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The Influence of Locally Increased Gravity Wave Drag on the Middle Atmosphere Circulation – A Model Study

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Internal gravity waves (GW) are one of the most dominant features in the middle atmosphere. They are a main contributor for energy and angular momentum transport and thus play an important role for atmospheric dynamics such as the Quasi Biennial Oscillation or the Brewer-Dobson circulation (BDC). GPS radio occultation measurements (e.g. Sacha et al., 2015) have shown that GW can appear in local hotspots, e.g. in the lower stratosphere of the Eastern Asia/North-western Pacific (EA/NP) region. Using these data as an input for the GW parameterization of a 3D primitive equation model for the middle and upper atmosphere (MUAM) we study the dynamical effects of such a localized breaking region. We further introduce an additional artificial GW drag in the lower stratosphere EA/NP region and show that a localized GW forcing is more efficient in creating planetary waves (PWs) than zonally uniform GW forcing. We observe PWs propagating both equatorward and poleward and upward along the edge of the polar vortex. Possible consequences for the polar vortex stability and stratosphere-troposphere exchange in the tropical region are discussed. Finally, applying 3D wave activity flux and 3D residual circulation diagnostics, we investigated the possible role of this area in the longitudinal variability of the BDC with a hypothesis of its enhanced downwelling branch in this region.