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A Climatology of Ice in Arctic, Midlatitude and Tropical Cirrus: Implications for Nitric Acid partitioning

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In the frame of ten aircraft field campaigns in the Arctic (Polstar 1997 & 1998, Envisat 2003, Euplex 2003), at midlatitudes (Envisat 2002, Cirrus 2003 & 2004) and in the Tropics (Ape Theseo 1999, Troccinox 2005, Scout 2005), numerous flights penetrating cirrus clouds were performed. During all flights the ice water content (IWC) of the clouds was detected using three versions of the Lyman-alpha-hygrometer FISH (Fast In-situ Stratospheric Hygrometer), each adapted to a specific aircraft: GFD-Learjet, DLR-Falcon, M55-Geophysica. From the large FISH database we derived a climatology of IWC in dependence on temperature for Arctic, midlatitude and tropical cirrus clouds. In addition, we report a relation of IWC to the ice surface area (ISA) and the number and size of the clouds ice crystals. With this new cirrus climatology it is possible to further estimate for example the steady state relative humidities inside cirrus clouds or the HNO3 content of ice clouds. Here, we will show a climatology of HNO3 in ice versus IWC (and ISA) by using the observed HNO3 range in ice in dependence on temperature, determined from published data. From this HNO3 climatology new insights in the importance of the different mechanisms determining the HNO3 content in ice, such as IWC, temperature and available HNO3 are gained. The HNO3 climatology can also be helpful for the interpretation of individual measurements.