FSU Meteorological Seminar Series, Autumn 2022

Dr. Danielle Touma

NCAR Advanced Study Program

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

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 after an extreme fire weather event by the end of the 21st century. The frequency of extreme fire weather events followed within one year by at least one spatially co-located extreme rainfall event doubles in California and increases by 700% in the Pacific Northwest. In addition, more than 90% of extreme fire weather events in California, Colorado, and the Pacific Northwest could eventually be followed by at least three spatially co-located extreme rainfall events within 5 years in such a scenario. These temporally compounding events could lead to a greater risk of debris flows and flash floods, magnifying wildfire-related damages incurred by a region.

Time: Thursday, Oct. 22, 2022 @ 3:00 PM
Location: 1044 EOA
Host: Dr. Allison Wing