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Catastrophic Fires in Russian Forests

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American Geophysical Union, Fall Meeting 2010, abstract #GC33A-0931

We evaluated the contribution of catastrophic fires to the total burned area and the amount of tree mortality in Russia since the 1970's. Such fires occurred in the central regions of European Russia (1972, 1976, 1989, 2002, 2010), Khabarovsk krai (1976, 1988, 1998), Amur region (1997-2002), Republics of Yakutia and Tuva (2002), Magadan and Kamchatka oblast (1984, 2001, 2010), and Irkutsk, Chita, Amur regions, Buryat, Agin national districts (2003, 2007-08). We define a catastrophic fire as a single high-severity fire that covers more than 10,000 ha and results in total consumption of the litter and humus layers and in high tree mortality, or the simultaneous occurrence of several high-severity fires in a given region with a total area exceeding 10,000 km². Fires on this scale can cause substantial economic, social and environmental effects, with regional to global impacts. We hypothesize that there is a positive feedback between anticyclone growth and energy release from wildfires burning over large areas. Usually the first blocking anticyclone appears in June in Russia, bringing with it dry weather that increases fire hazard. The anticyclonic pattern has maximum activity in the end of July and disappears around the middle of August. When high fire activity occurs, the anticyclone may strengthen and develop a blocking character that prevents cyclonic patterns from moving into anticyclone-dominated areas, where the fire danger index may be more than six times the average maximum. The likelihood of uncontrolled fire situations developing increases greatly when the fire number and burned area exceed critical values as a function of conditions that favor high intensity fires. In such situations fire suppression by regional forest protection services becomes impossible and federal resources are required. If the appearance of a blocking anticyclone is forecast, active fire prevention and suppression of small fires (most of which appear to be human caused) is critical. Based on NOAA and TOMS daily data, we estimated fire emissions (including CO₂, CO, CH₄ and other smoke aerosols) of over 70 Tg Carbon for Yakutian fires in 2002 and more than 120 Tg C for all Russian fires in 2010. We note the potential for increasing amounts of methane emissions when fires occur in permafrost zones and peat bogs. Post-fire changes in permafrost and vegetation cover are discussed in the connection changes in solar radiance balance. During the fire season of 2006 in the Eastern-Siberian, Transbaikal, and Far East regions we identified more than 15,000 fires with a total area of 120,000 km². From 2002-2010 the annual number of fires in this area ranged from 10,000 to 16,500, and annual burned areas ranged from a low of 30 000 km² in 2004 to a high of 145,000 km² in 2003.

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