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Vertical distributions of small cirrus cloud particles from balloon-borne in-situ measurements

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Thin and cold ice clouds are important for the radiative budget, yet they are difficult to measure. They are often high in the troposphere where they reflect incoming sunlight, creating a cooling effect. At the same time these clouds absorb longwave radiation from Earth, creating a greenhouse effect. Knowledge of the net effect is crucial and depends on the microphysical properties of the clouds, which at these altitudes and temperatures are often composed of small particles of 100 μm or less in size. Most of in-situ data reported in the literature have been sampled with aircraft probes, which have known issues with such small particles due to sizing and shattering problems, in addition to having also a small and size-dependent sampling volume for these particles.
A series of balloon-borne in-situ measurements, currently being carried out from a high-latitude location in northern Sweden (Kiruna, 68N 21E), combined with previous balloon-borne measurements from other locations, are used to study properties of small cloud ice particles at a variety of temperatures and altitudes. Among other properties, size distributions and concentrations are analysed as a function of height within the cloud layer. Results are compared to literature data from aircraft probes to shed more light on the uncertainties related to the difficulties of these probes in measuring small particles.