

Concentration of small ions measured over the Pacific Ocean

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It has been proposed that climate could be affected by changes in cloudiness caused by variations in the intensity of galactic cosmic rays in the atmosphere. The cause of it is considered as a new particle formation with an ion induced nucleation. The ion-induced nucleation is occurred under the low concentration of particles and high concentration of ions, but there are a few reports. Then we observed small ions and aerosol size distributions over the Pacific Ocean.

Observations were performed from December 1, 2011 to March 6, 2012 on the R/V Hakuho Maru KH-11-10 and KH-12-1 (EqPOS) cruises over the Pacific Ocean. Small ions were measured with the Gerdien type meter (COM-3400). The critical mobility was set 0.7 cm²/V/s and we measured positive and negative ions alternately. Size distributions from 4.4 to 5000 nm in diameter were measured with a scanning mobility particle sizer (SMPS, TSI 3936N25 or 3936L22) and an optical particle counter (OPC, RION KR12 or KC01D). Small ions are generated with ionization of air by cosmic rays or radiation from radioactive substances. Small ions are lost by various mechanisms such as ion-ion recombination and ion-aerosol attachment. In order to estimate the contribution of the lost by ion-aerosol attachment, a coagulation sink was calculated. The coagulation sink can be determined from $CoagS = \sum [K_{ij}N_j]$. Here K_{ij} is the coagulation coefficient and N_j is the number concentration in size class j (Kulmala et al., 2001).

Main results are as follows:

1. There is a negative relation between ion concentration and coagulation sink over the Pacific Ocean. This suggests that concentration of small ions decreases by ion-aerosol attachment.
2. There is a positive relation between ion concentration and wind speed over the Pacific Ocean. This suggests that small ions are generated by bubble bursts of sea water.

References

Kulmala et al., Tellus, 53B, 479-490, 2001

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