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Cloud geometry from airborne stereo imagery

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During the NARVAL-II and NAWDEX field campaigns, passive remote sensing in the visible and near infrared range of the electromagnetic spectrum allows to remotely investigate cloud microphysical parameters like droplet effective radius, thermodynamic phase or optical thickness. However this information is not directly contained in the measured spectral radiance but must be reconstructed by some retrieval method. Such a method combines multiple available sources of information (of course including spectral radiance) to produce an estimate for the desired quantity (e.g. effective droplet radius). Generally, this estimate will become more accurate the more sources of information are used to constrain the result.

One obvious source of auxiliary information is the observed illumination geometry, which is known to have a significant impact on the accuracy of microphysical retrieval methods. Furthermore, this impact intensifies with increasing spatial resolution of the observing instrument (due to 3D radiative transfer effects). The geometry of a cloud microphysics retieval method is mostly defined by the position of the sun, the position and viewing direction of the observer and the position and orientation of the observed cloud. The first two components are easily obtained, while the latter must be estimated if there is no additional instrumentation available. This work focusses on finding a robust automatic method to extact as much information on the cloud geometry as possible from stereographic images of the observed clouds. This information can later be combined with information from spectral methods to provide an accurate estimate of the lacking third part of the observation geometry, namely cloud surface location and orientation.

This method will be applied to data from the NARVAL-II and NAWDEX field campaigns where a comparision to Lidar and Radar is possible and the downward-looking perspective additionally offers the possibility to obtain a high resolution 2D horizontal cloud top height field which can be used to study horizontal anisotropies of the cloud size distribution.