Climate Extremes and Aerosols: Attribution of the Past and Compound Impact in the Future

Over Asia, a robust pattern of "Drying-Wet-Drying" trend over the three most populated regions (India, South China, North China, respectively) have been observed in the past few decades. Yet, the cause of the 30-year trend is rather unclear, with conflicting arguments on the importance of natural variability, the greenhouse gas, land cover, and aerosols. Most of the previous studies, however, fail to provide a holistic explanation for all three major regions simultaneously. We show that the aerosol-cloud interaction induced oceanic cooling, provide a critical piece in reproducing the past trend. Only a fraction of climate models with complex treatment of aerosol-cloud interaction capture the observed pattern, thus unconstrained model dataset provides biased outlook of extreme rainfall in this region.

On the other hand, the climate extreme and air pollution can be entangled and lead to compound health impact. An integrated assessment of human exposure to the joint occurrence of heat and haze extremes and the future changes has been missing. Based on a high-resolution decadal-long model simulation using a state-of-the-science regional chemistry-climate model, here we show that: heat extreme frequency averaged over South Asia increases from 45 days/year in the Decade 2000 (1997-2004) to 78 days/year in the Decade 2050 (2046-2054). The human exposure to hazy weather over South Asia is also projected to increase substantially under RCP8.5, in contrast to projected air quality improvement globally. Even more concerning is the model projection of the joint occurrence of heat and hazy hazard (HHH). These rare events would have substantial increases in the future with a 175% increase in frequency and a 100% increase in duration.

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Refreshments and Meet the Speaker at 3:00pm