Geophysical Research Abstracts, Vol. 9, 06717, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06717

Parameterization of spontaneous radiation of inertia-gravity waves from jet streaks in poleward breaking Rossby waves

Ch. Zülicke (1,2) and D.H.W. Peters (1)

(1) Leibniz Institute of Atmospheric Physics, Kühlungsborn, Germany, (2) Now at the Leibniz Institute for Baltic Sea Research, Warnemünde, Germany
(christoph.zuelicke@io-warnemuende.de)

Poleward breaking Rossby waves are frequently appearing in the North Atlantic / European sector in winter. From the visual inspection of 4 years (1999 - 2003) of ECMWF analyses a daily frequency of 40 % was estimated. Ten field campaigns haven been launched in Kühlungsborn (54 $^{\circ}$N, 12 $^{\circ}$E) during such events. Inertia-gravity waves were diagnosed from radiosondes and radar observations which were shallower (1.7 km), slower (8.8 hrs) and stronger (16 m^2 s^{-2}) than the climatologically mean values. For these campaigns, hindcasts were undertaken with the NCAR/PSU 5-th generation Mesoscale Model (MM5).

The model and observation data were used to validate parameterizations of inertia-gravity wave action in the lower stratosphere in terms of synoptic-scale forcing fields. A Lighthill equation was derived for a shallow water model in quasi-geostrophic approximation. With a forcing in terms of the cross-stream ageostrophic wind speed at tropopause level we found an explained variance of 32 %. The effects of damping and Jones critical level absorption were quantified in a WKB model. Its application to the data revealed an explained variance of about 81 %.

The following conceptual picture emerges: The large-scale winter constellation of tropospheric (upper level) and stratospheric (polar night) jet stream forces Rossby waves to break poleward downstream in the North Atlantic / European sector. Regionally focused tropospheric jet streaks at the north-eastern edge of these Rossby waves have the potential for increased spontaneous radiation of inertia-gravity waves. Due to the polar jet they may propagate upward into the middle atmosphere.