NCAR | CLIMATE & GLOBAL DYNAMICS

CGD Seminar Series

Anthropogenically-driven increases in extreme fire weather conditions and subsequent extreme precipitation events

Danielle Touma

University of California, Santa Barbara

Date: Tuesday 4 May 2021

Time: 11am – 12pm

For Zoom information, please contact Tracy Baker tbaker@ucar.edu

For live stream information, visit the CGD Seminar Webpage

ABSTRACT

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 disentangle the roles of anthropogenic aerosol and greenhouse gases (GHG) emissions, biomass burning and land use/land cover change on extreme fire weather – i.e., dry, warm, and windy conditions that lead to fire ignition and spread. By leveraging the CESM "all-forcing" and "all-but-one-forcing" Large Ensemble experiments, we show that historical greenhouse gas emissions have increased the risk of extreme fire weather in recent decades, and could double this risk in many wildfire-prone regions by the end of the 21st century. While aerosols have generally dampened the risk of extreme wildfire conditions in the past, their effect is diminished and more localized in future projections. These findings provide key insight into the observed and projected changes in wildfire risks and have significant implications for mitigation and adaptation strategies.

Next, I use the all-forcing CESM Large Ensemble to explore the implications of heightened fire weather conditions in future years on the probability of post-fire extreme precipitation over the Western U.S. Generally, we find robust and substantial increases in the likelihood of extreme precipitation occurring subsequent to an extreme fire weather event by the end of the 21st century. In Western Colorado and Northern California, the likelihood of an extreme precipitation event occurring within one year after an extreme fire weather event increases from 20% to 60%, and the fraction of extreme precipitation events that fall within one year after an extreme fire event increases by 30% between 1980-2100. In Western Colorado, these changes are largely driven by robust increases in extreme precipitation event frequency, while large increases in the frequency of extreme fire weather events lead to the substantial changes in California. These temporally compounding events could lead to a greater risk of debris flows and flash floods and could magnify wildfire-related damages incurred by a region.