

# Assignment 2: Almond Function

Steven Cognac, Marie Rivers, Bri Baker

4/7/2022

## Read in Climate Data

```
# import climate data hosted on Namoi Tague's github
clim <- read.csv(
  "https://raw.githubusercontent.com/naomitague/ESM232_Examples/main/Data/clim.txt",
  sep = " ", header=TRUE)
```

## Run Almond Yield Anomaly Model.

```
# import function
source(here("R", "almond_yield_anom.R"))

# run function using climate data
almond_yield_anomaly <- almond_yield_anom(climate_data = clim)
```

```
# pull yield anomaly for years of interest
anom_2000 <- almond_yield_anomaly$almond_yield_anom_tons_per_acre[almond_yield_anomaly$year == 2000]
anom_2001 <- almond_yield_anomaly$almond_yield_anom_tons_per_acre[almond_yield_anomaly$year == 2001]
anom_2002 <- almond_yield_anomaly$almond_yield_anom_tons_per_acre[almond_yield_anomaly$year == 2002]

# print values
anom_2000
```

```
## [1] 9.599988
```

```
anom_2001
```

```
## [1] 159.512
```

```
anom_2002
```

```
## [1] 0.2450914
```

## Summary of Outputs

```
# plot almond yield
almond_plot <- ggplot(data = almond_yield_anomaly,
                      aes(x = year, y = almond_yield_anom_tons_per_acre)) +
  geom_point() +
  labs(title = "Modeled Almond Yield Anomaly",
       y = "tons/acre")

# plot of mean February minimum temperature
temp_min_plot <- ggplot(data = almond_yield_anomaly, aes(x = year, y = tn_2_values)) +
  geom_line() +
  labs(title = "Mean of Observed Minimum February Temperatures",
       y = "°C")

# precipitation plot
precip_plot <- ggplot(data = almond_yield_anomaly, aes(x = year, y = p_1_values)) +
  geom_col() +
  labs(title = "Total January Precipitation",
       y = "mm")

(almond_plot / precip_plot / temp_min_plot) +
  labs(caption = "Estimated anomaly of annual almond yields and model inputs based on the paper by Lobe",
       theme(plot.caption = element_text(hjust = 0), plot.caption.position = "plot") +
  plot_annotation(tag_levels = c("1", "2", "3"), tag_prefix = 'Figure ')
```

Figure 1

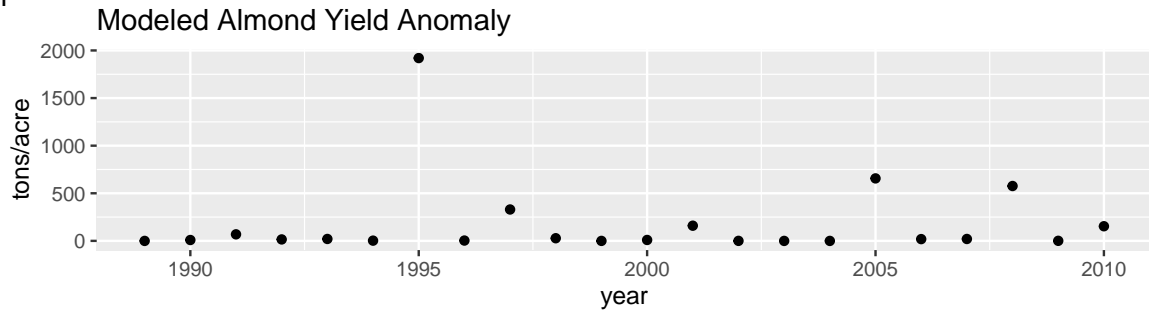


Figure 2

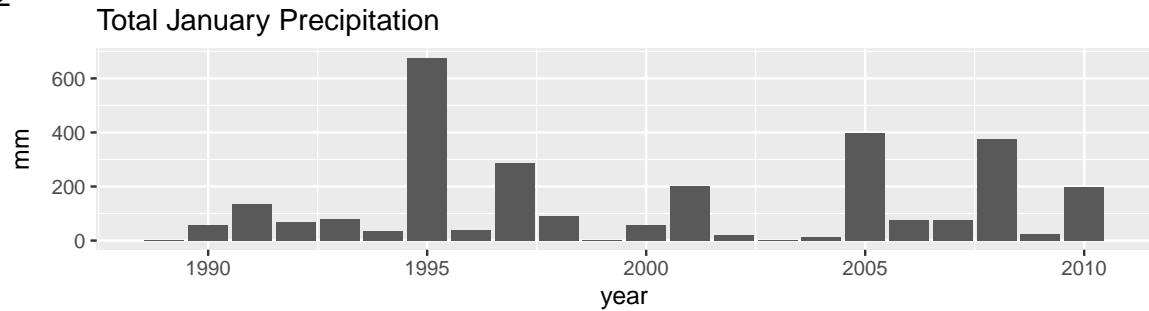
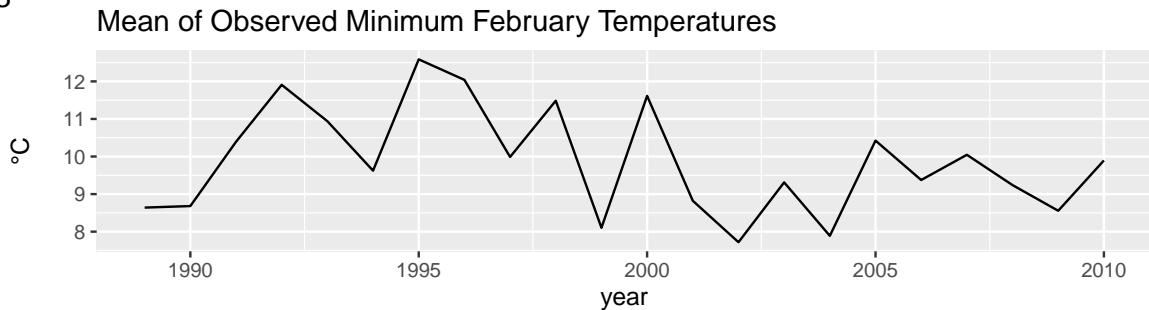


Figure 3



Estimated anomaly of annual almond yields and model inputs based on the paper by Lobell et al. 2006;  
Impacts of future climate change on California perennial crop yields: Model projections with climate and crop uncertainties

## Summary of results

The input of this function uses a dataframe of daily climate variables (precipitation, minimum temperature, and maximum temperature). The outputs of our model indicate that almond yield anomaly, January precipitation totals, and average February temperature minimum are closely linked. This is because the climate data are the predictors utilized as inputs in the model developed by Lobell et al. (2006). Almond yield anomaly is more strongly correlated with January precipitation than with February minimum temperature.