Simulated observation of tropospheric ozone and CO with the Tropospheric Emission Spectrometer (TES) satellite instrument

M. Luo, R.Beer, D.J. Jacob, J.A. Logan, and C.D. Rodgers

J. Geophys. Res., 107, 10.129/2001JD000804, 2002.
[full text (PDF)]

ABSTRACT. The Tropospheric Emission Spectrometer (TES) on board NASA's Aura satellite (to be launched mid-2003) will provide measurements of global distributions of ozone, CO, and other key chemical species in the troposphere. In order for TES to meet a design lifetime of five years it has been determined that a global survey strategy with approximately 50% duty cycle must be identified. In this study, simulated concentrations of ozone and CO from the GEOS-CHEM global three-dimensional model of tropospheric chemistry are used as a time-varying synthetic atmosphere for demonstrating and assessing the capabilities of TES nadir observations. Auto- correlation analyses of the model species fields for different time lags identify a significant 1-day correlation and support a 1-day-on, 1-day-off observation strategy. Three major steps are then taken to demonstrate and evaluate TES products: (1) species profiles along TES orbit track are sampled from the model 3-D, time-varying fields with cloudy scenes (50-60% of total scenes) removed; (2) nadir retrieved profiles ("Level 2 products") are obtained from these "true" synthetic profiles using TES retrieval characteristic functions; (3) interpolated daily global maps ("Level 3 products") are generated to compare with the original model fields. The latter comparison indicates that the error in the Level 3 products relative to the true fields for ozone and CO is less than 10% in about 70% of cases, and less than 20% in about 90% of cases. The two major sources of error lie in the asynoptic orbital sampling, the retrieval, and the Level 3 global mapping.