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Rossby waves in total ozone over south polar region

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Large-scale disturbances of the total ozone column (TOC) at the high southern latitudes are analyzed in the terms of barotropic Rossby waves. The Total Ozone Mapping Spectrometer measurements during Antarctic spring are used. A spectral analysis is applied to derive amplitudes and phases of the zonal wave number 1, 2 and 3. These harmonics are dominant components of planetary waves at the edge region of the polar stratospheric vortex (60^oS-75^oS). It is shown that the TOC zonal dynamics is in a good agreement with the linear prediction in the geostrophic approximation based on Charney-Obukhov equation. The dependence of wave dynamics in high southern latitudes on parameters of sea level pressure and zonal flow in the lower stratosphere is discussed. Zonal harmonic velocity depends directly on the pressure change with latitude and on meridional profile of zonal wind in the lower stratosphere. Latitudinal profile of zonal flow velocity determines harmonics with maximal amplitude. It is found that the amplitude of zonal wave 1 correlates with the width of latitude interval, where the zonal flow holds constant angular velocity. The proposed numerical model of Rossby wave dynamics in geostrophic approximation is in a good agreement with the observed variations of the total ozone distribution over south polar region.

NCEP reanalysis data is provided by the NOAA-CIRES Climate Diagnostics Center, Boulder, Colorado, from their Web site at http://www.cdc.noaa.gov.html. The daily data of the TOMS measurements from http://toms.gsfc.nasa.gov/ozone_v8.html. This research was partly supported by CRDF UKP2-2644-KV-05 grant, and 06BF051-12 project.