



On Cirrus Cloud Supersaturations and Ice Crystal Numbers

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High quality aircraft in-situ observations of water vapour supersaturations and respective ice crystal numbers measured in cirrus clouds during ten flights in several tropical, mid-latitude and Arctic field experiments in the temperature range 185-240K are presented. We show that low ice crystal numbers at temperatures <200 K are responsible for the high, persistent supersaturations observed inside of cirrus in this temperature range. We further show that these low ice crystal numbers could only be explained by homogeneous ice nucleation in case of very low (about 1 cm/s) vertical velocities. If higher vertical velocities -that are very likely to occur- would have been present, the number of ice crystals must have been larger and the high supersaturations could not persist over a longer time period. Possibly the cold cirrus have formed by heterogeneous ice nucleation.

This finding leads us to the hypothesis, that the 'supersaturation puzzle' described by Peter et al. 2006 (Science) turns into a 'freezing puzzle' with new questions (i) What kind of heterogeneously freezing aerosols are present in the uppermost UT, (ii) Are there only very small temperature fluctuations or (iii) Do mechanisms yet unknown exist that can suppress or slow down the homogeneous formation of ice crystals at temperatures below 200 K?