



Bayesian Multiple Change Point Analysis: A new approach to handle phenological data derived from webcam photography

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Phenological observations have a long tradition, in contrast, digital webcam-based research has considerably increased only in the last years due to the development of user-friendly digital camera systems and its little material and staff costs. Webcam photographies provide spectral information in red, green and blue (RGB) wavelengths which mirror the seasonal colour changes during bud burst, leaf unfolding, senescence and leaf fall.

Recent publications have mainly demonstrated two types of image data analysis to define onset dates of certain phenological stages to compare species and growing seasons easily – on the one hand sigmoid-shaped logistic functions were fitted to datasets, on the other hand maxima and minima of first and second derivatives were calculated. Mainly by reason of the quality of the webcam pictures these methods work well, however, changing light and weather conditions complicate data analysis with increasing camera-to-subject distance.

Webcam images from 2006 and 2007 displaying about 600 meters altitudinal difference of the south slope of the “Großer Falkenstein” (1315 m. a.s.l.), located in the Bavarian Forest National Park (Germany), were analysed with aforementioned methods and compared with results derived from a Bayesian multiple change point model. The pictures provide colour information of different tree species, e.g. *Fagus sylvatica*, *Populus tremula* and *Larix decidua*, as well as trees in different altitudes (700-1100 m). The Bayesian model allows not only the calculation of phenological change points during the year but also the probability of changes at a certain day can be estimated. Especially while handling low quality webcam data in remote areas this method will lead to a higher accuracy in describing phenological events in the growing season.