QOS2016-39, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

The Ozone Radiative Seasonal Cycle and its Contributions to Tropical Cyclone Potential Intensities

D. M. Gilford, S. Solomon, and K. A. Emanuel
Massachusetts Institute of Technology, Cambridge, MA, United States (dgilford@mit.edu)

Stratospheric ozone is a powerful radiative constituent with a strong control on local temperatures through shortwave absorption. Lower stratospheric dynamics and stratospheric chemistry lead to a consistent seasonal cycle in tropical ozone concentrations that varies by height and latitude. Previous work has shown that the annual cycle in tropical lower stratospheric ozone radiatively amplifies the local temperature annual cycle by up to 35%. In this study the ozone and temperature seasonal cycles throughout the tropical tropopause layer (TTL) are examined and radiative linkages are quantified. Because tropopause temperatures affect tropical cyclone (TC) potential intensities (PI), which have far reaching societal impacts, the "ozone radiative seasonal cycle" has the potential to impact TC PI. We use Aura Microwave Limb Sounder ozone observations, the Parallel Offline Radiative Transfer model, and reanalyses data to investigate the impact of the ozone radiative seasonal cycle on tropopause temperatures and TC PI. We also explore the sensitivity of the ozone radiative seasonal cycle to the vertical structure of the ozone seasonal cycle, which has not been previously addressed. In each tropical ocean basin we determine the contributions of tropopause temperatures and the ozone radiative seasonal cycle to the seasonal cycles in TC PI. Results show that nearly half of the magnitude of the ozone radiative seasonal cycle at the tropopause is due to nonlocal ozone variability above the tropopause. Such radiative sensitivity indicates that the seasonal cycles of tropical tropopause temperatures and TC PI are influenced by variations in middle stratospheric ozone. Results suggest that future long-term trends in the seasonal cycle of tropical lower and middle stratospheric ozone are important for the future evolution of tropopause temperature and TC PI seasonality.