# Analysis of trends in sweet cherry flowering data across Europe

Bénédicte Wenden[1,2], Mahendra Mariadassou[3], José Antonio Campoy[1,2], José Quero-Garcia[1,2], Elisabeth Dirlewanger[1,2]

[1]INRA, UMR 1332 Biologie du Fruit et Pathologie, F-33140 Villenave d'Ornon, France
[2]Université de Bordeaux, UMR 1332 de Biologie du Fruit et Pathologie, F-33140 Villenave d'Ornon, France
[3]INRA, UR 1077 Mathématique, Informatique et Génome, 78350 Jouy-en-Josas, France

## Introduction

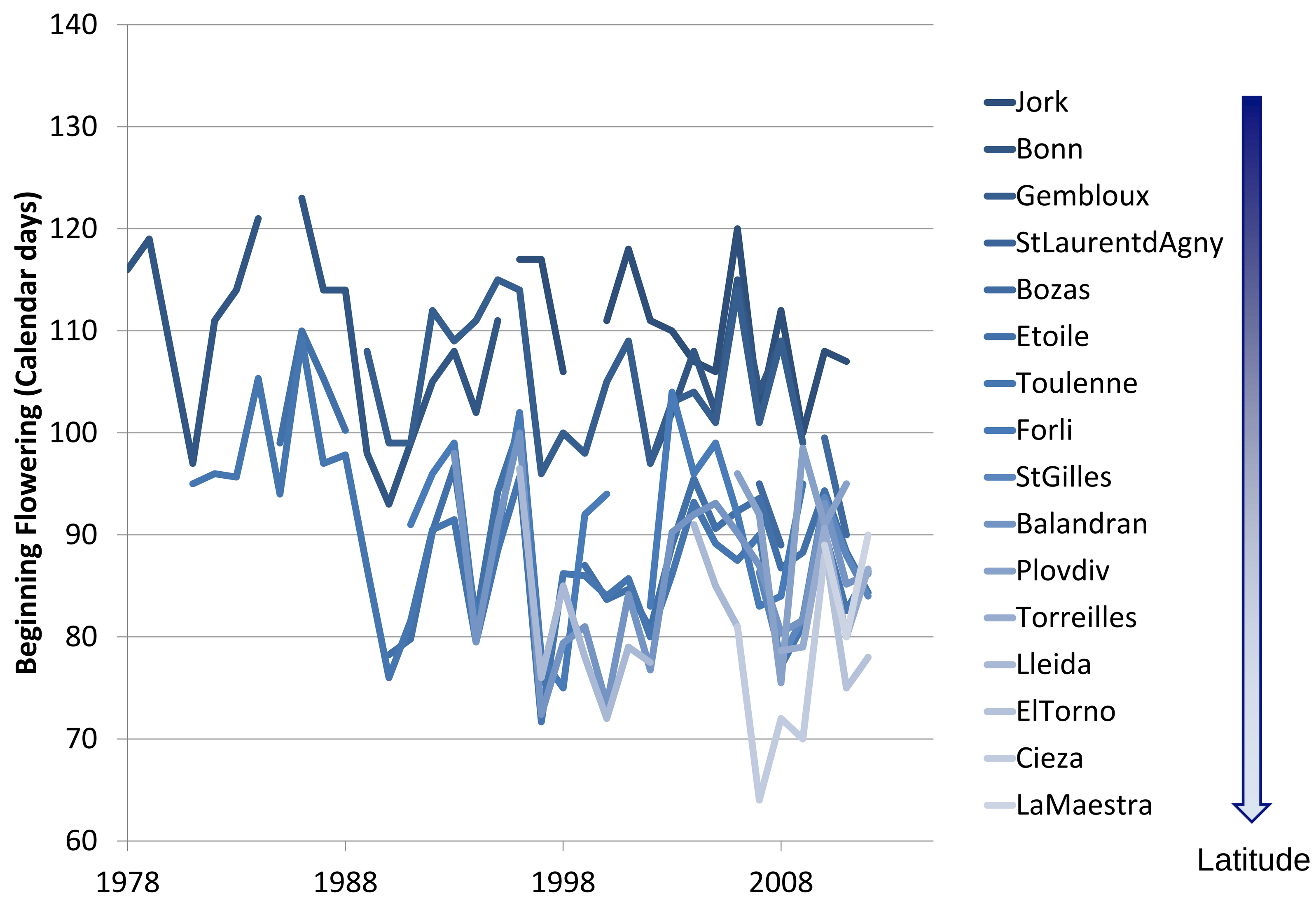
In temperate fruit trees, most key phenological stages are highly dependent on environmental conditions. In particular, correct timing for dormancy and flowering is essential to ensure good fruit production and quality. As a result, in a swiftly-changing environment, temperate fruit crop adaptation in many areas will be at risk in the coming decades. Global changes in environmental conditions include warmer autumn/winter periods and higher risks of frosts in the early spring, leading to a wide range of problems: flower and fruit set, sun-scald, cross-pollination or novel host-pest interaction.
With the final aim of better understanding the response of flowering to climatic conditions, flowering data for various sweet cherry cultivars from numerous sites in Europe, characterized by a wide range of climatic conditions, have been collected and analysed.

Extract the main trends in the flowering dates over Europe and better understand the response to temperature in contrasted environments

## Collecting sweet cherry flowering data from European countries

Ctifl

Cherry COST FA1104



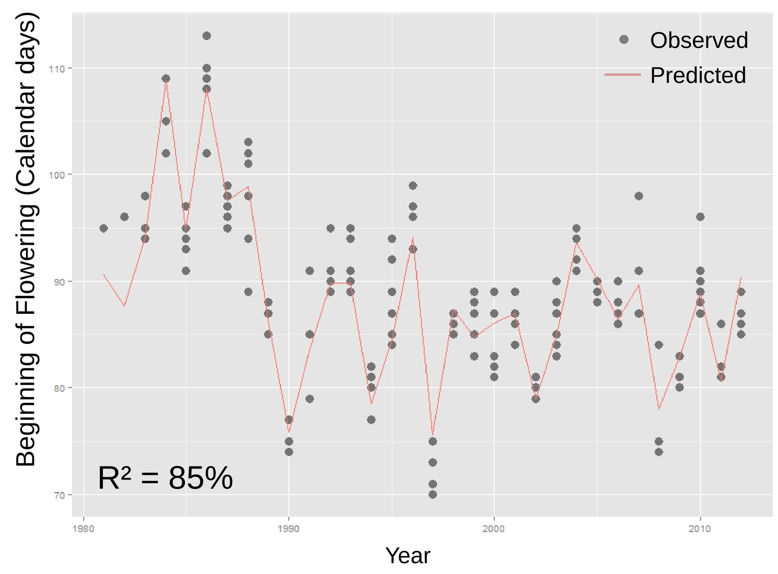

Flowering data were provided through a national network of experimentation (CTIFL) and a European COST action on sweet cherry that INRA-Bordeaux is leading.

- 17 000 data points
- 1978 - 2013
- Beginning, full, end of flowering, maturity dates

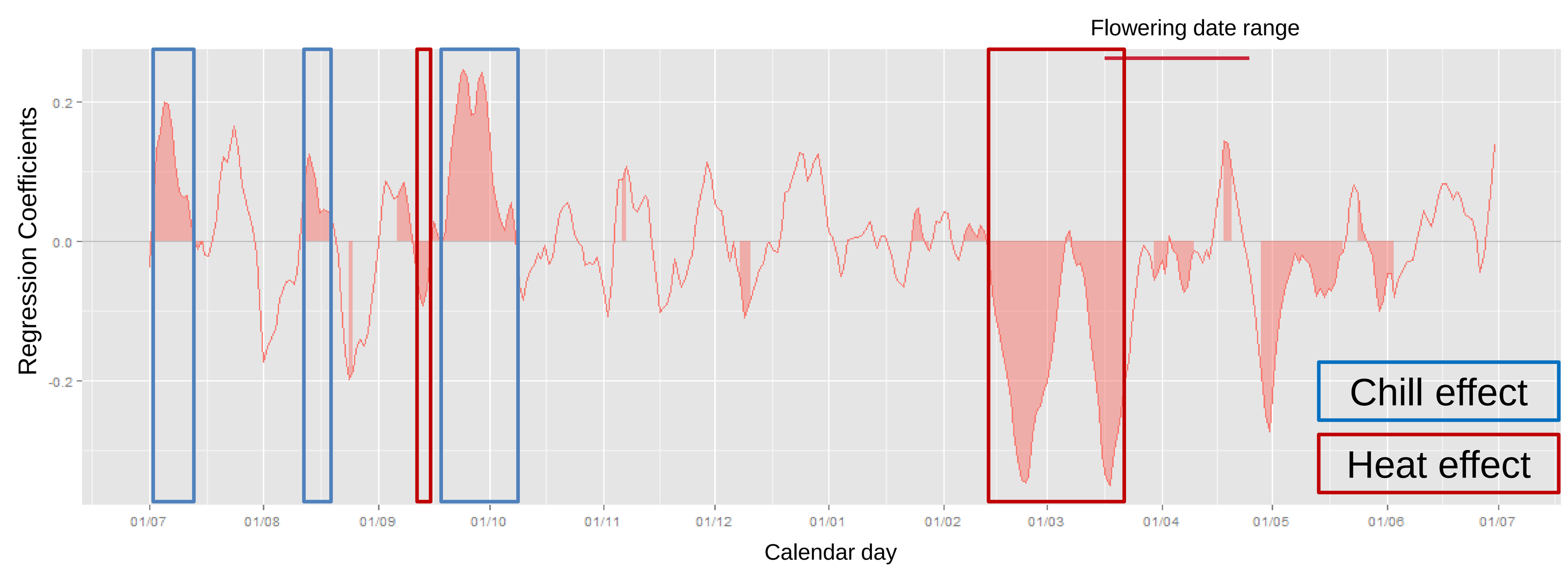
- What characterizes early or late years?
- Which temperatures have a significant effect on flowering date?

## Data analysis – Response to temperature

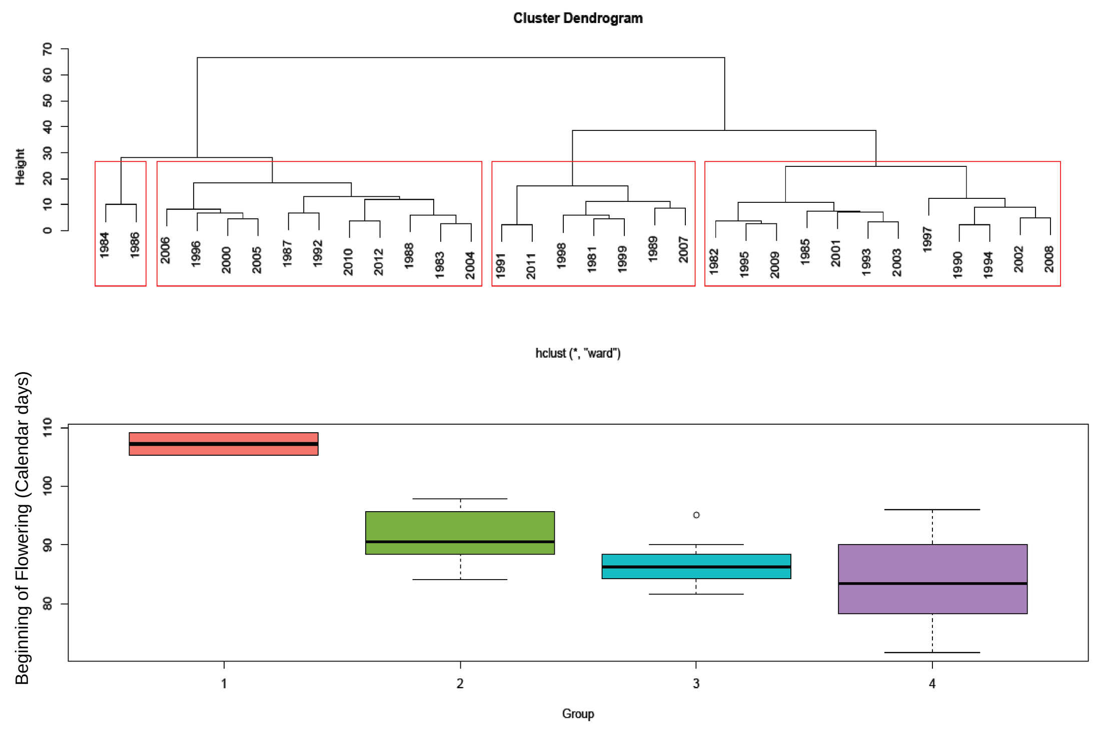
Partial Least Squares (PLS) Regression allows **regression** of the **flowering date** with multiple 365 **correlated variables (Daily Temperatures)** associated with 365 **coefficients**




Predictions using PLS regression for Beginning of flowering on Burlat in Bordeaux




Temperature coefficients for Beginning of flowering on Burlat in Bordeaux (July to June) Filled zones correspond to **VIP >0.8** (Variable Importance on the Projection): periods with a significant effect of temperature on flowering date.




Hierarchical clustering on years according to flowering dates and their temperature parameters obtained from the PLS regression analysis

High predictive efficiency

Chill effect / or negative heat effect on flowering in July, August and September/October

Confirmation of the heat requirement period in February/March

Years clustering allows analyses of the main temperature trends within the cluster groups

(Adapted from ChillR R package; Luedeling *et al.*, 2012)

## Perspectives

This PLS regression package for phenology is currently being improved to allow multi-cultivar and multi-sites analyses. It will represent a valuable statistical tool for extracting the main trends in the phenology response to climatic conditions. European data will allow comparing the responses to contrasted temperature conditions.
We will further investigate the periods identified as crucial for chill requirements, especially the unexpected ones (July).
These results represent the first step towards developing a predictive model for flowering in sweet cherry that will integrate phenology data together with genetic and genomic information.

RGC7 7th International Rosaceae Genomics Conference

**7th International Rosaceae Genomics Conference / June 24-26, 2014 – Seattle, Washington, USA**