Exploring the Influence of Wind on Wildfire Behavior in China: A Data-Driven Study Using Machine Learning and Remote Sensing

Authors : Rida Kanwal, Wang Yuhui, Song Weiguo

Abstract : Wildfires are one of the most prominent threats to ecosystems, human health, and economic activities. Wind is a driving factor of wildfires. This paper combines machine learning (ML) and remote sensing (RS) to assess the effects of wind on wildfires in Chongqing Province from August 16-23, 2022. In this research, Landsat 8 satellite images are used for the estimation of the difference normalized burn ratio (dNBR), which represents the prefire and postfire vegetation conditions. Wind data were sourced from the European Centre for Medium-Range Weather Forecasts (ECMWF) Reanalysis version 5 (ERA5) dataset and analyzed with geographic information system (GIS) mapping. Correlation analysis between the wind speed and FRP revealed a significant relationship. An autoregressive integrated moving average (ARIMA) model was developed for wind forecasting, and linear regression was used to determine the effect of wind speed on FRP. The results depicted high wind speed as one of the prominent factors behind the surge in FRP. Winds blowing to the northwest (NW), where wildfires spread, were discovered in the wind-rose plots. Furthermore, this model was validated with data from different provinces of China. This study integrated ML, RS, and GIS to analyze wildfire behavior for effective prediction and management strategies.

Keywords : wildfires, machine learning, wind, wind speed