4.185 Impacts of Climatic and Land-Use Changes on Global Aerosol Burden.

Early Career Scientist

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Abstract:

Climatic and land use changes have been found to affect atmospheric aerosols and climate worldwide, but the mechanisms and pathways involved are not well understood. Here we use a global coupled aerosol-chemistry-climate-land model (CESM with CAM4 and CLM4) to investigate how aerosols respond to future climatic and land-use changes. Time-sliced simulations are conducted for the base year (2000) and a future year (2050). For the future year, three future projected scenarios driven by both climate and land-use projections following the Representative Concentration Pathways RCP8.5 are conducted. The first scenario considers future projected biogenic emissions, allowing us to investigate the effects of modified plant activities and emissions of biogenic volatile organic compounds. The second scenario considers future biomass burning emissions following future climate and land-use. The third scenario combines both sources, allowing us to look at combined effects of both emissions. The same three scenarios are repeated for the base year, but with 2000-level emissions, climate and land-use. In the first scenario, 2050-level biogenic emissions causes 0.7% increase in PM2.5 global aerosol burden compared to 2000-level biogenic emissions, with effects ubiquitous in many places globally. In the second scenario, 2050-level biomass burning emissions causes 8.7% increase in PM2.5 aerosol burden. Burning decreases in Central Africa and Southeast Asia, while increasing drastically in Northeast Europe. In the third scenario, the combination of both 2050-level emissions lead to 12.2% increase in PM2.5 aerosol burden compared to year 2000. The combined effect is more than the additive sum of the two individual effects, indicating a synergistic effect that reflects enhanced levels of biomass burning aerosol particles serving as nuclei for secondary organic aerosol formation from biogenic gases. These experiments show that contributions of biogenic and biomass burning emissions to PM2.5 increase in year 2050, with biomass burning emissions being a generally more significant contributor.