

Do spontaneously generated inertia-gravity waves have an impact on the sharpness of the extratropical tropopause?

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The sharpness of the extratropical tropopause is investigated in idealized baroclinic life cycle experiments. Both balanced and unbalanced motions are considered. Previous work suggests that balanced dynamics increases tropopause sharpness in anticyclonic regions, while decreasing tropopause sharpness in cyclonic regions. The net effect is predicted to be a sharpening. In addition, it is well established that the growth of baroclinic disturbances is accompanied by spontaneous emission of inertia-gravity waves in the tropopause region. The role of these waves for the tropopause sharpness has not been the focus of earlier studies.

Numerical simulations of idealized baroclinic life cycles were carried through using the Lokal-Modell (LM) of the German Weather Service. Regarding balanced dynamics, the simulations support the predictions from previous work. The mechanism responsible for the net sharpening involves vertical convergence and divergence of the vertical wind, with the sharpening through vertical convergence dominating. In addition, the experiments show the presence of large amplitude inertia-gravity waves. Their impact on tropopause sharpness can be locally significant, but the experiments carried through suggest that their net effect is small.