

# MLS-related Scientific Publication

Scientific Theme: Atmospheric Chemistry

**The existence of a tertiary ozone maximum in the high-latitude middle mesosphere,**  
D. Marsh et al., *Geophys. Res. Lett.*, **28**, 4531–4534, Dec. 15, 2001.

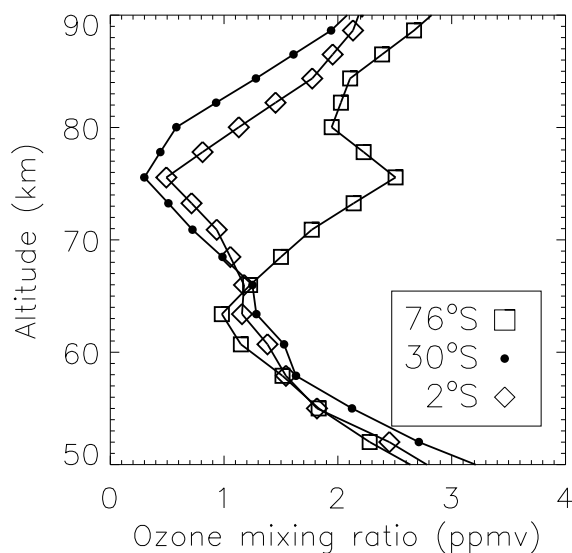
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## Summary and MLS contribution

This paper provides evidence for the existence of a tertiary ozone maximum in the high latitude middle mesosphere (near 75 km altitude), based on ozone data from two satellite instruments as well as photochemical modeling. The CRYogenic Infrared Spectrometers and Telescopes for the Atmosphere (CRISTA) instrument (flown on the Shuttle in Nov. 1994 and Aug. 1997) provided ozone data up to 90 km and showed the existence of a tertiary maximum near 72 km, in Aug. 1997. 183 GHz ozone data from the Upper Atmosphere Research Satellite (UARS) Microwave Limb Sounder (MLS) experiment (Sep. 1991 launch) during Aug. 1992 confirm the maximum observed in CRISTA data. Figure 2 from this paper (shown below) displays MLS nighttime average profiles at several southern latitudes. The localized tertiary maximum occurs in the winter at high latitudes, between the stratospheric (primary) and thermospheric (secondary) maxima. Model calculations predict this tertiary maximum as a result of diminished water vapor photolysis at short UV wavelengths (and large optical depths) and the subsequent decrease in odd hydrogen ozone destruction (via  $O + OH$  and  $O + HO_2$  reactions regenerating  $O_2$ ), leading to increased ozone. The magnitude of the maximum is overestimated by the model, with possible reasons still under investigation.

This work benefits society through its implications for our detailed understanding of ozone photochemistry in the upper atmosphere.



**Figure 2.** Mean mesospheric profiles of MLS 183 GHz radiometer ozone measurements taken between August 16 and 21, 1992. Approximate local times of observations are 2035, 2350, and 0049 hours at 76°S, 30°S, and 2°S respectively. Between 52 and 63 profiles are included in each mean profile.