MEETING

Determining Critical Open Science Questions Regarding Biosphere-Atmosphere Interactions

Measuring and Modeling at the Interface of Air Quality and Climate to Understand Biosphere-Atmosphere Interactions; New Brunswick, New Jersey, 26–27 May 2011

The southeastern United States has not warmed like other U.S. regions in response to global climate change. This anomaly may be related to aerosols derived from biogenic volatile organic compounds (BVOCs) and the related aerosol direct and indirect radiative effects. To understand the causal relationships that result in this trend, the scientific community must ask, What sources and processes control the fate of biogenic compounds in anthropogenically influenced environments? What are the climate-relevant properties and air quality impacts?

Approximately 30 atmospheric scientists with experimental (field and laboratory) and modeling backgrounds met to discern the most critical open science questions regarding biosphere-atmosphere interactions. An objective of the meeting was to formulate targeted science questions and broadly discuss the tools, approaches, and measurements needed to answer them.

For example, the degree to which anthropogenic pollution alters biogenic emissions, fluxes, and their fate remains poorly understood. Conventional wisdom regarding biogenic emissions has been that BVOCs, most importantly, isoprene, react in the atmosphere to increase ozone (O_3) while decreasing hydroxyl radical (OH). However, current models cannot adequately describe oxidant concentrations in biogenically dominated areas, and the oxidation pathways are still uncertain and hotly debated. Until recently, biogenic contributions to the atmospheric particulate matter (PM) burden were thought to arise largely from terpene oxidation with minor contribution from plant debris (e.g., cuticular waxes). Recently, isoprene has been shown to contribute to regional secondary organic aerosol (SOA), as have interactions between biogenic and anthropogenic emissions. Chemical tracers of BVOC contributions to SOA have been measured in a variety of environments, including the southeastern United States and the free troposphere. Yet adequate process level and regional level understandings of the coupled effects among BVOCs and the atmosphere's oxidative capacity and aerosol burden remain elusive.

Often, substantial leaps in progress require community-based efforts that rely on simultaneous colocated measurements, controlled laboratory studies, and openly distributed models. The workshop participants propose that as a community, scientists studying biosphere-atmosphere interactions focus their varied talents within the next few years on answering the following critical open science questions. Regional and global models, as well as satellites, indicate that the southeastern United States is a good laboratory in which to address these questions:

1. How can existing biogenic emissions models be evaluated and improved to better describe fluxes of the thousands of BVOCs and oxygenated BVOCs?
2. What measurement techniques are critical to enhancing scientists' understanding of the gas phase chemistry of BVOCs and their role as oxidant and aerosol precursors? What is the optimal deployment?
3. To what extent do anthropogenic influences affect biogenic SOA formation?
4. To what extent is there aqueous or cloud processing of BVOCs, their oxidation products, and related aerosols?
5. What are the climate-relevant properties of biogenic aerosol (VOC of biogenic origin)?

The organizers gratefully acknowledge workshop support from the U.S. National Science Foundation (award AGS-1135038). Further information, including a list of participants, can be found at http://climate.envsci.rutgers.edu/SOAS. Interested parties may wish to attend an open Southern Oxidant and Aerosol Study town hall meeting this December at the AGU Fall Meeting.

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