Geophysical Research Abstracts
Vol. 17, EGU2015-6443, 2015
EGU General Assembly 2015

Observations of gravity waves from satellite and implications for the wave driving of the SAO

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The dynamics at low latitudes in the stratosphere and lower mesosphere is governed by an interplay of the quasi-biennial oscillation (QBO) and the semiannual oscillation (SAO) of the zonal wind. It is known that tropical dynamics has significant influence on the atmosphere over a large range of altitudes and latitudes. For example, QBO and SAO effects are seen in the MLT region, and there is a significant influence of the QBO on surface weather and climate in the Northern Hemisphere during winter. Still, global models have large difficulties in simulating a realistic QBO and SAO. One main uncertainty is the wave driving of these oscillations, in particular the driving by gravity waves (GWs).

We derive GW temperature variances, GW momentum fluxes and potential GW drag from over three years of High Resolution Dynamics Limb Sounder (HIRDLS) satellite data in the stratopause region. These observations are compared with the SAO driving due to planetary waves, as well as the zonal wind tendencies, both determined from the ECMWF ERA-Interim (ERAI) reanalysis. HIRDLS satellite observations and ERAI support the general assumption that, due to selective filtering of the GW spectrum by the QBO in the stratosphere, GWs mainly contribute to the SAO momentum budget during SAO eastward wind shear. However, during SAO westward wind shear the GW contribution is usually smaller, and the wave driving is dominated by planetary waves, probably of extratropical origin. Still, we find indications in both satellite observations and ERAI that sometimes GW drag is important also during SAO westward wind shear.