Meeting Report

on

“International Conference on Aerosols, Clouds and Monsoon”

held at

The Indian Institute of Technology Kanpur, November 15 – 17, 2004

Substantial Indian research activities related to aerosols, clouds and monsoon are taking place in the central and southern parts of India. In recent years, the northern parts of India are facing problems of dense haze and fog, and as a result the 460 million people living in the Indo-Gangetic basin are affected. To attract attention to the associated problems of the northern part of India, a three days International Conference on “Aerosols, Clouds and Monsoon” was held during November 15-17, 2004 on the campus of the Indian Institute of Technology, Kanpur, which lies in the central part of the Indo-Gangetic basin. The symposium was attended by about 120 delegates from various universities and research institutions in India and scientists from USA, Japan, Germany, Taiwan and Greece. In recent years, it is believed that due to growing pollution, solar radiation to the Earth’s surface is being reduced and it was suggested that systematic and long term atmospheric observations be carried out over parts of India to understand this reduction. Based on limited data, it was shown that the effects of green house gases have significantly increased after 1950s and as a result India is
about 6-7% darker compared to what it was before 1950. During the INDOEX experiment Asian Brown Cloud (ABC) was discovered. This is responsible for changing climatic and weather conditions and in order to understand the dynamics and influence of ABC, numerous experiments must be taken over by the Indian scientists. Under a research program (ISRO-GBP) (Indian Space Research Organization – Geosphere Biosphere Program) sponsored by the Indian Space Research Organization, several research institutions are participating in the multi wavelength radiometer (MWR) measurements in the last decade and have measured the characteristic of the aerosols. The characteristics of the aerosols are highly influenced by the monsoon. Aerosol properties show a large temporal heterogeneity and large seasonal dependence of the radiative forcing. For understanding such large heterogeneity and seasonal dependence of radiative forcing, efforts are being made to extend the MWR network at 22 locations over the entire India. The MWR observations are being complemented by the Kanpur Aeronet station which is part of the global NASA Aeronet network. Four years of continuous measurements at IIT Kanpur have provided very interesting data on aerosol parameters, which are very dependent on the season. The characteristic of aerosols differ significantly prior to the monsoon, after the monsoon and also during the winter period. Dust events are observed every year during May and June; as a result, the aerosols optical thickness changes significantly.

The need for an aerosol data Center was felt, a Center considered by the ISRO-GBP so that such data are easily available to the scientists for detailed analysis. Specifically, the importance of proper estimation of the radiative forcing due to anthropogenic aerosols
in the Asian region resulting from the rapid growth of population and industrialization was brought out. Details of the SKYNET network in East Asia handled by Japanese scientists, similar to AERONET, which is global, was discussed as it will be useful in understanding the anthropogenic impact on climate comprehensively, due to the fact that the Asian aerosols are highly heterogeneous in the chemical and optical characteristics. The importance of one station in the central part of Indian region and one in the Indo-Gangetic basin was emphasized.

In an interesting presentation on the comparison of MODIS and aeronet data, a large difference in aerosol optical depth was found during summer. It was suggested that during summer due to dust storm events large dust, loading occurs in the Indo-Gangetic basin. The MODIS algorithm team may consider to take a new look at the algorithm for dust loaded sites in India, especially over the Indo-Gangetic basin. The relevant dust is transported from the Thar Desert and also from the Arabia. The interaction of particulate matter with water in clear condition and foggy atmosphere was presented. Detailed model studies are required to understand the dense fog and haze over the Indo-Gangetic basin.

The aerosol characteristics over the Indo-Gangetic basin was found to vary seasonally. Moreover, it is increasing due to the increase of population growth and rapid urbanization in the basin. Over the Ganga basin, the declining trend of total ozone column using TOMS data at various locations was presented and it was emphasized that the cause of such changes can be understood using detailed modeling.

The need of LIDAR and a dense ground network were highlighted to understand the air
pollution and dispersion over the Indian sub-continent. Studies related to carbon and carbon mono-oxide and their source inventory of forest fires and biomass burning in the entire India sub-continent using satellite data and vegetation statistics have shown one to one relation with the urban and dense vegetated areas in India.

The opposite surface ozone trends over the different rural and urban regions were presented. The need for surface ozone monitoring stations at various places was expressed. A road campaign in which several academic and research institutions participated during February 2004 from the southern tip of India to the fringe of the Ganga basin, gave valuable information about the surface and atmospheric inhomogeneity. Similar to this land campaign, another stationary campaign located at 8 places covering west (Delhi) to east (Kolkata) in the Indo-Gangetic basin was planned for whole month of December 2004 in which 70 scientists from 22 academic and research institutions participated. The main aim of this campaign was to understand the dynamics of the atmospheric aerosols, ozone and its precursors. Long term studies related to surface ozone and various pollutants like NOx, CO, VOCs etc have shown that the safest concentration of surface ozone over India is about 87 ppmv.

Numerous scientific projects dealing with marine and land campaigns have been carried out in India since 1990 to study the effects of the climate, weather conditions and monsoon over India to the Bay of Bengal and the Arabian Sea. These are sponsored by the Department of Science and Technology, New Delhi.

In an interesting presentation, it was brought out that the Bio- and radioactive aerosols and nano particles (1.0 to 100 nm) are emerging as a novel contribution to aerosols.
Such studies are very important for the Indian sub-continent. The size distribution characteristics of some therapeutic nebulizers manufactured in India for administering bronchodilators was presented, which have size range of 2-6 µm. While suggesting to concentrate on fine particles sizes < 1µm, it was suggested to focus on patient related factors while manufacturing such nebulizers.

Highlights of the partnership with School Science-Education Programme in the US were made and such program is very much needed to involve school teachers and young students.

Two panel discussions were arranged with panelists from India and abroad. The panel discussion took place on **Data Sharing** in which Panel member were scientists from national and international agencies responsible in looking after the aerosol data. The panel discussion was arranged to resolve data sharing problems in India which is a much debated and sensitive subject. The bulk of the operational meteorological data and satellite data is utilized by the major departments like the India Meteorological Department (IMD) and the Department of Space (DOS). There have been difficulties expressed by scientists outside these departments in acquiring data for research. This has been a major handicap. The campaign mode data acquired under the Government funding (sponsored by the Department of Science and Technology) sponsored monsoon related field programs which created specific data centers and the data were freely made available to atmospheric-ocean science community within 2-years of the completion of the experiments. It was pointed out that the handling of data was not satisfactory with regard to the field campaigns on Aerosol-chemistry either under INDOEX or in the
IGBP-related field experiments although the INDOEX data acquired under an NSF project are available through UCAR to anyone. It was pointed out that the studies carried out in India are mostly based on internet or meteorological re-analysis projects by US, European and Japanese agencies. It was suggested that field campaign related data have a short-use period and the best results from the data collected during the field campaigns are obtained if the data are processed and distributed within 2-years of the field campaigns in a systematic manner. It was suggested that in India similar work and data sharing culture should be developed as it exists for the Aeronet program. The funding agencies in India should also ensure, as it is done in US, that the data must be made available in the public domain if it is collected under science program funded by the Government for the benefit of the larger scientific community.

After a detailed discussion, following recommendations were made:

- A culture of data sharing among the scientists must be developed. Such approach will increase the aerosol related research.
- Funding agencies in India must ensure that the data are made available to the funding agencies for appropriate distribution to interested scientists.
- Different groups in India should evolve culture of data sharing.

Not many institutions are currently having atmospheric science program. A Panel discussion on Atmospheric Science Education in Institutes of Higher Learning was held and the following suggestions were made:

- Need for the introduction and of multidisciplinary areas like atmospheric
sciences in undergraduate education in India.

- Specialized branches of atmospheric science like Geophysical, Fluid dynamics, Mathematical modeling, Earth radiation budget, Climate studies and modeling like climate change, hydrology and the study of Atmospheric Water Cycle and its modeling, atmospheric/environmental pollution and Atmospheric Technology may be introduced at the first year course of engineering disciplines.

- Need for summer schools in atmospheric sciences in the country and exposure to the young students to various national facilities.

- Research facilities related to atmospheric sciences may be enhanced in the Engineering colleges; various atmospheric parameters may be studied to generate long term data records for understanding of climatology.

In the symposium 44 papers were presented orally and 32 poster presentations were made. The Symposium was sponsored by the Indian Aerosols Science and Technology Association (IASTA) and various Indian agencies (ISRO, DST, CSIR, UPCST, AICTE and BNRS).

Ramesh P. Singh (ramesh@iitk.ac.in), Vinod Tare and S.N. Tripathi

Department of Civil Engineering, Indian Institute of Technology, Kanpur – 208 016, India