AMF-China in 2008
An Ideal Platform for
Studying Aerosol Climate Effects

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Participants:

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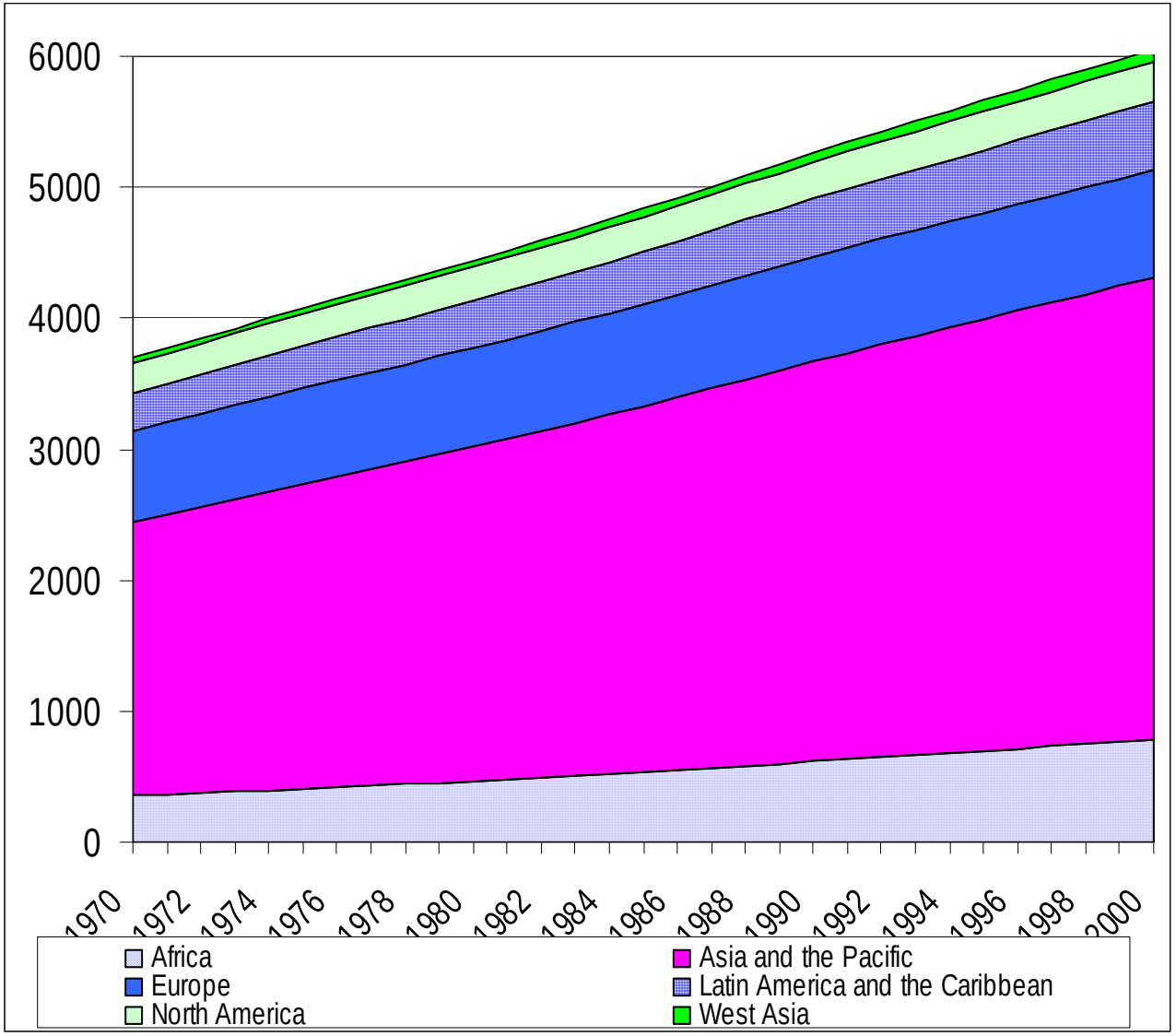
and Staff from at least three DOE Labs and hopefully
More from the ARM|ASP Communities

Goals

- *Acquisition of essential cloud, aerosol and meteorological parameters using the ARM mobile facility to study the aerosol indirect effects in China.*
- *Understanding the mechanisms of the aerosol indirect effects under the special circumstances of the region.*
- *Examining the roles of aerosols in affecting regional climate and atmospheric circulation with a special focus on the impact of the East Asian monsoon system.*

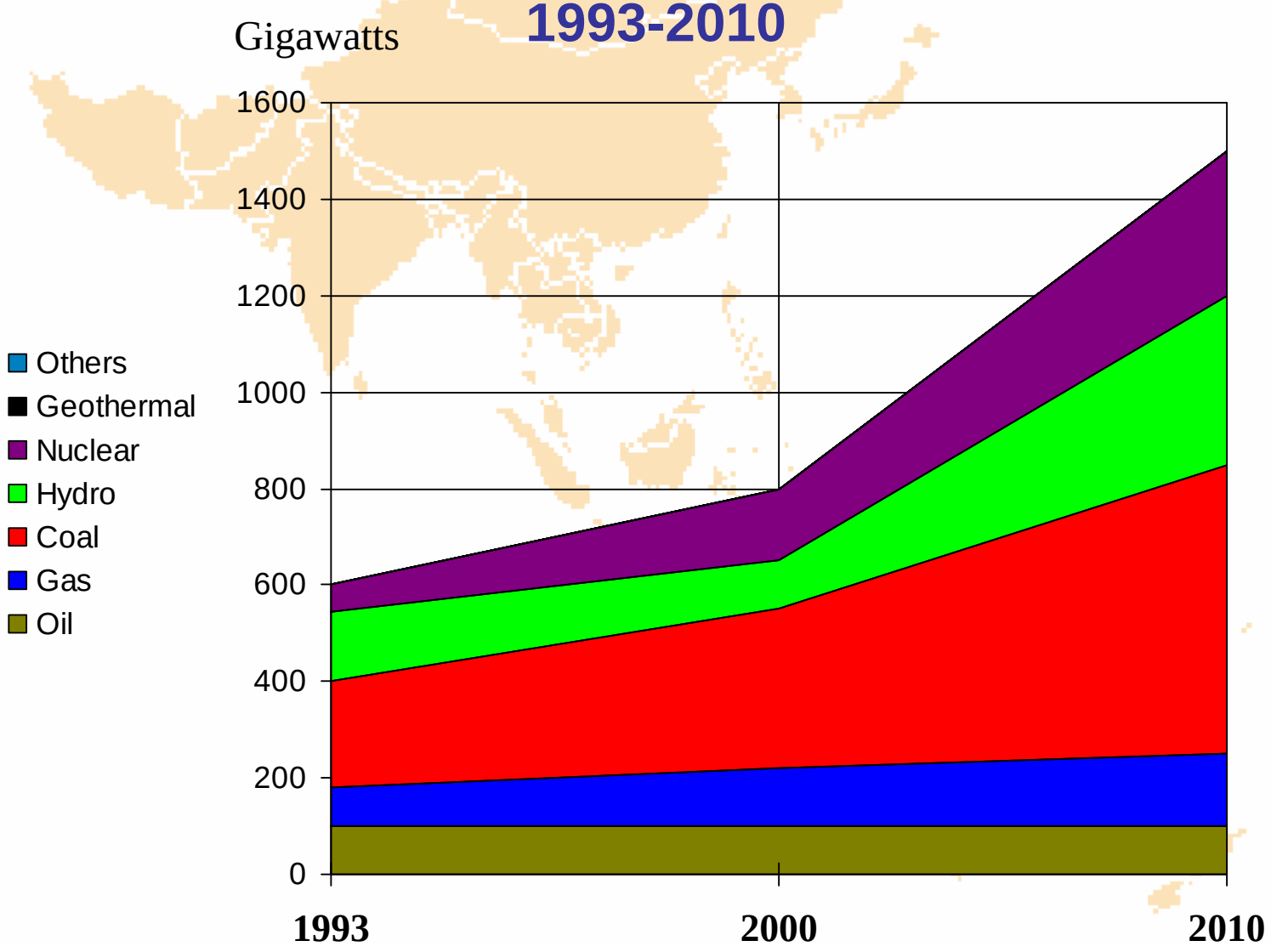
World Population(M) by Region 1970 – 2000



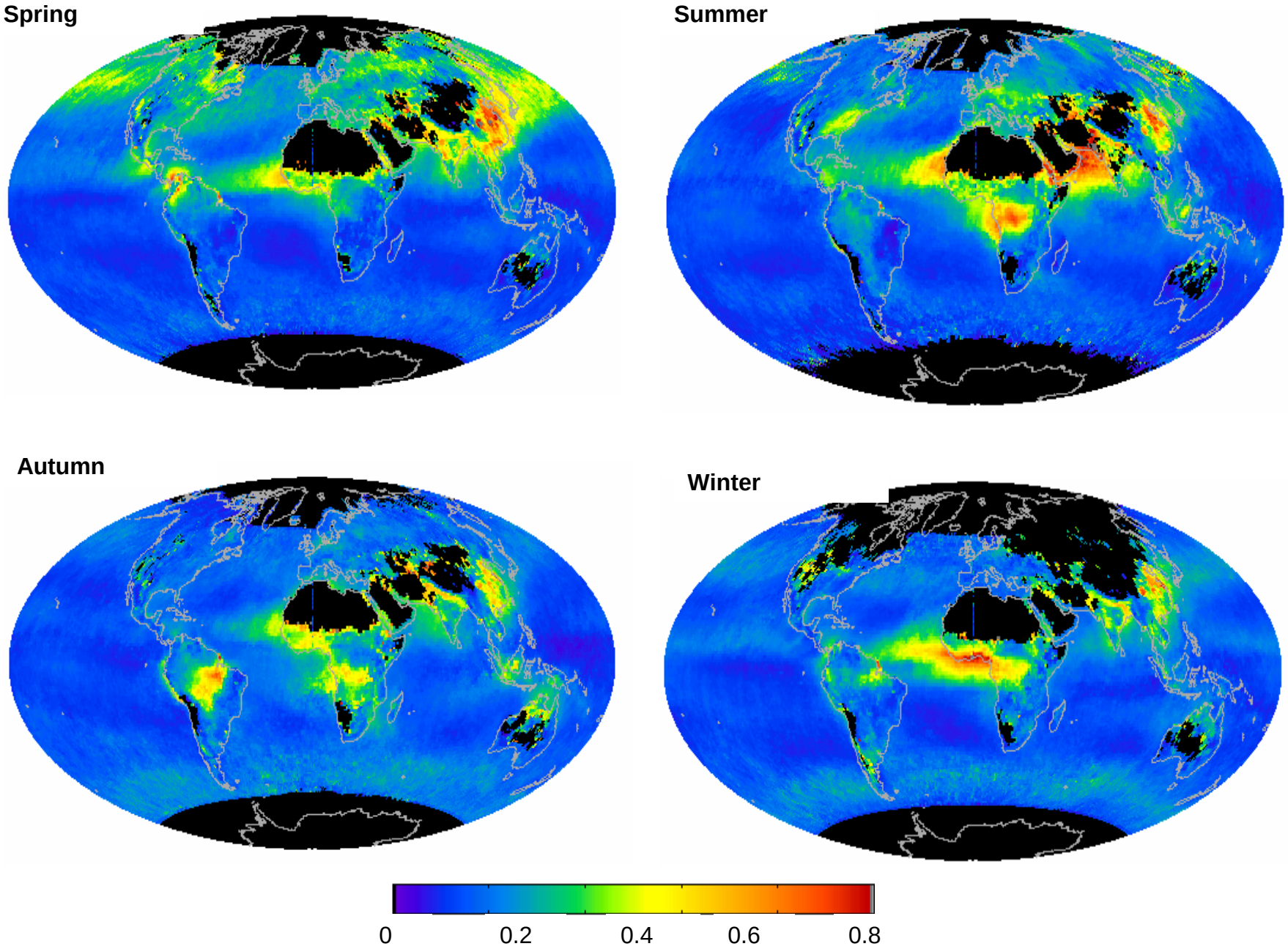
Asia has two-thirds of world population growth
Each year Asia population increases by 50 million

Air pollution: an emerging environmental issue in Asia

GROWTH IN INSTALLED CAPACITY IN ASIA 1993-2010

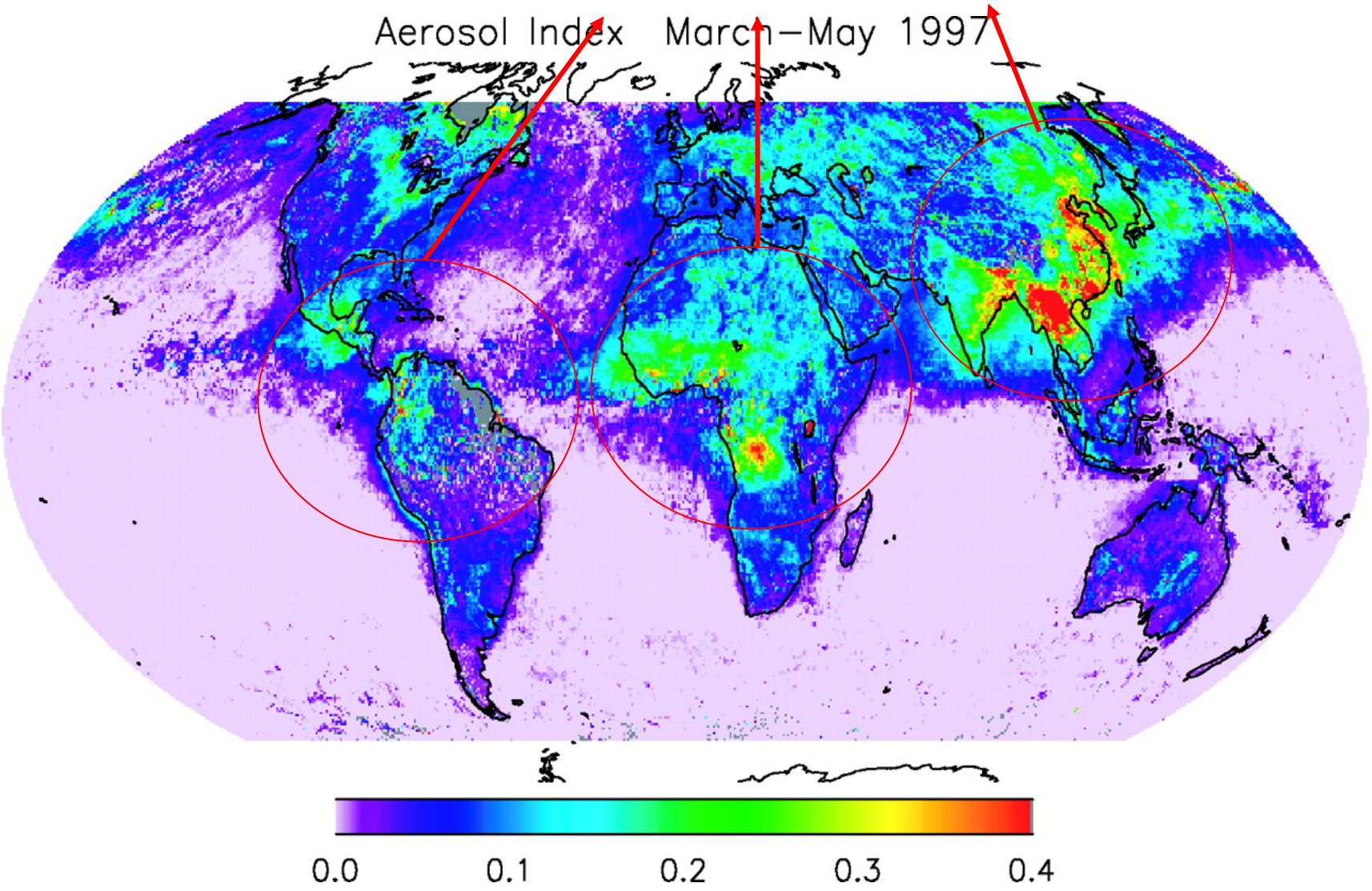


Source: Pacific Energy Outlook, Strategies and Policy Imperatives to 2010

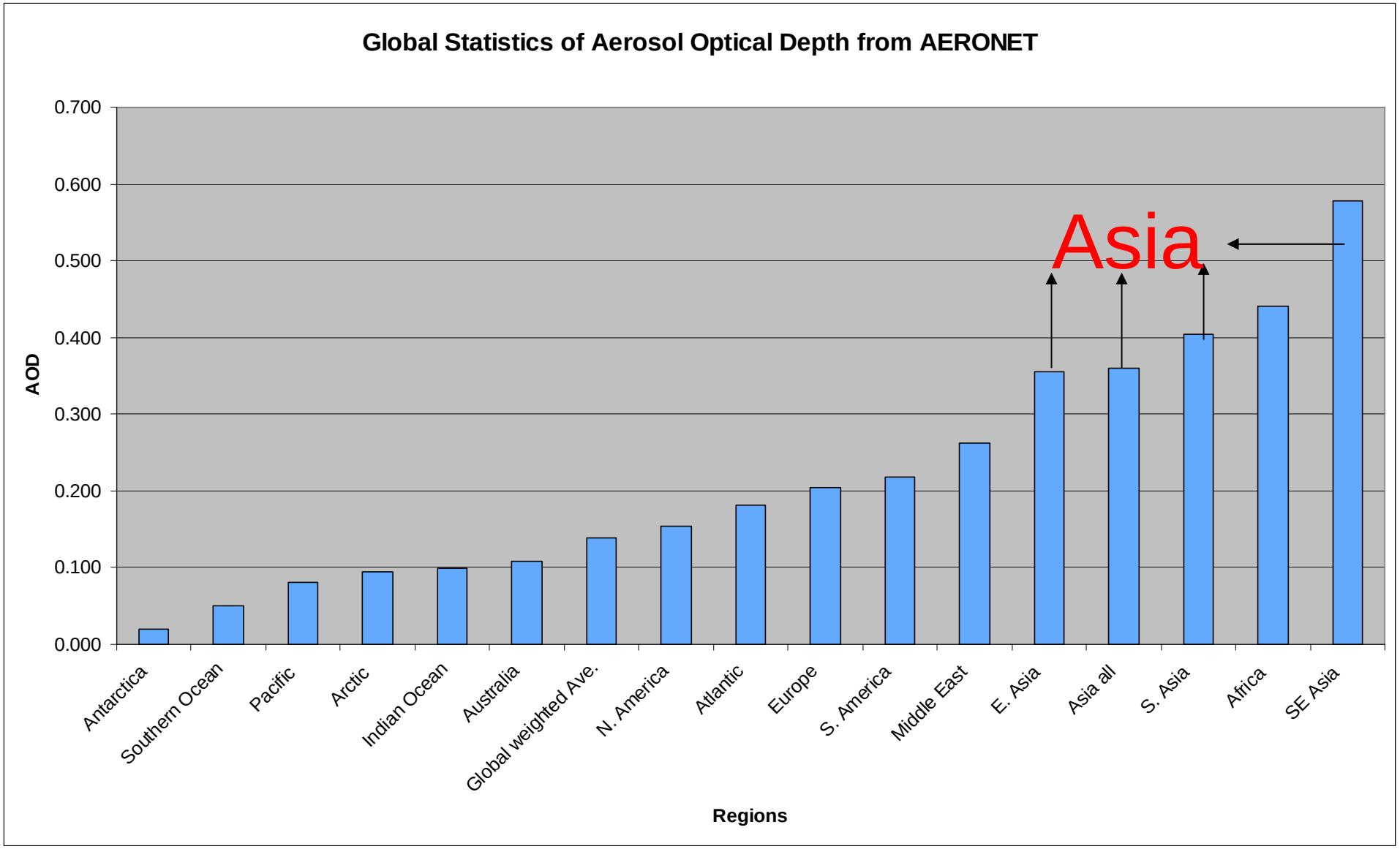


Average optical thickness

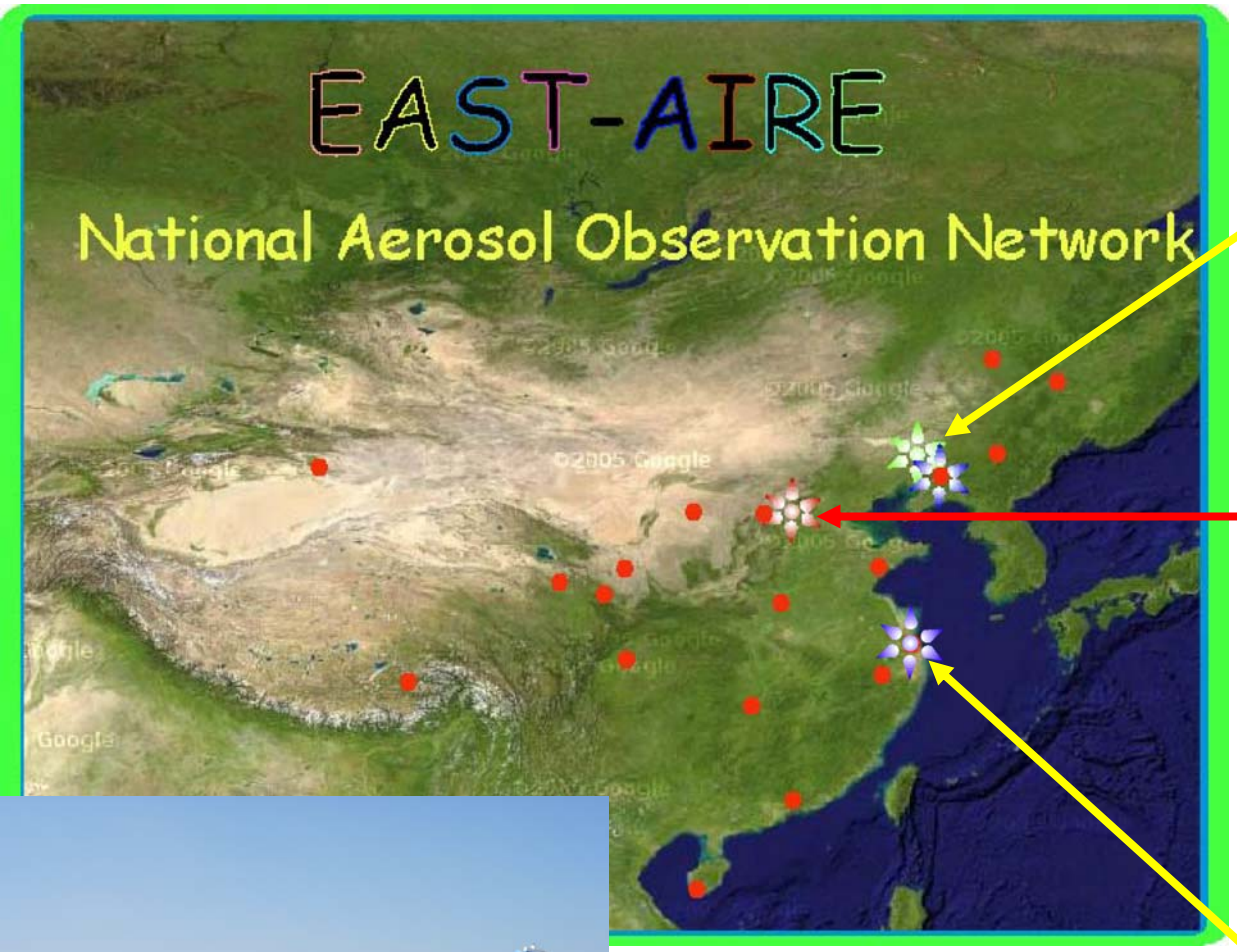
Regions of fine-mode and strong absorptive aerosols

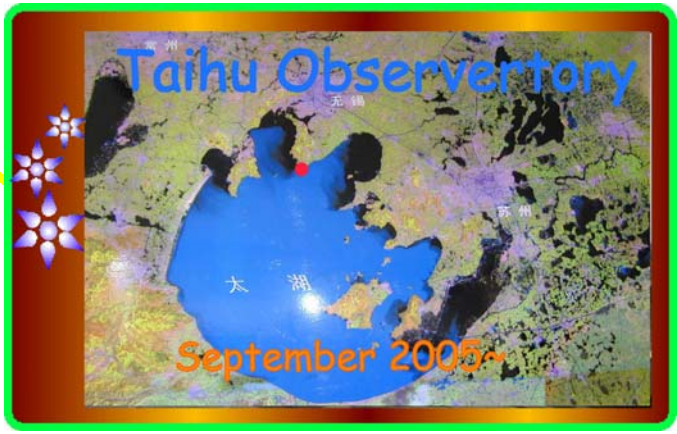


Breon et al. (Science 2002)


Global Statistics of Aerosol Optical Depth from AERONET
AOD
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Asia
Antarctica
Southern Ocean
Pacific
Arctic
Indian Ocean
Australia
Global weighted Ave.
N. America
Atlantic
Europe
S. America
Middle East
E. Asia
Asia all
S. Asia
Africa
SE Asia
Regions

Current Observational Activates



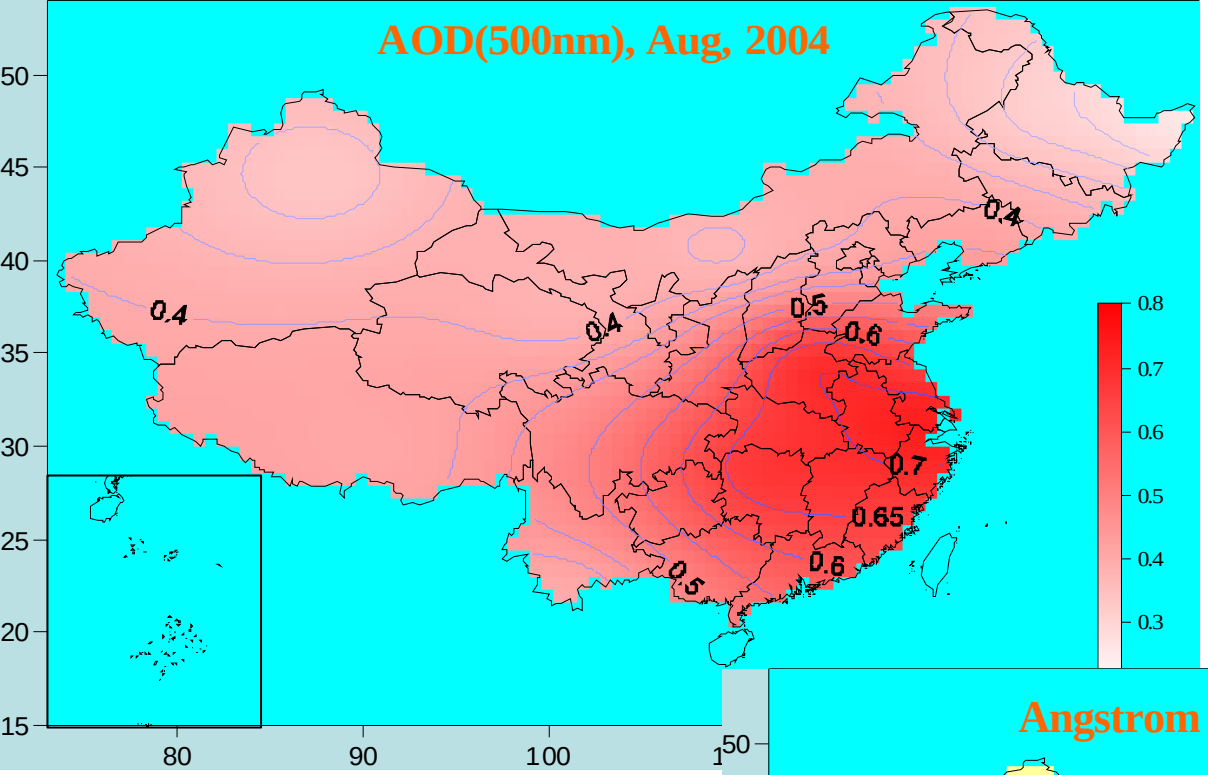


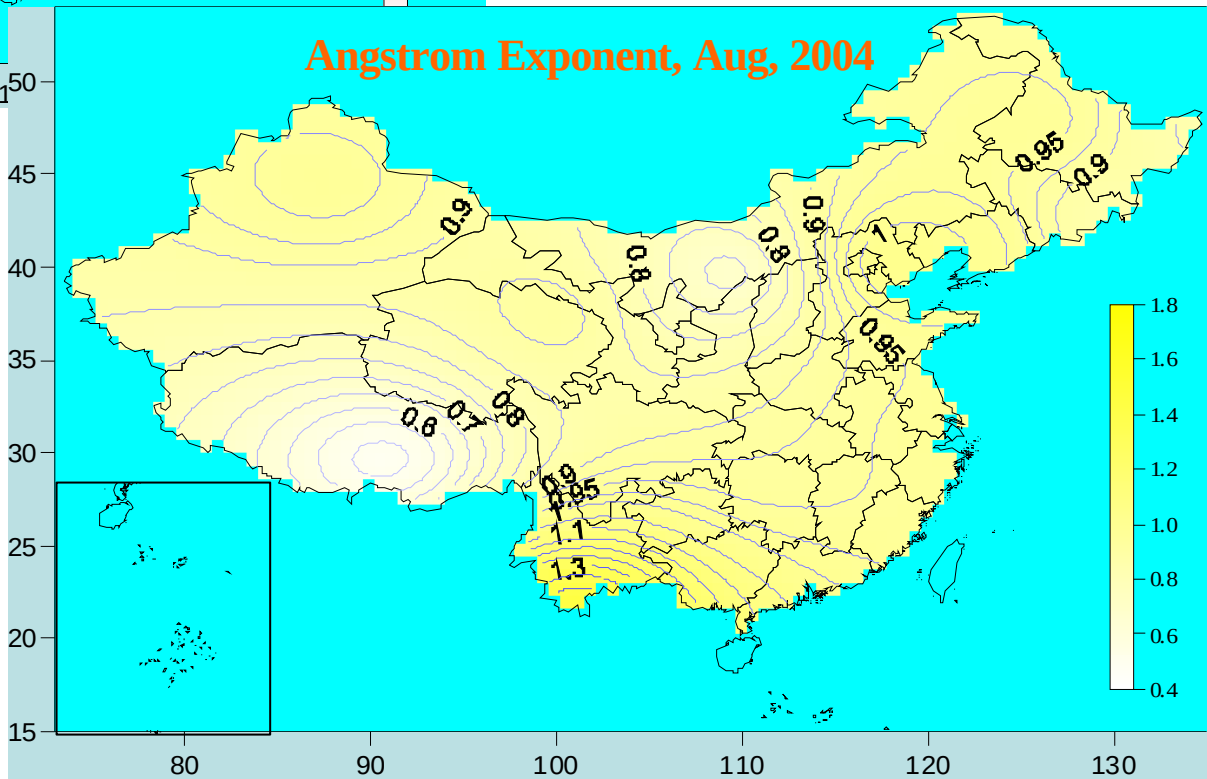
www.atmos.umd.edu/~zli

Radiation Instruments

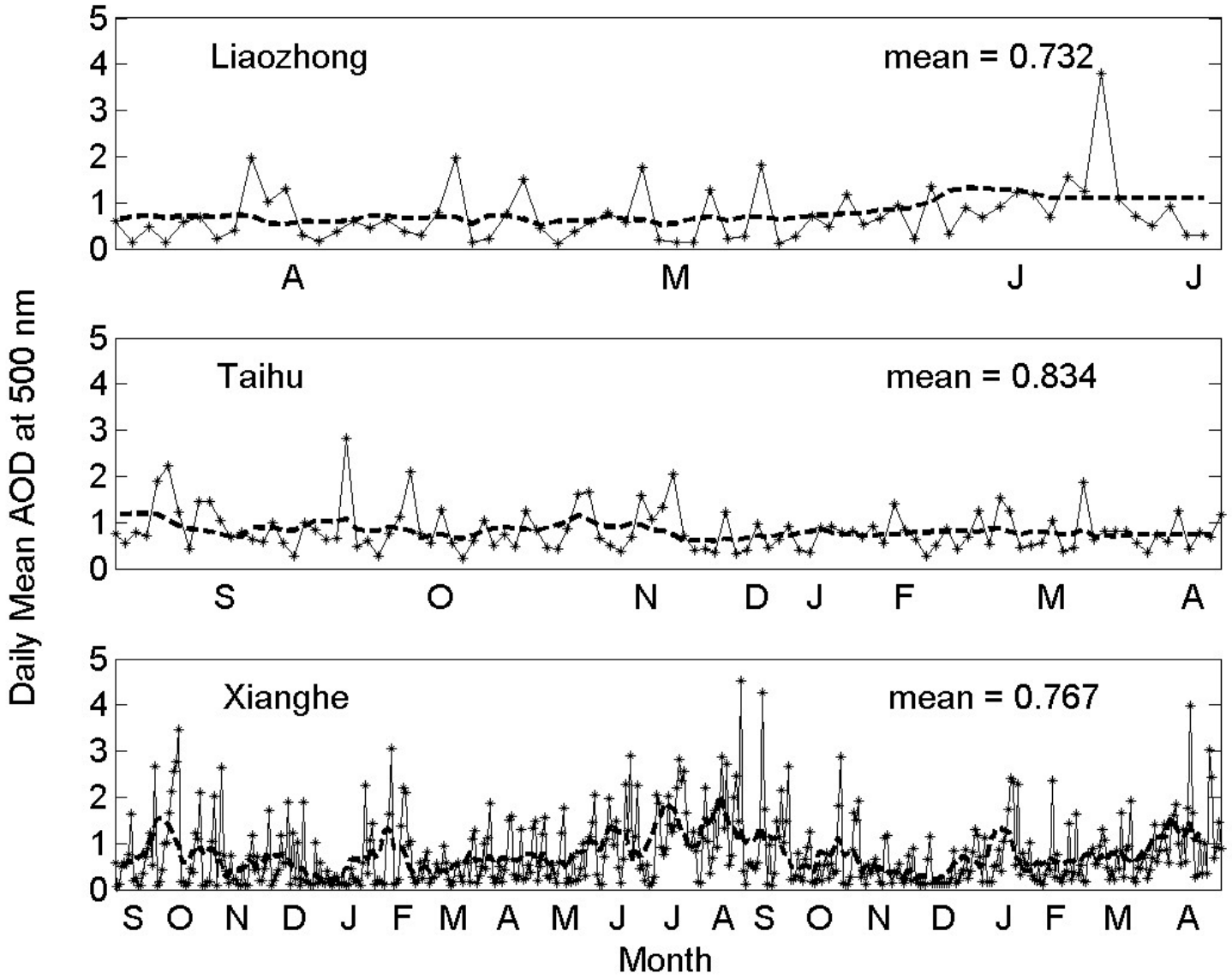
Aerosol Instruments

Cloud Instruments

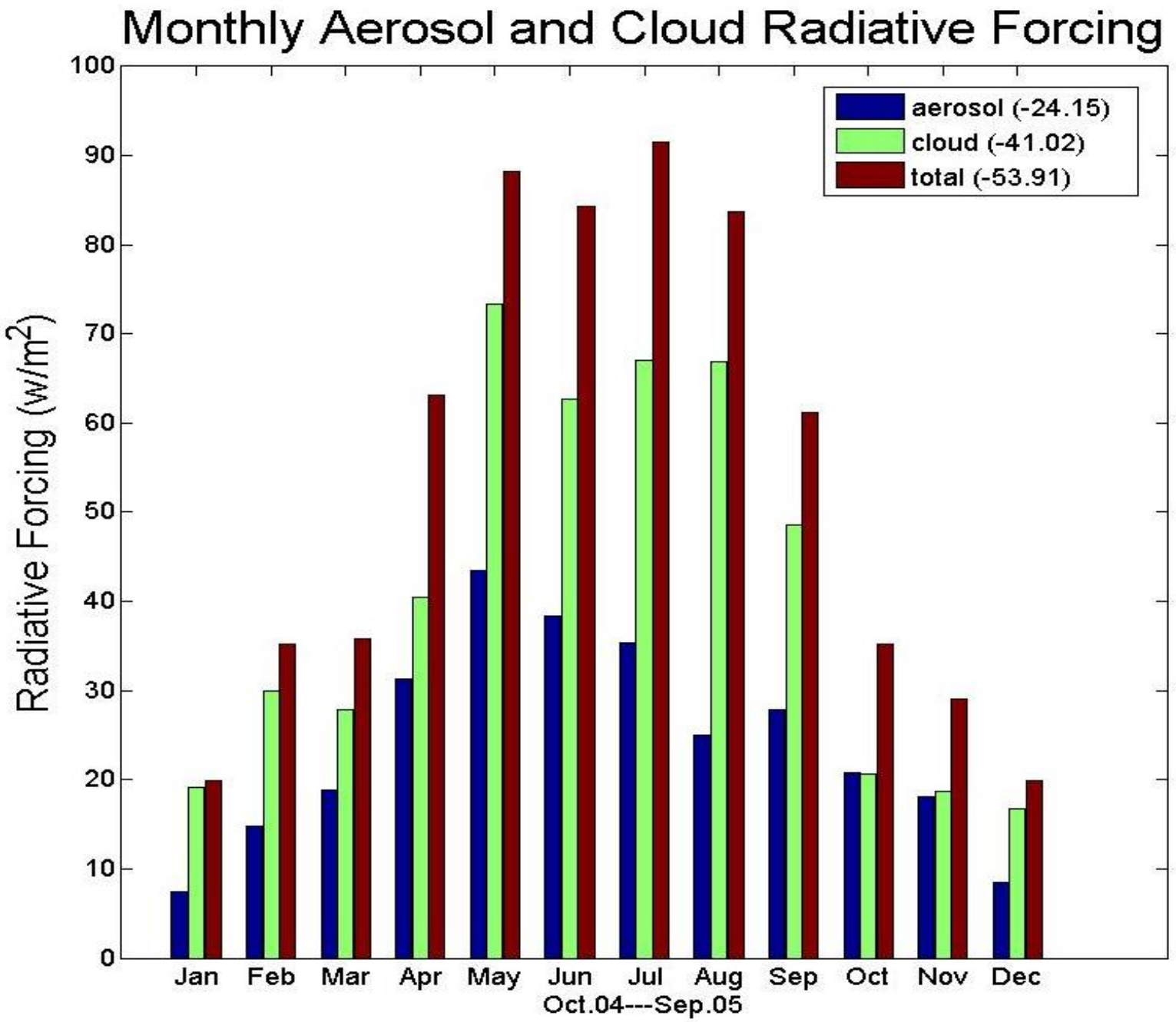

AOD(500nm), Aug, 2004
0.4
0.4
0.4
0.5
0.6
0.7
0.65
0.6
0.5
0.8
0.7
0.6
0.5
0.4
0.3
50
45
40
35
30
25
20
15
80
90
100

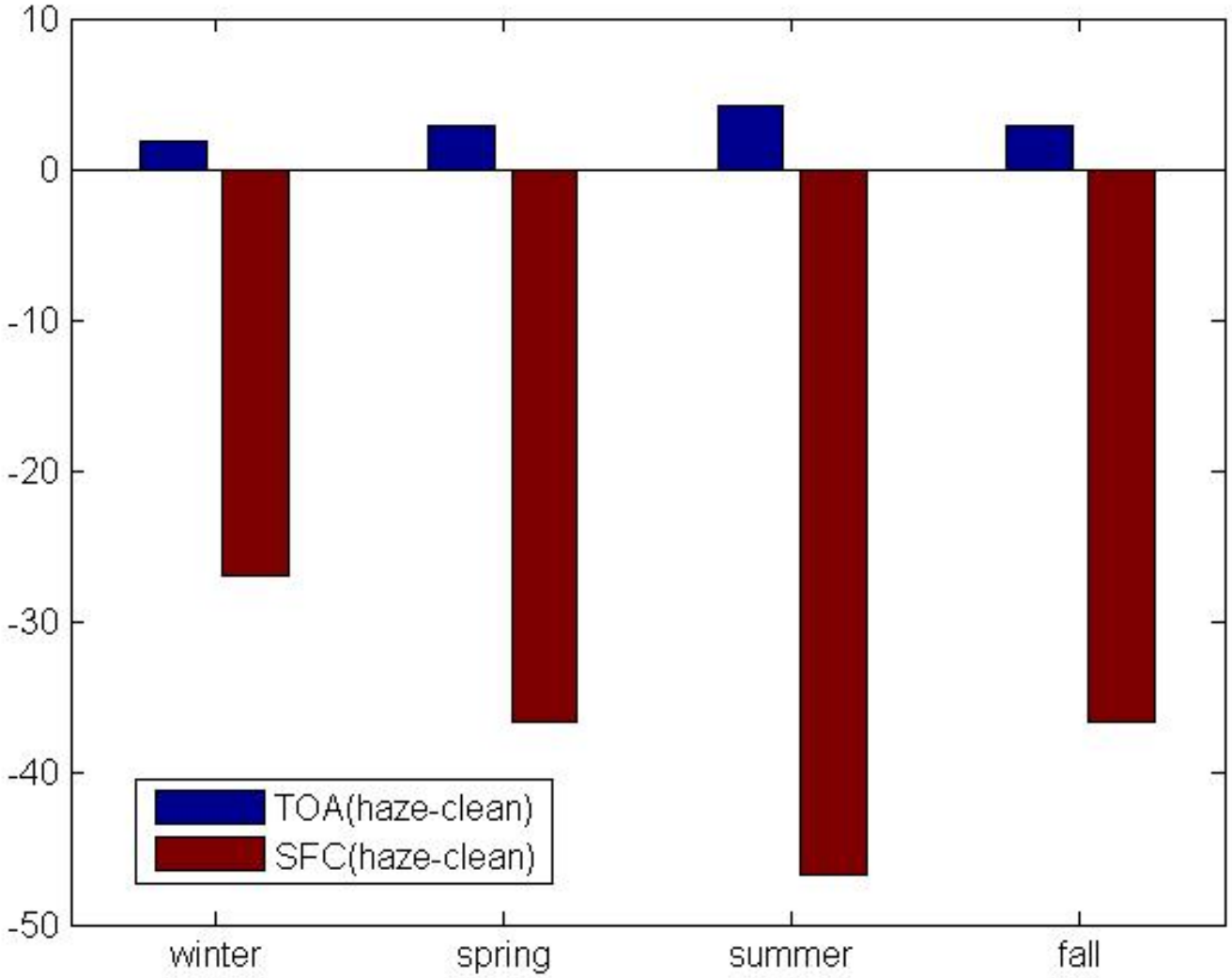

Angstrom Exponent, Aug, 2004
0.9
0.8
0.8
0.9
1
0.95
0.9
0.95
0.6
0.7
0.8
0.9
0.95
1.1
1.3
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
50
45
40
35
30
25
20
15
80
90
100
110
120
130

Aerosol Optical depth at Three Sites in China



Daily ng,
April he,
September 2004 – April 2006.


Monthly Aerosol and Cloud Radiative Forcing
aerosol (-24.15)
cloud (-41.02)
total (-53.91)
Radiative Forcing (w/m2)
0
10
20
30
40
50
60
70
80
90
100
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Oct.04---Sep.05


10
0
-10
-20
-30
-40
-50
TOA(haze-clean)
SFC(haze-clean)
winter
spring
summer
fall

Journal of Geophysics Research EAST-AIRE Special Issue

Li, Z., X. Xia, M. Cribb, M. Wen, P. Wang, H. Chen, B. Holben, S.-C. Tsay, T. Eck, E.G. Dutton, F. Zhao, 2006, Aerosol optical properties and radiative effects in Northern China. *In press*..

Xin, J., Y. Wang, Z. Li, P. Wang, W.-M. Hao, B.L. Nordgren, G. Liu, S. Hubo, AOD and Angstrom exponent of typical aeroso observed in Chinese Sun Hazemeter Network from August 2004 to September 2005. *in press.*

Li, C., L.T. Marufu, R.R. Dickerson, Z. Li, J.W. Stehr, H. Chen, and P. Wang, T. Wen, In-Situ Measurements of Trace Gases and Aerosol Optical Properties at a Rural Site in Northern China during EAST-AIRE IOP 2005. *revised*

Zhao, Z., and Z. Li, 2006, Estimation of aerosol single scattering albedo from a combination of spectral direction radiation and broadband total radiation measurements, *in press.*

Xia, X., H. Chen, Z. Li, P. Wang, J. Wang, Ground-based remote sensing of aerosol properties and direct radiative forcing in a Shenyang suburban region, North China, *in press.*

Dickerson, R.R., C. Li, Z. Li, J.W. Stehr, P. Wang, H. Chen, J. Yang, The mechanism of long range transport of trace gases and aerosols from China: The role of dry convection. *Under revision.*

Li, C., L.T. Marufu, R.R. Dickerson, Z. Li, Impact of heating season on the emissions of trace gases and aerosols, *to be submitted in April.*

Chaudhry, Z., J.V. Martins, Z. Li, W. Nan, T. Wen, L. Marufu, In Situ Measurements of Aerosol Mass Concentration and Spectral Absorption During EAST-AIRE. *to be submitted soon.*

Wen, T., Y. Wang, R. Dickerson, Z. Li, Analysis of long-term measurements of SO2, CO, OC/EC in China, *submitted in April.*

Huebert, B., Zhuang, S. Powell, et al., Near-Source vs Offshore Measurements of Asian Aerosols: Do They Agree? *to be submitted soon.*

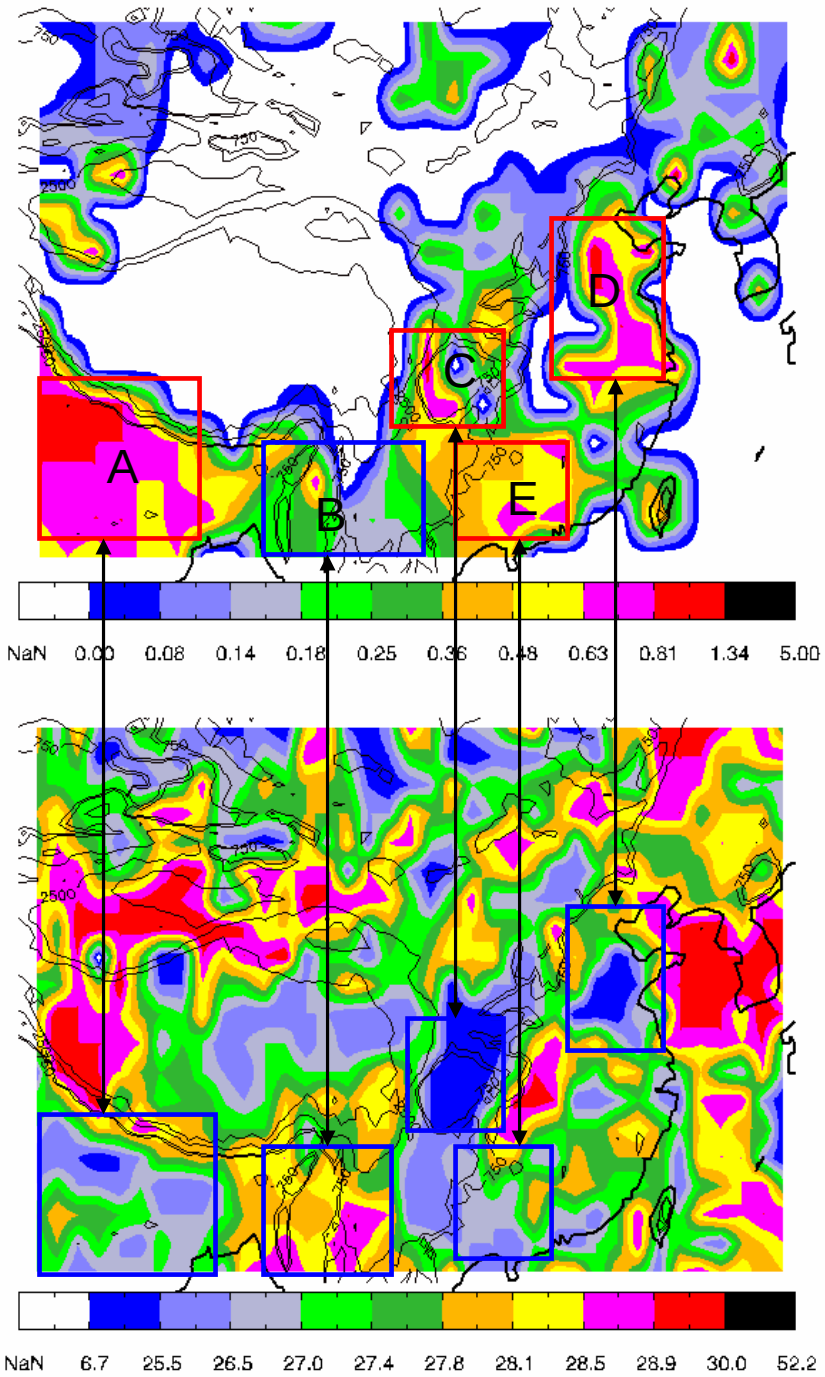
Li, Z., R. Dickerson, H. Chen, P. Wang, S.-C. Tsay, H. Maring, B. Holben, B. Huebert, V. Martin, Y.S. Wang, East Asian Stud of Tropospheric Aerosols: an International Regional Experiment (EAST-AIRE): An introduction and highlight of major finding *to be submitted soon*

Some Glimpse of Aerosol Indirect Effects Obtained from Space -Important mechanism to be explored

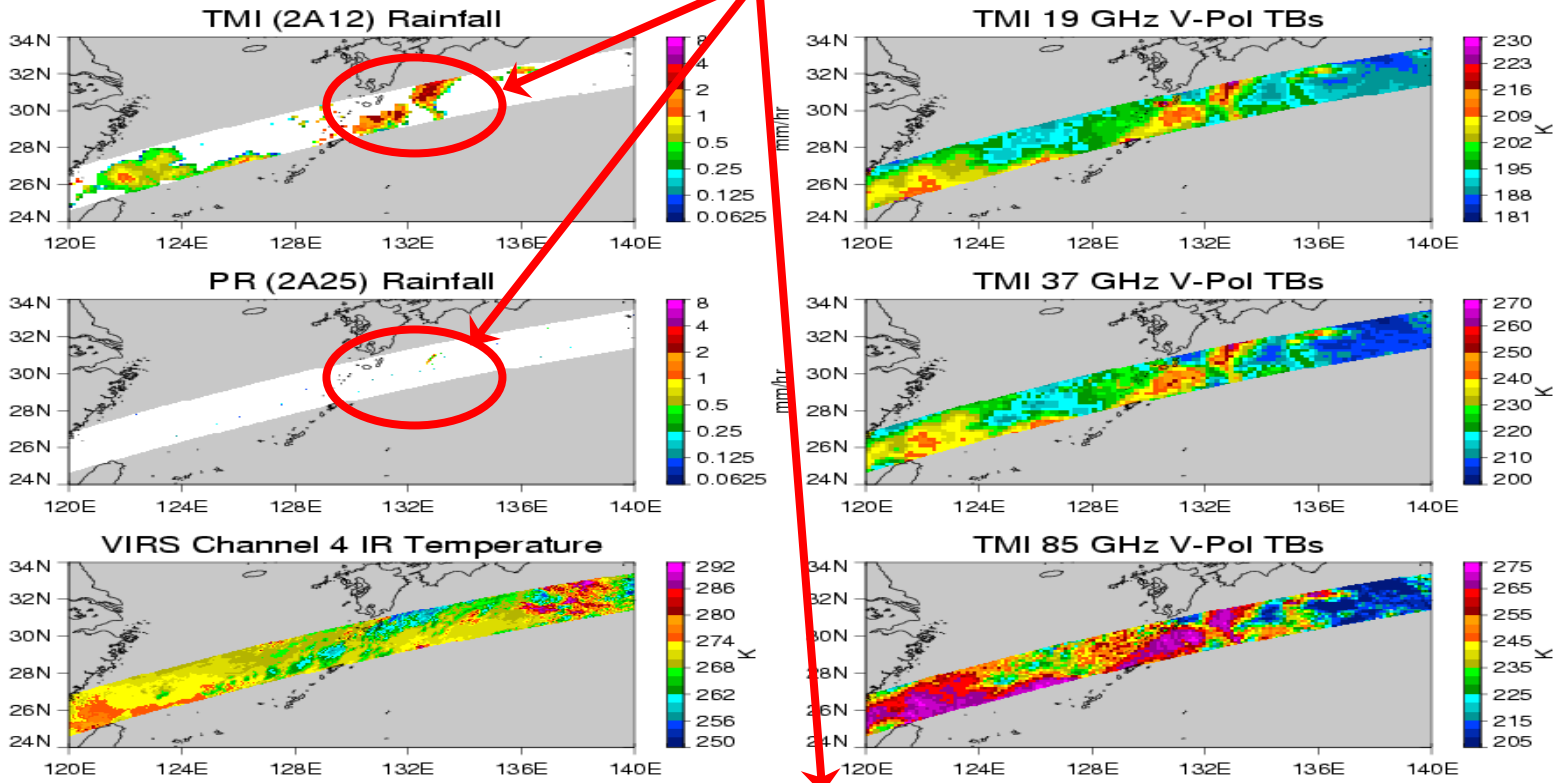
- Reducing droplet size for water clouds
- Suppressing rainfall
- Increasing crystal size for ice clouds
- Strengthening Pacific winter storm
- Change the monsoon circulation

Impact on droplet size

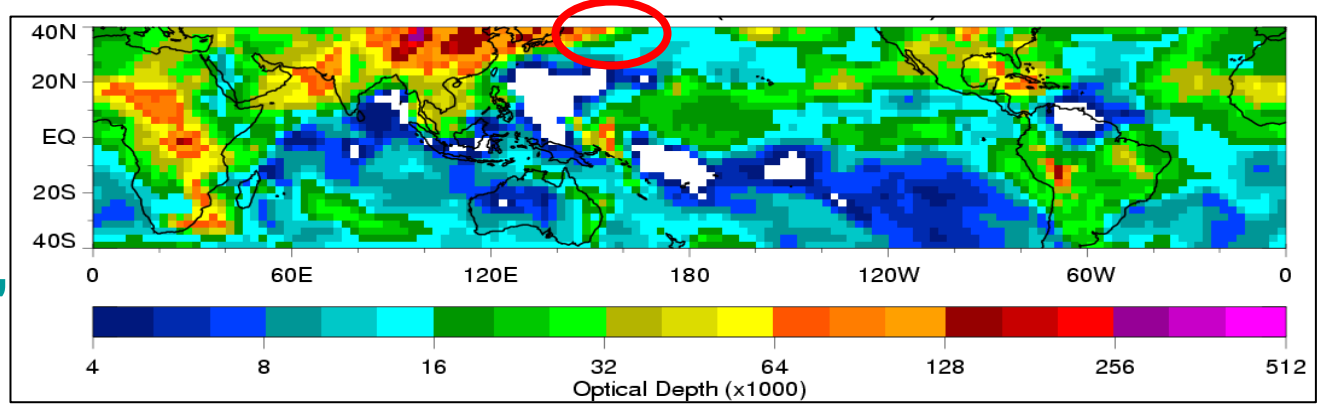
- ‘A’: Northern India valley with high AOD
- ‘B’: Southwestern China and northeast India with low AOD [The contrast will produce a corresponding seesaw pattern in DER]
- ‘C’: Sichuan basin with high AOD
- ‘D’: Central and eastern China with high AOD
- ‘E’: Industrialized province of Guangdong with high AOD



Aerosol Impacts?



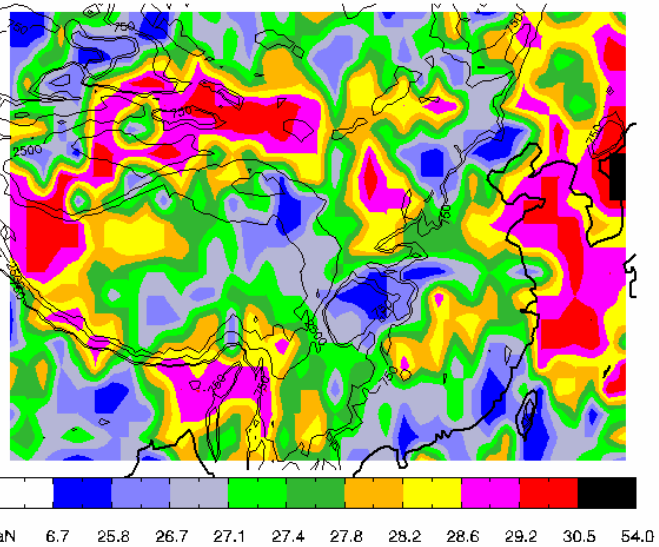
GOCART Sulfate Aerosol (Feb. 01, 2000)



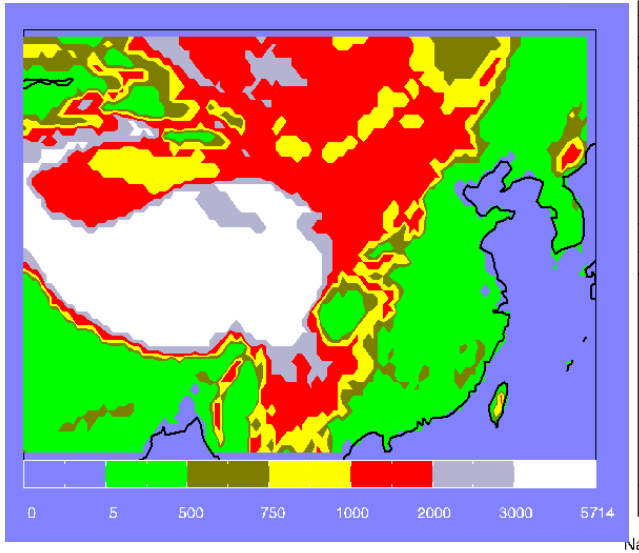
Courtesy of CSU TRMM Team

Comparison between US and China

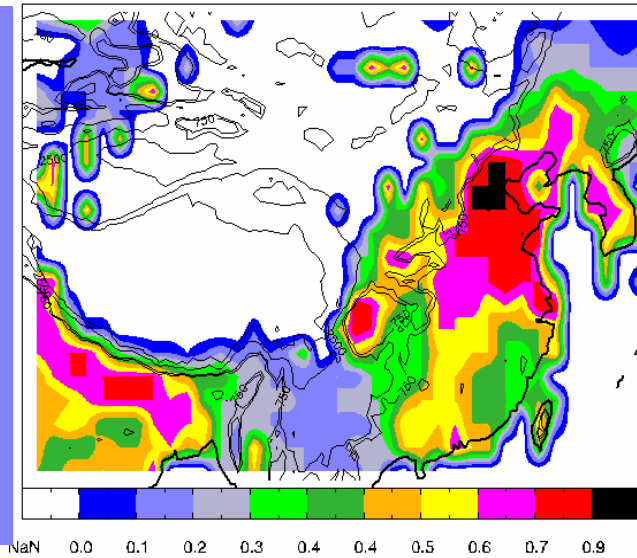
Ice Cloud Particle Size

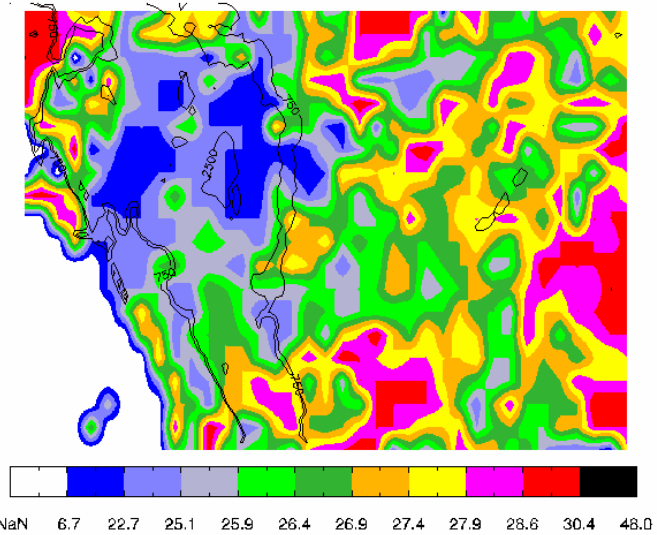


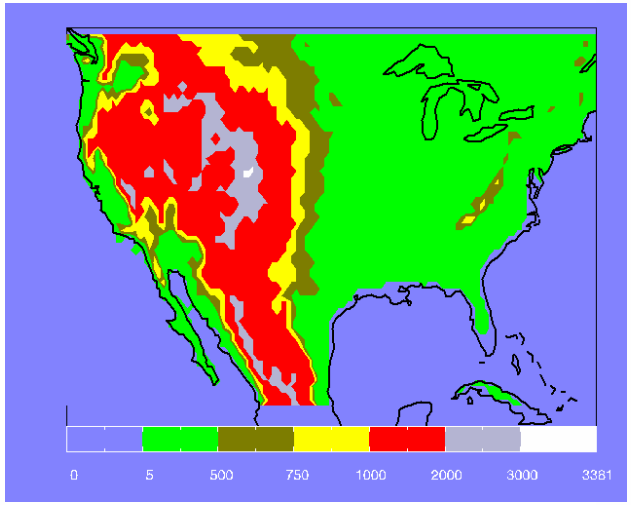
Elevation

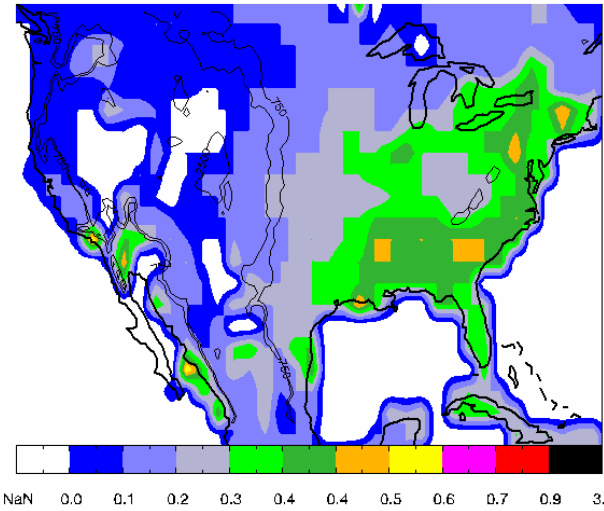


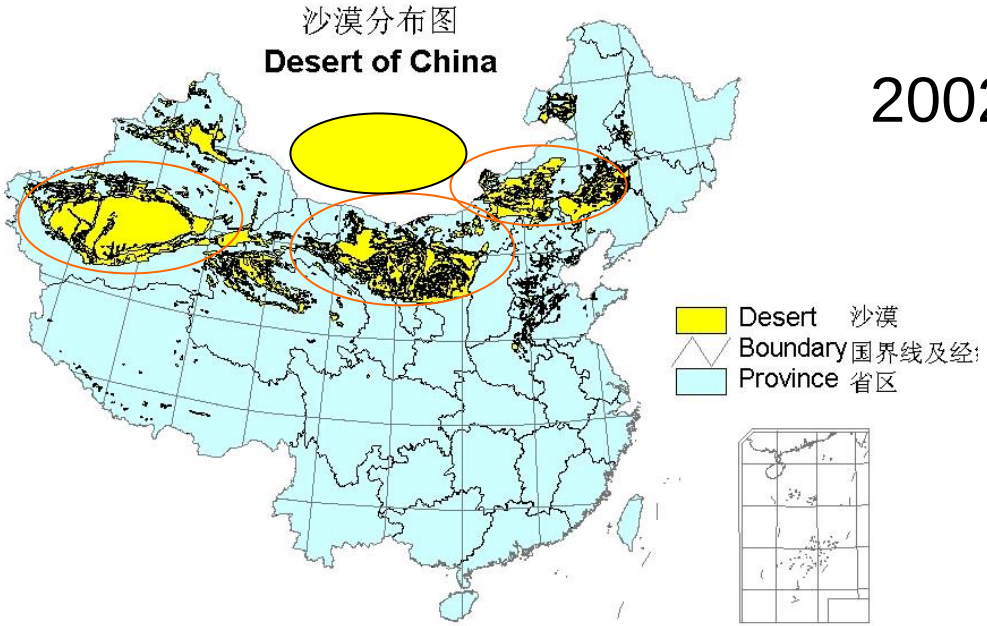
Aerosol Optical Depth



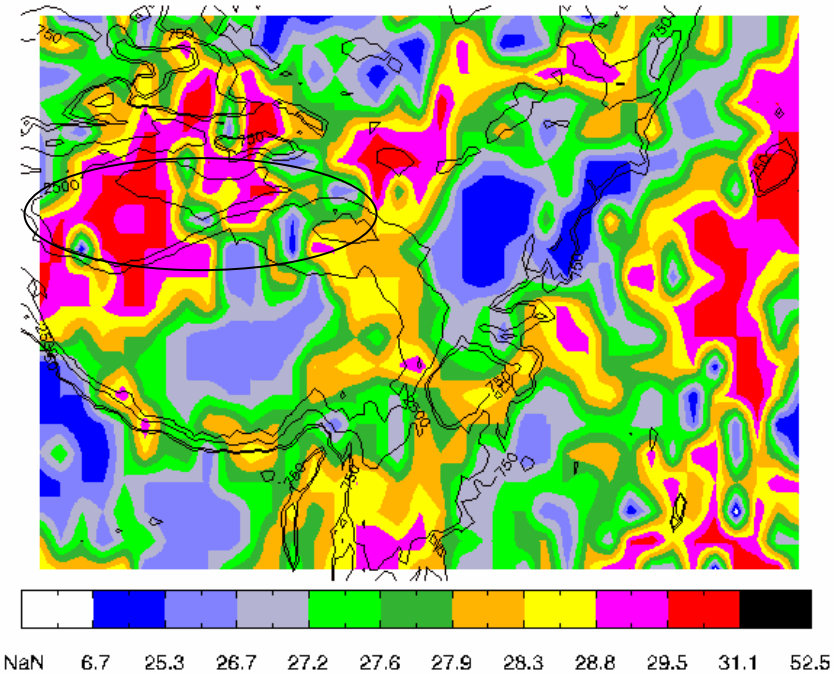


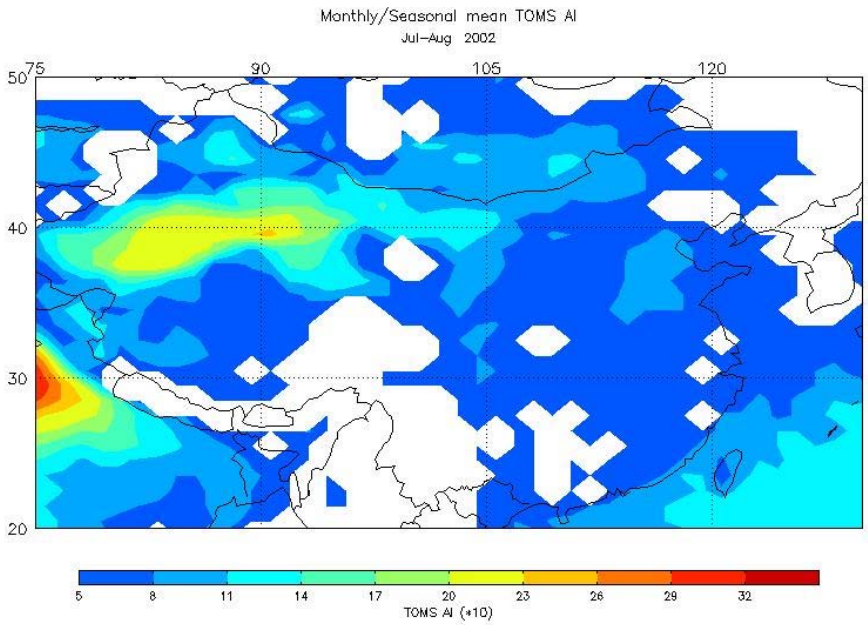






2002



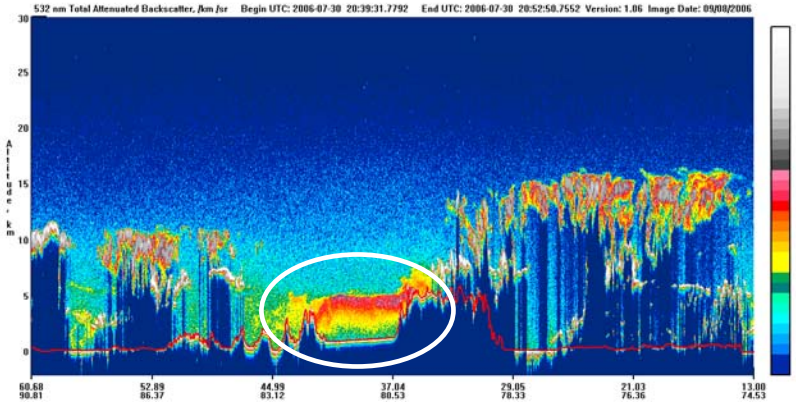


Features to notice

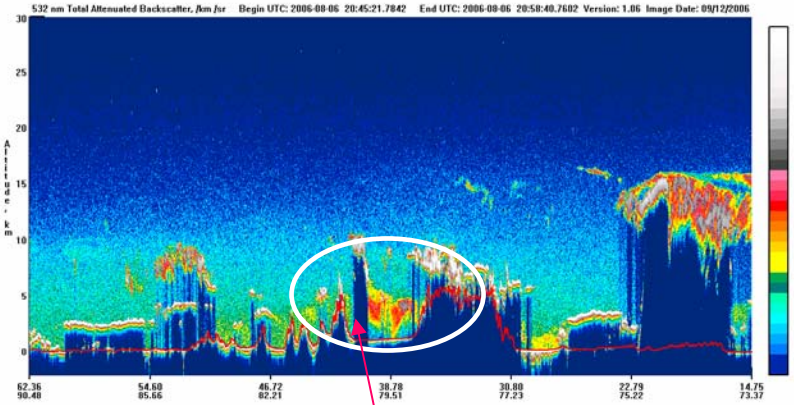
- Correspondence between areas with large AI value and desert distribution
- In Northwestern China and southern Mongolia there is a band of area with large ice particle sizes
- There's an established land-sea contrast in terms of DER size

Persistent Elevated dust layers over Taklamakan desert

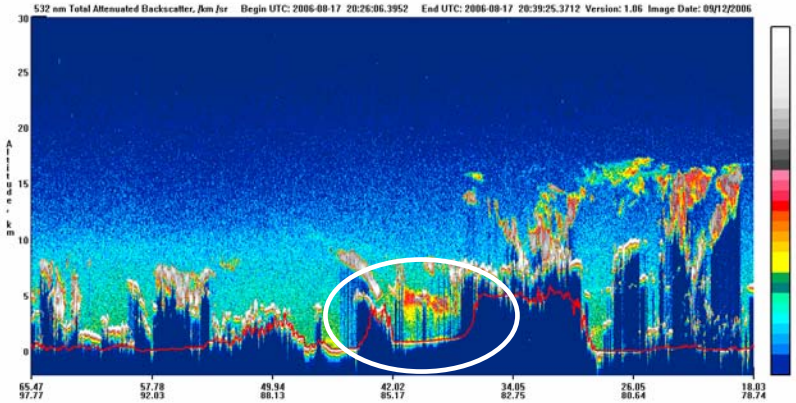
CALIPSO, July 30, 2006



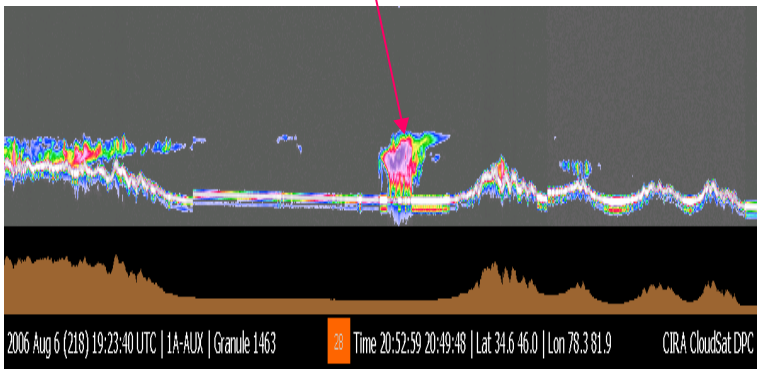
CALIPSO, Aug 6, 2006



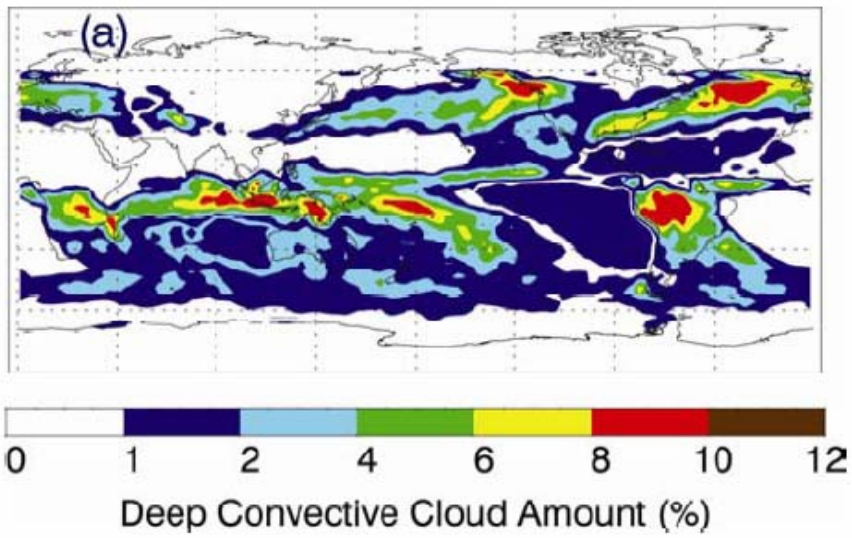
CALIPSO, Aug 30, 2006

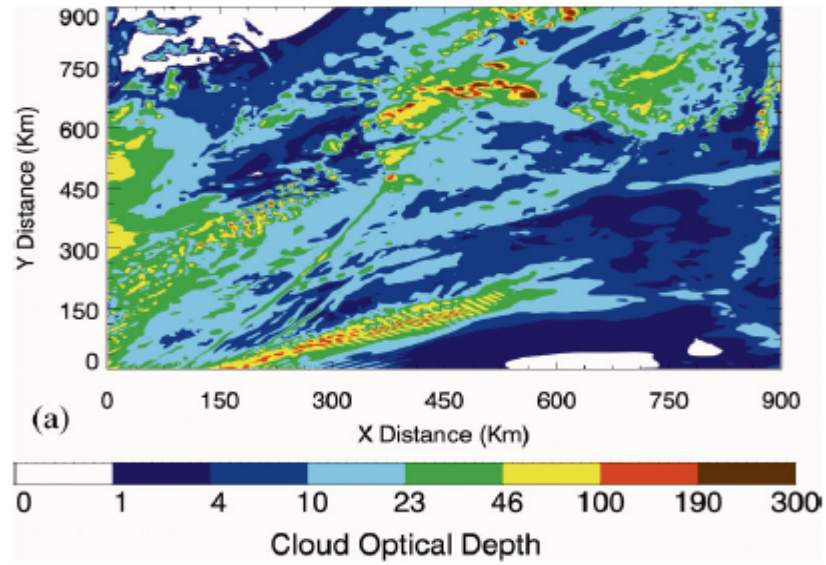


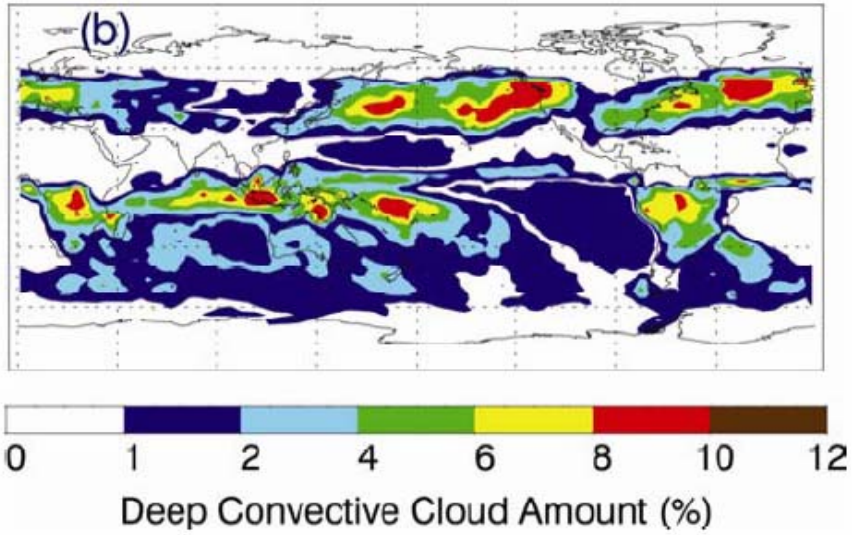
CLOUDSAT, Aug, 2006

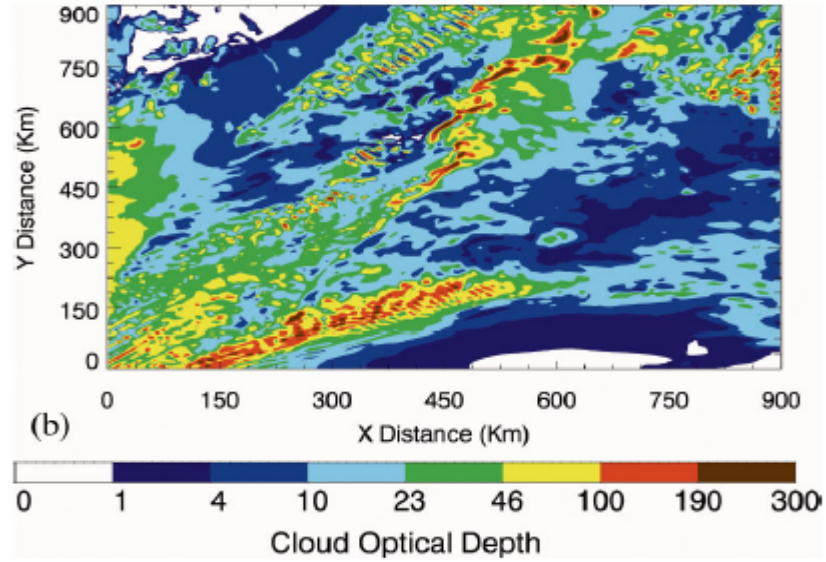


Impact on Pacific storm track









Zhang et al. 2006

North Drought and South Flooding Trend in China

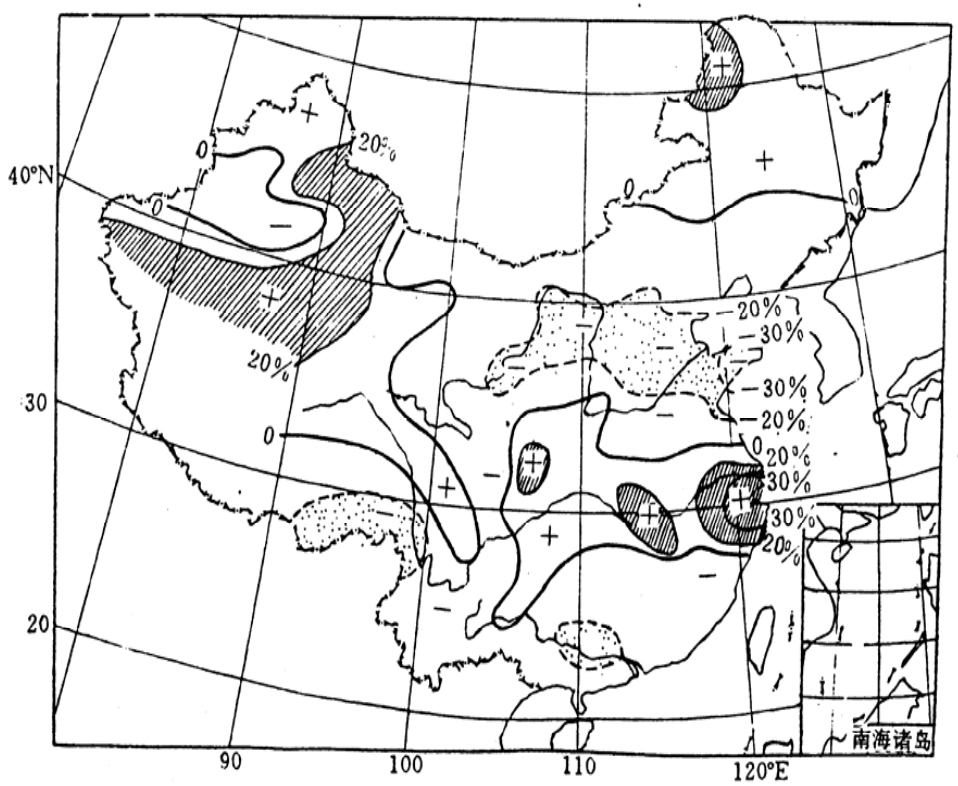
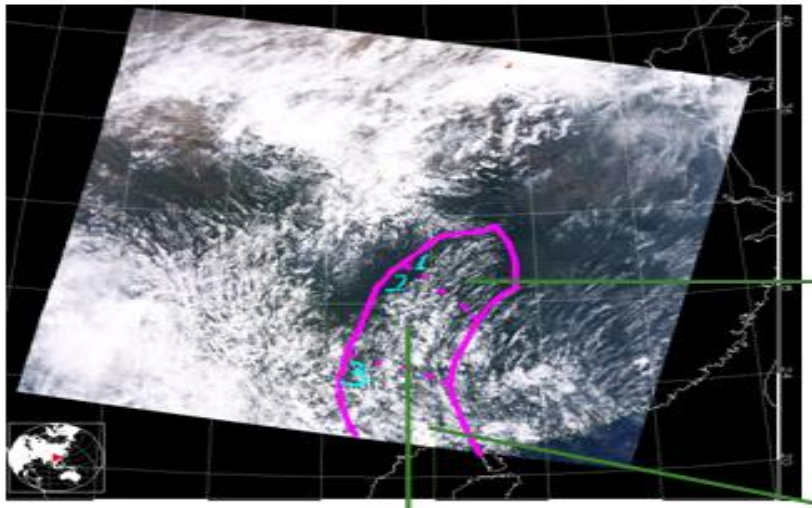
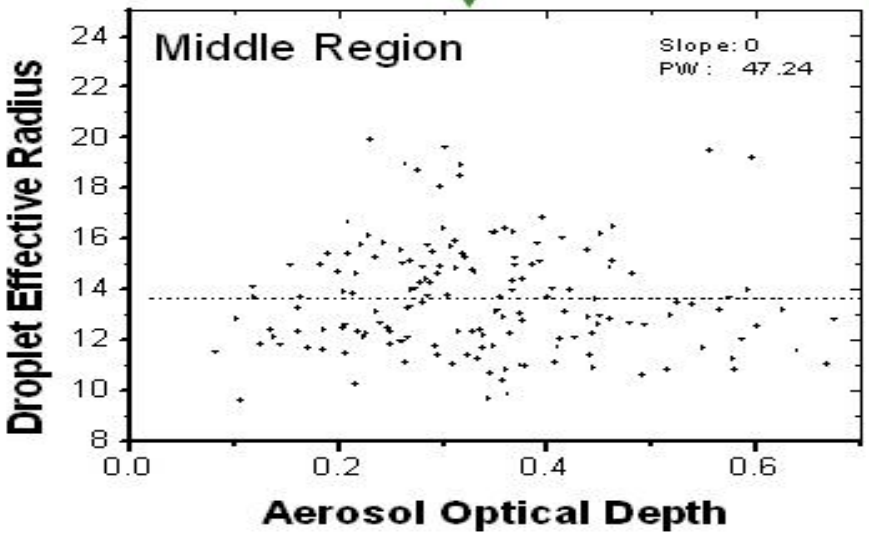


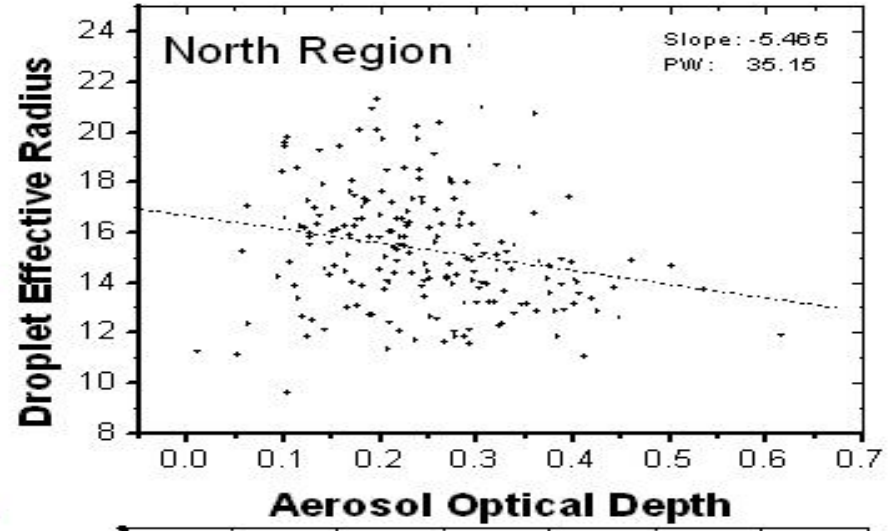
图 2　近 14 年(1980～1993 年)7～8 月全国雨量平均距平(相对于 1951～1980 年平均)分布
(阴影区距平≥+20%，而碎点区距平≤−20%)

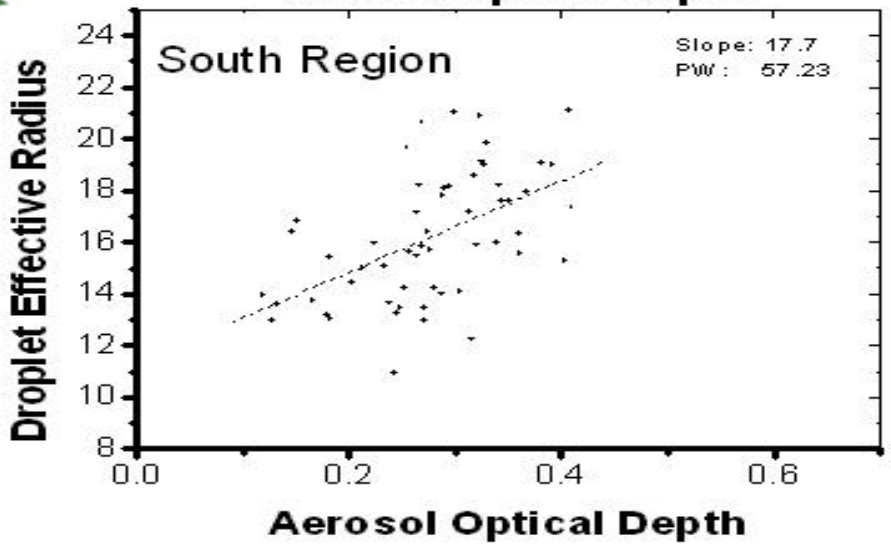
Aerosol Direct Radiative Forcing or Aerosol Indirect Effect?

Remote Sensing Studies



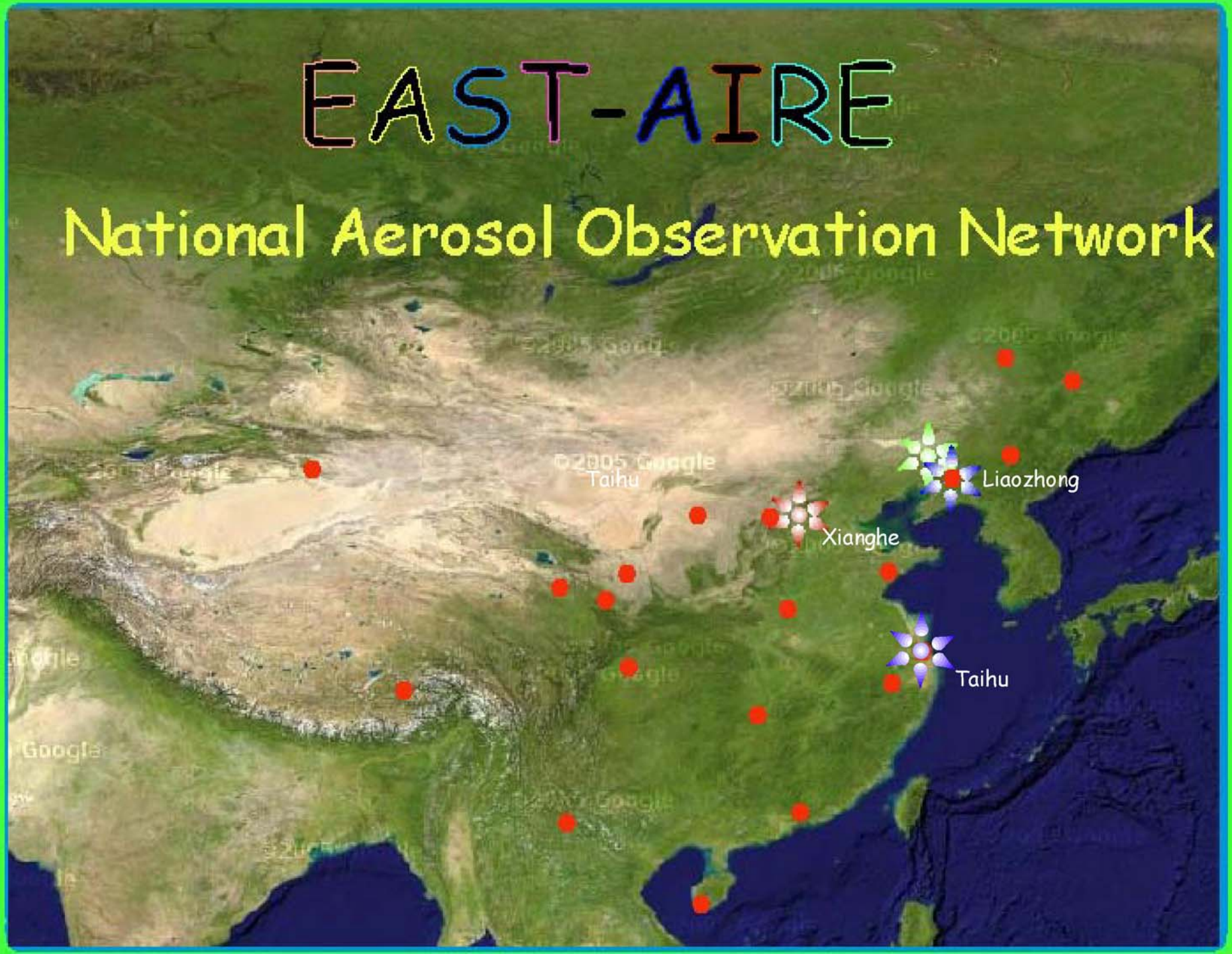






EAST-AIRE

National Aerosol Observation Network

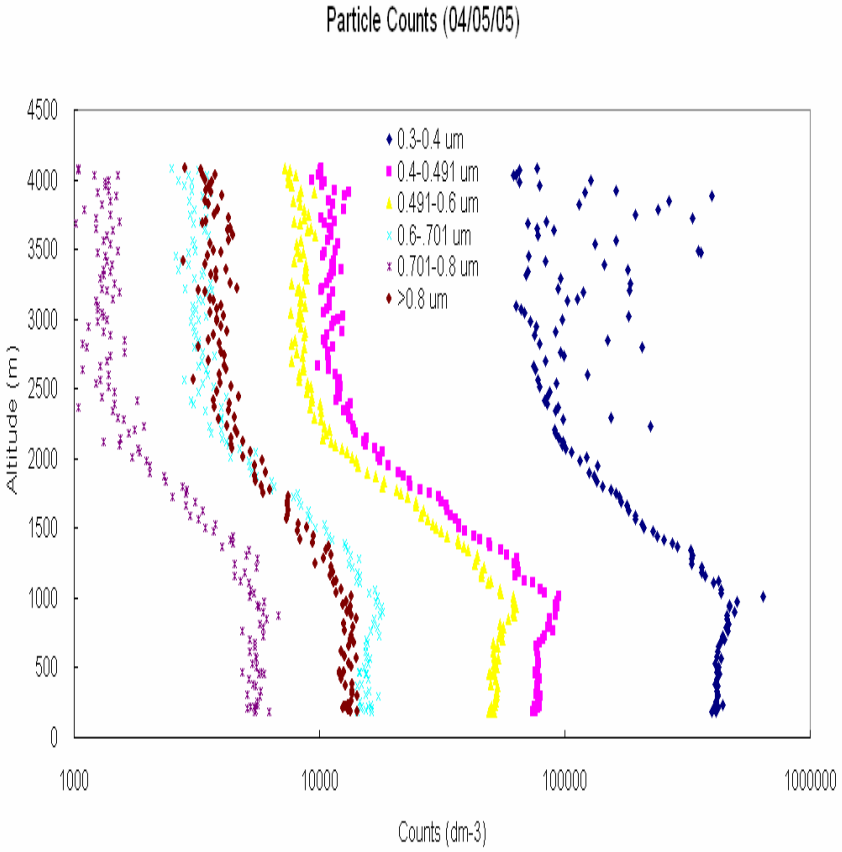


常 州
无 锡
Proposed Site for
AMF Deployment
苏 州
太 湖

AMF-China Schedule

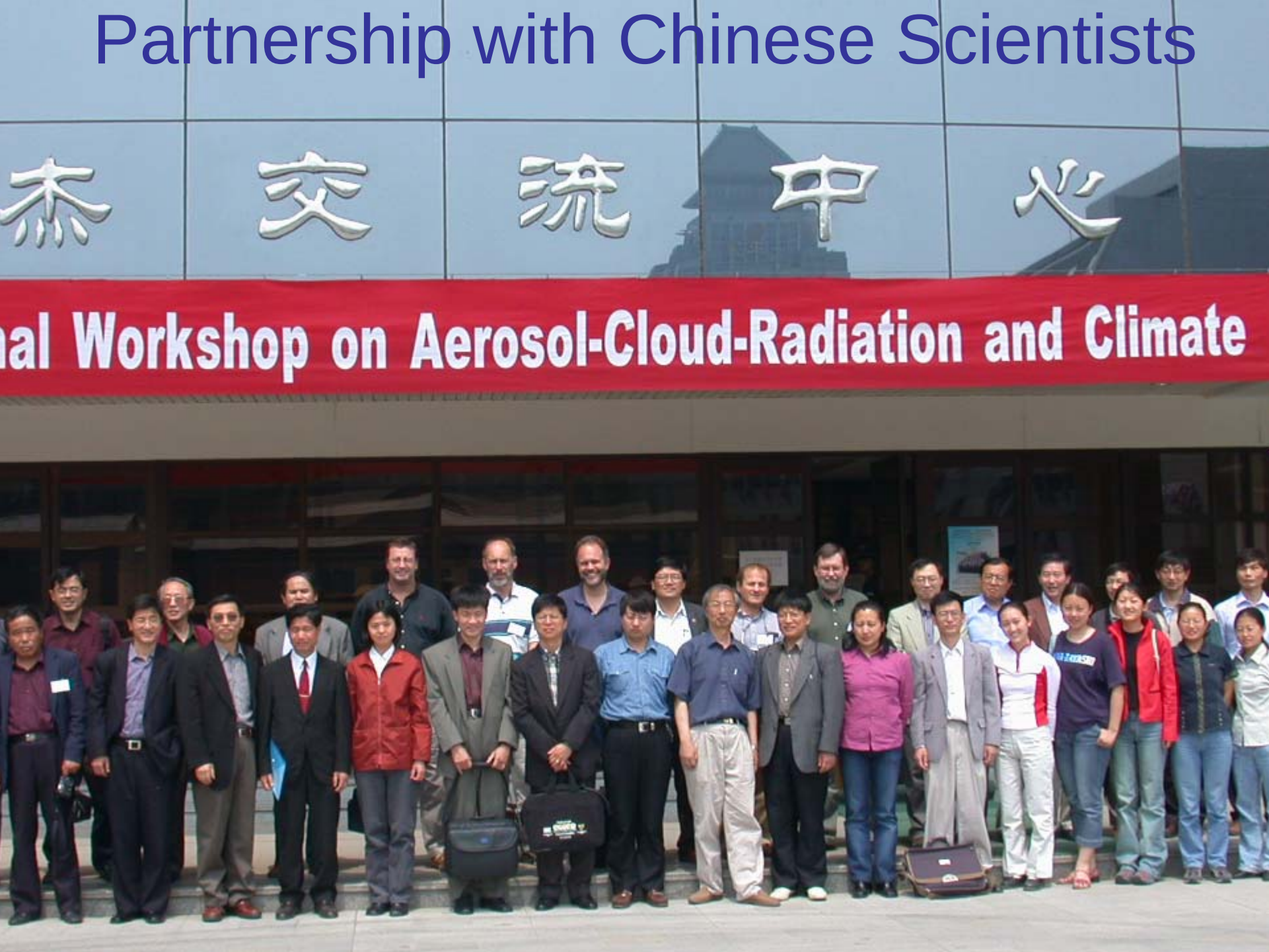
- 2006, preliminary preparation, coordination, bilateral agreement, etc.
- Early 2007, site evaluation
- Summer 2007, science and planning meeting between US and Chinese participants
- Jan-Feb 2008, instrument shipping and set-up
- March 15 – Dec. 30, AMF operation
- Sometime in 2008, airborne campaign
- You are welcome to join and contribute more instruments, especially the air-borne ones.

Particle Counts @ Liaozhong (04/05/05)



Support and Partnership with Chinese Scientists and Agencies

Partnership with Chinese Scientists



Strong Support from Chinese Funding Agencies

WELCOME ON BOARD!

IF YOU ARE HUNGRY,
LOCAL DELICACY IS
WAITING FOR YOU
2005.01.14 01:43