Letters To The Editor

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THE MOBILITY OF THE SMALL IONS OF THE ATMOSPHERE AT POONA

Atmospheric-electric observations were started some years ago at the Instruments Section of the Meteorological Office, Poona, with a view to determine the values of the various atmospheric-electric elements and to study the relations between them and meteorological phenomena at this station. The results obtained have been discussed in a number of papers[1,2,3]. In this note the mobility of the small ions of the atmosphere at Poona as derived from the simultaneous measurements of the conductivity and the ion-content of the air, carried out at the Meterological Office, Poona during 1935-37 is discussed. The numbers of positive and negative small ions were obtained by means of an Ebert ion-counter while the polar conductivities were measured directly with a Gerdien apparatus. Details of the instrumental equipment and of the methods employed for obtaining the data were the same as those described in a previous paper by Sil[2]. The values of mobility for the positive and the negative ions have been computed from all satisfactory individual determinations of λ and n from the relation $K = \frac{\lambda}{n\,e}$, K being the mobility, λ the conductivity, n the ionic number and e the unit charge.

All the data are based on observations taken at 10 A.M., Indian Standard Time. In all, 151 determinations have been made use of and the monthly average values of the mobilities together with the number of determinations for each month are given in Table 1; the monthly average values for mobilities are also plotted in Fig. 1.

TABLE 1

Mean monthly values of mobility in cm^2 $volt^{-1}$ $sec.^{-1}$ at 10 hrs. I.S.T. at Poona during 1935-37.

Month	*K*+	*K*−	*No. of determinations.*
January	0.91	1.09	14
February	1.09	1.01	15
March	1.03	1.11	10
April	1.17	1.19	11
May	*1.20*	*1.21*	12
June	1.14	1.14	17
July	1.17	1.19	20
August	1.15	1.14	15
September	1.07	1.10	9
October	0.86	0.92	9
November	0.94	0.96	9
December	*0.85*	*0.88*	10
Mean	1.06	1.09	Total 151
Maximum value	113%	111%	of the yearly means.
Minimum value	80%	80%	

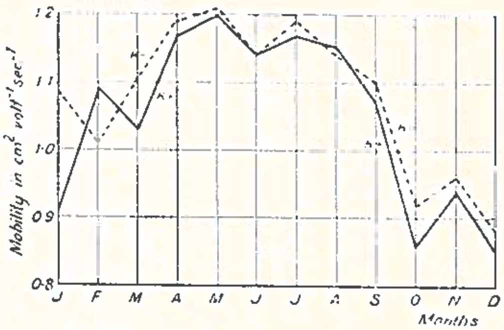

Fig. 1. Monthly average values of positive and negative mobilities at Poona at 1000 IST.

It is seen that the mobility values are generally high during the summer months—March to May—as well as during the monsoon season—June to September—and are the highest in May; they are generally low during the post-monsoon and winter seasons and reach a minimum value in the month of December. So far as the monsoon (rainy) season—June to September—is concerned, the occurrence of higher mobility is understandable as the air during this period at this station is in a comparatively purer state and its dust contents reach the minimum value. As regards the low mobility values noticed during the winter months, it may be mentioned that during winter at Poona, fog is a frequent occurrence in the mornings followed by haze upto the time of observation and sometimes even continuing till noon. During haze, the air is full of dust and Aitken nuclei and the presence of these is probably responsible for the occurrence of fall in mobility and for the lowering of conductivity to a large extent. The mean value of mobility for the year works out to be 1.06 cm.^{2} volt^{-1} sec^{-1}. for the positive ions and 1.09 cm.^{2} volt^{-1} sec^{-1}. for the nagutive ions ; the maximum and minimum monthly values are about 112 percent and 80 percent respectively of the yearly means for both ions. The present yearly mean values are in fairly good agreement with the observations taken at most land stations. They are, however, below the figures given by a few workers [4,5] and are also found to be much lower than those obtained over the ocean[6]. At Poona, the average value for negative mobility being higher than that for positive mobility, the average value of the ratio $K-/K+$ is greater than one and amounts to 1.03.

In order to ascertain the frequency-distribution of determinations of mobility the individual determinations were grouped separately for both types of ions according to the values of mobility ranging from 0.4 to 2.0 for which the frequency curves for both K+ and K— have been drawn and given in Fig. 2.

The frequency curves indicate different mobility-groups. The most prevalent group of the positive ions has mobilities ranging from 0.9 to 1.1 and there are four other groups with mobilities of 0.7, 1.4, 1.7 and 0.5 cm^2. volt^{-1} sec.$^{-1}$ The negative ions also appear to fall in five mobility groups ; the most prevalent group has a mobility of 1.1 and the remaining four have mobili

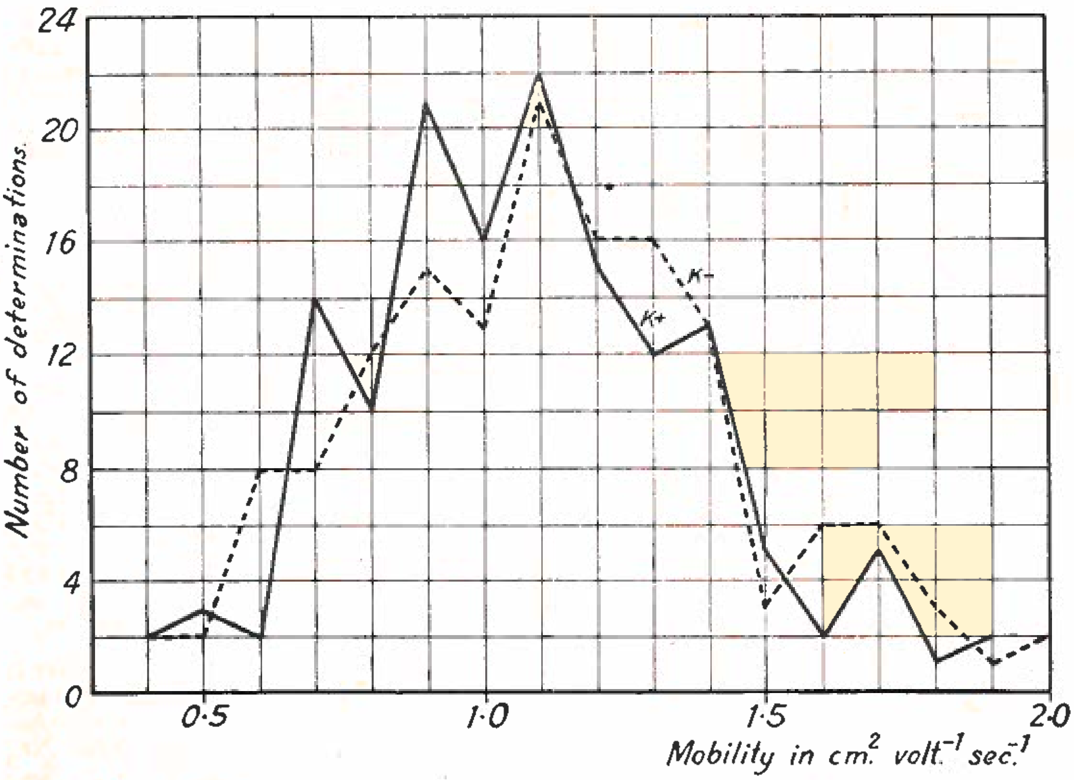

Fig. 2

Frequency distribution of determinations of mobility at Poona at 1000 I.S.T.

ties of 0.9, 1.2 to 1.3, 1.6 to 1.7 and 0.6 to 0.7 $cm.^2$ $volt^{-1}$ $sec.^{-1}$. It would be seen that the mobility values for the different groups agree favourably for the ions of the two signs.

During the course of the observations, it was noticed that the mobility measurements showed fluctuations depending upon the meteorological conditions prevailing at the time of observations, *e.g.*, the observations indicated that higher mobilities were associated with rain. Mean of 14 observations during rain gave values of 1.21 and 1.15 for *+ve* and *—ve* mobility respectively against the values of 1.06 and 1.09 based on all observations. This is due to a purification of the air by rain drops. During hazy conditions, it was noticed that the mobility generally decreased to a considerable extent owing to the presence of dust and certain other impurities in the air.

The observations discussed here were taken during the years 1935 to 1937 when the author was working in the Instruments Section of the Meteorological Office, Poona, under the guidance of Mr. J. M. Sil, to whom the author wishes to express his gratefulness. Thanks are also due to the Director General of Observatories for affording facilities for the work.

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