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A different perspective on how parameterized orographic gravity waves influence atmospheric transport and dynamics in current generation global climate models

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In the atmosphere, internal gravity waves (GWs) are a naturally occurring and ubiquitous, though intermittent phenomenon. In addition, GWs (especially orographic; OGWs) are asymmetrically distributed around the globe. In current generation global climate models (GCMs), GWs are usually smaller than the model grid resolution and the majority of their spectrum therefore must be parameterized. To some extent, the intermittency and asymmetry of a spatial distribution of the resulting OGW drag (OGWD) is present also in GCMs. As the GW parameterization schemes in GCMs are usually tuned to get the zonal mean climatology of particular features right, an important question emerges: what kind of influence do GW parameterizations have on the individual models atmosphere locally? Here we focus on answering this question regarding the impact of spatiotemporally intermittent OGW forcing in the extra-tropical lower stratosphere region (LS). The LS region is characterized by a strong interplay of chemical, physical and dynamical processes. To date, the representation of this dynamically active region in models frequently mismatches observations. Although we can find a climatological maximum of oGWD in the LS, the role of OGW forcing for the transport and composition in this region is poorly understood. We combine observational evidence, idealized modeling and statistical analysis of GCM outputs to study both the short-term and long-term model response to the OGW forcing. The results presented will question the relationship between the advective part of the Brewer- Dobson circulation and the zonally asymmetric GW forcing, and a so-far neglected link between oGWD and large-scale quasi-isentropic stirring will be discussed.