Geophysical Research Abstracts
Vol. 15, EGU2013-9240, 2013
EGU General Assembly 2013

Excitation of quasi two-day waves in the mesosphere by gravity wave induced jet instabilities

Manfred Ern, Peter Preusse, Silvio Kalisch, Martin Kaufmann, and Martin Riese

Forschungszentrum Juelich GmbH, Institute of Energy and Climate Research - Stratosphere (IEK-7), Juelich, Germany (m.ern@fz-juelich.de)

Quasi two-day waves (QTDWs) are important planetary wave modes that always occur in the mesosphere when the summertime mesospheric westward wind jet decays. They can attain considerable amplitudes of over 10K in temperature and of several ten m/s in zonal and meridional wind. Gravest zonal wavenumbers observed are 3 and 4.

Details of the forcing mechanism of QTDWs are investigated using Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) satellite data. For this purpose we derive from SABER data: geostrophic background winds and potential vorticity gradients, daily QTDW temperature and wind amplitudes, as well as Eliassen-Palm fluxes (EP fluxes) and from the EP flux divergence also QTDW drag on the zonal background wind. Further, gravity wave (GW) momentum fluxes and GW drag are derived from pairs of observed temperature altitude profiles using the method by Ern et al. (2004, 2011).

We find that QTDWs are excited in regions of strong curvature of the zonal wind jets when these start to decay. This curvature is induced by GW dissipation, as indicated by strongly enhanced GW drag observed directly above these jet instabilities. Above the jet instabilities the EP flux of the QTDWs is directed upward, and downward below. QTDWs are weakening the easterly jet in its core in the middle mesosphere, and they are counteracting the wind reversal from easterlies in the mesosphere to westerlies in the upper mesosphere/lower thermosphere. These observations are compared with a QTDW modeling study by Pendlebury (2012), and good qualitative agreement is found. Our observations support the theory that QTDWs are atmospheric normal modes excited by jet instabilities. Also non-uniformities of the global distribution of GWs that are observed during summer in the subtropics might play a role in details of the QTDW excitation.