ATS/CIRA Colloquium

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Hosted by Jim Hurrell

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Effects of human-driven emissions and climate intervention on wildfire-related risks

Anthropogenic climate change is already driving large increases in wildfire frequency and extent globally, a trend expected to continue throughout the 21st century. In this talk, I first disentangle the roles of anthropogenic industrial aerosol and greenhouse gases (GHG) emissions on extreme fire weather – i.e., dry, warm, and windy conditions that lead to fire ignition and spread. By leveraging the CESM1 "all-forcing" and "all-but-one-forcing" Large Ensemble experiments, I show that industrial aerosols have generally dampened the risk of extreme wildfire conditions in the past, but their effect is diminished and more localized in future projections. On the other hand, historical greenhouse gas emissions have increased the risk of extreme fire weather in recent decades and could more-than-double this risk in many regions by the end of the 21st century, including the Amazon, Southeast Asia, and the Mediterranean. Next, I investigate the role of climate intervention through stratospheric aerosol injection (SAI) in preventing projected increases in wildfire risk. Using the CESM2 ARISE-SAI-1.5 experiment, I show that SAI dampens 21st century increases in extreme fire weather conditions in many parts of the globe but simultaneously amplifies wildfire risk in parts of South America, Africa, and Southeast Asia. Lastly, I use the CESM1 all-forcing Large Ensemble to explore the implications of heightened fire weather conditions on the probability of post-fire extreme precipitation over the Western U.S. I show robust and substantial increases in the likelihood of extreme precipitation occurring after an extreme fire weather event throughout the 21st century. The frequency of extreme fire weather events followed within one year by a spatially co-located extreme rainfall event doubles in California and increases by 700% in the Pacific Northwest. These temporally compounding events could lead to a greater risk of debris flows and flash floods, magnifying wildfire-related damages incurred by a region. Together, my findings provide key insight into the impact of political and societal decisions on observed and projected changes in wildfire-related risks across the globe.