MLS-Related Scientific Publication

Scientific Themes: Atmospheric Dynamics.

Kelvin wave signatures in stratospheric trace constituents, Part I: ozone, nitrous oxide, methane, and CFC-12. Philip W. Mote and Timothy J. Dunkerton, *J. Geophys. Res.*, Vol.109, D03101, doi:10.1029/002JD003370, 2004.

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Summary

This study finds evidence of Kelvin wave signatures in ozone from the Microwave Limb Sounder (MLS) and Cryogenic Limb Array Etalon Spectrometer (CLAES) instruments aboard the Upper Atmosphere Research Satellite. Predominant variations near 10 days are associated with a Kelvin wave mode previously identified in MLS temperature. Variations in CLAES methane, nitrous oxide, and CFC-12 each show some evidence of influence by this Kelvin mode. The results presented here show that the observing characteristics of the instrument can influence the derived structure and properties of Kelvin waves.

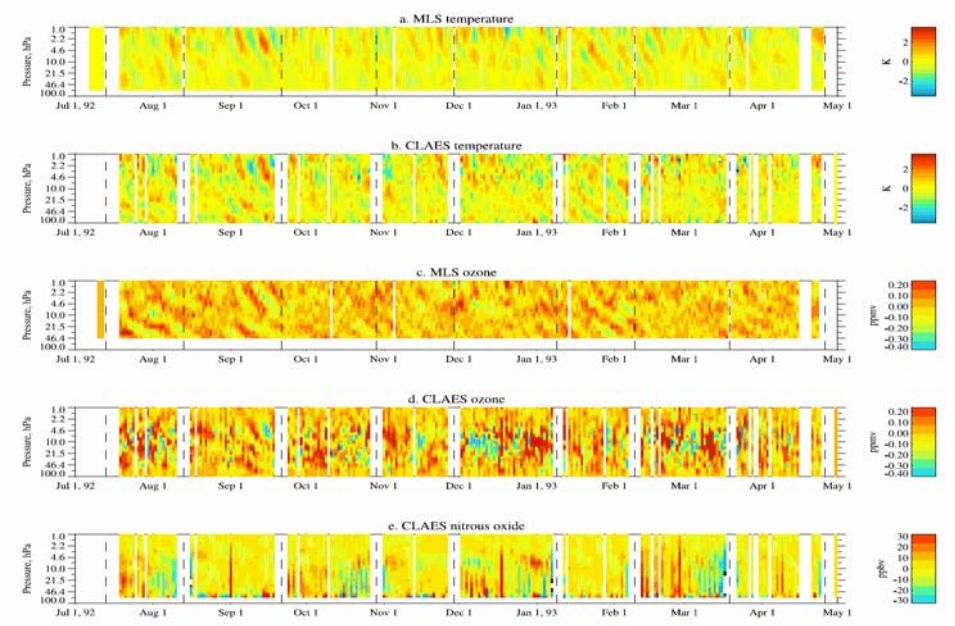

Figure 2. Time-height plots of the wavenumber-one component (cosine) along the equator of the field indicated. Contour interval for temperature (a,b) is 0.4K; for ozone (c,d), 0.1 ppmv; for methane (e), 0.05 ppmv. Vertical dashed lines denote days when the UARS performed a yaw maneuver; the CLAES instrument was shut off for several days around each yaw day. The mean during each yaw cycle was removed in order to account for a small yaw-dependent bias, which mainly affected CLAES ozone. Downward-propagating features are clearly evident in MLS temperature (Figure 2a). Of particular interest are the large-amplitude events in September1992 and January-February 1993. The one that is most obvious in Figure 2a has period near 10 days, vertical wavelength 20 km in the upper stratosphere, and horizontal phase speed 48m/s. There is a very good correspondence between the variations in CLAES temperature (Figure 2b) and the variations in MLS temperature just discussed. CLAES has the advantage of extending into the troposphere, and it appears that the variations noted in the MLS data are linked to variations at 100 hPa. MLS ozone data (Figure 2c) also clearly show downward-propagating features, and most correspond well to the temperature variations. Unfortunately, CLAES ozone data Figure 2d are too noisy to reveal clearly the same sorts of variations that are shown in Figure 2c. There are intriguing suggestions of the same descending features, especially in August-September 1992, as those in MLS. The variance is larger than with MLS ozone data (Figure 1d).