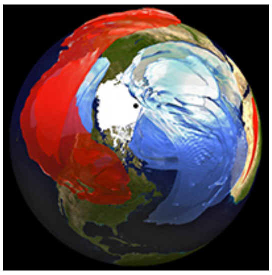

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Towards a transient gravity wave drag parameterization

The aim of the presented work is to improve the parameterization of sub-grid scale gravity wave (GW) effects on the resolved flow in atmospheric models in a large altitude range from the upper troposphere ($\sim 5km$) to the lower thermosphere ($\sim 110km$). State of the art GW parameterization schemes are using the steady-state approximation for the wave field and therefore assume an instantaneous GW propagation neglecting direct interactions between the GW field and the resolved flow within the whole altitude range mentioned above. As such these schemes rely on GW breaking and critical layer filtering as the only mechanisms to accelerate/decelerate the resolved flow. It has been shown in idealized simulations that by dropping the steady-state assumption the contribution of direct GW-meanflow interaction to the GW drag can be as important as that of wave breaking (Bölöni et al., 2016, *J. Atmos. Sci.*, **73**, 4833-4852). This motivated the implementation of a transient GW model (MS-GWaM: Multi Scale Gravity Wave Model) to the upper atmosphere version of the ICON (ICOsahedral Nonhydrostatic model) model (Borchert et al., 2018, submitted to *Geosci. Model Dev.*). MS-GWaM does not rely on the steady-state assumption and thus includes transient direct GW-meanflow interactions. First validations of UA-ICON with MS-GWaM indicate potential improvements of the middle-atmospheric circulation compared to the steady-state GW drag parameterizations: in line with the URAP (UARS Reference Atmosphere Project) climatology mesospheric wind reversals and the equatorward tilt of the polar night jet are more pronounced. The transient propagation in MS-GWaM substantially contributes to an increase of the GW intermittency in the whole altitude range giving a better comparison with superpressure balloon observations.

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