

Seasonal and Episodic Variations in Tropospheric Ozone over North America

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Knowledge of the ozone budget in the troposphere over North America (NA) is required to properly understand the various mechanisms that contribute to the measured distribution and to develop and test models capable of simulating and predicting this key player in atmospheric chemical and physical processes. Recent field campaigns including the 2004 and 2006 INTEX Ozone Network Studies (IONS) <http://croc.gsfc.nasa.gov/intexb/ions06.html> that have included intensive ozone profile measurements from ozonesondes provide a unique data set for describing tropospheric ozone over a significant portion of the North American continent. These campaigns have focused on the spring and summer seasons when tropospheric ozone over NA is particularly influenced by long-range transport processes, significant photochemical ozone production resulting from both anthropogenic and natural (lightning) precursor emissions, and exchange with the stratosphere. This study uses ozone profiles measured over NA to describe the seasonal behavior of tropospheric ozone over NA with an emphasis on the spring and summer. This includes the variability within seasons at a particular site as well as the contrasts between the seasons. Emphasis is placed on the variations among the sites including latitudinal and longitudinal gradients and how these differ through the seasons and with altitude in the troposphere. Regional differences are most pronounced during the summer season likely reflecting the influence of a wider variation in processes influencing the tropospheric ozone distribution including lightning NO_x production in the upper troposphere and active photochemistry from human emitted precursors in the lower troposphere. In all seasons, including the summer, transfer from the stratosphere significantly influences the upper tropospheric distribution at mid latitude (35-55°N) locations. Although the seasonal maximum is found in spring in most locations and throughout much of the troposphere, this season tends to show less geographic variability compared to the summer. The FLEXPART Lagrangian tracer model is used to help identify processes associated with distinctive profile characteristics in the ozonesonde measurements.

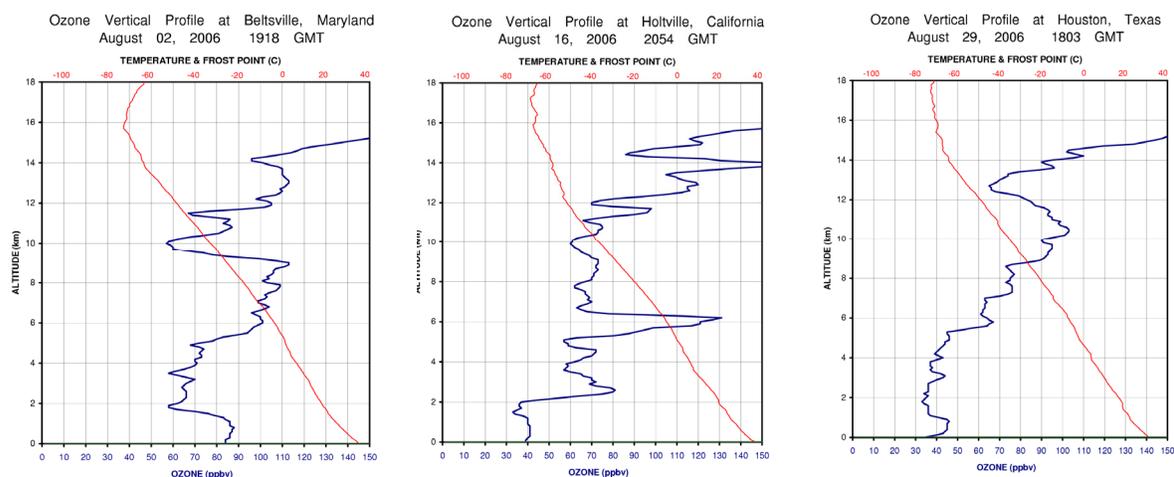


Figure 1. Three ozone profiles (blue solid line) illustrating various processes affecting tropospheric ozone that were seen during the August IONS 2006 ozonesonde campaign.