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Editorial

Ice Nucleation in the Atmosphere

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Ice particles in the atmosphere contribute to the largest uncertainty in interpretations of the Earth's changing energy budget. The large variability in number, size, and shape of cirrus and mixed-phase cloud particles makes it difficult to understand and parameterize their microphysical and respective radiative properties. The development of a detailed understanding of ice clouds in the atmosphere relies on the combined use of field measurements, modelling at different scales, and laboratory studies that provide the necessary fundamentals knowledge.

In this paper, we gather contributions related to concentrations and ice activation properties of ice nucleating particles in the atmosphere as well as contributions from laboratory studies. We facilitate the exchange of knowledge among different approaches. To this end, the combined knowledge of chemists, biologists, and crystallographers with regard to aerosol composition must interact with the ice dynamic models provided by physicists, meteorologists, and computational modelers to gain a better understanding of this process.

In this special issue, five original papers have been summerized, each of which confronts research associated with atmospheric ice nucleation. Häusler et al. [1] present a new, precise, and automated controlled laboratory set-up that monitors heterogeneous ice nucleation of well-defined, micrometer-sized water droplets. It also gives access to the freezing triggered by medium- and low-active ice nucleation particles, which otherwise are not easily accessible. Four papers focus on ice nucleation particles from specific regions, such as the high-altitude research station of Mount Jungfraujoch [2], the Mississippi River and its major tributaries [3], volcanic eruptions [4], and biological ice nucleation particles from bushes and berries [5]. Although the first investigation [2] provides the results of a field study, the latter three [3–5] discuss laboratory experiments. Thus, this issue makes an important and broad contribution to the field of atmospheric ice nucleation, differentiating ice nucleation particles according to origin, chemistry, structure, and morphology. We thank the editing office for their excellent support to realize this achievement, and to collect and publish the innovative articles in this issue.

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