Seasonal Difference Exploration

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Explore the seasonal differences

```
load("./dt_long.RData")
load("./ID_in.RData")
load("./beta.res.postmean.RData")

dt_season <-
  dt_long %>%
  drop_na() %>%
  filter(ID %in% ID_in) %>%
  distinct(ID, .keep_all = TRUE) %>%
  select(ID, Season, Month, Nature) %>%
  mutate(Month = factor(Month, levels = month.name))
```

```
season_diff <-
  merge(dt_season, beta.res.postmean, by = c("ID")) %>%
  janitor::clean_names()

# Beta0
intercept.fit <- lm(intercept ~ month + season + nature, data = season_diff)
# Beta1
wind_prev.fit <- lm(wind_prev ~ month + season + nature, data = season_diff)
# Beta2
lat_change.fit <- lm(lat_change ~ month + season + nature, data = season_diff)
# Beta3
long_change.fit <- lm(long_change ~ month + season + nature, data = season_diff)
#Beta4
wind_change.fit <- lm(wind_change ~ month + season + nature, data = season_diff)

summary(intercept.fit)
```

```
##
## Call:
## lm(formula = intercept ~ month + season + nature, data = season_diff)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.43433 -0.03822  0.00234  0.04052  0.38709
##
## Coefficients:
```

```
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     4.4810021  0.3902677  11.482   <2e-16 ***
## monthApril      0.0232609  0.1113880   0.209   0.8346
## monthMay        0.0259813  0.0942017   0.276   0.7828
## monthJune       0.0275693  0.0922175   0.299   0.7651
## monthJuly       0.0125400  0.0918533   0.137   0.8914
## monthAugust    -0.0198034  0.0913669  -0.217   0.8285
## monthSeptember -0.0070528  0.0912856  -0.077   0.9384
## monthOctober    0.0093435  0.0913761   0.102   0.9186
## monthNovember   0.0145692  0.0924416   0.158   0.8748
## monthDecember   0.0057977  0.0976110   0.059   0.9527
## season         -0.0003419  0.0001895  -1.804   0.0717 .
## natureET        0.0008449  0.0298315   0.028   0.9774
## natureNR        0.0008122  0.0484835   0.017   0.9866
## natureSS        0.0141564  0.0205164   0.690   0.4904
## natureTS        0.0118370  0.0166932   0.709   0.4785
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.09022 on 682 degrees of freedom
## Multiple R-squared:  0.03095,    Adjusted R-squared:  0.01105
## F-statistic: 1.556 on 14 and 682 DF,  p-value: 0.0866
```

```
summary(wind_prev.fit)
```

```
##
## Call:
## lm(formula = wind_prev ~ month + season + nature, data = season_diff)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.135790 -0.019433  0.002041  0.022272  0.061680
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     1.343e+00  1.215e-01  11.058  < 2e-16 ***
## monthApril      1.479e-02  3.467e-02   0.427 0.669679
## monthMay       -1.180e-04  2.932e-02  -0.004 0.996789
## monthJune       5.393e-03  2.870e-02   0.188 0.850987
## monthJuly       1.540e-02  2.859e-02   0.539 0.590174
## monthAugust     2.332e-02  2.843e-02   0.820 0.412418
## monthSeptember  2.610e-02  2.841e-02   0.919 0.358560
## monthOctober    2.108e-02  2.844e-02   0.741 0.458718
## monthNovember   2.461e-02  2.877e-02   0.856 0.392526
## monthDecember   8.824e-03  3.038e-02   0.290 0.771531
## season         -2.252e-04  5.899e-05  -3.817 0.000147 ***
## natureET        3.733e-03  9.284e-03   0.402 0.687709
## natureNR       -1.461e-02  1.509e-02  -0.969 0.333111
## natureSS       -3.330e-03  6.385e-03  -0.522 0.602172
## natureTS       -5.998e-03  5.195e-03  -1.155 0.248693
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.02808 on 682 degrees of freedom
```

```
## Multiple R-squared:  0.0659, Adjusted R-squared:  0.04672
## F-statistic: 3.437 on 14 and 682 DF,  p-value: 1.998e-05
```

```
summary(lat_change.fit)
```

```
##
## Call:
## lm(formula = lat_change ~ month + season + nature, data = season_diff)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.90321 -0.07062  0.00781  0.07691  0.95935
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     4.131e-02  6.667e-01   0.062    0.951
## monthApril      1.656e-02  1.903e-01   0.087    0.931
## monthMay        7.088e-02  1.609e-01   0.440    0.660
## monthJune      -7.088e-03  1.575e-01  -0.045    0.964
## monthJuly      -9.091e-03  1.569e-01  -0.058    0.954
## monthAugust    -5.225e-02  1.561e-01  -0.335    0.738
## monthSeptember -3.611e-02  1.559e-01  -0.232    0.817
## monthOctober   -2.862e-02  1.561e-01  -0.183    0.855
## monthNovember   2.400e-02  1.579e-01   0.152    0.879
## monthDecember  -5.431e-02  1.668e-01  -0.326    0.745
## season          3.655e-05  3.238e-04   0.113    0.910
## natureET       -7.020e-02  5.096e-02  -1.378    0.169
## natureNR        5.897e-03  8.283e-02   0.071    0.943
## natureSS       -1.352e-03  3.505e-02  -0.039    0.969
## natureTS       -1.545e-02  2.852e-02  -0.542    0.588
##
## Residual standard error: 0.1541 on 682 degrees of freedom
## Multiple R-squared:  0.02561,    Adjusted R-squared:  0.005609
## F-statistic:  1.28 on 14 and 682 DF,  p-value: 0.2137
```

```
summary(long_change.fit)
```

```
##
## Call:
## lm(formula = long_change ~ month + season + nature, data = season_diff)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.30817 -0.03599  0.00530  0.04273  0.50782
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.8336700  0.3531651  -2.361   0.0185 *
## monthApril      0.0416468  0.1007984   0.413   0.6796
## monthMay        0.0632772  0.0852459   0.742   0.4582
## monthJune       0.0556884  0.0834504   0.667   0.5048
## monthJuly       0.0361214  0.0831208   0.435   0.6640
## monthAugust     0.0123691  0.0826807   0.150   0.8811
```

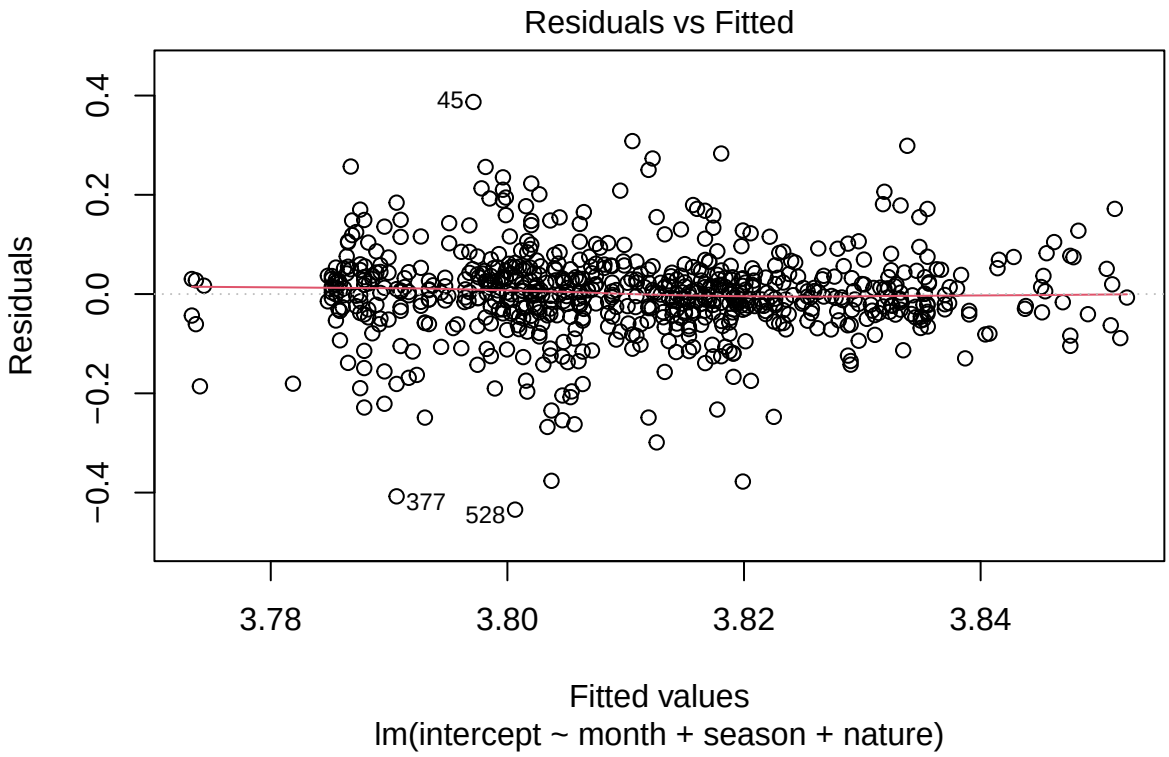
```
## monthSeptember  0.0212965  0.0826071   0.258   0.7966
## monthOctober    0.0341549  0.0826890   0.413   0.6797
## monthNovember   0.0263450  0.0836532   0.315   0.7529
## monthDecember   0.0422468  0.0883312   0.478   0.6326
## season          0.0002184  0.0001715   1.273   0.2033
## natureET       -0.0263888  0.0269955  -0.978   0.3287
## natureNR        0.0030556  0.0438742   0.070   0.9445
## natureSS        0.0126339  0.0185659   0.680   0.4964
## natureTS       -0.0231521  0.0151062  -1.533   0.1258
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08164 on 682 degrees of freedom
## Multiple R-squared:  0.05042,    Adjusted R-squared:  0.03093
## F-statistic: 2.586 on 14 and 682 DF,  p-value: 0.001201
```

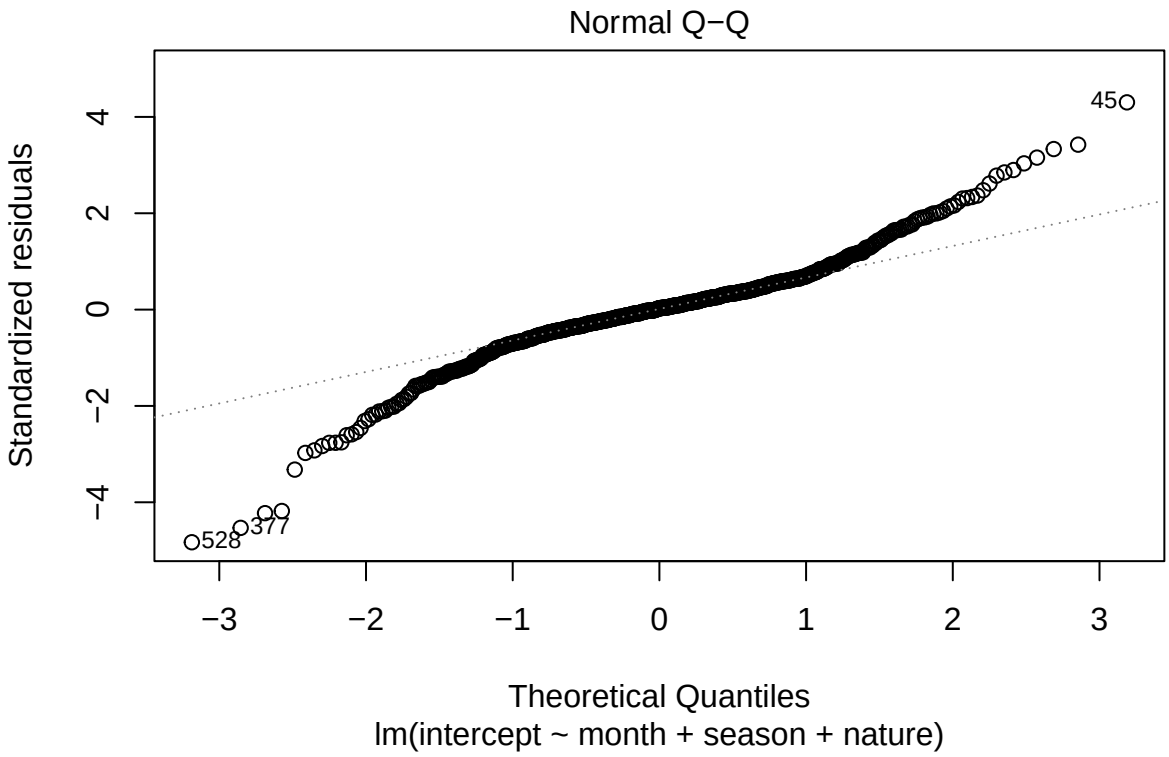
```
summary(wind_change.fit)
```

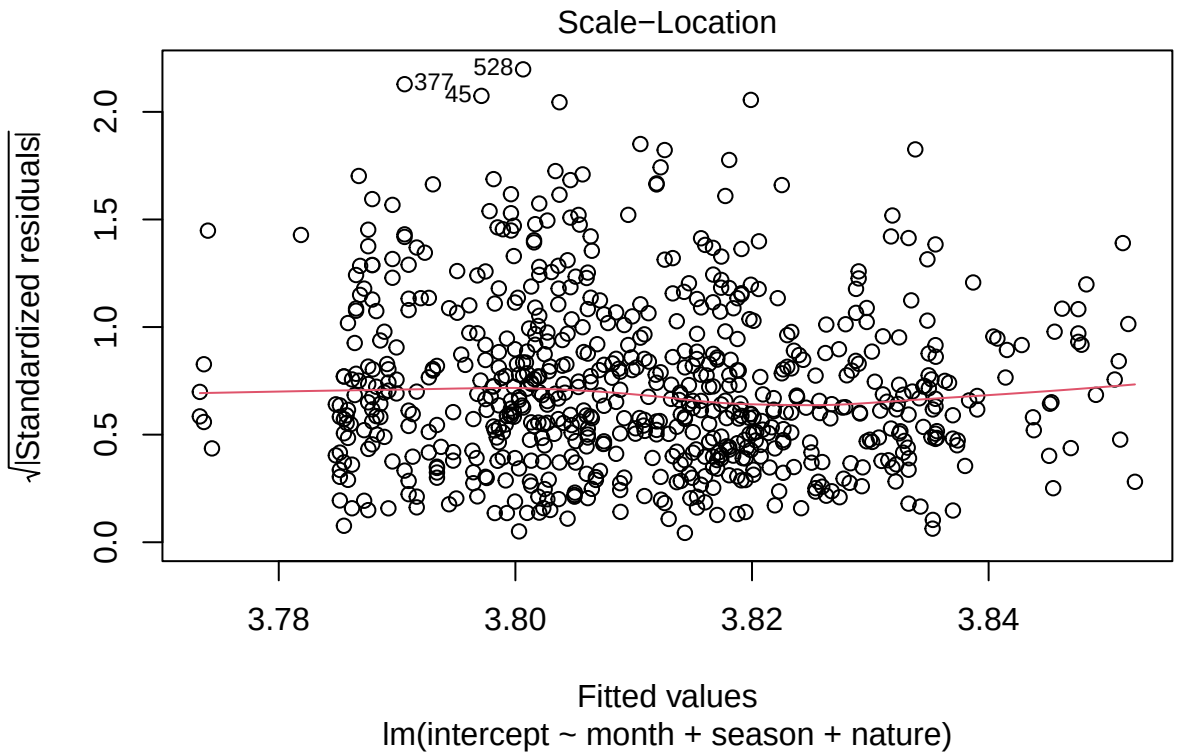
```
##
## Call:
## lm(formula = wind_change ~ month + season + nature, data = season_diff)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.40181 -0.04476 -0.00309  0.04544  0.35691
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     2.890e-01  3.809e-01   0.759    0.448
## monthApril      3.618e-02  1.087e-01   0.333    0.739
## monthMay       -1.629e-02  9.195e-02  -0.177    0.859
## monthJune       2.377e-02  9.001e-02   0.264    0.792
## monthJuly       1.308e-02  8.965e-02   0.146    0.884
## monthAugust     3.124e-02  8.918e-02   0.350    0.726
## monthSeptember  4.448e-02  8.910e-02   0.499    0.618
## monthOctober    3.505e-02  8.919e-02   0.393    0.694
## monthNovember   2.091e-02  9.023e-02   0.232    0.817
## monthDecember   1.142e-02  9.527e-02   0.120    0.905
## season          9.048e-05  1.850e-04   0.489    0.625
## natureET       -2.092e-02  2.912e-02  -0.719    0.473
## natureNR       -2.173e-02  4.732e-02  -0.459    0.646
## natureSS       -2.385e-02  2.003e-02  -1.191    0.234
## natureTS       -1.750e-02  1.629e-02  -1.074    0.283
##
## Residual standard error: 0.08806 on 682 degrees of freedom
## Multiple R-squared:  0.02104,    Adjusted R-squared:  0.000943
## F-statistic: 1.047 on 14 and 682 DF,  p-value: 0.404
```

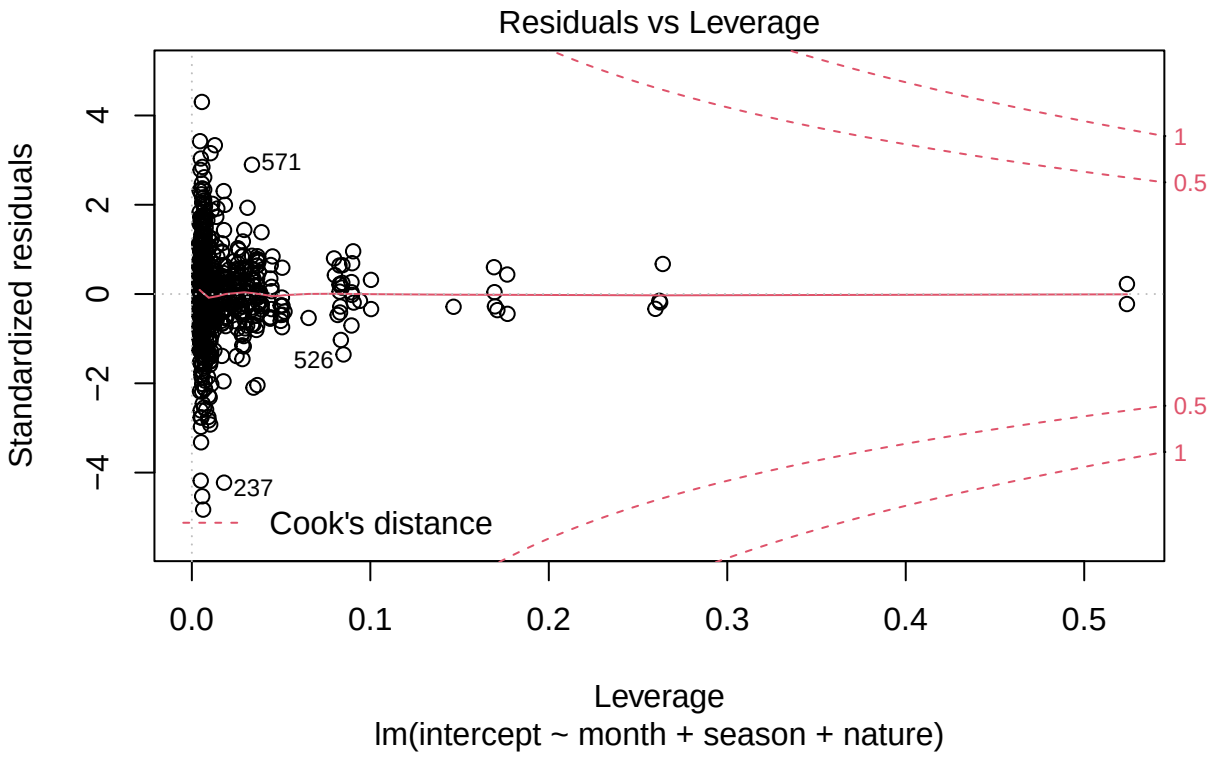
```
plot(intercept.fit)
```

```
## Warning: not plotting observations with leverage one:
##   680
```


Residuals vs Fitted
Residuals
0.4
0.2
0.0
−0.2
−0.4
45
377
528
3.78
3.80
3.82
3.84
Fitted values
lm(intercept ~ month + season + nature)


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(intercept ~ month + season + nature)
45
377
528
−4
−2
0
2
4
−3
−2
−1
0
1
2
3


Scale−Location
√|Standardized residuals|
0.0
0.5
1.0
1.5
2.0
377
528
45
3.78
3.80
3.82
3.84
Fitted values
lm(intercept ~ month + season + nature)




```
sum0 <- as.data.frame(summary(intercept.fit)$coefficients[,c(1,4)]) %>% rename(beta0.fit.Est = Estimate)
sum1 <- as.data.frame(summary(wind_prev.fit)$coefficients[,c(1,4)]) %>% rename(beta1.fit.Est = Estimate)
sum2 <- as.data.frame(summary(lat_change.fit)$coefficients[,c(1,4)]) %>% rename(beta2.fit.Est = Estimate
sum3 <- as.data.frame(summary(long_change.fit)$coefficients[,c(1,4)]) %>% rename(beta3.fit.Est = Estima
sum4 <- as.data.frame(summary(wind_change.fit)$coefficients[,c(1,4)]) %>% rename(beta4.fit.Est = Estima

kable(cbind(sum0, sum1, sum2, sum3, sum4)) %>%
  kable_paper()
```

	beta0.fit.Est	Pr(>|t|)	beta1.fit.Est	Pr(>|t|)	beta2.fit.Est	Pr(>|t|)	beta3.fit.Est	Pr
(Intercept)	4.4810021	0.0000000	1.3431063	0.0000000	0.0413063	0.9506172	-0.8336700	0.01
monthApril	0.0232609	0.8346449	0.0147943	0.6696787	0.0165579	0.9306863	0.0416468	0.67
monthMay	0.0259813	0.7827813	-0.0001180	0.9967888	0.0708822	0.6597505	0.0632772	0.45
monthJune	0.0275693	0.7650618	0.0053935	0.8509869	-0.0070875	0.9641298	0.0556884	0.50
monthJuly	0.0125400	0.8914489	0.0154032	0.5901741	-0.0090910	0.9538180	0.0361214	0.66
monthAugust	-0.0198034	0.8284715	0.0233206	0.4124181	-0.0522548	0.7378961	0.0123691	0.88
monthSeptember	-0.0070528	0.9384385	0.0261005	0.3585599	-0.0361073	0.8169707	0.0212965	0.79
monthOctober	0.0093435	0.9185853	0.0210829	0.4587183	-0.0286163	0.8546050	0.0341549	0.67
monthNovember	0.0145692	0.8748155	0.0246144	0.3925264	0.0239972	0.8792681	0.0263450	0.75
monthDecember	0.0057977	0.9526542	0.0088244	0.7715305	-0.0543131	0.7447475	0.0422468	0.63
season	-0.0003419	0.0717253	-0.0002252	0.0001471	0.0000365	0.9101708	0.0002184	0.20
natureET	0.0008449	0.9774141	0.0037334	0.6877086	-0.0702038	0.1687975	-0.0263888	0.32
natureNR	0.0008122	0.9866387	-0.0146142	0.3331114	0.0058967	0.9432660	0.0030556	0.94
natureSS	0.0141564	0.4904257	-0.0033299	0.6021721	-0.0013517	0.9692484	0.0126339	0.49
natureTS	0.0118370	0.4785102	-0.0059979	0.2486925	-0.0154533	0.5880814	-0.0231521	0.12