# An Australian wine grape Phenology model

Dane Thomas[1,2] , Marcos Bonada[1,2], Wendy Cameron[3], Joanna Gambetta[4], Peter Hayman[1,2], Victor Sadras[1,2] and Paul Petrie[1,2]

[1]South Australian Research and Development Institute, GPO Box 397, Adelaide SA 5001
[2]School of Agriculture, Food and Wine, The University of Adelaide, Waite Campus, Glen Osmond SA 5064
[3]Melbourne University, Parkville Vic 3052
[4]CSIRO, Werribee Vic 3030

## Introduction

Phenology models are useful for tactical and strategic decisions in viticulture. These include timing of pesticide applications to ensure withholding periods are met or managing preparations for harvest. Accurate models will also aid our understanding of environmental and management impacts on vintage advancement and compression.

Directly using models developed in other continents gave poor performance in Australia. We are developing and testing a range of phenology models that relate local temperature observations and historical dates for development from budburst to harvest in Australia.

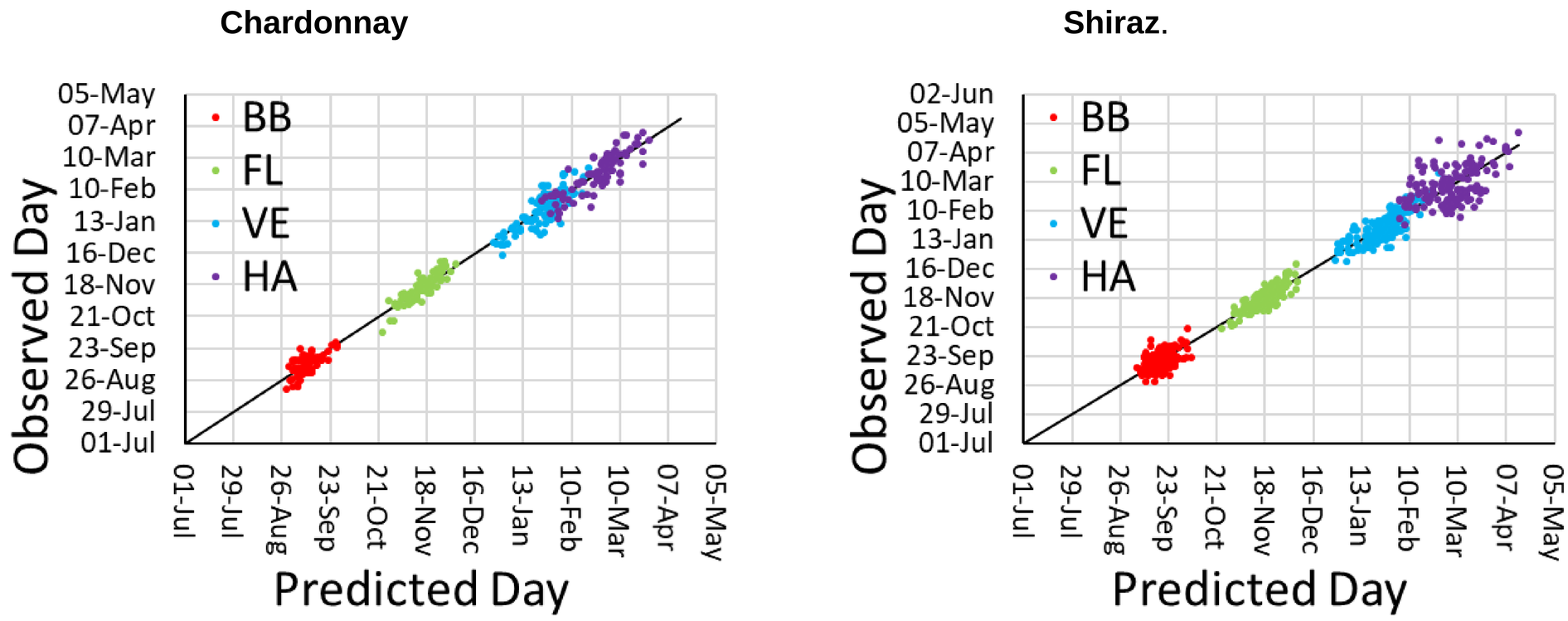
## Methods

- Phenological data (730 vintage years) from WA, SA and Victoria have been used covering 10 varieties, although most observations are of Chardonnay (129 vintage years), Shiraz (233 vintage years), Cabernet Sauvignon (103 vintage years) and Merlot (77 vintage years).
- Model validity will be improved by using more observations. Please contact us if you are able to provide further phenology observations.
- Models were developed to predict date of phenophases from the accumulation of Heat sums.
- Heat sums were calculated using temperature functions with different sensitivities to mean daily temperature or to hourly temperature.
- Models were developed commencing at either a common date (e.g. 1 July, 14 Aug) or commencing at an earlier phenophase (e.g. budburst).
- Model performance were examined by Root Mean Square Error (RMSE), Correlation and Nash-Sutcliffe model efficiency.

## Results

- Chardonnay was modelled better than Shiraz.
- The dates of budburst and flowering were modelled more accurately with an RMSE of roughly 7 days compared to date of veraison with RMSE of 9 days (Figure 1).
- Harvest (or maturity) was the most poorly predicted phenophase in all varieties. In Chardonnay it had an RMSE of 10 days. In Shiraz it had an RMSE of more than 15 days.
- The prediction of days between budburst and flowering was very good, and slightly better than the prediction of days between flowering and veraison. The prediction of days between veraison and harvest was extremely poor (correlation <0.1).
- No single model performed best for all phenophases and varieties. We found models that penalised both very low and very high temperatures performed better, while those using hourly temperatures generally performed no better than those using mean daily temperature.

***Figure 1.*** *Predicted day of the phenophases compared to Observed day according to a better performing model for Chardonnay (left) and Shiraz (right). The heat sum function, similar to biologically effective degree days, was GDD with base of 5 ℃ but with a maximum of 19 ℃. Phenophases were modelled from accumulated daily heat sums commencing from 14 August. 1:1 lines shown in black.*




## Conclusion

- The decline on model performance at later phenophases is consistent with the temperature driven developmental nature of processes up to flowering and the resource (water and carbon) driven process dominant during ripening.

Wine Australia

**FURTHER INFORMATION**

**Dane Thomas**
**P:** (08) 84290670
**E:** dane.thomas@sa.gov.au
www.pir.sa.gov.au

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