

A satellite image showing a large, swirling brown plume of aerosols over the ocean, likely originating from Asia. The plume is surrounded by white clouds and dark ocean water. The text is overlaid on the right side of the image.

Timothy Logan

 University of North Dakota

Department of Atmospheric Science

THE PHYSICO-CHEMICAL PROPERTIES OF ASIAN AEROSOLS

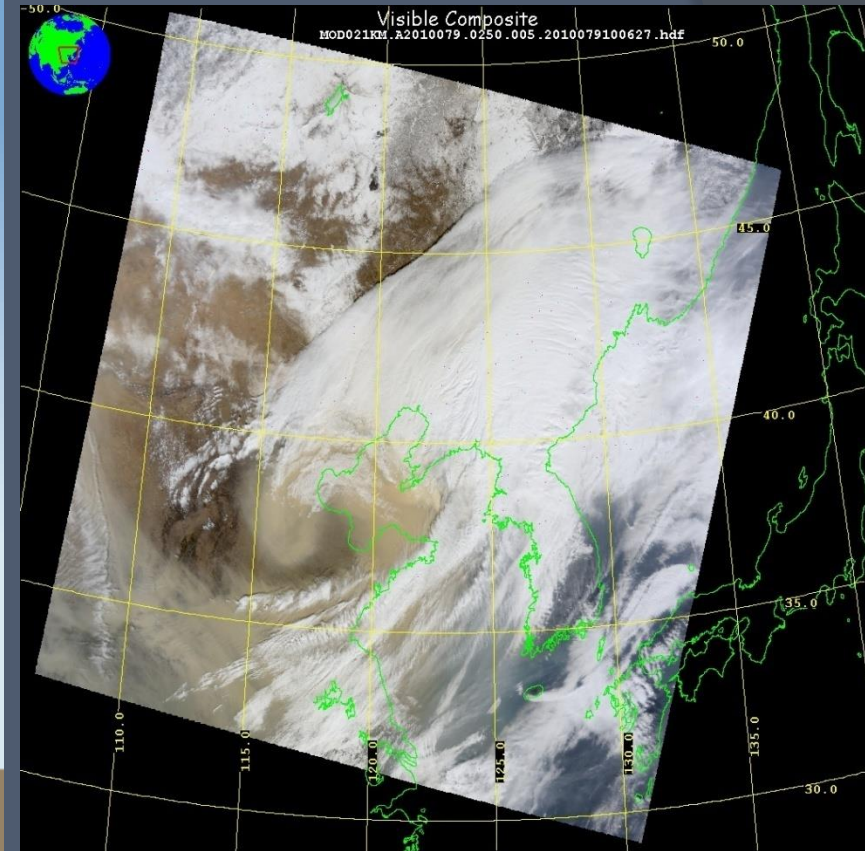
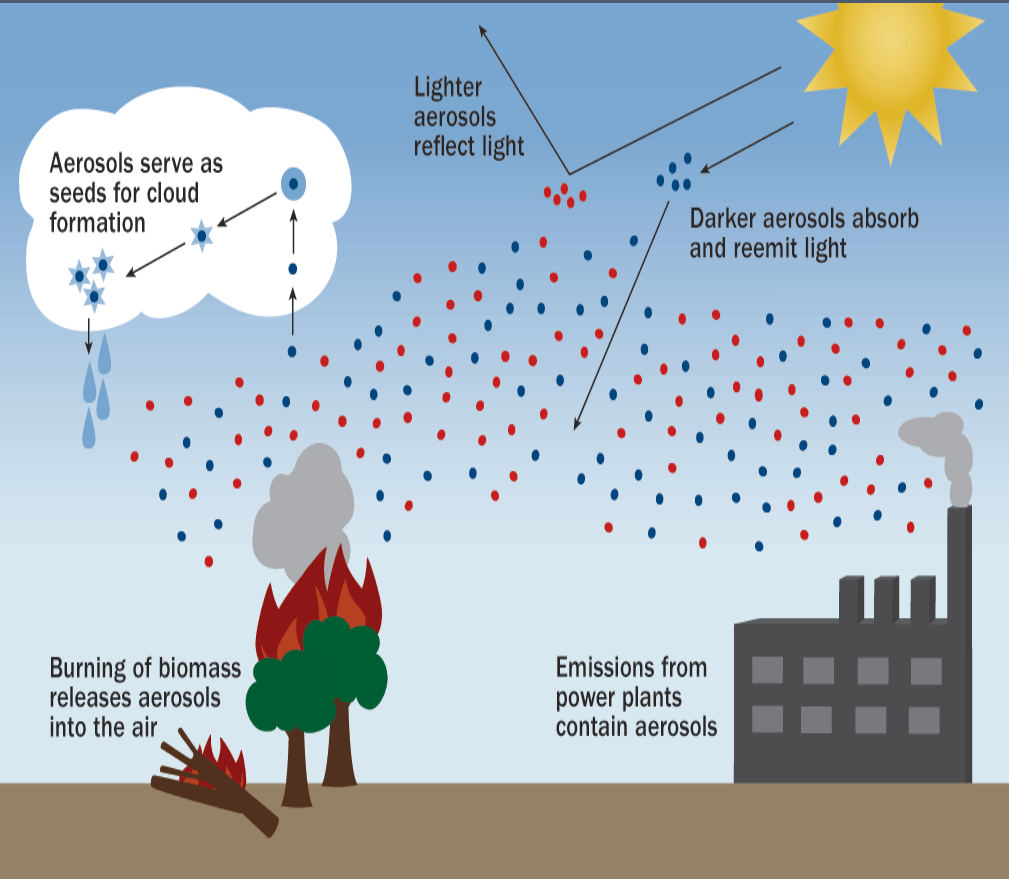
Outline

- ① Aerosol Characteristics
 - Formation and Behavior
- ① Aerosol Detection and Transport
 - Asian aerosol events
 - Past research findings
- ① Aerosol Classification
 - Current research
 - Seasonal variability
- ① Research Applications
 - Primary tools and methods
 - Main goals and applications

Aerosol Characteristics

Anthropogenic Aerosols

Natural Aerosols



Aerosol Detection

- ① Size and composition of aerosols
 - Attenuation of EM radiation illustrates the nature of aerosols
 - Aerosol optical depth (AOD)
 - Aerosol attenuation (extinction) is the sum of the aerosol scattering and absorption of light
 - Extinction part – correlated with size
 - Absorption part – correlated with composition
 - Recent studies looking into this
 - Main focus of current research

Aerosol Detection

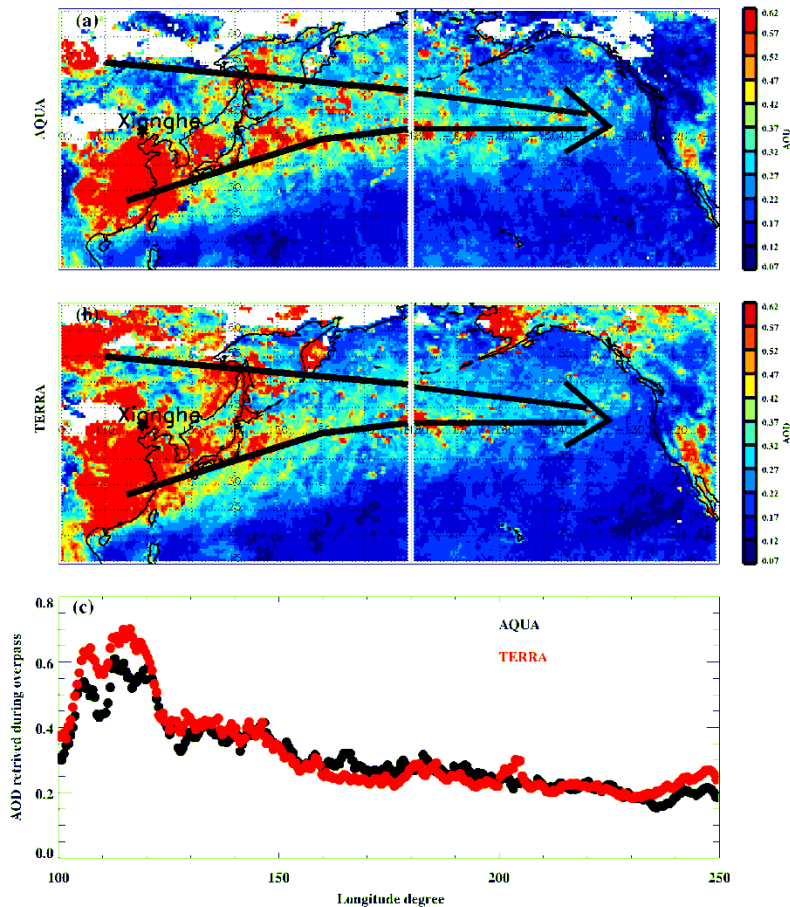
◎ My past research

- Used dependence of extinction AOD over a wavelength interval (Angstrom exponent or α)
 - Distinguishes between small and large aerosols
 - Fine mode vs. coarse mode aerosols
 - Does not distinguish aerosol composition
 - Some pollution aerosols can disguise themselves as large size natural aerosols
- Detected Asian aerosol events capable of transporting large amounts of dust and pollution via the Pacific Ocean to North America
 - Primarily used aerosol size as a proxy

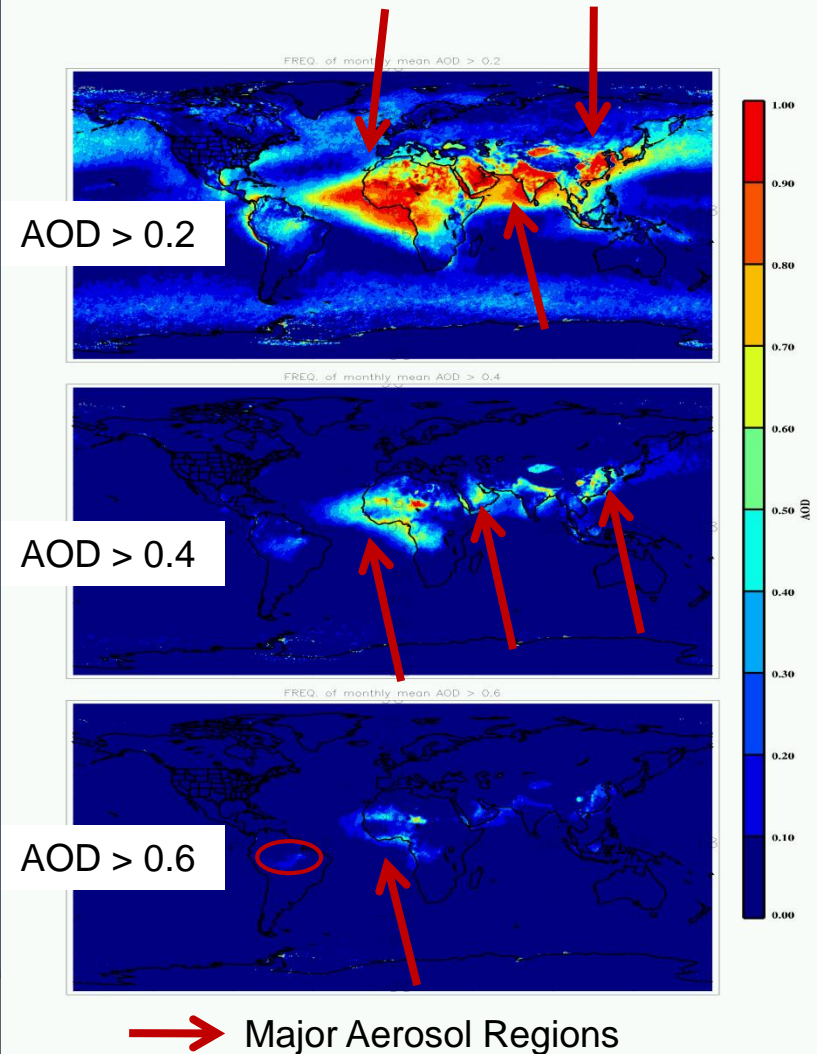
Aerosol Transport

Aerosol Transport Trend

MODIS AOD Retrievals



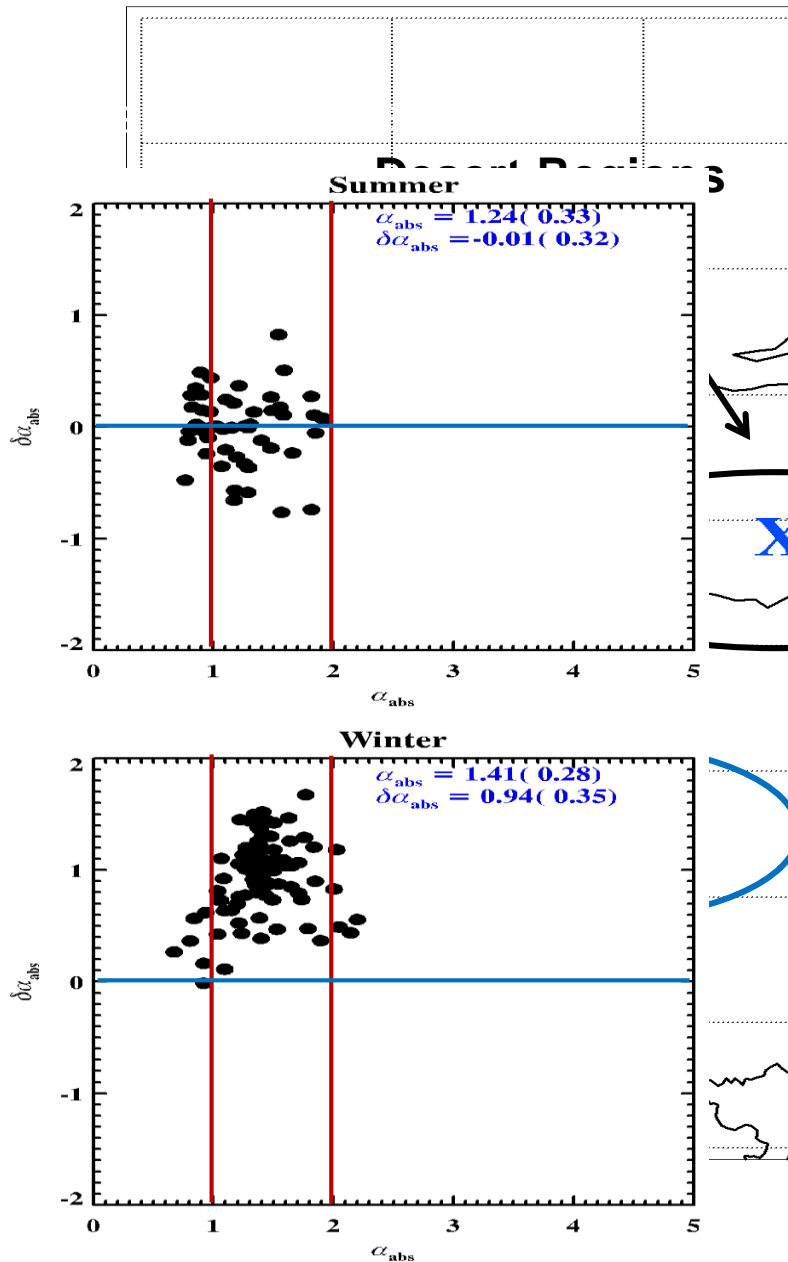
Aerosol Optical Depth Frequency of Occurrence



Aerosol Classification

- ◎ Current research uses second derivative of the absorption part of AOD
 - Spectral curvature or $\delta\alpha_{\text{abs}}$ (slope of α_{abs})
 - Develop a classification scheme that reduces ambiguities in Asian aerosol composition
 - Preliminary results show a clustering of different types of aerosols
 - Sulfate, biomass, mineral dust, black carbon
 - Can also see a seasonal variability and rate of change of Asian aerosol composition

AERONET Observation Sites



Discussion (Absorption)

- Most mean α_{abs} values for the two seasons fall between 1 and 2 (red lines)
 - Mean $\delta\alpha_{\text{abs}}$ (blue line) explains seasonal variance
- Summer – mean $\delta\alpha_{\text{abs}}$ is slightly negative
 - Sulfate and/or other scattering aerosols
- Winter – mean $\delta\alpha_{\text{abs}}$ is much higher
 - Indicating strong absorption
 - Result of coal and wood combustion for heat

Research Applications

- ① My research both past and present relies heavily on in situ AERONET, aircraft, space based, and re-analysis observations.
 - NASA sponsored/maintained platforms
- ① Main goal of research is to classify aerosols and the variability of their compositions as they transport far away from their source regions
 - Determine their effects on climate change and human health

Thank You



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Extra Slides

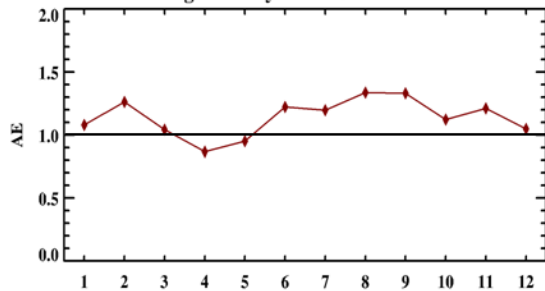
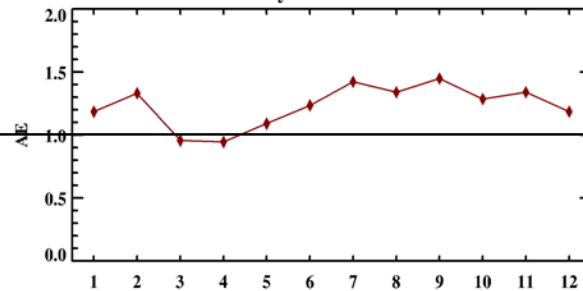
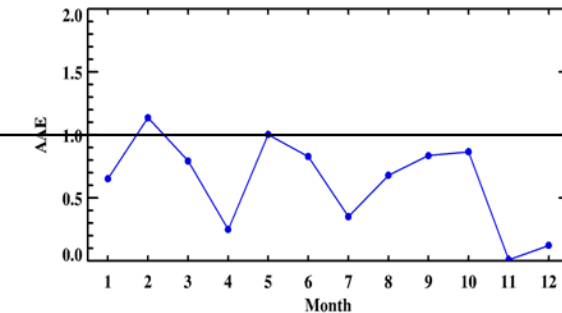
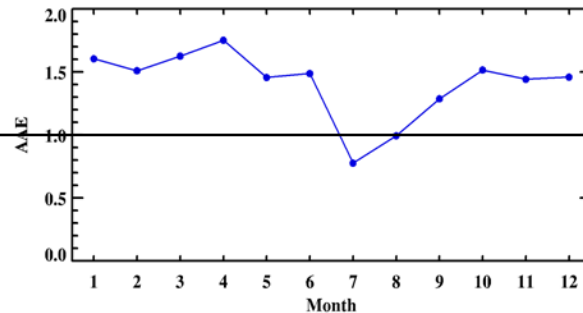
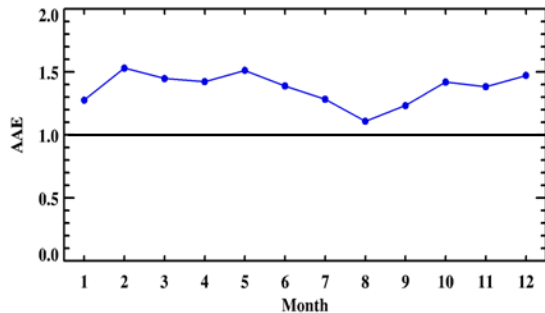
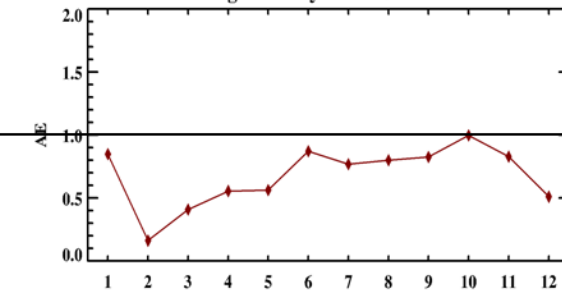
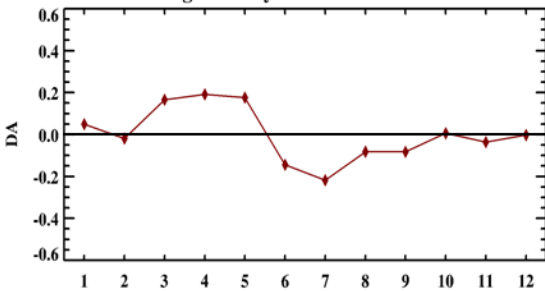
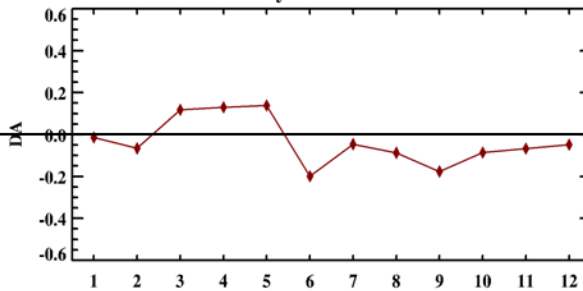
Aerosol Characteristics

⦿ Aerosol formation

- Classified as either man-made (anthropogenic) or natural

⦿ Aerosol behavior

- In terms of climate change – direct vs. indirect effect
 - Influence solar radiation vs. cloud physical properties
- Effects are influenced by physical and chemical properties of aerosols
 - Radiative properties, size and chemical structure

Xianghe Yearly Trend of AE and AAE**Taihu Yearly Trend of AE and AAE****Dalanzadgad Yearly Trend of AE and AAE****Xianghe Yearly Trend of DA and ADA****Taihu Yearly Trend of DA and ADA****Dalanzadgad Yearly Trend of DA and ADA**