Evaluation of ice nucleating activity of mineral aerosols: importance of mineralogy and aging process

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Ice crystals may be formed in the super-cooled liquid phase clouds with the aid of aerosol particles that act as ice nuclei. Among various aerosol particles that act as ice nuclei, mineral dusts are considered most ubiquitous due to their abundance in the earth’ s atmosphere. However, the mechanism by which mineral dusts act as efficient ice nuclei is not well understood. The purpose of this study is to narrow down the mineralogical factors that determine their initial ice nucleation activity. This study employed a cold-float technique to evaluate ice nucleation activity of mineral dusts with various mineralogical compositions. We show that there are potentially three major mineralogical factors controlling the ice nucleating activity of feldspar mineral group, namely, the cation type, solid solution state and ordering structure. In addition, we found that the ice nucleating activity of feldspar drops and shows similar activity as the clay minerals following treatment by sulfate acid, suggesting atmospheric aging may slow down the ice nucleation by the most efficient mineral types (e.g. K-feldspar). These results have important implications in the ice nucleating activity of mineral dusts in the actual atmosphere.

