Lidar observations of ozone in the subtropical eastern Pacific UTLS and its relationship to meridional transport; Part 2: Lower and mid-stratosphere

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Abstract

Various aspects of isentropic transport in the Northeastern subtropical pacific lower stratosphere during the summer 2002 and its connection to the ozone variations observed by lidar are reviewed. This presentation will examine the statistical significance and relationships between various transport diagnostics such as back-trajectories or PV advection, and the ozone fluctuations as observed by lidar in the lower and mid-stratosphere. Another presentation in this session will focus on the subtropical tropopause region.

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 Ertel's PV at several isentropic levels from 415 to 1500 K, and correlate them to ozone 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 particular a clear long-period planetary wave signature can be observed on the high-resolution 3D PV field at MLO from early June through the end of July, signature that was barely identifiable on the original coarse-grid models. This PV signature is positively correlated between 415 and 700 K with the ozone fluctuations measured by lidar. Above about 700 K the PV fluctuations are negatively correlated with ozone measured at both sites.

Back-trajectory calculations applied at all isentropic levels to each ozone profile measured at both sites reveal a significant effect of meridional transport to the ozone fluctuations. In particular ozone-rich air was observed in early summer and identified to be coming from mid and high latitudes, presumably as the result of the Northern hemisphere winter vortex final breakup in late spring. Ozone-poor air was observed later

in the season, and coincides with more zonally trapped trajectories owed to the well-established summer Easterly jet. Most of the ozone-poorest air masses were found to be of tropical origins.

A close investigation is necessary to evaluate the relative importance of summer ozone chemistry and meridional transport in order to accurately explain the observed ozone fluctuations.

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