



Reflection of climatic changes in Altai phenology

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The last decades of the past century showed noticeable climate changes in many parts of the Earth (IPCC, 2007). Numerous models suggest that the climate changes will continue, showing a variable intensity especially in mountain regions. Altai Mountains, located at the boundary of taiga, desert, and semiarid regions of Central Asia, are exposed to intensive climatic and environmental changes. Analysis of changes in phenological parameters is the simplest process for track changes in the ecology of species in response to climate change.

We present climatic characteristic and statistical analysis changes of thermal and precipitation regimes in Altai Mountains (Russian and Mongolian Altai), and the response of phenological parameters to these changes. The close correlation between temperature series of the Russian and northern part of Mongolian Altai is determined. At the same time, a correlation between precipitation data is observed only for the cold (November - March) seasons. It was found that the rate of temperature increase for the period under consideration (1940-2012) ranged from 0.15 to 0.55 °C/10 years, and the most significant increase was registered during the cold seasons. An increase of annual means of precipitation is in the range from 2.32 to 6.37 mm / 10 years. The maximal increase (29 mm / 10 years) was observed in the data from the Kara-Tyureck station, whose location is the highest one of the considered stations (2600 m). During the maximal warming (1980-1999), a 2-4.5 times increase of annual average temperature was observed as compared to the period of 1940 - 1979. The amount of precipitation is increased for Ust'-Koksa (5 times) and Ulgiy (2 times) stations, but it is 3 times lower for Kosh-Agach and Kara-Tyureck stations.

The results of the correlation analysis of temperature and precipitation data for the analyzed Russian and Mongolian Altai stations were confirmed and detailed by the wavelet and wavelet coherence / phase analysis. The temperature series variations obtained with the wavelet analysis correspond to the periods of North Atlantic Oscillation and solar activity variation, and precipitation are in good agreement with changes in Pacific Decadal Oscillation.

The analyzed climatic change influenced on the beginning of pollination of different plant species in Altai region. If average (for 27 years) of the beginning of pollination of *Artemisia gmelinii* (a typical representative of Central Asian steppe vegetation) was counted at 24 of August, a mass pollination of this species was at 5th of September. So deviation reached 14 days.

Under condition of more cool summer the pollination in most cases (80 %) started later. Additionally we counted average temperature of beginning of pollination of this species which was + 21.5 C0, and sums of action temperatures (+5 C0) = 1675, (+10 C0) = 1491.