



## Spring phenology in taiga and tundra

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According to several studies, the onset of spring has tended to get earlier in the last few decades. However, most studies analyze the phenological variations either for a short time period (since 1982 with satellite observations), or for a restricted region using ground observations. Ground observations, satellite observations and modeling were analysed jointly to study phenological variations in boreal Eurasia in 1936-2005, and 1920-2005 in Central Siberia. The results show that the trend that is observed by remote sensing is essentially due to a shift at the end of the 1980's, related to a shift in the spring temperature and in the climatic indices. In West Siberia and European Russia, the trend to an earlier spring has existed since as early as 1940. In contrast, the central and eastern parts of Siberia display successive trends with opposite signs, and the trend observed by remote sensing is due to both very early leaf appearance in the 1990's and to very late leaf appearance in 1983-1984, showing that the trend must not be extrapolated to predict future phenology.

In the aspen forests in Central Canada, the leaf appearance got earlier during the 1980's, but it got later in the 1990's; thus the range of leaf appearance dates in the 2000's is within the range of those in the 1970's.

The green-up model was then applied over the low arctic tundra region. It reproduces the green-up dates estimated using remote sensing correctly, with a RMS difference of 5 days, and it reproduces the ground observations of dwarf birch leaves in Alaska with less than 3 days error, showing that a model based on air temperature is able to predict low arctic phenology. The model was applied over the whole low arctic region from 1958 to 2002. In North East Canada and North East Russia, no remarkable trend is found in the timing of green-up, whereas a ten day advance is recorded in the last few decades in North Alaska and in North West Siberia.