

# Reproduce Fric et al. (2020) analysis

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## Recreate original results

We wanted to confirm that we understood correctly the Fric et al. analysis. We attempted to recreate the original Fric et al. analysis. Given time in the future, we may revisit some specific datasets for which our results disagree, but we are able to recreate the results for most models.

```
#Start clean  
rm(list=ls())  
library(tidyverse)
```

```
## -- Attaching packages ----- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.2      v purrr   0.3.4  
## v tibble  3.0.3      v dplyr   1.0.1  
## v tidyr   1.1.1      v stringr 1.4.0  
## v readr   1.3.1      v forcats 0.5.0
```

```
## -- Conflicts ----- tidyverse_conflicts() --  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag()    masks stats::lag()
```

```
library(ggplot2)  
library(gridExtra)
```

```
##  
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':  
##  
##      combine
```

```
#Import fric results (fric.results; RData file created by Fric_result_import.Rmd)  
load("data/fric_results.RData")  
  
#Import formatted occurrence data (alldata; RData file created by LarsenShirey_dataFormatting.Rmd)  
load("data/occurrences.RData")  
fricdata<-alldata  
rm(alldata)
```

Now to try the analysis.

```

fricdatasets<-fric.results %>%
  group_by(name, region) %>% tally()

### Can we recreate their analysis?
regi<-1
lm.result.diff<-NULL
for(regi in 1:nrow(fricdatasets)){
  tempdata<-fricdata %>% filter(name==fricdatasets$name[regi], region==fricdatasets$region[regi])
  #onset single regression
  temponset<-tempdata %>% group_by(rndLat) %>% filter(SuccDay==min(SuccDay))
  temponset<-temponset %>% filter(!is.na(year))
  onset.sr<-summary(lm(SuccDay~rndLat, data=temponset))$coefficients

  #onset residual regression
  onset.1<-lm(SuccDay~year, data=temponset)
  temponset$yrresid<-onset.1$residuals
  onset.2<-lm(yrresid~alt, data=temponset)
  temponset$altyrresid<-onset.2$residuals
  onset.rr<-summary(lm(altyrresid~rndLat, data=temponset))$coefficients

  #termination single regression
  tempterm<-tempdata %>% group_by(rndLat) %>% filter(SuccDay==max(SuccDay))
  tempterm<-tempterm %>% filter(!is.na(year))
  term.sr<-summary(lm(SuccDay~rndLat, data=tempterm))$coefficients

  #termination residual regression
  term.1<-lm(SuccDay~year, data=tempterm)
  tempterm$yrresid<-term.1$residuals
  term.2<-lm(yrresid~alt, data=tempterm)
  tempterm$altyrresid<-term.2$residuals
  term.rr<-summary(lm(altyrresid~rndLat, data=tempterm))$coefficients

  #filter reported results
  temp.fric<-fric.results %>%
    filter(name==fricdatasets$name[regi], region==fricdatasets$region[regi])
  tempdiff<-tibble(
    name=tempdata$name[1],
    region=tempdata$region[1],
    onset.n=nrow(temponset),
    onset.src.me = (onset.sr[2,1]),

```

```

onset.srp.me = (onset.sr[2,4]),
onset.srR.me = ifelse(onset.sr[2,4]<0.05,ifelse(onset.sr[2,1]>0,1,-1),0),
onset.src.fric = (filter(temp.fric, model=="lat")$onset.coef ),
onset.srp.fric = (filter(temp.fric, model=="lat")$onset.p_mean ),
onset.srR.fric = (filter(temp.fric, model=="lat")$onset.response ),
onset.rrc.me = (onset.rr[2,1]),
onset.rrp.me = (onset.rr[2,4]),
onset.rrR.me = ifelse(onset.rr[2,4]<0.05,ifelse(onset.rr[2,1]>0,1,-1),0),
onset.rrc.fric=(filter(temp.fric, model=="corr")$onset.coef ),
onset.rrp.fric = (filter(temp.fric, model=="corr")$onset.p_mean ),
onset.rrR.fric = (filter(temp.fric, model=="corr")$onset.response ),
term.src.me = (term.sr[2,1]),
term.srp.me = (term.sr[2,4]),
term.srR.me = ifelse(term.sr[2,4]<0.05,ifelse(term.sr[2,1]>0,1,-1),0),
term.src.fric = (filter(temp.fric, model=="lat")$term.coef ),
term.srp.fric = (filter(temp.fric, model=="lat")$term.p_mean ),
term.srR.fric = (filter(temp.fric, model=="lat")$term.response ),
term.rrc.me = (term.rr[2,1]),
term.rrp.me = (term.rr[2,4]),
term.rrR.me = ifelse(term.rr[2,4]<0.05,ifelse(term.rr[2,1]>0,1,-1),0),
term.rrc.fric = (filter(temp.fric, model=="corr")$term.coef ),
term.rrp.fric = (filter(temp.fric, model=="corr")$term.p_mean ),
term.rrR.fric = (filter(temp.fric, model=="corr")$term.response ) )

lm.result.diff<-bind_rows(lm.result.diff,tempdiff)
rm(tempdata, temponset, tempterm, temp.fric, onset.sr, onset.rr, term.sr, term.rr,tempdiff)
}

summary(lm.result.diff)

```

```

##      name      region      onset.n      onset.src.me
## Length:105      Length:105      Min.   : 5.0      Min.   : -2.6232
## Class :character Class :character 1st Qu.:15.0      1st Qu.: -0.6314
## Mode  :character Mode  :character Median :19.0      Median : 0.1171
##                                     Mean  :20.5      Mean   : 0.3949
##                                     3rd Qu.:27.0      3rd Qu.: 1.3741
##                                     Max.   :39.0      Max.   : 4.1775
## onset.srp.me      onset.srR.me      onset.src.fric      onset.srp.fric
## Min.   :0.00000    Min.   : -1.0000    Min.   : -2.6232    Min.   :0.00000
## 1st Qu.:0.01763    1st Qu.: 0.0000    1st Qu.: -0.6314    1st Qu.:0.01001
## Median :0.18893    Median : 0.0000    Median : 0.1232    Median :0.16922
## Mean   :0.31814    Mean   : 0.1429    Mean   : 0.3822    Mean   :0.30833
## 3rd Qu.:0.56374    3rd Qu.: 0.0000    3rd Qu.: 1.3387    3rd Qu.:0.60191
## Max.   :0.98712    Max.   : 1.0000    Max.   : 4.1775    Max.   :0.98701
## onset.srR.fric      onset.rrc.me      onset.rrp.me      onset.rrR.me
## Min.   : -1.0000    Min.   : -1.98598    Min.   :0.0000    Min.   : -1.000
## 1st Qu.: 0.0000    1st Qu.: -0.09812    1st Qu.:0.1058    1st Qu.: 0.000
## Median : 0.0000    Median : 0.40079    Median :0.3760    Median : 0.000
## Mean   : 0.1333    Mean   : 0.59771    Mean   :0.3872    Mean   : 0.181
## 3rd Qu.: 0.0000    3rd Qu.: 1.01595    3rd Qu.:0.6443    3rd Qu.: 0.000
## Max.   : 1.0000    Max.   : 4.43208    Max.   :0.9464    Max.   : 1.000
## onset.rrc.fric      onset.rrp.fric      onset.rrR.fric      term.src.me
## Min.   : -1.9099    Min.   :0.00000    Min.   : -1.000    Min.   : -2.90317
## 1st Qu.: -0.1173    1st Qu.:0.07898    1st Qu.: 0.000    1st Qu.: -0.72412
## Median : 0.3727    Median :0.37674    Median : 0.000    Median : -0.02922
## Mean   : 0.5711    Mean   :0.39276    Mean   : 0.181    Mean   : 0.07122
## 3rd Qu.: 0.8863    3rd Qu.:0.67835    3rd Qu.: 0.000    3rd Qu.: 0.91742
## Max.   : 4.3313    Max.   :0.99961    Max.   : 1.000    Max.   : 4.10620
## term.srp.me      term.srR.me      term.src.fric      term.srp.fric
## Min.   :0.000027    Min.   : -1.0000    Min.   : -2.90317    Min.   :0.0000006
## 1st Qu.:0.033905    1st Qu.: 0.0000    1st Qu.: -0.72412    1st Qu.:0.0204120
## Median :0.208278    Median : 0.0000    Median : -0.02922    Median :0.1863427
## Mean   :0.314248    Mean   : 0.1238    Mean   : 0.07225    Mean   :0.3019252
## 3rd Qu.:0.551103    3rd Qu.: 0.0000    3rd Qu.: 0.91742    3rd Qu.:0.5171176
## Max.   :0.978261    Max.   : 1.0000    Max.   : 4.10620    Max.   :0.9778691
## term.srR.fric      term.rrc.me      term.rrp.me      term.rrR.me
## Min.   : -1.0000    Min.   : -2.0572    Min.   :0.0003315    Min.   : -1.00000
## 1st Qu.: 0.0000    1st Qu.: -0.2865    1st Qu.:0.1167625    1st Qu.: 0.00000
## Median : 0.0000    Median : 0.2550    Median :0.3060596    Median : 0.00000
## Mean   : 0.1143    Mean   : 0.2180    Mean   :0.3975083    Mean   : 0.06667

```

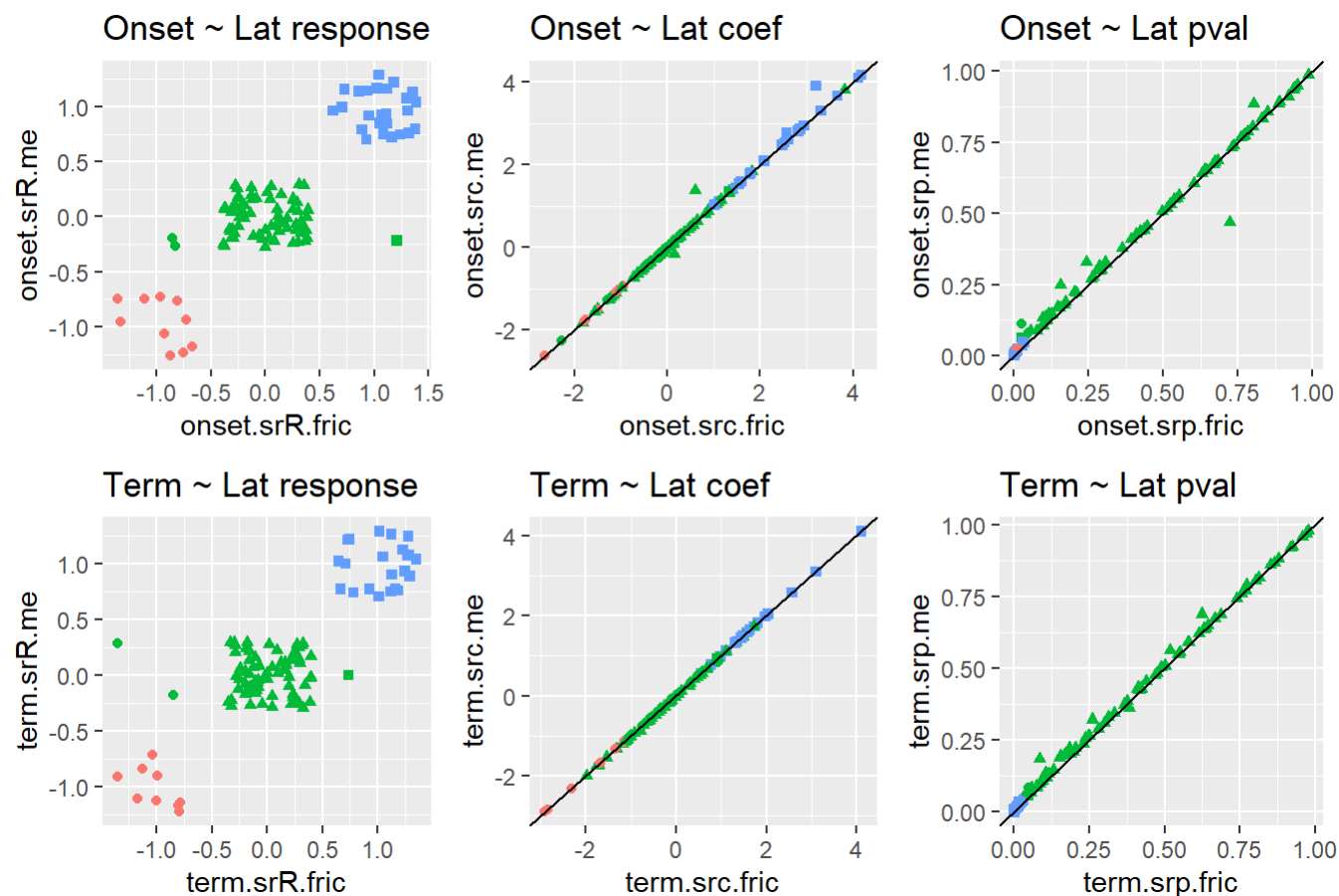
```
## 3rd Qu.: 0.0000 3rd Qu.: 0.7297 3rd Qu.:0.6678974 3rd Qu.: 0.00000
## Max. : 1.0000 Max. : 3.6841 Max. :0.9943900 Max. : 1.00000
## term.rrc.fric term.rrp.fric term.rrR.fric
## Min. :-2.0543 Min. :0.0001309 Min. :-1.00000
## 1st Qu.: -0.2454 1st Qu.:0.1156675 1st Qu.: 0.00000
## Median : 0.2261 Median :0.2911718 Median : 0.00000
## Mean : 0.2213 Mean :0.3796113 Mean : 0.07619
## 3rd Qu.: 0.7963 3rd Qu.:0.6653921 3rd Qu.: 0.00000
## Max. : 3.6603 Max. :0.9960557 Max. : 1.00000
```

### compare single regression results

```
#Single regression comparisons
srplot1<-ggplot(data=lm.result.diff, aes(x=onset.srR.fric, y=onset.srR.me, color=as.factor(onset.srR.me), shape=as.factor(onset.srR.fric))) + geom_jitter(height=0.3) + labs(title="Onset ~ Lat response", color="Y-resp")+ theme(legend.position = "none")
srplot2<-ggplot(data=lm.result.diff, aes(x=onset.src.fric, y=onset.src.me, color=as.factor(onset.srR.me), shape=as.factor(onset.srR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Onset ~ Lat coef") + theme(legend.position = "none")
srplot3<-ggplot(data=lm.result.diff, aes(x=onset.srp.fric, y=onset.srp.me, color=as.factor(onset.srR.me), shape=as.factor(onset.srR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Onset ~ Lat pval") + theme(legend.position = "none")
srplot4<-ggplot(data=lm.result.diff, aes(x=term.srR.fric, y=term.srR.me, color=as.factor(term.srR.me), shape=as.factor(term.srR.fric))) + geom_jitter(height=0.3) + labs(title="Term ~ Lat response", color="Y-resp") + theme(legend.position = "none")
srplot5<-ggplot(data=lm.result.diff, aes(x=term.src.fric, y=term.src.me, color=as.factor(term.srR.me), shape=as.factor(term.srR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Term ~ Lat coef") + theme(legend.position = "none")
srplot6<-ggplot(data=lm.result.diff, aes(x=term.srp.fric, y=term.srp.me, color=as.factor(term.srR.me), shape=as.factor(term.srR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Term ~ Lat pval") + theme(legend.position = "none")

grid.arrange(grobs=list(srplot1,srplot2,srplot3,srplot4,srplot5,srplot6), nrow=2, top="Single Regression Comparison")
```

## Single Regression Comparison



```
failed<-NULL
```

```
paste("We did not detect the same Onset response as Fric (single reg.) for ",nrow(lm.result.diff %>% filter(onset.srR.me!=onset.srR.fric) )," datasets.",sep="")
```

```
## [1] "We did not detect the same Onset response as Fric (single reg.) for 3 datasets."
```

```
if(nrow(lm.result.diff %>% filter(onset.srR.me!=onset.srR.fric) )>0 ){
(lm.result.diff %>% filter(onset.srR.me!=onset.srR.fric) %>%
  select(name, region, onset.n, onset.src.me, onset.src.fric, onset.srp.me, onset.srp.fric, onset.srR.me, onset.srR.fric))
}
```

```
## # A tibble: 3 x 9
##   name region onset.n onset.src.me onset.src.fric onset.srp.me onset.srp.fric
##   <chr> <chr>   <int>       <dbl>         <dbl>         <dbl>         <dbl>
## 1 Coli~ N. Am~     5       -1.28         -1.28         0.112         0.0261
## 2 Ere~ N. Am~     9        1.34         1.34         0.0631         0.0274
## 3 Euph~ Europe    11       -2.27        -2.27         0.0808         0.0492
## # ... with 2 more variables: onset.srR.me <dbl>, onset.srR.fric <dbl>
```

```
failed<-c(failed, which(lm.result.diff$onset.srR.me!=lm.result.diff$onset.srR.fric))
```

```
paste("We did not detect the same Termination response as Fric (single reg.) for ",nrow(lm.result.diff %>% filter(term.srR.me!=term.srR.fric) )," datasets.",sep="")
```

```
## [1] "We did not detect the same Termination response as Fric (single reg.) for 3 datasets."
```

```
if(nrow(lm.result.diff %>% filter(term.srR.me!=term.srR.fric) )>0 ){
  lm.result.diff %>% filter(term.srR.me!=term.srR.fric) %>%
  select(name, region, onset.n, term.src.me, term.src.fric, term.srp.me, term.srp.fric, term.srR.me, term.srR.fric)
}
```

```
## # A tibble: 3 x 9
##   name region onset.n term.src.me term.src.fric term.srp.me term.srp.fric
##   <chr> <chr>   <int>       <dbl>         <dbl>         <dbl>         <dbl>
## 1 Bolo~ Europe    19       -0.751        -0.751         0.0565         0.0388
## 2 Euch~ N. Am~    11       -1.09         -1.09         0.0834         0.0480
## 3 Lyca~ Europe    29        0.917         0.917         0.0559         0.0467
## # ... with 2 more variables: term.srR.me <dbl>, term.srR.fric <dbl>
```

```
failed<-c(failed, which(lm.result.diff$term.srR.me!=lm.result.diff$term.srR.fric))
print("Species for which our single regression response results vary:")
```

```
## [1] "Species for which our single regression response results vary:"
```

```
lm.result.diff$name[failed]
```



```
## [1] "Colias pelidne"      "Erebia mancinus"      "Euphydryas maturna"
## [4] "Boloria napaea"       "Euchloe creusa"       "Lycaena virgaureae"
```

```
lm.result.diff[which(lm.result.diff$term.srR.me!=lm.result.diff$term.srR.fric),]
```

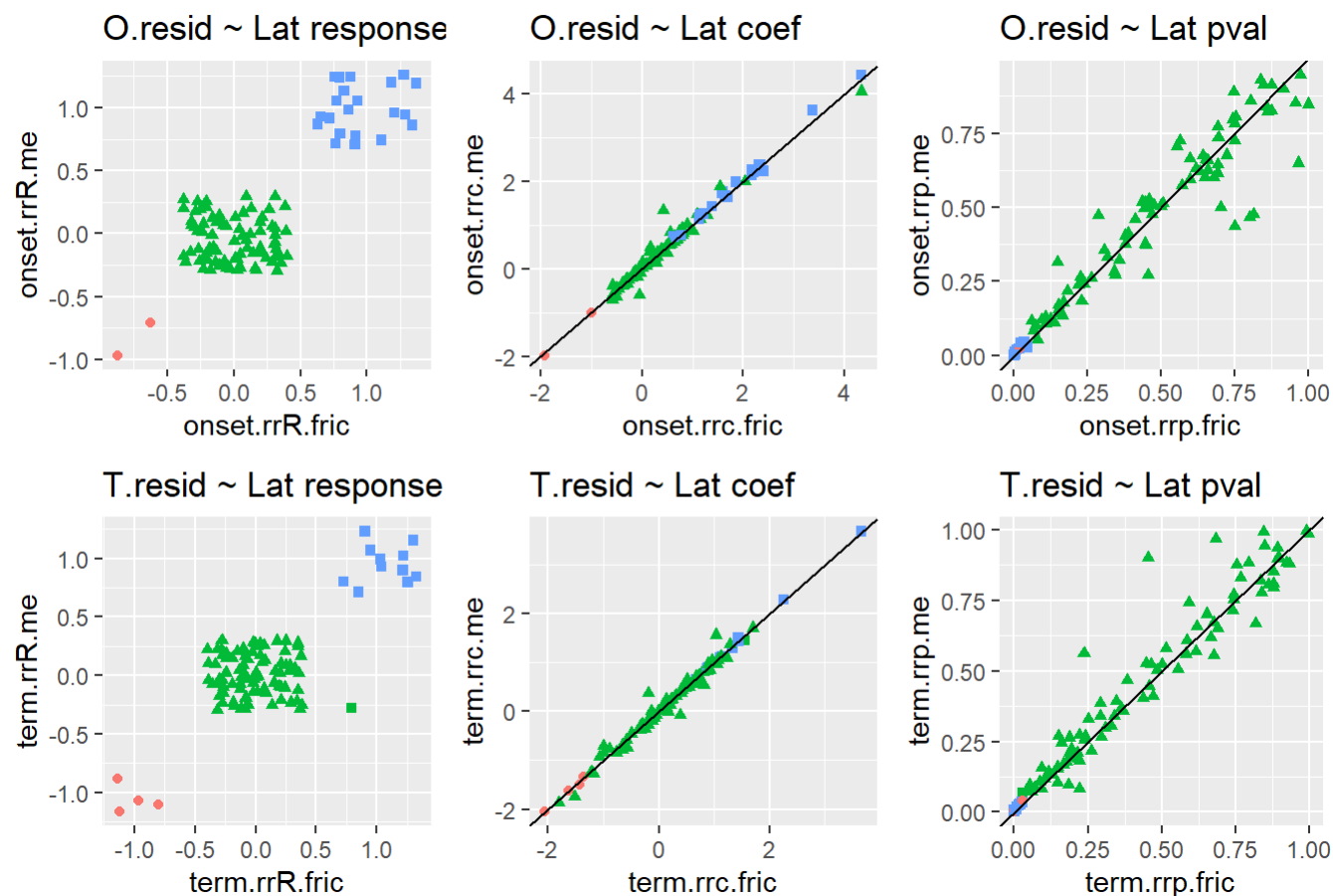
```
## # A tibble: 3 x 27
##   name region onset.n onset.src.me onset.srp.me onset.srR.me onset.src.fric
##   <chr> <chr>   <int>      <dbl>      <dbl>      <dbl>      <dbl>
## 1 Bolo~ Europe    19      -1.11      0.0102      -1      -1.11
## 2 Euch~ N. Am~    11       1.33      0.0885       0       1.33
## 3 Lyca~ Europe    29      -1.20      0.0872       0      -1.20
## # ... with 20 more variables: onset.srp.fric <dbl>, onset.srR.fric <dbl>,
## #   onset.rrc.me <dbl>, onset.rrp.me <dbl>, onset.rrR.me <dbl>,
## #   onset.rrc.fric <dbl>, onset.rrp.fric <dbl>, onset.rrR.fric <dbl>,
## #   term.src.me <dbl>, term.srp.me <dbl>, term.srR.me <dbl>,
## #   term.src.fric <dbl>, term.srp.fric <dbl>, term.srR.fric <dbl>,
## #   term.rrc.me <dbl>, term.rrp.me <dbl>, term.rrR.me <dbl>,
## #   term.rrc.fric <dbl>, term.rrp.fric <dbl>, term.rrR.fric <dbl>
```

compare residual regression results

```
#Residual regerssion comparisons
rrplot1<-ggplot(data=lm.result.diff, aes(x=onset.rrR.fric, y=onset.rrR.me , color=as.factor(onset.rrR.me), shape=as.factor(onset.rrR.fric))) + geom_jitter(height=0.3) + labs(title="O.resid ~ Lat response", color="Y-Resp") + theme(legend.position = "none")
rrplot2<-ggplot(data=lm.result.diff, aes(x=onset.rrc.fric, y=onset.rrc.me, color=as.factor(onset.rrR.me), shape=as.factor(onset.rrR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="O.resid ~ Lat coef") + theme(legend.position = "none")
rrplot3<-ggplot(data=lm.result.diff, aes(x=onset.rrp.fric, y=onset.rrp.me, color=as.factor(onset.rrR.me), shape=as.factor(onset.rrR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="O.resid ~ Lat pval") + theme(legend.position = "none")
rrplot4<-ggplot(data=lm.result.diff, aes(x=term.rrR.fric, y=term.rrR.me, color=as.factor(term.rrR.me), shape=as.factor(term.rrR.fric))) + geom_jitter(height=0.3) + labs(title="T.resid ~ Lat response", color="Y-resp") + theme(legend.position = "none")
rrplot5<-ggplot(data=lm.result.diff, aes(x=term.rrc.fric, y=term.rrc.me, color=as.factor(term.rrR.me), shape=as.factor(term.rrR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="T.resid ~ Lat coef") + theme(legend.position = "none")
rrplot6<-ggplot(data=lm.result.diff, aes(x=term.rrp.fric, y=term.rrp.me, color=as.factor(term.rrR.me), shape=as.factor(term.rrR.fric))) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="T.resid ~ Lat pval") + theme(legend.position = "none")

grid.arrange(grobs=list(rrplot1,rrplot2,rrplot3,rrplot4,rrplot5,rrplot6), nrow=2, top="Residual Regression Comparison")
```

## Residual Regression Comparison



```
failed<-NULL
```

```
paste("We did not detect the same Onset response as Fric (resid reg.) for ",nrow(lm.result.diff %>% filter(onset.rrR.me!=onset.rrR.fric) )," datasets.",sep="")
```

```
## [1] "We did not detect the same Onset response as Fric (resid reg.) for 0 datasets."
```

```

if(nrow(lm.result.diff %>% filter(onset.rrR.me!=onset.rrR.fric) )>0 ){
lm.result.diff %>%  filter(onset.rrR.me!=onset.rrR.fric) %>%
  select(name, region, onset.n, onset.rrc.me, onset.rrc.fric, onset.rrp.me, onset.rrp.fric, onset.rrR.me, onset.rrR.fric)
}
failed<-c(failed, which(lm.result.diff$onset.rrR.me!=lm.result.diff$onset.rrR.fric))

paste("We did not detect the same Termination response as Fric (resid reg.) for ",nrow(lm.result.diff %>% filter(term.rrR.me!=term.rrR.fric) )," datasets.",sep="")

```

```
## [1] "We did not detect the same Termination response as Fric (resid reg.) for 1 datasets."
```

```

if(nrow(lm.result.diff %>% filter(term.rrR.me!=term.rrR.fric) )>0 ){
  (lm.result.diff %>%  filter(term.rrR.me!=term.rrR.fric) %>%
    select(name, region, onset.n, term.rrc.me, term.rrc.fric, term.rrp.me, term.rrp.fric, term.rrR.me, term.rrR.fric))
}

```

```

## # A tibble: 1 x 9
##   name region onset.n term.rrc.me term.rrc.fric term.rrp.me term.rrp.fric
##   <chr> <chr>   <int>      <dbl>      <dbl>      <dbl>      <dbl>
## 1 Bolo~ N. Am~    14        1.45        1.56        0.0680      0.0284
## # ... with 2 more variables: term.rrR.me <dbl>, term.rrR.fric <dbl>

```

```

failed<-c(failed, which(lm.result.diff$term.rrR.me!=lm.result.diff$term.rrR.fric))
print("Species for which our residual regression response results vary:")

```

```
## [1] "Species for which our residual regression response results vary:"
```

```
lm.result.diff$name[failed]
```

```
## [1] "Boloria epithore"
```

\*

With regard to this mostly successful attempt above, we note:

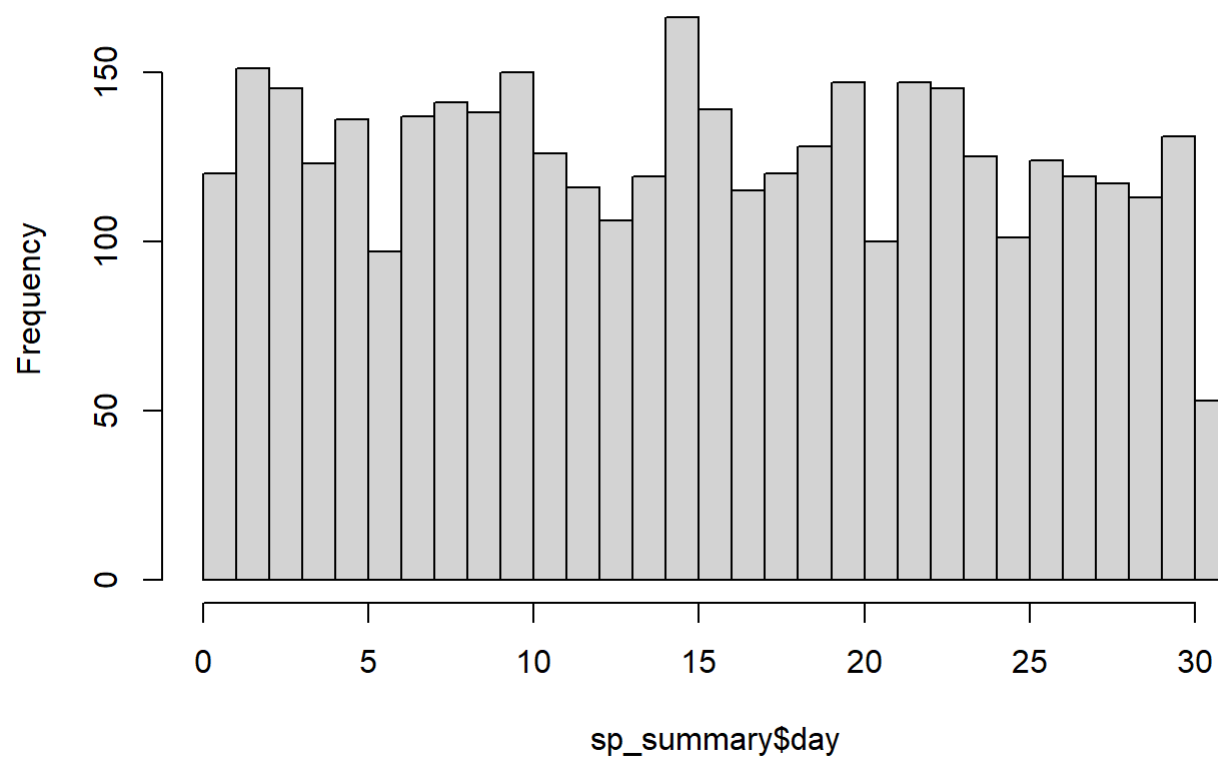
```
sp_summary<-fricdata %>%
  group_by(name, region, rndLat) %>%
  filter(name %in% fric.results$name, SuccDay==min(SuccDay) | SuccDay==max(SuccDay)) %>%
  mutate(day1=ifelse(day==1,1,0), metric=ifelse(SuccDay==min(SuccDay),"onset","term"))
sp_1<-sp_summary %>% group_by(name, region, rndLat, metric, SuccDay, day1) %>% tally()

print(paste(nrow(filter(sp_1,n>1, metric=="onset")), " onset dates and ",nrow(filter(sp_1,n>1, metric=="term")), " termination
dates have more than one occurrence for the day; we believe that all data points that matched the minimum or maximum SuccDay
were included in the original regressions. This affected ",length(unique(sp_1$name[sp_1$n>1])), " species in the original ana
lysis. There is no information in the original paper about how an occurrence record would have been selected when multiple o
ccurrences occur on the onset or termination day; for residual regressions, this matters because the different altitudes and
years associated with the occurrence records could change the results.", sep=""))
```

```
## [1] "142 onset dates and 103 termination dates have more than one occurrence for the day; we believe that all data points
that matched the minimum or maximum SuccDay were included in the original regressions. This affected 85 species in the origi
nal analysis. There is no information in the original paper about how an occurrence record would have been selected when mul
tiple occurrences occur on the onset or termination day; for residual regressions, this matters because the different altitu
des and years associated with the occurrence records could change the results."
```

```
hist(sp_summary$day, breaks=c(0:31))
```

## Histogram of sp\_summary\$day



```
table(sp_summary$day)
```

```
##
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
## 120 151 145 123 136 97 137 141 138 150 126 116 106 119 166 139 115 120 128 147
## 21 22 23 24 25 26 27 28 29 30 31
## 100 147 145 125 101 124 119 117 113 131 53
```

```
print(paste(nrow(filter(sp_1,day1==1, metric=="onset")), " onset dates and ",nrow(filter(sp_1,day1==1, metric=="term")), " termination dates occur on the first day of the month; we believe that these data points were included in the original regressions, despite the methods of the article saying these were filtered out. This affected ",length(unique(sp_1$name[sp_1$day1==1])), " species in the original analysis. We found that when we excluded these dates, an additional 7 responses among our comparisons did not match.", sep=""))
```

```
## [1] "75 onset dates and 32 termination dates occur on the first day of the month; we believe that these data points were included in the original regressions, despite the methods of the article saying these were filtered out. This affected 51 species in the original analysis. We found that when we excluded these dates, an additional 7 responses among our comparisons did not match."
```

✱

Our initial attempt

```
#Load fric results
load("data/fric_results.RData")

#Load occurrence data
load('data/occurrences_FricAnalysis.RData')
fricdatasets<-fricdata %>%
  group_by(name, region) %>% tally()
## NEED TO ADD THIS CODE

### Can I recreate their analysis?
regi<-1
lm.result.diff<-NULL
for(regi in 1:nrow(fricdatasets)){
  tempdata<-fricdata %>% filter(name==fricdatasets$name[regi], region==fricdatasets$region[regi])
  #onset single regression
  temponset<-tempdata %>% group_by(rndLat) %>% filter(SuccDay==min(SuccDay))
  temponset<-filter(temponset, !is.na(year))

  onset.sr<-summary(lm(SuccDay~rndLat, data=temponset))$coefficients

  #onset residual regression
  onset.1<-lm(SuccDay~year, data=temponset)
  temponset$yrresid<-onset.1$residuals
  onset.2<-lm(yrresid~alt, data=temponset)
  temponset$altyrresid<-onset.2$residuals
  onset.rr<-summary(lm(altyrresid~rndLat, data=temponset))$coefficients

  #termination single regression
  tempterm<-tempdata %>% group_by(rndLat) %>% filter(SuccDay==max(SuccDay))
  tempterm<-filter(tempterm, !is.na(year))
  term.sr<-summary(lm(SuccDay~rndLat, data=tempterm))$coefficients

  #termination residual regression
  term.1<-lm(SuccDay~alt, data=tempterm)
  tempterm$altresid<-term.1$residuals
  term.2<-lm(altresid~year, data=tempterm)
  tempterm$altyrresid<-term.2$residuals
  term.rr<-summary(lm(altyrresid~rndLat, data=tempterm))$coefficients

  #filter reported results
```



```

temp.fric<-fric.results %>%
  filter(name==fricdatasets$name[regi], region==fricdatasets$region[regi])
tempdiff<-tibble(
  name=temponset$name[1],
  region=temponset$region[1],
  onset.n=nrow(temponset),
  onset.src.me = (onset.sr[2,1]),
  onset.src.fric = (filter(temp.fric, model=="lat")$onset.coef ),
  onset.srp.me = (onset.sr[2,4]),
  onset.srp.fric = (filter(temp.fric, model=="lat")$onset.p_mean ),
  onset.srR.me = ifelse(onset.sr[2,4]<0.05,ifelse(onset.sr[2,1]>0,1,-1),0),
  onset.srR.fric = (filter(temp.fric, model=="lat")$onset.response ),
  onset.rrc.me = (onset.rr[2,1]),
  onset.rrc.fric=(filter(temp.fric, model=="corr")$onset.coef ),
  onset.rrp.me = (onset.rr[2,4]),
  onset.rrp.fric = (filter(temp.fric, model=="corr")$onset.p_mean ),
  onset.rrR.me = ifelse(onset.rr[2,4]<0.05,ifelse(onset.rr[2,1]>0,1,-1),0),
  onset.rrR.fric = (filter(temp.fric, model=="corr")$onset.response ),
  term.src.me = (term.sr[2,1]),
  term.src.fric = (filter(temp.fric, model=="lat")$term.coef ),
  term.srp.me = (term.sr[2,4]),
  term.srp.fric = (filter(temp.fric, model=="lat")$term.p_mean ),
  term.srR.me = ifelse(term.sr[2,4]<0.05,ifelse(term.sr[2,1]>0,1,-1),0),
  term.srR.fric = (filter(temp.fric, model=="lat")$term.response ),
  term.rrc.me = (term.rr[2,1]),
  term.rrc.fric = (filter(temp.fric, model=="corr")$term.coef ),
  term.rrp.me = (term.rr[2,4]),
  term.rrp.fric = (filter(temp.fric, model=="lat")$term.p_mean ),
  term.rrR.me = ifelse(term.rr[2,4]<0.05,ifelse(term.rr[2,1]>0,1,-1),0),
  term.rrR.fric = (filter(temp.fric, model=="corr")$term.response ))

lm.result.diff<-bind_rows(lm.result.diff,tempdiff)
rm(tempdata, temponset, tempterm, temp.fric, onset.sr, onset.rr, term.sr, term.rr,tempdiff)
}

summary(lm.result.diff)

```

```

##      name      region      onset.n      onset.src.me
## Length:105      Length:105      Min.   : 5.00      Min.   :-2.4370
## Class :character Class :character 1st Qu.:15.00      1st Qu.: -0.5643
## Mode  :character Mode  :character Median :19.00      Median : 0.1152
##                                     Mean  :20.32      Mean  : 0.3886
##                                     3rd Qu.:27.00      3rd Qu.: 1.3650
##                                     Max.   :39.00      Max.   : 4.2559
## onset.src.fric      onset.srp.me      onset.srp.fric      onset.srR.me
## Min.   :-2.6232      Min.   :0.0000001      Min.   :0.00000      Min.   :-1.0000
## 1st Qu.: -0.6314      1st Qu.:0.0188199      1st Qu.:0.01001      1st Qu.: 0.0000
## Median : 0.1232      Median :0.2123591      Median :0.16922      Median : 0.0000
## Mean   : 0.3822      Mean   :0.3215776      Mean   :0.30833      Mean   : 0.1429
## 3rd Qu.: 1.3387      3rd Qu.:0.5637360      3rd Qu.:0.60191      3rd Qu.: 0.0000
## Max.   : 4.1775      Max.   :0.9871186      Max.   :0.98701      Max.   : 1.0000
## onset.srR.fric      onset.rrc.me      onset.rrc.fric      onset.rrp.me
## Min.   :-1.0000      Min.   :-1.9748      Min.   :-1.9099      Min.   :0.00000
## 1st Qu.: 0.0000      1st Qu.: -0.1543      1st Qu.: -0.1173      1st Qu.:0.08244
## Median : 0.0000      Median : 0.4008      Median : 0.3727      Median :0.35308
## Mean   : 0.1333      Mean   : 0.6073      Mean   : 0.5711      Mean   :0.37651
## 3rd Qu.: 0.0000      3rd Qu.: 0.9866      3rd Qu.: 0.8863      3rd Qu.:0.62982
## Max.   : 1.0000      Max.   : 4.5447      Max.   : 4.3313      Max.   :0.95071
## onset.rrp.fric      onset.rrR.me      onset.rrR.fric      term.src.me
## Min.   :0.00000      Min.   :-1.0000      Min.   :-1.000      Min.   :-3.09680
## 1st Qu.:0.07898      1st Qu.: 0.0000      1st Qu.: 0.000      1st Qu.: -0.65171
## Median :0.37674      Median : 0.0000      Median : 0.000      Median :-0.07754
## Mean   :0.39276      Mean   : 0.1905      Mean   : 0.181      Mean   : 0.07055
## 3rd Qu.:0.67835      3rd Qu.: 0.0000      3rd Qu.: 0.000      3rd Qu.: 0.91742
## Max.   :0.99961      Max.   : 1.0000      Max.   : 1.000      Max.   : 4.10620
## term.src.fric      term.srp.me      term.srp.fric      term.srR.me
## Min.   :-2.90317      Min.   :0.000027      Min.   :0.0000006      Min.   :-1.0000
## 1st Qu.: -0.72412      1st Qu.:0.039455      1st Qu.:0.0204120      1st Qu.: 0.0000
## Median :-0.02922      Median :0.224368      Median :0.1863427      Median : 0.0000
## Mean   : 0.07225      Mean   :0.324942      Mean   :0.3019252      Mean   : 0.1238
## 3rd Qu.: 0.91742      3rd Qu.:0.556551      3rd Qu.:0.5171176      3rd Qu.: 0.0000
## Max.   : 4.10620      Max.   :0.971110      Max.   :0.9778691      Max.   : 1.0000
## term.srR.fric      term.rrc.me      term.rrc.fric      term.rrp.me
## Min.   :-1.0000      Min.   :-2.0539      Min.   :-2.0543      Min.   :0.0007642
## 1st Qu.: 0.0000      1st Qu.: -0.3022      1st Qu.: -0.2454      1st Qu.:0.1238575
## Median : 0.0000      Median : 0.2603      Median : 0.2261      Median :0.3003034
## Mean   : 0.1143      Mean   : 0.2050      Mean   : 0.2213      Mean   :0.3961417

```

```
## 3rd Qu.: 0.0000 3rd Qu.: 0.7632 3rd Qu.: 0.7963 3rd Qu.:0.6460594
## Max. : 1.0000 Max. : 3.7013 Max. : 3.6603 Max. :0.9768169
## term.rrp.fric term.rrR.me term.rrR.fric
## Min. :0.0000006 Min. :-1.00000 Min. :-1.00000
## 1st Qu.:0.0204120 1st Qu.: 0.00000 1st Qu.: 0.00000
## Median :0.1863427 Median : 0.00000 Median : 0.00000
## Mean :0.3019252 Mean : 0.06667 Mean : 0.07619
## 3rd Qu.:0.5171176 3rd Qu.: 0.00000 3rd Qu.: 0.00000
## Max. :0.9778691 Max. : 1.00000 Max. : 1.00000
```

### *#Single regression comparisons*

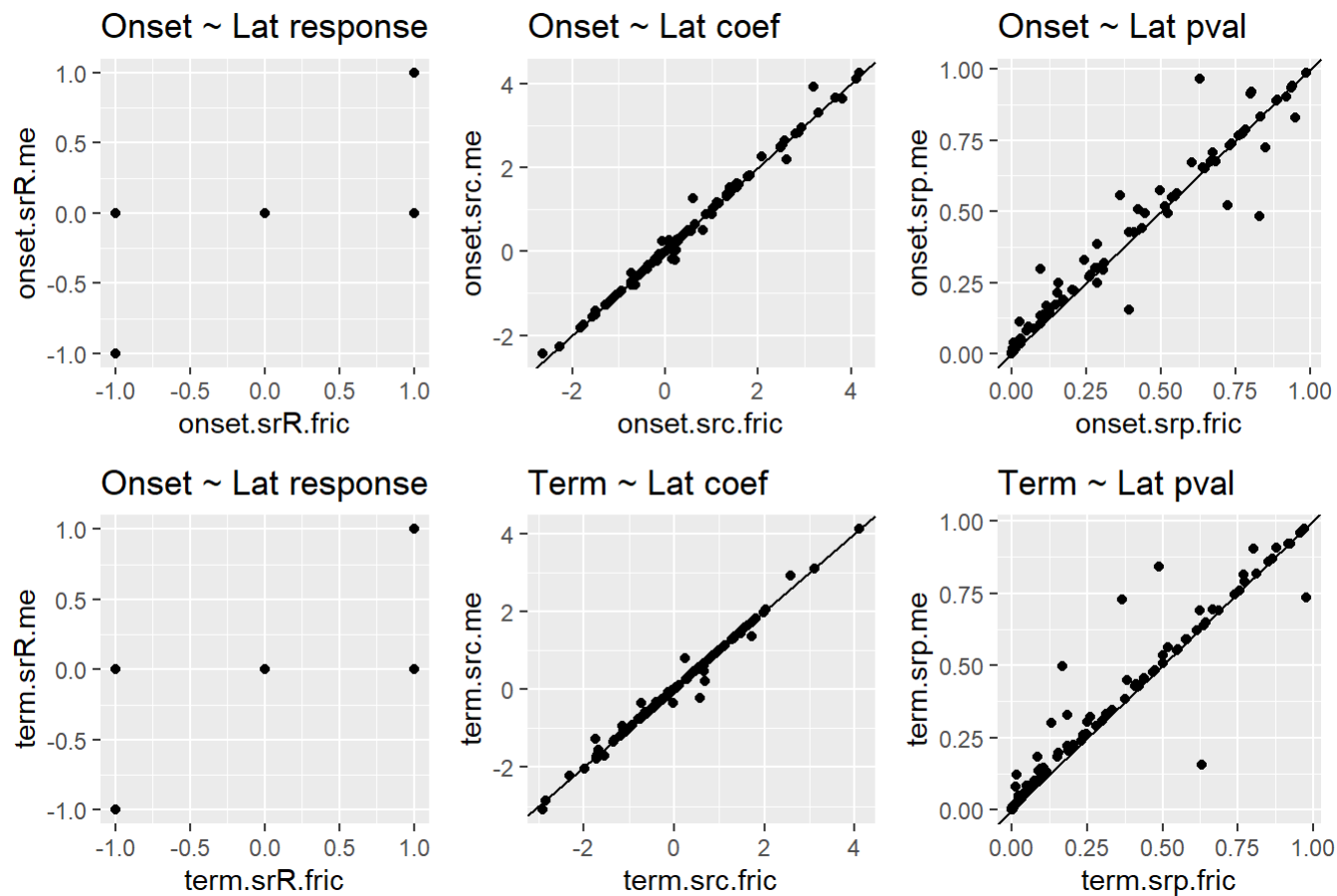
```
srplot1<-ggplot(data=lm.result.diff, aes(x=onset.srR.fric, y=onset.srR.me)) + geom_point() + labs(title="Onset ~ Lat response")
srplot2<-ggplot(data=lm.result.diff, aes(x=onset.src.fric, y=onset.src.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Onset ~ Lat coef")
srplot3<-ggplot(data=lm.result.diff, aes(x=onset.srp.fric, y=onset.srp.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Onset ~ Lat pval")
srplot4<-ggplot(data=lm.result.diff, aes(x=term.srR.fric, y=term.srR.me)) + geom_point() + labs(title="Onset ~ Lat response")
srplot5<-ggplot(data=lm.result.diff, aes(x=term.src.fric, y=term.src.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Term ~ Lat coef")
srplot6<-ggplot(data=lm.result.diff, aes(x=term.srp.fric, y=term.srp.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="Term ~ Lat pval")
```

### *#Residual regression comparisons*

```
rrplot1<-ggplot(data=lm.result.diff, aes(x=onset.rrR.fric, y=onset.rrR.me)) + geom_point() + labs(title="O.resid ~ Lat response")
rrplot2<-ggplot(data=lm.result.diff, aes(x=onset.rrc.fric, y=onset.rrc.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="O.resid ~ Lat coef")
rrplot3<-ggplot(data=lm.result.diff, aes(x=onset.rrp.fric, y=onset.rrp.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="O.resid ~ Lat pval")
rrplot4<-ggplot(data=lm.result.diff, aes(x=term.rrR.fric, y=term.rrR.me)) + geom_point() + labs(title="T.resid ~ Lat response")
rrplot5<-ggplot(data=lm.result.diff, aes(x=term.rrc.fric, y=term.rrc.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="T.resid ~ Lat coef")
rrplot6<-ggplot(data=lm.result.diff, aes(x=term.rrp.fric, y=term.rrp.me)) + geom_point() + geom_abline(slope=1, intercept=0) + labs(title="T.resid ~ Lat pval")
```

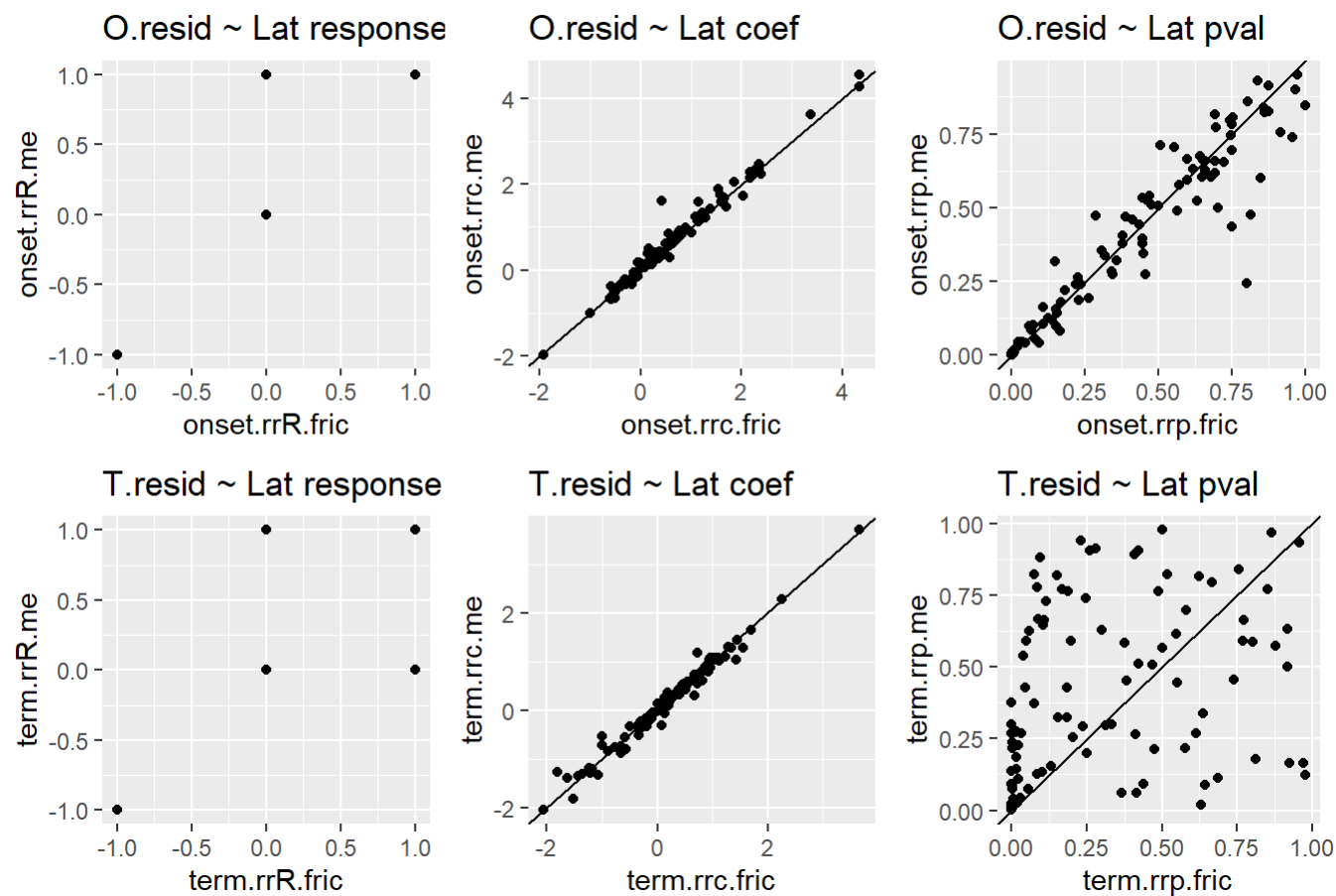
```
grid.arrange(grobs=list(srplot1,srplot2,srplot3,srplot4,srplot5,srplot6), nrow=2, top="Single Regression Comparison")
```

## Single Regression Comparison



```
grid.arrange(grobs=list(rrplot1,rrplot2,rrplot3,rrplot4,rrplot5,rrplot6), nrow=2, top="Residual Regression Comparison")
```

## Residual Regression Comparison



End of File.