dowel comparison

Libraries:

```r
library(tidyverse)
```

Load data:

```r
dowels <- read_csv("../data/raw/1115pumpdata.csv")

dowels1205 <- read_csv("../data/raw/1205pumpdata.csv")

nodowels <- read_csv("../data/raw/1019pumpdata.csv")
```

```
## Warning: Missing column names filled in: 'X10' [10]
```

Tidy data:

```r
nodowels2 <- nodowels %>%
  select(-X10)

colnames(nodowels2) <- colnames(dowels)

dowels2 <- dowels %>%
  mutate(dowels = 'yes dowels')

nodowels2 <- nodowels2 %>%
  mutate(dowels = 'no dowels')

dowels12052 <- dowels1205 %>%
  mutate(dowels = "yes dowels 2", `mass volume concentration (ppm)` = as.numeric(`mass volume concentra
```

```
## Warning in evalq(as.numeric(`mass volume concentration (ppm)`),
## <environment>): NAs introduced by coercion
```

```r
data <- rbind(dowels2, nodowels2, dowels12052)

tidy <- data %>%
  mutate(`Sample Time` = if_else(dowels == "yes dowels"&`time series` > 2, (`time series` - 3)*300 + 330
  filter(`Sample Time` < 7000)

tidy <- tidy %>%
  rename(mvc = `mass volume concentration (ppm)`, t = `Sample Time`)
```
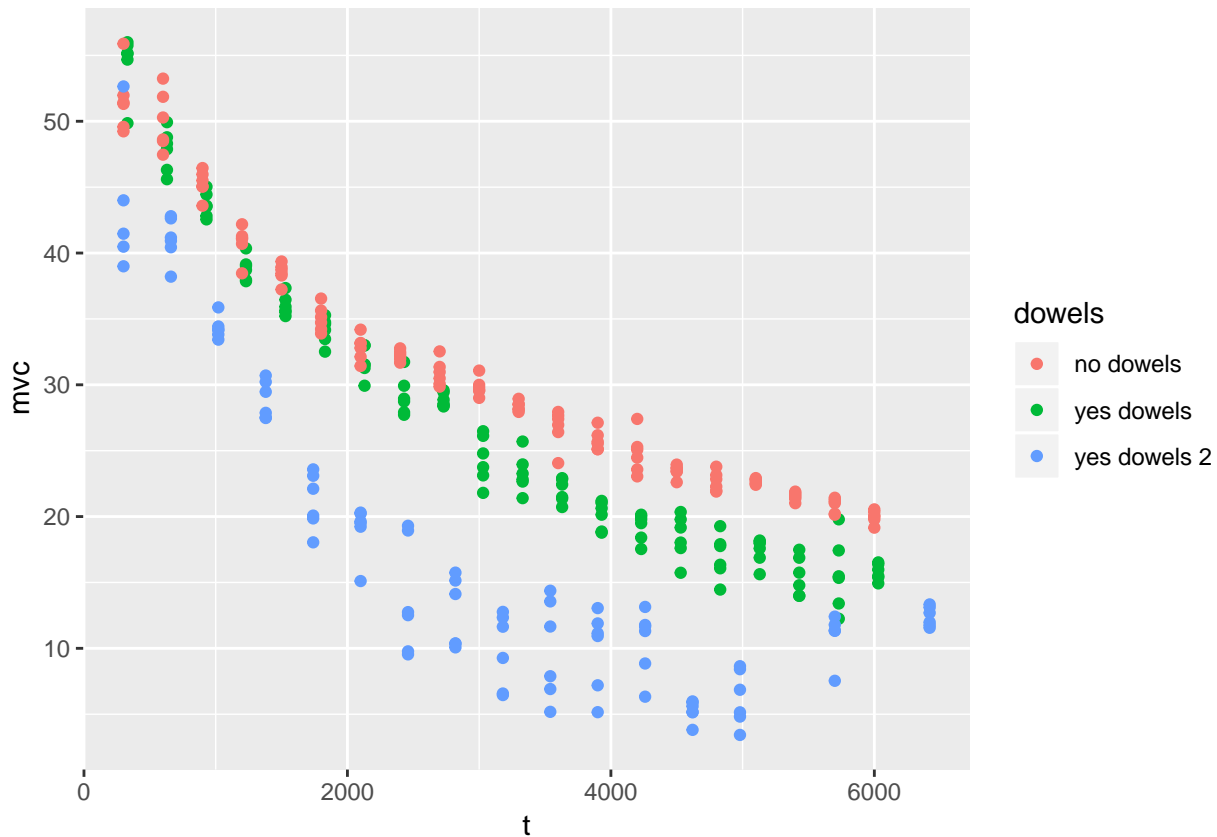
Initial data plot (simple):

```r
rm(data, dowels, dowels2, nodowels, nodowels2, dowels12052, dowels1205)

tidy %>%
```

```r
ggplot(aes(x = t, y = mvc, color = dowels)) +
  geom_point()
```

Warning: Removed 14 rows containing missing values (geom_point).

I had been beginning to worry we might have gotten negative results (no k_c), but this graph shows that's not the case! Hoorah!

Model:

no dowels:

```r
ndm <- tidy %>%
  filter(dowels == "no dowels") %>%
  lm(log(mvc) ~ t, data = .)

summary(ndm)
```

```
##
## Call:
## lm(formula = log(mvc) ~ t, data = .)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.14451 -0.03879 -0.00674  0.04417  0.16388
##
## Coefficients:
```

```
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.908e+00  1.079e-02  362.16   <2e-16 ***
## t           -1.620e-04  3.003e-06  -53.94   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0569 on 118 degrees of freedom
## Multiple R-squared:  0.961,  Adjusted R-squared:  0.9607
## F-statistic:  2910 on 1 and 118 DF,  p-value: < 2.2e-16
```

dowels:

```r
ydm <- tidy %>%
  filter(dowels == "yes dowels") %>%
  lm(log(mvc) ~ t, data = .)

summary(ydm)
```

```
##
## Call:
## lm(formula = log(mvc) ~ t, data = .)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.201016 -0.051007 -0.007986  0.047554  0.313311
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.949e+00  1.672e-02  236.24   <2e-16 ***
## t           -2.229e-04  4.618e-06  -48.27   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08751 on 118 degrees of freedom
## Multiple R-squared:  0.9518, Adjusted R-squared:  0.9514
## F-statistic:  2330 on 1 and 118 DF,  p-value: < 2.2e-16
```

Graph with models overlaid

```r
tidy %>%
  ggplot(aes(x = t, y = mvc, color = dowels, group = t)) +
  geom_point(alpha = .2) +
  stat_function(fun = function(x) exp(coef(ndm)[1]+coef(ndm)[2]*x), color = "red", size = 0.05) +
  stat_function(fun = function(x) exp(coef(ydm)[1]+coef(ydm)[2]*x), color = "blue", size = 0.05) +
  xlim(c(0,NA)) +
  scale_color_manual(values = c("red", "blue", "green"))
```

```
## Warning: Removed 14 rows containing missing values (geom_point).
```