551·578·1(541·2)

RECORD OF AN ABNORMAL RAINFALL OVER CALCUTTA ON 10 OCTOBER 1965

During the course of a systematic investigation of the salinity of rain water over Calcutta, it was found that the rain water collected on 10 October 1965 had an abnormal salt content. This is shown in Table 1.

One possibility examined was that the saline rain collected on 10 October 1965, owed its salinity to some cyclonic storm over the Bay of Bengal. This hypothesis was confirmed through an enquiry made at the Meteorological Office, Calcutta. Indeed there occurred a deep depression at Chittagong coast (22°N) during morning hours of 9 October 1965, which must have violently churned the sea surface and uplifted a large number of sea salt nuclei into the turbulent atmosphere. The transport of these nuclei from the sea surface to the air and their diffusion over large areas had also been reported by Eriksson (1958) and Woodcock (1950, 1953). The major portion of the sea salt nuclei usually returns to the sea as condensation droplets. However, some are carried inlands by strong winds and precipitated as rains, as may have happened in the present case. Such a phenomenon had also been noted by Miller (1914) who reported a maximum chlorine content of 3920 mg/l in rain water collected at Butt of Lewis, Outer Hebrides, Scotland. In such cases it may perhaps be expected that the ratio of certain constituents

TABLE 1

Values obtained for a few successive rain occasions both before and after the abnormal rain of 10 October 1965

S. No.	Date	Specific conductivity ($\mu\mho$/cm)	Chlorides as Cl (mg/l)	Total hardness mg $CaCO_3$/l	*pH*	Remarks
1	20-8-65	51·7	4·0	10·0	6·2	All chloride values marked t are less than 1·0 mg/l.
2	21-8-65	34·5	t	8·7	6·8	
3	23-8-65	28·4	1·0	7·0	6·6	
4	30-8-65	39·5	t	10·2	6·8	
5	31-8-65	25·2	t	6·3	7·2	
6	1-9-65	33·2	t	6·7	7·0	
7	2-9-65	26·1	t	8·0	6·8	
8	18-9-65	139·3	5·0	36·5	7·0	
9	23-9-65	28·8	t	8·5	6·5	
10	28-9-65	15·0	t	2·0	6·6	
11	10-10-65	3957·0	851·2	186·0	8·8	Abnormal rain
12	16-10-65	100·0	1·0	30·0	7·3	
13	17-10-65	102·0	1·0	40·0	7·6	
14	19-10-65	112·3	2·5	33·0	7·8	
15	20-10-65	106·5	2·5	22·0	6·7	
16	21-10-65	25·0	t	2·0	7·1	

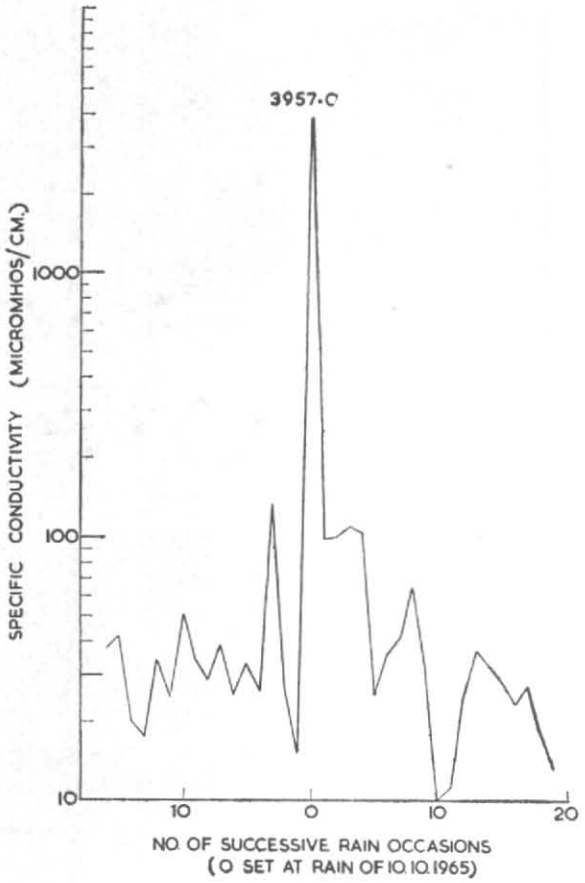

Fig. 1. Semilog plot of specific conductivity *vs* successive rain occasions before and after the rain of 10 October 1965

e.g., Cl/SO_4, (Na+K)/(Ca+Mg) etc should remain more or less unaltered. Our results indicate that some sort of fractionation takes place during diffusion process in the atmosphere as shown in Table 2. Moreover, the high alkali content of the rain water suggests that considerable modification is also possible through atmospheric contamination. As a matter of fact, subsequent rainfalls (immediately after 10 October 1965) showed progressively declining alkalinity, although normal rain water is usually acidic in character. Table 1 gives the values for different constituents in rain water collected

TABLE 2

Ratios of salt contents

	$\frac{Cl}{SO4}$	$\frac{Cl}{HCO_3}$	$\frac{Na+K}{Ca+Mg}$	$\frac{Na}{Cl}$
Rain water collected on 10 Oct 1965 over Calcutta	25·5	1·5	9·0	1·5
Sea water, Bay of Bengal (Orissa coast)	9·6	216·0	3·6	0·87
Oceanic water (average)	10·1	232·0	3·8	0·88

on a few successive rain occasions both before and after 10 October 1965, while Fig. 1 shows the semi-logarithmic plot of the specific conductivity of rain water against the number of successive rain occasions. It may be noted that the specific conductivity is directly proportional to the total salt content of the rain water.

It is not unlikely that the atmospheric contamination referred to above, owed its origin to the Taal volcanic eruptions south of Manila on 28 and 30 September 1965. Such eruptions are always known to emit carbon dioxide and sulphurous gases profusely. The hazy yellow colour of the rain water, its sulphite content, high temporary hardness and the presence of large quantity of water insoluble matter, strongly indicate such a possibility. In particular, the presence of a strong easterly upper wind blowing during this period from the Pacific Ocean towards Bengal (as revealed by the wind charts) lends support to this view point.

Thanks are due to Prof. S. K. Banerji, D.Sc., F.N.I. (ex-Director General, India Meteorological Department), for his valuable discussions.

PARTHA BANERJI
P. K. MUKHOPADHYAY
B. K. HANDA
S. D. CHATTERJEE

Department of Physics,
Jadavpur University, Calcutta

April 18, 1966

REFERENCES

Eriksson, E. 1958 *Climatology*, UNESCO Rev. Res.
Miller, N. H. J. 1914 *J. Scot. met. Soc.*, **16**, p. 141.
Woodcock, A. H. 1950 *J. Met.*, **7**, p. 397.
1953 *Ibid.*, **10**, p. 362.