The Influence of pH on Immersion-mode Ice-nucleating Particles with Implications for cloud-phase partitioning

Juliana Mejia Sepulveda

University of Arizona, USA

Author list (excluding presenting author)

Sylvia Sullivan, Tejo Bheemasetti, Rashed Rahman

Abstract

Cloud-phase partitioning refers to whether the thermodynamic phase in clouds is liquid or ice, which has both radiative and hydrological impacts. Determining the cloud phase partitioning between liquid, ice, and mixed-phase is crucial to determining the earth-atmosphere system radiative energy budget. Several conditions will affect the cloud phase, such as temperature through homogeneous ice nucleation by supercooled water (below -37°C) or ice-nucleating particle (INP) concentrations through heterogeneous ice nucleation (between 0°C and -37°C). However, the effect of cloud water chemistry, specifically aerosol acidity, is still uncertain on heterogeneous ice nucleation efficiency. This study aims to examine the impact of pH on the effectiveness of ice nucleation in droplets that undergo immersion freezing. A frozen droplet assay setup will be used to examine different dust mineralogies from the Sonoran desert in Arizona in acidic, neutral, and basic aqueous solutions. The droplet-freezing assay consists of a LAUDA ECO model RE1050S cooling thermostat, with silicone oil as the coolant. Samples are placed in assay plates that will be held through an aluminum tray in contact with the coolant. Additionally, we will be testing rain samples collected in different seasons, such as the monsoon season in Arizona during July and August, as well as during the winter season. Rain samples will be captured using a sequential rain sampler that consists of 8-12 glass jars fed by the outflow of a tipping bucket gauge. The outcome of this study will let us test if pH has a strong influence on ice-nucleating efficiency and, as a consequence, on cloud-phase partitioning. Our results will help to constrain cloud radiative effects at the global scale and to understand changes in the North American monsoon and its associated rainfall at the regional scale.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

ACAM: Atmospheric Chemistry and the Asian Monsoon

IGAC Regional Working Groups

Americas Working Group