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Hydrological impacts of wildfires on diverse climatic regions

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Abstract

Wildfires are a natural, commonly occurring phenomenon for many forest ecosystems, affecting vegetation distribution and density, but they also can exert a considerable influence on the affected region's hydrology, leading to changes in river runoff until vegetation and hydrological processes return to their prior state. Although numerous studies have explored the hydrological consequences of forest wildfires at the basin and river level, studies following comparative and large-scale approaches remain limited. To address this gap, our work utilises an extensive dataset of runoff observations worldwide, as well as MODIS burned area data and other climate variables, enabling a systematic evaluation and comparison of the hydrological response to forest wildfires across various hydrological regions and biomes, from boreal to mid-latitude and equatorial areas. Through our analysis, we uncover contrasting impacts of wildfires on hydrological processes, underscoring their pivotal role of hydroclimatic factors in shaping their hydrological response. Notably, we find that mid-latitude river discharges are the most affected by wildfires. In contrast, wildfires in the equatorial and sub-tropical regions affect river runoff to a smaller degree.

Keywords: wildfires, burned area, river runoff,