cellulose filters were used for samples that would be analyzed for metal concentrations. Single stage impactor plates were used to collect size resolved (PM_{0.5} and PM_{2.5}) samples. Samples were collected before, during, and after a haboob event. The samplers were run for 3 hours to ensure enough sample mass was obtained.

PM Concentrations

![Graph showing PM concentrations](image)

Enrichment Factors

![Graph showing enrichment factors](image)

Iron Solubility

![Graph showing iron solubility](image)

Summary

- During haboob events, PM concentrations increase significantly for a very short period of time with PM_{2.5} increasing an order of magnitude more than PM_{2.5} (See Eagar et al. poster #19).
- Al (blue) is used as a tracer for crustal material and as a result should increase in concentration during haboob events as PM concentrations increase, which is shown in Figure 2.
- Cd (red) can be used as a tracer of anthropogenic activity. In Figure 3, Cd concentrations increase during haboob events, but they also increase during other periods.
- Enrichment factors of anthropogenic elements, such as Cu and Sb, decrease during haboob events as more PM and mineral dust is brought into the area. However, their enrichment factors return to previous values within approximately 24 hours after the haboob event as PM and mineral dust particles fall out of suspension (Figure 4).
- Other enriched elements (EF > 10) included Zn, Mo, Cd, Sn, W and in some samples Pb (Not shown).
- Soluble iron content of PM_{2.5} aerosols decreased during haboob events and appear to slowly increase after haboob events. Additionally, during periods of rain, soluble iron increases, possibly as a result of increased humidity (Figure 5).

References

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2. The Environmental Protection Agency air monitoring site was used to obtain PM_{2.5} and PM_{10} concentrations.