Particle Deposition and Frequency of Haboobs in the CAP LTER

Jershon Eagar[1], Pierre Herckes[1], and Hilairy Hartnett[1,2]

[1]School of Molecular Sciences, Arizona State University, Tempe, AZ

[2]School of Earth and Space Exploration, Arizona State University, Tempe, AZ

In the CAP region summer monsoons foster intense dust storms, *i.e.*, haboobs.

Thunderstorms produce convective outflows that lift dust hundreds of meters into the air in the appearance of a billowing wall of dust. Haboobs have the potential to deposit and redistribute large quantities of matter.

Conceptual diagram of haboob initiation (left) and Aug 20, 2013 nighttime haboob (right) as seen by ADEQ South Mountain webcam.

There has been increased interest in haboobs in social media and in the press with speculation that haboobs have become more intense and more frequent in recent years.

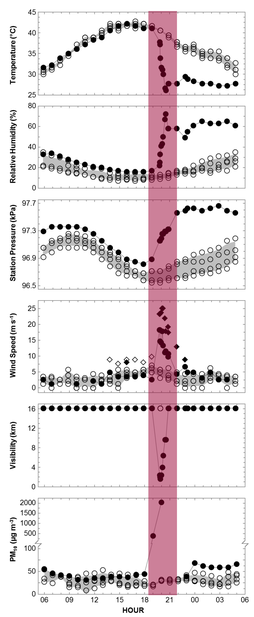
This poster presents basic statistics of CAP haboobs from 2005 to 2014, their modeled deposition, and their potential to impact Tempe Town Lake (TTL) chemistry.

Methodology

Meteorological and air quality data were employed in haboob classification (red box, right). When available, photos from webcams, the press, or social media were used to confirm classification.

A deposition model was developed based on Stokes law to predict the deposition of dust particles.

A TTL dataset generated from previous LTER work was used for comparison purposes.



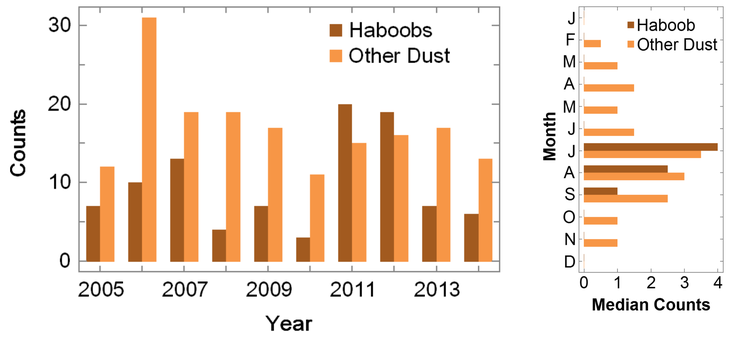
Haboob signature on June 29, 2014 in solid circles. Open circles and gray area is the previous 4 days of data and the 10th to 90th percentile respectively.

Acknowledgments

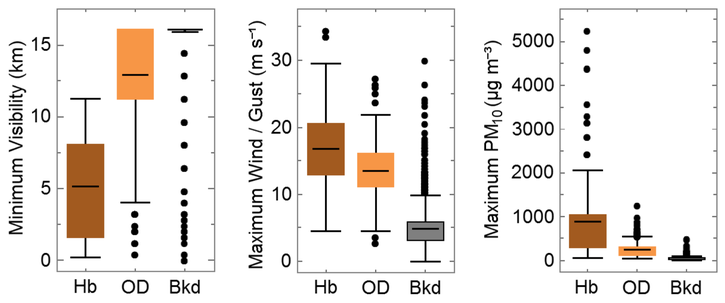
We thank the students in Hilairy Hartnett's lab who collected and analyzed TTL samples.

Results and Discussion

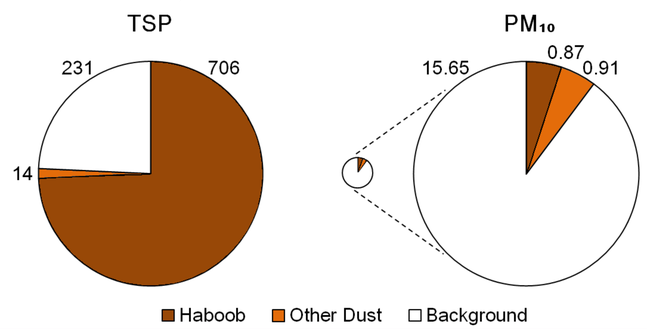
The frequency of haboobs in CAP varied substantially from year to year from 2005 to 2014 with a range of 3 to 20 and an average of 9.6 haboobs per year, most of which occurred in the summer monsoon months (Jul – Sep).



The classification method is robust with statistically significant differences in particulate concentrations, wind and gust speeds, and visibility for haboobs (Hb), other dust events (OD) and background time periods (Bkd).

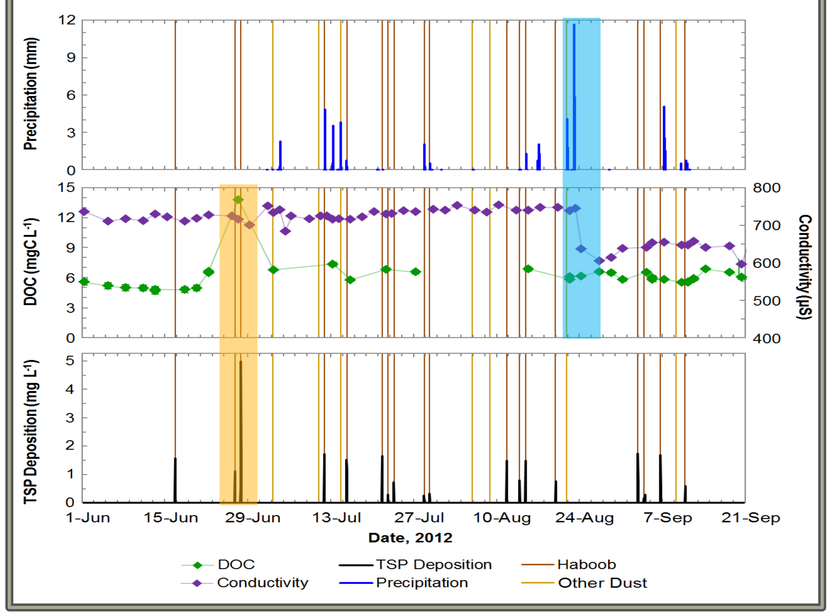


The deposition of all suspended particles (TSP) was predicted to be orders of magnitude larger than that of particles with aerodynamic diameters less than 10 µm (PM_{10}) with means of 950 and 17 kg $ha^{-1}yr^{-1}$ respectively. Annual TSP deposition is comparable with deposition reported elsewhere (*e.g.*, Middle East, Northern Africa).



Results (continued)

There is little clear evidence for changes in TTL chemistry that are coincident with haboob events. Most changes in chemistry coincide with rain and flow into the lake (blue box, below). For the one coincidence of a chemistry spike with a haboob (yellow box, below) the spike was much larger than the modeled deposition. Lake management practices appear to have a stronger influence on TTL chemistry than haboobs.



Summary

The annual frequency of haboobs in CAP varied by nearly an order of magnitude; most occurred during the monsoon season. No overall changes in frequency were seen during the time period investigated.

In CAP, haboobs are responsible for the major part of dry deposition (74%) over the whole year. Most of the dry deposition comes from very large particles (dust), some of which might just be lifted and redeposited locally, causing a redistribution in the area.

Coincidence between CAP haboob events and changes in TTL chemistry was not readily apparent. Future research is warranted to identify haboob redistribution and haboob biochemical impact on other systems in the CAP urban ecosystem.