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Assessment of post-fire changes of hydrological regime of watersheds based on the analysis of remote sensing data and standard hydrometeorological observations

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Forest fires are regular at large territories of Siberia. Fire occurrence is expected to increase in the future due to climate change and anthropogenic influence. Though there are many studies on vegetation and landscapes transformation after fire the analysis of associated hydrological and geomorphologic changes in permafrost environments in Russia are rare.
Broadening our previous study on fire impact on hydrology in remote area of the Baikal region (Semenova et al., 2015a, b; Lebedeva et al., 2014) the following objectives for this study were set up: i) describe changes in streamflow after extensive 2003 forest fire in several middle-size river basins in Siberian permafrost zone ii) assess change in sediment flux after the fire in the same catchments iii) attribute found responses to dominating landscapes and the level of vegetation disturbance and other factors, iv) analyze the mechanisms of those changes using the analysis of ground and remote sensing data.
Following severe drought 2002-2003 extensive fires occurred in spring and summer of 2003 in the southeast part of Russia when more than 20 million ha were affected by disaster. Vast remote regions in Transbaikal region lack any special observations on fire impact of 2003 on hydrological regime of disturbed areas. Therefore hydrological data on water and suspended sediment flow from standard network of Russian Hydrometeorological Service was used combined with remote sensing data analysis to assess post-fire changes.
Six watersheds in the upstreams of the Vitim River located at the Vitim Plateau are chosen for this study. In our analysis we used daily river discharge data for 6 gauges and 10-days average suspended sediment discharge for 3 gauges. Semenova et al. (2015a, b) detected short-term impact of fire on runoff manifested in significant increase (up to 40-50 %) of summer flow after the fire. The analysis of suspended sediment data revealed that the impact of fire on sediment flow regime can be traced during 4-6 years after the fire and is expressed by increased, compared with the "stationary" period sediment load for the entire range of water discharges.
MODIS Burned Area dataset was the main source we used to determine fire sites and the duration of the fire. It was also the source of fire intensity determination. The multispectral Landsat imagery was used for analysis of vegetation disturbance caused by fire. The spectral indices RdSWVI were estimated for the assessment of the severity and extent of fire damage based on the results of the experimental study in Buryatiya and Chitinskaya region (Bartalev et al., 2010). Such, depending on the the indices RdSWVI the vegetation was classified into 5 categories depending on its status from “healthy” to “totally dead” and the distributions of different vegetation condition classes by certain landscapes were obtained.
Finally, the correlation between the degree of vegetation damage and specific changes in water flow and suspended sediment are explored.

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