6.060 Evaluating Uncertainties in OMI-based estimates of Nitrogen Oxide Production Efficiency by Lightning over the tropics and subtropics.

Presenting Author:
Dale Allen, University of Maryland College Park, allen@atmos.umd.edu

Co-Authors:
Kenneth Pickering, NASA GSFC
Eric Bucsela, SRI International
Robert Holzworth, University of Washington
Amitabh Nag, Vaisala Inc.
Nickolay Krotkov, NASA GSFC

Abstract:

Lightning flashes heat the air to temperatures exceeding 20,000 K dissociating molecular oxygen and nitrogen, which then combine to create nitric oxide (NO), which quickly reacts with molecular oxygen to form nitrogen dioxide (NO_2), a strong absorber in the visible that is measured from space by the Ozone Monitoring Instrument (OMI) aboard NASA's Aura satellite. Recently, we developed an algorithm to retrieve the lightning NOx (LNOx) signal from OMI and have applied it to estimate LNOx production efficiency (moles of NOx per flash) over the Gulf of Mexico for June-August 2007-2011 using detection-efficiency adjusted flash data from the ground-based World Wide Lightning Location Network (WWLLN) and Vaisala Global Lightning Data 360 (GLD360) networks. Currently, we are expanding the analysis regions to include central- and western-Africa, the western Pacific, and the Amazon Basin and the time periods to include September-November 2010-2012. Conceptually, the algorithm takes the total slant column NO_2 from OMI, removes the stratospheric contribution and tropospheric background (NO_2 from sources other than recent lightning) and then calculates the LNOx vertical column from the LNO2 slant column using an appropriate air mass factor. In practice, the algorithm is applied to locations where the OMI cloud radiance fraction exceeds 90% suggestive of active convection. In these regions, the background contribution to the column is believed to be small. In this presentation, we will show results for several of these regions with an emphasis on quantifying uncertainties in the estimates. These uncertainties include random and systematic errors in OMI slant columns, the stratospheric vertical column amount, WWLLN and GLD360 detection efficiencies, the OMI Optical Centroid Pressure below which OMI cannot see LNOx, the flash counting window, CRF threshold, and the approach used to estimate the tropospheric background.