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# A database of microphysical and optical properties of thin to thick cirrus clouds derived from bimodal particle size distributions

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The detailed information on the particle size distributions (PSDs) of ice clouds is essential for various topics of radiative transport in a cloudy atmosphere. However, retrieval of microphysical and optical properties from PSDs from remote sensing instruments are affected by a lack in the information content of the measurement quantities, which does not allow to retrieve all parameter of a PSD. Usually, cirrus PSD parameterizations based on in situ measurements are used to reduce the number of unknowns in the retrieval process. The same arguments are applicable for model calculation on the radiative impact of cirrus clouds, where cirrus can have a warming or cooling effect depending on their microphysical (size, number, and shape) and macrophysical (thickness and height) properties. Detailed information on the PSD shape are essential to improve the retrievals with forward models, where usually a priori information on the shape of the PSD are required, and for radiative transfer calculation for the quantification of the cloud radiative effect of cirrus.

Here, we will present a more detailed analysis of the PSD measurements compiled in a recent large database (see Krämer et al., 2022, EGU, AS 1.15). With 11 campaigns and 238 flight hours in cloud conditions the database is currently the most comprehensive datasets for studying PSD parameters and the potential importance of the bimodality of ice cloud PSDs. The PSDs are not affected by the so-called shattering effect and cover for all campaigns particle diameters down to 3 microns.

The procedure to derive microphysical and optical properties from the measured PSDs is to select predefined ice water content (IWC) and temperature grids for computing mean conditions. The database covers IWC from $10^{-6}$ to 1 $g/m^3$ and is especially well-suited to investigate optically thinnest clouds hitherto not included in PSD data bases. Other gridding parameters have been also investigated, for example number density. An iterative approach for fitting bimodal lognormal functions to the measured PSD by minimizing a cost function have been applied to the data with overall good fitting results. Characteristics of the fitted PSDs and the corresponding microphysical and optical properties will be presented.