Forest fire conditions in Eurasian regions from model simulation

Chernokulsky A.V. and Mokhov I.I.
A.M. Obukhov Institute of Atmospheric Physics RAS, Moscow, Russia
chern_av@ifaran.ru

Forest fires are one of the most hazardous regional consequences of global warming of the climate. Fire conditions can be characterized by indices based on meteorological data, including the Nesterov fire index (Nesterov 1949), Zhdanko index (Zhdanko, 1964), modified Nesterov index (Groisman et al, 2007). In particular, Nesterov fire hazard index (*FHI*) is defined as:

$$FHI = \sum_{P>3mm} (T_{\max} - T_{dew}) \cdot T_{\max},$$

where $T_{\max}$ is the maximal temperature in °C and T_{dew} is the temperature of the dew-point (depending on relative humidity and temperature) in °C. Summation is performed for those days when the daily precipitation P does not exceed 3 mm. At P>3mm, the FHI value turns to zero. The values of fire hazard potential are divided into five ranges. Conditions with FHI < 300 (regime I) are not considered hazardous. Conditions in the ranges 300–1000, 1000–4000, 4000–10000, and >10000 are considered regimes with low (II), moderate (III), high (IV), and extreme (V) level of fire hazard.

In the present paper, we estimate the regimes of fire hazard in North Eurasian regions at the end of 20st century and during possible climate changes in the 21st century based on numerical calculations using MGO regional climatic model (Shkolnik et al., 2006, 2007).

Figures 1 and 2 show distributions of the mean summer FHI for the European and Asian part of Russia for the period 1991–2000. Southern latitudes are generally characterized by extreme FHI values. Boundaries of the regions with forests were distinguished according to satellite data (Hansen et al., 2000). Southern boundary of the regions with forests is associated with regime III with moderate FHI values. Remarkable exception is related with the Siberian region to the east from Baikal Lake. There forest zone locates in regime IV with high level of fire hazard.

Forests in midlatitudes are associated mainly with low FHI conditions (regime II) as well for high latitudes over European part of Russia (Fig. 1).

We analyzed also simulations for 2041-2050 and for 2091-2100 periods under the SRES-A2 scenario (Mokhov, et al, 2006). Tendencies of change for summer precipitation differ in sign in the northern and southern latitudes. Differences in the temperature changes are not so dramatic for different regions. Regional temperature changes differ only in their value but not in sign: they are generally positive in the 21st century according to model simulations. The combination of change in temperature and hydrological characteristics leads to a general increase in fire indices for south regions in Northern Eurasia by the end of the 21st century in particular to the east from Baikal Lake in Siberia.

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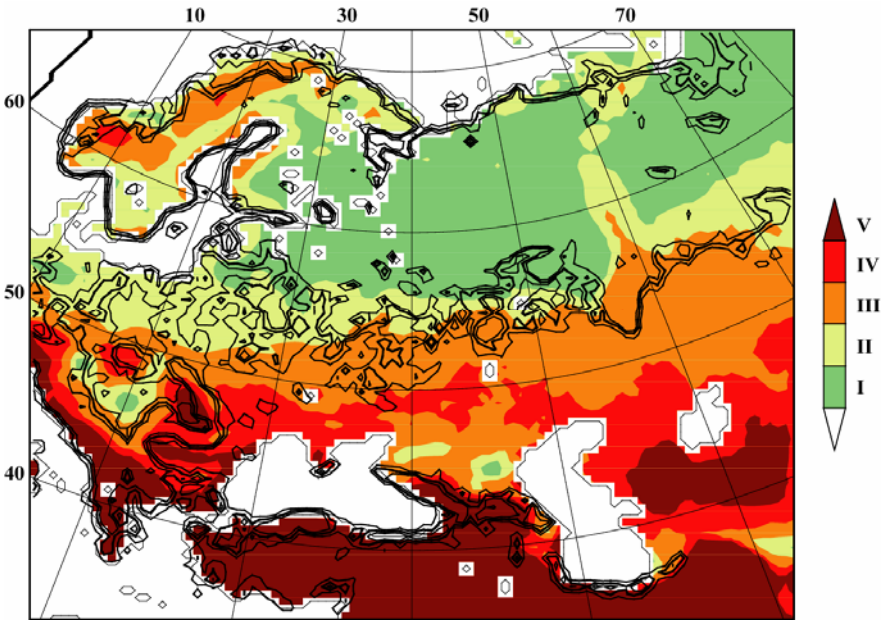
Fig.1 Distribution of the mean summer *FHI* for the terminal 20th century at the European part.



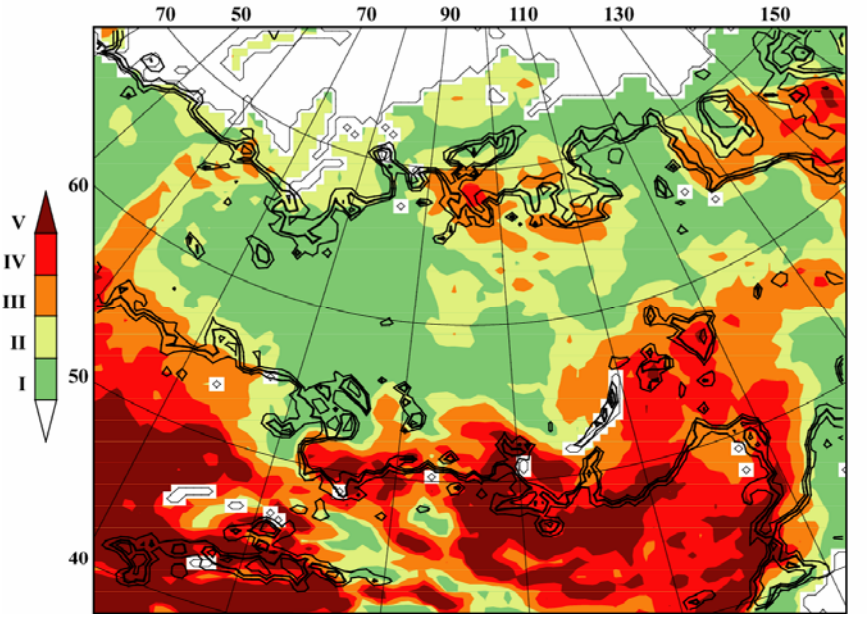


Fig.2 Distribution of the mean summer *FHI* for the terminal 20th century at the Asian part.

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