

PNAS Figures

PAZ

22 novembre 2016

Required R-packages:

```
# Data wrangling
library("plyr")
library("dplyr")

# Melting data sets & changin axes
library("reshape2")
library("ggrepel")

# Plotting:
library("ggplot2")
library("cowplot")
library("gridExtra")
library("Cairo")
library("GGally")
library("scales")
```

Working directory

```
# setwd("D:/Documents/these_pablo/Alteckendorf2016/R")
# setwd("/Users/DayTightChunks/Documents/PhD/Routput/Alteck/R")
# setwd("D:/Documents/these_pablo/Alteckendorf2016/00_TransparencyFolder")
getwd()

## [1] "D:/Documents/these_pablo/Alteckendorf2016/HydrologicalMonitoring"
```

Soils

```
weeklySoil = read.csv2("Data/WeeklySoils_Rng.csv", na.strings=c('#DIV/0!', '', 'NA'), header = TRUE)
weeklySoil$Date.ti <- as.POSIXct(strptime(weeklySoil$Date.ti, "%Y-%m-%d %H:%M", tz="EST")) # csv typos,
#weeklySoil$Date.ti <- as.POSIXct(strptime(weeklySoil$Date.ti, "%d/%m/%Y %H:%M", tz="EST"))
sum(is.na(weeklySoil$Date.ti))

## [1] 0

#weeklySoil$Conc.ComSoil.SD <-
# ifelse(weeklySoil$Conc.ComSoil.SD == as.character("#DIV/0!"), NA, as.numeric(as.character(weeklySoil$Conc.ComSoil.SD)))

str(weeklySoil)

## 'data.frame':   51 obs. of  19 variables:
##  $ ID          : Factor w/ 51 levels "AW-N-0","AW-N-0x",...: 2 19 36 1 18 35 3 20 37 10 ...
##  $ Transect     : Factor w/ 3 levels "N","S","T": 1 2 3 1 2 3 1 2 3 1 ...
##  $ Wnum         : int   -1 -1 -1 0 0 0 1 1 1 2 ...
```

```
## $ Date.Soil      : Factor w/ 17 levels "03/05/2016 13:10",...: 13 13 13 16 16 16 3 3 3 7 ...
## $ Date.ti       : POSIXct, format: "2016-03-25 00:04:00" "2016-03-25 00:04:00" ...
## $ Conc.mug.g.dry.soil: num  0.018 0.029 0.02 1.398 2.881 ...
## $ Conc.ComSoil.SD  : num  NA NA NA NA NA ...
## $ N_compsoil      : int   NA NA NA NA NA NA 2 2 3 3 ...
## $ comp.d13C       : num  NA NA NA NA NA ...
## $ comp.d13C.SD    : num  NA NA NA NA NA ...
## $ comp.d13C.SE     : num  NA NA NA NA NA ...
## $ DD13C.comp      : num  NA NA NA NA NA ...
## $ f.comp          : num  NA NA NA NA NA ...
## $ B.comp          : num  NA NA NA NA NA ...
## $ f.min.comp       : num  NA NA NA NA NA ...
## $ B.min.comp       : num  NA NA NA NA NA ...
## $ f.mean.comp      : num  NA NA NA NA NA ...
## $ B.mean.com       : num  NA NA NA NA NA ...
## $ MassSoil.g       : num  12.41 19.12 4.33 963.74 1899.2 ...
```

```
# weeklySoil = weeklySoil %>%
# group_by(Transect) %>%
# arrange(Transect, Wnum)
```

```
weeklySoil$Transect <- factor(weeklySoil$Transect, levels = c("N", "T", "S"))
```

Soil Concentrations

```
#####
# Concentrations
#####
#####
#####
```

```
#weeklySoil$ti[3] <- as.POSIXct("2016-04-14 08:25:00")
#weeklySoil$ti[14] <- as.POSIXct("2016-04-14 08:25:00")
#weeklySoil$ti[24] <- as.POSIXct("2016-04-14 08:25:00")
#lb1a2 <- paste("App.")
lbW012 <- paste("App.W0/1/2")
lbW9 <- paste("App.W9")
```

```
limits_conc_soil <- aes(ymin=Conc.mug.g.dry.soil-Conc.ComSoil.SD, ymax=Conc.mug.g.dry.soil+Conc.ComSoil.SD)
#limits_conc_soil <- aes(ymin=mean-0.5, ymax=mean+0.5)
```

```
pd <- position_dodge(0.5) # move them .05 to the left and right
```

```
co = ggplot(weeklySoil[1:48, ],
  aes(x=Date.ti, y=Conc.mug.g.dry.soil, colour=Transect, group = Transect)) +
```

```
  geom_point() +
  geom_line() +
```

```
  # Error bars
  geom_errorbar(limits_conc_soil, width=.1, position=pd) +
  # scale_y_continuous(limits=c(0,10), oob = rescale_none) +
```

```
  # Themes and axes
```

```

theme_bw() +
theme(legend.position = "top",
      axis.text.x=element_blank(),
      axis.title.x=element_blank()
    ) +

scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +
ylab(expression(paste("Conc. S-Meto. ", {{mu}}*g / g.soil.dry}}))) +
# facet_wrap(~Transect, nrow = 3) +
# xlab("Date") +
# theme(axis.text.x=element_text(angle = 45, hjust = 1)) +
# scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +

# Smooth linear models
# stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
# stat_smooth(method = "lm") +

# Text
# W0 Application
# annotate("text", x = as.POSIXct('2016-03-25 08:04:00'), y = 4, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-04-14 08:04:00'), y = 0.5, xend = as.POSIXct('2016-03-26 01:04:00'),
                  arrow = arrow(length = unit(0.2, "cm")))) +

# W1 Application
geom_segment(aes(x = as.POSIXct('2016-04-14 08:04:00'), y = 0.5,
                  xend = as.POSIXct('2016-04-05 08:04:00'), yend = 0), color = "black",
              arrow = arrow(length = unit(0.2, "cm")))) +

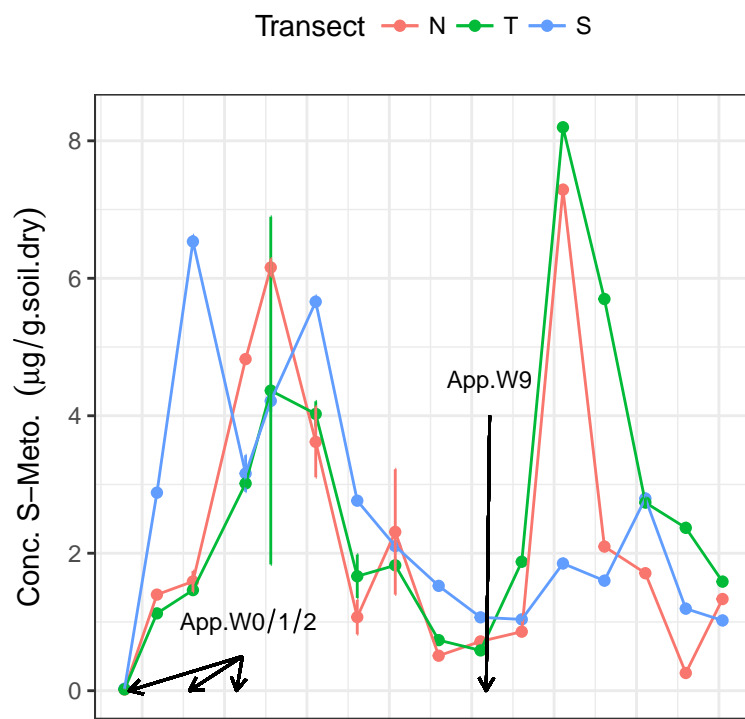
# W2 Application
annotate("text", x = as.POSIXct('2016-04-15 08:04:00'), y = 1, label = lbW012, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-04-14 08:04:00'), y = 0.5,
                  xend = as.POSIXct('2016-04-13 08:04:00'), yend = 0), color = "black",
              arrow = arrow(length = unit(0.2, "cm")))) +

# W9 Application
annotate("text", x = as.POSIXct('2016-05-26 08:04:00'), y = 4.5, label = lbW9, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-05-26 08:04:00'), y = 4,
                  xend = as.POSIXct('2016-05-25 18:04:00'), yend = 0), color = "black",
              arrow = arrow(length = unit(0.2, "cm"))))

#geom_text_repel(aes(label=Wnum),
#               size = 3,
#               arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
#               force = 0.5,
#               point.padding = unit(0.5, 'lines'),
#               max.iter = 2e3,
#               nudge_x = .05)

```

co



```
# Linear model
# ggsave(co, filename = "CompositeConcLM.png", width = 7, height = 5, units = "in", scale = 1)

ggsave(co, filename = "CompositeConcLM.tiff", height = 10, width = 8.7, units = 'cm')

# No linear model
# ggsave(co, filename = "CompositeConc.png", width = 7, height = 5, units = "in", scale = 1)
```

Soil isotope signatures

```
initialDelta = -31.21
weeklySoil$DD13C.comp <- (weeklySoil$comp.d13C - (initialDelta))

limits_dCsoil <- aes(ymin=comp.d13C-comp.d13C.SD, ymax=comp.d13C+comp.d13C.SD)
#limits_dCsoil <- aes(ymin=comp.d13C-0.5, ymax=comp.d13C+0.5)
lb1a <- paste("App.-S-meto.")
lb1ab <- paste("delta^{13}~C:-31.21")
lb1a2 <- paste("App. ")

lbW012 <- paste("App.W0/1/2")
lbW9 <- paste("App.W9")

isCo = ggplot(weeklySoil, aes(x=Date.ti, y=comp.d13C, colour=Transect, group = Transect)) +
  geom_errorbar(limits_dCsoil, width=.05) +
  geom_point() +
  theme_bw() +
  #stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
```

```

stat_smooth(method = "lm") +
facet_wrap(~Transect, nrow = 3) +
xlab("Date") +
theme(axis.text.x=element_text(angle = 45, hjust = 1)) +
#ylab(expression(paste({delta}^"13", "C", ' \u2113'))) +
ylab(expression(paste({delta}^"13", "C", ' (\u2030)'))) +
scale_y_continuous(breaks=seq(-34,-21,2)) +
geom_hline(yintercept = -31.21, color = "dodgerblue4", linetype = "dotted") +
geom_hline(yintercept = -30.71, color = "dodgerblue3", linetype = "dotted") +
geom_hline(yintercept = -31.71, color = "dodgerblue3", linetype = "dotted") +
annotate("text", x = as.POSIXct('2016-04-05 22:04:00'), y = -22.5, label = lb1a, parse = T, size = 3.0)
annotate("text", x = as.POSIXct('2016-04-05 22:04:00'), y = -23.5, label = lb1ab, parse = T, size = 3.0)

annotate("text", x = as.POSIXct('2016-03-25 08:04:00'), y = -29, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-03-25 08:04:00'), y = -29.8,
                    xend = as.POSIXct('2016-03-25 08:04:00'), yend = -31.0),
              arrow = arrow(length = unit(0.2, "cm")) +
              annotate("text", x = as.POSIXct('2016-04-03 00:04:00'), y = -29, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-04-03 00:04:00'), y = -29.8,
                    xend = as.POSIXct('2016-04-05 08:04:00'), yend = -31.0),
              arrow = arrow(length = unit(0.2, "cm")) +
              annotate("text", x = as.POSIXct('2016-04-13 08:04:00'), y = -25, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-04-13 08:04:00'), y = -26,
                    xend = as.POSIXct('2016-04-13 08:04:00'), yend = -31.0),
              arrow = arrow(length = unit(0.2, "cm")) +
              annotate("text", x = as.POSIXct('2016-05-26 08:04:00'), y = -29, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-05-26 08:04:00'), y = -29.8,
                    xend = as.POSIXct('2016-05-25 08:04:00'), yend = -31.0),
              arrow = arrow(length = unit(0.2, "cm")) +
              #scale_x_continuous(breaks=seq(0,11,1)) +
              scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +

              #annotate("text", x = as.POSIXct('2016-05-30 20:04:00'), y = -30.5, label = lb1a, parse = T, size = 2)
              theme(legend.position = "top")

# isCo

# Linear model (LM)
# ggsave(isCo, filename = "CompositeIsotopesLM.png", width = 7, height = 5, units = "in", scale = 1)
# No linear model
# ggsave(isCo, filename = "CompositeIsotopes.png", width = 7, height = 5, units = "in", scale = 1)

# View(weeklySoil)

# Ommitted, graph is tautological.
### Delta vs. f (Soils)
soilf = ggplot(weeklySoil, aes(x=f.comp, y=DD13C.comp, colour=Transect, group = Transect)) +
  #geom_errorbar(limits_dCsoil, width=.05) +
  geom_point() +
  theme_bw() +
  stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
  #stat_smooth(method = "lm") +

```

```

facet_wrap(~Transect, nrow = 3) +
scale_x_reverse() +
xlab("Fraction remaining (f)") +
theme(axis.text.x=element_text(angle = 45, hjust = 1)) +
#ylab(expression(paste({delta}^"13", "C", ' \211')))) +
ylab(expression(paste({Delta~delta}^"13", "C", ' (\u2030)')) +
#scale_y_continuous(breaks=seq(-34,-21,2)) +
theme(legend.position = "top") +
#geom_text_repel(aes(label=WeekNo, color = factor(Transect)),
#arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
#force = 1,
#point.padding = unit(1.0, 'lines'),
#max.iter = 2e3,
#nudge_x = .2) +

geom_point()

# soilf

#####
#####
#####
### DeltaDelta vs time
#####
# View(weeklySoil)
# limits_DdCsoil <- aes(ymin=comp.d13C-comp.d13C.SD-initialDelta, ymax=comp.d13C+comp.d13C.SD-initialDelta)
limits_DdCsoil <- aes(ymin=comp.d13C-comp.d13C.SE-initialDelta, ymax=comp.d13C+comp.d13C.SE-initialDelta)
# pd <- position_dodge(0.5)
# A0df[1:27,]
deltaTime = ggplot(weeklySoil[1:48, ], aes(x=Date.ti, y=DD13C.comp, colour=Transect, group = Transect)) +
  geom_errorbar(limits_DdCsoil, width=.5) +
  geom_point() +

# Themes and axes
theme_bw() +
theme(legend.position="none",
      # axis.title.x = element_blank(),
      axis.text.x=element_text(angle = 45, hjust = 1)
    ) +
xlab("Date") +
scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +

ylab(expression(paste({Delta~delta}^"13", "C", ' (\u2030)')) +
scale_y_continuous(breaks=seq(0, 8, 1)) +
# ylab(expression(paste({delta}^"13", "C", ' \211')))) +
# ylab(expression(paste({delta}^"13", "C", ' (\u2030)')))) +
# facet_wrap(~Transect, nrow = 3) +

# Smooth linear models
stat_smooth(method = "lm", se=FALSE) +
# stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
# stat_smooth(data=subset(weeklySoil[4:27, ]), method = "lm", formula = y~x, se=F) +
# stat_smooth(data=subset(weeklySoil[18:36, ]), method = "lm", formula = y~x, se=F) +

```

```

# Text
# Application W0
annotate("text",
  x = as.POSIXct('2016-04-04 01:04:00'), y = 6, label = lbW012, parse = T, size = 3.0) +
geom_segment(aes(x = as.POSIXct('2016-04-03 08:04:00'), y = 5.5,
  xend = as.POSIXct('2016-03-25 22:04:00'), yend = -0), color = "black",
  arrow = arrow(length = unit(0.2, "cm")))) +
#annotate("text",
#  x = as.POSIXct('2016-04-03 00:04:00'), y = 2, label = lb1a2, parse = T, size = 3.0) +

# Application W1
geom_segment(aes(x = as.POSIXct('2016-04-03 08:04:00'), y = 5.5,
  xend = as.POSIXct('2016-04-05 08:04:00'), yend = 0), color = "black",
  arrow = arrow(length = unit(0.2, "cm")))) +
# annotate("text", x = as.POSIXct('2016-04-15 08:04:00'), y = 1, label = lb1a2, parse = T, size = 3.0) +

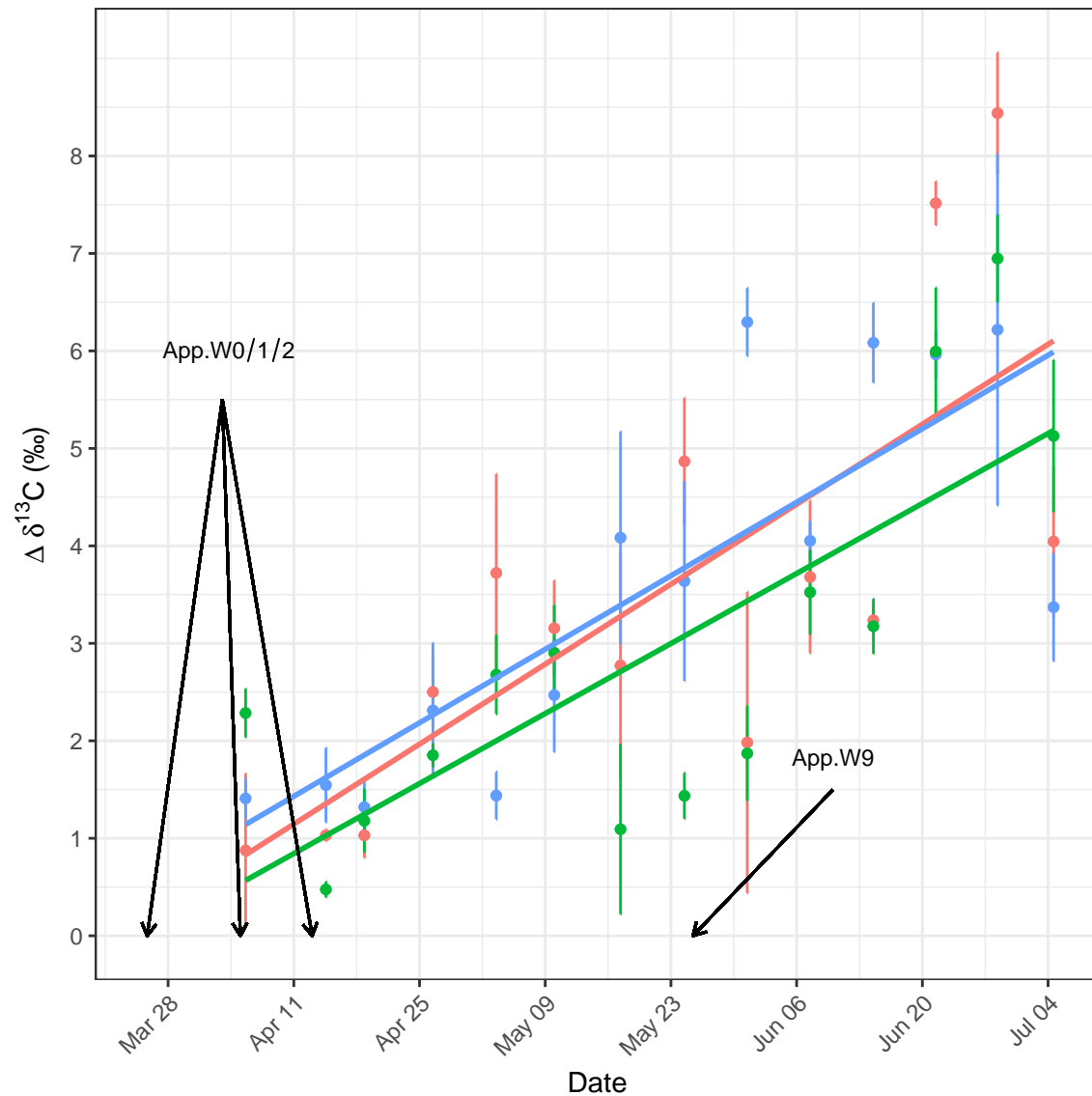
# Application W2
geom_segment(aes(x = as.POSIXct('2016-04-03 08:04:00'), y = 5.5,
  xend = as.POSIXct('2016-04-13 08:04:00'), yend = 0), color = "black",
  arrow = arrow(length = unit(0.2, "cm")))) +

# Application W9
annotate("text",
  x = as.POSIXct('2016-06-10 08:04:00'), y = 1.8, label = lbW9, parse = T, size = 3.0) +
geom_segment(aes(x = as.POSIXct('2016-06-10 08:04:00'), y = 1.5,
  xend = as.POSIXct('2016-05-25 18:04:00'), yend = 0), color = "black",
  arrow = arrow(length = unit(0.2, "cm")))) # +

#geom_text_repel(aes(label=Wnum, color = factor(Transect)),
#  #
#    arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
#  #
#    force = 1,
#  #
#    point.padding = unit(1.0, 'lines'),
#  #
#    max.iter = 2e3,
#  #
#    nudge_x = .2)

deltaTime

```



```
#soils = plot_grid(co, deltaTime, ncol = 1, nrow = 2, align = "v")
#soils
```

Degradation

```
lb1a2 <- paste("App.")

lb1b <- paste("(A)~epsilon:-1.5")
lb1b2 <- paste("(B)~epsilon:-2.0")

Bsoil =ggplot(weeklySoil)+
  #geom_errorbar(limits_dCsoil, width=.05) +
  #geom_point(aes(x=Date.ti, y=B.comp, colour=Transect, group = Transect)) +
  geom_point(aes(x=Date.ti, y=B.min.comp, colour=Transect, group = Transect)) + #, color = "dodgerblue4"
```



```

theme_bw() +
# stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
#stat_smooth(aes(x=Date.ti, y=B.min.comp), method = "lm", se = F, color = "dodgerblue4") +
#stat_smooth(aes(x=Date.ti, y=B.comp), method = "lm", se = F, color = "grey40") +

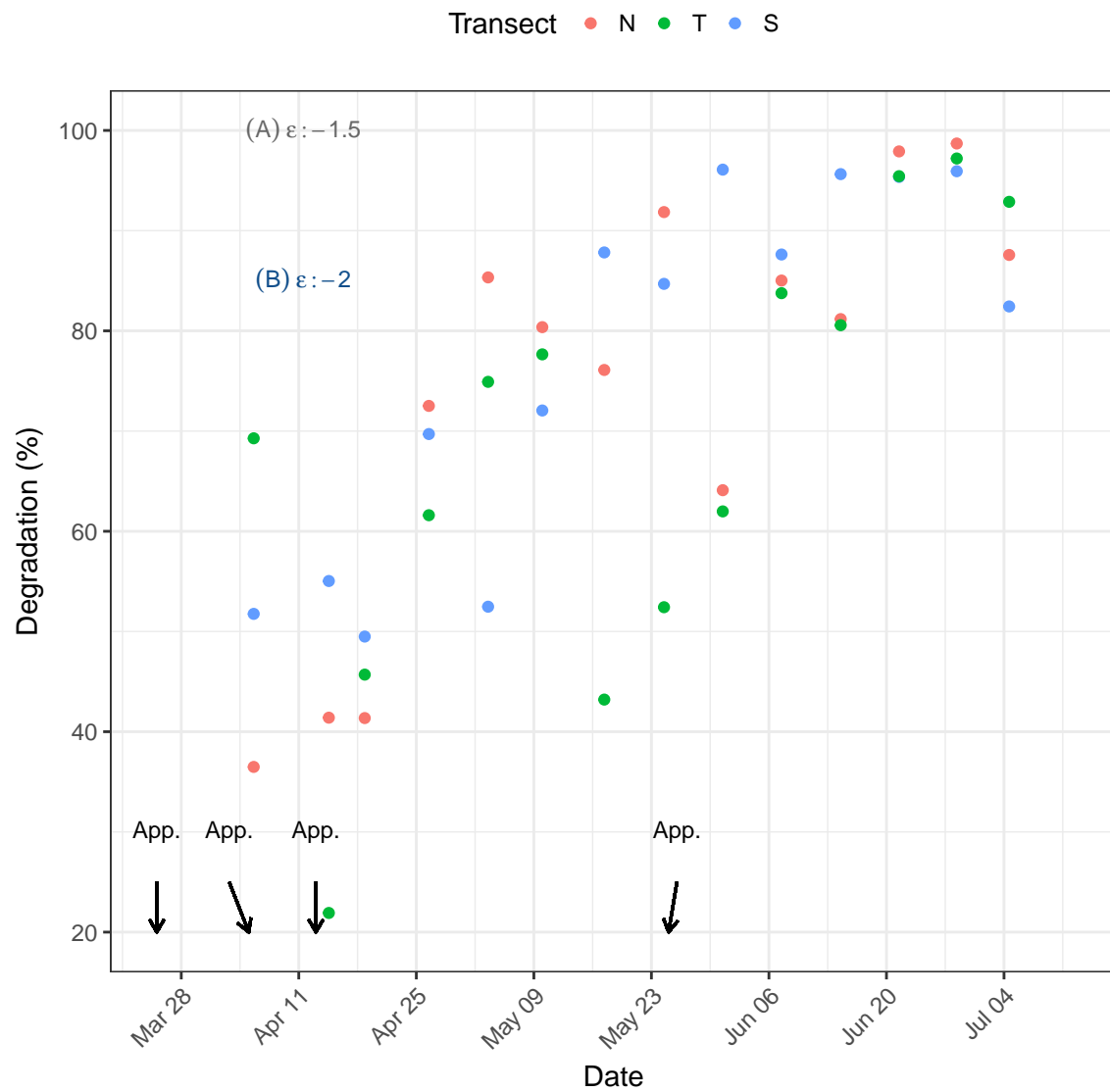
# Individual / broken lines
#geom_smooth(data=subset(weeklySoil[10:27, ]), aes(x=Date.ti, y=B.min.comp), method = "lm", se = F, c
#geom_smooth(data=subset(weeklySoil[31:45, ]), aes(x=Date.ti, y=B.min.comp), method = "lm", se = F, c
#geom_smooth(data=subset(weeklySoil[10:27, ]), aes(x=Date.ti, y=B.comp), method = "lm", se = F, color
#geom_smooth(data=subset(weeklySoil[31:45, ]), aes(x=Date.ti, y=B.comp), method = "lm", se = F, color

# Continous lines
# geom_smooth(data=subset(weeklySoil[1:45, ]), aes(x=Date.ti, y=B.min.comp), method = "lm", formula =
# geom_smooth(y=B.min.comp, method = "lm", formula = y ~ poly(x, 2)) +
# facet_wrap(~Transect, nrow = 3) +
xlab("Date") +
theme(axis.text.x=element_text(angle = 45, hjust = 1)) +
#ylab(expression(paste({delta}~"13", "C", ' \211')))) +
ylab("Degradation (%)") +
scale_y_continuous(breaks=seq(0, 100, 20)) +
#geom_hline(yintercept = -31.47, color = "dodgerblue4", linetype = "dotted") +
#geom_hline(yintercept = -30.97, color = "dodgerblue3", linetype = "dotted") +
#geom_hline(yintercept = -31.97, color = "dodgerblue3", linetype = "dotted") +
annotate("text", x = as.POSIXct('2016-04-11 20:04:00'), y = 100, label = lb1b, parse = T, size = 3.0,
annotate("text", x = as.POSIXct('2016-04-11 20:04:00'), y = 85, label = lb1b2, parse = T, size = 3.0,

annotate("text", x = as.POSIXct('2016-03-25 08:04:00'), y = 30, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-03-25 08:04:00'), y = 25,
xend = as.POSIXct('2016-03-25 08:04:00'), yend = 20),
arrow = arrow(length = unit(0.2, "cm")))) +
annotate("text", x = as.POSIXct('2016-04-03 00:04:00'), y = 30, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-04-03 00:04:00'), y = 25,
xend = as.POSIXct('2016-04-05 08:04:00'), yend = 20),
arrow = arrow(length = unit(0.2, "cm")))) +
annotate("text", x = as.POSIXct('2016-04-13 08:04:00'), y = 30, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-04-13 08:04:00'), y = 25,
xend = as.POSIXct('2016-04-13 08:04:00'), yend = 20),
arrow = arrow(length = unit(0.2, "cm")))) +
annotate("text", x = as.POSIXct('2016-05-26 08:04:00'), y = 30, label = lb1a2, parse = T, size = 3.0)
geom_segment(aes(x = as.POSIXct('2016-05-26 08:04:00'), y = 25,
xend = as.POSIXct('2016-05-25 08:04:00'), yend = 20),
arrow = arrow(length = unit(0.2, "cm")))) +
scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +
#scale_x_continuous(breaks=seq(0,11,1)) +
theme(legend.position = "top")

```

Bsoil



```
# Linear model
ggsave(Bsoil, filename = "CompositeDegradationLM.png", width = 7, height = 5, units = "in", scale = 1)

#deltaCo = plot_grid(co, isCo, ncol = 2, nrow = 1, align = "h")
# deltaCoBio = plot_grid(co, isCo, Bsoil, ncol = 3, nrow = 1, align = "h")
# deltaCoBio

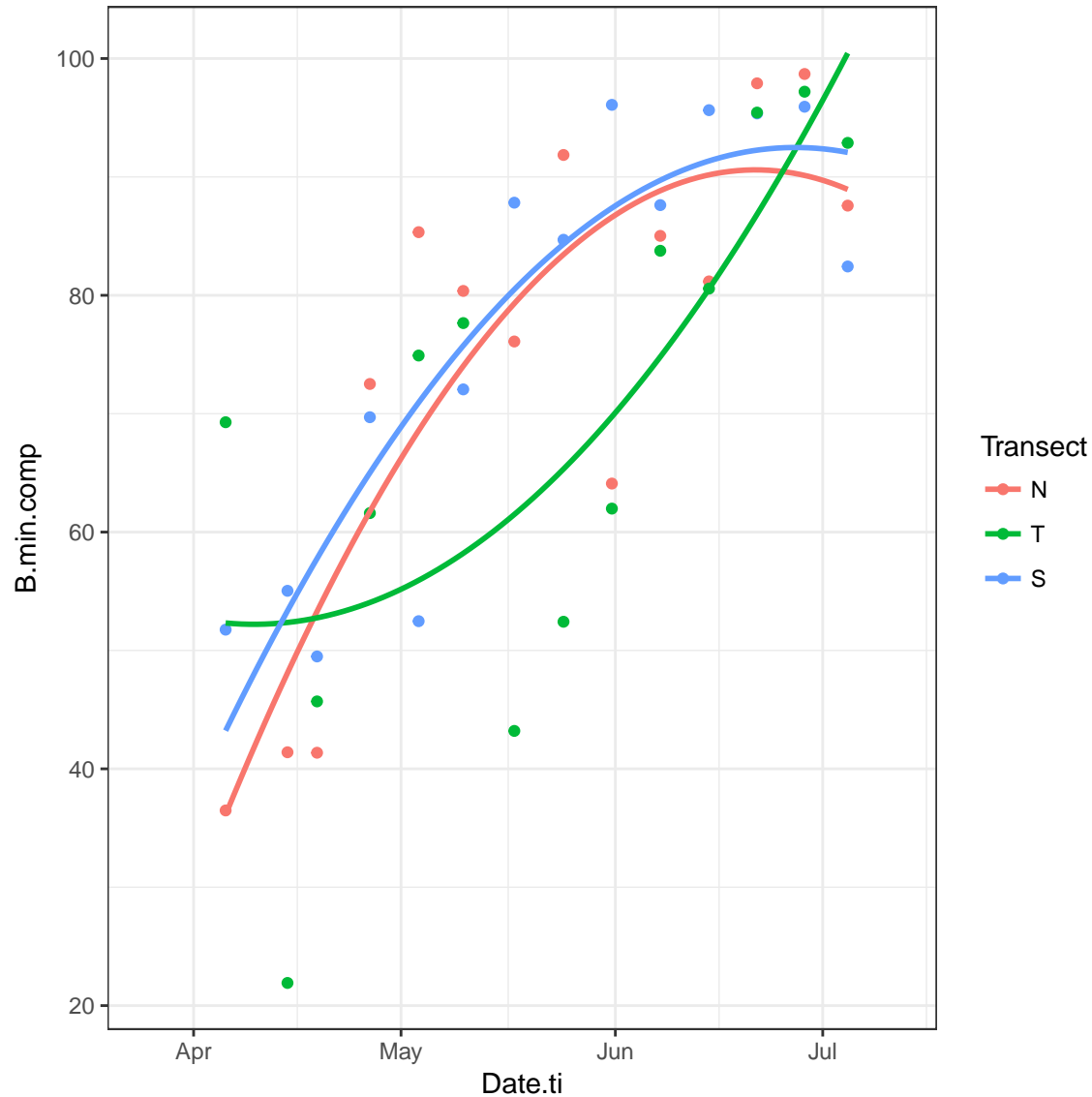
# Linear model
#ggsave(deltaCo, filename = "CompositeConcLM.png", width = 6, height = 7, units = "in", scale = 1)
#ggsave(deltaCoBio, filename = "SoilConcDeltBio_LM.png", width = 11.69, height = 8.27, units = "in", scale = 1)

# No linear model
#ggsave(deltaCo, filename = "CompositeConc.png", width = 6, height = 7, units = "in", scale = 1)

# weeklySoil2 = weeklySoil[1:45, ]
# View(weeklySoil2)
```

```
Bsoil2 = ggplot(weeklySoil, aes(x=Date.ti, y=B.min.comp, colour=Transect, group = Transect)) +
  geom_point() +
  # geom_point(aes(x=Date.ti, y=B.comp, colour=Transect, group = Transect)) +
  theme_bw() +
  stat_smooth(method = "lm", formula = y ~ poly(x, 2), se=FALSE)
```

Bsoil2



Water

```
A0df = read.csv2("Data/WeeklyHydroContam_R.csv")
str(A0df)
```

```
## 'data.frame':   51 obs. of  59 variables:
## $ ti           : Factor w/ 51 levels "2016-03-25 00:04:00",...: 1 2 3 4 5 6 7 8 9 10 ...
```

```

## $ WeekSubWeek      : Factor w/ 51 levels "W0-0x","W0-1",...: 1 2 3 4 5 6 26 27 28 29 ...
## $ tf               : Factor w/ 51 levels "2016-03-25 12:02:00",...: 1 2 3 4 5 6 7 8 9 10 ...
## $ iflux            : num  1.25 1.12 1.31 1.46 16.33 ...
## $ fflux            : num  1.13 1.31 1.46 16.45 15.18 ...
## $ changeflux       : num  -0.119 0.189 0.148 14.989 -1.15 ...
## $ peak             : num  1.25 1.38 1.64 38.4 18.67 ...
## $ valley           : num  1.118 1.082 0.929 1.449 13.201 ...
## $ tdiff            : num  12 82.5 37.6 27.3 23.1 ...
## $ chExtreme        : num  -0.13 0.256 0.33 36.944 -3.133 ...
## $ AveDischarge.m3.h : num  1.2 1.21 1.28 14.32 15.53 ...
## $ Volume.m3        : num  14.4 100.2 48.3 390.4 359.2 ...
## $ Sampled.Hrs      : num  12 82.5 37.6 27.3 23.1 ...
## $ Sampled          : Factor w/ 2 levels "Not Sampled",...: 1 2 1 2 2 1 2 2 1 2 ...
## $ Conc.mug.L       : num  NA 0.246 NA 6.788 6.561 ...
## $ Conc.SD          : num  NA 0.0193 NA 0.2894 0.1906 ...
## $ N.x              : int  NA 3 NA 3 3 NA 3 3 NA 3 ...
## $ diss.d13C        : num  NA -26.7 NA -30.5 -30.6 ...
## $ SD.d13C          : num  NA 0.936 NA 0.106 0.151 ...
## $ se.d13C          : num  NA 0.5403 NA 0.0612 0.0874 ...
## $ MES.mg.L         : num  NA 53.4 NA 62.5 22.5 ...
## $ MES.sd           : num  NA NA NA NA NA NA NA NA NA NA ...
## $ MO.mg.L          : num  NA 0 NA 0.001 0.0001 NA 0.0001 0.0001 NA 0.0058 ...
## $ Conc.Solids.mug.gMES: num  NA 0.645 NA 0.126 0.436 ...
## $ N.y              : int  NA NA NA NA NA NA NA 3 3 NA NA ...
## $ filt.d13C        : num  NA NA NA NA NA ...
## $ filt.SD.d13C     : num  NA NA NA NA NA ...
## $ filt.se.d13C     : num  NA NA NA NA NA ...
## $ DD13C.diss       : num  NA 4.545 NA 0.741 0.59 ...
## $ DD13C.filt       : num  NA NA NA NA NA ...
## $ f.diss           : num  NA 0.0689 NA 0.6459 0.706 ...
## $ f.filt           : num  NA NA NA NA NA ...
## $ B.diss           : num  NA 93.1 NA 35.4 29.4 ...
## $ B.filt           : num  NA NA NA NA NA ...
## $ NH4.mM           : num  NA NA NA 0.05 NA NA NA NA NA NA ...
## $ TIC.ppm.filt     : num  NA NA NA 51.8 44.8 NA 66.7 52.1 NA 69.4 ...
## $ Cl.mM            : num  NA NA NA 1.48 1574 ...
## $ NO3...mM         : num  NA NA NA 616 778 ...
## $ PO4..mM          : int  NA NA NA NA NA NA NA NA NA NA ...
## $ NPOC.ppm         : num  NA NA NA 4 4.4 NA 5.8 3.4 NA 9.1 ...
## $ TIC.ppm.unfilt   : num  NA NA NA 44.8 26.4 NA 39 32.3 NA 54.8 ...
## $ TOC.ppm.unfilt   : num  NA NA NA 4.7 5.4 NA 2.7 3.8 NA 3.9 ...
## $ ExpMES.Kg        : num  NA 5.35 NA 24.4 8.08 ...
## $ DissSmeto.mg     : num  NA 24.6 NA 2649.9 2357 ...
## $ FiltSmeto.mg     : num  NA 3.45 NA 3.07 3.52 ...
## $ TotMassOut.mg    : num  NA 28.1 NA 2653 2360.5 ...
## $ FracDiss         : num  NA 0.877 NA 0.999 0.999 ...
## $ FracFilt         : num  NA 0.12301 NA 0.00116 0.00149 ...
## $ Appl.Mass.g      : num  6369 0 0 0 0 ...
## $ CumAppMass.g     : num  6369 6369 6369 6369 6369 ...
## $ SimOutDiss.g     : num  0 0.0246 0 2.6499 2.357 ...
## $ SimOutFilt.g     : num  0 0.00345 0 0.00307 0.00352 ...
## $ SimOutSmeto.g    : num  0 0.0281 0 2.653 2.3605 ...
## $ CumOutDiss.g     : num  0 0.0246 0.0246 2.6745 5.0315 ...
## $ CumOutFilt.g     : num  0 0.00345 0.00345 0.00652 0.01004 ...

```

```
## $ CumOutSmeto.g      : num  0 0.0281 0.0281 2.681 5.0416 ...
## $ BalMassDisch.g     : num  6369 6369 6369 6367 6364 ...
## $ FracMassOut        : num  0 0.000308 0 0.029119 0.025909 ...
## $ FracDeltaOut       : num  0 -0.00821 0 -0.88723 -0.79334 ...

# Adding a Weeks column for labelling
AOdf$WeekSubWeek <- as.character(AOdf$WeekSubWeek)
Split <- strsplit(AOdf$WeekSubWeek, "-", fixed = TRUE)
AOdf$Weeks <- sapply(Split, "[", 1)

AOdf$WeekSubWeek <- factor(AOdf$WeekSubWeek, levels = unique(AOdf$WeekSubWeek))
AOdf$Weeks <- factor(AOdf$Weeks, levels = unique(AOdf$Weeks))
AOdf$ti <- as.POSIXct(strptime(AOdf$ti, "%Y-%m-%d %H:%M", tz="EST"))
sum(is.na(AOdf$ti))

## [1] 0
```

Outlet - Concentrations

```
# View(AOdf)

limits_conc <- aes(ymin=Conc.mug.L-Conc.SD, ymax=Conc.mug.L+Conc.SD, color = Weeks, group = Weeks)

concl <- ggplot(AOdf, aes(x=ti, y=Conc.mug.L)) +
  geom_point(aes(color = Weeks, group = Weeks)) +

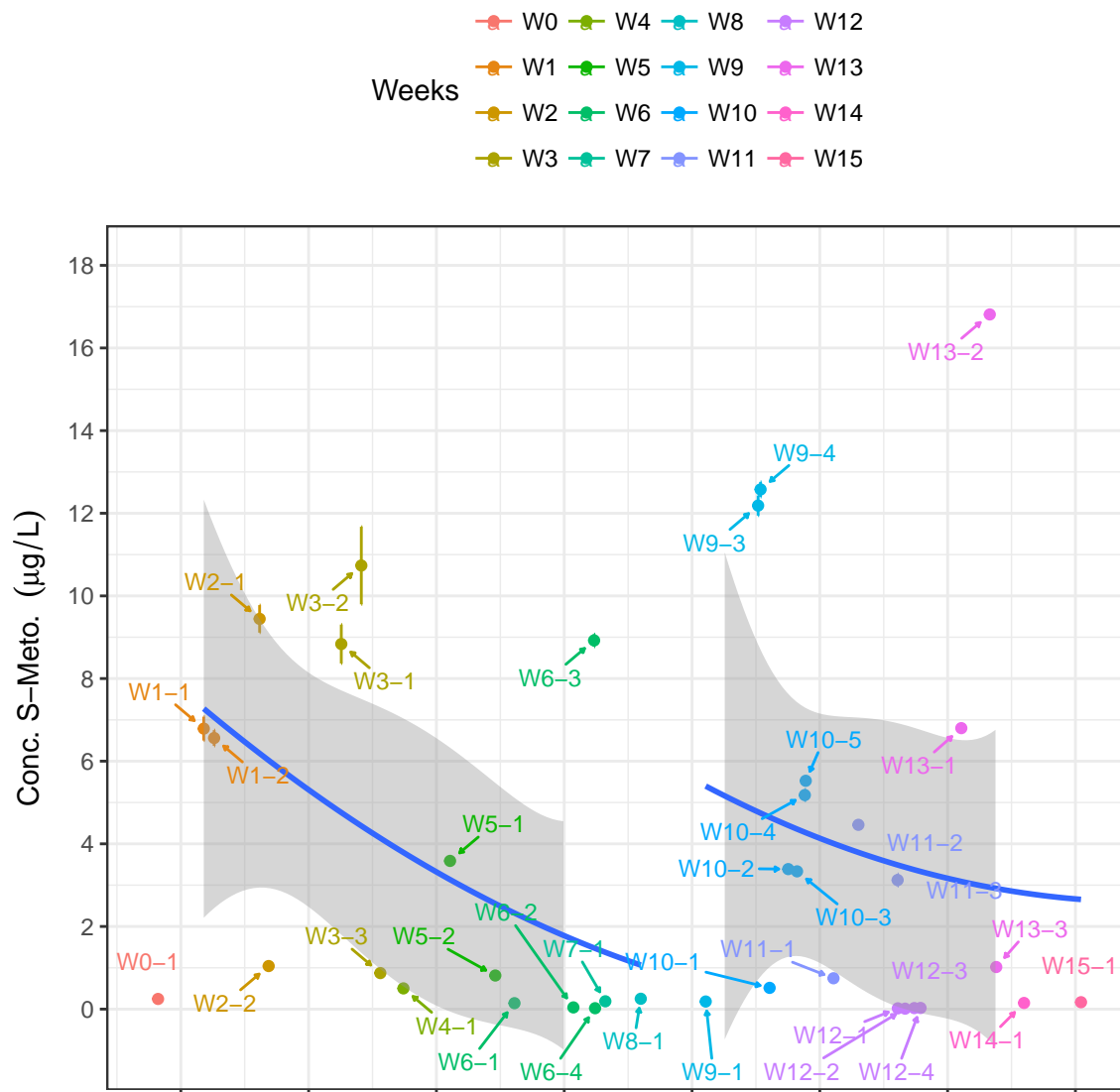
  # Error bars
  geom_errorbar(limits_conc, width=1) +

  # Themes and axes
  theme_bw() +
  theme(# axis.text.x=element_text(angle = 45, hjust = 1),
        axis.text.x=element_blank(),
        axis.title.x=element_blank(),
        legend.position="top"
        )+
  guides(col = guide_legend(nrows = 2)) + # Sets legend parameters
  xlab("Date") +
  scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +
  ylab(expression(paste("Conc. S-Meto. ", {([mu]*g / L)}))) +
  scale_y_continuous(breaks = c(18,16,14,12,10, 8, 6, 4, 2, 0), limits = c(-1, 18) ) +

  # Smooth linear models
  geom_smooth(data=subset(AOdf[4:27, ]), method = "lm", formula = y ~ poly(x, 2)) +
  geom_smooth(data=subset(AOdf[27:length(AOdf), ]), method = "lm", formula = y ~ poly(x, 2)) +

  # Text
  # Application W9
  # annotate("text",
  #         x = as.POSIXct('2016-06-10 08:04:00'), y = -1, label = lbW9, parse = T, size = 3.0) +
  # geom_segment(aes(x = as.POSIXct('2016-06-05 08:04:00'), y = -1,
```

```
#           xend = as.POSIXct('2016-05-25 18:04:00'), yend = -0.9), color = "black",
#           arrow = arrow(length = unit(0.2, "cm")))) +
geom_text_repel(aes(label=WeekSubWeek, color = factor(Weeks)), # WeekSubWeek or Weeks
  size = 3,
  arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
  force = 0.5,
  point.padding = unit(0.5, 'lines'),
  max.iter = 2e3,
  nudge_x = .05)
conc1
```



```
conc2 <- ggplot(A0df[28:length(A0df),], aes(x=ti, y=Conc.mug.L)) +
  geom_point( aes(color = Weeks, group = Weeks)) +
```

```

# Error bars
# geom_errorbar(aes(ymin=mean.d13C-SD.d13C, ymax=mean.d13C+SD.d13C), width=.1) +
geom_errorbar(limits_conc, width=1) +

# Themes & axes
# theme_gray() +
theme_bw() +
theme(legend.position = "none") +
theme(axis.text.x=element_text(angle = 45, hjust = 1),
      axis.text.y = element_blank(),
      legend.title = element_blank(),
      plot.margin = unit(c(0,3.5,0,0), "lines")) +
#scale_x_datetime(breaks = date_breaks("week"), labels = date_format("%m/%d")) +
scale_y_continuous(breaks = c(20,15,10,5,0), limits = c(-5, 20) ) +
xlab("Date") +
ylab("") +

# Smooth linear models
stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
#geom_hline(yintercept = -31.21, color = "dodgerblue4", linetype = "dotted") +
#geom_hline(yintercept = -30.71, color = "dodgerblue3", linetype = "dotted") +
#geom_hline(yintercept = -31.71, color = "dodgerblue3", linetype = "dotted") +

# Text
#annotate("text", x = as.POSIXct('2016-06-25 00:04:00'), y = -31.2, label = lb1, parse = T) +
annotate("text", x = as.POSIXct('2016-05-27 08:04:00'), y = -3, label = "App.4", parse = T) +
geom_segment(aes(x = as.POSIXct('2016-05-26 08:04:00'), y = -4,
                xend = as.POSIXct('2016-05-26 08:04:00'), yend = -5.0),
            arrow = arrow(length = unit(0.2, "cm")))) +
geom_text_repel(aes(label=Weeks, color = factor(Weeks)),
               size = 3,
               arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
               force = 0.5,
               point.padding = unit(0.5, 'lines'),
               max.iter = 2e3,
               nudge_x = .05)

#concs = plot_grid(conc1, conc2, ncol = 2, nrow = 1, align = "h")
#concs

```

Outlet Isotopes - Continuous

```

A0df$SD.d13C.err <- ifelse(is.na(A0df$SD.d13C), 0.5, A0df$SD.d13C)
# limits_dC <- aes(ymin=diss.d13C-SD.d13C.err, ymax=diss.d13C+SD.d13C.err, color = Weeks, group = Weeks)
limits_dC <- aes(ymin=diss.d13C-SD.d13C, ymax=diss.d13C+SD.d13C, color = Weeks, group = Weeks)
# View(A0df)

iso <- ggplot(A0df, aes(x=ti, y=diss.d13C)) +
  #geom_errorbar(aes(ymin=mean.d13C-SD.d13C, ymax=mean.d13C+SD.d13C), width=.1) +
  geom_errorbar(limits_dC, width=1) +
  #theme_gray() +

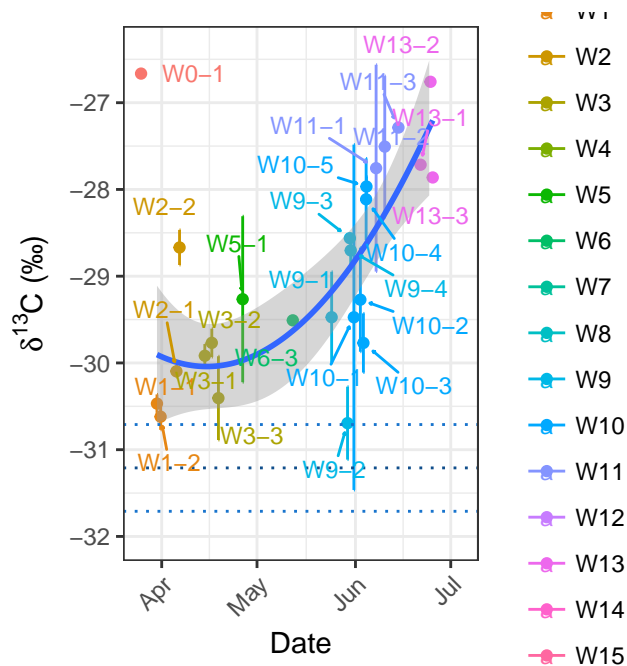
```

```

theme_bw() +
theme(axis.text.x=element_text(angle = 45, hjust = 1)) +
#scale_x_datetime(breaks = date_breaks("week"), labels = date_format("%m/%d")) +
geom_point(aes(color = Weeks, group = Weeks)) +
#stat_smooth(method = "lm", formula = y ~ x) +
geom_smooth(data=subset(A0df[4:length(A0df), ]), method = "lm", formula = y ~ poly(x, 2)) +
#stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
#theme(axis.text.x = element_blank()) +
#theme(plot.margin = unit(c(1,1,1,1), "lines")) +
geom_hline(yintercept = -31.21, color = "dodgerblue4", linetype = "dotted") +
geom_hline(yintercept = -30.71, color = "dodgerblue3", linetype = "dotted") +
geom_hline(yintercept = -31.71, color = "dodgerblue3", linetype = "dotted") +
#annotate("text", x = as.POSIXct('2016-06-25 00:04:00'), y = -31.2, label = lb1, parse = T) +
xlab("Date") +
#theme(legend.position="top") +
scale_y_continuous(breaks = c(-32,-31,-30,-29, -28, -27), limits = c(-32, -26.4) ) +
ylab(expression(paste({delta}^13"C", ' (\u2030)'))) +
geom_text_repel(aes(label=WeekSubWeek, color = factor(Weeks)),
size = 3,
arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
force = 0.5,
point.padding = unit(0.5, 'lines'),
max.iter = 2e3,
nudge_x = .05)
#ylab(expression(paste({delta}^13"C", ' (\u2030)')))
#ylab(expression(paste({delta}^13"C")))

```

iso



```

ggsave(iso, filename = "Outlet_Delta_ti_cont.png", width = 8, height = 5, units = "in", scale = 1)

```

```

# DeltaDelta Water

```



```

#limits_DdCwater <- aes(ymin=diss.d13C-SD.d13C-initialDelta, ymax=diss.d13C+SD.d13C-initialDelta, color =
limits_DdCwater <- aes(ymin=diss.d13C-se.d13C-initialDelta, ymax=diss.d13C+se.d13C-initialDelta, color =

iso2 <- ggplot(A0df, aes(x=ti, y=DD13C.diss)) +
  # Error bars
  # geom_errorbar(aes(ymin=mean.d13C-SD.d13C, ymax=mean.d13C+SD.d13C), width=.1) +
  geom_errorbar(limits_DdCwater, width=1) +

  # Themes and Axes
  # theme_gray() +
  # theme(axis.text.x = element_blank()) +
  # theme(plot.margin = unit(c(1,1,1,1), "lines")) +
  theme_bw() +
  theme(legend.position="none",
        # legend.title = element_blank(),
        axis.text.x=element_text(angle = 45, hjust = 1)) +
  guides(col = guide_legend(nrow = 2)) + # Sets legend parameters
  xlab("Date") +
  scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +

  # scale_y_continuous(breaks = c(-32,-31,-30,-29, -28, -27), limits = c(-32, -26.4) ) +
  # scale_y_continuous(breaks = c(6, 4, 2, 0), limits = c(-1, 6) ) +
  scale_y_continuous(breaks=seq(0, 6, 1)) +
  ylab(expression(paste({Delta}, {delta}^"13", "C", ' (\u2030)')) +

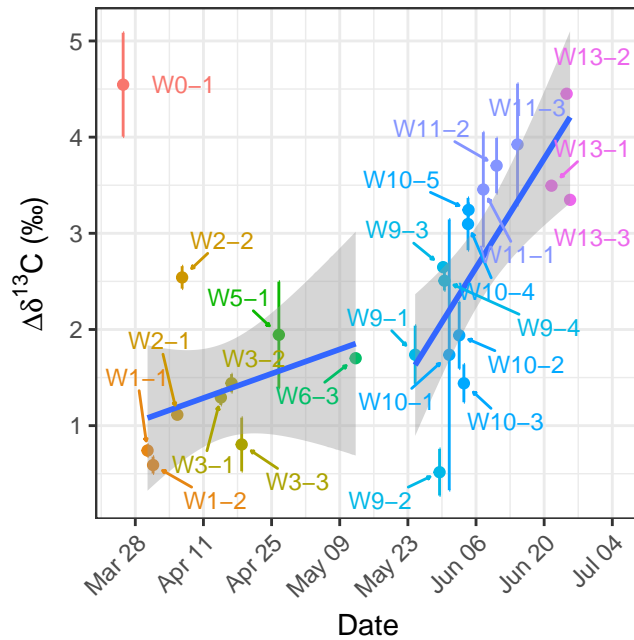
  #scale_x_datetime(breaks = date_breaks("week"), labels = date_format("%m/%d")) +
  geom_point( aes(color = Weeks, group = Weeks)) +

  # Smooth linear models
  # stat_smooth(method = "lm", formula = y ~ x) +
  # geom_smooth(data=subset(A0df[4:length(A0df), ]), method = "lm", formula = y ~ poly(x, 2)) +
  geom_smooth(data=subset(A0df[4:27, ]), method = "lm", formula = y~x) +
  geom_smooth(data=subset(A0df[28:length(A0df), ]), method = "lm", formula = y ~ x) +

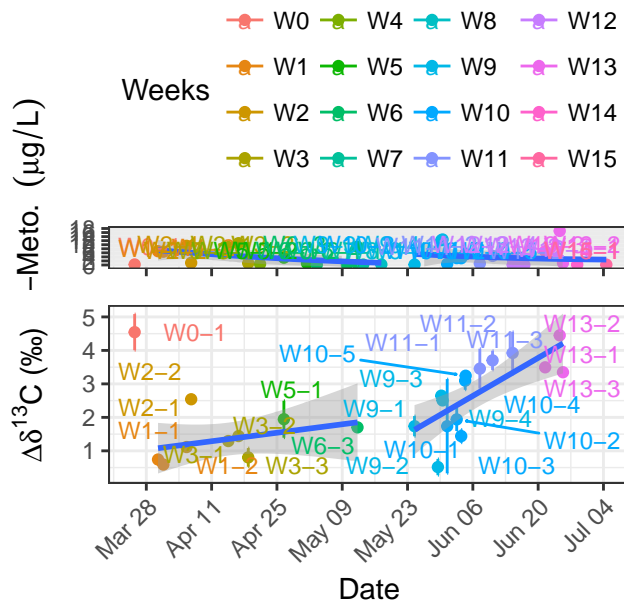
  # Text
  # annotate("text",
  #         x = as.POSIXct('2016-06-10 08:04:00'), y = 0.3, label = lbW9, parse = T, size = 3.0) +
  # geom_segment(aes(x = as.POSIXct('2016-06-05 08:04:00'), y = 0.2,
  #                 xend = as.POSIXct('2016-05-25 18:04:00'), yend = 0), color = "black",
  #             arrow = arrow(length = unit(0.2, "cm")))) +
  # annotate("text", x = as.POSIXct('2016-06-25 00:04:00'), y = -31.2, label = lb1, parse = T) +
  geom_text_repel(aes(label=WeekSubWeek, color = factor(Weeks)),
                  size = 3,
                  arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
                  force = 0.5,
                  point.padding = unit(0.5, 'lines'),
                  max.iter = 2e3,
                  nudge_x = .05)
  #ylab(expression(paste({delta}^"13", "C", ' \u2111'))))
  #ylab(expression(paste({delta}^"13", "C"))))

```

iso2



```
concIsoWater = plot_grid(conc1, iso2, ncol = 1, nrow = 2, align = "v")
concIsoWater
```



```
# plot_grid(co, deltaTime, ncol = 1, nrow = 2, align = "v")
```

All plots

```
concSoils <- co + theme(legend.position='none')
concWater <- conc1 + theme(legend.position='none')
```

```

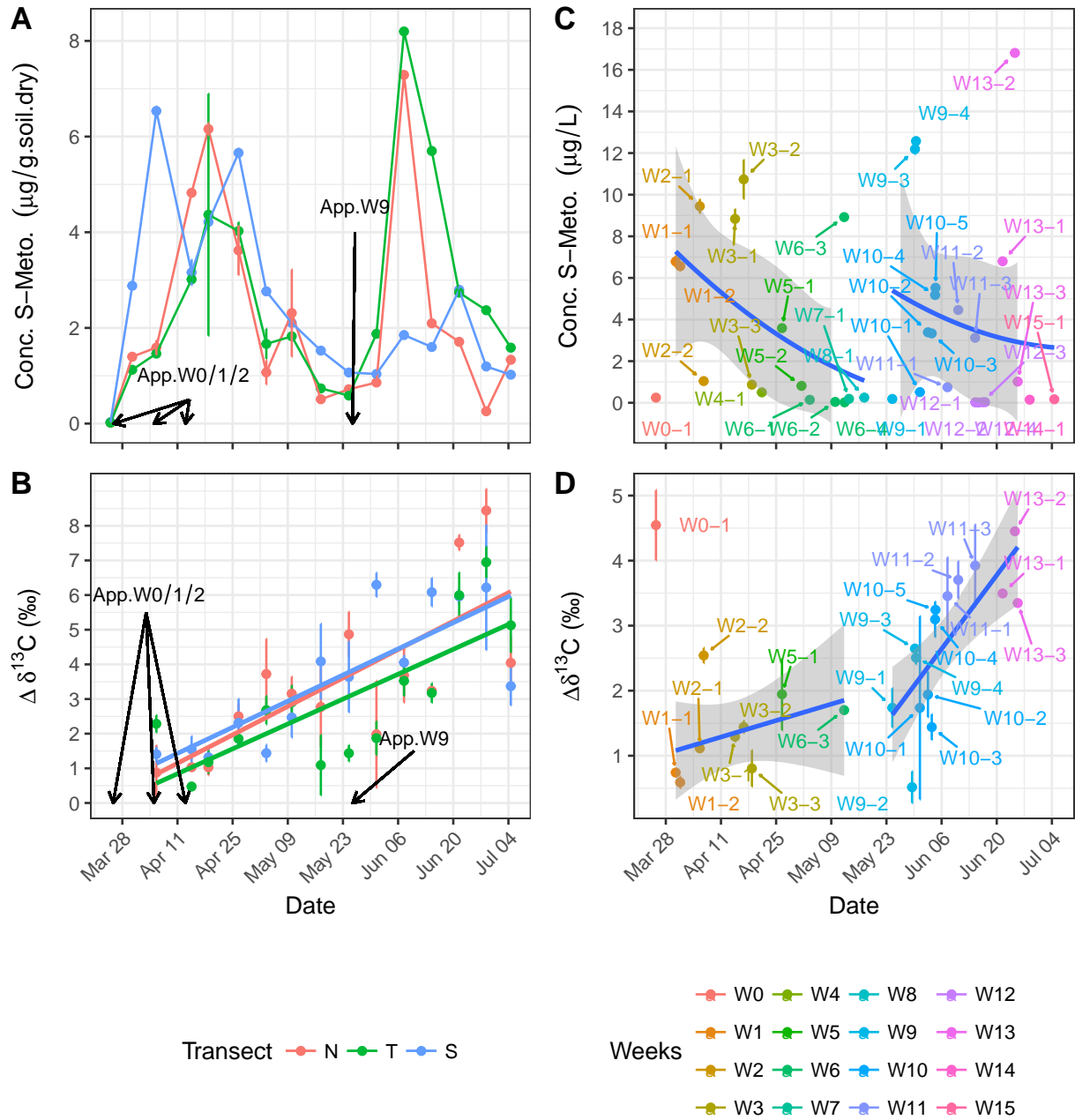
legend_soils = get_legend(co)
legend_water = get_legend(conc1)

grid4 <- plot_grid(concSoils, concWater, deltaTime, iso2,
                   ncol = 2, nrow = 2, align = "v",
                   labels = c("A", "C", "B", "D"))

fig1 <- ggdraw() +
  draw_plot(grid4, x=0, y=.2, width = 1, height = .8) +
  draw_plot(legend_water, x=0.5, y = 0, width = 0.5, height = 0.2) +
  draw_plot(legend_soils, x=0, y=0, width = 0.6, height = 0.2)

fig1

```



```
ggsave(fig1, filename = "SoilsAndOutlet.tiff", height = 18, width = 17.8, units = 'cm')
```

Mass balance approach

```
library("ggplot2")
library("scales")
library("reshape2")
library("zoo")

soilsOut = read.csv2("Data/MassBalance_R.csv", header = T)
```

```

soilsOut$ti <- as.POSIXct(soilsOut$ti, "%Y-%m-%d %H:%M", tz = "EST")
sum(is.na(soilsOut$ti))

## [1] 0

print("Mass Balance Soils")

## [1] "Mass Balance Soils"

str(soilsOut)

## 'data.frame':    52 obs. of  27 variables:
##  $ ti                : POSIXct, format: "2016-03-25 00:04:00" "2016-03-25 12:04:00" ...
##  $ WeekSubWeek       : Factor w/ 51 levels "W0-0x","W0-1",...: 1 2 3 4 5 6 26 27 28 29 ...
##  $ B.diss            : num  NA 93.1 NA 35.4 29.4 ...
##  $ B.filt           : num  NA NA NA NA NA ...
##  $ CumOutDiss.g      : num  0 0.0246 0.0246 2.6745 5.0315 ...
##  $ CumOutFilt.g      : num  0 0.00345 0.00345 0.00652 0.01004 ...
##  $ CumAppMass.g      : num  6369 6369 6369 6369 6369 ...
##  $ B.comp.North      : num  NA NA NA NA NA ...
##  $ MassSoil.g.North  : num  12.4 NA NA 963.7 NA ...
##  $ comp.d13C.North   : num  NA NA NA NA NA ...
##  $ comp.d13C.SD.North : num  NA NA NA NA NA ...
##  $ comp.d13C.SE.North : num  NA NA NA NA NA ...
##  $ ID.N              : Factor w/ 17 levels "AW-N-0","AW-N-0x",...: 2 NA NA 1 NA NA 3 NA NA 10 ...
##  $ B.comp.Talweg     : num  NA NA NA NA NA ...
##  $ MassSoil.g.Talweg : num  4.33 NA NA 243.43 NA ...
##  $ comp.d13C.Talweg  : num  NA NA NA NA NA ...
##  $ comp.d13C.SD.Talweg : num  NA NA NA NA NA ...
##  $ comp.d13C.SE.Talweg : num  NA NA NA NA NA ...
##  $ ID.T              : Factor w/ 17 levels "AW-T-0","AW-T-0x",...: 2 NA NA 1 NA NA 3 NA NA 10 ...
##  $ B.comp.South     : num  NA NA NA NA NA ...
##  $ MassSoil.g.South  : num  19.1 NA NA 1899.2 NA ...
##  $ comp.d13C.South   : num  NA NA NA NA NA ...
##  $ comp.d13C.SD.South : num  NA NA NA NA NA ...
##  $ comp.d13C.SE.South : num  NA NA NA NA NA ...
##  $ ID.S              : Factor w/ 17 levels "AW-S-0","AW-S-0x",...: 2 NA NA 1 NA NA 3 NA NA 10 ...
##  $ CatchMassSoil.g   : num  35.9 NA NA 3106.4 NA ...
##  $ BulkCatch.d13     : num  NA NA NA NA NA ...

# Melt data set

##Subset the necessary columns
soilsRemainMass <- soilsOut[, c("ti", "CumAppMass.g", "CumOutDiss.g", "CumOutFilt.g", "CatchMassSoil.g")]

# Replace each NA with the most recent non-NA prior to it.
# Purpose: To match continuous outlet time array
soilsRemainMass$CatchMassSoil.g <- na.locf(soilsRemainMass$CatchMassSoil.g)
# View(soilsRemainMass)

##Then rearrange your data frame
remainMassMolten = melt(soilsRemainMass, id=c("ti"))
# View(remainMassMolten)

pg <- remainMassMolten
# Change variable names:

```

```

levels(pg$variable)[levels(pg$variable)=="CumAppMass.g"] <- "Applied Cum. (Survey)"
levels(pg$variable)[levels(pg$variable)=="CumOutDiss.g"] <- "Dissolved Cum. (Outlet)"
levels(pg$variable)[levels(pg$variable)=="CumOutFilt.g"] <- "Sediment Cum. (Outlet)"
levels(pg$variable)[levels(pg$variable)=="CatchMassSoil.g"] <- "Catch. Mass (0.5cm Soil)"

# Change the order:
levels(pg$variable)

## [1] "Applied Cum. (Survey)"      "Dissolved Cum. (Outlet)"
## [3] "Sediment Cum. (Outlet)"    "Catch. Mass (0.5cm Soil)"

pg$variable <- factor(pg$variable, levels = c("Applied Cum. (Survey)", "Catch. Mass (0.5cm Soil)", "Dis
# names(pg)[names(pg)=="variable"] <- "Estimated Mass"

massBalTop <- ggplot(pg) +
  geom_line(aes(x=ti, y=value, group = variable, color=variable)) +

  # Themes and axes
  theme_bw() +
  theme(# axis.text.x=element_text(angle = 45, hjust = 1),
        axis.text.x=element_blank(),
        axis.title.x=element_blank(),
        axis.title.y = element_text(hjust = 0.0),
        legend.position="none"

        )+
  labs(color = "Estimated Mass") +
  guides(col = guide_legend(ncol = 2)) + # Sets legend parameters

  # xlab("Date") +
  scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +
  ylab(expression(paste("S-Meto. ", {(g)}))) +
  scale_y_continuous(breaks = c(100, 5000, 10000, 20000), limits = c(100, 20000) )
  # scale_y_continuous(trans=log_trans(), breaks=c(1,5,10,50,100,500,1000,2000,3000,4000,5000))

massBalBottom <- ggplot(pg) +
  geom_line(aes(x=ti, y=value, color=variable)) +

  # Themes and axes
  theme_bw() +
  theme(axis.text.x=element_text(angle = 45, hjust = 1),
        #axis.text.x=element_blank(),
        #axis.title.x=element_blank(),
        axis.title.y = element_blank(),
        legend.position="none"

        )+
  # guides(col = guide_legend(nrows = 2)) + # Sets legend parameters
  xlab("Date") +
  scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +
  ylab(expression(paste("Mass. S-Meto. ", {(g)}))) +

  scale_y_continuous(breaks = c(1, 25, 50, 100), limits = c(0, 100) )

```

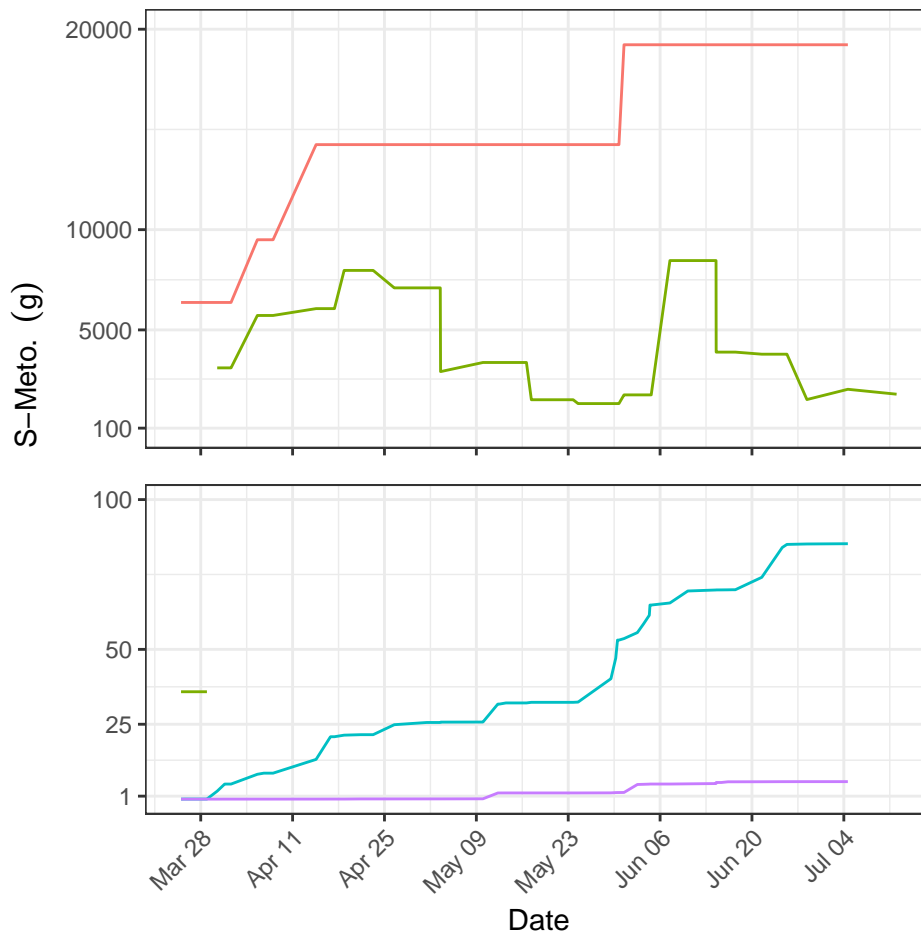
```

massBalLegend <- ggplot(pg) +
  geom_line(aes(x=ti, y=value, color=variable)) +

  # Themes and axes
  theme_bw() +
  theme(axis.text.x=element_text(angle = 45, hjust = 1),
        #axis.text.x=element_blank(),
        #axis.title.x=element_blank(),
        legend.position="top"
  )+
  guides(color = guide_legend(title = "Mass Distribution", title.position = "top"))+
  # guides(col = guide_legend(nrows = 2)) + # Sets legend parameters
  xlab("Date") +
  scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +
  ylab(expression(paste("Mass. S-Meto. ", {(g)}))) +
  scale_y_continuous(breaks = c(1, 25, 50, 100), limits = c(0, 100) )

massBal = plot_grid(massBalTop, massBalBottom, ncol = 1, nrow = 2, align = "v")
massBal

```



Catchment degradation based on bulk signatures

```
# Pure and cuve isotope average
d13Co = -31.2144

# Lab enrichment:
# Alteck
epsilon_max = -1.5 # +/- 0.3 (@ 20C, 20% vwc)
epsilon_min = -2.0 # +/- 0.2 (@ 20C, 40% vwc)

epsilon_mean = -1.75

# Vine
# (@ 20C, 20% vwc) -0.8 +/- 0.1
# (@ 30C, 20% vwc) -1.4 +/- 0.2
# (@ 20C, 40% vwc) -1.7 +/- 0.2
# Average

# Remaining fraction
soilsOut$DD13C.bulk <- (soilsOut$BulkCatch.d13 - (d13Co))

# Max epsilon (30C, 20%)
soilsOut$f.bulk <-
  ((10^(-3)*soilsOut$BulkCatch.d13 + 1)/(10^(-3)*d13Co + 1))^(1000/(epsilon_max))

soilsOut$B.bulk <-
  (1 - soilsOut$f.bulk)*100

# Min epsilon (20C, 40%)
soilsOut$f.min.bulk <-
  ((10^(-3)*soilsOut$BulkCatch.d13 + 1)/(10^(-3)*d13Co + 1))^(1000/(epsilon_min))

soilsOut$B.min.bulk <-
  (1 - soilsOut$f.min.bulk)*100

# Mean epsilon (# Alteck)
soilsOut$f.mean.bulk <-
  ((10^(-3)*soilsOut$BulkCatch.d13 + 1)/(10^(-3)*d13Co + 1))^(1000/(epsilon_mean))

soilsOut$B.mean.bulk <-
  (1 - soilsOut$f.mean.bulk)*100

bulkB <- ggplot(soilsOut, aes(x=ti, y=B.mean.bulk)) +
  geom_point() +
  # geom_point(aes(x=Date.ti, y=B.comp, colour=Transect, group = Transect)) +

# Theme and axes
theme_bw() +
ylab("Degr. %") +
```



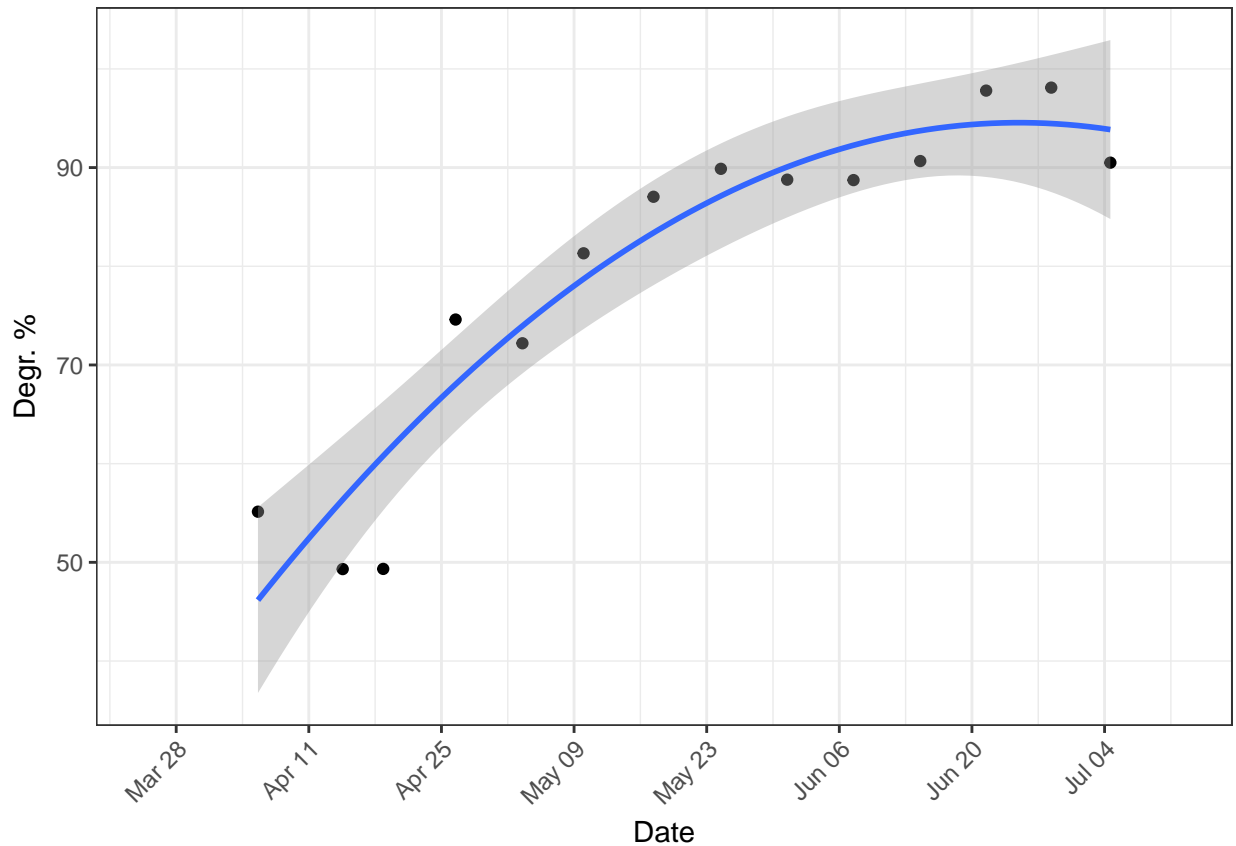
```

theme(legend.position = "top",
      #axis.title = element_blank(),
      #axis.title.x = element_blank(),
      #axis.text.x = element_blank()
      axis.text.x=element_text(angle = 45, hjust = 1)
    ) +
xlab("Date") +
scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +

# scale_y_continuous(breaks = c(25, 50, 75, 100), limits = c(0, 100) ) +
# stat_smooth(method = "lm", formula = y ~ poly(x, 2), se=FALSE)
# geom_smooth(data=subset(weeklySoil[14:28, ]), method = "lm", formula = y ~ poly(x, 2), se = F) +
geom_smooth(aes(group = 1), method = "lm", formula = y ~ poly(x, 2))
# stat_smooth(data=subset(weeklySoil[4:39, ]), method = "lm", formula = y ~ poly(x, 2), se = F)
# stat_smooth(method = "lm", formula = y ~ x, se=FALSE)
#geom_text_repel(aes(label=Wnum, color = factor(Transect)),
#               size = 3,
#               arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
#               force = 0.5,
#               point.padding = unit(0.5, 'lines'),
#               max.iter = 2e3,
#               nudge_x = .05)

```

bulkB



Degradation based on transect signatures

```
# Merge Bulk Degradation into weekly soil dataframe (only one (e.g. South) transect as root)
bulkDegDF <- soilsOut[, c("ti", "WeekSubWeek", "ID.S", "BulkCatch.d13", "B.mean.bulk", "B.bulk", "B.mi
bulkDegDF <- na.omit(bulkDegDF)
bulkDegDF$Transect <- "Bulk"
names(bulkDegDF)[names(bulkDegDF) == "B.mean.bulk"] <- "B.mean.com"
names(bulkDegDF)[names(bulkDegDF) == "ti"] <- "Date.ti"

#Splitting the identifier name into Type, Week No., tc..
bulkDegDF$ID.S <- as.character(bulkDegDF$ID.S)
split <- strsplit(bulkDegDF$ID.S, "AW-S-", fixed = T)
bulkDegDF$Wnum <- sapply(split, "[", 2) # Creates new column without "Split0"

bulkDegDF$Week = paste("W", bulkDegDF$Wnum, sep = "")

bulkDegDF <- bulkDegDF[, c("Date.ti", "Transect", "B.mean.com", "Week")]

wSoil <- weeklySoil[, c("Date.ti", "Transect", "B.mean.com")]
wSoil$Week <- NA
wSoilBulkDeg <- rbind(wSoil, bulkDegDF)

#names(bulkDegDF)[names(bulkDegDF) == "ID.S"] <- "ID"
#wSoilBulkDeg <- merge(weeklySoil, bulkDegDF, by="ID", all = T)
#wSoilBulkDeg$BulkLabel[!is.na(wSoilBulkDeg$WeekSubWeek)] <- "Bulk"

levels(wSoilBulkDeg$Transect)[levels(wSoilBulkDeg$Transect)=="N"] <- "North"
levels(wSoilBulkDeg$Transect)[levels(wSoilBulkDeg$Transect)=="T"] <- "Talweg"
levels(wSoilBulkDeg$Transect)[levels(wSoilBulkDeg$Transect)=="S"] <- "South"
levels(wSoilBulkDeg$Transect)[levels(wSoilBulkDeg$Transect)=="Bulk"] <- "Bulk Fraction"

levels(wSoilBulkDeg$Transect)

## [1] "North"          "Talweg"         "South"          "Bulk Fraction"

wSoilBulkDeg$Transect <- factor(wSoilBulkDeg$Transect, levels = c("North", "Talweg", "South", "Bulk Fra

# View(weeklySoil)
Bsoil2 = ggplot(wSoilBulkDeg, aes(x=Date.ti, y=B.mean.com, colour=Transect, group = Transect)) +
  # Bsoil2 = ggplot(wSoilBulkDeg, aes(x=Date.ti)) +
  #
  # stat_smooth(aes(y=B.mean.bulk), method = "lm", formula = y ~ poly(x, 2), se=T) +
  # geom_point(aes(y=B.mean.com, colour=Transect, group = Transect)) +
  # geom_point(aes(y=B.mean.bulk, group=BulkLabel, colour="Bulk Isotopes")) +
  geom_point() +
  scale_colour_manual(values=c("#F8766D", "#7CAE00", "#619CFF", "black")) +
  stat_smooth(data=subset(wSoilBulkDeg, Transect == "Bulk Fraction"), method = "lm", formula = y ~ poly
  # geom_point(aes(x=Date.ti, y=B.comp, colour=Transect, group = Transect)) +
  # Theme and axes
  theme_bw() +
  ylab("Degr. %") +
```

```

theme(legend.position = "top",
      #axis.title = element_blank(),
      axis.title.x = element_blank(),
      axis.text.x = element_blank()
      #axis.text.x=element_text(angle = 45, hjust = 1)
      ) +
# xlab("Date") +
scale_x_datetime(breaks = date_breaks("2 weeks"), labels = date_format("%b %d")) +
# ylab(expression(paste("Degradation %")) ) +

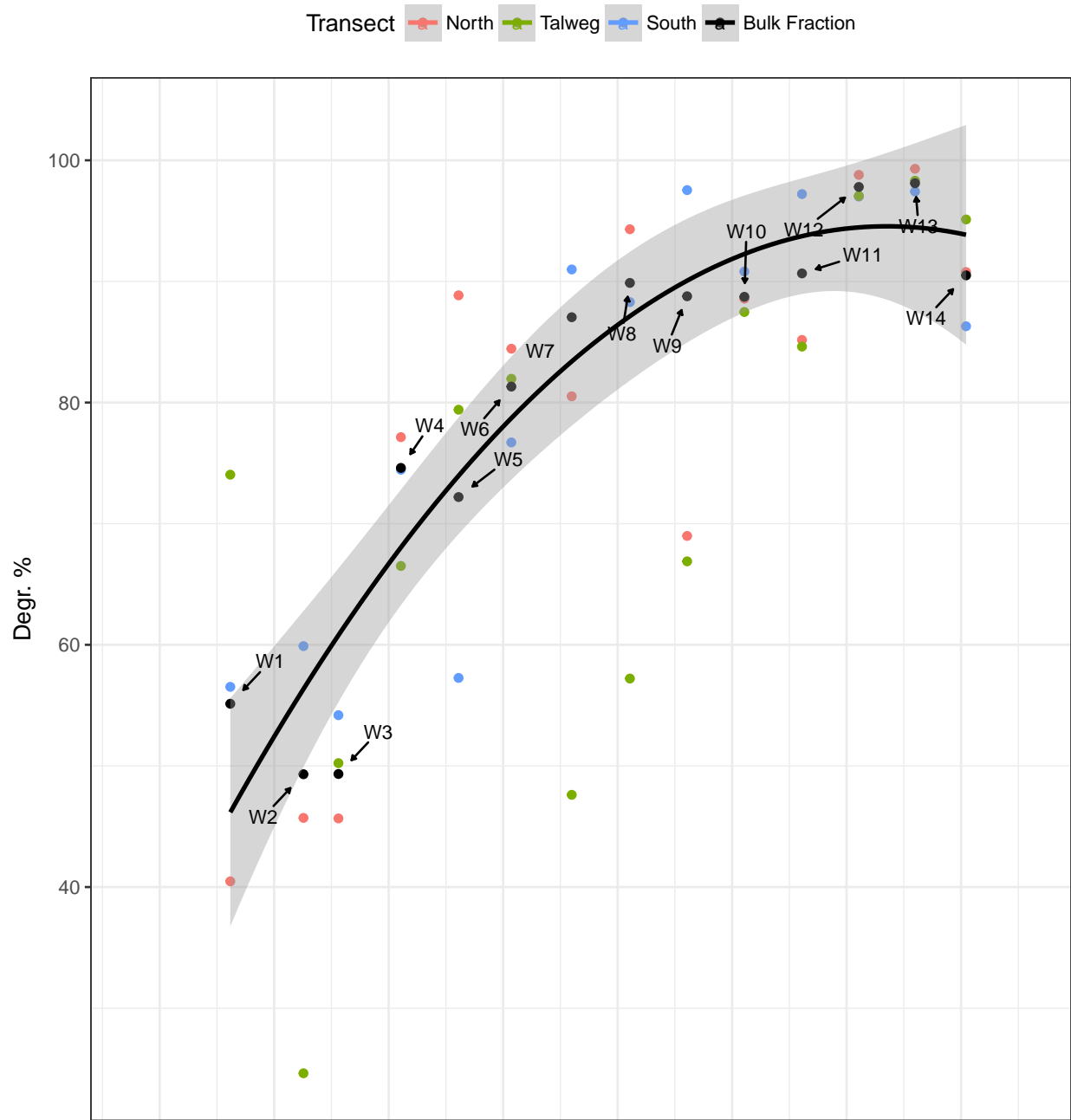
# scale_y_continuous(breaks = c(25, 50, 75, 100), limits = c(0, 100) ) +

# geom_smooth(data=subset(weeklySoil[14:28, ]), method = "lm", formula = y ~ poly(x, 2), se = F) +
# geom_smooth(aes(group = 1), method = "lm", formula = y ~ poly(x, 2)) +
# stat_smooth(data=subset(weeklySoil[4:39, ]), method = "lm", formula = y ~ poly(x, 2), se = F)
# stat_smooth(method = "lm", formula = y ~ x, se=FALSE)
geom_text_repel(aes(y=B.mean.com, label=Week),
                size = 3,
                arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
                force = 0.9,
                point.padding = unit(0.9, 'lines'),
                max.iter = 2e3,
                nudge_x = .05)

#geom_text_repel(aes(y=B.mean.bulk, label=Wnum, color = factor(Transect)),
#               size = 3,
#               arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
#               force = 0.5,
#               point.padding = unit(0.5, 'lines'),
#               max.iter = 2e3,
#               nudge_x = .05)

```

Bsoil2



```
## Merging both figures
```

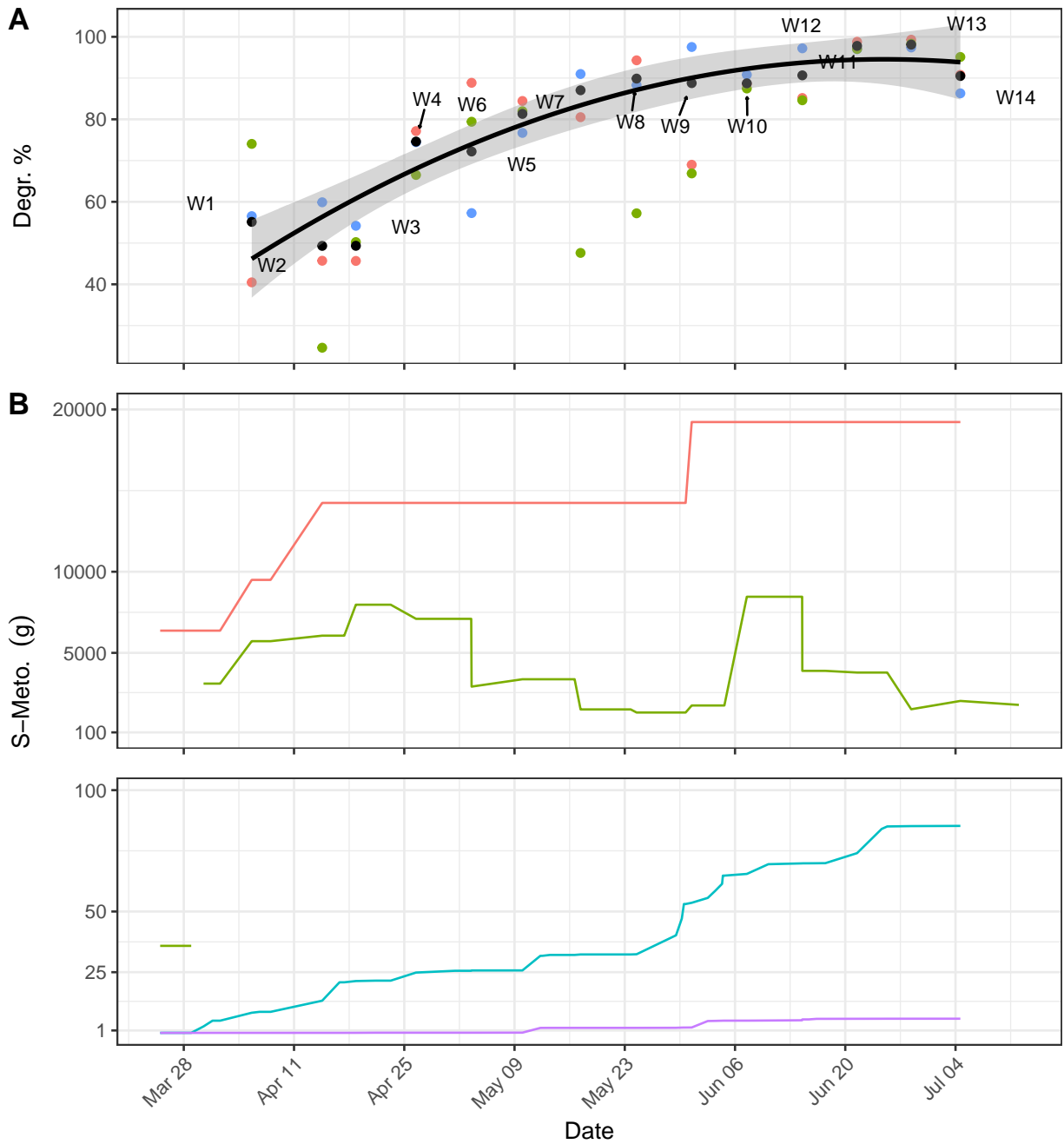
```
# massBalNoL <- massBal + theme(legend.position='none')
```

```
BsoilNoL <- Bsoil2 + theme(legend.position='none')
```

```
legend_mass = get_legend(massBalLegend + guides(colour = guide_legend(title = "Mass Distribution", tit.  
legend_deg = get_legend(Bsoil2 + guides(colour = guide_legend(title.position = "top", nrow = 4, byrow =
```

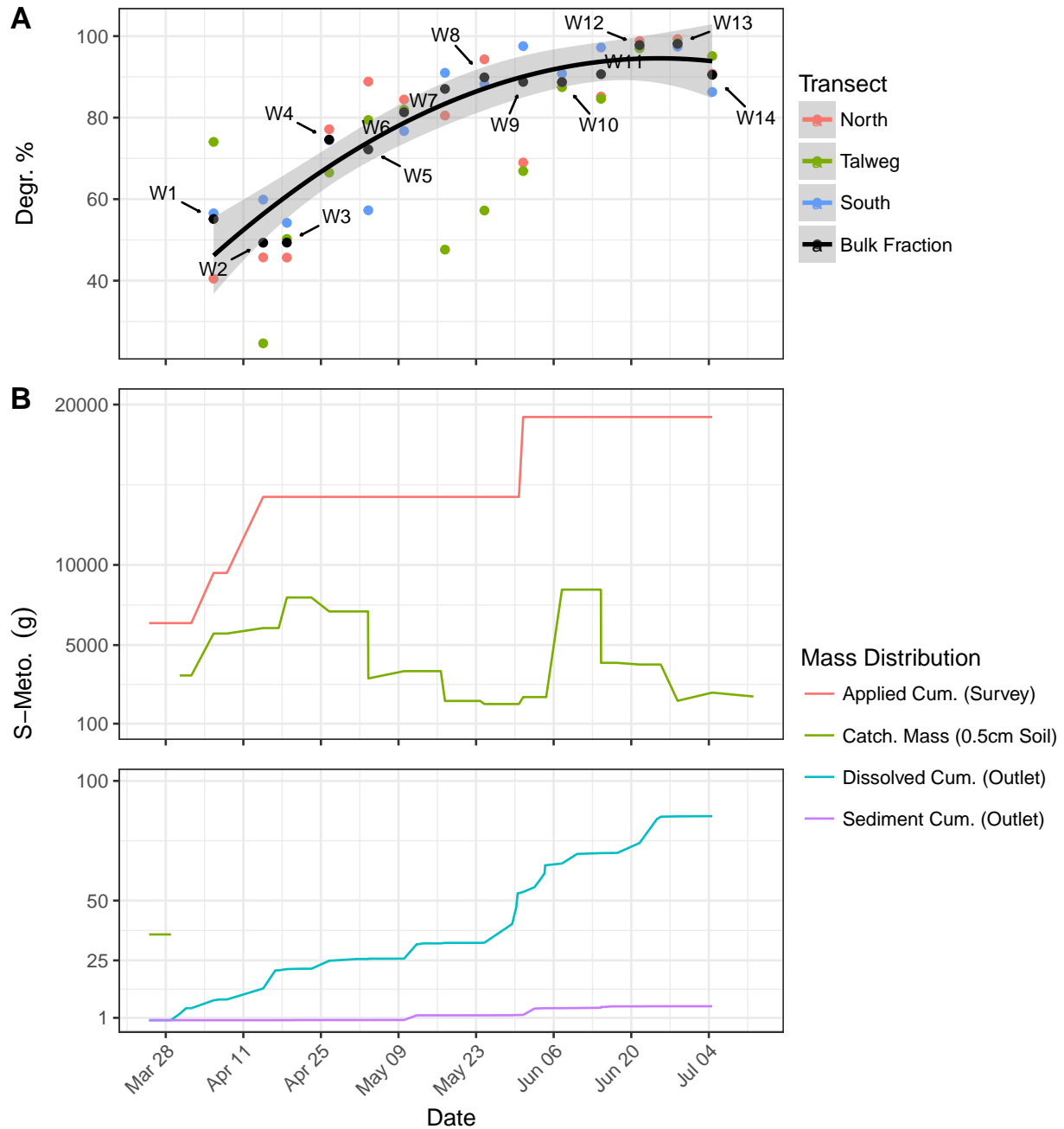
```
gridPartB <- plot_grid(BsoilNoL, massBalTop, massBalBottom,  
                        ncol = 1, nrow = 3, align = "v",
```

```
labels = c("A", "B"))
gridPartB
```



```
fig2 <- ggdraw() +
  draw_plot(gridPartB, x=0, y=0, width = 0.75, height = 1) +
  draw_plot(legend_deg, x=0.5, y =0.7, width = 0.65, height = 0.3) +
  draw_plot(legend_mass, x=0.5, y=0.2, width = 0.75, height = 0.3)
```

```
fig2
```



```
ggsave(fig2, filename = "BvsMassBal.tiff", height = 10, width = 17.8, units = 'cm')
```

XY-Plots

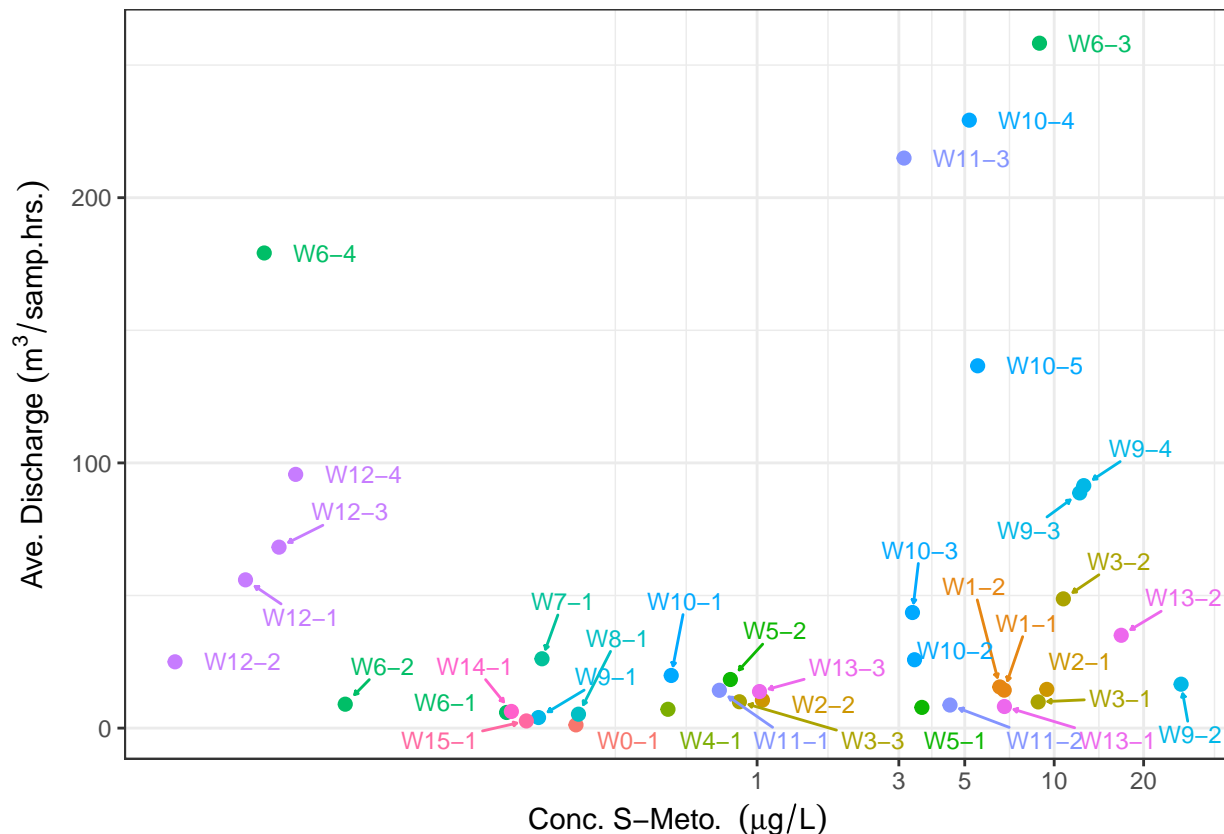
```
QC <- ggplot(A0df, aes(y=AveDischarge.m3.h, x=Conc.mug.L, group = WeekSubWeek, color = Weeks)) +
  geom_point(size = 2) +
  theme_bw() +
  theme(axis.text.y = element_blank()) +
  theme(legend.title=element_blank()) +
  theme(plot.margin = unit(c(0,0.5,0,0), "lines")) +
```

```

#stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +
theme_bw() +
theme(legend.position="none") +
#scale_y_continuous(trans=log_trans(), breaks=c(1, 5, 10, 50, 100, 200)) +
scale_x_continuous(trans=log_trans(), breaks=c(1, 3, 5, 10, 20)) +
ylab(expression(paste("Ave. Discharge ", {(m^{3} / samp.hrs. )}))) +
xlab(expression(paste("Conc. S-Meto. ", {(mu*g / L)}))) +
geom_text_repel(aes(label=WeekSubWeek, color = factor(Weeks)),
  size = 3,
  arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
  force = 0.5,
  point.padding = unit(0.5, 'lines'),
  max.iter = 2e3,
  nudge_x = .05)

```

QC



```

QD <- ggplot(A0df, aes(y=AveDischarge.m3.h, x=diss.d13C, group = WeekSubWeek, color = Weeks)) +
  geom_point(size = 2) +
  theme_bw() +
  theme(axis.text.y = element_blank()) +
  theme(plot.margin = unit(c(0,0.8,0,0), "lines")) +
  #theme(legend.title=element_blank()) +
  #theme(legend.text = element_text(size = 10)) +
  theme(legend.position="none") +
  #stat_smooth(method = "lm", formula = y ~ poly(x, 2)) +

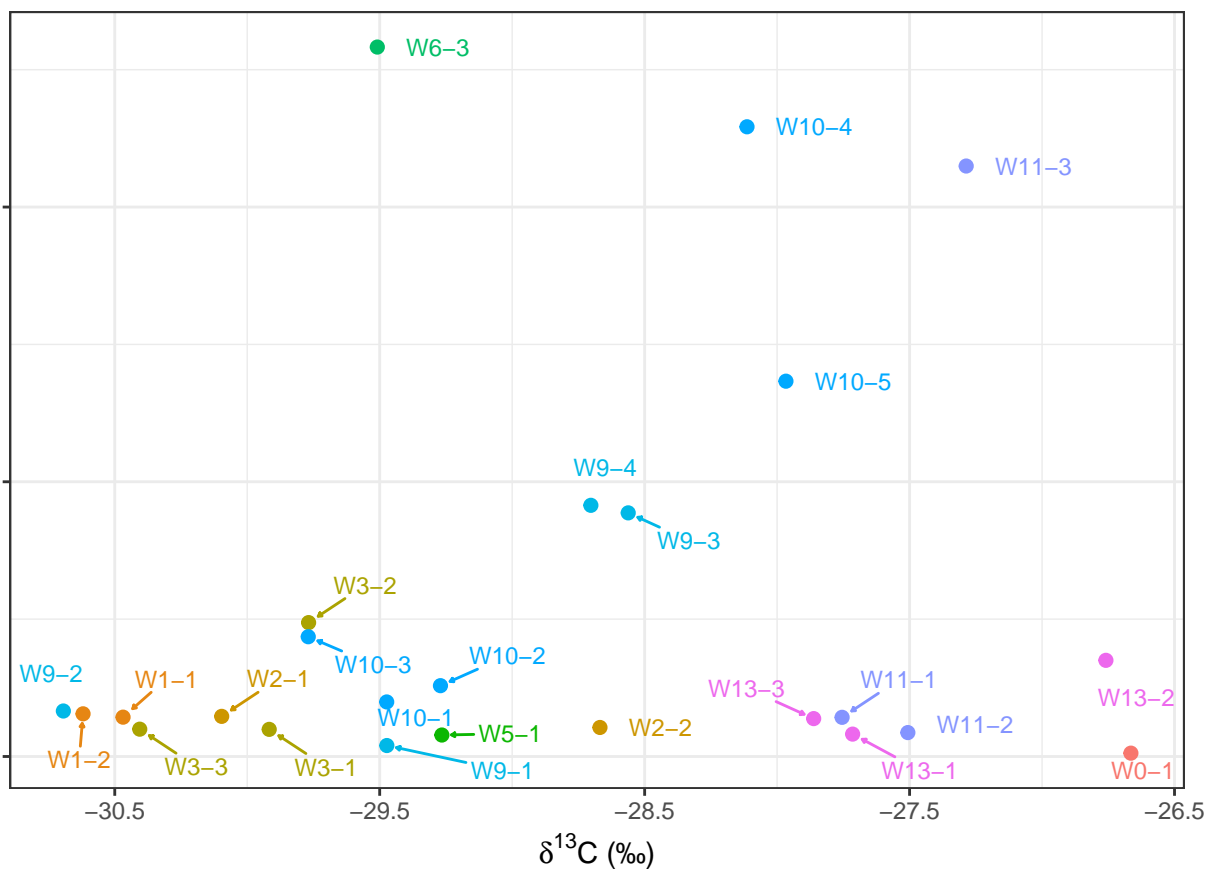
```

```

#scale_y_continuous(trans=log_trans(), breaks=c(1, 3, 5, 8, 10, 30, 50, 80, 100, 300)) +
ylab(expression(paste("Ave. Discharge ", {(m^{3} / sample)}))) +
ylab("") +
scale_x_continuous(breaks=seq(-31.5, -26.5, 1)) +
xlab(expression(paste({\delta}^{13}, "C", ' (‰)'))) +
geom_text_repel(aes(label=WeekSubWeek, color = factor(Weeks)),
  size = 3,
  arrow = arrow(length = unit(0.005, 'npc'), type = "closed"),
  force = 0.5,
  point.padding = unit(0.5, 'lines'),
  max.iter = 2e3,
  nudge_x = .05)

```

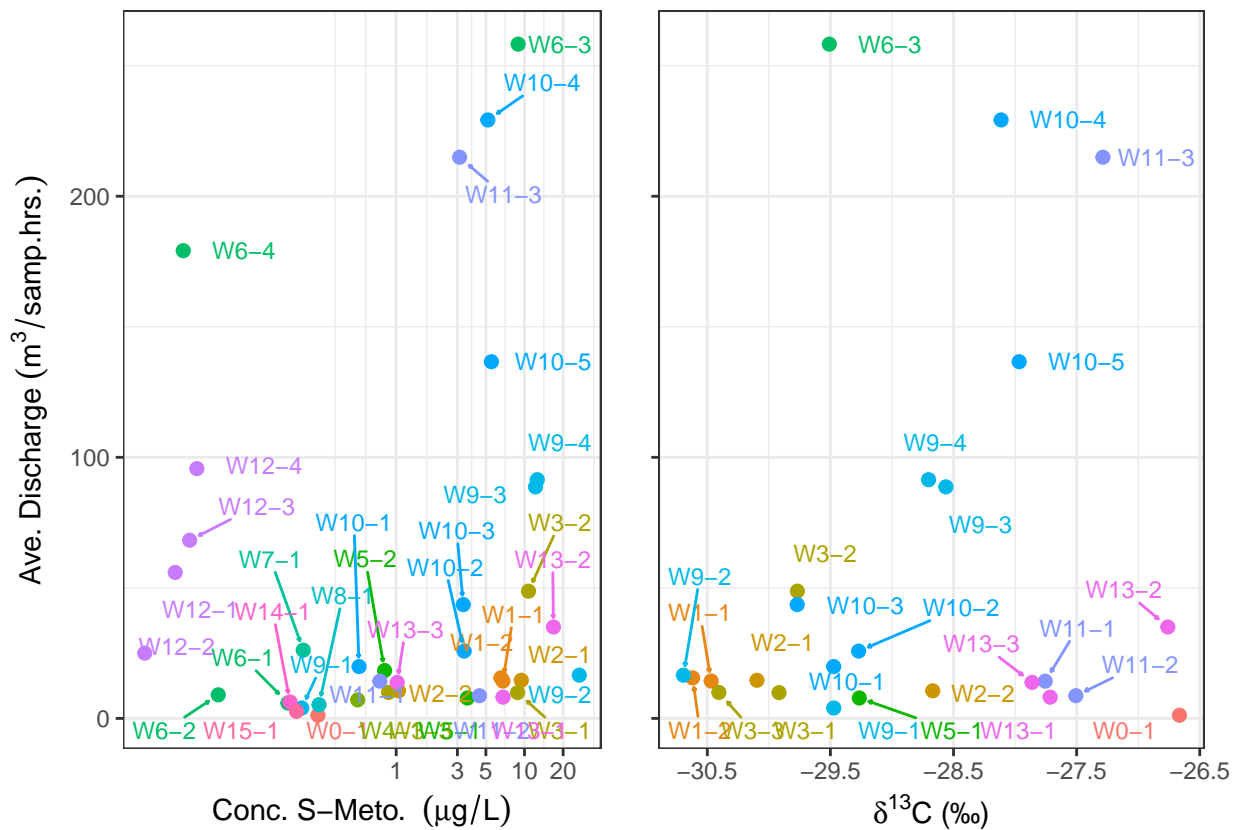
QD



```

acd = plot_grid(QC, QD, ncol = 2, nrow = 1, align = "h")
acd

```

```
ggsave(acd, filename = "Disch_Conc_Delta_XYlabs.png", width = 8, height = 5, units = "in", scale = 1)
#ggsave(acd, filename = "Disch_Conc_Delta_XY.png", width = 8, height = 5, units = "in", scale = 1)
#ggsave(acd, filename = "Disch_Conc_Delta_W.pdf", width = 8, height = 4.6, units = "in", scale = 1)
```