INVESTIGATIONS ON WEATHER FORECASTING AND LONG-TERM CLIMATE CHANGES IN ANTARCTICA

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ENROUTE FROM GOA TO ANTARCTICA ON BOARD THE SHIP (Nov. 28, 1986 to Jan. 2, 1987)

a. A total of 136 sets of conventional surface meteorological information at six hourly, intervals were collected together with continuous records of surface pressure.

b. A two-hourly monitoring of Aitken Nuclei and weather was made throughout the period and 239 sets of surface concentration of Aitken Nuclei were recorded.

c. A total of 31 samples were collected of aerosols on 0.8 im millipore filters.

d. 42 sets of intensity of direct solar radiation at four selected wavelength were recorded to obtain extinction coefficients in the atmosphere.

e. In addition to above, while in fast ice (Dec. 21,1986-Jan. 2, 1987), a continuous weather watch was kept in association with IAF/IN Meteorological Officers together with collection and analysis of fascimile charts for the purpose of providing weather forecast for logistic operations.

AT DAKSHIN GANGOTRI

a A microprocessor based 8 channel temperature scanner with 80 column printer was installed, tested and calibrated on 30th Dec. 1986 in the Meteorological Laboratory at Dakshin Gangotri. The sensors (PT-100 RTDs) for recording air temperatures at 3 levels (ground, 3 mts and 5 mts) for surface boundary layer study were installed at suitable site on 3rd Jan. 1987. The hourly air temperature data records started on Jan. 4,1987 (1900 Z) and a total of 143 temperature profiles were recorded until 11 Jan. 1987 (1500 Z).

b Three PT-100 RTDs were installed in snow (at 1,2 and 3 mts depths) after the completion of snow clearing operations at the suitable site on 11 Jan. 1987. From 11 Jan. 1987 (1600 Z), a continuous hourly record of airand snow temperatures at six levels in the vertical have been monitored. Until 20 Feb. 1987 (0800 Z), a total of 897 vertical profiles of temperature in the near surface boundary layer have been recorded for studies on Cryosphere-Atmosphere energy exchange processes. The relevant equipments were left at the site for continuous recording of air and snow temperatures in the winter months.

c Six flasks each of one litre capacity were filled with air samples for monitoring the trace gas concentrations to investigate the problem of climate changes in relation to ozone depletion in Antarctica.

d Two vertical profiles of Aitken Nuclei concentrations (from surface to 7000 ft) were monitored over Dakshin Gangotri together with observations of air temperatures

and wind for the purpose of understanding the micro-physics of cloud formation in Antarctica.

AT MAITRI HILLS CAMP (Jan. 14, 1987 to Feb. 11, 1987)

a. Conventional surface meteorological observations were; monitored at six hourly intervals and a total of 110 sets of observations were recorded.

b. Special hourly observations of surface wind, pressure' and temperature were made for a period of 8 days to study the physics of hatabatic wind flow in Maitri Hills region.

c. Two hourly monitoring of Aitken nuclei concentrations with surface wind, temperature, pressure and cloud amount/type were done. A total of 281 samples of data on Aitken nuclei concentrations has been recorded.

d. Seven profiles on vertical distribution of Aitken nuclei concentrations (from surface to 2 kms) were monitored over Maitri-Wohlthot region.

e. 10 samples of surface aerosol concentration were collected at Maitri Hills region using 80.8 m millipore filter.

f. 90 sets of spectral measuren.snts of intensity of direct solar radiation in selected wavelength bands were made at Maitri Hills region.

g. Snow samples at selected sites were collected in 12 sampling bottles (each of one litre capacity) for chemical analysis with a view to investigate water chemistry of polar region.

ENROUTE FROM ANTARCTICA TO GOA (February 21 to March 18, 1987)

a. Conventional surface meteorological observations were monitored at six hourly interval and a total of 104 sets of observations were recorded.

b. A total of 188 samples of data on surface number density of Aitken Nuclei and weather at 2 hourly interval was recorded.

c. 11 samples of surface aerosol concentration were collected on 0.8 m millipore filter.

PRELIMINARY RESULTS

a. The average values of Aitken nuclei over the Indian Ocean as well as at Maitri Hills in Antarctica were found to be considerably lower than those found in India.

b. The average number of Aitken nuclei under clear sky conditions over South Indian Ocean is about 30% higher than those reported for Atlantic and Pacific Oceans.

c At Maitri Hills, the Aitken nuclei concentrations of less than 500 cm^3 comprise 46% of all observations.

d. No systematic diurnal variation in the concentration of Aitken nuclei was found in Antarctica.

e. No definite correlation between Aitken nuclei and either wind speed or wave height (in high seas) could be traced.

f. The occurrence of stratus cloud was typical for high concentrations of Aitken nuclei at the surface.

g. More Aitken nuclei were present at all levels over Maitri-. Wohlthot region than over the ice shelf under clear sky condition.

h. About 10 to 12 hours in advance of approaching a frontal weather system at sea as well as over Maitri hills, the Aitken nuclei increased sharply above the average value. Further verification of such observations in future expedition should be useful for weather forecasting in Antarctica.

i. Turbulent heat fluxes are an integral part of the energy balance of the ice cover in Antarctica. Low relative humidity and high average wind speeds in Antarctica are primarily responsible for vigorous turbulent neat transfer *here*.
transfer here.

j. The snow temperature at 1, 2 and 3 m depths have an increasing tendency in January and start decreasing in February at all depths.

k. A typical diurnal cycle in air temperatures at air-ice interface, 3 m and 5 m in vertical are observed both in January and February.

I. The cloud in Schirmacher Oasis region reduce the outgoing longwave flux by about 40 to 70% and thus increase the net radiation at the surface (greenhouse effect).

m. Clouds also reduce the solar radiation at the surface by reflecting incident radiation back to space thus decreasing the net radiation balance (albedo effect).

n. Infrared radioactive energy loss from the top of low cloud is a source of buoyancy for the cloud layer and this could have important consequences for planetary boundary layer structure and cloud development.This calls for a detailed investigation on the vertical distribution of radioactive fluxes in the atmosphere