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Past and future trends of forest fire danger in Europe

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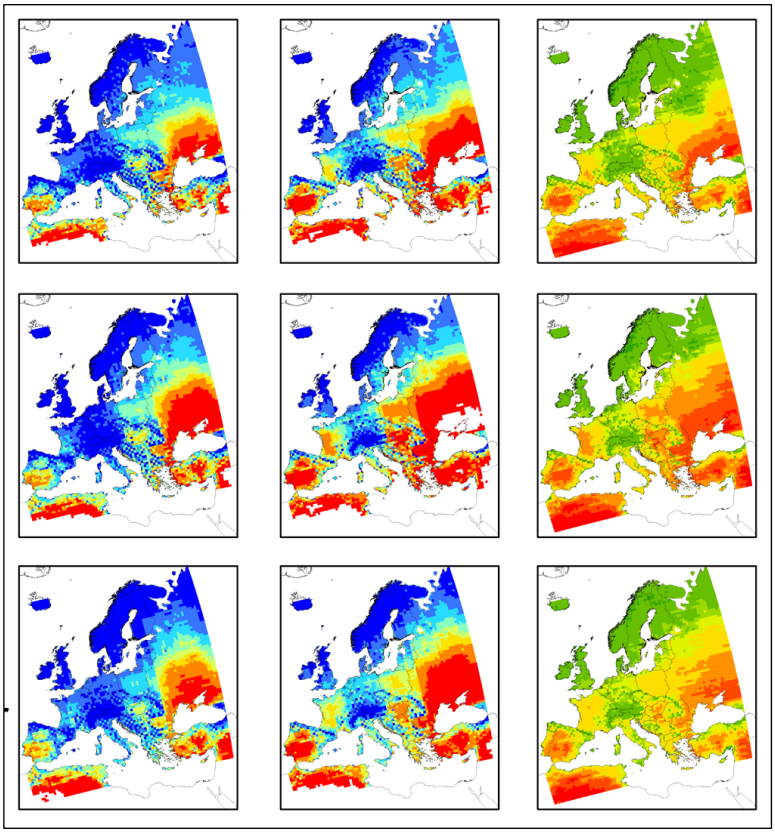

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Forest fire danger is meant to rate the component of fire risk dependent on weather conditions. Fire danger indices, normally applied on a daily bases, can be summarized for each year to rate the seasonal severity (i.e. the fire potential due to weather) and its changes over time. The index of Seasonal Severity Rating (SSR) has been derived from daily values of Van Wagner's Fire Weather Index (FWI, Van Wagner 1987) the fire danger assessment method most widely applied all over the world (San Miguel-Ayanz et al. 2003).

To track past fire potential changes due to climate, past trends were analyzed computing seasonal fire severity conditions based on daily weather data for the period 1958 to 2006. The European Centre for Medium Range Weather Forecast (ECMWF) ERA40 dataset was used to extract meteorological variables needed to compute daily value of fire danger in Europe, with a resolution of 1.25° and a time window from 1958 until 2002. The time series was extended until 2006 with analysis data from the MARS archive of the same ECMWF. The spatial distribution of the SSR long term averages is shown in Figure 1.

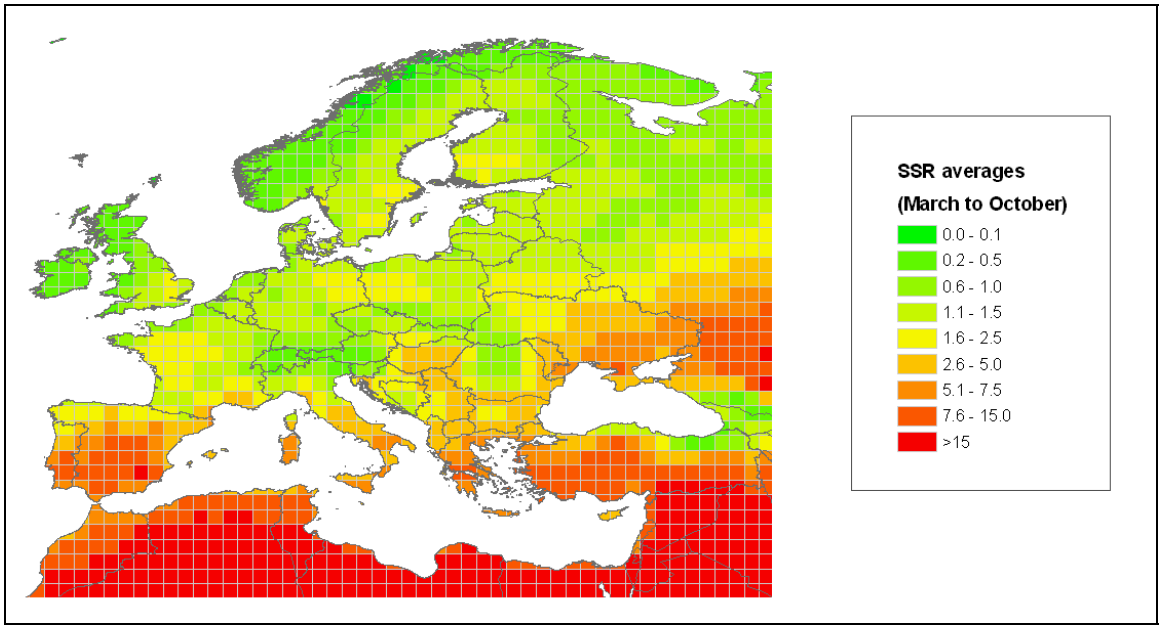

Figure 1. Spatial distribution of Seasonal Severity Rating (SSR) long term averages (49 years, 1958 to 2006)

Seasonal Severity Rating trends were then modeled with regression analysis and the statistical significance of trends were assessed with the Cox-Stuart trend test (Cox and Stuart, 1955). Results are shown in Figure 2. The average trend 1958-2006 was computed for all the grid cells, but it resulted to be statistically significant only for 21% of the cases (15% positive and 6% negative), which appear to be concentrated in specific geographical areas.

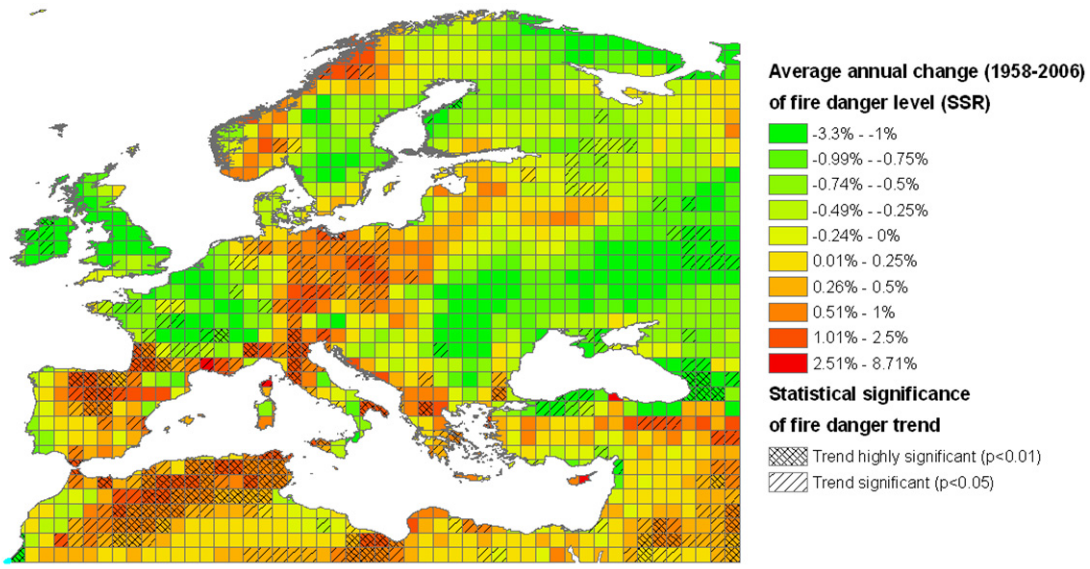

Figure 2. Trends of fire danger level from 1958-2006 assessed using the Seasonal Severity Rating (SSR).

Future projections were derived for the IPCC SRES scenario A2, processing data from the PRUDENCE data archive, namely the daily high resolution data (12 km) from HIRHAM model run by DMI, for the time periods 1960-90 (control) and 2070-2100 (projections) (see Figure 3). Results confirm in Europe, projections assessed for North America (Flannigan et al. 2005) with a significant increase of fire potential, an enlargement of the fire prone area and a lengthening of the fire season.

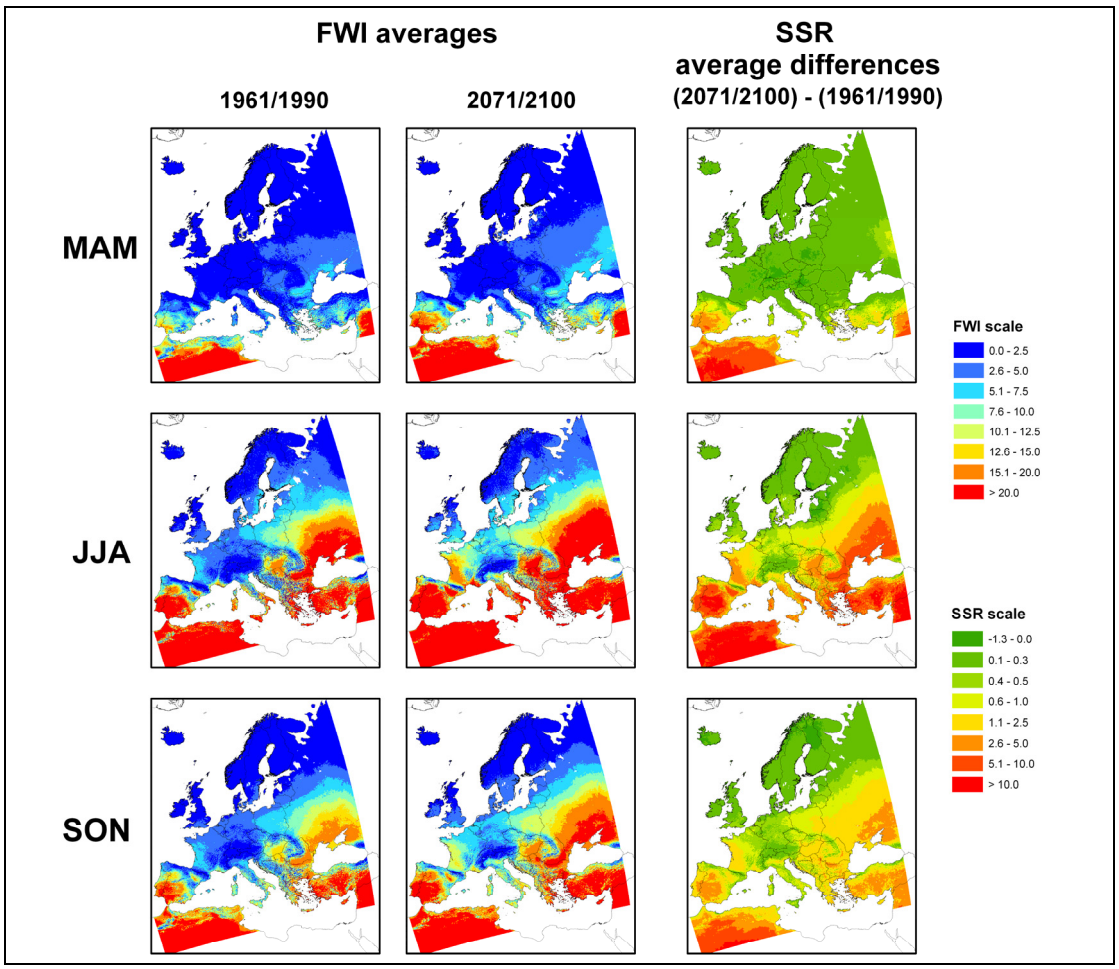

Figure 3. Projected (2071-2100) and control (1961-1990) three-monthly fire danger levels in Europe for the IPCC SRES high emissions A2 climate change scenario. Fire danger in winter months (DJF) is not shown because negligible.

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Abstract
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