

Size-dependent wildfire occurrences in the boreal Eurasia and driving factors

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Large areas are burned every year in the boreal Eurasia. Pollutants emitted from fires in the Boreal Eurasia could be transported to the Arctic and the consequential deposition could accelerate the Arctic warming. However, there are so far limited knowledges on the wildfire pattern in the boreal Eurasia and the causes. Our purposes are to clarify the temporal and spatial pattern of wildfire and to investigate the factors affecting wildfire occurrence in the boreal Eurasia during 2005-2014.

Focusing on a domain in 50–75°N, 30–180°E, we divided the boreal Eurasia into 15 sub-regions and investigated the wildfire occurrences based on the Moderate Resolution Imaging Spectroradiometer MCD64A1 burned area product. Lands were burned mainly (96%) in >100ha size, although with large small fires (<100ha) counts (58%). Interannually, large land losses (>30 million hectares) occurred in 2008, 2010, 2012 and 2014 over the whole domain. Seasonally, wildfires occurred since April, peaked in July to August, and continued until October. Spatially, six high fire-prone regions were identified locating at the southwestern Russia, Kazakhstan, southwest Siberia, central Siberia, eastern Siberia and the Far East. Furthermore, we investigated the relations of burned area with climatic indices such as temperature, precipitation and soil drought index (Palmer Drought Severity Index, PDSI) in each sub-region. It was found that the burned area in southwest Russia, Kazakhstan, west Siberia had positive relation with temperature ($p < 0.05$). On the other hand, burned area had negative relations with precipitation and PDSI ($p < 0.05$) in most of the fire-prone regions. These results indicate that wildfire occurrence were fostered by the dry soil and air conditions. Furthermore, burned area is likely related to snow melting date, to which early snow melting date caused larger burned area. Our study implies that under a warmer world, wildfires in the boreal Eurasia tend to be severer and mega-fires more frequent.