THE DOE
ATMOSPHERIC SCIENCE PROGRAM

ANNUAL SCIENCE TEAM MEETING (FY 2006)
PROGRAM STATUS AND MEETING OUTLINE & OBJECTIVES

Stephen E. Schwartz

ASP Chief Scientist

Alexandria VA, October 31 - November 1, 2005

DOE CLIMATE CHANGE RESEARCH DIVISION

RESEARCH OBJECTIVES

- ***Improve understanding*** of factors affecting the Earth's radiant-energy balance.
- ***Predict accurately*** any global and regional climate change induced by increasing atmospheric concentrations of aerosols and greenhouse gases.
- Quantify sources and sinks of energy-related greenhouse gases, especially carbon dioxide.
- ***Improve the scientific basis*** for assessing . . . the potential consequences of climatic changes. . .

http://www.er.doe.gov/production/ober/CCRD_top.html

ATMOSPHERIC SCIENCE PROGRAM
MAJOR MILESTONES

2004		
March 2	Chief Scientist selected	
April 29	BERAC approval of ASP Reconfiguration	
May 4	Federal Register announcement	
June 21	Proposals due; ~154 proposals received	
September 21	Proposal reviews completed	
November 4	Recommended projects announced	
2005		
January 25	Science Team meeting (FY 2005)	
May	Black carbon detection intercomparison	***Results!***
July	MASE - MArine Stratus Experiment	***Results!***
October 31	Science Team meeting (FY 2006)	
2006		
March	MAX-MEX Megacity Aerosol eXperiment - MEXico City	
August	MAX-TEX Megacity Aerosol eXperiment - TEXas	

Atmospheric Science Program
Program Deliverables

Models and parameterizations suitable for representing aerosol properties and processes required to compute aerosol radiative forcing of climate in large-scale climate models, together with an assessment of their accuracy and limitations. . .

- Relating ***aerosol light scattering and absorption***, including dependence on relative humidity and other controlling variables, to aerosol chemical and microphysical properties.
- Relating ***cloud microphysical properties*** and dependence on controlling variables, to concentration, and chemical and microphysical properties of pre-cloud aerosol.
- Relating the ***evolution of aerosol composition and microphysical properties***, and optical and cloud nucleating properties, to concentrations of precursor gases, properties of the pre-existing aerosol, cloud processing, and other controlling variables.

Atmospheric Science Program
Science Deliverables

- 1. Field measurements
- 2. Laboratory and theoretical research
- 3. Instruments for improved measurements
- 4. Models, modules, and parameterizations
- 5. Dissemination of research results

ATMOSPHERIC SCIENCE PROGRAM
PROGRAM COMPONENTS

Science Team:

32 Projects from DOE National Laboratories, Other Federal Agencies, Universities, and Private Sector

- Laboratory studies and theory
- Field studies
- Instrument development
- Modeling

Science Support:

- Aircraft operations
- Core airborne chemical and microphysical measurements
- Ground-based meteorological, chemical, and aerosol measurements
- Data processing and archiving

Adjunct Science Team:

8 Projects from DOE National Laboratories, Universities, and Other Federal Agencies

Support from NIGEC, EPSCoR, and other sources

DOE Research Aircraft Facility

Grumman Gulfstream 159 (G-1) twin turboprop aircraft

DOE RESEARCH AIRCRAFT FACILITY

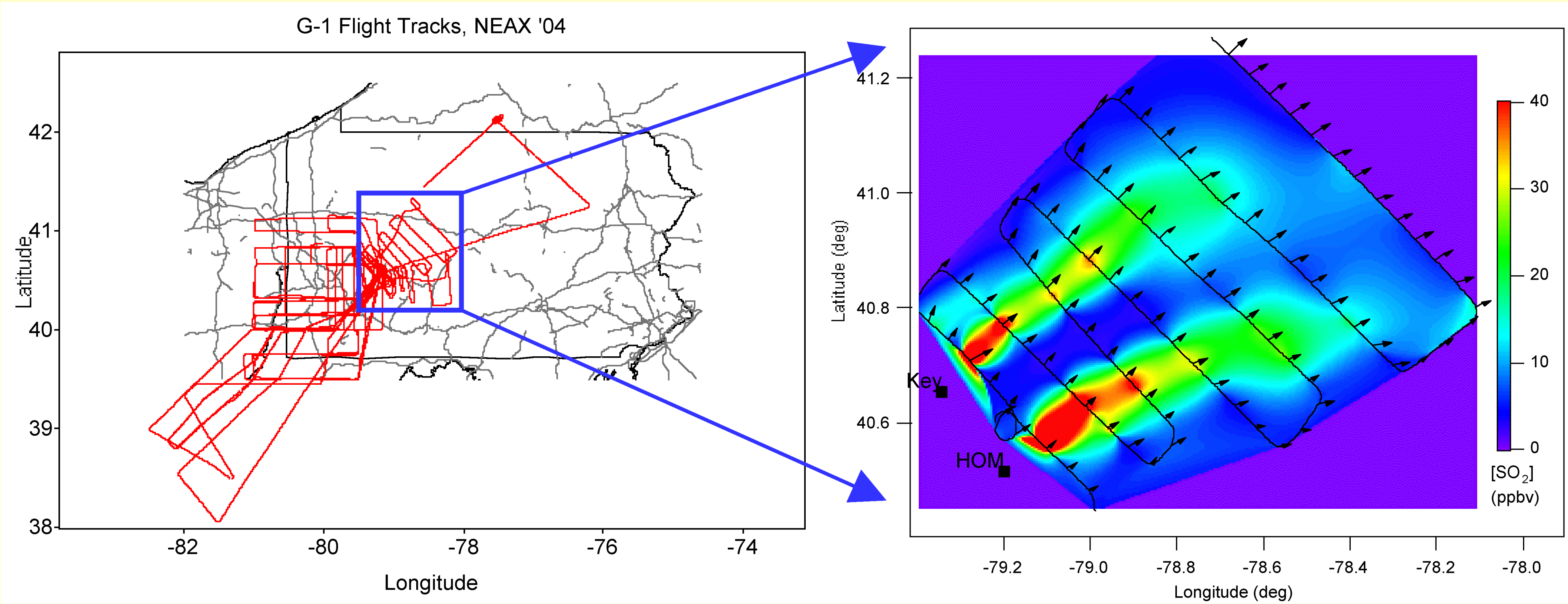
Scientists and flight crew participating in 2005 MArine Stratus Experiment (MASE) off California coast

DOE RESEARCH AIRCRAFT FACILITY
INTERIOR VIEWS

View Forward

View Aft

RECONSTRUCTION OF ATMOSPHERIC CONCENTRATION FIELDS



Two-dimensional reconstruction of SO_2 mixing ratio in plumes downwind of Keystone and Homer power plants from aircraft transects

METRICS OF SUCCESS IN ASP

- Development and application of methods for the ***study of aerosol processes*** controlling aerosol radiative forcing of climate and climate change
  - Instruments, models, lab studies
  - Major field campaigns, on our own or with others
  - Data sets available for use by ourselves and others
  - Outstanding record of publication in peer-reviewed journals
  - Special issues, symposia at national meetings
- ***Improved understanding*** of these processes
- ***Model-based representation*** of these processes with ***known and reasonable uncertainty***
- ***Deliverables that are useful and used*** and lead to better CCSP products
- A whole that ***greatly*** exceeds the sum of the parts

Index of ftp://ftp.ecd.bnl.gov/pub

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ATMOSPHERIC SCIENCE PROGRAM

PUBLICATIONS

It is the intent of this page to provide a listing of, and where possible, links to, journal articles and other publications reporting research conducted in the Department of Energy's Atmospheric Science Program. Where links are given as digital object identifiers (doi: followed by a string of characters) the article may be retrieved by clicking on the link or by copying the doi number and pasting it into the doi resolver page http://dx.doi.org/.

Present and past ASP investigators are requested to review this list for accuracy and completness and also to provide DOI numbers of their publications if possible; alternatively, links to the publications on the investigators' own servers should be provided.

[2005] [2004] [2003] [2002] [2001] [2000]

2005

Peer-Reviewed Articles & Book Chapters

Bahreini, R., M. D. Keywood, N. L. Ng, V. Varutbangkul, S. Gao, R. C. Flagan, J. H. Seinfeld, D. R. Worsnop, and J. L. Jimenez. Measurement of Secondary Organic Aerosol (SOA) from Oxidation of Cycloalkenes, Teprenes, and m-Xylene using an Aerodyne Aerosol Mass Spectrometer. *Environ. Sci. Technol.* 39 (15), 5674-5688,Ý doi:10.1021/es048061a (2005).

Barnard, J. C., E. I. Kassianov, T. P. Ackerman, S. Frey, K. Johnson, B. Zuberi, L. T. Molina, M. J. Molina, J. S. Gaffney, and N. A. Marley, Measurements of Black Carbon Specific Absorption in the Mexico City Basin during the MCMA 2003 Field Campaign. *Atmos. Chem. Phys.*, submitted (2005).

Berkowitz, C. M., Doran, J. C., Shaw, W. J., Springston, S. R., and Spicer, C. W. Trace-gas mixing in isolated urban boundary layers: Results from the 2001 Phoenix Sunrise Experiment. *Atmos. Environ.*, doi:10.1016/j.atmosenv.2005.08.039, in press (2005).

Berkowitz, C. M., C. W. Spicer, and P. V. Doskey. Hydrocarbon Observations and Ozone Production Rates in Western Houston during the Texas 2000 Air Quality Study. *Atmos. Environ.* 39 (19), 3383-3396 doi:10.1016/j.atmosenv.2004.12.007 (2005).

DeWekker, S. J. F., D. G. Steyn, J. D. Fast, M. W. Rotach, and S. Zhong. Convective boundary layer structure and RAMS performance in a very steep valley. *Environ. Fluid Mech.* 5, 35-62 (2005).

Fast, J. D, W. I. Gustafson, Jr., R. C. Easter, R. A. Zaveri, J. C. Barnard, E. G. Chapman, and G. A. Grell. Evolution of ozone, particulates, and aerosol direct forcing in the vicinity of Houston using a fully-coupled meteorology, chemistry, and aerosol model. *J. Geophys. Res.*, submitted (2005).

Fast, J. D., K. J. Allwine, R. N. Dietz, K. L. Clawson, and J. C. Torcolini. Dispersion of perfluorocarbon tracers within the Salt Lake Valley during VTMX 2000. *J. Appl. Meteor.*, submitted (2005).

Fast, J. D., J. C. Torcolini, and R. Redman. Pseudovertical temperature profiles and the urban heat island measured by a temperature datalogger network in Phoenix, Arizona. *J. Appl. Meteor.* 44, 3-13, doi:10.1175/JAM-2176.1 (2005).

Gaffney, J. S. and Nancy A. Marley. Analysis of Peroxyacyl Nitrates (PANs), Organic Nitrates, Peroxides, and Peracids. In Chromatographic Analysis of the Environment, 3rd Edition, L. Nollett, Ed., Marcel Dekker/CRC Press, in press (2005); ISBN 0824726294.

63 papers thus far in 2005!

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SCIENTIFIC/TECHNICAL QUESTIONS AND CONCERNS

- ***"Expectation mismatch"*** between present understanding of aerosol processes and what the modeling community expects.

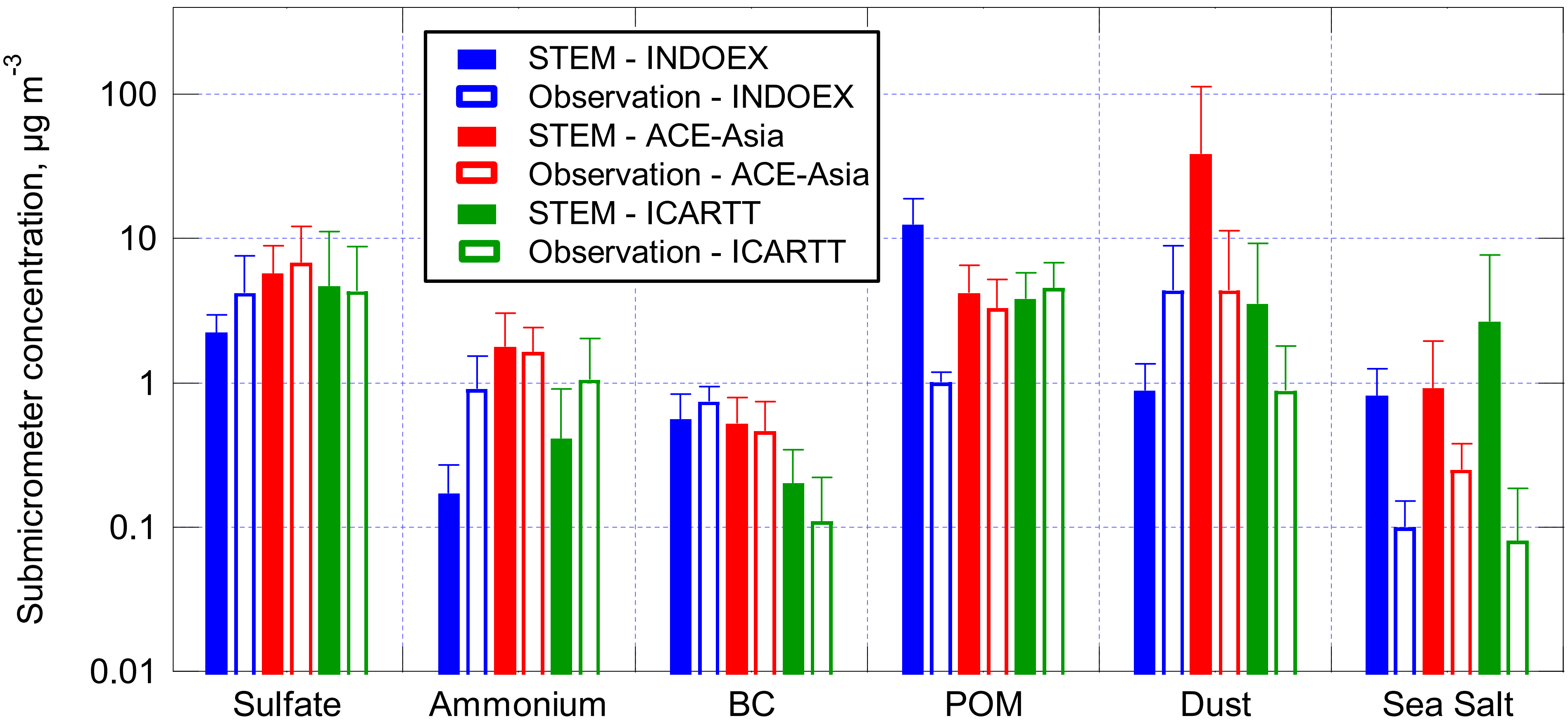
- ***Timetable***. Will the mechanistic understanding and model-based representation be available in time to meet the needs of the policy community?

- ***Alternative approaches***. Can semi-empirical, observation-based approaches to aerosol properties be developed that can meet the needs of the modeling and policy communities more rapidly than an approach based wholly on mechanistic understanding?

- ***"Impedance mismatch"*** between what we are doing in ASP and what the modeling community requires or can use.

MEASURED AND MODELED AEROSOL SPECIES CONCENTRATIONS

Project Means and Standard Deviations in Three Campaigns



Bates *et al.*, *Atm Chem Phys*, Submitted, 2005

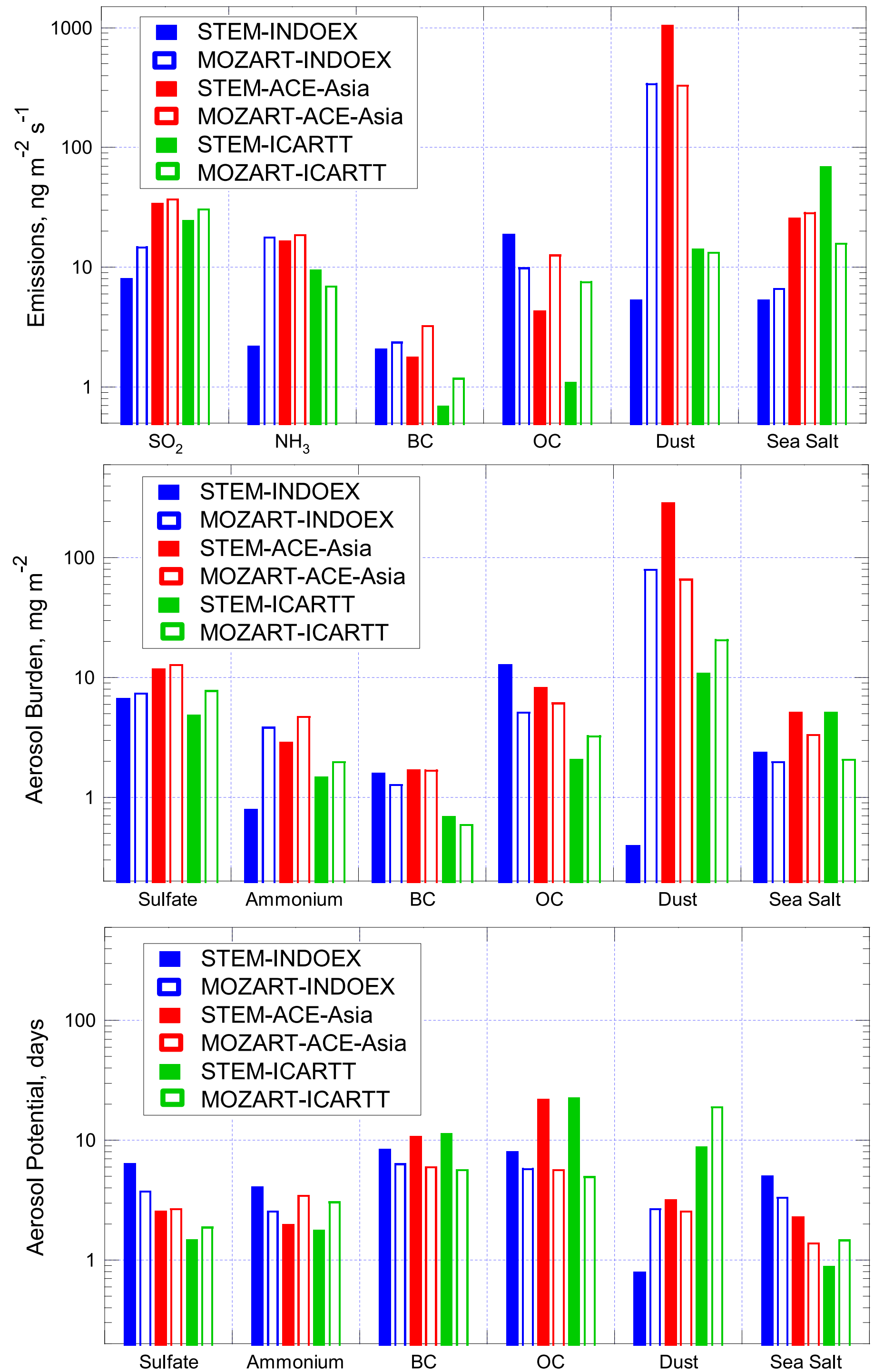
COMPARISON OF TWO MODEL CALCULATIONS OF AEROSOL SPECIES BURDENS IN INDOEX, ACE-ASIA, AND ICARTT

Project- and area-means

Analyzed meteorological fields

Aerosol Potential = Burden/Emissions

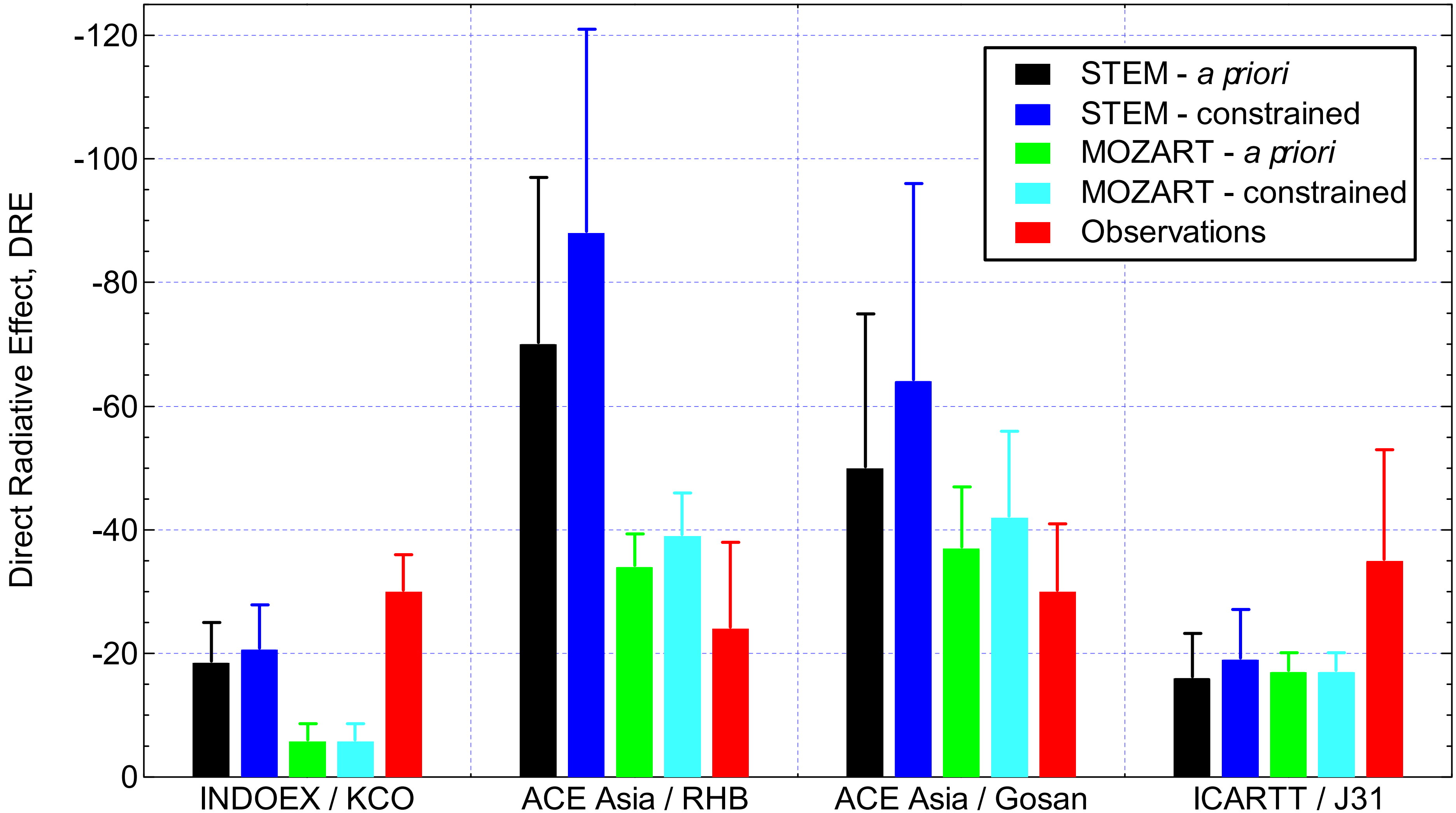
Models: STEM and MOZART



Bates *et al.*, *Atm Chem Phys*, Submitted, 2005

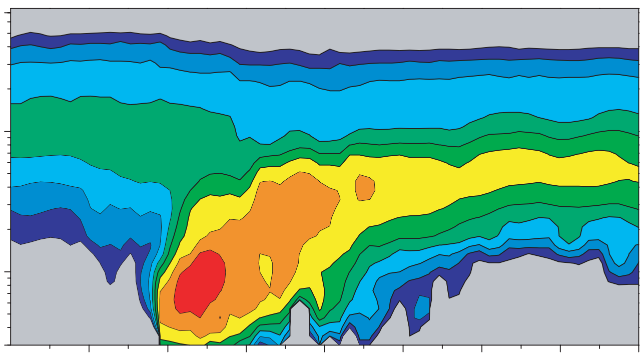
MEASURED AND MODELED DIRECT AEROSOL RADIATIVE EFFECT

Project Means and Standard Deviations of Aerosol Influence On Clear-Sky Solar Irradiance in Three Campaigns

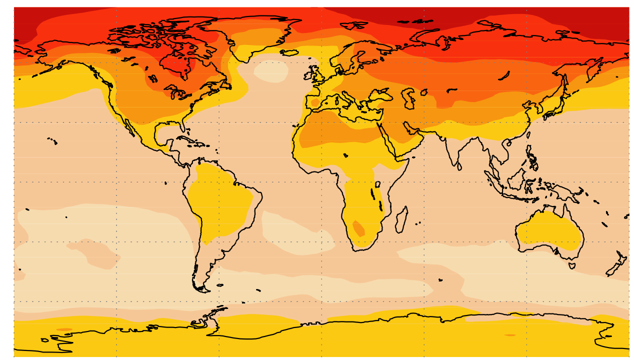


Bates *et al.*, *Atm Chem Phys*, Submitted, 2005

BUILDING BRIDGES TO THE MODELING COMMUNITY



Aerosol process research



Climate models

How can the ***research*** we do in ASP and the ***mechanistic understanding*** we develop be represented in process models that will be ***useful and used*** in large-scale modeling with CTMs and GCMs?

REQUIREMENT FOR DETERMINING AEROSOL RADIATIVE FORCING OF CLIMATE CHANGE

Perturbation of net irradiance at the top of the atmosphere (TOA) due to ***anthropogenic*** aerosols.

Requirement:

Determine anthropogenic aerosol radiative flux perturbation as a function of space (360° × 180°) and time (24 × 365).

Accuracy ***better than ± 0.5 W m***$^{-2}$ (*Schwartz, JAWMA, 2004*).

Based on determining climate sensitivity to ± 30%.

REQUIREMENTS TO DETERMINE AEROSOL RADIATIVE INFLUENCES AND FORCING

3-D map of size-dependent particle concentration, composition, size distribution, size-dependent composition, and morphology, at present and as a function of secular time.

Dependence of aerosol loading and properties on emissions of aerosols and aerosol precursors.

Emissions of aerosols and aerosol precursors as a function of secular time.

Dependence of aerosol optical properties, cloud-nucleating properties, and radiative and hydrological influences on aerosol loading and microphysical properties and on ambient contitions (RH, supersaturation, etc.).

Representing this chemical, microphysical, optical understanding in modules, and evaluating these modules.

Representation of these phenomena in CTM's, RTM's and climate models.

ATMOSPHERIC SCIENCE PROGRAM

FY 2006 SCIENCE TEAM MEETING

October 30-November 1, 2005
Alexandria VA

Agenda

1030	1100	Warren Washington, NCAR	What do Climate Models Require from Aerosol Researchers: My Views
1101	1131	V. Ramaswamy, NOAA GFDL	What are we learning about aerosol effects on climate through model simulations and model-observation comparisons?
1132	1202	Gavin Schmidt, NASA GISS	Aerosols in Earth System Modelling: Inputs, outputs and validation

1341	1411	Philip Cameron-Smith, LLNL	Anatomy of a successful parameterization
1412	1442	Steve Ghan, PNNL	Aerosol Properties and Processes in Global Climate Models: How can ASP Help?
1443	1513	Jean-François Lamarque, NCAR	Aerosols in global models: from direct effect to nucleation
1514	1544	Paul Ginoux, NOAA GFDL	Merging datasets for better closure of radiative effect of aerosols simulated with a GCM: Case of hygroscopic particles

PROGRAMMATIC CONCERNS

- Science support teams are understaffed. Not enough technical and professional support.
- Field Projects may suffer from critical measurements not being made because support for staff is not available.
- ASP is in danger of not keeping up with the state of the art in measurement of essential quantities.
- Progress will be made much faster (super-linearly) the more measurements and approaches that can be brought to bear in our field studies, by adding more projects to the ASP Science Team to better characterize aerosol properties and processes.

ASP Science Highlights

841	900	Jim Hudson	ASP Science Highlight: **CCN Measurements during MASE**
901	916	Yin-Nan Lee	ASP Science Highlight: **Aerosol Chemical Composition determined using the PILS-IC on the G1 during MASE**
917	932	Carl Berkowitz	ASP Science Highlight: **In-situ measurements at Point Reyes during MASE**
1407	1427	Paul Davidovits	ASP Science Highlight: **Intercomparison of Instruments Measuring Black Carbon Content and Optical Properties of Soot Particles**

1428	1448	Brian Barkey	ASP Science Highlight: **Aerosol refractive index determination using genetic algorithm search methods of polar nephelometer scattering measurements**
1449	1509	Bob McGraw	ASP Science Highlight: **Statistical analysis and parameterization of nucleation rate measurements: Interpretation and correlation with vapor composition and temperature**
1510	1530	Yangang Liu	ASP Science Highlight: **Two Issues Surrounding Indirect Aerosol Effects: Dispersion Effect and Autoconversion Parameterization**
1556	1616	Jose-Luis Jimenez	ASP Science Highlight: **Organic Aerosol Analysis with Aerosol Mass Spectrometry**
1617	1632	Rahul Zaveri	ASP Science Highlight: **Overview of the Aerosol Chemistry Module MOSAIC**
1633	1648	Jerome Fast	ASP Science Highlight: **Multi-Scale Simulation of Aerosols and Radiative Forcing within a Community Model**