

Distribution of ozone in the midlatitude UTLS

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This paper summarises the dynamical influences determining the ozone distribution in the midlatitude UTLS. The overall budget in this region is dominated by downward transport in the stratosphere by the Brewer-Dobson circulation and chemical destruction in the lower troposphere and at the surface. The distribution of ozone, however, is strongly affected by a range of dynamical processes causing exchange of air between the UT and LS. Wave breaking, whether of Rossby waves or gravity waves, provides a useful paradigm with which to describe these processes. The dominant mechanism for breaking Rossby waves is equatorward, consistent with the mean direction of the Brewer-Dobson circulation in the extratropics. This breaking gives rise to streamers of high PV and cut-off lows, and their associated distortions of the tropopause. Poleward-breaking Rossby waves also occur, generating distinctive layers of low ozone in the LS. The large-scale strain field set up by the mean flow and the larger scale Rossby waves causes smaller-scale structures to be elongated to thin sheets or filaments, readily mixed with the background air by 3-D turbulence. Turbulent mixing is effective in the vertical, and is often strongly enhanced by inertia-gravity waves emanating from baroclinic zones, or mountain waves over orography. In the troposphere, baroclinic instability produces characteristic airflows from the surface to the upper troposphere and vice-versa. In the process, air from very different source regions can be brought into close proximity and mix. Convection provides another mechanism for effecting such mixing.