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[Volumes and Issues](#) [Contents of Issue 5](#)

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## Cirrus cloud occurrence as function of ambient relative humidity: a comparison of observations obtained during the INCA experiment

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**Abstract.** Based on in-situ observations performed during the Interhemispheric differences in cirrus properties from anthropogenic emissions (INCA) experiment, we introduce and discuss the cloud presence fraction (CPF) defined as the ratio between the number of data points determined to represent cloud at a given ambient relative humidity over ice (RHI) divided by the total number of data points at that value of RHI. The CPFs are measured with four different cloud probes. Within similar ranges of detected particle sizes and concentrations, it is shown that different cloud probes yield results that are in good agreement with each other. The CPFs taken at Southern Hemisphere (SH) and Northern Hemisphere (NH) midlatitudes differ from each other. Above ice saturation, clouds occurred more frequently during the NH campaign. Local minima in the CPF as a function of RHI are interpreted as a systematic underestimation of cloud presence when cloud particles become invisible to cloud probes. Based on this interpretation, we find that clouds during the SH campaign formed preferentially at RHIs between 140 and 155%, whereas clouds in the NH campaign formed at RHIs somewhat below 130%. The data show that interstitial aerosol and ice particles coexist down to RHIs of 70-90%, demonstrating that the ability to distinguish between different particle types in cirrus conditions depends on the sensors used to probe the aerosol/cirrus system. Observed distributions of cloud water content differ only slightly between the NH and SH campaigns and seem to be only weakly, if at all, affected by the freezing aerosols.

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