



# **Project Atmospheric Brown Clouds (ABC)**

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**Second  
International Training School on Atmospheric Brown Clouds (ABC)**

**4-14 December 2006**

**Bangkok, Thailand**

**Report on the Second**  
**International Training School on Atmospheric Brown Clouds (ABC)**  
**4-14 December 2006 in Bangkok (Thailand) and Hanimaadhoo, Maldives**

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## **1. Background**

Project Atmospheric Brown Clouds (ABC) is a concerted effort among UNEP, a group of distinguished atmospheric scientists and researchers led by Prof. V. Ramanathan, governments in Asia, and research institutions in Asia, Europe and the United States to address the causes and impacts of occurrence of atmospheric brown clouds (ABC), an emerging environmental challenge. The 3 major programs of the project are observatory program, impact assessment program, and awareness and mitigation program.

The regional capacity building, which is one of its important components of the project ABC, aims at enabling the scientists and researchers in the Asia-Pacific region to study the science and potential impacts of atmospheric brown clouds (ABC) in the region through the development of necessary physical infrastructure and training young scientists and researchers in the field of atmospheric science. In order to enhance the knowledge in atmospheric science of the young researchers and senior students from the region the Project ABC has been organizing the International Training School on Atmospheric Brown Clouds at a regular basis. The first training school was organized in October 2004 with active participation of 15 young researchers and graduate students from 7 countries in Asia.

As a part of the ongoing capacity building activities of the Project ABC, the 2<sup>nd</sup> **International Training School on Atmospheric Brown Clouds (ABC)** was organized during 4-14 December 2006 with the financial support from National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA), and Swedish International Development Cooperation Agency (Sida). The summary of the training school is presented here.

## **2. Announcement**

The ABC Training School was announced in the UNEP Regional Resource Centre for Asia and the Pacific (UNEP-RRCAP) website in July 2006, in the UCSD ABC homepage, and also distributed through ABC Science Team's e-mail contacts and the meetings organized or participated by UNEP.

## **3. Coordinators/Organizers**

With the recommendations from the Science Team Chair (Prof. V.Ramanathan) and Vice Chair (Prof. H. Rodhe), a working group was set up consisting of two course directors and organizers from UNEP and C4 as follows. Prof. K.-R Kim and Dr. Mark Lawrence, who are the members of the ABC Science Team, acted as course directors.

## **4. Participants**

### **4.1 Trainees**

More than 70 applications were received from young and enthusiastic researchers, post doctoral researchers and graduate students involved in atmospheric studies in 18 countries. The course directors, with the important advises from ST Chiar and Vice Chair, ranked all applicants based on the merits such as their level of education, involvement in ABC activities in their home country, involvement in atmospheric research activities, their potential to be involved with ABC in future and continue research in atmospheric studies. From the pool of the applications received, the participants for the training school were selected based on merit while maintaining the geographical balance and demographic distribution. A total of 25

participants (10 female and 15 male) from 11 countries (Bangladesh, China, India, Italy, Maldives, Nepal, Pakistan, Rep. of Korea, Thailand, United States, and Vietnam) were selected. The list of the candidates who participated in the training school is presented in Annex 1.

#### **4.2 Resource Persons**

There were 16 resource persons including the ST Chair, Vice Chair, ST Members, and other prominent scientists from Asia and outside in the training school. The list of resource persons is presented in Annex 2.

#### **5. Program**

The training school was aimed at

1. providing the participants with the theoretical background and overview of current knowledge in atmospheric science as a basis for helping them to interpret the measurements they will be making within ABC,
2. familiarizing the participants through hands-on training with the operation and functionality of the instruments for ABC monitoring and research.

In order to achieve these objectives the training school was divided in to two parts:

1. A first week (4-8 Dec.) of intense lectures on atmospheric issues and discussion sessions at UNEP Regional Resource Center for Asia and the Pacific (RRC.AP) at Asian Institute of Technology, Bangkok.
2. A second week (10-14 Dec.) of hands-on training at the Maldives Climate Observatory at Hanimaadhoo (MCO-H), a super observatory for the Project ABC.

#### **5.1 Course Lectures**

Most of the lectures were of 1.5 hour long with about 15 min for discussion and interaction with the lecturer, and among the participants. There were two video lectures. The hard copies of reading materials and lecture notes provided by some lecturers were also provided. Despite our attempt to collect lecture notes before the school began, it was not successful as most of the lecturers didn't provide the material before the deadline given to them to submit the teaching materials. The following lectures were delivered, and the detail of those lectures is available in electronic version (compiled in a CD).

##### **4 December**

- Lecture 1: Overview of the climate system [*Prof. V. Ramanathan*]  
 Lecture 2: Industrial ecology and sustainable development [*Dr. Bala Rajasekhar*]  
 Lecture 3: Is global warming man-made? A story of the Keeling curve [*Prof. K. R. Kim*]

##### **5 December**

- Lecture 4: Recent developments on GHG monitoring (CO<sub>2</sub> and man-made compounds), GHG activities in ABC [*Prof. K. R. Kim*]  
 Lecture 5: Introduction to atmospheric gas and aerosol Chemistry [*Prof. James J. Schauer*]  
 Lecture 6: Overview of in-situ measurement techniques (especially recent advances) for aerosol research [*Prof. James J. Schauer*]

##### **6 December**

- Lecture 7: Aerosol optical properties and radiative forcing over the Asian region [*Dr. D. Y. Kim* (Video lecture)]  
 Lecture 8: Aerosol impacts on the Earth's climate examined using satellite remote sensing and a climate model [*Prof. Teruyuki Nakajima*]  
 Lecture 9: Aerosol chemical and optical properties [*Dr. Ulrich Pöschl* (Video lecture)]  
 Lecture 10: Impact of pollution on crops [*Dr. Naveen Kalra*]

**7 December**

- Lecture 11: The Asian Monsoon and its variability in relation to atmospheric aerosols, and insights into the role aerosols may play in the agriculture of South Asia [*Dr. Dev Raj Sikka*]
- Lecture 12: ABC-Asia: Air pollution, brown clouds and climate change [*Prof. V. Ramanathan*]
- Lecture 13: Regional Modelling and Emissions Dataset Development for Southern Asia [*Dr. Vanisa Surapipith*]
- Lecture 14: Transport of pollutants in the tropical troposphere [*Dr. Mark Lawrence*]

**8 December**

- Lecture 15: Wet and dry deposition processes: Impacts on material, crops and natural ecosystems [*Prof. Henning Rodhe*]
- Lecture 16: Principles of precipitation chemistry analysis and results from a study of possible acidification in Thailand [*Dr. Hathairatana Garivait*]
- Lecture 17: Field measurements and laboratory investigations of particulate matter and trace metals [*Dr. Bala Rajasekhar*]
- Lecture 18: Outlook: Difficulties in understanding and modeling tropical convection and wet deposition [*Dr. Mark Lawrence*]



Course Lecturers and Trainees at UNEP RRC.AP, Bangkok

**5.2 Hands-on training**

The hands-on training part was conducted from 10 to 14 December at Maldives Climate Observatory in Hanimaadhoo, The Maldives. The training part was divided into 4 courses as follows, and thus participants were also divided into 4 smaller groups accordingly such that each participant gets an opportunity to handle each set of instruments for a day. The groups were rotated so that all will be exposed to all MCOH instruments. The following is the course outline.

- Course 1: Aerosol physical properties (Total particle number counts with CPC, Fine particle number size distribution with SMPS, Coarse particle size distribution with APS, and inlet systems) [*Dr. Maheswar Rupakheti*]
- Course 2: Aerosol optical properties (Absorption coefficients and Black Carbon concentration with Aethalometer, Scattering coefficient with Nephelometer) [*Praveen Siva*]
- Course 3: Solar radiation fluxes (Direct, Diffuse and Global solar radiation instruments, Net radiation in NIR) [*Dr. Muvva V. Ramana*]

Course 4: Radiation fluxes and aerosol optical depths (AOD) (Narrow band radiometer, CIMEL sunphotometer, Microtops sunphotometer) [Dr. Muvva Ramana]

### 5.2.1. Activities at MCO-H

The instructors introduced various instruments to the trainees and provided with the working principles and parameters measured with those instruments. They were instructed on the step-by-step procedure for the data analysis, including the quality check, and interpretation of the analysis. The trainees were then given hands-on training and demonstration in operating and collecting data from a variety of state-of-the-art instruments for radiation, aerosol, precipitation and meteorological measurements.



The participants listening to an instructor at MCOH

The participants collected the data with various instruments and analyzed the data. The participants were able to measure aerosol total number concentrations with CPC, aerosol number size distributions with SMPS and APS, aerosol optical properties i.e. scattering coefficients with Nephelometer and absorption coefficients with Aethelometer, aerosol optical depth (AOD) with CIMEL sunphotometer, AOD, column ozone and water vapor concentrations with Microtops sun-photometer, global, direct and diffuse fluxes in the short and long-wave bands with pyranometers, pyrhemometers, and Meteorological observations. They were able to compute parameters such as single scattering albedo, Angstrom coefficient, and radiative forcing.

The participants also learned how to interpret their results with the aid of other simultaneously measured parameters. At the end of the day each group presented their data, data analysis and interpretation of the data and possible science behind the variation of various parameters. Every participant was given a chance to present the data analysis result.



Training Instructors and Trainees at MCO-H, Maldives

At the end of the program, the participants briefly presented their research activities, and explained how they could benefit from the training school or link their research with ABC activities. Overall, everyone participated actively, and it was very encouraging to see their eagerness to play with instruments, collect data, analyze and interpret them.

## 6. Evaluation

UNEP carried out an evaluation of the both parts of the training school by the participants. The evaluation session at the RRC.AP for the teaching part was attended by Mr. Surendra Shtrestha, the UNEP Regional Director for Asia and the Pacific. The evaluation questionnaire was prepared by UNEP in consultation with the course directors, Prof. K.-R. Kim and Dr. Mark Lawrence.

Overall, 47% of the participants rated the teaching part in Bangkok as excellent while remaining 42% rated it as good. Likewise, 44% rated the training part at MCO-H as excellent while 50% rated it as good. None of the participants rated both part as unsatisfactory or as poor. The evaluation questionnaire with its detail analysis including the comments from the participants is presented in Annex 3.

## 7. Certificate of Participation

UNEP issued the certificate of participation to all participants who completed the training school successfully.

LIST OF PARTICIPANTS  
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**4-14 December 2006 in Bangkok (Thailand) and Hanimaadho, Maldives**

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Note: Ms. Thana and Dr. Settachan attended only the teaching part in Bangkok, three technicians at MCO-H from the Department of Meteorology, Maldives (Mr. Saleem, Mr. Thoaha, and Mr. Moosa) participated in only the training part at MCO-H. Mr. Tongchai Kanabkaew from Asian Institute of Technology participated in the teaching part in Bangkok as an observer.

Annex 2

## LIST OF LECTURERS

**International Training School on Atmospheric Brown Clouds (ABC)**  
**4-14 December 2006 in Bangkok (Thailand) and Hanimaadhoo, Maldives**

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Annex 3

Summary of the Evaluation  
**International Training School on Atmospheric Brown Clouds (ABC)**  
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1. How did you know about the training school?  
UNEP website, forwarded by UNEP to governments, personal communication with UNEP staff, supervisors/Professors, e-mail announcements in the institute, colleague, scientific community.

The participants responded to the following questions with rank score from 1 through 5, where, 1 = not at all, 2 = a little, 3 = somewhat, 4 = mostly, 5 = completely. The table shows the percentage of responses to the individual question. The numbers without parentheses represent the evaluation of the teaching part in Bangkok while those in the parentheses represent the evaluation for training part in Hanimaadhoo.

<i>Overall Objective and Content</i>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
2	Were the objectives clear and precise?	0 (0)	0 (0)	5 (6)	<b>60</b> (31)	35 <b>(63)</b>
3	Were the objectives attained?	0 (0)	0 (0)	10 (12)	<b>70</b> <b>(50)</b>	20 (38)
4	Was the content well structured?	0 (0)	0 (0)	25 (6)	<b>65</b> <b>(63)</b>	10 (31)
5	Was the content linked to the objectives?	0 (0)	0 (0)	5 (0)	<b>65</b> (37)	30 <b>(63)</b>
6	Was the content presented clearly?	0 (0)	0 (0)	15 (12)	<b>70</b> <b>(50)</b>	15 (38)
<i>Methodology</i>						
7	Was the method used appropriate for the training program and you as a professional?	0 (0)	0 (0)	25 (6)	<b>55</b> <b>(63)</b>	20 (31)
8	Did the methodology help you to share your own knowledge and experience?	0 (0)	0 (0)	25 (12)	<b>60</b> <b>(59)</b>	15 (29)
9	Did the instructors teach course effectively?	0 (0)	5 (0)	0 (0)	<b>70</b> (33)	25 <b>(67)</b>
10	Was the level of the material too difficult?	25 <b>(50)</b>	<b>35</b> (14)	20 (25)	20 (12)	0 (0)
11	Was much of the material irrelevant or uninteresting to you?	<b>37</b> <b>(53)</b>	9 (20)	18 (20)	36 (7)	0 (0)
12	Were the visual aids (e.g., power point presentation) clear and easy to follow?	0 (0)	0 (0)	11 (0)	42 (44)	<b>47</b> <b>(56)</b>
<i>Logistics</i>						
13	Was the training venue adequate?	0 (0)	0 (0)	5 (6)	40 (44)	<b>55</b> <b>(50)</b>
14	Was the timing of the agenda comfortable?	0 (0)	6 (6)	20 (13)	<b>50</b> <b>(44)</b>	30 (38)
15	Was the length of the sessions appropriate?	0 (0)	10 (12)	25 (25)	<b>50</b> <b>(50)</b>	15 (13)

16. Overall, how would you rate the training school?

**Bangkok:** Excellent: **47%**, Good: 42%, Average: 11%, Unsatisfactory: 0%, and Poor: 0%.

**Hanimaadhoo:** Excellent: 44%, Good: **50%**, Average: 6%, Unsatisfactory: 0%, and Poor: 0%.