2024 Nevada Space Grant and NASA EPSCoR Statewide Meeting

Machine Learning for Exploring Wildfire Smoke Emissions: A Data-Driven Approach

Rahele Barjeste Vaezi [1,2], Michael Nia[1,2], and Farnaz Hosseinpour [1,2]

[1] Desert Research Institute, Reno, NV, USA

[2] University of Nevada-Reno, Reno, NV, USA

Correspondence: Rahele.Barjestevaezi@dri.edu

The significant impacts of wildfire smoke emissions highlight the crucial need for in-depth investigations. These emissions can be transported to far distances, endangering communities far away. Analyzing the long-term climate data may improve our understanding of how climate variability impacts emissions from wildfires in California and Nevada regions. We conducted a correlation study to investigate the possible relationships between different atmospheric conditions during wildfires in California. Machine learning (ML) techniques are strong tools that can identify patterns and relationships in big datasets with multiple input variables, providing insights that may be challenging or impossible to find with traditional methods in atmospheric science research. This study aims to apply the ML techniques to further explore the relationships between smoke emissions from wildfires and the key variables in weather and climate. Specifically, investigating the nonlinear connections between wildfire smoke emissions and regional climate using ML models is endeavored. We apply an ensemble of remotely sensed observations and the historical Modern-Era Retrospective Analysis for Research and Applications, the second version (MERRA-2) reanalysis data from 2000 to 2021 to develop ML algorithms. Incorporating fire-related atmospheric variables, including temperature, wind speed, potential vorticity, pressure velocity based on different vertical levels, is essential for developing the ML models. The ultimate goal of this study is to gain further insight into the complex mechanisms of wildfire smoke emissions and their transport to downwind areas.