Geophysical Research Abstracts, Vol. 7, 05282, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05282

Can Phenological Observations and their Statistical Modeling Describe Ecological Response to Climate Change for Switzerland Back to Preindustrial Times?

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Ecological response to recent climate change has been detected. Very clearly, this ecological fingerprint of a changing climate can be seen in plant phenological spring events such as budburst or flowering dates since the 1960s. The shift towards earlier appearance of spring events mirrors warming trends of late winter and spring temperatures based on phenological network observations starting in the 1950s (e.g. Walther et al. Nature 416 389–395 2002; Root et al. Nature 421 57–60 2003). Here we present different statistical reconstructions and associated uncertainties of a phenological spring event (flowering of the cherry tree) to describe the influence of regional temperature changes on interannual to decadal time-scale covering the last 280 years. Differences stem from the choice of calibration periods and predictand variables. Long, homogenized station temperature series are used as predictors. The temperature series are used in a nested procedure and then regressed to a set of different cherry tree flowering series (predictands) from the extended Swiss plateau region. The predictand series include a mean flowering date calculated from the phenological observation network of MeteoSwiss and two independent series from Liestal (northern Switzerland) and Grossaffoltern (west-central Plateau). In addition, regression models are calibrated from 1766 to 1801 when reliable phenological observations and long station temperature series are available. The comparison of the set of reconstructed phenological spring events with historical observations allows us to see whether regional 20th century warming and the corresponding ecological response is unique in time or whether the same response can also be seen in data in preindustrial times.