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STRATOSPHERIC FALLOUT AND ICE-FORMING AEROSOLS

Satya Murty and Ramana Murty (1971) have compared beta activity of fallout, ozone and ice-forming aerosols at surface layers to study the possibility of the transport of ice-forming aerosols from the stratosphere. Since the source of the beta activity is the stratosphere, an increase in its levels indicates enhanced transfer from the stratosphere and this provides a basis (along with ozone) for examining the stratospheric origin of the ice-forming aerosols. In this connection, the following comments are pertinent.

(*a*) During the period April 1962 to 4 November 1962, the U.S. Dominic nuclear weapon test series was in progress. These tests were of both low and high yields. In addition to the U.S. test series, U.S.S.R. also conducted a number of tests from 5 August 1962 to 24 December 1962. Details, including yields, of these tests have been tabulated in the USAEC Report HASL-142, 1964. Tropospheric fallout was present throughout the period as indicated by the presence of short-lived fission product Ba^{140} (half-life 12·8 days) and has been reported in literature (Rangarajan *et al.* 1968). Further, during early June 1965 fresh tropospheric activity from the second Chinese test

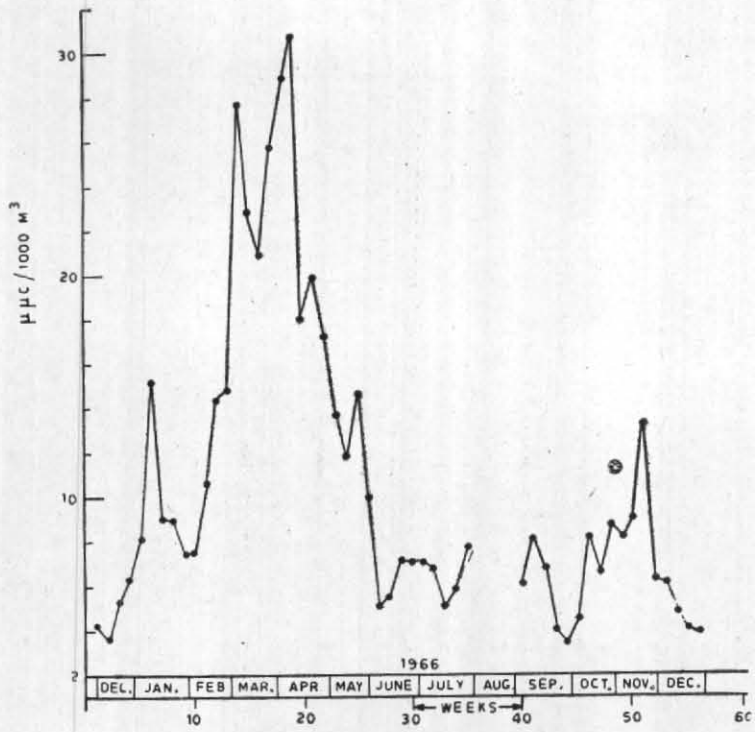

Fig. 1

Weekly average activity of Cs^{137} in surface air at Bombay

of 14 May 1965 was detected at several stations in India (Rangarajan and Gopalakrishnan 1969).

The fluctuations in tropospheric fallout as it circles the globe along with the westerly winds is well-known (Vohra *et al.* 1961). It is felt therefore that some of the periods chosen by Satya Murty and Ramana Murty for their study, *viz.*, April-December 1962 and June 1965 (Fig. 3b of their publication), are not suitable as the increase in beta activity cannot be definitely attributed to increased stratospheric fallout.

(*b*) The authors have chosen a rise by at least 10 per cent above the previous day's level as the criterion for determining an increase in beta fallout levels. A better criterion would be a steady increase in levels of one to two weeks' duration as in the case of ozone. It is well-known that stratospheric fallout is maximum during the spring season but this increase occurs in 'pulses', *i.e.*, superimposed on the seasonal increase there are short-term variations of about one to two weeks' duration. Fig. 1 shows such a variation in Cs^{137} (half-life 30 years) levels at Bombay during the period 1965-1966. In the figure, weekly averages have been presented to smoothen the scatter of the daily values. It is felt that examination of ice-forming aerosols during such periods of significant short-term increases (without tropospheric fallout) would be more meaningful than a 10 per cent increase, as, during periods of low fallout activity, the accuracy of the data itself may be of the order of ± 10 per cent.

(*c*) Satya Murty and Ramana Murty also examine the tropopause data at Delhi for relating their structure with the ice-nuclei burst. It is felt that tropopause data at Delhi only may not be enough. The "pulses" of increase mentioned above seem to occur simultaneously at several stations on many occasions as shown in Fig. 2. In this figure the daily beta activity has been converted to Cs^{137} levels by multiplying with the ratio of average monthly Cs^{137} to average monthly beta activity. This was necessary as only monthly average Cs^{137} values were available and the procedure applies an approximate empirical correction for the complex beta decay. This simultaneous occurrence of the "pulses of increase" suggests that the synoptic situations over wide areas have to be examined to relate the short-term increases to stratospheric-tropospheric exchange, rather than the tropopause structure at a single station. In view of the fast mixing within the troposphere, (as shown by the rapid detection of fallout debris from high

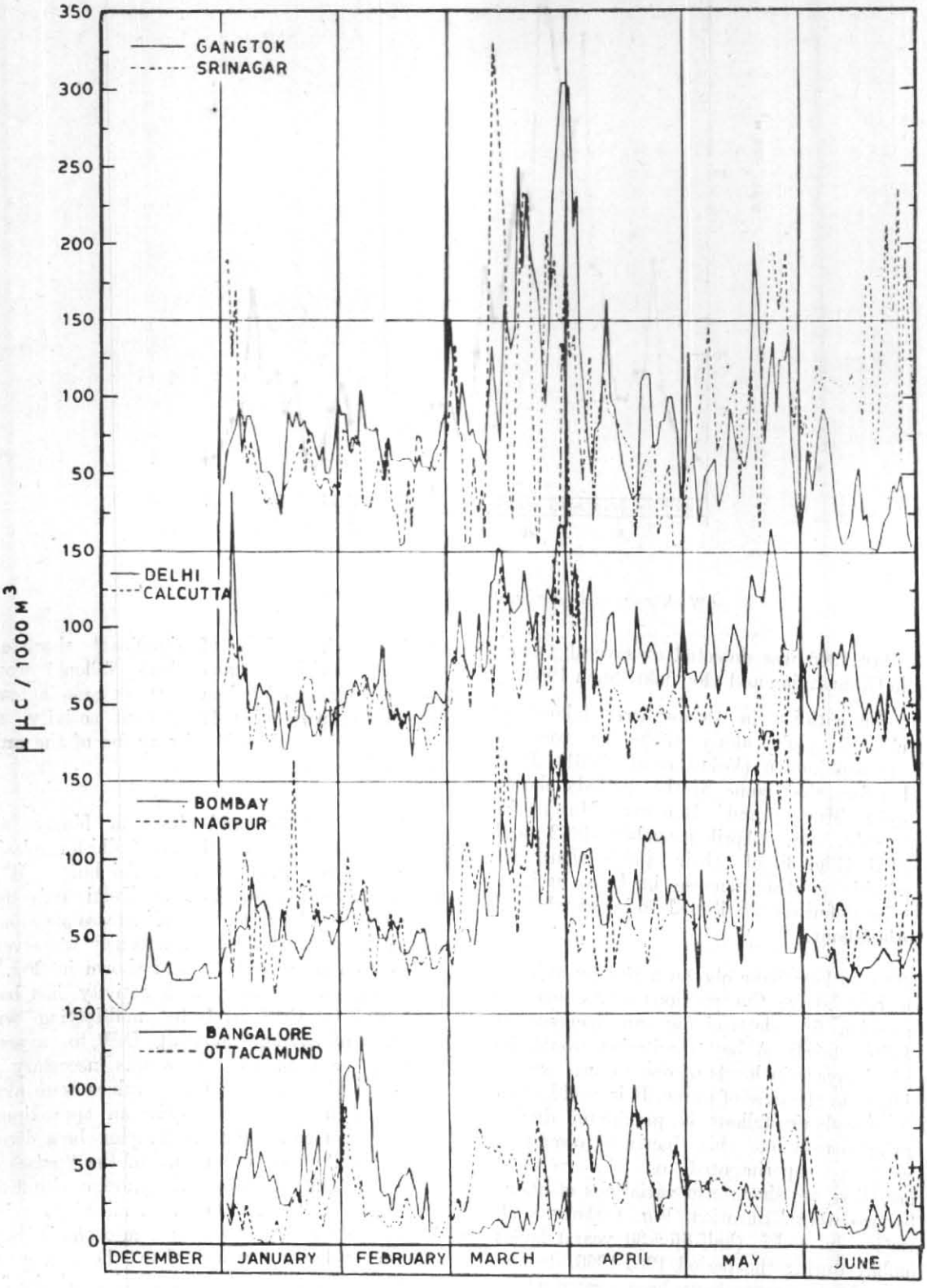

Fig. 2

Calculated concentrations of Cs^{137} in surface air at various stations in India during Dec 1962 to Jun 1963

latitude USSR tests), a large injection of activity across the tropopause even at middle latitude could be detected at tropical latitudes, depending on the magnitude of the transfer.

The study of the type carried out by Satya Murty and Ramana Murty could throw considerable light on the origin of ice-forming nuclei if these considerations are borne in mind.

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