Matthew S. Johnson
NASA Ames Research Center
Email: matthew.s.johnson@nasa.gov

Title:
Evaluating a priori ozone profile information used in TEMPO (Tropospheric Emissions: Monitoring of Pollution) tropospheric ozone retrievals

Abstract:
A primary objective for TOLNet is the evaluation and validation of space-based tropospheric O_3 retrievals from future systems such as the Tropospheric Emissions: Monitoring of Pollution (TEMPO) satellite. This study is designed to evaluate the tropopause-based O_3 climatology (TB-Clim) dataset which will be used as the a priori profile information in TEMPO O_3 retrievals. This study also evaluates model simulated O_3 profiles, which could potentially serve as a priori O_3 profile information in TEMPO retrievals, from near-real-time (NRT) data assimilation model products (NASA Global Modeling and Assimilation Office (GMAO) Goddard Earth Observing System (GEOS-5) Forward Processing (FP) and Modern-Era Retrospective analysis for Research and Applications version 2 (MERRA2)) and full chemical transport model (CTM), GEOS-Chem, simulations. The TB-Clim dataset and model products are evaluated with surface (0-2 km) and tropospheric (0-10 km) TOLNet observations to demonstrate the accuracy of the suggested a priori dataset and information which could potentially be used in TEMPO O_3 algorithms. This study also presents the impact of individual a priori profile sources on the accuracy of theoretical TEMPO O_3 retrievals in the troposphere and at the surface. Preliminary results indicate that while the TB-Clim climatological dataset can replicate seasonally-averaged tropospheric O_3 profiles observed by TOLNet, model-simulated profiles from a full CTM (GEOS-Chem is used as a proxy for CTM O_3 predictions) resulted in more accurate tropospheric and surface-level O_3 retrievals from TEMPO when compared to hourly (diurnal cycle evaluation) and daily-averaged (daily variability evaluation) TOLNet observations. Furthermore, it was determined that when large daily-averaged surface O_3 mixing ratios are observed (>65 ppb), which are important for air quality purposes, TEMPO retrieval values at the surface display higher correlations and less bias when applying CTM a priori profile information compared to all other data products. The primary reason for this is that CTM predictions better capture the spatio-temporal variability of the vertical profiles of observed tropospheric O_3 compared to the TB-Clim dataset and other NRT data assimilation models evaluated during this study.