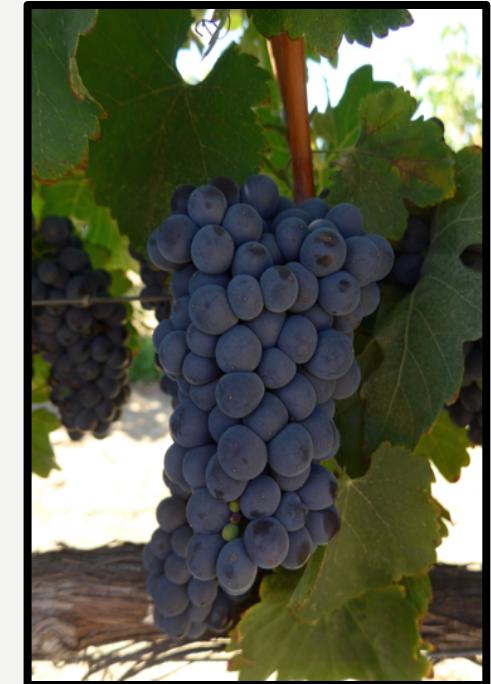


MIRA
GARNER

**BAYES CLASS 9
MARCH 2021:
WINEGRAPE
INTERPHENOPHASES**

Interphenophase: the duration between individual phenological events

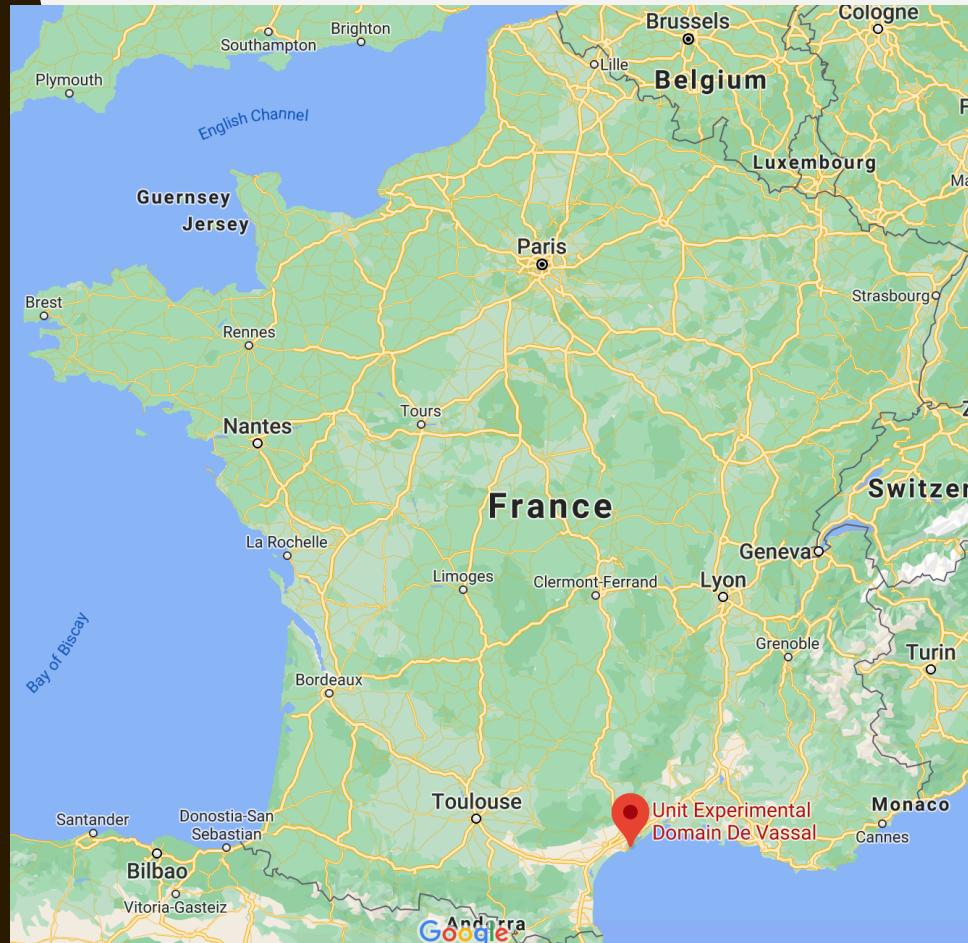


Budburst to Flowering

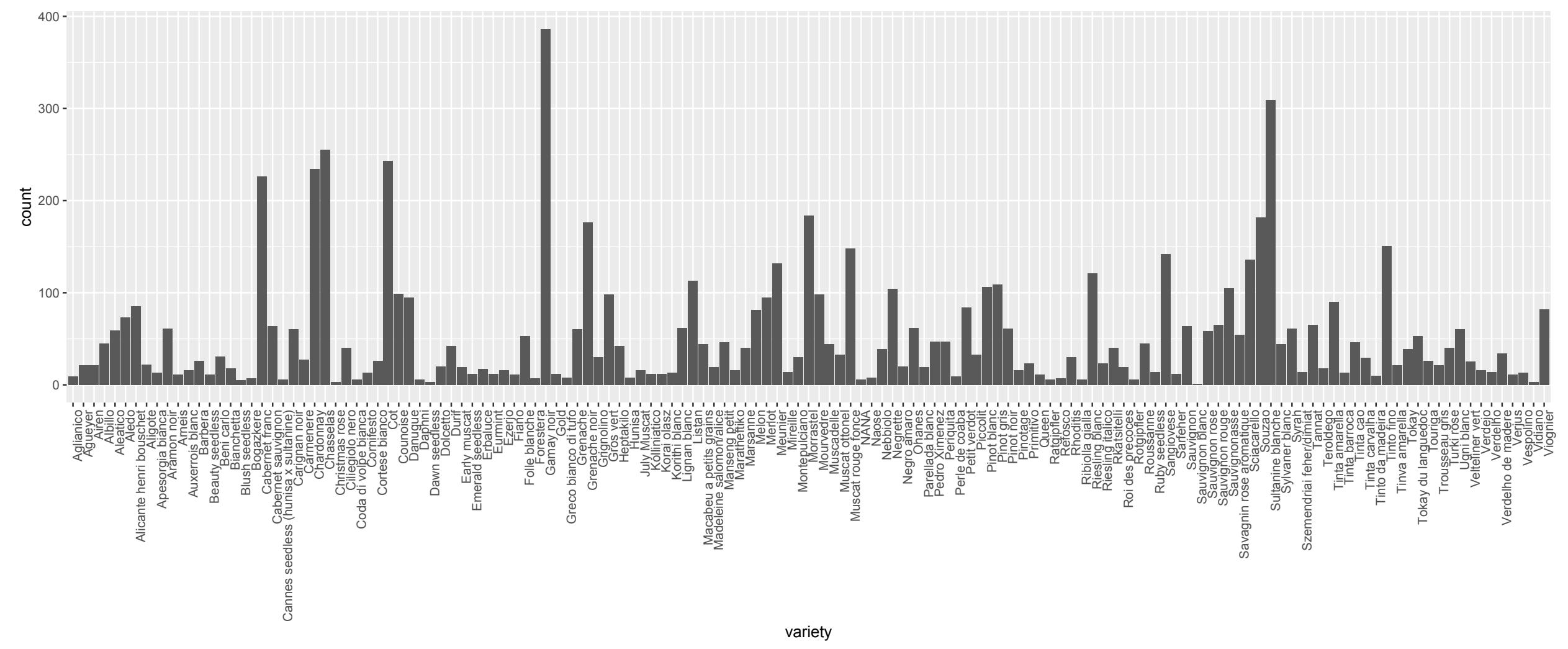
Flowering to Veraison

Veraison to Maturity

THE DATASETS: DOMAINE DE VASSAL

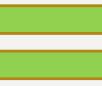


<https://amarchinthevines.org/2015/11/05/domaine-vassal-wine-worlds-heritage-site/>



VARIETY DIVERSITY

RESEARCH QUESTIONS

- I. Have the durations of the interphenophases changed since the 1980s?
 - Veraison and maturity (harvest) 
 - Flowering and veraison 
 - Budburst and flowering 

RESEARCH QUESTIONS

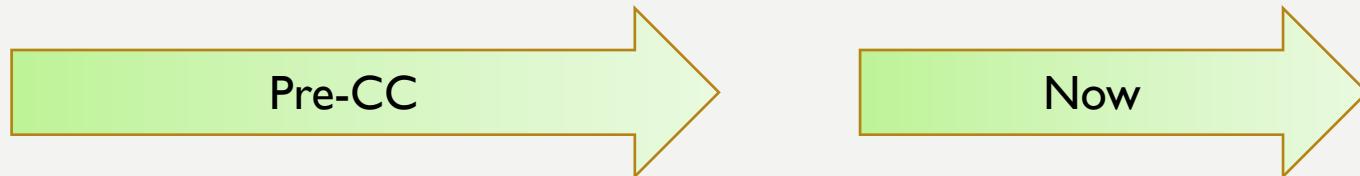
2. If so, do these changes differ among varieties?
 - We expect to see difference among varieties.
 - Late-ripening vs early-ripening

Fruit Ripening Interphenophase

Early-Ripening Variety



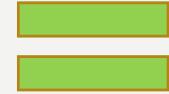
Late-Ripening Variety



RESEARCH QUESTIONS

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

GDD Pre-CC



GDD Now

RESEARCH QUESTIONS

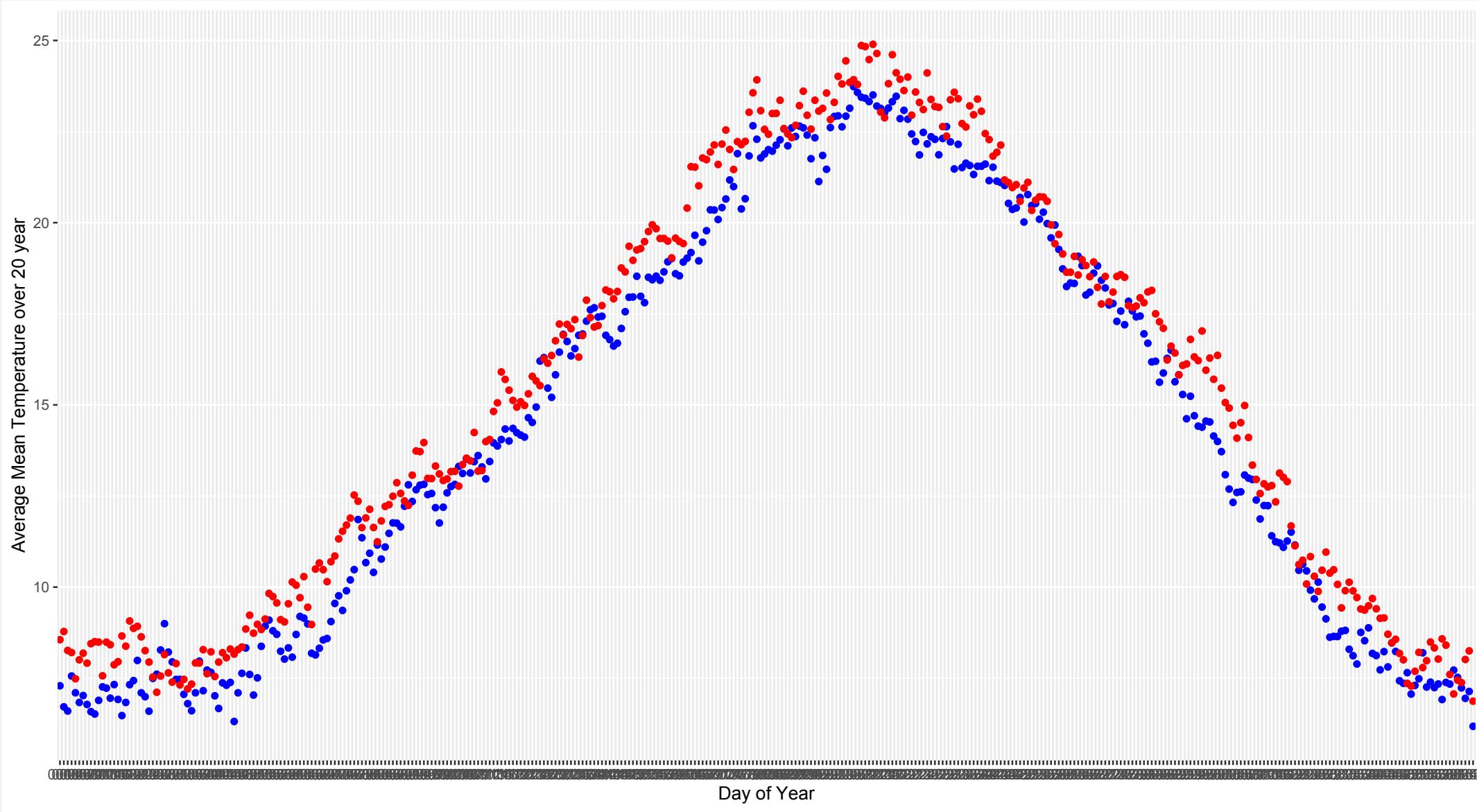
4. Is warming equal across seasons?

Uneven warming is more likely but I don't have specific predictions.

1955-1975

VS

1995-2015



MODEL: DURATION IN DAYS:

- I. Have the durations of the interphenophases changed since the 1980s?

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

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

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

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

*year hinged!

MODEL: DURATION IN GDD:

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

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

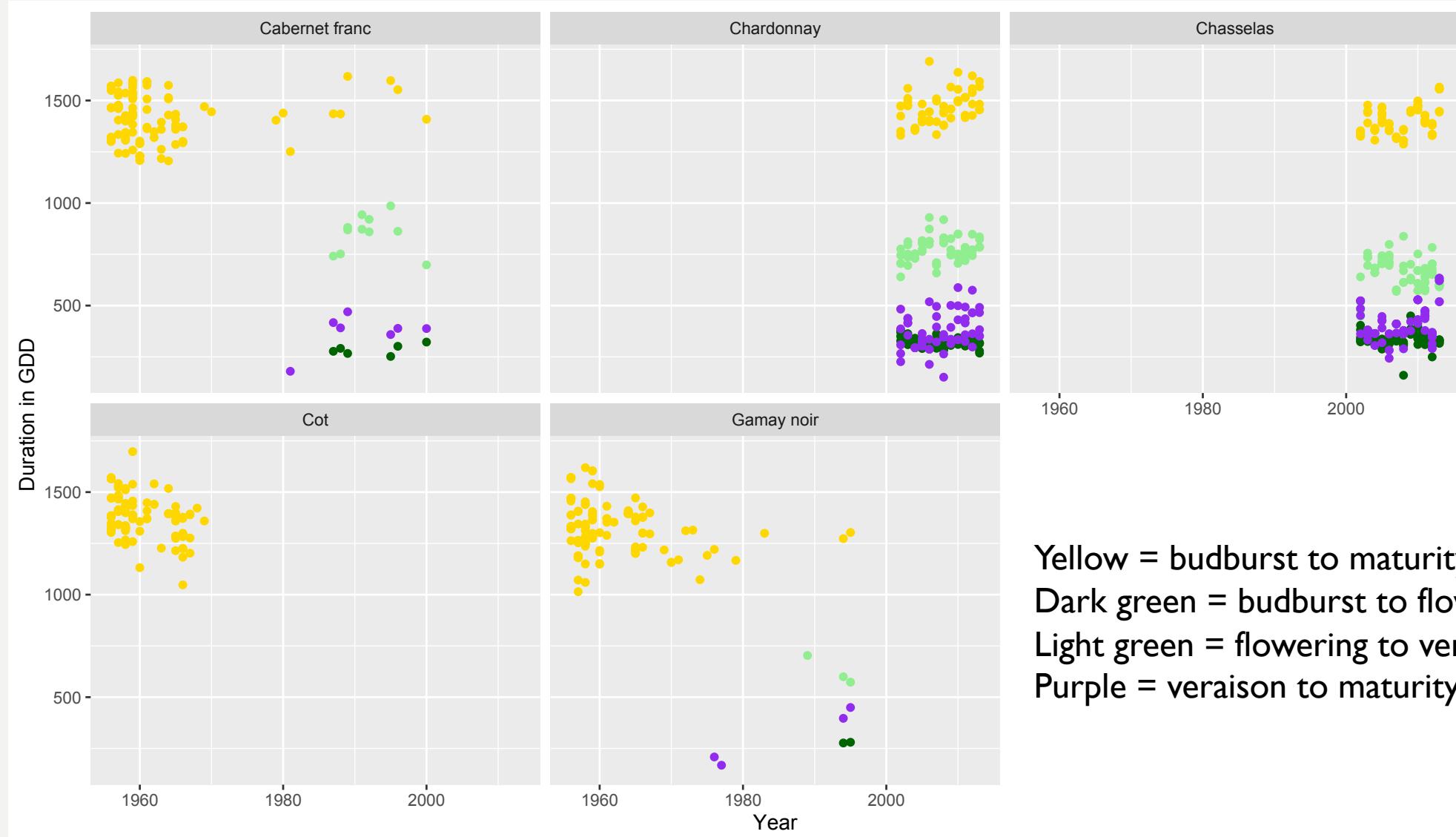
$$\mu_{variety} = \alpha_{variety} + \beta_{variety} * year \quad (6)$$

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

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

*year hinged!

WITNESS VARIETY GDD

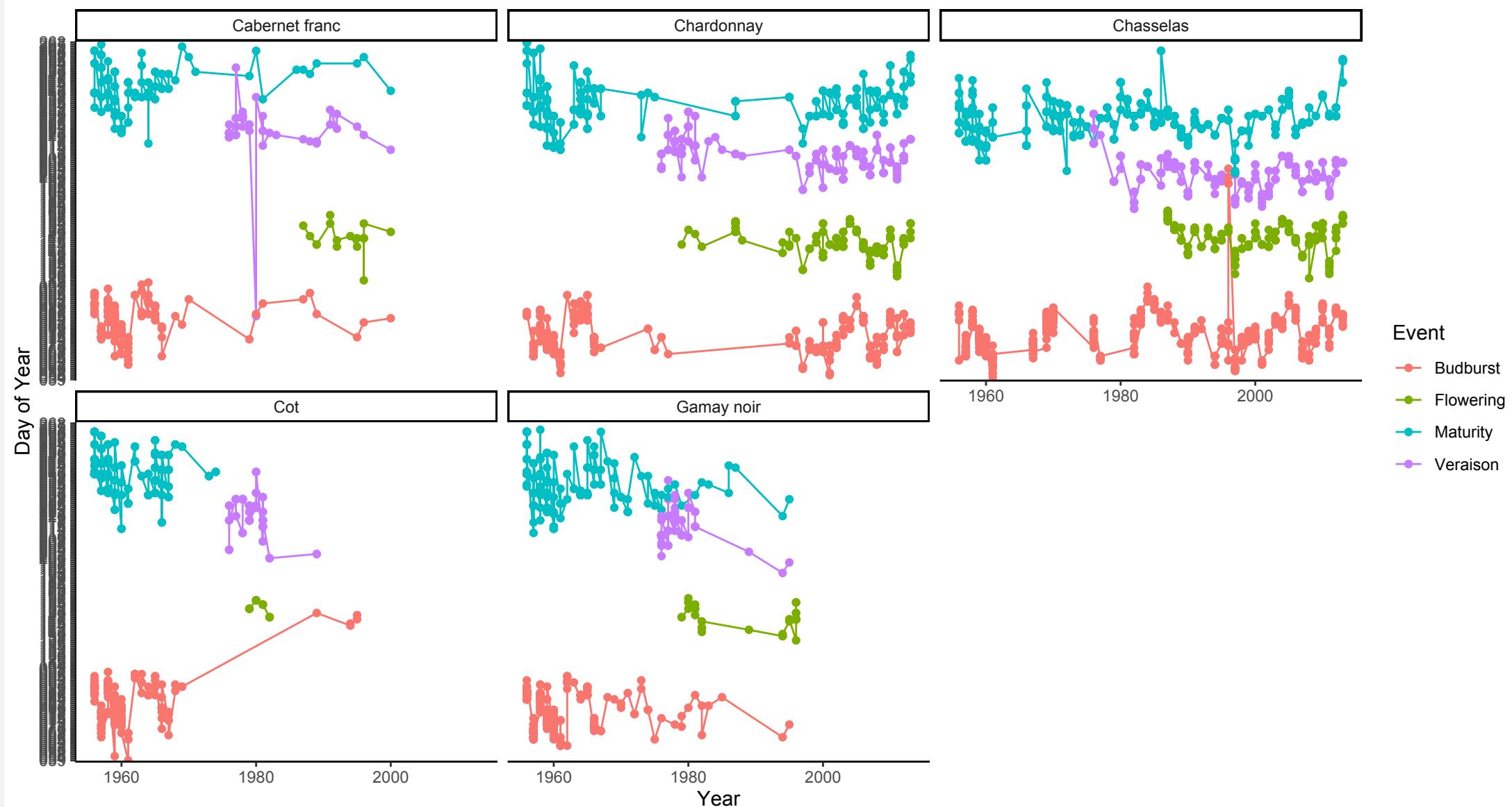


Yellow = budburst to maturity
Dark green = budburst to flowering
Light green = flowering to veraison
Purple = veraison to maturity

ALL VARIETIES GDD



WITNESS EVENT DATE

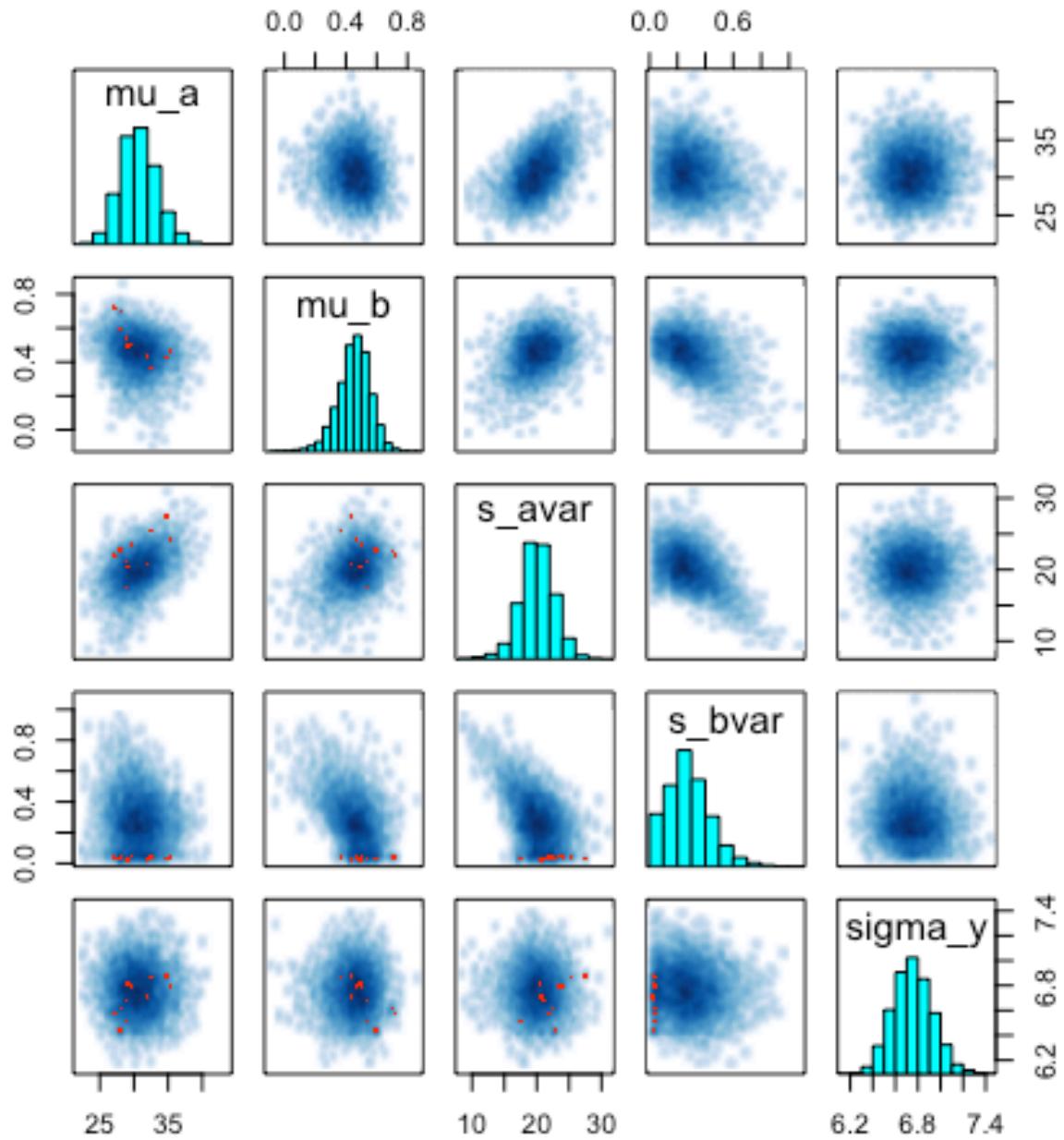


MODEL WARNINGS

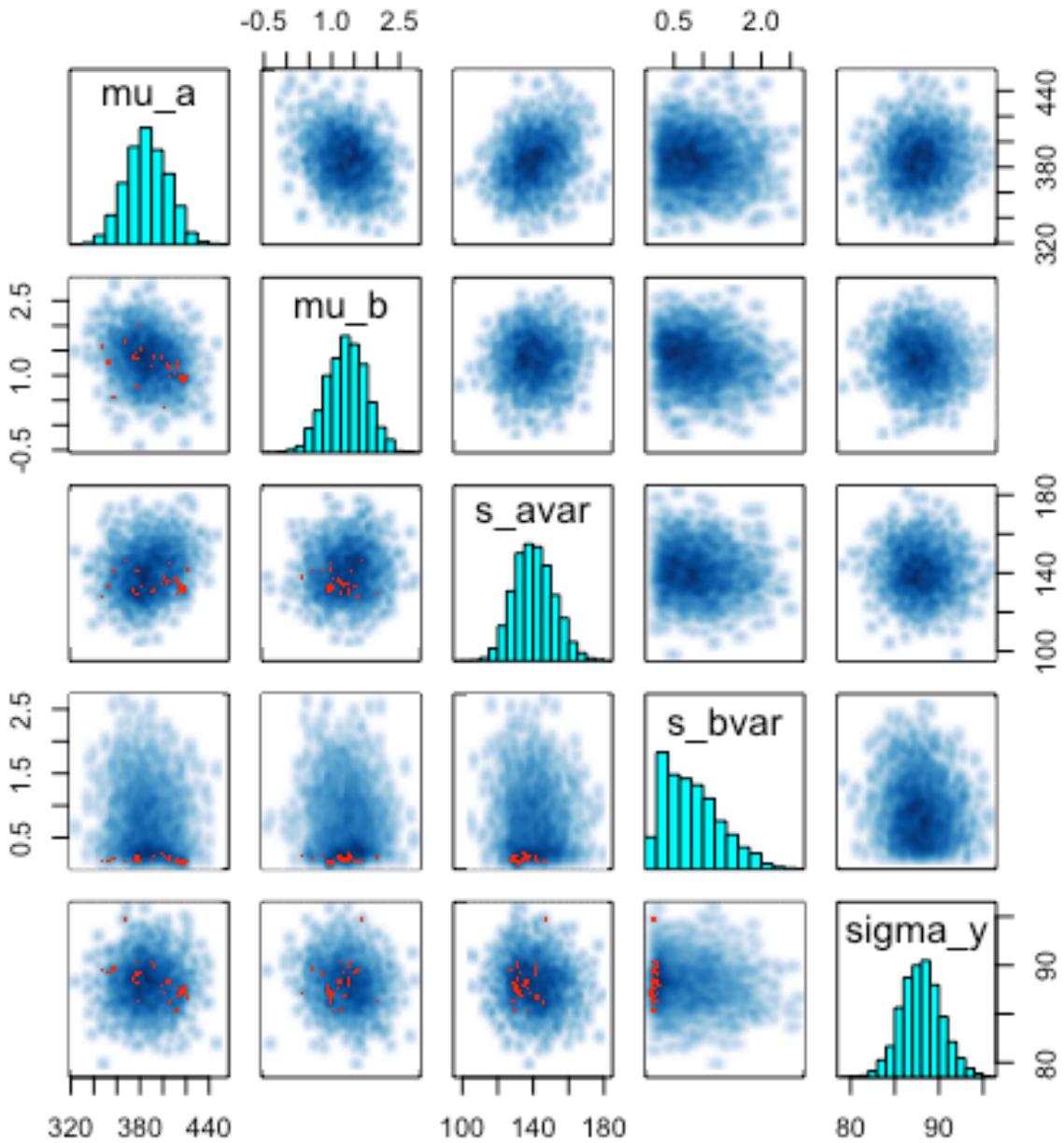
- Days Model warnings (8000 sample, 6000 warmup): 14 divergent transitions, bulk effective and tail effective sample size too low, low `n_eff`
- GDD Model warning (8000 sample, 7000 warmup): 46 divergent transitions, `n_eff` low, `s_bvar` chains not mixed and `mu_b` doesn't look great either



MODEL VRMT DAYS DURATION



MODEL VRMT GDD



NEXT STEPS

- Deal with data dropping out and duplicates?
- Models – change priors based on graphs and total season GDD?
- Variety differences – add dummy variable into models for early, middle, late (as classified by Jancis Robinson?)
- Uneven warming – new model for our climate data? More simple analysis?
- Event date changes – again, new model?

