2025 Special Seminar on The IDEC Institute

IDEC # 105
PHIS # 50

Individual droplet freezing method for identifying individual ice nucleating particles

Abstract

The characteristics of aerosol particles that act as ice-nucleating particles (INPs) under mixed-phase cloud conditions are crucial for improving precipitation forecasts and understanding the water cycle. However, the physicochemical properties of INPs remain poorly understood, leading to significant uncertainties in their representation in numerical models. The number of particles acting as INP accounts for only one out of 10^4-5 particles depending on the temperature. This scarcity of INPs hampers the understanding of their ice nucleating properties. Our group has developed a method to identify INP on an individual particle basis and applied to atmospheric samples collected in the forested environment and high-altitude samples collected by aircraft.

We participated in two aircraft observation campaigns to identify INPs from samples collected over the Atlantic Ocean, where particles from various sources are emitted, transported, and mixed. Our goal was to characterize the particle types, mixing states, and emission sources of these INPs.

Highly active INPs collected in the Southeastern coast of north America were morphologically and chemically identified as bioaerosols, likely spores, and were frequently internally mixed with sea salt components such as Na and Cl. In contrast, less active INPs shared similar morphologies and were primarily composed of mineral particles, as indicated by the presence of fluorescence, Al, and Fe. However, sea salt components were scarcely detected in samples collected near the Cape Verde Islands, suggesting externally mixed mineral particles.

Backward trajectory analyses suggest that the highly active ice nucleating bioaerosols observed off the Eastern coast of the U.S. originated from terrestrial vegetation. These findings indicate that bioaerosols of continental origin serve as an important source of INPs under mixed-phase cloud conditions over the Atlantic Ocean.

Date

2025 7/14 Monday
10:00 ▶11:00

Online

https://00m.in/brcbT

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Venue

Hiroshima University, Graduate School of Advanced Science of Matter Build A, 6F Seminar room601-(2)

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