A data-driven model for Fennoscandian wildfire danger

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ABSTRACT

Wildfires are natural phenomena that pose a threat to humans and contribute to considerable carbon and methane emissions. Mapping of wildfire danger at national and international levels are typically based on traditional fire danger indices that use meteorological data as input, such as the Canadian forest fire weather index (FWI). Today's plethora of available data sets allow for direct investigations of which combination of absolute and relative states of hydrometeorological variables are most important for fire occurrences over large regions. We employ a data-driven approach (primarily using the Random Forest algorithm) to identify dominant natural predictors for month-to-month wildfire occurrences across Fennoscandia. This region has received little attention in the fire literature, compared to other boreal regions and more fire-prone regions further south. Shallow volumetric soil water anomaly stood out as the dominant predictor, followed by predictors related to temperature and deep volumetric soil water. The selected predictors emphasise the importance of other predictors than weather alone. The final model showed similar fire danger prediction capability as FWI, illustrating the potential of data-driven models to be used jointly with process-based approaches, in order to evaluate the agreement and spread among different types of models. The predictors used in our study are available in most climate models and transferable to different climate scenarios. Accordingly, our model allows for analyses of future changes in fire occurrence characteristics.

Keywords: wildfire; data-driven model; machine-learning; Fennoscandia