

Quasi-Stationary Planetary Waves in Total Ozone and their Correlation with Lower Stratospheric Temperature

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Heispheric maps of monthly total ozone display distinct waves of low zonal wavenumbers during winter. Moreover one observes good correlation of total ozone with the lower stratospheric temperature. Using eight years of data, the climatological features of these waves and the strength and significance of the correlation are assessed.

A stationary, linear, quasi-geostrophic model with coupled dynamics and ozone photochemistry is used for a more detailed analysis. The results of the model calculations agree satisfactorily with the observations. It turns out that the impact of photochemistry on the wave dynamics is negligible, and that ozone can be considered as a passive tracer. As far as transport is concerned, both horizontal and vertical advection in the lower stratosphere contribute substantially to the observed deviation from zonal symmetry. An estimation of the impact of nonlinear terms in the ozone continuity equation suggests that linearization is a better approximation in the Southern Hemisphere than in the Northern Hemisphere.

The question of the total ozone - temperature correlation is examined. It proves useful to think in terms of parcel displacements due to the waves in connection with the quasi-conserved basic state quantities ozone mixing ratio and potential temperature.