**Explicit simulation of gravity waves up to the lower thermosphere using a global circulation model**

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Increased computer facilities allow to run general circulation model (GCMs) with significantly higher resolution and/or higher complexity than several years ago. Nevertheless, the closure problem of unresolved dynamical scales remains an issue, especially when the scales of parameterized gravity waves (GWs) and resolved GWs become comparable. In addition, turbulent diffusion must always be parameterized along with other subgrid-scale dynamics. A practical solution to the combined closure problem for GWs and turbulent diffusion is to dispense with a parameterization of GWs, apply a high spatial resolution, and to represent the unresolved scales by a macro-turbulent diffusion scheme such as to account for damping of resolved waves in a self-consistent fashion. This is the approach of a few GCMs that extend from the surface to the lower thermosphere and simulate a realistic GW drag and the associated summer-to-winter-pole residual circulation in the upper mesosphere. In this presentation we describe such a model, namely a new version of the Kühlungsborn Mechanistic general Circulation Model (KMCM), which includes explicit (though idealized) computations of radiative transfer and the tropospheric moisture cycle. Particular emphasis is spent on 1) the turbulent diffusion scheme, 2) the energy deposition of waves, and 3) the question of attenuation of resolved GWs at critical levels. We also discuss the fact that, for resolutions that are typically feasible in middle atmosphere GCMs, the resolved GW scales are strongly resolution-dependent.