Abstract

The 'Cherry Tree Phenology' is an analysis of phenological cherry tree flowering observations. The data covers the extended Swiss Plateau region from Alps to the Basel area. The 280-year composite series includes a set of 14 different records of the 'flowering of the cherry tree' from 1721–2000. The contributions consist of observations from phenological networks as well as records by independent observers.

This interdisciplinary study includes methods from phenological biology, plant physiology, climatology and history. The influence of global and climate change processes on the flowering dates of the cherry tree blossoms are described from different perspectives. In particular, the relation of pre-flowering mean temperature and the flowering date is assessed.

When available, observations from phenological networks were averaged into yearly mean flowering dates in order to remove microclimatic and cultivar specific differences. A comparison between the yearly mean dates of the network observations and independent observations show that the series are well correlated for the 1951/1978–2000 period. Correlation coefficients range between r = 0.78 and 0.91. Mean and single flowering dates from 1721 to 2000 were corrected for altitude to a reference level of 550 m a.s.l. which is the median station height of the Swiss Phenological Network in the study area. The dates were adjusted by + (-) 2.5 days per 100 meters below (above) the reference altitude.

The most important environmental impact factor for the cherry tree flowering date is temperature. For the 1951–2000 period, the most influential pre-flowering mean temperature period was assessed by comparison of the flowering date with monthly and seasonal means at the representative station (Zürich-SMA). A comparison of monthly and combined monthly mean temperatures with the flowering date revealed that the February–April period were highest correlated (r = – 0.82). The correlation is even higher with a subperiod of the Liestal-Record (r = – 0.88). The negative sign describes the inverse physical dependance of the flowering date from temperatures. Thus, warmer mean February–April temperatures result in an earlier flowering date and vice versa.

Based on this relationship a linear regression model, calculated from a predictor set of European monthly mean temperatures, was used to predict the annual flowering date. The correlation coefficient in the calibrating period 1951–1995 was r = 0.84. The comparison of

the observed and reconstructed flowering date for the 1721–1995 period revealed a high common variability (r = 0.61). Systematic differences before 1900 can be attributed to differences in the definition of the phenological phase. The longterm mean of the observed flowering date 1721–2000 is April 21 (day of year 111) with a standard deviation of approximately ten days. For the reconstrucuted series 1721–1995 the mean flowering day is on April 26 (day of year 116) with a standard deviation of five days.

In order to assess the quality of the observation series, subperiods of the contributing records were compared with the statistical reconstruction. Correlation analysis was applied to compare variability. Coefficients range from 0.38 to 0.91. Systematic differences are revealed by comparing mean values for the 14 subperiods. In addition, suprasegmental comparison was assessed by moving correlation analysis with a 31-year time window. Even though significant at 99 % level during the whole study period, three time windows showed a systematic lower moving correlation coefficient. Whereas the lower correlation during the 1827–1845 period can be attributed to unprecise observations, the other two periods (1755–1765, 1885–1895) seem to reveal a lower dependency of the flowering dates on spring temperature.

Systematic differences between observed and reconstructed was additionally assessed with historical source analysis. It is shown that metadata such as biographical notes of the observer and detailed place and phenological phase descriptions, can explain some of the bias in the series.