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自然海水から生成する一次海洋エアロゾルの雲凝結核活性の野外実験による測定
A field experiment to determine the CCN activity of primary marine aerosols generated from natural seawater

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Oceanic surface waters contain a large amount of organic substances produced by marine biota, which are transferred to the atmosphere as primary marine aerosols (PMA) by bubble bursting processes. The organics potentially play an important role in regulating the physico-chemical properties of the PMA, including the cloud condensation nuclei (CCN) activity. Our current knowledge on the relationship of the organics in PMA and the particle properties is, however, still limited despite recent laboratory/field studies on PMA. To better characterize the CCN activity of PMA associated with the organics, we preformed an experiment of particle production by the bubble bursting of natural seawater.

The experiment was conducted in Maizuru Bay, the Japan Sea, onboard R/V Ryokuyo-Maru, Maizuru Fishery Research Station, Kyoto University. The PMA generator, which floats on the sea, was prepared to produce aerosols by the bursting of air bubbles in natural seawater. The generator is equipped with a bubble-producing glass ball filter, through which compressed dry air was passed, at 30 to 40 cm below the air-sea interface. The bubbles rose to the sea surface and burst inside a 30 L PTFE dome. The generated PMA were transferred to the instruments onboard through PTFE tubing. Dried PMA was introduced to a differential mobility analyzer (DMA) for size selection, and the resulting monodisperse aerosol was transferred to a condensation particle counter and a continuous flow thermal gradient CCN counter to measure the number concentrations of condensation nuclei (CN) and CCN, respectively. The activation diameters (D_{act}) of the PMA at supersaturations ranging from 0.1% to 0.5% were calculated from the CCN to CN ratios. Surface seawater samples were also collected, which were used for the determination of chlorophyll-a (chl-a) concentrations.

The chl-a concentrations inside Maizuru Bay (IMB) were much higher than that outside Maizuru Bay (OMB). The D_{act} of the generated PMA at IMB and OMB were clearly different in particular at higher supersaturations (0.3% and 0.5%); D_{act} of PMA at IMB were larger than that of PMA at OMB. The hygroscopicity parameter kappa (Peters and Kreidenweis, 2007) calculated for the PMA at the highest supersaturation were lower than that of sodium chloride, suggesting that the PMA were the mixture of less hydroscopic organics and sea salts. The results suggest that organics in seawater transferred to the atmosphere as PMA are enriched especially in the ultrafine mode and affect the particle CCN activity.

Reference: Petters, M. D., and S. M. Kreidenweis (2007), A single parameter representation of hygroscopic growth and cloud condensation nucleus activity, *Atmos. Chem. Phys.*, 7(8), 1961-1971.

キーワード: 一次海洋エアロゾル, 雲凝結核, 有機物, 自然海水
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