Geophysical Research Abstracts
Vol. 13, EGU2011-6930, 2011
EGU General Assembly 2011

The seasonal behavior of Rossby wave breaking processes on the Northern Hemisphere

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In a changing climate Rossby wave breaking processes may be changed too. For example, the zonally asymmetric ozone distribution of the stratosphere has a strong influence on the strength and the position of the polar vortex as well as on the upper tropospheric large-scale flow characteristics. In the extratropics, the changing large-scale flow (or wave guide) determines the propagation of Rossby waves and the diffluence of the flow defines regions of enhanced anticyclonic Rossby wave breaking. It is known that events of poleward breaking Rossby waves are often observed over the North Atlantic-European or Eastern Pacific region in wintertime.

The investigation is focused on the seasonal influence of the observed large-scale flow in the upper troposphere on poleward Rossby wave breaking events and its link to precipitation. The seasonal behavior of events of poleward breaking Rossby waves during the decades of the 1980s and 1990s has been studied based on ECMWF Reanalysis data.

We can show that the different, diffluent and confluent, large-scale flow structure determines the region and behavior of Rossby wave breaking events. These events are separated into four breaking types: poleward (up- and downstream) or equatorward (up- und downstream). The seasonal behavior of these four breaking types is studied in more details. We identified a strong seasonal dependence with major poleward breaking events in winter and minor in summer time over the North Atlantic-European region. Further, in some SGCM experiments we can show that the varying large-scale flow explains mainly the seasonal variation of poleward Rossby wave breaking events. Furthermore, in a composite study the impact of Rossby wave breaking events on regional enhanced precipitation is examined.