The Effect of Measured Ozone Profiles on Ultraviolet (UV) Photolysis Rate Coefficients in the Troposphere

K. Lantz[1], I. Petropavlovskikh[1] and C. Long[2]

[1]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309; 303-497-7280, E-mail: Kathy.O.Lantz@noaa.gov
[2]NOAA Climate Prediction Center, Camp Springs, MD 20746

The Tropospheric UV and Visible Radiative Transfer Model (TUV-RTM) is used to evaluate the impact of measured ozone profiles on UV photolysis rate coefficients in the troposphere compared to the default U.S. Standard atmosphere ozone profile often used in photochemical models. The ozone profiles used in the calculations are from three sources: 1) Ozonesondes from the Earth System Research Laboratory of NOAA during the summer and fall of 2000; 2) Brewer Umkehr retrievals from the NOAA-EPA Brewer spectrophotometer Network (NEUBrew) during the winter, spring, summer, fall of 2007; and 3) ozonesondes from Valparaiso University during IONS and INTEX-B campaigns in the summer of 2004 and spring/summer 2006. The radiative transfer calculations are performed from the surface to 12 km. Sensitivity studies are performed for the effect of redistribution of ozone to the boundary layer and for a shift in the altitude position of the ozone peak on UV solar radiation. Larger effects are seen in shorter wavelengths of the photoyolysis rate coefficent of ozone (jO_3) and at larger solar zenith angles. Usage of the U.S. standard atmosphere ozone profile in computations of jO_3 will slightly underestimate by 1-2% the photolysis rate constants for small surface ozone amounts and will overestimate the surface photolysis rate constant by 2-8% for larger amounts of surface ozone. In the vertical, the standard ozone profile has the ozonepause 5 km lower than observations for the Houston area. As a result, usage of the standard profile will increasingly underestimate the ozone photolysis rate constant by approximately 0-10%. Changes in jO_3 will affect the concentration of the hydroxyl radical in the atmosphere and therefore the oxidative capacity of the atmosphere.

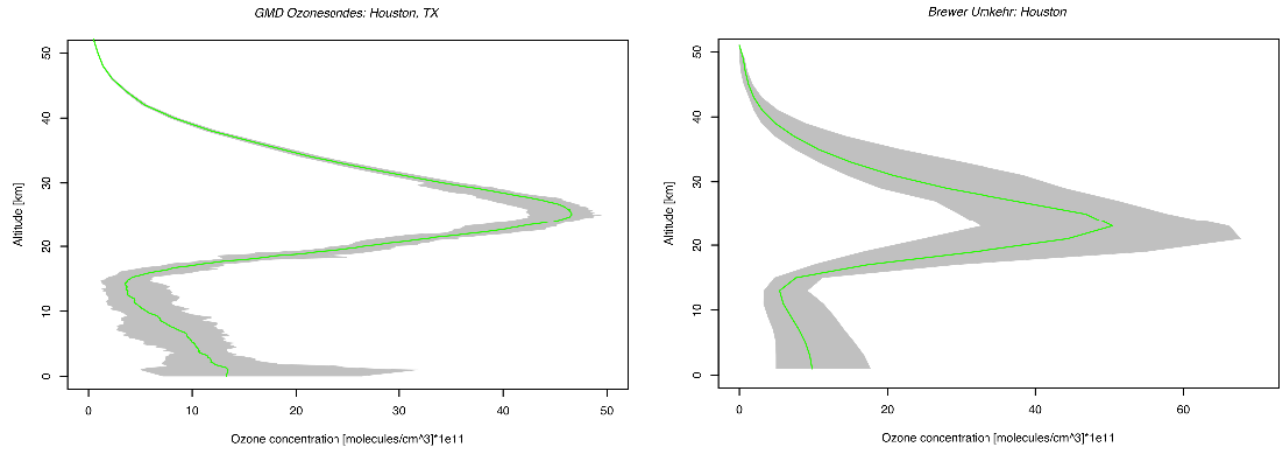

Figure 1. Ozondesondes from NOAA Global Monitoring Division in summer and Fall, 2000 (left). Umkehr Ozone profiles from NEUBrew Network for clear-days across the year, 2007 (right).