

Lidar observations of ozone in the subtropical eastern Pacific UTLS and its relationship to meridional transport; Part 1: Effect of Rossby waves in the tropopause region

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Abstract

Various aspects of isentropic transport in the Northeastern subtropical Pacific lower stratosphere and its connection to the ozone variations observed by lidar during the summer 2002 are reviewed. This presentation will focus on the subtropical tropopause region, and specifically on the effect of Rossby wave fluctuations and breaking and its connection with the ozone fluctuations as observed by lidar. Another presentation in this session will focus on the lower and mid-stratosphere.

Several runs of a high resolution PV-advection model with inputs from the standard operational models ECMWF (analysis) and NCEP (reanalysis) are used to identify finer structures of high PV at several isentropic levels from 320 to 400 K, and correlate them to ozone fluctuations measured by three lidars operated by the Jet Propulsion Laboratory at Table Mountain Facility, California (TMF, 34.4N), and Mauna Loa Observatory, Hawaii (MLO, 19.5N). In June and July 2002, highly significant positive correlation is found between PV and ozone at both sites. Several Rossby wave breaking events are associated with higher values of ozone in a wide tropopause layer topped by a thermal tropopause that follows the WMO definition (around 370 K), and bottomed by a dynamical tropopause defined here as the local maximum of vertical gradient of Ertel's PV (from 330 to 365 K). Immediately preceding and following the wave breaking events lower ozone values correlate well with lower PV located just below the dynamical tropopause, the latter almost rising up to the thermal tropopause, and making what were stratospheric isentropic levels during the wave breaking events tropospheric isentropic levels just before and after.

As a complementary tool to the high-resolution advection model, back-trajectory calculations were made for each ozone measurement, and air masses of high PV and

high ozone were easily identified as coming from the mid and higher latitudes, that is, from the so-called overworld. Air masses with lower values of ozone also have lower values of PV, and are clearly identified as of tropical tropospheric origin.

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