Contribution ID: **17** Type: **Poster**

Ice cloud generation by transient gravity wave parameterization

Tuesday 8 October 2024 14:00 (6 minutes)

The formation of ice clouds (cirrus clouds) in the tropopause region requires moderate or even high vertical velocities up to several m/s when homogeneous freezing is involved. Such vertical velocities result from convective updrafts, turbulence or gravity waves. However, all those processes are only purely represented in the tropopause region of climate models. This in turn leads to misrepresentation of the temporal and spatial variability of cirrus clouds in climate models and consequently to increased uncertainties in the radiative effect of the clouds.

In a recent study the asymptotic analyses of the interactions between gravity waves and cirrus clouds revealed simplified equations for the description of ice formation and ice dynamics forced by gravity waves. Based on this study, here we present an approach for the self consistent coupling of an existing transient GW parameterization to cirrus parameterization. Idealized experiments of wave packet propagation within an ice supersaturated region show a high agreement in the cirrus evolution between the wave-resolving and wave-parameterized simulation. Implications of the above results for the cirrus parameterization in climate models will be discussed.

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Session Classification: Postersession & Coffee