Paper 2: Interactions & isolating factors: Jeff, Christy, Lizzie, Ailene\* (1) , Miriam

Summary of problem/question:

We know that there are discrepancies in plant phenological responses within experiments vs observational studies. Phenological responses in experiments are less sensitive to warming (i.e. they advance fewer days per degree of warming) then in observational studies over time. The underlying cause of this discrepancy is unclear, however. We first compare GDDcrit across experiments and observations, for studies that contain the same species. We then use detailed plot-level microclimate data from experimental warming studies to test one possible cause: that warming experiments alter soil moisture in ways that may reduce the climate sensitivity of phenological events.

Specifically, we ask:

1. How do GDD affect phenology in experiments vs observational studies?
2. How do warming treatments alter soil moisture?
3. How do temperature and soil moisture interact to affect phenology?

Approach:

1. How do GDD affect phenology in experiments vs observational studies?

This is the one that I’m struggling with- how do we realistically compare these, using GDD. Would we expect GDD to be the same across experiments and observations, if species match? There are two possible approaches I can think of to address this question, but I’m honestly not sure that either is valid!

* 1. Plot GDDcrit values by study type (experiment, observation) and look at variation (among treatments, years)?
     1. Model: lmer(GDDcrit~studytype + (1|site/spp))
  2. Compare GDDcrit in warm years vs cold years for observational studies, and by temp treatment for experiments
     1. Observational Model: lmer(GDDcrit~temperature + (1|site/spp))

Where “temperature” = mean annual temperature or some seasonal temperature? (the idea is to see how GDDcrit varies with temp)

* + 1. Experiment Model: lmer(GDDcrit~temperature + (1|site/spp))

Where “temperature” = mean annual temperature (or some seasonal temperature) measured in the plot

1. How do warming treatments alter soil moisture?
   1. Compare soil moisture by temperature treatment
   2. Plots over time?
   3. Model: lmer(soil moisture~temptreatment + (1|site))
   4. Miriam is working on this
2. How do temperature and soil moisture interact to affect phenology?
   1. Look at effect of temperature treatment on GDDcrit with and without Precip added and/or interaction between temperature and soil moisture
   2. Plot GDDcrit values by temp and precip treatment (or using measured temp/soil moisture?)
   3. Model: lmer(GDDcrit~temptreament\*preciptreatment + (1|site/spp))
   4. I am working on this