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Influence of wildfires on atmospheric composition and carbon uptake of forest ecosystems in Central Siberia: the establishing of a long-term post-fire monitoring system

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Calculations of direct emissions of greenhouse gases from boreal wildfires remain uncertain due to problems with emission factors, available carbon, and imprecise estimates of burned areas. Even more varied and sparse are accurate in situ calculations of temporal changes in boreal forest carbon dynamics following fire.
Linking simultaneous instrumental atmospheric observations, GIS-based estimates of burned areas, and ecosystem carbon uptake calculations is vital to fill this knowledge gap. Since 2006 the Zotino Tall Tower Observatory (ZOTTO; www.zottoproject.org) a research platform for large-scale climatic observations is operational in Central Siberia (60°48'N, 89°21'E). The data of ongoing greenhouse gases measurements at the tower are used in atmospheric inversions studies to infer the distribution of carbon sinks and sources over central Northern Eurasia.
We present our contribution to reducing uncertainties in estimates of fire influence on atmospheric composition and post-fire ecosystem carbon uptake deduced from the large-scale fires that happened in 2012 in the tall tower footprint area. The burned areas were estimated from Landsat ETM 5,8 satellite images, while fires were detected from Terra/Aqua MODIS satellite data. The magnitude of ecological change caused by fires ("burn severity") was measured and mapped with a Normalized Burn Ratio (NBR) index and further calibrated by a complementary field based Composite Burn Index (CBI). Measures of fire radiative power (FRP) index provided information on fire heat release intensity and on the amount and completeness of biomass combustion. Based on the analyzed GIS data, the system of study plots was established in the 5 dominating ecosystem types for a long-term post-fire monitoring. On the plots the comprehensive estimation of ecosystem parameters and carbon pools and their mapping was organized with a laser-based field instrumentation system.
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