Current trends in changes of growing season dates and length in the Russian southern European taiga

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Current trends in changes of growing season dates and length in the Russian southern European taigaA. Severtsov Institute of Ecology and Evolution Problems, Russian Academy of SciencesVygodskaya N.N, Varlagin A.V., Kurbatova Ju. A.With predicted global warming in the boreal zone, the growing-season length (GSL) may be expected to increase due to an earlier start of spring (Myneni et al., 1997; White et al., 1999; Sereze et al., 2000). These trends may cause carbon uptake increase by forest ecosystems and changes of annual NEE and NEP across the boreal zone (White et al., 2000; Saxe et al.,2001). However, changing conditions of the growing season are important not only for the ecosystem carbon balance and for water and energy balance in a future climate as well. From our climate records in the Russian southern European taiga, a distinct tendency of earlier spring starts is found from the late 60s to 1996 of the 20th century. In spring, the earlier onset of dates with mean daily air temperature (Td) above 0oC was 4.6 days per decade. Similar shifts of dates with mean Td above 5oC and 10oC were found 3.8 и 3.5 days per decade respectively. However, for the period of 1997-2004 this tendency changed for the opposite one. As a result, spring linear trends of earlier starts for 1970-2004 became zero or even negative. Due to a tendency of later ends of the growing season in fall, the whole growing season shifted to the second half of the year. Despite of weak positive trends of both spring and fall mean temperatures in the region, mean periods with Td above 0oC, 5oC, and 10oC estimated for the last 35 years do not significantly differ from the mean long-term climatic norm. Weak statistical relationships (R2<0.3) between annual mean, minimum and maximum temperatures and the GSL (with Td>5 and 100C) and a warm season length (WSL) with temperature above 0oC are found. Simultaneously, both WSL and GSL increase with increased continentality of climate caused by the annual temperature amplitude increase in different years. On average, with the annual amplitude increase by 10oC in the range 18- 38oC observed, the WSL shortens by 16 days and the GSL shortens by 7-8 days. The cause of no trend in WSL changes is that a number of days with Td above 0oC increases in spring with a rate 2.9 days per decade and decreases in fall with a rate 2.1 days per decade.However, these long-term trends are found on the background of high variability of both dates (the start and end) of the growing season and lengths of GSL and WSL, with less stable trends of the warm season dates. Based on 7-year tower measurements of net ecosystem CO2-exchange in spruce forests in the southern taiga, the difference in dates of the photosynthetically active period onset estimated from half-hourly CO2-uptake and Td crossing the 0oC threshold was found to vary 1 to 11 days. CO2-uptake usually starts later that the mean Td crosses > 0oC.