

Comparison of Seasonal Cycles of Tropospheric Ozone from Three Chemistry-Climate Models (CCMs) with Measurements

D. Parrish^{1,2}

¹Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-497-5274, E-mail: david.d.parrish@noaa.gov

²NOAA Earth System Research Laboratory, Chemical Sciences Division, Boulder, CO 80305

Measurement of ozone at NOAA/GMD sites provides critical data sets for evaluating the chemistry-climate model treatment of the tropospheric ozone budget. The Trinidad Head, California site is particularly important as it provides a characterization of baseline ozone transported to North America from the Pacific Ocean. It is this baseline ozone that provides the background concentrations to which North American pollution is added.

We compare measured and modeled seasonal cycles of tropospheric ozone at seven marine boundary layer sites from around the globe. Three of these sites are in the GMD network, including Trinidad Head where ozone sonde launches provide the means to evaluate the seasonal cycle through the depth of the troposphere. Fourier transform analysis of monthly mean measurement data within the marine boundary layer (MBL) throughout the globe indicates that two, and only two, frequency terms make significant contributions to the seasonal cycle - the fundamental (one sine cycle per year) and the second harmonic (two sine cycles per year) - at all sites.

Fourier transform analysis of chemistry-climate model (CCM) output is in qualitative accord with the measurement data within the MBL (see upper panel of figure). However, above the MBL the models show significant disagreement with the Trinidad Head sonde data. This disagreement indicates that the treatment of MBL dynamics in the CCMs is inadequate. We present approaches for quantitative comparisons of model results with measurements, and discuss important disagreements. Importantly, we derive comparison metrics from the measurements that can be used in future model-measurement comparisons.

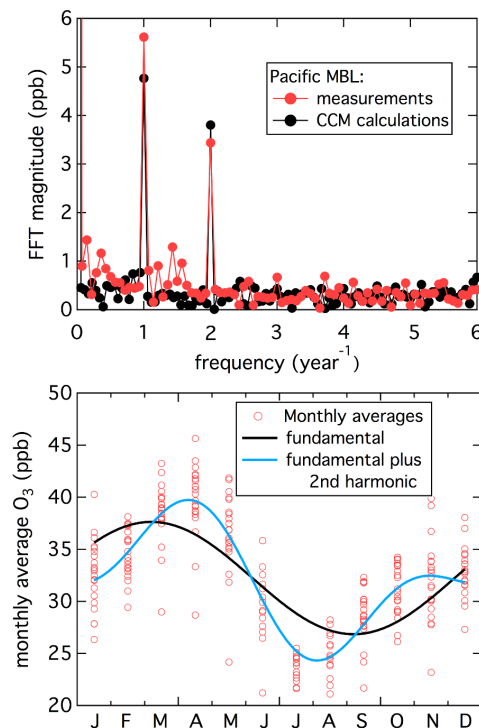


Figure 1. The figure shows the results of this analysis for the Pacific MBL at the North American coast. These data include Trinidad Head surface ozone measurements.