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The influence of teleconnection patterns on wildland fire

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Abstract

Wildland fire is a natural disaster affecting the ecosystem, human property, and even human life. Three conditions need to be satisfied for fires: fuel, ignition source, and favorable weather conditions to spread fires. Teleconnections refer to climate anomalies being related to each other in geographically separated regions, they play an important role in local to large-scale fire occurrence by modifying the fuels and fire weather conditions. However, it is not clear so far how teleconnections influence wildfire. Here we used the random forest method, 11 teleconnection climate indices (CIs), three kinds of fire indicators (atmospheric-, hydrologic-, or vegetation indicators), and burned area (BA) data from 2003 to 2018 to study how the CIs influence BA (the pathways from CIs to fire indicators and then from fire indicators to fire). The results show that according to the influenced region fraction, the Tropical Northern Atlantic index (TNA, 23.6%) is the most important climate index followed by El Niño Southern Oscillation (ENSO, 20.1%), Indian Ocean Dipole (IOD, 15.7%), and Pacific–North American Pattern (PNA, 13.0%). The vegetation-related indicators (normalized difference infrared index (NDVI) and gross primary productivity (GPP)) tend to be highly related to both CIs and BA followed by hydrologic-related indicators (fire weather index (FWI) and aridity anomaly index (AAI)). The atmospheric-related indicators (vapor pressure deficit (VPD) and shortwave downward radiation (Rad)) are barely related to the CIs as they are more variable in time while the CIs serve more like long-term influence.

Keywords: wildland fire; teleconnection; fire indicator