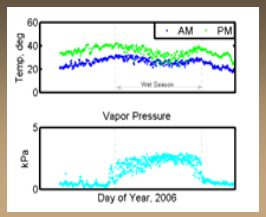
Niamey Dust Product from AOS and MFRSR Measurements

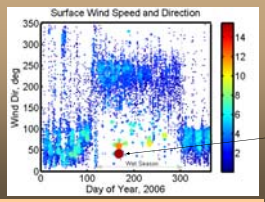
A.S. Koontz, C. J. Flynn, PNNL, Anne Jefferson, CIRES, University of Colorado, Boulder, J. C. Barnard, PNNL

Understanding the role of aerosols and how they influence climate change and the radiation budget is becoming increasingly important. Recent studies have found that mineral dust in the atmosphere contributes to direct radiative forcing and potentially to tropical cyclogenesis. Thus, determining precisely when dust is in the atmosphere over a site like Niamey, may be important for algorithm development, and for further data analysis.

Aerosols in the atmosphere around Niamey are composed largely of dust and smoke. Dust may be local in origin, or it may have been transported from the Sahara by strong winds from the North. Further, the characteristics of a dust-laden aerosol are quite different from a smoke-laden aerosol. The climate at Niamey is monsoonal, where the dry season is from November through April. Dry season aerosols exhibit different characteristics, when compared to wet season aerosols. We present some meteorological data, data from both the AOS and the MFRSR, and preliminary "dust metric" results.

Meteorological Data



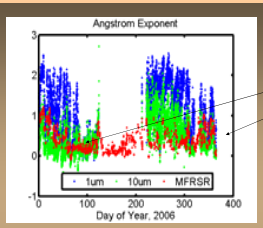


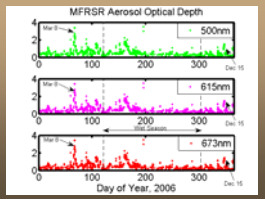
Size of circles indicate wind speed, in m/s

Start Date	End Date	Day of Year
12/29/2005		
01/15/2006		15
01/18/2006	01/20/2006	18-20
02/16/2006	02/18/2006	47-49
02/25/2006		
03/07/2006	03/11/2006	66-70
03/16/2006	03/18/2006	75-77
03/29/2006	04/06/2006	88-94
04/08/2006	04/21/2006	99-110
04/25/2006	04/26/2006	115-116
05/26/2006	05/27/2006	145-146
11/8/2006	11/13/2006	312-313
11/15/2006		319
11/17/2006	11/19/2006	321-323
12/02/2006	12/03/2006	336-337
12/13/2006	12/17/2006	347-351
12/28/2006	01/03/2007	362-363

Largest average wind speed was observed on June 17

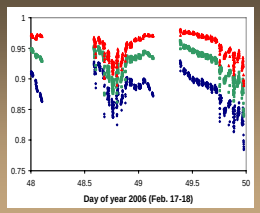
Angstrom Exponent and AODs



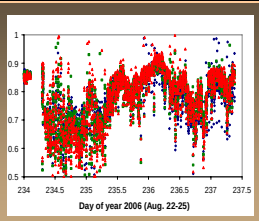


During the dry season, the MFRSR Angstrom exponent tends to be similar to the AOS 10um Angstrom exponent.

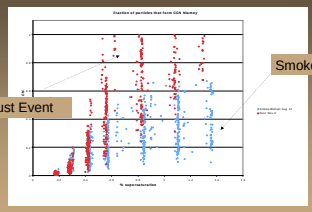
Phenomena Observed or Derived from AOS Data



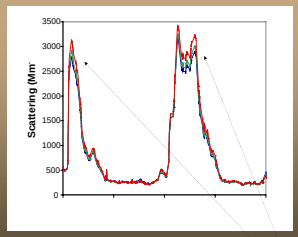
Dry Season SSA



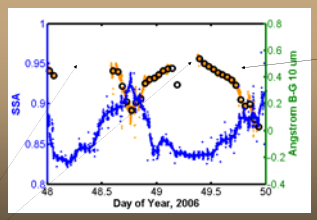
Wet Season SSA



Fraction of particles that form CCN



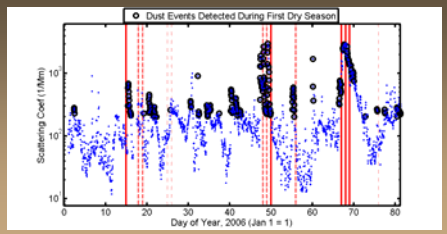
Backscatter, 2006/03/17-18

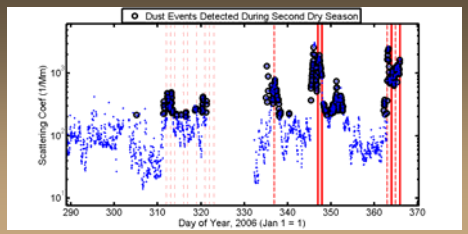


Angstrom Exponent, 2006/03/17-18

Circles identified by dust metric as dust events

Dust Metric Results





In the plots above, red lines show dust events confirmed by lidar; black circles indicate dust events reported by our dust metric.

Data products used to generate the metric are all from AOS, hourly averages

- backscatter fraction, 10um, green
- submicron scattering fraction, green
- SSA
- B_G Angstrom exponent, 10um and 1um

Next Steps

- Make screened, gridded, Niamey data available to other researchers from the ARM Archive.
- Examine relationships between aerosol bulk properties, intensive properties, column AOD, column Angstrom exponents, and vertical extinction profiles.
- Extend the dust metric to a scalar with more gradation indicating relative significance of soot versus dust.

ARM Atmospheric Radiation Measurement

Office of Science U.S. Department of Energy

Image courtesy of NASA and the Visible Earth Team: http://veimages.gsfc.nasa.gov/20522/wafrica_AMO_2006071.jpg