Analysis_MovSpd_TempDisc

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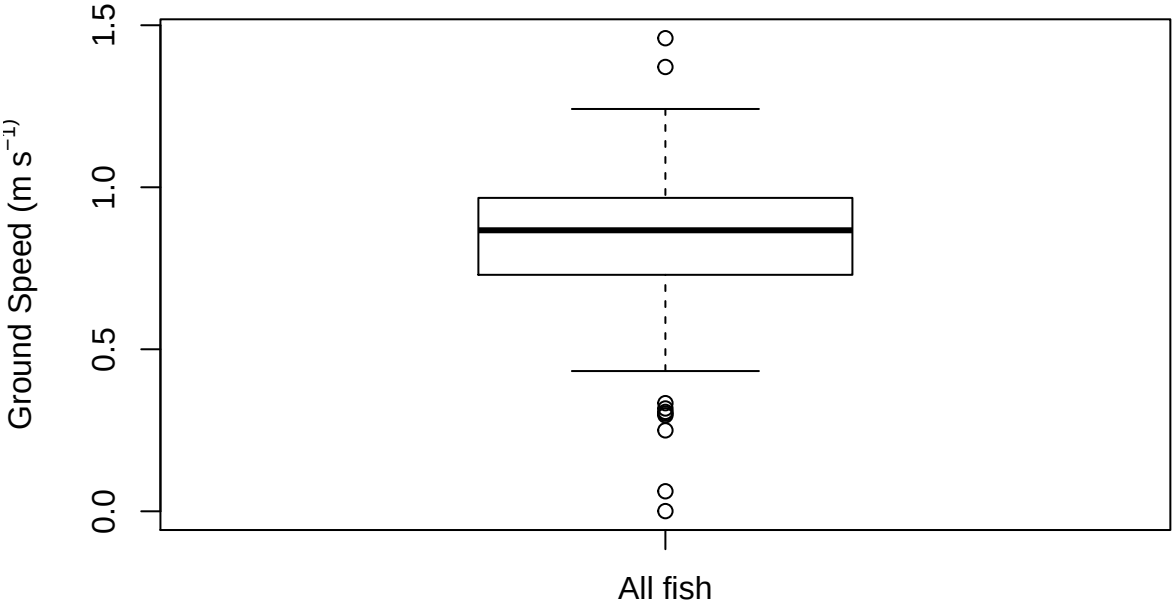
Movement Speed (mean spd per track)

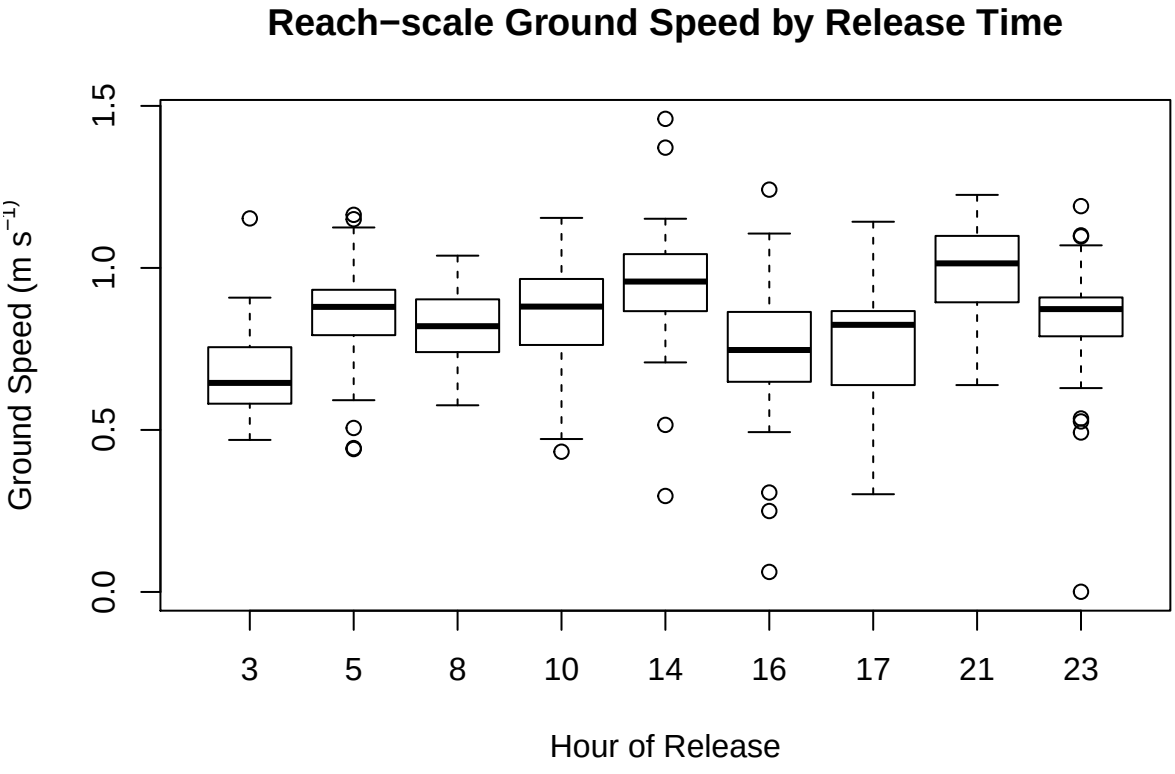
Using the dataset filtered and discretized by time, we'll calculate the mean movement speed per track
Visualize with a variety of plots

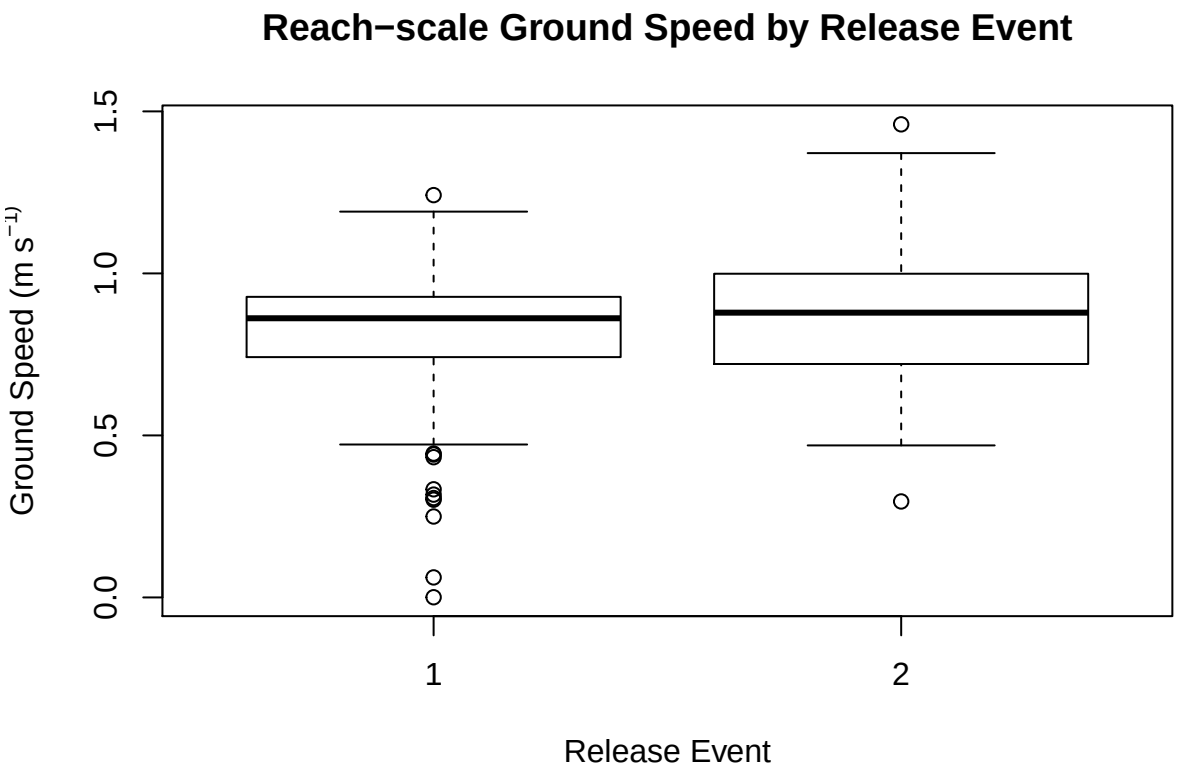
Calculate overall path speeds

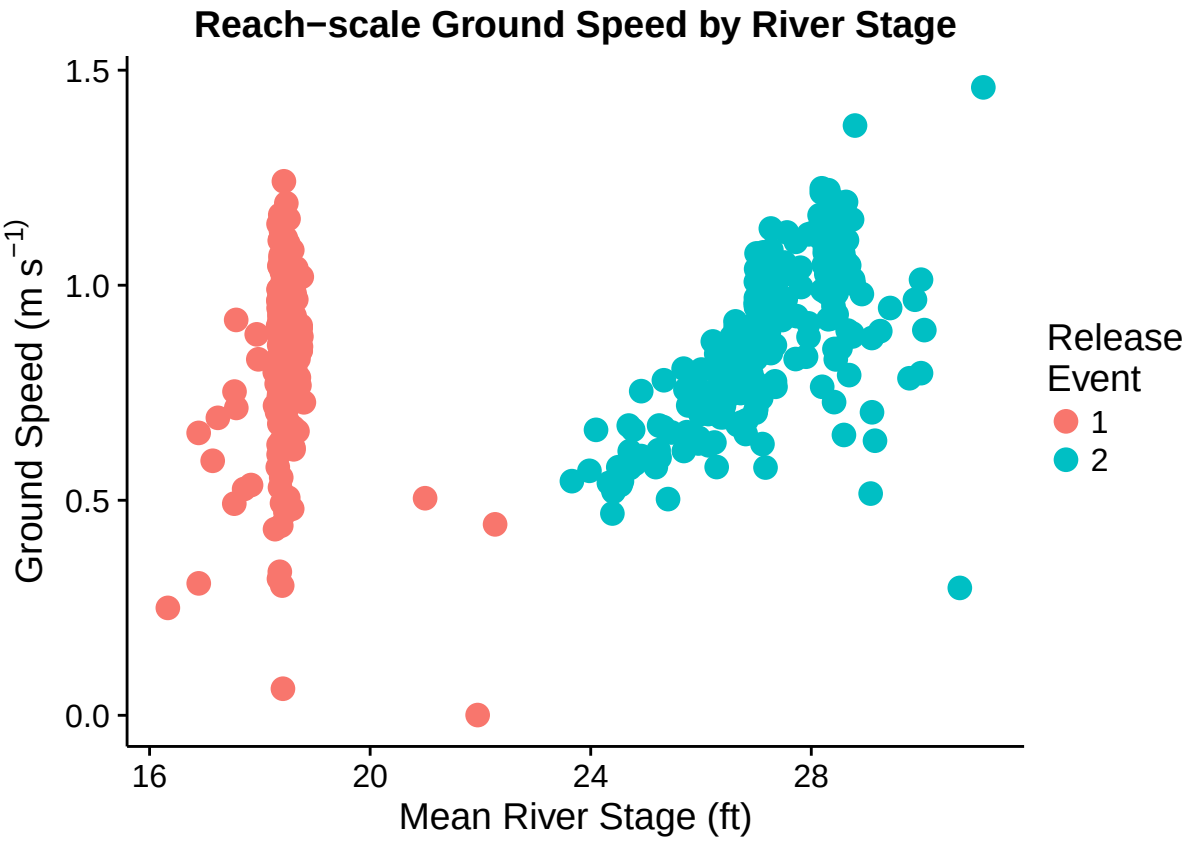
Using path length and passage time

Plot all speeds






Reach−scale Ground Speed by Release Event
Ground Speed (m s−1)
0.0
0.5
1.0
1.5
1
2
Release Event



Statistical effect of release hour

There is a significant effect of release hour, both then it is considered as a continuous variable and as a factor, but the models and the plots indicate that the effect is very small. We will include the release hour as a mixed effect in future models, but because there is such a huge spread in release hours we won't analyze these groups seperately.

```
mps.RelHr <- lm(mps ~ (RelHr), data=pathspd)
 summary(mps.RelHr)
```

```
##
## Call:
## lm(formula = mps ~ (RelHr), data = pathspd)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.91300 -0.10639  0.00043  0.12217  0.60747
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.757571   0.018575  40.784  < 2e-16 ***
## RelHr       0.006783   0.001289   5.261 2.27e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 0.1835 on 428 degrees of freedom
## Multiple R-squared:  0.06073,    Adjusted R-squared:  0.05854
## F-statistic: 27.67 on 1 and 428 DF,  p-value: 2.273e-07
```

```
  #plot(mps.RelHr)  # meets assumptions just fine!

  # post-hoc test designed for linear models with factor predictor: multcomp::glht() was recommended
    pathspd$RelHrfac = factor(pathspd$RelHr)
    testmod = lm(mps ~ 0+RelHrfac, data = pathspd)
     summary(testmod)
```

```
##
## Call:
## lm(formula = mps ~ 0 + RelHrfac, data = pathspd)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.84075 -0.08488  0.01519  0.10054  0.51225
##
## Coefficients:
##            Estimate Std. Error t value Pr(>|t|)
## RelHrfac3   0.67301    0.02305   29.20   <2e-16 ***
## RelHrfac5   0.85881    0.02200   39.04   <2e-16 ***
## RelHrfac8   0.82462    0.02261   36.47   <2e-16 ***
## RelHrfac10  0.84533    0.02283   37.03   <2e-16 ***
## RelHrfac14  0.95093    0.02220   42.84   <2e-16 ***
## RelHrfac16  0.72933    0.03168   23.02   <2e-16 ***
## RelHrfac17  0.75551    0.03292   22.95   <2e-16 ***
## RelHrfac21  0.99324    0.02220   44.74   <2e-16 ***
## RelHrfac23  0.84133    0.02200   38.24   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1646 on 421 degrees of freedom
## Multiple R-squared:  0.9645, Adjusted R-squared:  0.9637
## F-statistic:  1270 on 9 and 421 DF,  p-value: < 2.2e-16
```

```
    posthoc.mod = glht(testmod, linfct = mcp(RelHrfac="Tukey"))
     summary(posthoc.mod)
```

```
## Warning in RET$pfunction("adjusted", ...): Completion with error > abseps

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##
```
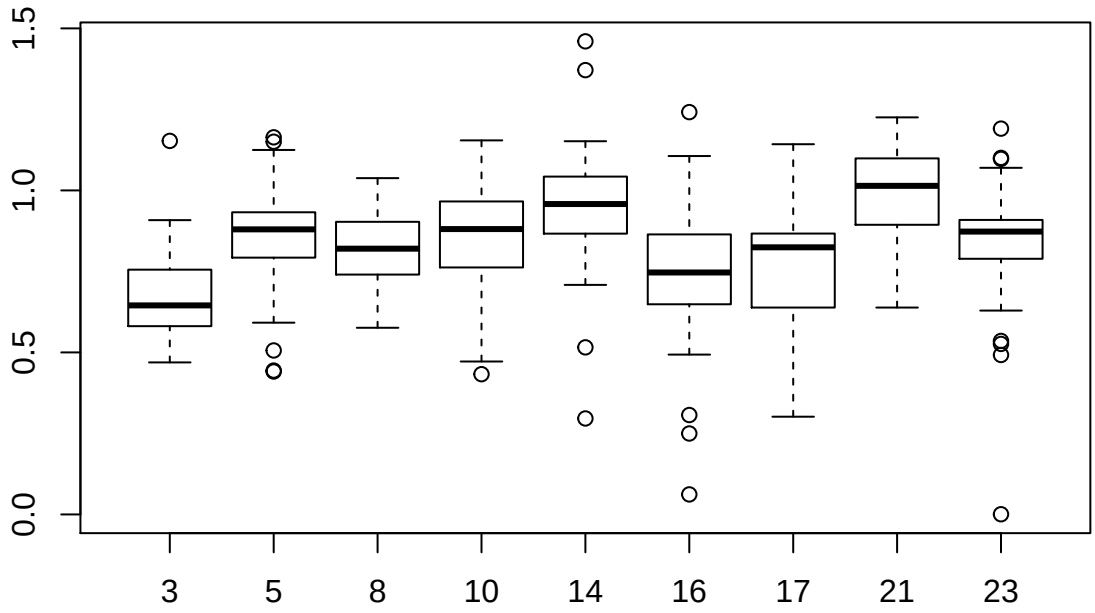

```
##   Simultaneous Tests for General Linear Hypotheses
##
## Multiple Comparisons of Means: Tukey Contrasts
##
##
## Fit: lm(formula = mps ~ 0 + RelHrfac, data = pathspd)
##
## Linear Hypotheses:
##                Estimate Std. Error t value Pr(>|t|)
## 5 - 3 == 0    0.185806   0.031864   5.831    <0.01 ***
## 8 - 3 == 0    0.151607   0.032291   4.695    <0.01 ***
## 10 - 3 == 0   0.172323   0.032443   5.312    <0.01 ***
## 14 - 3 == 0   0.277918   0.032002   8.684    <0.01 ***
## 16 - 3 == 0   0.056317   0.039180   1.437   0.8804
## 17 - 3 == 0   0.082502   0.040192   2.053   0.5020
## 21 - 3 == 0   0.320227   0.032002  10.007    <0.01 ***
## 23 - 3 == 0   0.168316   0.031864   5.282    <0.01 ***
## 8 - 5 == 0   -0.034199   0.031548  -1.084   0.9757
## 10 - 5 == 0  -0.013483   0.031703  -0.425   1.0000
## 14 - 5 == 0   0.092112   0.031252   2.947   0.0792 .
## 16 - 5 == 0  -0.129489   0.038570  -3.357   0.0234 *
## 17 - 5 == 0  -0.103304   0.039598  -2.609   0.1824
## 21 - 5 == 0   0.134421   0.031252   4.301    <0.01 ***
## 23 - 5 == 0  -0.017490   0.031111  -0.562   0.9997
## 10 - 8 == 0   0.020716   0.032132   0.645   0.9993
## 14 - 8 == 0   0.126311   0.031687   3.986    <0.01 **
## 16 - 8 == 0  -0.095290   0.038924  -2.448   0.2568
## 17 - 8 == 0  -0.069104   0.039942  -1.730   0.7233
## 21 - 8 == 0   0.168621   0.031687   5.321    <0.01 ***
## 23 - 8 == 0   0.016710   0.031548   0.530   0.9998
## 14 - 10 == 0  0.105595   0.031842   3.316   0.0266 *
## 16 - 10 == 0 -0.116006   0.039050  -2.971   0.0747 .
## 17 - 10 == 0 -0.089821   0.040065  -2.242   0.3754
## 21 - 10 == 0  0.147904   0.031842   4.645    <0.01 ***
## 23 - 10 == 0 -0.004007   0.031703  -0.126   1.0000
## 16 - 14 == 0 -0.221601   0.038684  -5.728    <0.01 ***
## 17 - 14 == 0 -0.195415   0.039708  -4.921    <0.01 ***
## 21 - 14 == 0  0.042309   0.031392   1.348   0.9143
## 23 - 14 == 0 -0.109601   0.031252  -3.507   0.0143 *
## 17 - 16 == 0  0.026186   0.045692   0.573   0.9997
## 21 - 16 == 0  0.263911   0.038684   6.822    <0.01 ***
## 23 - 16 == 0  0.112000   0.038570   2.904   0.0887 .
## 21 - 17 == 0  0.237725   0.039708   5.987    <0.01 ***
## 23 - 17 == 0  0.085814   0.039598   2.167   0.4241
## 23 - 21 == 0 -0.151911   0.031252  -4.861    <0.01 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## (Adjusted p values reported -- single-step method)
```

```
    boxplot(mps ~ RelHrfac, data = pathspd)
```



Statistical effect of release event

Release Events 1,2&3 are not significantly different from one another, nor are 4 and 5 significantly different from one another, but the two groups (1,2,3 vs 4,5) are different. This make sense, as 1,2 and 3 were released before over topping, and 4 and 5 were during the overtopping event.

```
mps.RelEv <- lm(mps ~ RelEv, data=pathspd)
 summary(mps.RelEv)
```

```
##
## Call:
## lm(formula = mps ~ RelEv, data = pathspd)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.82232 -0.10933  0.02542  0.11803  0.59571
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.78150    0.02865  27.273   <2e-16 ***
## RelEv        0.04139    0.01815   2.281    0.023 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
## Residual standard error: 0.1882 on 428 degrees of freedom
## Multiple R-squared:  0.01201,    Adjusted R-squared:  0.0097
## F-statistic: 5.202 on 1 and 428 DF,  p-value: 0.02305
```

```
  #plot(mps.RelEv)  # meets assumptions pretty well?

  # as an anova test, with tukey posthoc test
 #   testmod = aov(mps ~ 0+RelEvfac, data = pathspd)
 #    summary(testmod)
 #   TukeyHSD(testmod)
  pathspd$RelEvfac = factor(pathspd$RelEv)
  t.test(mps ~ 0+RelEvfac, data = pathspd)
```

```
##
##  Welch Two Sample t-test
##
## data:  mps by RelEvfac
## t = -2.2809, df = 427.98, p-value = 0.02305
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.077063587 -0.005722768
## sample estimates:
## mean in group 1 mean in group 2
##       0.8228919       0.8642851
```

```
  boxplot(mps ~ RelEvfac, data = pathspd, ylab="Mean Track Speed (mps)", xlab="ReleaseEvent")
```