



Mountain wave-induced chlorine activation during the Arctic winters 1996 -2003

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Satellite measurements of OCIO, an indicator of stratospheric chlorine activation, show a significant increase during times with strong mountain wave activity. We investigated data from the Global Ozone Monitoring Experiment (GOME) from 1995 to 2003, the retrieval of the atmospheric absorber OCIO has been performed with the method of DOAS. In a case study, we investigated the effect of the mountain wave PSC type 2 event on January 21, 1997 regarding the heterogeneous chlorine activation processes. Combining the GOME observations with radiative transfer calculations, the OCIO vertical column densities are derived, and by applying pressure and temperature profiles from mesoscale simulations, the mixing ratios for OCIO and ClO at the different altitude levels are estimated. The increase in the level of chlorine activation was found to be substantial. Our findings are in good agreement with previous model studies, where comparable increases and areas of chlorine activation were calculated. Similar increases are found for all cold Arctic winters during the time of GOME measurements (1995-2003). The eight year data set of GOME enables us to assess the frequency of the mountain wave induced rises in chlorine activation and thereby provides the opportunity to estimate their contribution to chlorine activation in the Arctic stratosphere during the time of GOME measurements. It is found that the observed increases in chlorine activation are concentrated in the month of January, when the activity of stratospheric mountain waves peaks. In most of the cases these rises appear in the lee of the Scandinavian mountain ridge, only few mountain wave induced enhancements of the OCIO column densities were found for the East Greenland Coast and the Urals.