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# In-situ ice particle measurements over northern Sweden

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Ice clouds play an important role in the energy budget of the atmosphere. They are at high altitudes, absorb longwave radiation from below and, as they are cold, emit little infrared radiation. This greenhouse effect warms the Earth-atmosphere system. On the other hand, ice clouds have a cooling effect by reflecting incoming solar short wave radiation. The net effect is crucial for the atmosphere, but will depend highly on the cloud's horizontal extent, vertical position, ice water content (IWC), and ice particle microphysical properties such as size and shape. A series of in-situ balloon measurements has been started at Kiruna, Sweden, which is located at 68°N. Fewer in-situ ice cloud measurements exist at these high latitudes compared to mid- or tropical latitudes. Also temperatures in the upper troposphere can be around -60 °C, a temperature range under-represented in available in-situ data. Ice particles are collected with a balloon-borne replicator launched from Esrange Space Center (near Kiruna, Sweden). Measurements are complemented by a radiosonde added to the instrument. The shape and size as well as IWC are determined from the replicas. The data are analyzed to reveal relationships between IWC and other measurements such as temperature and volume extinction coefficient. Such relationships can be used for validation and improvement of satellite retrievals of IWC from, for example, thin cirrus measurements with satellite-borne lidar.