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1 A climatology of Rossby wave breaking events in the Northern Winter Hemisphere

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A climatology of Rossby wave breaking events is derived based on a diagnostic parameter that is a function of the large-scale diffluent/confluent flow and the meridional wave flux component for quasi-stationary Rossby waves in a zonally varying basic flow. The parameter is suitable to identify separately Rossby wave breaking events that are evolving poleward upstream/downstream (P1/P2) or equatorward upstream/downstream (LC1/LC2). Based on ECMWF ReAnalysis (ERA-40), we found two pronounced regions for P1- and LC2-type breaking waves (which evolve cyclonically), over the Northeast Pacific and the northern North Atlantic, and two extended belts of P2- and LC1-type breaking waves (which evolve anticyclonically), over the North Pacific / North America region and the North Atlantic / European-West Asian region. The relationship between Rossby wave fluxes in a diffluent/confluent flow and Rossby wave breaking indicated by overturning of potential vorticity on isentropic surfaces is discussed. Further, based on simplified model calculations with the GCM ECHAM4, we show that large fractions of the different types of Rossby wave breaking events are related to zonal variations of the stratospheric polar vortex and associated diffluent/confluent flow fields in the upper troposphere / lower stratosphere region.