

Seasonal Difference Exploration

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Explore the seasonal differences

```
load("./dt_long.RData")
load("./MCMC.res.2.RData")

dt_wind =
  dt_long %>%
    mutate(intercept = 1) %>%
    drop_na()
# 700 after drop_na
IDs <- unique(dt_wind$ID)

# 694 observations >=5
ID_in <- NULL
for (i in 1:length(IDs)) {
  dt_temp = dt_wind[which(dt_wind$ID == IDs[i]),][,1]
  m = nrow(dt_temp)
  # need to drop observations less than 5
  if (m <= 5){
    next
  }else{
    ID_in = c(ID_in, IDs[i])
  }
}

dt_mtx_full = dt_wind %>% filter(ID %in% ID_in)

dt_season <- dt_mtx_full[!duplicated(dt_mtx_full$ID),] %>%
  select(ID, Season, Month, Nature)

# use posterior mean of beta as our final Bayesian model coefficients
beta.res.post = matrix(rep(0,694*5), 694, 5)
for (i in 5001:10000) {
  B.res = MCMC.res.2$B[[i]]
  B.res = as.data.frame(B.res)
  beta.res.post = beta.res.post + B.res
}

beta.res.postmean = beta.res.post/5000
```

```

season_diff <- cbind(dt_season, beta.res.postmean) %>% 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
## -5.412e-04 -3.910e-06 -6.000e-08  1.000e-07  4.042e-04
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.172e-06  1.304e-04   0.017   0.987
## monthAugust  4.621e-06  2.166e-05   0.213   0.831
## monthDecember 8.235e-07  2.464e-05   0.033   0.973
## monthJanuary  6.254e-07  3.671e-05   0.017   0.986
## monthJuly     7.075e-07  2.189e-05   0.032   0.974
## monthJune     8.228e-07  2.209e-05   0.037   0.970
## monthMay      1.172e-05  2.276e-05   0.515   0.607
## monthNovember 4.125e-07  2.195e-05   0.019   0.985
## monthOctober -4.099e-06  2.162e-05  -0.190   0.850
## monthSeptember 6.976e-07  2.162e-05   0.032   0.974
## season       -1.862e-09  6.387e-08  -0.029   0.977
## natureET      2.182e-06  9.192e-06   0.237   0.812
## natureNR      1.982e-06  1.420e-05   0.140   0.889
## natureSS      8.723e-07  6.146e-06   0.142   0.887
## natureTS      8.600e-07  4.791e-06   0.179   0.858
##
## Residual standard error: 2.974e-05 on 679 degrees of freedom
## Multiple R-squared:  0.01182,    Adjusted R-squared:  -0.008552
## F-statistic: 0.5802 on 14 and 679 DF,  p-value: 0.8816

```

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

```

##
## Call:
## lm(formula = wind_prev ~ month + season + nature, data = season_diff)
##
## Residuals:

```

```
##           Min           1Q           Median           3Q           Max
## -1.349e-05 -1.050e-08  3.800e-09  1.218e-07  2.164e-05
##
## Coefficients:
##           Estimate Std. Error   t value Pr(>|t|)
## (Intercept)    1.000e+00  4.832e-06   2.07e+05  <2e-16 ***
## monthAugust   -1.605e-07  8.024e-07  -2.00e-01   0.842
## monthDecember -3.320e-08  9.128e-07  -3.60e-02   0.971
## monthJanuary  -1.740e-08  1.360e-06  -1.30e-02   0.990
## monthJuly     -3.037e-08  8.109e-07  -3.70e-02   0.970
## monthJune     -3.230e-08  8.185e-07  -3.90e-02   0.969
## monthMay      -4.673e-07  8.433e-07  -5.54e-01   0.580
## monthNovember -1.767e-08  8.133e-07  -2.20e-02   0.983
## monthOctober   1.636e-07  8.010e-07   2.04e-01   0.838
## monthSeptember -2.828e-08  8.011e-07  -3.50e-02   0.972
## season        4.358e-10  2.367e-09   1.84e-01   0.854
## natureET       -7.946e-08  3.406e-07  -2.33e-01   0.816
## natureNR       -6.874e-08  5.261e-07  -1.31e-01   0.896
## natureSS       -2.573e-08  2.277e-07  -1.13e-01   0.910
## natureTS       -1.846e-08  1.775e-07  -1.04e-01   0.917
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.102e-06 on 679 degrees of freedom
## Multiple R-squared:  0.01232,    Adjusted R-squared:  -0.008043
## F-statistic: 0.6051 on 14 and 679 DF,  p-value: 0.8621
```

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

```
##
## Call:
## lm(formula = lat_change ~ month + season + nature, data = season_diff)
##
## Residuals:
##           Min           1Q           Median           3Q           Max
## -4.006e-07 -1.124e-08 -1.430e-09  1.042e-08  4.561e-07
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -1.376e-07  2.168e-07  -0.634  0.52604
## monthAugust   -8.337e-08  3.601e-08  -2.315  0.02089 *
## monthDecember -9.173e-08  4.096e-08  -2.239  0.02545 *
## monthJanuary  -9.005e-08  6.103e-08  -1.475  0.14055
## monthJuly     -8.942e-08  3.639e-08  -2.457  0.01425 *
## monthJune     -8.983e-08  3.673e-08  -2.446  0.01472 *
## monthMay      -9.876e-08  3.784e-08  -2.610  0.00926 **
## monthNovember -9.650e-08  3.650e-08  -2.644  0.00839 **
## monthOctober  -8.551e-08  3.595e-08  -2.379  0.01765 *
## monthSeptember -8.443e-08  3.595e-08  -2.348  0.01914 *
## season        1.052e-10  1.062e-10   0.991  0.32226
## natureET       1.465e-08  1.528e-08   0.959  0.33804
## natureNR      -2.774e-08  2.361e-08  -1.175  0.24038
## natureSS       1.573e-08  1.022e-08   1.539  0.12422
## natureTS       1.672e-08  7.967e-09   2.099  0.03622 *
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.945e-08 on 679 degrees of freedom
## Multiple R-squared:  0.02772,    Adjusted R-squared:  0.00767
## F-statistic: 1.383 on 14 and 679 DF,  p-value: 0.1555

summary(long_change.fit)

##
## Call:
## lm(formula = long_change ~ month + season + nature, data = season_diff)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.734e-06 -8.040e-09  2.550e-09  1.264e-08  3.201e-07
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -5.625e-07  3.362e-07  -1.673   0.0947 .
## monthAugust   -7.196e-10  5.582e-08  -0.013   0.9897
## monthDecember -6.647e-09  6.350e-08  -0.105   0.9167
## monthJanuary   1.669e-08  9.462e-08   0.176   0.8600
## monthJuly      -4.588e-09  5.642e-08  -0.081   0.9352
## monthJune      6.986e-09  5.694e-08   0.123   0.9024
## monthMay       1.498e-08  5.867e-08   0.255   0.7985
## monthNovember  8.913e-09  5.658e-08   0.158   0.8749
## monthOctober   1.741e-09  5.573e-08   0.031   0.9751
## monthSeptember -3.754e-09  5.573e-08  -0.067   0.9463
## season        2.835e-10  1.646e-10   1.722   0.0855 .
## natureET      -1.188e-08  2.369e-08  -0.501   0.6164
## natureNR       6.026e-08  3.660e-08   1.646   0.1002
## natureSS       5.651e-09  1.584e-08   0.357   0.7214
## natureTS      -3.366e-09  1.235e-08  -0.273   0.7853
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.667e-08 on 679 degrees of freedom
## Multiple R-squared:  0.0161, Adjusted R-squared:  -0.004189
## F-statistic: 0.7935 on 14 and 679 DF,  p-value: 0.6769
```

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

```
##
## Call:
## lm(formula = wind_change ~ month + season + nature, data = season_diff)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.985e-05 -2.380e-06 -4.800e-07  2.100e-07  6.416e-04
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -1.188e-08  2.369e-08  -0.501   0.6164
## monthAugust   -7.196e-10  5.582e-08  -0.013   0.9897
## monthDecember -6.647e-09  6.350e-08  -0.105   0.9167
## monthJanuary   1.669e-08  9.462e-08   0.176   0.8600
## monthJuly      -4.588e-09  5.642e-08  -0.081   0.9352
## monthJune      6.986e-09  5.694e-08   0.123   0.9024
## monthMay       1.498e-08  5.867e-08   0.255   0.7985
## monthNovember  8.913e-09  5.658e-08   0.158   0.8749
## monthOctober   1.741e-09  5.573e-08   0.031   0.9751
## monthSeptember -3.754e-09  5.573e-08  -0.067   0.9463
## season        2.835e-10  1.646e-10   1.722   0.0855 .
## natureET      -1.188e-08  2.369e-08  -0.501   0.6164
## natureNR       6.026e-08  3.660e-08   1.646   0.1002
## natureSS       5.651e-09  1.584e-08   0.357   0.7214
## natureTS      -3.366e-09  1.235e-08  -0.273   0.7853
```

```

## (Intercept)      1.000e+00  1.093e-04 9147.097  <2e-16 ***
## monthAugust      2.685e-06  1.815e-05   0.148   0.882
## monthDecember    -2.305e-07  2.065e-05  -0.011   0.991
## monthJanuary      4.600e-07  3.077e-05   0.015   0.988
## monthJuly         -7.035e-07  1.835e-05  -0.038   0.969
## monthJune         -4.563e-07  1.852e-05  -0.025   0.980
## monthMay          -2.692e-07  1.908e-05  -0.014   0.989
## monthNovember     -4.788e-07  1.840e-05  -0.026   0.979
## monthOctober      4.297e-07  1.812e-05   0.024   0.981
## monthSeptember    -7.785e-07  1.813e-05  -0.043   0.966
## season            2.413e-08  5.354e-08   0.451   0.652
## natureET           6.467e-07  7.705e-06   0.084   0.933
## natureNR           1.049e-06  1.190e-05   0.088   0.930
## natureSS           6.681e-07  5.152e-06   0.130   0.897
## natureTS           1.767e-06  4.016e-06   0.440   0.660
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.493e-05 on 679 degrees of freedom
## Multiple R-squared:  0.004184,    Adjusted R-squared:  -0.01635
## F-statistic: 0.2038 on 14 and 679 DF,  p-value: 0.9993

```