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Wildfire in Northern Eurasia and climate change

A. Shvidenko (1,2) and D. Schepaschenko (1,3)

(1) International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria (shvidenk@iiasa.ac.at), (2) Sukachev Institute of Forest, Siberian Branch of Russian Academy of Sciences, Krasnoyarsk, Russia, (3) Moscow State Forest University, Mytischi, Moscow Region, Russia

The presentation considers dynamics of fire regimes in Northern Eurasia (limited to territories of Russia) and their impacts on ecosystems and major global biogeochemical cycles. Historically, fire regimes in different regions were defined by natural climate variability, previous fire history and the level of direct human impact. The climate specifics over the last three decades in Russia substantially impacted fire extent, frequency and severity. Regular occurrence of mega(catastrophic) fires becomes a distinct feature of current fire regimes. Megafires (e.g., 1998, 2003, 2008, 2010) lead to degradation of ecosystems and the profound depletion of biodiversity, substantial increase of emissions, create special atmospheric and seasonal weather over large areas, cause considerable damage to the economy and infrastructure, as well as adversely affect the living conditions and health of the population in the regions of fire spread.

Based on a synthesis of remote sensing and ground data, the total area of wildfire in Russia between 1998-2010 is assessed at 106.9 x 10^6 ha or 8.23 x 10^6 ha yr^{-1}, varying from 4.2 (1999) up to 17.3 x 10^6 ha yr^{-1} (2003). The uncertainty of the assessment of burnt area was estimated at $\pm$ 9%, and direct emissions of carbon at $\pm$ 23% (CI 0.9). As a rule, $\sim$90% of the burnt area is located in Asian Russia, mainly in its southern half. About two-thirds (65.1%) of the total burned area is situated on forest land, 18.9% happened on agricultural land, 8.7% - on grass- and shrubland, and 7.3% - on wetland. The total amount of fuel that was consumed between 1998-2010 was assessed at 1.57 x 10^9 t C, or 121.0 Tg C yr^{-1}. Interannual variability of this value is high – from 50 (2000) up to 231 Tg C yr^{-1} (2003) depending on fire season type and geographical location of the fire. On average, our results are quite close to estimates given by the GFED3 – the latter are +11.5% by area, and +13.2% by emissions. The majority of carbon emissions were provided by forest fires (76.0% of the total), followed by emissions from wetland fires (15.8%). Carbon emissions in forests due to post fire dieback are close to the average amount of emissions caused by burning.

Current models suggest a doubling of the number of fires by the end of this century in the boreal zone. They predict increases of numbers of catastrophic fires and fires covering large areas; a significant increase in the intensity of fires; and increasing the amount and change in the composition of the gas emissions due to enhanced soil burning. The spatial correlation between catastrophic fires and large-scale climatic anomalies becomes more and more clear. Permafrost melting and subsequent landscape aridity most probably will lead to the degradation and destruction of coniferous forests, as well as to widespread distribution of "green desertification". Russia needs an urgent development and introduction of anticipatory strategy of forest fire protection which would satisfy the challenges of a changing world.