ABC- October 2004 Campaign

Comparison of instruments and measurements/
Validation of regional and global aerosol models

January 12, 2004

Table of Contents

		Page
Mission Statement		2
Duration		2
I.	Goals	2
	A. Primary goals	2
	B. Secondary goals	2
II.	Objectives	2
	A. Comparison of Instruments and Measurements	2
	B. Model Validation	2
	C. Training and Capacity Building	2
III.	Organization	3
	A. Planning committee	3
	B. Planning committee responsibilities	3
	C. Coordinating teams	3
IV.	Instrument and Method Comparison Strategy	4
	A. Structure of instrument/method comparison	4
	B. Instruments/Parameters of interest	5
	C. Specific comparison plans	6
	1. Intra-comparisons	6
	2. Inter-comparisons	6
	3. Technique comparisons	7
V.	Model Validation Strategy	7
VI.	Training and Capacity Building	9

Mission Statement
The ABC project will initiate its first field campaign by bringing together experimentalists and modelers in order to understand the fundamental issues involved with measuring and modeling the carbonaceous and inorganic components of combustion influenced aerosols, (i.e., brown clouds.)

Duration: October 7 to November 7, 2004.

I. Goals :

A. **Main Goal**: To understand the uncertainties in critical ABC measurements and facilitate improvements in instruments, measurement techniques and protocols.

B. **Supplementary Goal**: Jump-start the ABC observational program and begin the process of collaborating across national boundaries.

II. Objectives:

The campaign for accomplishing the primary objectives will be conducted from the two ABC super sites at Maldives and Gosan.

A. **Comparison of Instruments and Measurements**: To understand the range of various measurement techniques for determining critical parameters. In particular, the following parameters will be emphasized: Aerosol chemistry , aerosol optical properties, aerosol physical properties, gas measurements, rain chemistry, solar fluxes and Lidar profiles. It is our hope this comparison study will be useful for assessing the uncertainties in ABC measurements and for identifying the most superior methods and techniques.

B. **Model Validation**: Validate three-dimensional aerosol models using average and high resolution measurements of the parameters identified above. The model results will also be used to constrain expected values during instrument and measurement comparisons.

C. **Training and Capacity Building**: A one week workshop will be organized with lectures by the science team members on Brown cloud research, observational techniques and instrumentation. The participants will have a chance to assist in the observation campaign. The program will be coordinated by the super-site managers and the UNEP secretariat.

III. ORGANIZATION

A. Planning Committee

G. Carmichael,
C. Corrigan,
E. Dutton,
L. Granat,
A. Jayaraman,
Y. Kondo,
T. Nakajima,
J. Ogren,
V. Ramanathan,
G.Y. Shi,
S.C. Yoon

B. Planning Committee Responsibilities

1. Establish the protocols for the comparisons.
2. Determine the instruments, protocols and variables to be included in the comparison.
3. Solicit participation by experimental groups.
4. Determine the list of measurements required for model validation.
5. Entrain modeling groups to participate in the validation.
6. Establish protocols for data exchange.

C. Coordinating Teams

MALDIVES

Chief Scientist – V. Ramanathan
Site Manager – H. Nguyen
Site Scientists – C. Corrigan and M. Ramana

Aerosol – C. Corrigan
Radiation – E. Dutton & M. Ramana
Lidar – A. Jayaraman & M. Ramana
Gas Phase – xxxx
Rain Chemistry – L. Granat
Model Validation – G. Carmichael

GOSAN

Chief Scientist - xxxx
Site Manager - xxxx
Site Scientists - xxxx

Aerosol – xxxx
Radiation – xxxx
Lidar – xxxx
Gas Phase – xxxx
Rain Chemistry – xxxx
Model Validation – G. Carmichael

IV. INSTRUMENT AND METHOD COMPARISON STRATEGY

A. Structure of Instrument/Method Comparison – Three Components

Component 1 – Intra-instrument/method calibration

All similar instruments (or methods) will be calibrated and compared to ensure that reliable data is being obtained from every instrument participating in the ABC network. All comparisons of this type do not need to be done at one of the Super Observatories. Comparisons may be done by different regions or countries with only a few representative instruments being sent to the Super observatories. The measurements will also give an estimate of the expected data scatter for each type of instrument.

Example. All K&Z pyranometers compared to establish range of data scatter and to discern any faulty pyranometers.

Component 2 – Inter-instrument/method calibration

All instruments (or methods) utilizing the same general method of measuring a specific parameter, but of a different model or a different manufacturer, will be compared to establish calibration and correction criteria. These corrections will be applied to standardize the actual ABC data.

Example. Ecotech and TSI nephelometers
Example. EC/OC analysis methods
Example. Old model aethalometers vs new model aethalometers

Component 3 – Comparison of Techniques

Selected instruments using different methods to measure the same specific parameter will be compared to determine which method is most suitable for use at the ABC sites. These top instruments and methods will be emphasized as the suggested standard for future and upgraded ABC observatories.

Example. Filters vs. Aethalometer
Example. PM1, PM2.5, and PM10 filter cuts using different inlets

B. Instruments/Parameters Proposed for Comparisons (all components)

- Aerosol Chemistry
  - Sulfate
  - Nitrate
  - Organic carbon
  - Black carbon
  - other
- Aerosol Optical Properties
  - Scattering
  - Absorption
  - Aerosol optical depth
- Aerosol Physical Properties
  - Mass
  - Sub-micron size distribution
  - Coarse mode size distribution
- Gas Measurements
  - Ozone
  - CO
- Rain Chemistry
- Lidar
  - MPL and NIES
- Solar Fluxes
  - Pyranometers
  - Pyrheliometers
  - Narrowband radiometers
  - Global vs. direct + diffuse

C. SPECIFIC COMPARISON PLANS (*Please add your general plan or join current plans that need lead investigators, i.e., xxxx*)

1. Intra-comparisons

Intra and inter-instrument calibration of solar instrumentation (E. Dutton, M. Ramana, xxxx) (BOTH)

- Identify inferior instruments
- Determine accepted scatter between similar instruments
- Generate calibrations between differing instruments

Intra and Inter-comparison of Lidar systems (A. Jayaraman, xxxx)

Intra and Inter-comparison of gas measurements (H. Tanimoto, T. Wang) (BOTH)

Intra and Inter-comparison of nephelometers (xxxx)

Intra and Inter-comparison of light absorption instruments (Corrigan, xxxx) (BOTH)

Intra and Inter-comparison of aerosol optical depth measurements (xxxx)

Intra and Inter-comparison of aerosol size distributions (xxxx)

2. Inter-comparisons

Inter-method comparison of EC/OC laboratory analysis methods (C. Corrigan, xxxx) (BOTH)

- A direct comparison of various EC/OC analytical techniques employed by different laboratories participating in the ABC-Asia project.
- Each laboratory will analyze a portion of four filter samples taken under different conditions (aerosol loading, composition, etc.)
- The Maldives will provide two samples (pristine and polluted), Gosan will provide one sample, and xxxx will provide an urban influenced sample.
- Each laboratory will receive enough sample material for 5 repetitions.

Inter-method comparison of inorganic species laboratory analysis methods (Kondo?, Kim? xxxx)

- ?

3. Technique comparisons

Inter-technique comparison for quantifying inorganic aerosols (K. Prather, Y. Kondo, C. Corrigan) (MALDIVES, GOSAN)

- Compare filters measurements with PILS, AMS, ATOFMS, and other real-time techniques

Inter-method comparison of filter methods for accurately quantifying nitrate aerosol (xxxx) (MALDIVES, ?)

- test nylon filters and denuders versus PILS and mass spectrometers

Inter-method comparison of inlets employed by the ABC groups (Y.J. Kim, Y. Kondo, M. Koike,) (GOSAN)

- To evaluate that inlets used by participating groups in the ABC campaign are performing proper size cuts.
- Use an aerodynamic particle sizer to establish cut point
- Simultaneously collect filters behind the inlets for 7-10 days
- Employ a previously calibrated analytical technique to evaluate the concentrations of selected species on the collected filters and compare results.

Inter-technique comparison for semi-real time BC/light absorption instrumentation (C. Corrigan) (MALDIVES)

- Evaluate the feasibility and performance of semi-real time instruments for measuring black carbon mass and light absorption coefficients.
- Anticipated instruments/methods: Sunset semi-real time EC/OC analyzer, aethalometer, quartz filters, ThermoEnvironment MAAP, DRI photoacoustic, NASA cavity ring down, DMT SPSP, ATOFMS.
- Well performing instruments will be considered as permanent additions to ABC supersites.

Inter-technique comparison of hygroscopic growth measurements (xxxx)

V. MODEL VALIDATION STRATEGY

Regional and global scale aerosol models play an important role in the interpretation of the measurements by providing estimates of the 4-

dimensional context of the observations and by providing information on the contribution of various sources (regions, sectors and fuels). These models also the spatial and temporal distributions needed to evaluate effects (e.g., radiative forcings, crop yields etc). The major modeling activities associated with the ABC-October 2004 campaign are: 1) Pre-mission modeling analysis to provide information on the expected range of parameters to be observed, and to establish the model intercomparision framework that will be used in the intercomparison/validation phase; and 2) Post-mission comparison of model results with observed quantities, context analysis performed, and model results intercompared. Further details are presented below.

Pre-Mission Activities: In preparation of the October 2004 experiment the various modeling tools that will be used in the integration, interpretation, and evaluation will be identified, specific tasks identified, and protocols established. The tasks to be performed are outlined below:

1. Establish a modeling team. This will be done by forming by April 1. The team will include the modeling members of the project, as well as others from the community that wish to participate. (Carmichael, Collins, others…)

2. Throughout the spring and early summer the modeling team will develop detailed plans, and preliminary tests of the analysis will be carried out using available data sets. For example we will utilize outputs from global models as boundary conditions in the regional analysis, and in turn will pass our results on to the MACR model for use in estimating radiative forcing. We will work closely with the measurement teams, to understand the details of the data availability, to provide insights gained from the model predictions to help in the measurement strategy, to discuss how the observations will be utilized by the model, and what model products will be available to help understand the measurements.

3. Prepare emissions data base for use in the analysis. This will be coordinated with the various on-going emission work in the region by ABC-Asia. A decision will be made as to whether we agree to use a common emission inventories. If we choose not to, then it is necessary to document the similarities and differences BEFORE we present results.

4. Establish a modeling web-site to coordinate and display ongoing analysis and model products.

Intensive and Post-Mission Activities: During the intensive period model products in support of the operations are planned. Post-mission activities will focus on the comparison of model results with observed quantities, context analysis including source identification, and the intercomparison of the model results. Specifically,

1. It is anticipated that some real-time modeling analysis will be performed to support the intensive operations. This information will be disseminated via a web-site. Some near-real time comparison with measurements and observations are envisioned as well.

2. Comparison of model results with observations. Key issue here in timeliness of results will be coordination/planning of the merging the observations. Details need to be discussed prior to the execution.

3. Context analysis including source identification.

4. Intercomparison of model results, and analysis to identify reasons for similarities and differences.

5. Workshop to discuss preliminary findings.

VI. TRAINING AND CAPACITY BUILDING