

IGAC

Indian Activities on the Core Programme IGAC and Proposals for Network Activities

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1. Biogenic Emissions

1.1 1991 Methane Campaign

The most significant work was the undertaking of an extensive campaign for measurement of methane emission from rice paddy fields in India in 1991. Measurements were carried out during the entire kharif season covering 18 places located in West Bengal, Bihar, Assam, Uttar Pradesh, Orissa, Tamilnadu, Kerala and Delhi. The sites covered waterlogged, upland and irrigated areas. Measurements from different stations were intercalibrated with the nodal laboratory at the National Physical Laboratory. The absolute calibration compatibility at international level was established by exchanging samples with the Division of Atmospheric Physics, CSIRO, Australia and National Institute of Agro-Environment Sciences (NIAES), Tsukuba, Japan. During this period, training for measurements was also given to a scientist from Bangladesh.

Observations indicated that the flux rates are high primarily for rainfed waterlogged areas but are low for irrigated and upland areas. The total estimated methane emission for India was around 4 to 6 Tg/yr. This will indicate a global inventory of around 20 Tg/yr.

In view of this very surprising result, we had proposed in the Asian Planning Meeting for IGBP held in Singapore in December, 1991 undertaking of a campaign over the rice producing countries in Asia and as the first step have offered to organize a Regional Training Programme on Techniques and Measurement of Methane particularly from rice paddies. This training programme will be held at the National Physical Laboratory, New Delhi from September 20 to September 25, 1993. India has also offered to coordinate a methane campaign for all rice-producing countries in Asia.

1.2 Wetland Campaign

Another major programme that has just been undertaken concerns methane emission from wetlands. The present programme includes the Chilka Lake in Orissa and the mangrove areas in Orissa, Sunderbans in West Bengal and Gujarat Coast.

1.3 N₂O Emissions from River Discharges and Polluted Water

We believe an important area would be measurement of N₂O from river discharges from coastal ocean areas, from river discharges and from polluted rivers. For the coastal ocean areas, some measurements have already been made by the National Institute of Oceanography with its research vessels.

We would propose a coordinated measurements of N₂O emissions from river discharges in the Asian area.

2. Biomass Burning

Forest Research Institute at Dehradun has already completed a study on CO₂ emissions from deforestation, shifting cultivation, accidental and controlled fire and firewood burning in India. Additional activities now planned include emissions from the burning of agricultural wastes and domestic biomass burning. We are also attempting through joint efforts of the Forest Research Institute and the National Physical Laboratory to refine emission factors. A cooperative programme between the NPL at New Delhi and the Max Planck Institute of Chemistry in Germany is under discussion. A burning apparatus will be set up at the NPL. This study will also include emissions from wood stoves of different kinds which are used in India.

3. Acid Chemistry

A joint programme has started between Indian and Swedish scientists for precipitation and aerosol measurements with the following ends:

- to investigate the degree to which the alkaline material found in most Indian rain water samples is of local origin as distinguished from regionally transported material;

- to compare chemical compositions of precipitation in non urban areas with estimates of dry deposition (based on measurements of gases, aerosols and dustfall) and to derive nitrogenous species and other species of importance for the acidity of precipitation;
- to compare results obtained in India with those of other Asian countries and from Europe; and
- to compare results obtained in India with regional scale model calculations.

Two solar power wet-only collectors - and a number of sample bulk collectors for measuring wet deposition have been provided by the Swedish International Meteorological Institute. The stations which are now operating are at Poona (Indian Institute of Tropical Meteorology) and Goa (National Institute of Oceanography).

This programme is a part of the "Chemical Research and Environmental needs (CREN)" programme of the Commonwealth Science Council and is partially supported by them.

4. GASLAB Sampling in the Arabian Sea

This programme is under discussion between CSIRO, Australia and India.

The initial emphasis of this project is on carbon dioxide isotopes. A collaboration programme between CSIRO and Physical Research Laboratory, Ahmedabad on isotopes of greenhouse gases has already been organized under support from the International Atomic Energy Agency and the Australian Government. The major interest in this programme comes from the unusual monsoon forcing of the carbon cycle in the Arabian Sea and the Indian expertise in carbon dioxide isotope fractionation. A site in Southern Goa for establishing background levels of atmospheric constituents in the Indian region is already under discussion. When this programme is implemented, India will be a part of the international GASLAB sampling chain.

5. Ozone Programme

India has a very extensive network of ozone measuring stations. The techniques cover a wide variety of approaches: Dobson Spectrophotometer (New Delhi, Varanasi, Ahmedabad, Poona and Kodaikanal), Balloon Ozonesondes, surface ozonesondes, UV-B photometers and laser heterodyning system.

In relation to the IGAC Programme, the following specific activities are in progress:

- (i) The first and in our view the most important, concerns the transport of ozone and water vapour through the tropopause cold trap and the role of tropical-subtropical interface region in India in this context. This is being examined by making use of fortnightly balloon ozonesonde measurements carried out in the last decade as a part of the Indian Middle Atmosphere Programme for the three stations: Trivandrum (representing a tropical station), Delhi (a subtropical station) and Pune (a station in the transition region).
- (ii) A second study is in relation to the changes in tropospheric ozone for the Indian subcontinent as a whole using several decades of measurements.
- (iii) A third focus is to look for changes in the ozone profiles from biomass burning.

We would propose a network programme in the Asian region on the question of transport of ozone and water vapour. This could be achieved by having a coordinated programme in the equatorial Indian ocean with radiosonde and balloon ozonesonde flights from ship measurements. We also propose a coordinated programme of ozone changes from biomass burning in the Asian region. India would offer to coordinate this programme.

6. Water Vapour Measurements

An important question concerns reliable measurement of water vapour profiles up to stratospheric heights. We plan to have a preliminary intercomparison campaign in 1993 to be followed by a more comprehensive campaign in 1994 in Delhi on water vapour profiles taking advantage of availability of a Laser Heterodyning System in this location and incorporating several special radiosonde systems. The Max Planck Institute for Aeronomy, Lindau, Germany will try to cover heights above 20 km through the projected Space Shuttle - Atlas Mission II/III planned for 1993 and 1994 using microwave radiometry and 183 and 184 GHz. Since water vapour profiles are most crucial in chemical-climatic studies, we would welcome participation in these intercomparison campaigns from other Asian countries.