



Deployment of the ARM Mobile Facility (AMF) and the ARM Ancillary Facility (AAF) to Study Aerosol Indirect Effect in China 2008

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Introduction

Aerosols in China have exceptionally high loading and diverse properties whose influence has been detected across the Pacific Rim. The rapid pace of changes in the atmospheric environment over China provides a natural testbed for identifying and quantifying the climatic effects of aerosols. Preliminary analyses of multiple satellite datasets (MODIS, TMI, TRMM) indicate more complex and unique aerosol indirect effects than what is found in relatively cleaner environments. Unfortunately, China is one of the least observed regions, especially in terms of aerosol and cloud properties. To verify the satellite findings and gain a deeper understanding requires either in-situ measurements or independent ground-based remote sensing data or ideally both. To this end, the AMF and AAF will be deployed to southern and northern China to study the climatic effects of both anthropogenic (pollutants) and natural aerosols (primarily dust) from March to December 2008

Goals

1. Acquisition of essential cloud, aerosol and meteorological parameters using the ARM mobile facility to validate satellite-based findings;
2. Use of AMF measurements together with validated satellite retrievals and in-situ data to understand the mechanisms of the aerosol indirect effects in the region;
3. Examination of the roles of aerosols in affecting regional climate and atmospheric circulation with a special focus on the impact of the East Asian monsoon system.

Key Science Questions to Address

- How different are the cloud microphysics over heavily polluted regions in China from those found in clean regions elsewhere with similar meteorological conditions?
- Are the clouds embedded in severely polluted regions less efficient in producing rainfall than clouds in clean regions?
- What are the major mechanisms for aerosols in China to affect precipitation, cloud microphysics, water content and cloud lifetimes?
- What are the impacts of aerosols emitted in China on the East Asian monsoon system, and regional and global climate?
- To what extent do changes in aerosol emissions in China contribute to the observed changes in cloud and precipitation, especially with regards to the trend of the northern drought and southern flooding?

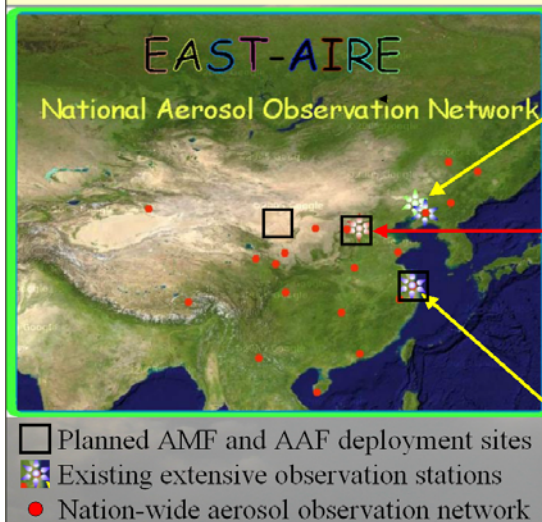
Observations and Objectives

- Deployment of the AMF in China for one year to acquire extensive measurements of aerosols, cloud, precipitation and radiation in northern and southern China, which are characterized by distinct climates and aerosol emissions;
- Enhancement of existing baseline ground observation stations and nation-wide aerosol survey stations so that the major types of aerosols are characterized and their temporal and spatial variations across China are quantified;
- Use of US airborne instruments onboard Chinese aircraft to measure the profiles of aerosol properties and cloud microphysics
- Acquisition, validation & improvement of remote sensing data sets from various sensors over the region in order to identify, reduce or remove any systematic errors.

Instruments deployed in the past and ongoing experiments



Past, Existing and Future US-China Collaborative Observation Activates



Taihu Site - Lake

Deployment: March - December 2008 (AMF)
Location: 31.702°N, 120.358°E
Elevation: 10 m
Cities nearby: Wuxi, Suzhou, Shanghai, Hangzhou, Nanjing
Annual Rainfall: 1184.4 mm
Annual Cloud Amount: 62%
Mean aerosol optical depth: 0.78
Mean aerosol single scattering albedo: 0.93
Mean aerosol Angstrom exponent: 1.21



Xianghe Site - Plain

Deployment: February - May 2008 (AAF)
Location: 39°45'14"N, 116°57'43"E
Elevation: 36 m
Cities Nearby: Wuxi, Suzhou, Shanghai, Hangzhou, Nanjing
Annual Rainfall: 571.9
Annual Cloud Amount: 45%
Mean aerosol optical depth: 0.82
Mean aerosol single scattering albedo: 0.90
Mean aerosol Angstrom exponent: ?



Zhangye Site - Desert

Deployment: June - December 2008 (AAF)
Location: 31.702°N, 120.358°E
Elevation: 1477.2 m
Cities nearby: Lanzhou, Jiayuguan, Jiuquan
Annual Rainfall: 87.7 mm
Annual Cloud Amount: 45%
Annual mean aerosol optical depth: ?
Annual mean aerosol single scattering albedo: ?

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