

COMPARISON OF METHODS FOR PHENOLOGY

Adrian M.I. Roberts

Biomathematics and Statistics Scotland

Climate change is likely to affect the timing of natural events and this in turn may upset ecosystems. As a result, there is renewed interest in phenology.

Phenological records can be related to weather data using association-based models or mechanistic models. Examples of the latter include thermal time models. In these the event is expected to occur once sufficient temperature-time units have been accumulated. There may also be a chilling requirement. Although in principle mechanistic models seem to provide the better approach because of their biological basis, they can be difficult to fit and are less flexible. Also such models are not available for all types of natural event.

In the case of association-based methods, linear regression is commonly used, particularly stepwise regression. However such methods generally do not perform well with many highly correlated regressors, so weather data is typically aggregated to monthly means. Penalised regression has been proposed as a way to analyse daily measurements, giving more interpretable results than other methods for high dimensional data such as partial least squares or ridge regression. Differences between consecutive regression coefficients are penalised, resulting in a smooth profile of coefficients. Extensions of this methodology allow the exploration of the effects of covariates, generating multidimensional surfaces of coefficients.

Here we compare penalised regression with some examples of mechanistic models. We investigate to what degree results from a penalised regression can be interpreted in terms of an underlying biological model and how the number of observations affects the quality of results.