Assessing and Predicting Wildfire Severity in California Based on Relationships Between Wildfires and Drought Using Machine Learning

Chen, Angela (School: William G. Enloe High School)

In recent years, many severe and destructive wildfires have plagued the state of California. Extreme fire conditions, such as drought, that occur especially during autumn months in California, have been taking place at the same time as many of these wildfires. In this study, the relationship was quantified between the self-calibrated Palmer Drought Severity Index (sc-PDSI) and wildfire severity in California during the time period 1984-2018, and a model was created that can work to predict the severity of future wildfires. The methods of wavelet transform coherence (WTC), cross wavelet transform (XWT), and continuous wavelet transform (CWT) were used in conjunction with machine learning algorithms to analyze and establish the relationship between sc-PDSI and wildfire severity. This study concludes that there was a significant relation between wildfire AE (areal extent) and sc-PDSI in 6-8, 5-6, and 2-3 year periods during the study period. The relationship was statistically significant (associated with 95% significance) and indicates that sc-PDSI is one of the main drivers for the wildfire AE in these periods. In addition, machine learning was utilized in conjunction with the Quantile Regression Model (QRM) in order to develop the prediction model and further analyze the relationship. The QRM results indicate that the sc-PDSI impact on wildfire AE is more pronounced for more severe wildfires compared to smaller wildfires. A prediction model of wildfire AE based on the QRM relation between AE and sc-PDSI was also developed to predict future wildfire AE in California. My findings are extremely significant as the prediction model can be used in the aid of damage control of wildfires in California, leading to fewer burned acres, less economic damage, and fewer casualties.

Awards Won:
Fourth Award of $500
National Oceanic and Atmospheric Administration - NOAA: Second Award of $500