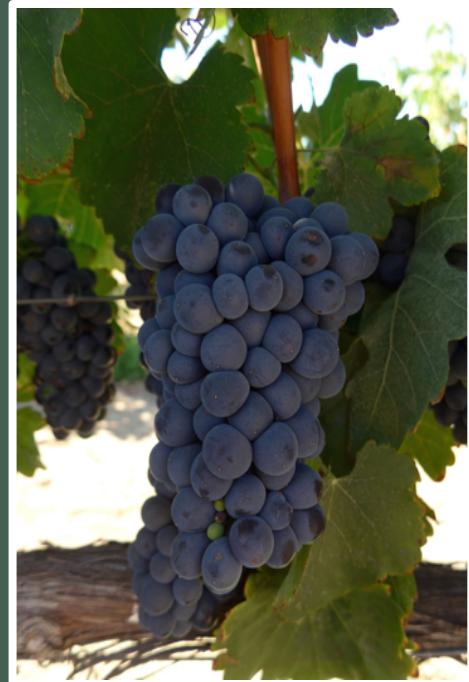


THE DURATION OF INTERPHENOPHASES IN WINEGRAPES

Mira Garner

Interphenophase: the duration between individual phenological events



Budburst to Flowering

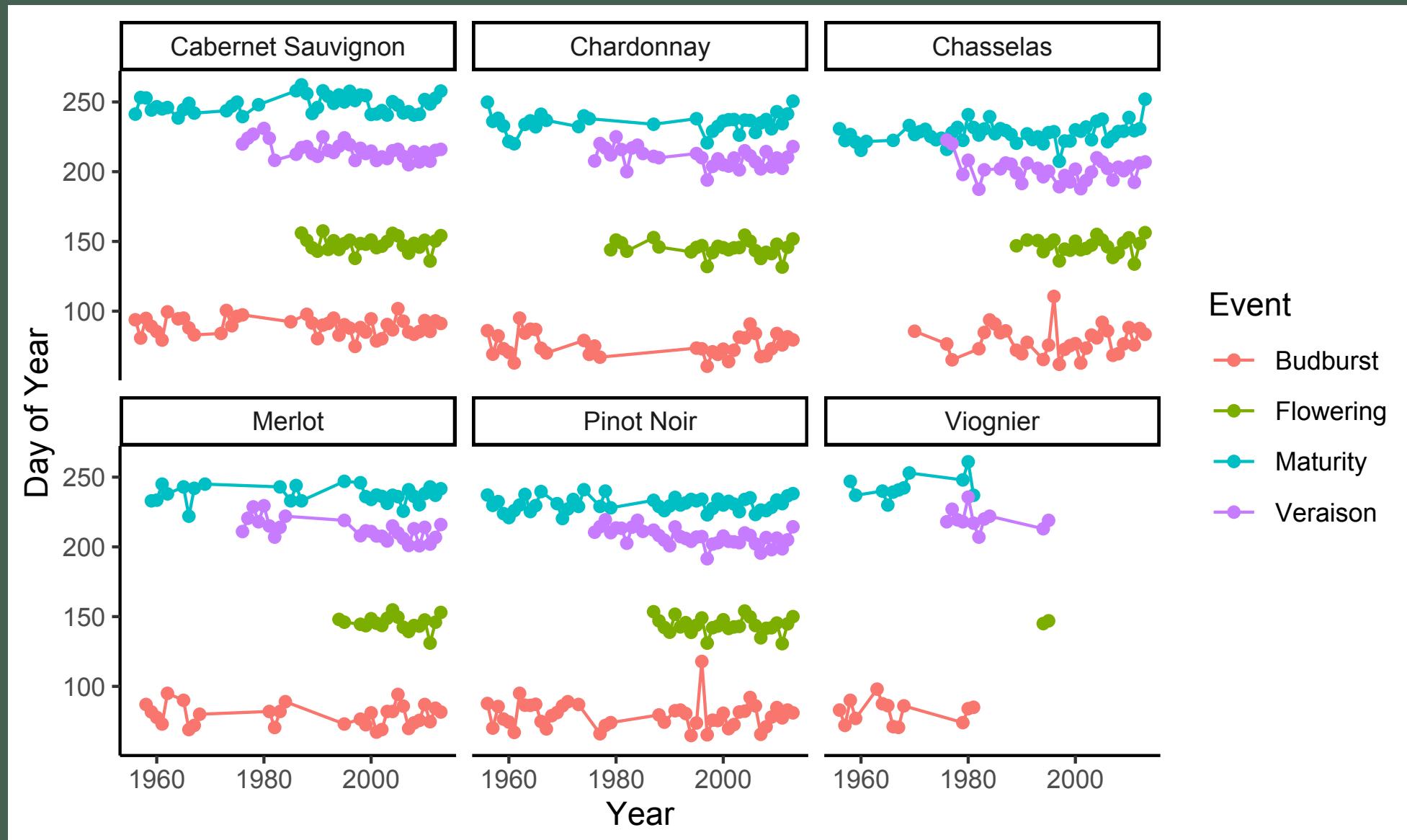
Flowering to Veraison

Veraison to Maturity

The Datasets: Domaine De vassal



<https://amarchinthhevines.org/2015/11/05/domaine-vassal-wine-worlds-heritage-site/>



1. Have the durations of the interphenophases changed since the 1980s?

- Veraison and maturity (harvest)
- Flowering and veraison
- Budburst and flowering

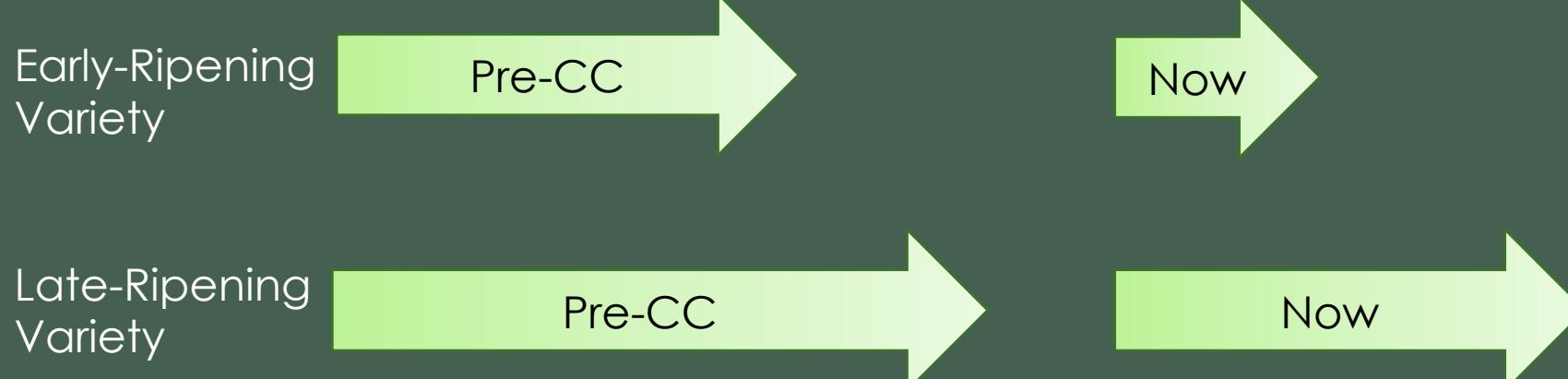


Research Questions

Research Questions

2. If so, do these changes differ among varieties?
 - We expect to see difference among varieties.
 - Late-ripening vs early-ripening

Fruit Ripening Interphenophase



Research Questions

3. Have growing degree days (GDD)
between phenological events changed
since the 1980s?

GDD Pre-CC  GDD Now

Research Questions

4. Does the required GDD of interphenophases correlate with shifts in phenological events in a way that constricts vine growth and development?

- We expect to see correlations between events and interphenophases.

- early budburst and flowering varieties  ripening GDD

- late budburst and flowering varieties  ripening GDD

Model: Duration in Days:

$$\text{Predicted Duration} \sim N(\mu_{variety}, e) \quad (1)$$

$$\mu_{variety} = \alpha_{variety} + \beta_{variety} * year \quad (2)$$

$$\alpha_{variety} \sim N(\mu_a, \sigma_a) \quad (3)$$

$$\beta_{variety} \sim N(\mu_b, \sigma_b) \quad (4)$$

Model: Duration in GDD:

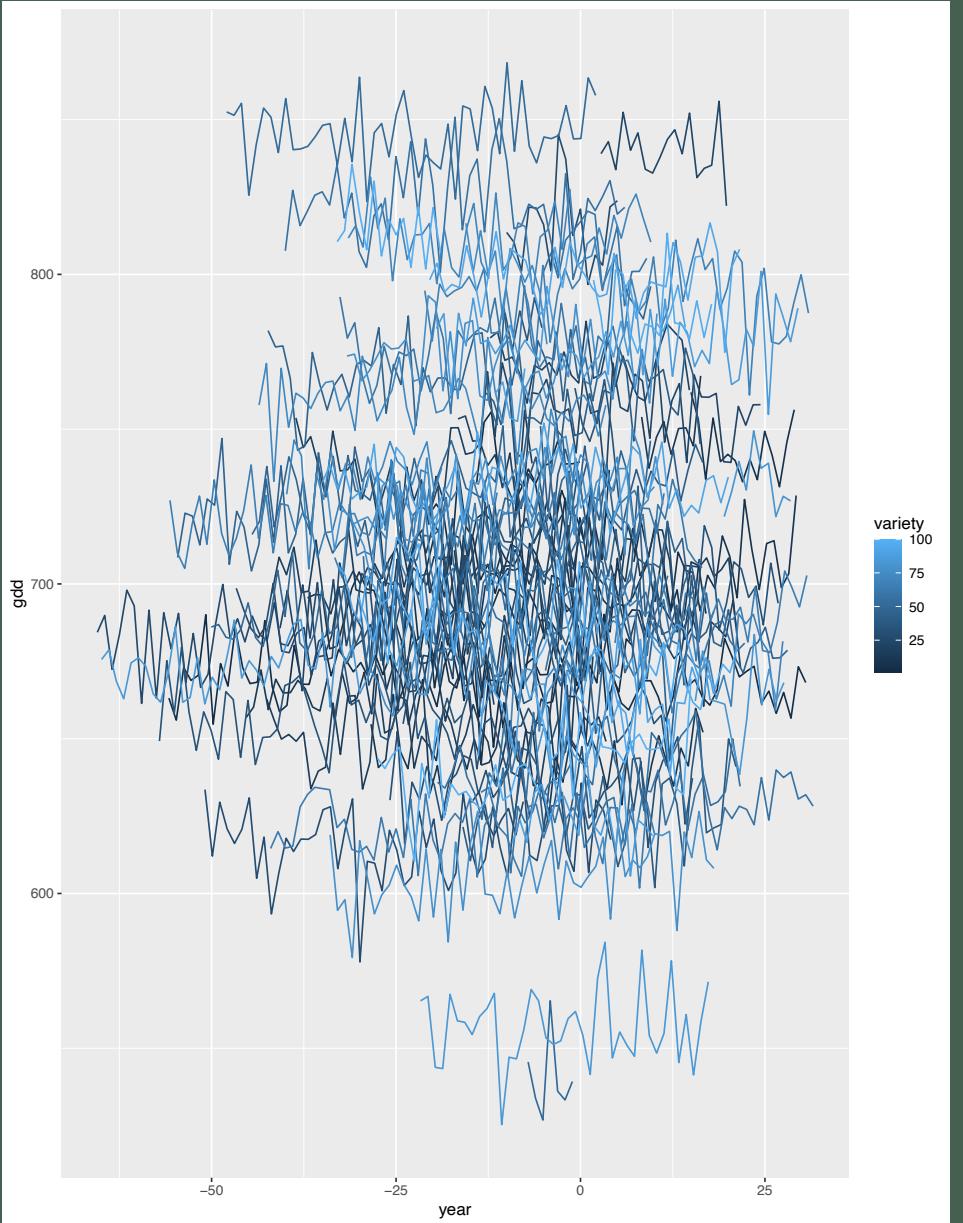
$$GDD \sim N(\mu_{variety}, e) \quad (5)$$

$$\mu_{variety} = \alpha_{variety} + \beta_{variety} * year \quad (6)$$

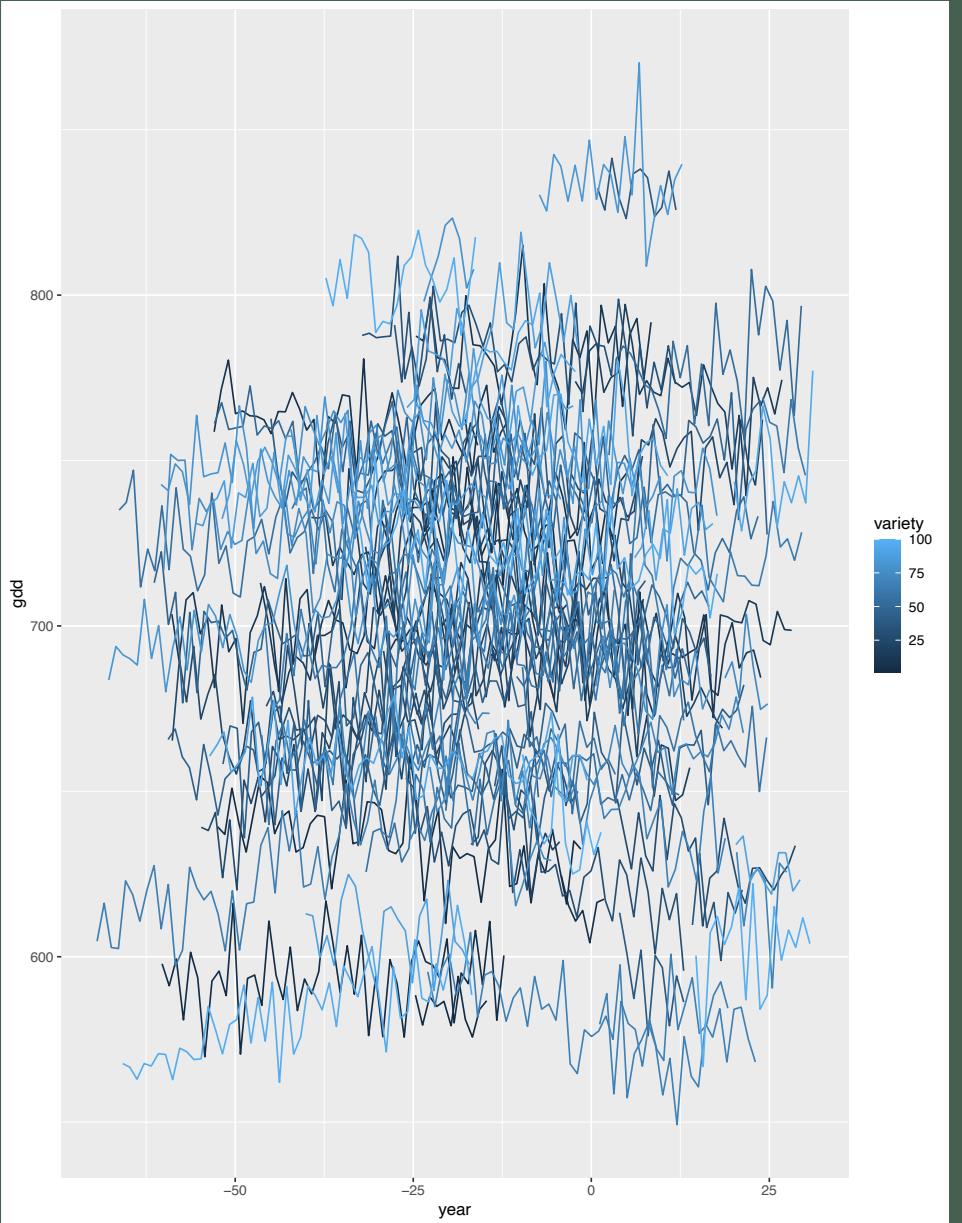
$$\alpha_{variety} \sim N(\mu_a, \sigma_a) \quad (7)$$

$$\beta_{variety} \sim N(\mu_b, \sigma_b) \quad (8)$$

Single slope Simulated Data



Multi Slope Simulated Data



Same error
for both
models:

```
Chain 4:           7.99676 seconds (Total)
Chain 4:
Warning message:
Bulk Effective Samples Size (ESS) is too low, indicating posterior means and medians may be unreliable.
Running the chains for more iterations may help. See
http://mc-stan.org/misc/warnings.html#bulk-ess
> #summo[grep("mu_ ", rownames(summo)),]
> #summo[grep("s\\_ ", rownames(summo)),]
> #summo[grep("sigma_y", rownames(summo)),]
> precis(modone)
224 vector or matrix parameters omitted in display. Use depth=2 to show them.
      Mean StdDev lower 0.89 upper 0.89 n_eff Rhat
mu_a    695.91   20.23     663.73     727.85    269 1.01
mu_b     -0.17    0.01     -0.19     -0.15     368 1.01
s_avar   49.89    5.20     41.86     58.39    1223 1.00
s_bvar    0.08    0.01     0.07     0.09    3431 1.00
sigma_y  83.53    2.29     79.91     87.27    5972 1.00
>
```

Next Steps

- Fix GDD model issue
- Start on model with event date as predictor
- Question 2 analyses

What's known about interphenophases?

