Compounding preconditions leading to wildfires differ across European climate regions

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Recent wildfire seasons broke records in terms of severity and damage in different regions of the world, e.g. in California in 2021 and in Southern Europe in 2022. The probability of such severe and large wildfires is enhanced by compounding meteorological conditions of hot, dry and windy weather, which lead to dry fuels supporting the spread of fires. Drivers of low-frequency but high-impact fire events operate on different spatio-temporal scales and are difficult to identify with classical regression methods. Here, we use causal inference methods to describe the relationships between different variables driving fires and quantify their effect on the occurrence of fire events. We examine hydro-meteorological and land-surface drivers of wildfires in different European climate regions by leveraging ESAs' FireCCI burnt area product together with CERRA reanalysis data from 2002 to 2022. Our results show region-specific patterns of the different variables prior to the wildfire events, which allow us to identify different wildfire pre-condition types. Highlighting the spatial variability of different wildfire drivers in various climate regions of Europe provides valuable insights for the development of targeted fire prevention measures and management.