Potential fire regimes in regions of Northern Eurasia from meteorological observations and reanalysis

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Meteorological observations from the RIHMI (http://www.meteo.ru) and the ERA-40 reanalysis data (Simmons and Gibson, 2000) are used for diagnosis of the forest fire conditions in regions of Northern Eurasia (Mokhov et al. 2005). We used different modifications of the Nesterov index I_F for combustibility of forest fires (Nesterov, 1949; Venevsky et al., 2002). In particular, this index was calculated by using maximum daily temperature at the surface, dew-point temperature (defined by relative humidity and temperature) and precipitation. The difference between the two temperatures was multiplied by the daily temperature and summed over the number of days since the first day with daily precipitation less than 3 mm. When the daily precipitation exceeds 3 mm, the I_F value is defined as zero.

$$I_F = \sum_{P<3mm} T_{max} \cdot \left(T_{max} - T_{dew}\right)$$

The ignition potentials are considered to be moderate, high and extreme ones for I_F values between 300 and 1000, between 1000 and 4000 and above 4000, correspondingly.

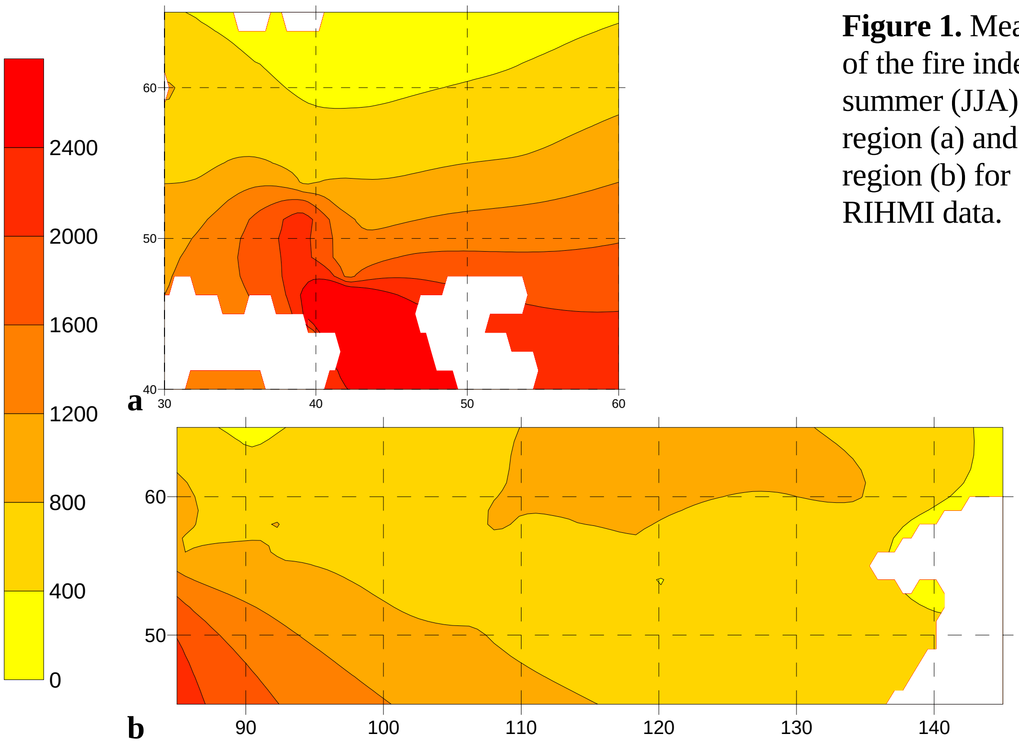

Figure 1. Mean distributions of the fire index I_F $(^oC)^2$ in summer (JJA) over European region (a) and Eurasian region (b) for 1961-2000 by RIHMI data.

Figures 1a,b show two examples of the I_F distributions for European (a) and Asian (b) regions in summer (June-July-August) for the period 1961-2000 based on Krigging gridding method by using RIHMI data for 47 Russian meteorological stations (17 stations for European part and 30 stations for Asian part) with the most detailed data.

Changes of fire regimes can be characterized by the relation k of I_F to its mean value $\langle I_F \rangle$ for the control period 1961-1990. According to observations values of $\langle I_F \rangle$ equal to 1605 $(^oC)^2$ for Moscow and 1568 $(^oC)^2$ for Irkutsk. For estimates from reanalysis data we used surface air temperature at noon T_{12h} instead of T_{max}. According to reanalysis data values of $\langle I_F \rangle$ equal to 1041 $(^oC)^2$ for Moscow and 570 $(^oC)^2$ for Irkutsk.

We also analyzed the probability P(k>2) for exceeding of k=2. Figure 2 display changes of P(k>2) in summer for Moscow in European region (a) and for Irkutsk in Asian region (b) from observations (RIHMI) and reanalysis data (ERA-40). In particular, the largest values of P(k>2) for Moscow in summer were noted in 1972 and 2002.

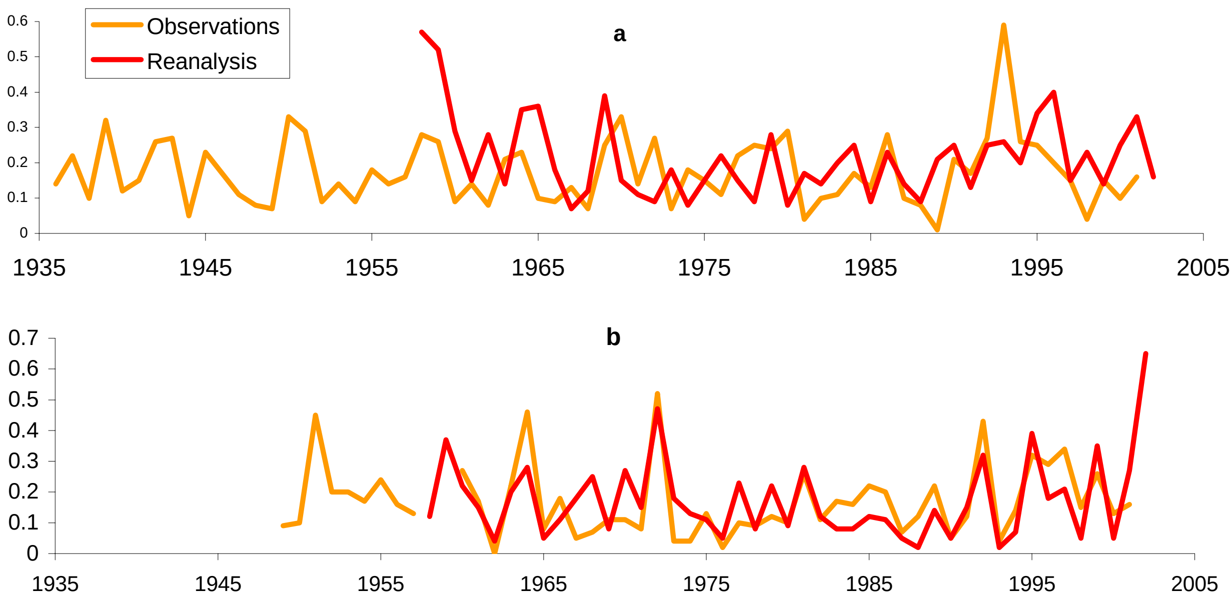

Figure 2. Changes of P(k>2) in summer for Moscow (a) and for Irkutsk (b) from observations and reanalysis data.

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