GDD predictions

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```
process_data <- readRDS(file.path(wd, "data/processed", "journe2024_replicate.rds"))

datac <-
  data.frame(site = process_data$sitenewname,
             latitude = process_data$Latitude,
             year = process_data$Year,
             date = process_data$Date,
             tmean = process_data$Tmean)

gdd_data <- datac %>%
  dplyr::group_by(site, year) %>%
  dplyr::mutate(tmean_filt = ifelse(tmean <= 35 & tmean >=5, tmean, 0),
                gdd = cumsum(tmean_filt)) %>%
  dplyr::select(-tmean_filt) %>%
  ungroup() %>%
  mutate(doy = as.numeric(strftime(date, format = "%j")),
         source = stringr::str_split(site, "_", simplify = T)[, 1])
```

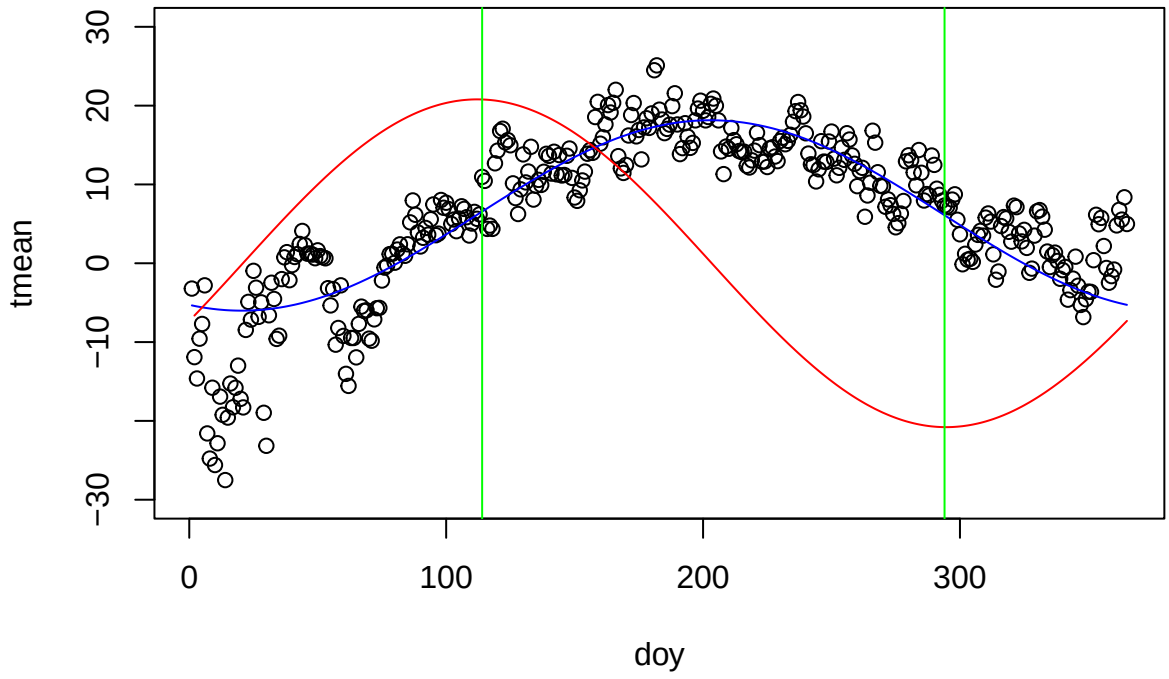
Start of season

```
gdd_data <- gdd_data %>%
  dplyr::group_by(site, year) %>%
  dplyr::mutate(ab5 = zoo::rollapplyr(as.numeric(tmean>=5), 5, sum, fill = 0),
                sos = first(doy[ab5 == 5])) %>%
  ungroup()

# order according to latitude
gdd_data$site <- factor(x = gdd_data$site,
                        levels = unique(gdd_data$site[order(gdd_data$latitude)]))
```

End of season

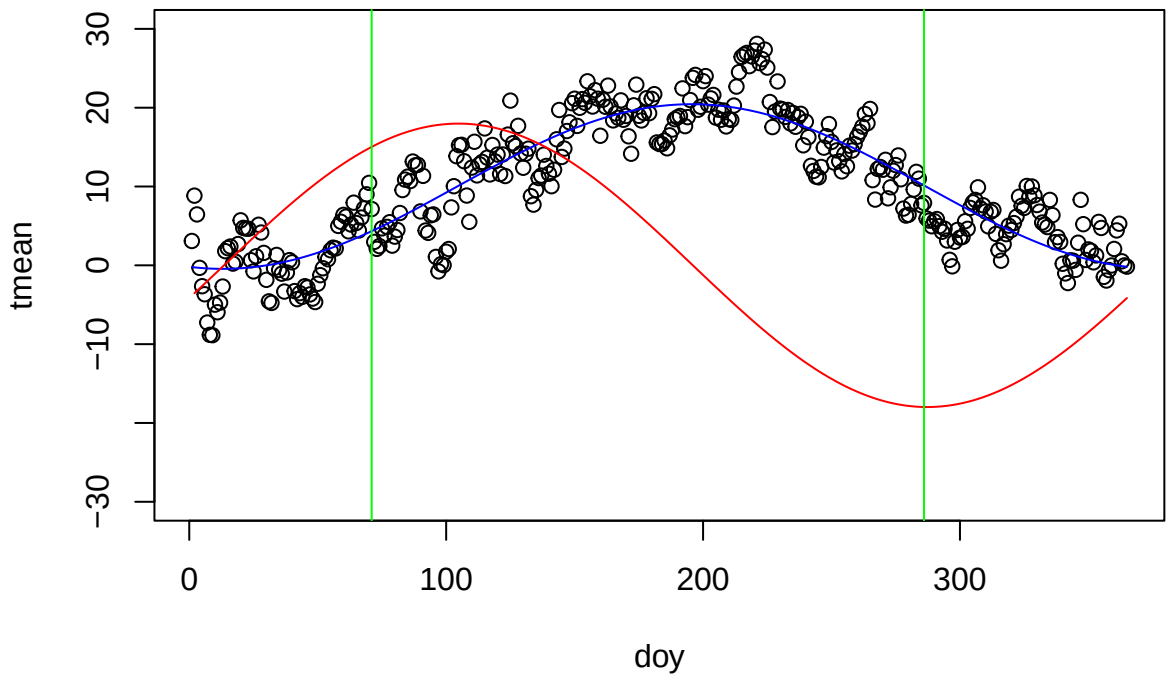
```
ex_data <- gdd_data %>%
               filter(site == "6013_15_FAGSYL" & year == 1987)

fit.lm <- lm(tmean ~ cos(2*pi*doy/365) + sin(2*pi*doy/365), data = ex_data)
```

```r
time <- 1:365
pred <- predict(fit.lm, newdata = list(doy = time))

plot(tmean ~ doy, data = ex_data,
     xlim = c(1, 365), ylim = c(-30, 30))
lines(pred ~ time, col = "blue")

fderiv <- diff(pred)/diff(time)
lines(fderiv*100 ~ time[2:365], col = "red")
abline(v=as.numeric(which(fderiv == min(fderiv))), col="green")
abline(v=unique(ex_data$sos), col="green")
```




```r
ex_data <- gdd_data %>%
               filter(site == "413_1_FAGSYL" & year == 2003)

fit.lm <- lm(tmean ~ cos(2*pi*doy/365) + sin(2*pi*doy/365), data = ex_data)

time <- 1:365
pred <- predict(fit.lm, newdata = list(doy = time))

plot(tmean ~ doy, data = ex_data,
     xlim = c(1, 365), ylim = c(-30, 30))
lines(pred ~ time, col = "blue")

fderiv <- diff(pred)/diff(time)
```

```
lines(fderiv*100 ~ time[2:365], col = "red")
abline(v=as.numeric(which(fderiv == min(fderiv))), col="green")
abline(v=unique(ex_data$sos), col="green")
```




```
gdd_data$eos <- NA

for(s in unique(gdd_data$site)){

  years <- unlist(unique(gdd_data[gdd_data$site == s, "year"]))

  for(y in years){

    fit.dat <- gdd_data %>% dplyr::filter(site == s & year == y)
    time <- fit.dat$doy
    fit.lm <- lm(tmean ~ cos(2*pi*doy/max(time)) + sin(2*pi*doy/max(time)), data = fit.dat)
    pred <- predict(fit.lm, newdata = list(doy = time))
    fderiv <- diff(pred)/diff(time)

    gdd_data[gdd_data$site == s & gdd_data$year == y, "eos"] <-
      as.numeric(which(fderiv == min(fderiv)))

  }

}
```

```
gdd_data %>%
  dplyr::select(site, latitude, sos, eos) %>%
  unique() %>%
  ggplot() +
  geom_boxplot(aes(y = eos, x = site, fill = latitude, color = latitude),
               alpha = 0.5) +
  geom_boxplot(aes(y = sos, x = site, fill = latitude, color = latitude),
               alpha = 0.5) +
  coord_cartesian(ylim = c(4,366), expand = FALSE, clip = "off") +
  scale_y_continuous(breaks = seq(5,365,30)) +
  theme_bw() +
  theme(axis.text.x = element_blank(),
        axis.title = element_blank(),
        axis.ticks.x = element_blank(),
        panel.grid.major.x = element_blank(),
        legend.position = 'none')
```