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NESL's Atmospheric Chemistry Division Seminar

Shedding light on air quality in Africa using satellite observations

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Abstract

Satellites offer the opportunity to observe atmospheric composition over rapidly developing nations. Population and economic growth in Africa is amongst the highest in the world, but air quality monitoring is limited to South Africa. Nigeria, Africa's largest economy, has rich oil and gas reserves. The levels of formaldehyde (HCHO), a high-yield oxidation product of nonmethane volatile organic compounds (NMVOCs), are similar to those over Southeast Asia. We find with OMI HCHO that per-capita anthropogenic NMVOC emissions from inefficient combustion and wasteful oil/gas extraction exceed emissions in China. Seasonal enhancements in OMI nitrogen dioxide (NO_2) and AIRS carbon monoxide (CO) are due to open fires. We find with ozone (O_3) from TES that Nigeria has very poor O_3 air quality in winter due to restricted ventilation, anthropogenic activity, and seasonal open fires. HCHO in Africa is not only anthropogenic, but also from oxidation of isoprene. Isoprene, emitted by vegetation, is a precursor of O_3 and aerosols and thus affects human health and climate. Except for Nigeria, isoprene dominates the HCHO signal outside of the biomass burning season. We use OMI-derived isoprene emissions obtained with OMI HCHO to identify temperature and leaf area index as the dominant drivers of seasonality for African savannas, and temperature only for weak seasonality of Equatorial forests. Emission inventories reproduce this seasonality, but are at least a factor of 2 too high in the tropics. We further evaluate the impact of isoprene on air quality in Africa by placing constraints on the yield of organic aerosol (OA) from isoprene with aerosol optical depth (AOD) from MODIS, and HCHO from OMI. We apply the same approach to the southeast US and use the GEOS-Chem chemical transport model with observations from the SEAC^{4}RS campaign to interpret our satellite-derived yields.

Monday, February 9

10:15 p.m. Refreshments

10:30 p.m. – Seminar

FL2-1001, Small Auditorium