Report on the *Refresher Course* on **Physics of the Atmosphere**, 14-25 November 2005 held at the Centre for Atmospheric and Oceanic Sciences, Indian Institute of Science, Bangalore and sponsored by the Indian Academy of Sciences, Bangalore and Indian Meteorological Society-Bangalore Chapter.

**Resource Persons:**
Prof. R. Narasimha, Prof. S. Gadgil, Prof. J. Srinivasan, Prof. B. N. Goswami (Course Coordinator), Prof. G.S. Bhat, Prof. D. Sengupta, Prof. R. Nanjundiah, Dr. S. K. Satheesh, Prof. M. Venkatachalappa, Prof. P. Siddheswar, Dr. G.B. Pant, Prof. P.V. Joseph, Prof. B.H. Subbaraya, Dr. V. Jayaraman and Dr. G. Viswanathan.

The response to the announcement for the Refresher Course through the Current Science and the Resonance was excellent. 58 teachers from different parts of the country were selected from among the applications received and invited to participate in the Course. For various reasons, finally 38 teachers attended the course. Most of the teachers were from Physics background except a few that were from Atmospheric Science background. While about 15 teachers were from greater Bangalore area, the rest represented the length and breadth of the country including Guwahati, Cochin, Srinagar (Kashmir), Ranchi, Mangalore, Rew (MP), Porayar (TN), Tirunelveli, Haryana, Hoshiarpur (Panjab), Orissa, Kanchipuram (TN), Karikkudi (TN), Gudivada (AP), Jhansi, Jabalpur, Kannur (Kerala), Umarkhed (MS), Allahabad (UP), New Delhi, Pune, Vidyanagar (Gujarat), Kakinada (AP) and Nellore (AP).

As teaching of Atmospheric Physics is not widespread in the country, the philosophy of this Course has been to introduce important phenomena in the atmosphere and to give an overview of quantitative aspects of dynamics and thermodynamics that provide physical understanding and predictive capability of these phenomena. Observing techniques, diagnosis of global observations and development of three-dimensional global models for weather and climate predictions were discussed. Recent development in this field also was highlighted as special lectures. The course content together with names of the resource persons are given in Annexure-I while the schedule of lectures is given in Annexure-II.

The Course started with an inaugural talk by Professor J. Srinivasan who highlighted the recent and exciting developments in atmospheric sciences. The Course began with some basics such as composition of the atmosphere, atmospheric general circulation, horizontal and vertical structure of wind and temperature by Prof. Goswami. This was followed by atmospheric thermodynamics by Prof. G.S. Bhat, atmospheric radiation by Prof. J. Srinivasan. With this background established, Profs. P.V. Jospeh and P. Siddheswar introduced the synoptic systems, monsoon depression, equation of motion and continuity equation. Prof. M. Venkatachalappa spoke on atmospheric waves. Prof. Najundiah has introduced complexities of developing three dimensional general circulation models for prediction of weather and climate. He also highlighted the challenges in developing more
accurate models for prediction of weather and climate. Dr. Satheesh delivered lectures on aerosols, clouds and precipitation. Some special topics such as Indian monsoon and its variability (Prof. S. Gadgil), El Nino and Southern Oscillation (ENSO), global warming, tropical cyclone (TC) and thunderstorms were also discussed in order to provide a flavor of interesting physical processes involved in some of the important and challenging weather and climatic phenomena.

All afternoons were primarily reserved for demonstrations and laboratory work. Some fluid dynamics movies illustrating some basic fluid dynamics processes (e.g. Drag, vorticity etc) were shown to the participants. An introduction to principle involved in remote sensing techniques was given by Dr. Satheesh. He also demonstrated the working of the automatic weather station (AWS) stationed at CAOS and various radiometers and instruments used for measurement of aerosol. Prof. Bhat carried out some simple experiments demonstrating how density stratification could lead to certain oscillations in the atmosphere and ocean. There was a visit to ISRO Satellite Centre (ISAC) to understand various steps of satellite integration.

Quantitative aspect of the atmospheric sciences was emphasized throughout the course. In order for the participants to carry forward quantitative aspect of the training during this course, we selected a copy of the book entitled “Meteorology-Understanding the Atmosphere” by Steven A. Ackerman and John A. Knox. The book covers a wide range of topics covered during the course. It is envisaged that the teacher participants will involve students in their respective places to maintain regular record of these important climatic variables. This is expected to not only provide good records of climatic data over a number of places but also enthuse some young students to get into this field. All the lecture materials have been written on a CD and copy of the CD was also given to each participant. A copy of the CD is enclosed as Annexure-III.

In addition to usual lectures, there were special five lectures. Prof. B.H. Subbhraya delivered lecture on Origin and Evolution of the Atmosphere, Dr. V. Jayaraman (ISRO HQ) on Indian satellite programme for climate studies, Dr. G. Viswanathan (ISTRAC, ISRO) on atmospheric radars, Dr. Jerome Vialard on ENSO and seasonal prediction, Dr. G.B. Pant (IITM, Pune) on paleoclimate reconstruction.

A short session was devoted in getting feedback from the participants. Several participants spoke highly about the course material and expressed that it would provide them the confidence and excitement to teach the introductory Atmospheric Science course being introduced in many institutions. The Concluding Session was presided over by Prof. B.N. Goswami. Professors N. Mukunda and B.H. Subbaraya and M.C. Radhakrishna were present. Prof. Mukunda gave away the certificates.

B N Goswami, Course Co-Ordinator.
List of participants of the Refresher Course on “Physics of the Atmosphere”, held at Centre for Atmospheric and Oceanic Sciences, Indian Institute of Science, Bangalore 560 012 during 14-25 November 2005

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