Estimation of biogenic VOC emissions and their corresponding impact on ozone and secondary organic aerosol formation in China

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Biogenic volatile organic compounds (BVOC) play an important role in global environmental chemistry and climate. In the present work, biogenic emissions from China in 2017 were estimated based on the Model of Emissions of Gases and Aerosols from Nature (MEGAN). The effects of BVOC emissions on ozone and secondary organic aerosol (SOA) formation were investigated using the WRF-CMAQ modeling system. Three parallel scenarios were developed to assess the impact of BVOC emissions on China's ozone and SOA formation in July 2017. Biogenic emissions were estimated at 23.54 Tg/yr, with a peak in the summer and decreasing from southern to northern China. The high BVOC emissions across eastern and southwestern China increased the surface ozone levels, particularly in the BTH (Beijing-Tianjin-Hebei), SCB (Sichuan Basin), YRD (Yangtze River Delta) and central PRD (Pearl River Delta) regions, with increases of up to 47 μ gm-3 due to the sensitivity of VOC-limited urban areas. In summer, most SOA concentrations formed over China are from biogenic sources (national average of 70%). And SOA concentrations in YRD and SCB regions are generally higher than other regions. Excluding anthropogenic emissions while keeping biogenic emissions unchanged results that SOA concentrations reduce by 60% over China, which indicates that anthropogenic emissions can interact with biogenic emissions then facilitate biogenic SOA formation. It is suggested that controlling anthropogenic emissions would result in reduction of both anthropogenic and biogenic SOA.

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