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Water to Ice Transition experiments at the AIDA-chamber: results from the novel ice experiment NIXE-CAPS

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The rate at which water transforms from the liquid to the solid phase in mixed phase clouds is one of the parameters that greatly influences the clouds radiative properties. However, one of the largest obstacles to the differentiation of water phase in clouds has been the lack of in-situ instruments that can detect the difference between liquid and ice.
The Novel Ice eXperimEnt - Cloud, Aerosol and Precipitation Spectrometer (NIXE-CAPS) is an airborne cloud probe providing information on the phase of each single cloud particle for the first time. NIXE-CAPS consists of several instruments: first, the NIXE-CAS, the particle spectrometer including the depolarization and particle by particle option and covering the size range of 0.6 - 50μm diameter. Size as well as the phase of each particle is detected with NIXE-CAS. Second, the NIXE-CIP-Greyscale, a Cloud Imaging Probe with three grey levels, covering 15 - 900μm in diameter. The new greyscale option provides an improved visibility of each cloud particle. In addition, a hot wire Liquid Water sensor (LWC-100) is integrated into the probe. NIXE-CAPS was successfully operated at the AIDA cloud chamber during two campaigns, the HALO-02 cloud spectrometer intercomparison campaign in 2008 and the Aerosol Cloud Interaction campaign ACI-03 in 2009. Drops and ice crystals were nucleated from soot, sulphuric acid and other aerosol particles during experiments covering the wide temperature range of -70°C to -5°C. The formation and development of warm, mixed phase and ice clouds was recorded with NIXE-CAPS. Especially, size segregated transition of water to ice was observed by the depolarization channel for the first time.
Here, we will focus on water to ice transition experiments and examine the freezing of differently sized particles. As an example an experiment will be presented where CCN were activated to water drops that then froze at

temperatures around -35°C. A first outcome of the data analysis is that no timeshift between the freezing of small and large particles was observed. However, the depolarisation signal or alternatively the shape of the differently sized particles varied with the tendency of the smallest particles to stay quasi spherical upon freezing.