Geophysical Research Abstracts
Vol. 14, EGU2012-12124, 2012
EGU General Assembly 2012

First flowering sensitivity analysis to climate on 19th century data: using phenophase as thermometer

A. Lehoczky (1), B. Szabó (2), R. Pongrácz (1), and F. Szentkirályi (3)

(1) Dept. of Meteorology, Institute of Geography and Earth Sciences, Eötvös Loránd University, Budapest, Hungary (e-mail: annamarialehoczky@gmail.com), (2) Dept. of Systematic Zoology and Ecology, Institute of Biology, Eötvös Loránd University, Budapest, Hungary (e-mail: barbara.szabo.elte@gmail.com), (3) Dept. of Zoology, Plant Protection Institute, Centre for Agricultural Research, Hungarian Academy of Sciences, Budapest, Hungary (e-mail: h2404sze@ella.hu)

Eco-climatological studies often refer that plant phenophases are strongly influenced by temperature. Consequently, these variables might be used as proxy in climate reconstructions. In the present study, we have investigated the first flowering response of numerous plant species to interannual fluctuation of seasonal temperatures (e.g., temperature sensitivity of the phenophase), also the rate of these species-specific sensitivities in order to test their applicability as proxy.

The analyses were accomplished using first flowering data sets recorded in the 19th century to get a reference time series from the period when recent anthropogenic warming effect did not influence the local climate conditions. In case of some species the results were compared to flowering characteristics of the same plants found in the second half of the 20th century. From the few available data sources recorded in the Carpathian Basin during the 19th century, the relatively long first flowering data sets of 16 plants and time series of monthly mean temperature (site: Hermannstadt; period: 1851-1891) were selected for the analyses. Because previously several results suggested that the winter/early spring temperature variability in the 20th century is significantly influenced by the teleconnection pattern of North Atlantic Oscillation (NAO), therefore we have also involved the winter NAO index into our analyses.

According to the aims of the present study the following issues were addressed using different statistical methods (e.g., trend analysis, cross-correlation function, and regression analysis): (i) the effect of mean monthly, bi-monthly, tri-monthly temperatures on first flowerings using a moving-window technique and from the obtained response surfaces each species-specific effective temperature value (Teff) was estimated; (ii) the temporal shifts of first flowering as a response of every plant species to a unit change in Teff were calculated. Furthermore (iii) the species ranking on the basis of the temperature sensitivity of first flowering; (iv) the accuracy of proxy estimations were determined.

The main conclusions of the study can be summarised as follows. The first flowering data of different plants were significantly synchronously fluctuated but temporal trends were not detected in any of the time series. The influence of effective temperatures on first flowering variability was significant (40-70% of the variability was explained by R2). Effect of the winter NAO was negligible (approximately 1%). Standard deviation of the first flowering time was larger in case of the earlier flowering species than the later flowering ones. Temperature sensitivities of observed plants to the effective temperatures were different. On the base of these characteristics the selected plant species were ranked. Furthermore, significant differences were shown when 19th and 20th century temperature sensitivities of the same plant species were compared. Using the first flowering data as proxy for different effective temperatures the accuracy of estimation was between 1.0 °C and 1.5 °C.