Geophysical Research Abstracts
Vol. 19, EGU2017-17855, 2017
EGU General Assembly 2017

Secondary gravity waves in the winter mesosphere: Results from a high-resolution global circulation model

Erich Becker (1) and Sharon Vadas (2)

(1) Leibniz-Institute of Atmospheric Physics, Theory and Modeling, Kuehlungsborn, Germany (becker@iap-kborn.de), (2) Northwest Research Associates, Boulder, Colorado, USA (vasha@cora.nwra.com)

General circulation models that simulate gravity waves (GWs) explicitly are expected to capture the spatial and temporal variability of the GW sources. Moreover, secondary GWs that result from the nonlinearity and intermittency of the primary GWs in the middle atmosphere can be studied. In this study we describe a new high-resolution version of the Kuehlungsborn Mechanistic general Circulation Model (KMCM). The model includes no GW parameterization, and unresolved dynamical scales are parameterized by a macro-turbulent diffusion scheme that accounts for damping of resolved waves in a self-consistent fashion. We analyze the model with regard to secondary GWs in the mesosphere during Austral winter. The westward GW drag in the lower winter mesosphere agrees well with that from conventional models with parameterized GWs, and it is strongly due to orographic GWs generated by the Andes and the Antartic Pensiula. Due to the high temporal and spatial intermittency of the primary GWs in the southern winter stratopause region, secondary GWs are generated and propagate to higher altitudes. These secondary GWs impose a substantial eastward drag in the mesopause region where they dissipate. The eastward GW drag results in an additional eastward maximum of the mean zonal wind around 90-100 km. We propose that when the polar night jet is strong, secondary GWs may play a significant role in the general circulation of the winter mesopause region. Radar measurements in the northern hemisphere during January 2016 are consistent with this finding.