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The impact of heterogeneous ice nuclei on cirrus cloud convection

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For cold cirrus clouds (*in situ* ice formation at temperatures $T < 235\,\mathrm{K}$) different competing formation mechanism could take place within the same environment (homogeneous freezing of solution droplets/heterogeneous nucleation). Heterogeneous nucleation occurs generally at lower supersaturations than needed for homogeneous nucleation, thus modifying or suppressing homogeneous nucleation events (e.g. Spichtinger & Cziczo, 2010). From box model results (e.g. Kärcher and Ström, 2003) it was claimed that heterogeneous nucleation can affect homogeneous nucleation events only for warm temperatures and/or low vertical velocities. The impact of heterogeneous ice nuclei (IN) on stratiform cirrus clouds was demonstrated in earlier high-resolution 2D studies (e.g. Spichtinger & Gierens, 2009b).

In this study we reinvestigate this paradigm for dynamically more complex situations, namely shallow cirrus cloud convection. A potentially unstable layer is lifted by a constant large-scale updraft. Latent heat release of the growing ice crystals leads to the formation of convective cells and high vertical updrafts up to $w \approx 1.5\,\mathrm{m\,s^{-1}}$. The impact of heterogeneous ice nucleation with prescribed IN concentrations ($0/5/10/50\,\mathrm{L^{-1}}$) is investigated in this high vertical velocity regime.