

OBSERVATION OF CONDENSATION ON SMALL AIR IONS IN THE ATMOSPHERE

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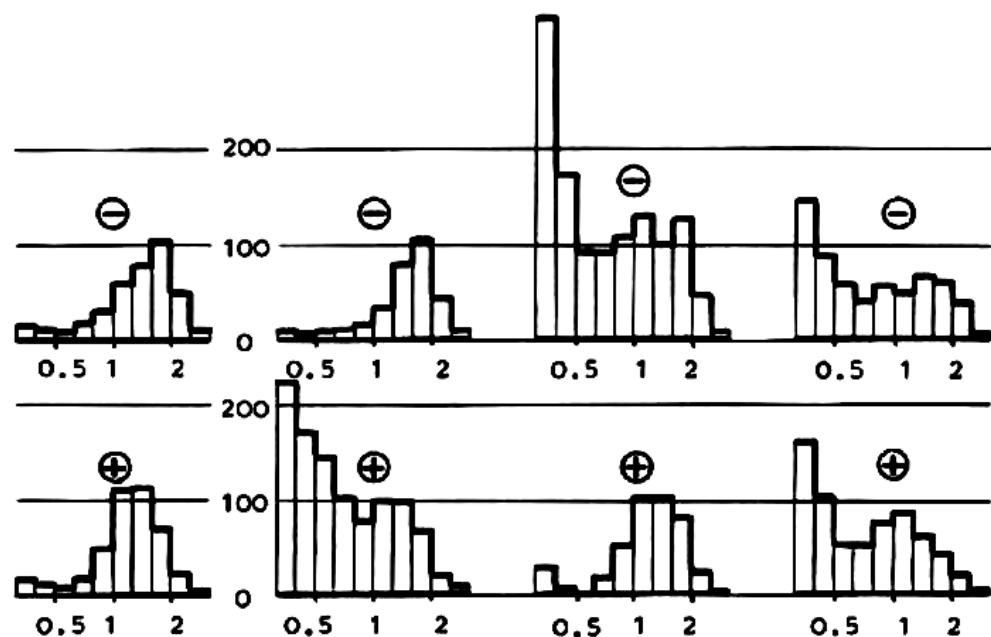
ABSTRACT

Air ion mobility spectrum was recorded at a rural site in a period of one year. Examples of spectra are explained on the basis of the hypothesis about the condensation of trace gases on cluster ions.

Air ion mobility spectrum arranged into 10 fractions logarithmically distributed in a range of $0.32-3.2 \text{ cm}^2/(\text{V}\cdot\text{s})$ was recorded at a rural site in a period of one year. Over 6000 mean-hour spectra of air ions of both polarities were obtained. Preliminary results have been published in [1].

Mobility spectra averaged for one year are shown in the Figure. The spectrum has a minimum near the mobility of $0.5 \text{ cm}^2/(\text{V}\cdot\text{s})$ which corresponds to a mass of about 1500 amu. This coincides with the boundary between clusters and small particles. There is no correlation between the concentrations of fractions situated on either side of this boundary. The air ions of greater mobilities are cluster ions, the air ions of lower mobilities are charged aerosol particles. Concentration of air ions of one polarity with mobilities $0.32-0.5 \text{ cm}^2/(\text{V}\cdot\text{s})$ was usually $20-30 \text{ cm}^{-2}$, in 4% of the cases it exceeded 50 cm^{-3} .

Additionally, examples of rarely occurring special situations are presented in the Figure. The high concentration of low-mobility air ions in these examples cannot be explained by the diffusion charging of aerosol particles when they are generated in great amount in neutral condition. This situation should be accompanied by strong suppression of cluster air ions but the suppression was not observed. Moreover, sometimes strong charge asymmetry is observed (see Figure) which cannot be explained by the hypothesis of diffusion charging of neutral particles. We suggest that the air ions with mobilities below $0.5 \text{ cm}^2/(\text{V}\cdot\text{s})$ in these examples are generated as a result of condensation of some substances on cluster ions. These low-mobility ions could be called condensation air ions. The observations presented in the Figure cannot be explained by the condensation of water as no dependence on the humidity of the air has been observed. The above results



Annual average 850610-860602 One hour 850613:01LT One hour 850905:15LT One hour 860302:09LT

Fig. Air ion mobility spectra. Abscissa shows the mobility in $\text{cm}^2/(\text{V}\cdot\text{s})$, ordinate shows fraction concentration in cm^{-3} .

can be explained on the basis of the hypothesis about the condensation of some trace gases on cluster ions. The connection between the nucleation on air ions and the impurities in the air has been noticed in discussion of a laboratory experiment [2]. If all air ions of both polarities and with mobilities of $0.32\text{--}0.5 \text{ cm}^2/(\text{V}\cdot\text{s})$ had a condensational nature, then this would mean the generation of about 1000 aerosol particles in cm^3 per hour at an average.

REFERENCES

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2. Cabane M., Giboni N., Madelaine G., Ollion P. (1978) Formation of condensation nuclei by ions of given polarity and age. J. Aerosol Sci., 9, 423-428.