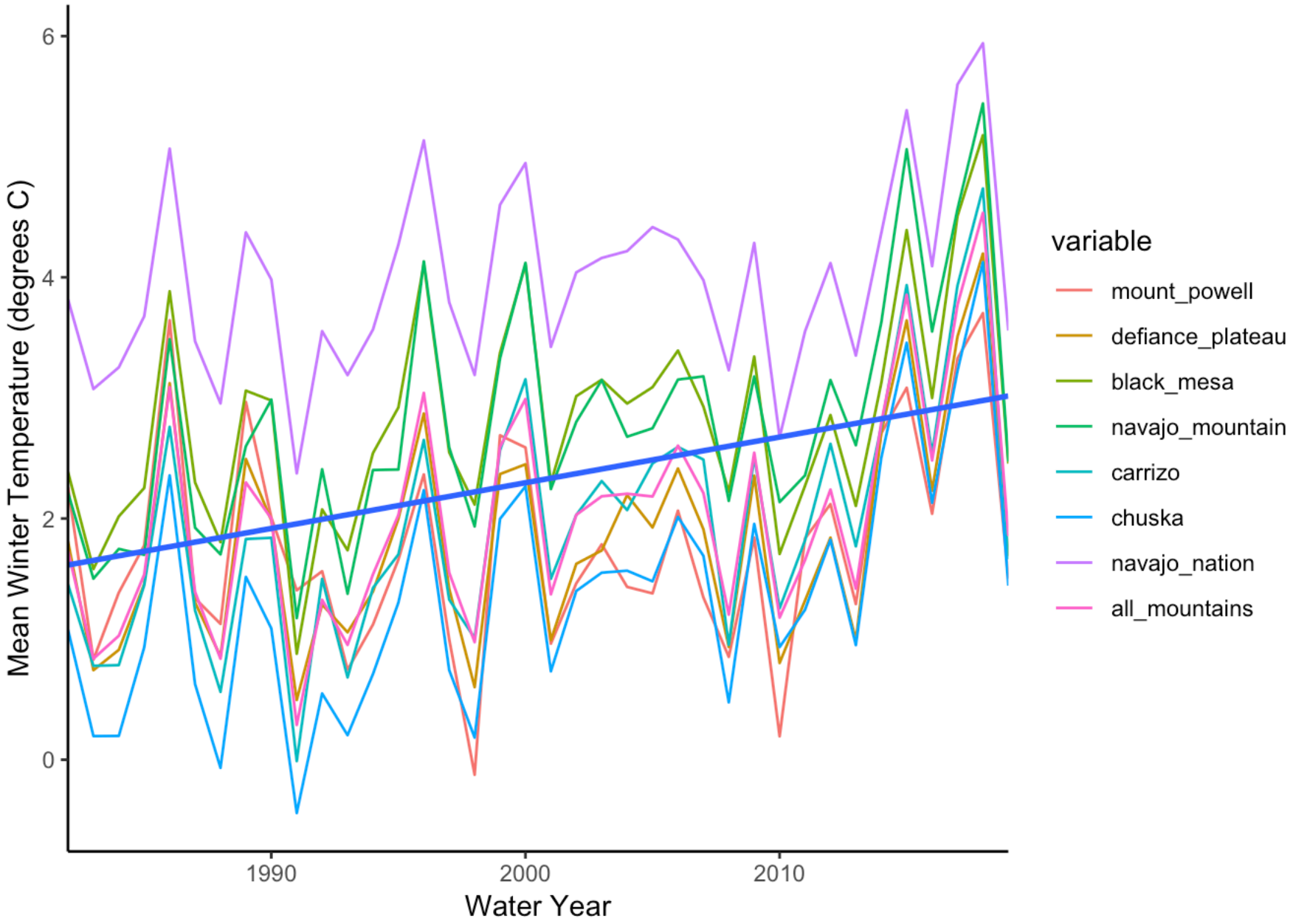
PRISM_temp

This Rmarkdown uses data extracted by Suzanne Goldstein from Google EArth Engine

data include:

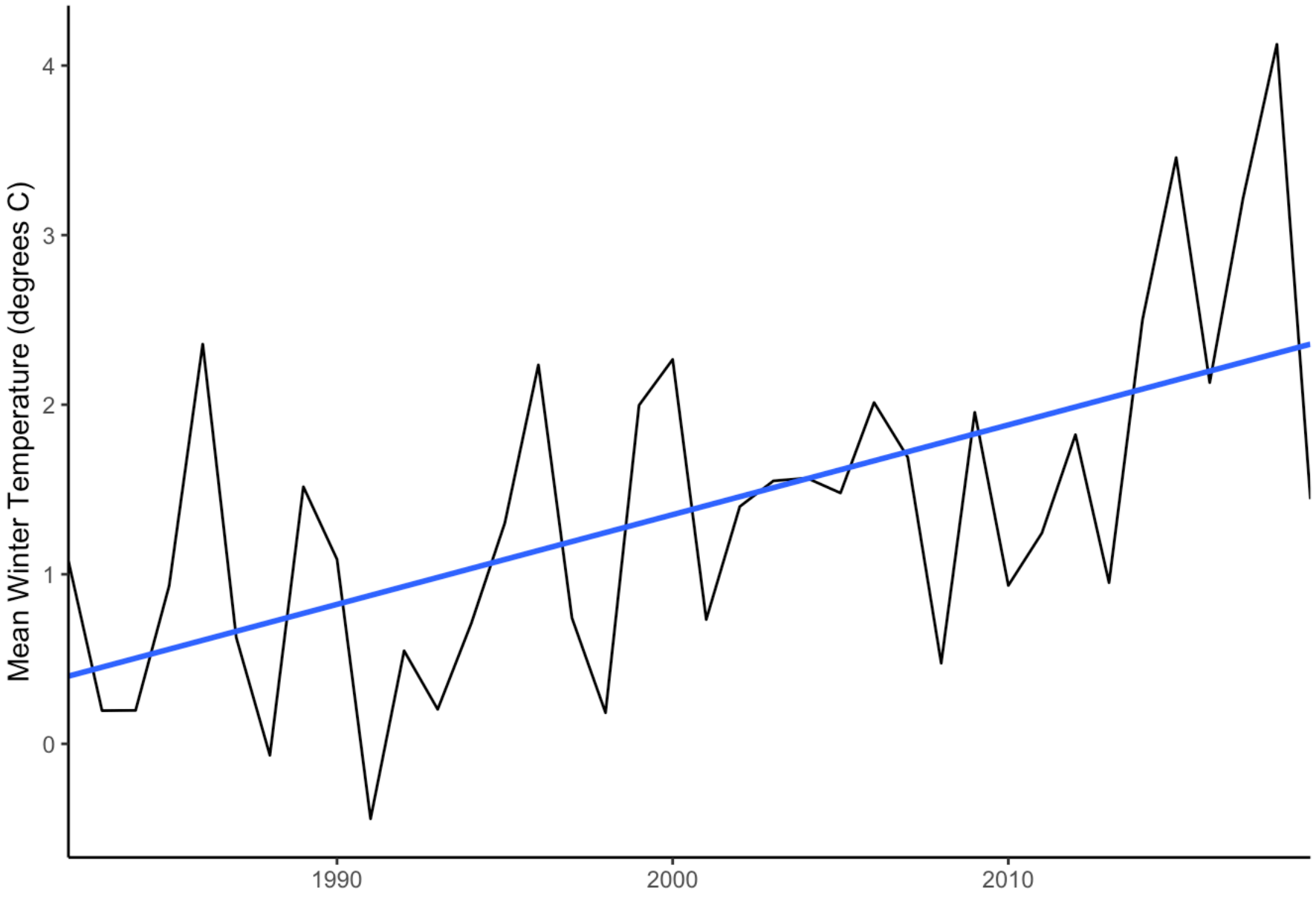
- monthly mean temperature data from PRISM
- anomalies for each mountain region of the Navajo Nation during the period 2002-2018 as compared to the 30-year normal for the period 1981-2010.

Mean winter temperature



Chuska

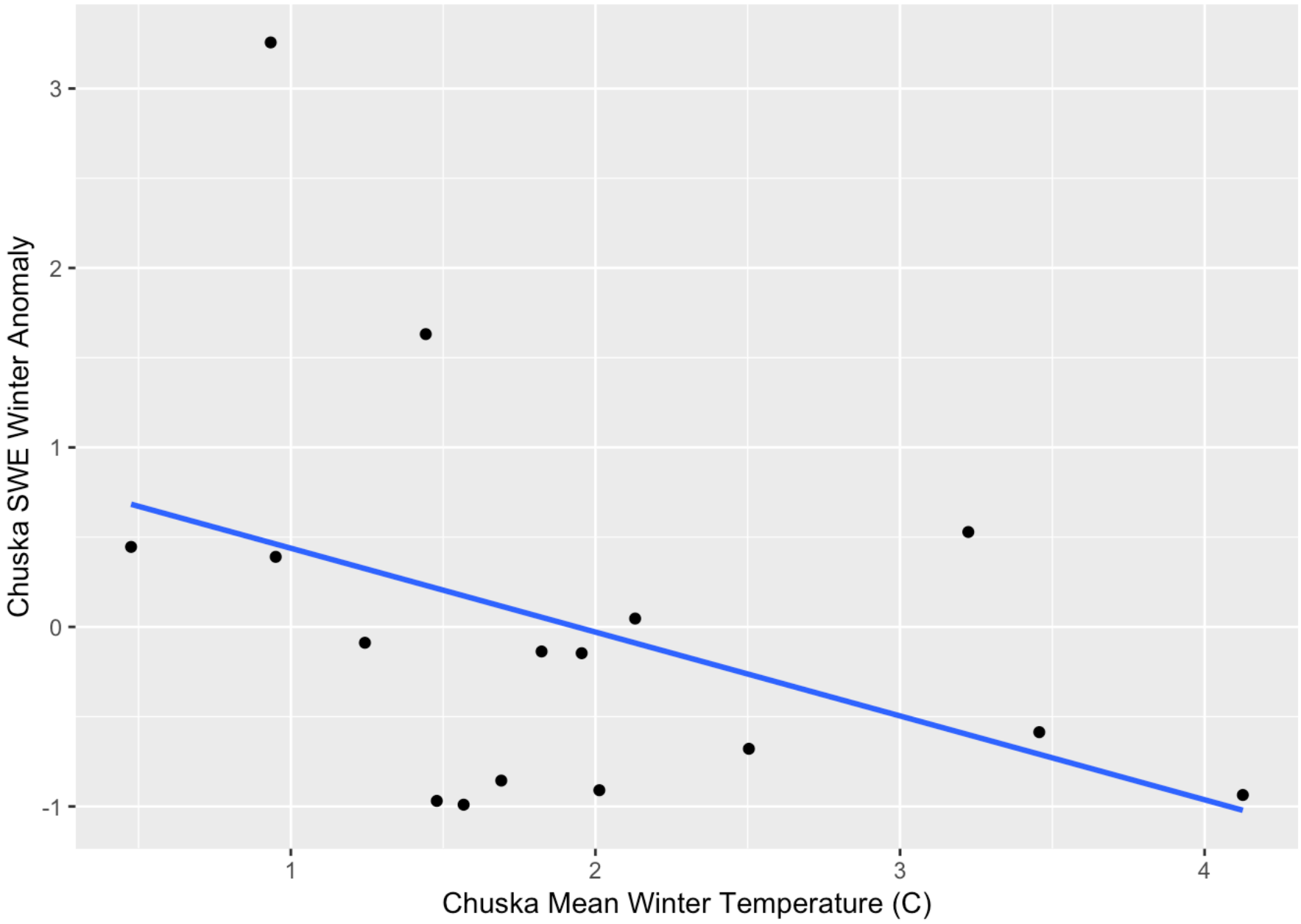
Average winter temperature




```
##
## Call:
## lm(formula = mean_temp ~ waterYear, data = wint_temp_chuska)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.3172 -0.6162 -0.0479  0.4021  1.8213
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -104.48884   23.87195  -4.377 9.89e-05 ***
## waterYear      0.05292    0.01193   4.435 8.32e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8066 on 36 degrees of freedom
## Multiple R-squared:  0.3533, Adjusted R-squared:  0.3353
## F-statistic: 19.67 on 1 and 36 DF,  p-value: 8.324e-05
```

- mean winter temperature has been increasing since 1980s
- slope of the line if 0.05 and p value < 0.0001

Chuska winter swe anomaly and chuska winter temperature

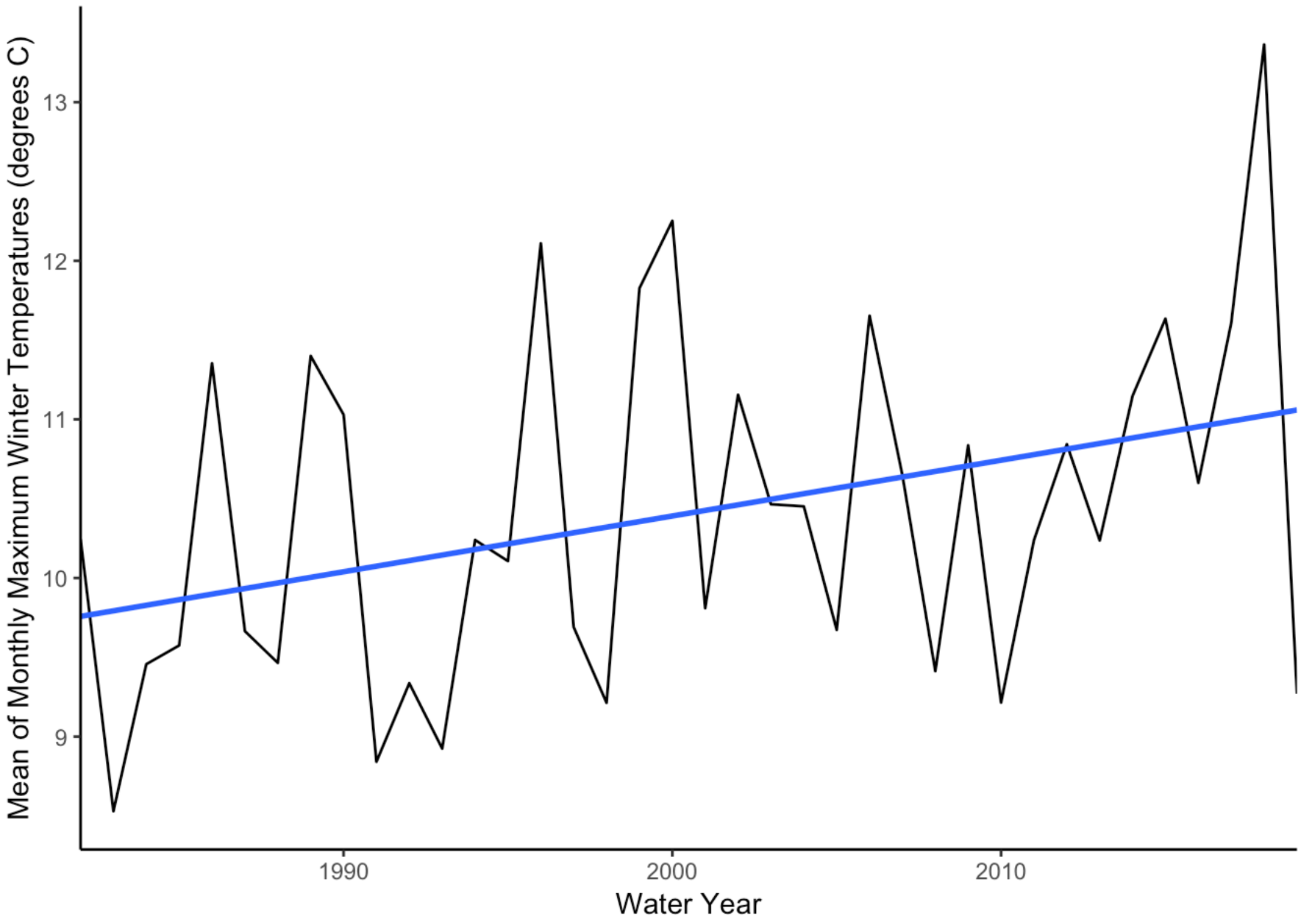



```
##
##  Pearson's product-moment correlation
##
## data:  ch_temp$swe_anom and ch_temp$mean_temp
## t = -1.6588, df = 14, p-value = 0.1194
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7502638  0.1131475
## sample estimates:
##       cor
## -0.4052897
```

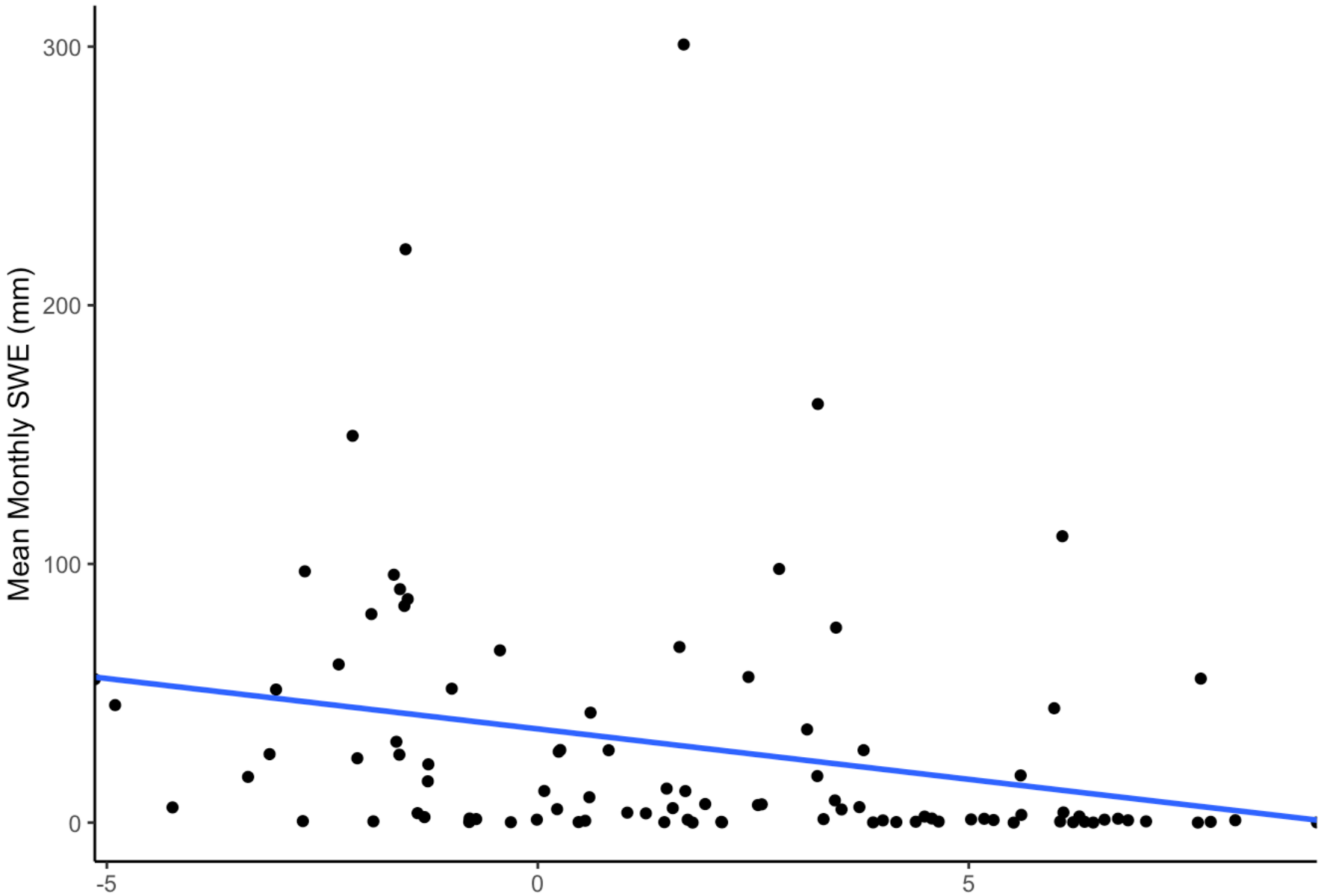
- Winter mean temperature and winter swe anomaly are negative correlated (r = -4.1, but not significantly)

monthly max

```
# average of the winter monthly maximums
wint_av_max_chuska <- temp_max %>%
  filter(month(date) %in% c(11,12,1,2,3,4)) %>%
  select(date, chuska) %>%
  add_water_year() %>%
  group_by(waterYear) %>%
  summarize(mean_temp_max = mean(chuska))
```

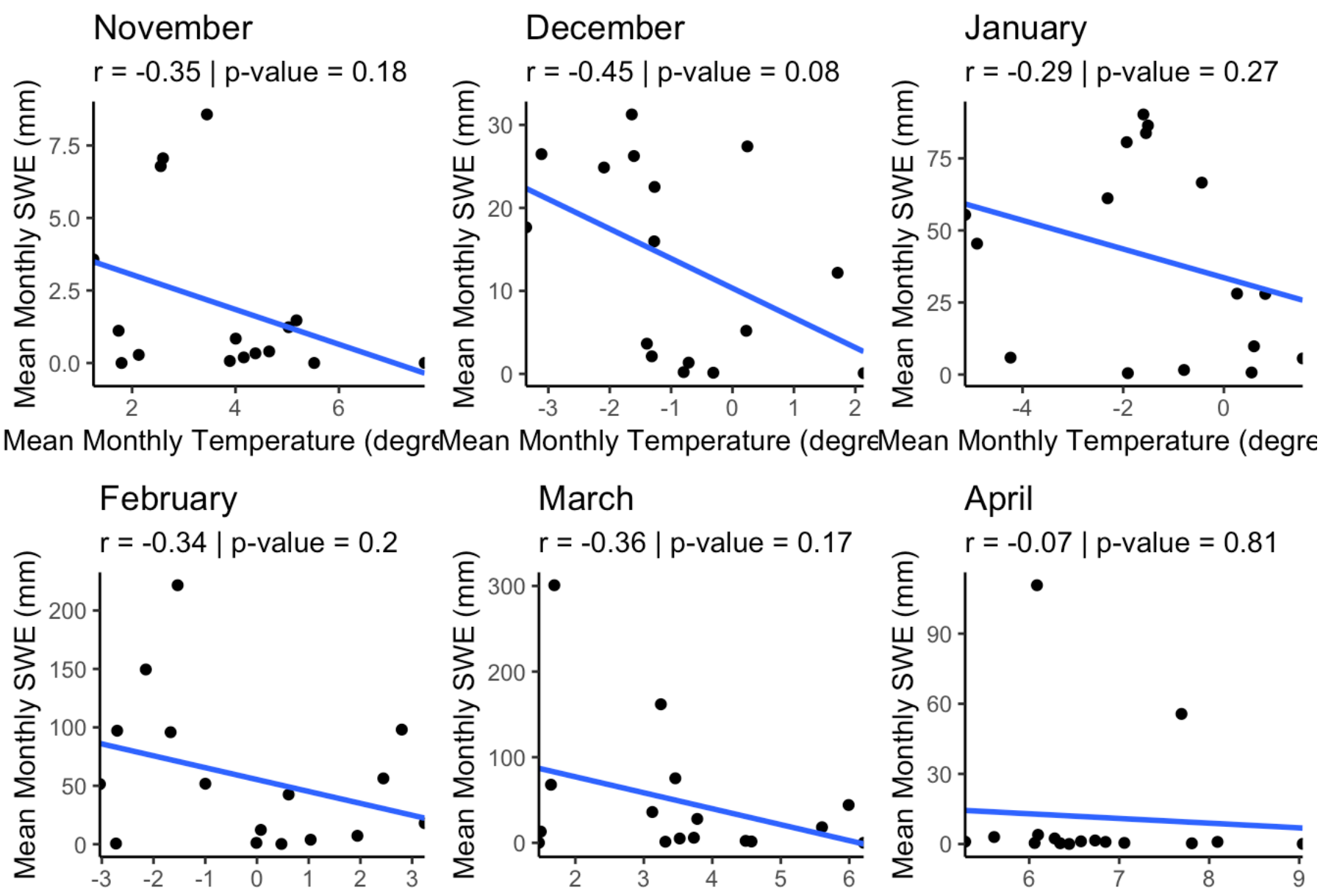


Actual monthly SWE values compared to mean temperature chuska




```
##
##  Pearson's product-moment correlation
##
## data:  ch_swe_temp_av$swe_mm and ch_swe_temp_av$chuska
## t = -2.7212, df = 94, p-value = 0.007751
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.44652268 -0.07373684
## sample estimates:
##       cor
## -0.270228
```

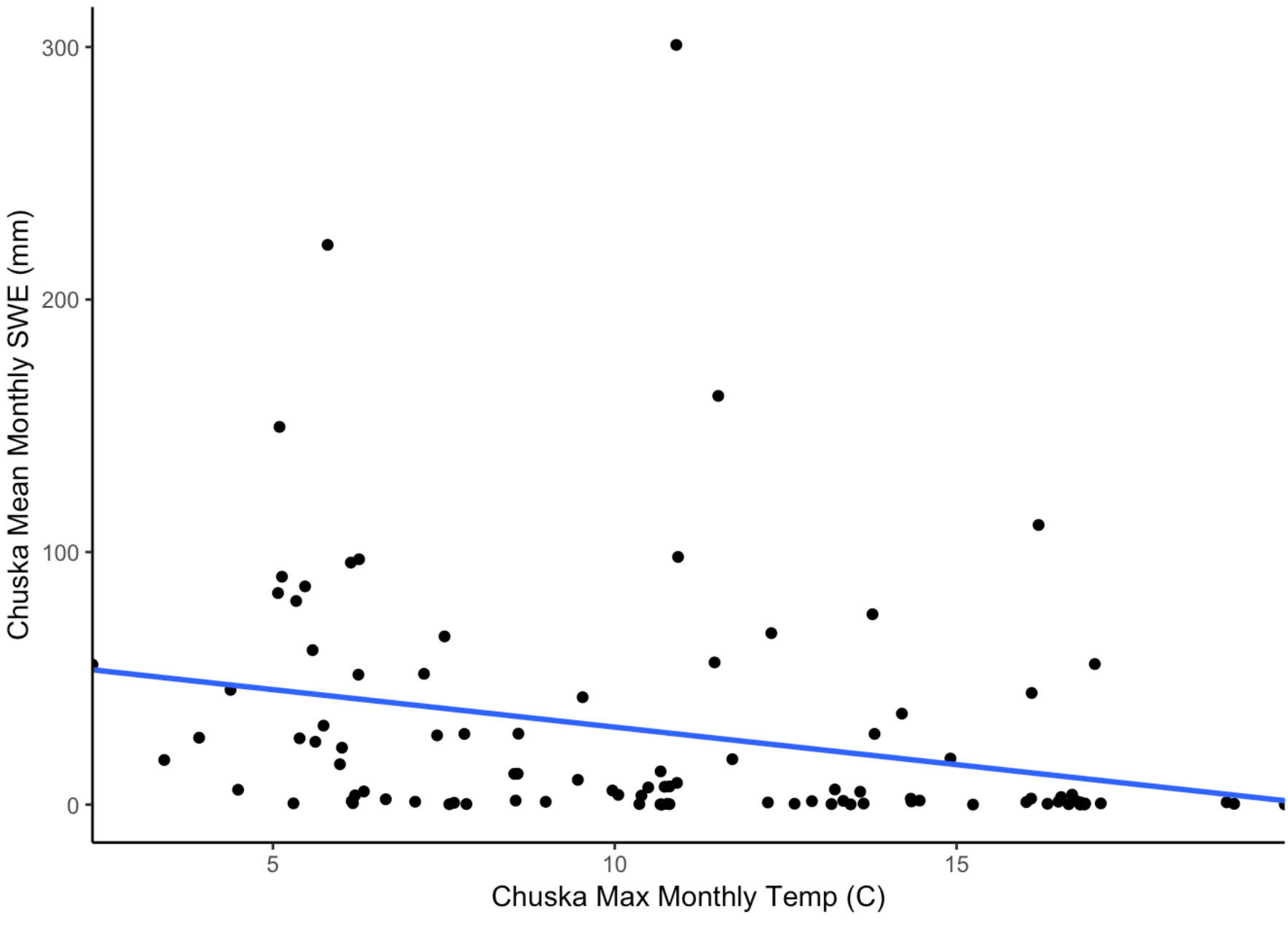
Relationship between Chuska winter swe and month average temperature




```
##
##  Pearson's product-moment correlation
##
## data:  ch_swe_temp_av$chuska and ch_swe_temp_av$swe_mm
## t = -2.7212, df = 94, p-value = 0.007751
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.44652268 -0.07373684
## sample estimates:
##       cor
## -0.270228
```

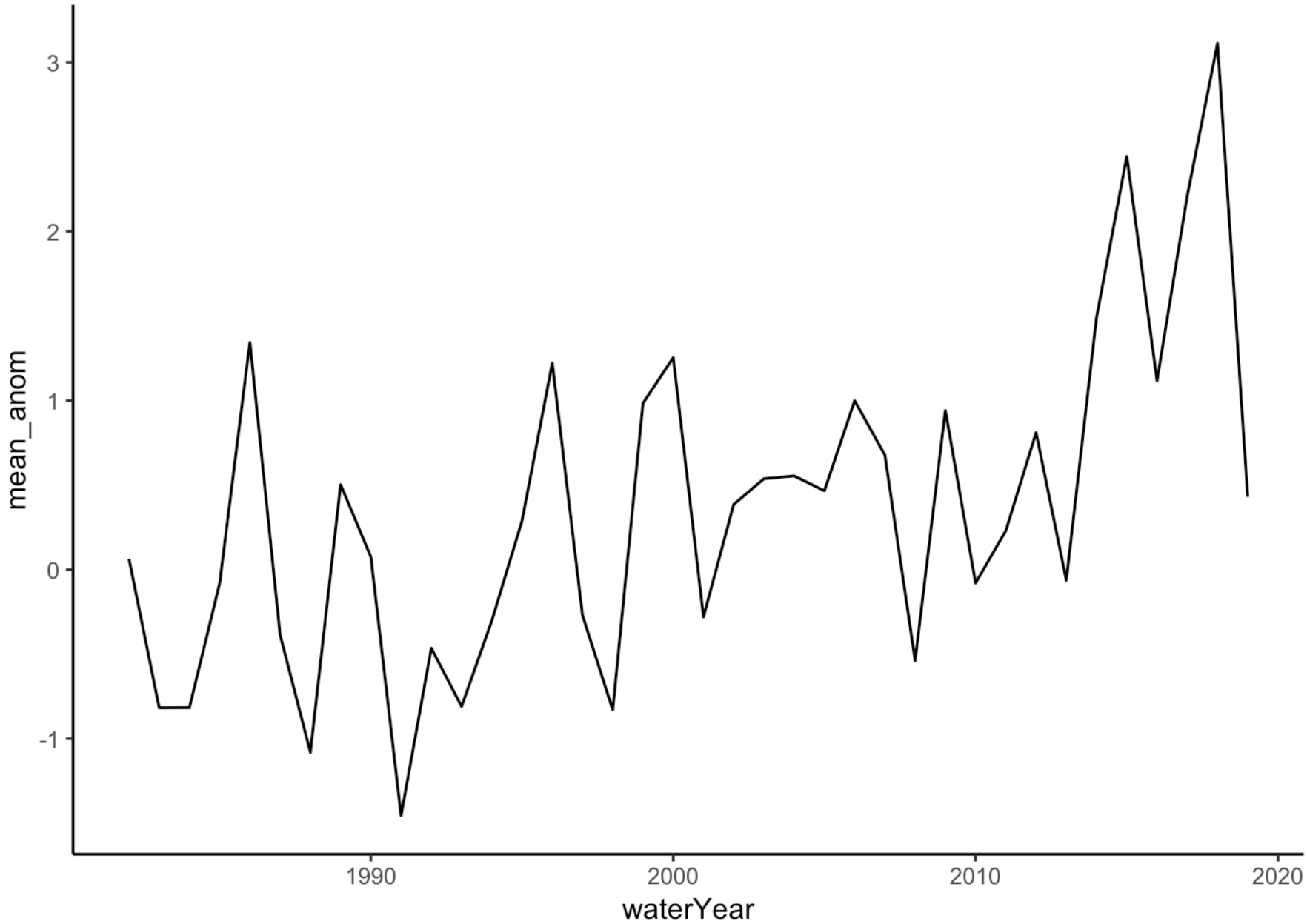
```
##
## Call:
## lm(formula = ch_swe_temp_av$swe_mm ~ ch_swe_temp_av$chuska)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -46.862 -23.797 -14.381   3.508 271.209
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)               36.212      5.580   6.490 4.01e-09 ***
## ch_swe_temp_av$chuska     -3.898      1.432  -2.721  0.00775 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 47.42 on 94 degrees of freedom
## Multiple R-squared:  0.07302,    Adjusted R-squared:  0.06316
## F-statistic: 7.405 on 1 and 94 DF,  p-value: 0.007751
```

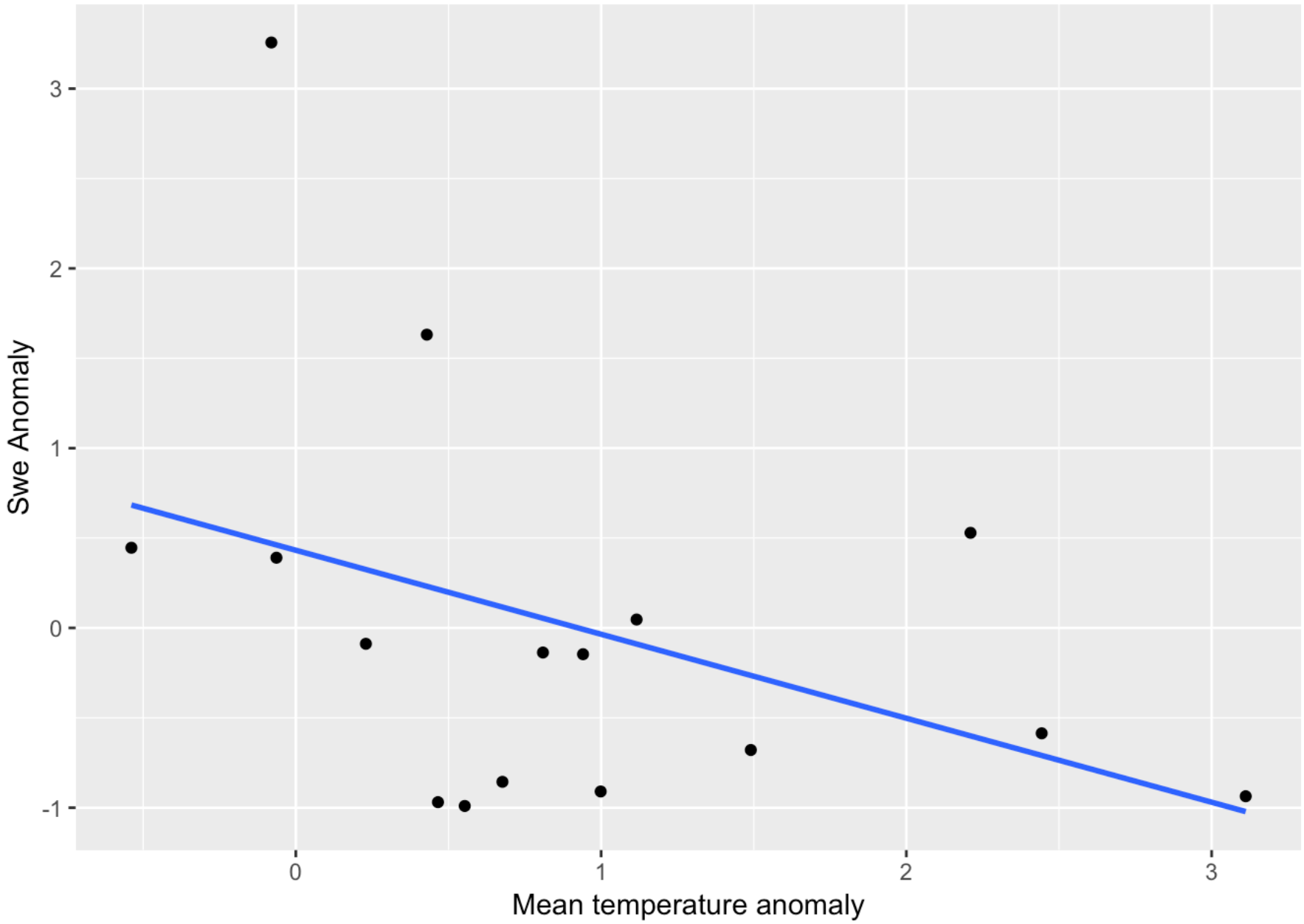
- Chuska monthly mean temperature and chuska mean monthly SWE have a negative correlation of



```
##
##  Pearson's product-moment correlation
##
## data:  ch_swe_temp_av_max$chuska and ch_swe_temp_av_max$swe_mm
## t = -2.6616, df = 94, p-value = 0.009146
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.44177103 -0.06784716
## sample estimates:
##        cor
## -0.2647321
```

Temperature anomaly from 1980-what? normals

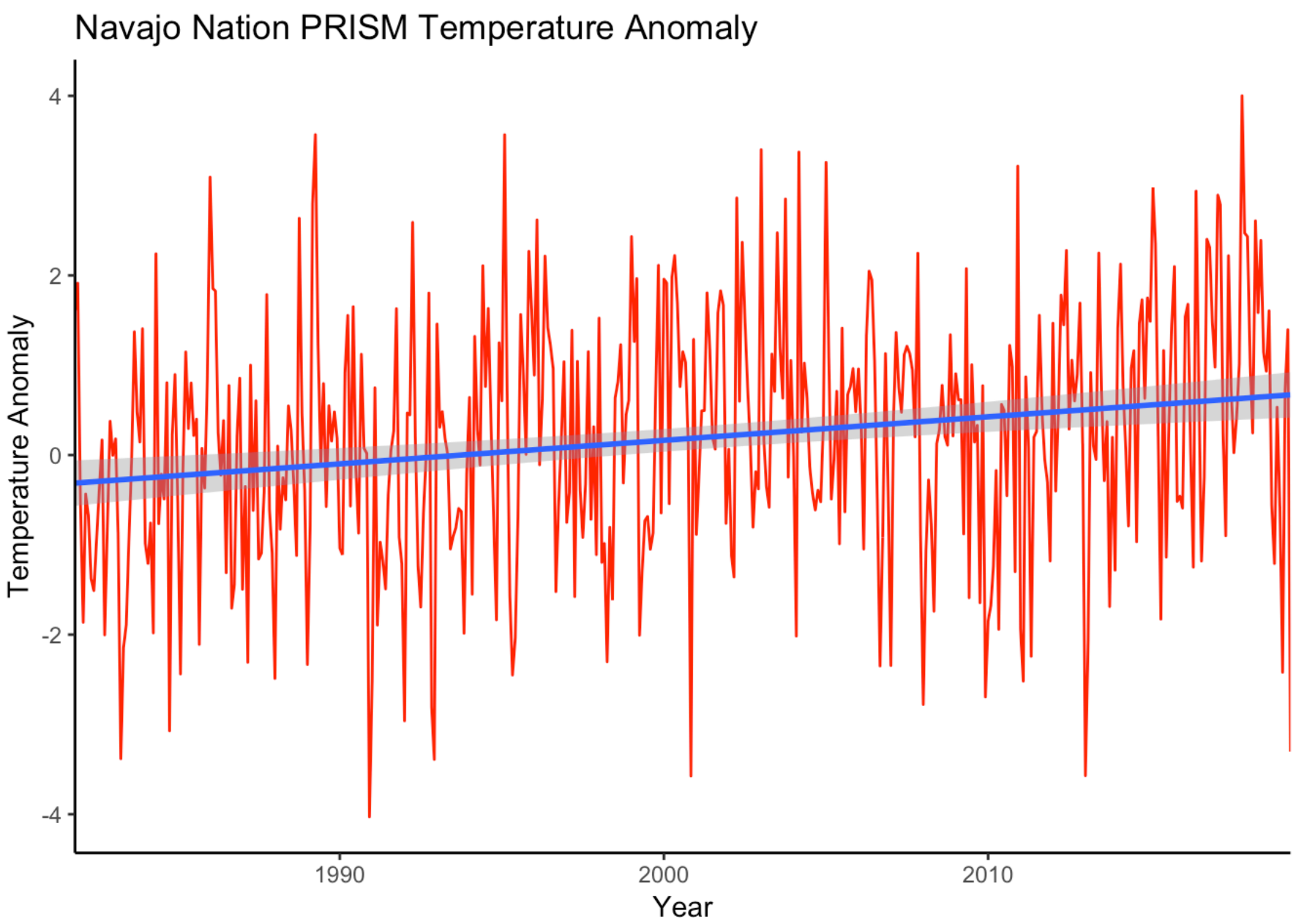




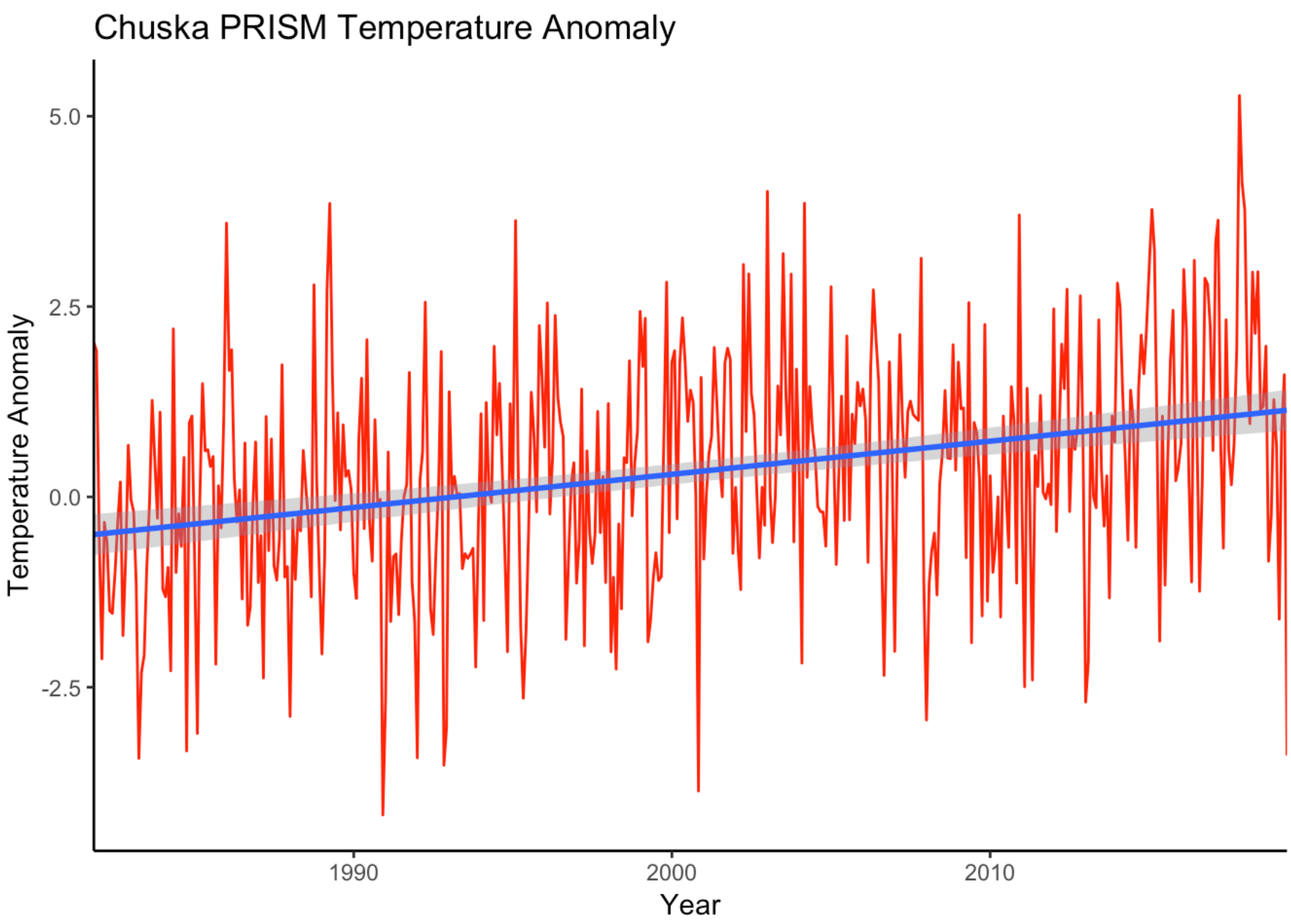

```
##
##  Pearson's product-moment correlation
##
## data:  ch_temp$anomaly_perc and ch_temp$mean_anom
## t = -1.659, df = 14, p-value = 0.1193
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.7502836  0.1131027
## sample estimates:
##       cor
## -0.4053276
```

do i want to include temperature?

Anomalies

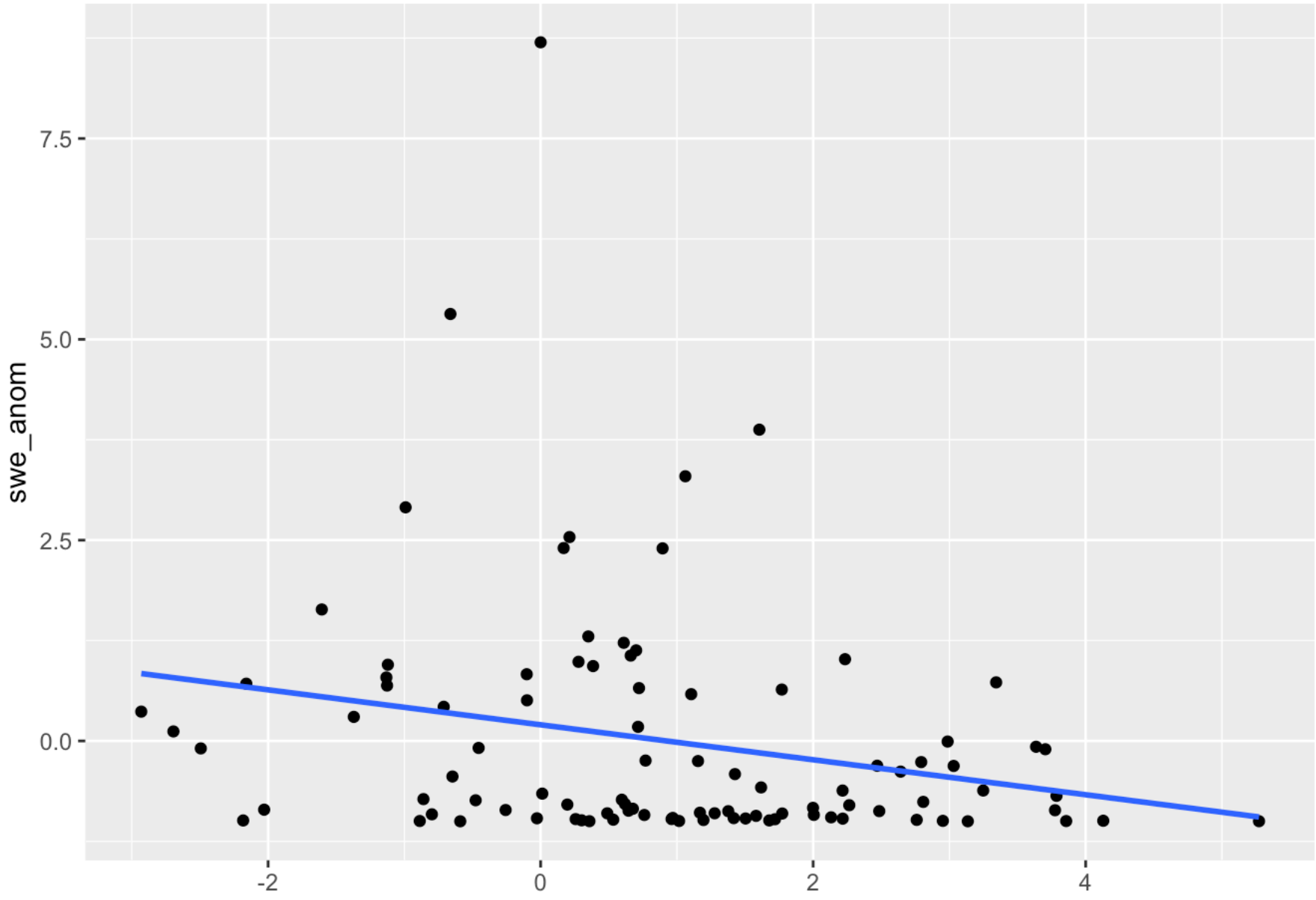



```
##
## Call:
## lm(formula = temp_anom$navajo_nation ~ temp_anom$date)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.0744 -0.8595  0.0573  0.8887  3.6862
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -6.226e-01  1.921e-01  -3.241  0.00128 **
## temp_anom$date  7.175e-05  1.621e-05   4.427  1.2e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.364 on 449 degrees of freedom
## Multiple R-squared:  0.04182,    Adjusted R-squared:  0.03968
## F-statistic:  19.6 on 1 and 449 DF,  p-value: 1.203e-05
```




```
##
##  Pearson's product-moment correlation
##
## data:  ch_temp_swe_anom$temp_anom and ch_temp_swe_anom$swe_anom
## t = -2.3958, df = 94, p-value = 0.01856
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  -0.42017244 -0.04140014
## sample estimates:
##       cor
## -0.2398949
```

```
# visualize it
ggplot(ch_temp_swe_anom, aes(x = temp_anom, swe_anom)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE)
```


swe_anom
7.5
5.0
2.5
0.0
-2
0
2
4
temp_anom