ORAL PRESENTATION

O-08. William Stockwell: Modeling atmospheric chemistry and the effect of emissions from the biosphere on air pollution and climate

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Biological emissions include nitrogenous, sulfurous, mercuric and organic compounds. Biogenically emitted organic compounds are especially reactive and produce large amounts of ozone, organic particles and other air pollutants. Measurements of biologically emitted compounds from a number of sites including Howard University's Research Site at Beltsville, Maryland are being used to test and improve the chemical mechanisms used in regional air quality models.

When air quality models under-perform, problems are usually attributed to emissions (including their quantity and the speciation of organic compounds); to meteorology and to sub-grid scale effects. All too often atmospheric chemical mechanisms are not questioned. Recent studies have shown that models do not predict full range of concentrations (from minimum to maximum) of ozone and other pollutants. Forecasted pollutant concentrations do not respond as much as measured concentrations to emission changes. There are significant problems in modeling the measuring the total oxidation rates of NO2. These problems suggest that there remain significant gaps in the chemical mechanisms in regional atmospheric chemistry models.

New research has lead to a new version of the gas-phase Regional Atmospheric Chemistry Mechanism, version 2, (RACM2), has been developed as a replacement the RACM1 and the older Regional Acid Deposition Mechanism (RADM). The updated version includes improved mechanisms for the atmospheric chemistry of isoprene and for aromatic compounds, and updated cross-sections and quantum yields for the photolysis reactions. Field data and environmental chamber data are being used to evaluate RACM2 mechanism's ability to simulate ozone, NO, NO2 and volatile organic compounds (VOCs). However it should be recognized that there remains too much uncertainty in the chemical kinetics database, including product yields and rate constant temperature dependences and that testing is limited to restricted concentration ranges (in chambers) and field data is collected mostly during summer pollution episodes.

Collaborating with the U.S. National Oceanic and Atmospheric Administration (NOAA) and the U.S. Environmental Protection Agency (EPA) the RACM2 is being implemented in the Community Multiscale Air Quality (CMAQ) model, widely used for air quality assessment and forecasting in the United States and internationally. Preliminary studies suggest that biogenically emitted organic compounds may be strong sources of aerosol particles with a possibly strong effect on climate.