

# Linear model analysis for temperature difference size

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```
library(viridisLite)
```

Temperature difference.

```
d2$dtemp <- d2$Itemp - d2$Otemp
```

Check interpretation.

```
d2[, plot := factor(plot)]
```

Should have 0 or 1 below.

```
table(table(d2[, .(plot, t.start)]))
```

```
##
##      0      1
## 11432  7240
```

Looks good.

```
fit1 <- lm(Itemp ~ poly(glorad, 3) + poly(Otemp, 3) + poly(wv2, 3) + plot, data = d2)
fit2 <- lm(dtemp ~ poly(glorad, 3) + poly(Otemp, 3) + poly(wv2, 3) + plot, data = d2)
fit2e <- lm(dtemp ~ glorad + I(glorad^2) + I(glorad^3) + Otemp + I(Otemp^2) + I(Otemp^3) +
  wv2 + I(wv2^2) + I(wv2^3) + plot, data = d2)
```

Check results

```
summary(fit1)
```

```
##
## Call:
## lm(formula = Itemp ~ poly(glorad, 3) + poly(Otemp, 3) + poly(wv2,
##      3) + plot, data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.8317 -0.5689  0.0357  0.5755  7.5907
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   15.084995   0.055754 270.565  < 2e-16 ***
```

```
## poly(glorad, 3)1 47.930745 1.594028 30.069 < 2e-16 ***
## poly(glorad, 3)2 -6.182799 1.246392 -4.961 7.19e-07 ***
## poly(glorad, 3)3 5.058263 1.214504 4.165 3.15e-05 ***
## poly(Otemp, 3)1 472.015367 1.382576 341.403 < 2e-16 ***
## poly(Otemp, 3)2 62.942758 1.238102 50.838 < 2e-16 ***
## poly(Otemp, 3)3 37.858014 1.224645 30.913 < 2e-16 ***
## poly(wv2, 3)1 -0.856308 1.419662 -0.603 0.546410
## poly(wv2, 3)2 -1.136325 1.259987 -0.902 0.367164
## poly(wv2, 3)3 -4.743684 1.222402 -3.881 0.000105 ***
## plot10 0.007191 0.078847 0.091 0.927335
## plot11 0.015696 0.078891 0.199 0.842306
## plot12 0.018574 0.078891 0.235 0.813871
## plot13 0.005582 0.078891 0.071 0.943596
## plot14 -0.015785 0.078888 -0.200 0.841413
## plot15 0.004344 0.078886 0.055 0.956083
## plot16 -0.034357 0.081828 -0.420 0.674596
## plot2 0.001819 0.078842 0.023 0.981599
## plot3 -0.001051 0.078801 -0.013 0.989360
## plot4 0.003512 0.078804 0.045 0.964453
## plot5 -0.020237 0.078805 -0.257 0.797340
## plot6 -0.046848 0.078762 -0.595 0.551992
## plot7 -0.036003 0.078761 -0.457 0.647604
## plot8 -0.011158 0.078845 -0.142 0.887468
## plot9 -0.046847 0.081813 -0.573 0.566924
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.196 on 7215 degrees of freedom
## Multiple R-squared: 0.9607, Adjusted R-squared: 0.9606
## F-statistic: 7350 on 24 and 7215 DF, p-value: < 2.2e-16
```

```
summary(fit2)
```

```
##
## Call:
## lm(formula = dtemp ~ poly(glorad, 3) + poly(Otemp, 3) + poly(wv2,
## 3) + plot, data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.8317 -0.5689  0.0357  0.5755  7.5907
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.127169   0.055754  20.217 < 2e-16 ***
## poly(glorad, 3)1 47.930745   1.594028  30.069 < 2e-16 ***
## poly(glorad, 3)2 -6.182799   1.246392  -4.961 7.19e-07 ***
## poly(glorad, 3)3  5.058263   1.214504   4.165 3.15e-05 ***
## poly(Otemp, 3)1 80.782856   1.382576  58.429 < 2e-16 ***
## poly(Otemp, 3)2 62.942758   1.238102  50.838 < 2e-16 ***
## poly(Otemp, 3)3 37.858014   1.224645  30.913 < 2e-16 ***
## poly(wv2, 3)1 -0.856308   1.419662  -0.603 0.546410
## poly(wv2, 3)2 -1.136325   1.259987  -0.902 0.367164
## poly(wv2, 3)3 -4.743684   1.222402  -3.881 0.000105 ***
```

```
## plot10      0.007191  0.078847  0.091 0.927335
## plot11      0.015696  0.078891  0.199 0.842306
## plot12      0.018574  0.078891  0.235 0.813871
## plot13      0.005582  0.078891  0.071 0.943596
## plot14     -0.015785  0.078888 -0.200 0.841413
## plot15      0.004344  0.078886  0.055 0.956083
## plot16     -0.034357  0.081828 -0.420 0.674596
## plot2       0.001819  0.078842  0.023 0.981599
## plot3      -0.001051  0.078801 -0.013 0.989360
## plot4       0.003512  0.078804  0.045 0.964453
## plot5      -0.020237  0.078805 -0.257 0.797340
## plot6      -0.046848  0.078762 -0.595 0.551992
## plot7      -0.036003  0.078761 -0.457 0.647604
## plot8      -0.011158  0.078845 -0.142 0.887468
## plot9      -0.046847  0.081813 -0.573 0.566924
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.196 on 7215 degrees of freedom
## Multiple R-squared:  0.6412, Adjusted R-squared:  0.64
## F-statistic: 537.2 on 24 and 7215 DF, p-value: < 2.2e-16
```

```
summary(fit2e)
```

```
##
## Call:
## lm(formula = dtemp ~ glorad + I(glorad^2) + I(glorad^3) + Otemp +
##      I(Otemp^2) + I(Otemp^3) + wv2 + I(wv2^2) + I(wv2^3) + plot,
##      data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.8317 -0.5689  0.0357  0.5755  7.5907
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.641e+00  2.090e-01 -12.639 < 2e-16 ***
## glorad       4.905e-03  4.345e-04  11.289 < 2e-16 ***
## I(glorad^2) -7.901e-06  1.560e-06  -5.063 4.22e-07 ***
## I(glorad^3)  6.008e-09  1.442e-09   4.165 3.15e-05 ***
## Otemp       8.528e-01  4.837e-02  17.631 < 2e-16 ***
## I(Otemp^2) -8.293e-02  3.592e-03 -23.087 < 2e-16 ***
## I(Otemp^3)  2.561e-03  8.284e-05  30.913 < 2e-16 ***
## wv2        -1.668e-01  5.388e-02  -3.095 0.001975 **
## I(wv2^2)    8.372e-02  2.325e-02   3.600 0.000320 ***
## I(wv2^3)   -1.046e-02  2.696e-03  -3.881 0.000105 ***
## plot10      7.191e-03  7.885e-02  0.091 0.927335
## plot11      1.570e-02  7.889e-02  0.199 0.842306
## plot12      1.857e-02  7.889e-02  0.235 0.813871
## plot13      5.582e-03  7.889e-02  0.071 0.943596
## plot14     -1.578e-02  7.889e-02 -0.200 0.841413
## plot15      4.344e-03  7.889e-02  0.055 0.956083
## plot16     -3.436e-02  8.183e-02 -0.420 0.674596
## plot2       1.819e-03  7.884e-02  0.023 0.981599
```

```
## plot3      -1.051e-03  7.880e-02  -0.013  0.989360
## plot4      3.512e-03  7.880e-02   0.045  0.964453
## plot5     -2.024e-02  7.880e-02  -0.257  0.797340
## plot6     -4.685e-02  7.876e-02  -0.595  0.551992
## plot7     -3.600e-02  7.876e-02  -0.457  0.647604
## plot8     -1.116e-02  7.885e-02  -0.142  0.887468
## plot9     -4.685e-02  8.181e-02  -0.573  0.566924
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.196 on 7215 degrees of freedom
## Multiple R-squared:  0.6412, Adjusted R-squared:  0.64
## F-statistic: 537.2 on 24 and 7215 DF,  p-value: < 2.2e-16
```

The two models are identical. (R-squared is lower for dtemp but that is just because we have already removed a lot of the variation by calculating a difference.) Interesting and reassuring that `plot` effects are small.

Let's generate scaled predictor variables for standardized coefficients (relative to 1 standard deviation of predictor variable). This will show which predictors are the most important compared to how much they vary.

```
fit3 <- lm(Itemp ~ poly(scale(glorad), 3) + poly(scale(0temp), 3) + poly(scale(wv2), 3) + plot, data = d2)
```

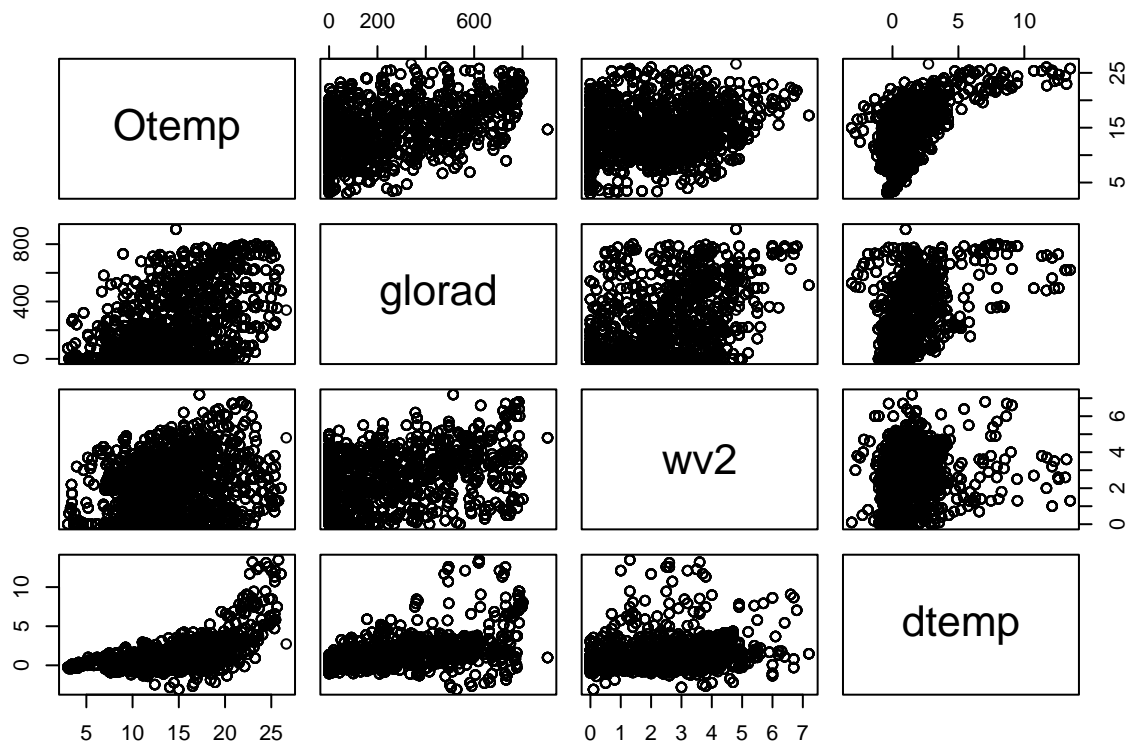
```
summary(fit3)
```

```
##
## Call:
## lm(formula = Intemp ~ poly(scale(glorad), 3) + poly(scale(0temp),
##      3) + poly(scale(wv2), 3) + plot, data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.8317 -0.5689  0.0357  0.5755  7.5907
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    15.084995   0.055754  270.565 < 2e-16 ***
## poly(scale(glorad), 3)1    47.930745   1.594028   30.069 < 2e-16 ***
## poly(scale(glorad), 3)2   -6.182799   1.246392   -4.961 7.19e-07 ***
## poly(scale(glorad), 3)3    5.058263   1.214504    4.165 3.15e-05 ***
## poly(scale(0temp), 3)1   472.015367   1.382576  341.403 < 2e-16 ***
## poly(scale(0temp), 3)2    62.942758   1.238102   50.838 < 2e-16 ***
## poly(scale(0temp), 3)3    37.858014   1.224645   30.913 < 2e-16 ***
## poly(scale(wv2), 3)1     -0.856308   1.419662   -0.603 0.546410
## poly(scale(wv2), 3)2     -1.136325   1.259987   -0.902 0.367164
## poly(scale(wv2), 3)3     -4.743684   1.222402   -3.881 0.000105 ***
## plot10           0.007191   0.078847    0.091 0.927335
## plot11           0.015696   0.078891    0.199 0.842306
## plot12           0.018574   0.078891    0.235 0.813871
## plot13           0.005582   0.078891    0.071 0.943596
## plot14          -0.015785   0.078888   -0.200 0.841413
## plot15           0.004344   0.078886    0.055 0.956083
## plot16          -0.034357   0.081828   -0.420 0.674596
```

```
## plot2          0.001819    0.078842    0.023 0.981599
## plot3         -0.001051    0.078801   -0.013 0.989360
## plot4          0.003512    0.078804    0.045 0.964453
## plot5         -0.020237    0.078805   -0.257 0.797340
## plot6         -0.046848    0.078762   -0.595 0.551992
## plot7         -0.036003    0.078761   -0.457 0.647604
## plot8         -0.011158    0.078845   -0.142 0.887468
## plot9         -0.046847    0.081813   -0.573 0.566924
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.196 on 7215 degrees of freedom
## Multiple R-squared:  0.9607, Adjusted R-squared:  0.9606
## F-statistic: 7350 on 24 and 7215 DF, p-value: < 2.2e-16
```

It looks like temperature (Otemp) is the most important. Is that supported by the measurements?

```
pairs(d2[, .(Otemp, glorad, wv2, dtemp)])
```



Seem so, yes.

Let's see how much worse the model is without the other two.

```
fit4 <- lm(Itemp ~ Otemp + I(Otemp^2) + I(Otemp^3) + plot, data = d2)
```

```
summary(fit4)
```

```
##
## Call:
## lm(formula = Itemp ~ Otemp + I(Otemp^2) + I(Otemp^3) + plot,
##     data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.2228 -0.7465 -0.0239  0.5444  7.9011
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.079e+00  2.241e-01  -9.276  <2e-16 ***
## Otemp        1.736e+00  5.105e-02  34.010  <2e-16 ***
## I(Otemp^2)   -7.275e-02  3.787e-03 -19.210  <2e-16 ***
## I(Otemp^3)    2.384e-03  8.752e-05  27.244  <2e-16 ***
## plot10       -3.845e-03  8.530e-02  -0.045   0.964
## plot11        9.706e-03  8.535e-02   0.114   0.909
## plot12        1.519e-02  8.535e-02   0.178   0.859
## plot13        6.594e-04  8.535e-02   0.008   0.994
## plot14       -1.546e-02  8.535e-02  -0.181   0.856
## plot15        3.771e-03  8.535e-02   0.044   0.965
## plot16       -3.132e-02  8.853e-02  -0.354   0.724
## plot2         4.368e-03  8.530e-02   0.051   0.959
## plot3        -3.313e-03  8.525e-02  -0.039   0.969
## plot4         3.483e-03  8.526e-02   0.041   0.967
## plot5        -2.915e-02  8.525e-02  -0.342   0.732
## plot6        -5.523e-02  8.521e-02  -0.648   0.517
## plot7        -4.392e-02  8.521e-02  -0.515   0.606
## plot8        -2.061e-02  8.530e-02  -0.242   0.809
## plot9        -5.405e-02  8.851e-02  -0.611   0.541
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.294 on 7221 degrees of freedom
## Multiple R-squared:  0.954, Adjusted R-squared:  0.9538
## F-statistic: 8313 on 18 and 7221 DF, p-value: < 2.2e-16
```

```
summary(fit1)
```

```
##
## Call:
## lm(formula = Itemp ~ poly(glorad, 3) + poly(Otemp, 3) + poly(wv2,
##     3) + plot, data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.8317 -0.5689  0.0357  0.5755  7.5907
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)      15.084995    0.055754 270.565 < 2e-16 ***
## poly(glorad, 3)1  47.930745    1.594028  30.069 < 2e-16 ***
## poly(glorad, 3)2 -6.182799    1.246392  -4.961 7.19e-07 ***
## poly(glorad, 3)3  5.058263    1.214504   4.165 3.15e-05 ***
## poly(Otemp, 3)1  472.015367    1.382576 341.403 < 2e-16 ***
## poly(Otemp, 3)2  62.942758    1.238102  50.838 < 2e-16 ***
## poly(Otemp, 3)3  37.858014    1.224645  30.913 < 2e-16 ***
## poly(wv2, 3)1    -0.856308    1.419662  -0.603 0.546410
## poly(wv2, 3)2    -1.136325    1.259987  -0.902 0.367164
## poly(wv2, 3)3    -4.743684    1.222402  -3.881 0.000105 ***
## plot10           0.007191    0.078847   0.091 0.927335
## plot11           0.015696    0.078891   0.199 0.842306
## plot12           0.018574    0.078891   0.235 0.813871
## plot13           0.005582    0.078891   0.071 0.943596
## plot14          -0.015785    0.078888  -0.200 0.841413
## plot15           0.004344    0.078886   0.055 0.956083
## plot16          -0.034357    0.081828  -0.420 0.674596
## plot2            0.001819    0.078842   0.023 0.981599
## plot3           -0.001051    0.078801  -0.013 0.989360
## plot4            0.003512    0.078804   0.045 0.964453
## plot5           -0.020237    0.078805  -0.257 0.797340
## plot6           -0.046848    0.078762  -0.595 0.551992
## plot7           -0.036003    0.078761  -0.457 0.647604
## plot8           -0.011158    0.078845  -0.142 0.887468
## plot9           -0.046847    0.081813  -0.573 0.566924
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.196 on 7215 degrees of freedom
## Multiple R-squared:  0.9607, Adjusted R-squared:  0.9606
## F-statistic: 7350 on 24 and 7215 DF, p-value: < 2.2e-16
```

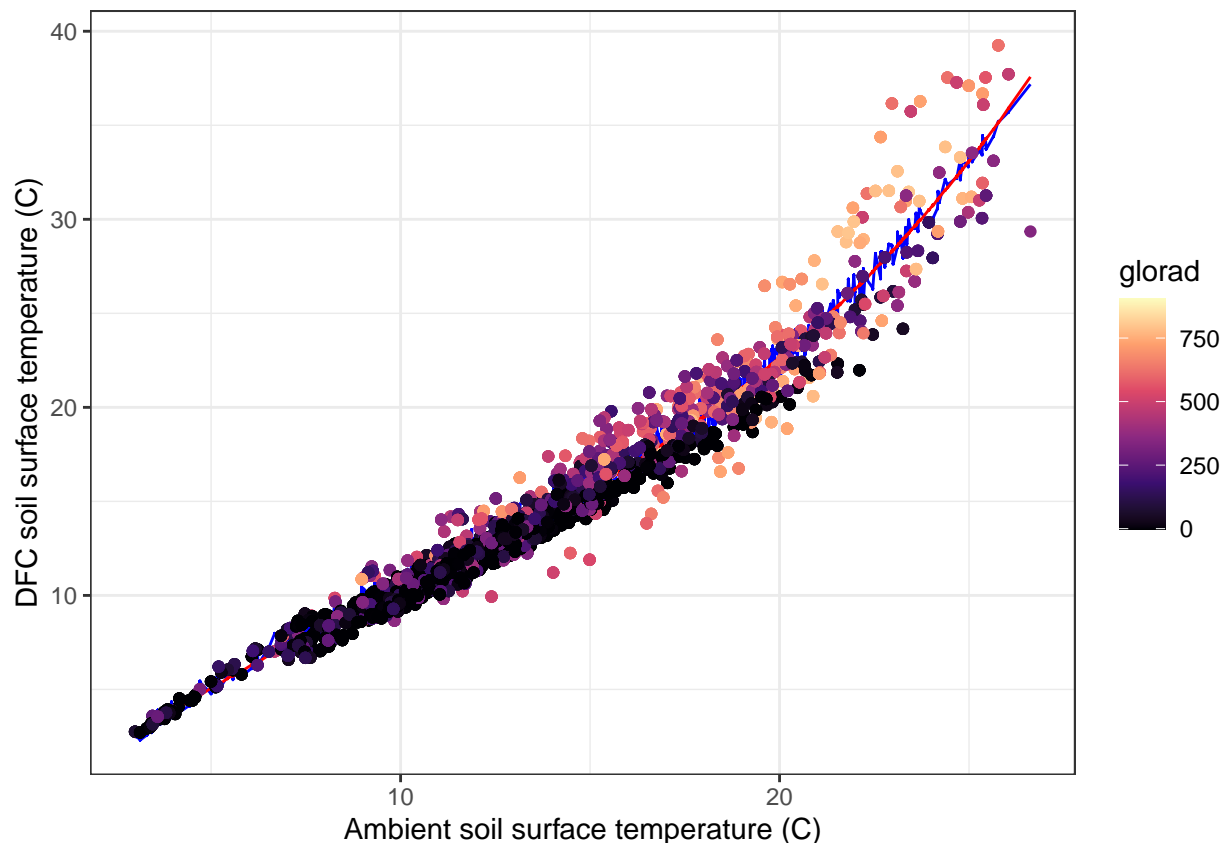
Worse than 2, not that much though. So effects of radiation and wind are not huge.

Generate predictions for plotting.

```
d2$Itemp.pred <- predict(fit1)
d2$Itemp.pred2 <- predict(fit2)
d2$Itemp.pred4 <- predict(fit4)
```

And take a look.

```
ggplot(d2, aes(Otemp, Itemp, colour = glorad)) +
  geom_line(aes(Otemp, Itemp.pred), colour = 'blue') +
  geom_line(aes(Otemp, Itemp.pred4), colour = 'red') +
  geom_point() +
  scale_color_viridis_c(option = 'magma') +
  theme_bw() +
  xlab('Ambient soil surface temperature (C)') + ylab('DFC soil surface temperature (C)')
```



So, temperature alone indeed does as well as the most complete model. But both miss a lot of the variation. How about effects of earlier weather? For that we need to add lagged predictor variables. Try previous hour.

```
wthr <- unique(d2[, .(t.start, Otemp, glorad, wv2)])
wthr[, t.start := t.start - 3600]
d2.orig <- d2
d2 <- merge(d2, wthr, by = 't.start', suffixes = c('', '.lag1'))
wthr[, t.start := t.start - 3600]
d2 <- merge(d2, wthr, by = 't.start', suffixes = c('', '.lag2'))
```

First, try interactions. Then include lagged predictors.

```
fit5 <- lm(Itemp ~ (poly(glorad, 3) + poly(Otemp, 3) + poly(wv2, 3))^2 + plot, data = d2)
fit6 <- lm(Itemp ~ (poly(glorad, 3) + poly(Otemp, 3) + poly(wv2, 3) +
  poly(glorad.lag1, 3) + poly(Otemp.lag1, 3) + poly(wv2.lag1, 3) +
  poly(Otemp.lag2, 3))^2 + plot, data = d2)
summary(fit5)
```

```
##
## Call:
## lm(formula = Itemp ~ (poly(glorad, 3) + poly(Otemp, 3) + poly(wv2,
##      3))^2 + plot, data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```



```

## -6.2561 -0.4592 0.0274 0.4865 6.0722
##
## Coefficients:
##
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.488e+01 5.212e-02 285.488 < 2e-16 ***
## poly(glorad, 3)1 2.338e+01 2.586e+00 9.043 < 2e-16 ***
## poly(glorad, 3)2 -2.382e+01 2.425e+00 -9.824 < 2e-16 ***
## poly(glorad, 3)3 1.128e+01 1.726e+00 6.538 6.68e-11 ***
## poly(0temp, 3)1 4.456e+02 2.432e+00 183.235 < 2e-16 ***
## poly(0temp, 3)2 5.171e+01 2.451e+00 21.101 < 2e-16 ***
## poly(0temp, 3)3 2.109e+01 1.857e+00 11.354 < 2e-16 ***
## poly(wv2, 3)1 3.479e+01 2.487e+00 13.985 < 2e-16 ***
## poly(wv2, 3)2 1.111e+00 3.140e+00 0.354 0.723596
## poly(wv2, 3)3 2.344e+01 2.381e+00 9.844 < 2e-16 ***
## plot10 7.717e-03 6.714e-02 0.115 0.908508
## plot11 2.331e-02 6.722e-02 0.347 0.728806
## plot12 3.283e-02 6.722e-02 0.488 0.625296
## plot13 1.022e-02 6.722e-02 0.152 0.879116
## plot14 -9.872e-03 6.724e-02 -0.147 0.883295
## plot15 2.349e-02 6.723e-02 0.349 0.726805
## plot16 1.243e-02 6.976e-02 0.178 0.858534
## plot2 7.825e-03 6.706e-02 0.117 0.907109
## plot3 1.655e-03 6.703e-02 0.025 0.980306
## plot4 -1.115e-03 6.704e-02 -0.017 0.986734
## plot5 -3.321e-02 6.704e-02 -0.495 0.620313
## plot6 -6.559e-02 6.700e-02 -0.979 0.327681
## plot7 -4.805e-02 6.700e-02 -0.717 0.473302
## plot8 -2.794e-02 6.710e-02 -0.416 0.677167
## plot9 -4.038e-02 6.968e-02 -0.579 0.562295
## poly(glorad, 3)1:poly(0temp, 3)1 1.135e+03 2.963e+02 3.831 0.000129 ***
## poly(glorad, 3)2:poly(0temp, 3)1 -1.226e+03 2.496e+02 -4.912 9.23e-07 ***
## poly(glorad, 3)3:poly(0temp, 3)1 -5.651e+02 1.655e+02 -3.414 0.000643 ***
## poly(glorad, 3)1:poly(0temp, 3)2 1.909e+03 3.096e+02 6.166 7.39e-10 ***
## poly(glorad, 3)2:poly(0temp, 3)2 2.027e+03 2.528e+02 8.018 1.25e-15 ***
## poly(glorad, 3)3:poly(0temp, 3)2 -8.786e+01 1.615e+02 -0.544 0.586416
## poly(glorad, 3)1:poly(0temp, 3)3 -1.473e+02 1.908e+02 -0.772 0.440216
## poly(glorad, 3)2:poly(0temp, 3)3 4.255e+02 1.465e+02 2.904 0.003692 **
## poly(glorad, 3)3:poly(0temp, 3)3 -1.378e+03 1.184e+02 -11.637 < 2e-16 ***
## poly(glorad, 3)1:poly(wv2, 3)1 4.001e+03 2.009e+02 19.916 < 2e-16 ***
## poly(glorad, 3)2:poly(wv2, 3)1 1.174e+03 1.620e+02 7.250 4.62e-13 ***
## poly(glorad, 3)3:poly(wv2, 3)1 -2.370e+02 1.312e+02 -1.806 0.070960 .
## poly(glorad, 3)1:poly(wv2, 3)2 -2.426e+03 2.088e+02 -11.617 < 2e-16 ***
## poly(glorad, 3)2:poly(wv2, 3)2 -1.350e+03 1.593e+02 -8.475 < 2e-16 ***
## poly(glorad, 3)3:poly(wv2, 3)2 2.666e+02 1.273e+02 2.094 0.036314 *
## poly(glorad, 3)1:poly(wv2, 3)3 1.693e+03 1.792e+02 9.445 < 2e-16 ***
## poly(glorad, 3)2:poly(wv2, 3)3 -4.505e+02 1.375e+02 -3.275 0.001060 **
## poly(glorad, 3)3:poly(wv2, 3)3 -2.107e+02 9.971e+01 -2.113 0.034650 *
## poly(0temp, 3)1:poly(wv2, 3)1 -2.859e+02 2.405e+02 -1.188 0.234683
## poly(0temp, 3)2:poly(wv2, 3)1 2.149e+03 2.387e+02 9.002 < 2e-16 ***
## poly(0temp, 3)3:poly(wv2, 3)1 9.415e+02 1.898e+02 4.961 7.19e-07 ***
## poly(0temp, 3)1:poly(wv2, 3)2 -2.545e+03 3.061e+02 -8.313 < 2e-16 ***
## poly(0temp, 3)2:poly(wv2, 3)2 8.242e+02 2.827e+02 2.915 0.003569 **
## poly(0temp, 3)3:poly(wv2, 3)2 3.979e+02 2.219e+02 1.793 0.073006 .
## poly(0temp, 3)1:poly(wv2, 3)3 -7.226e+02 2.291e+02 -3.154 0.001616 **

```

```
## poly(0temp, 3)2:poly(wv2, 3)3      1.538e+03  1.912e+02   8.044 1.01e-15 ***
## poly(0temp, 3)3:poly(wv2, 3)3      1.381e+03  1.583e+02   8.725 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.009 on 7078 degrees of freedom
## Multiple R-squared:  0.9723, Adjusted R-squared:  0.9721
## F-statistic: 4866 on 51 and 7078 DF, p-value: < 2.2e-16
```

```
summary(fit6)
```

```
##
## Call:
## lm(formula = Itemp ~ (poly(glorad, 3) + poly(0temp, 3) + poly(wv2,
##      3) + poly(glorad.lag1, 3) + poly(0temp.lag1, 3) + poly(wv2.lag1,
##      3) + poly(0temp.lag2, 3))^2 + plot, data = d2)
##
## Residuals:
```

	Min	1Q	Median	3Q	Max
	-4.1900	-0.3976	0.0022	0.3832	5.1480

```
##
## Coefficients:
```

	Estimate	Std. Error	t value
(Intercept)	1.646e+01	2.385e+00	6.903
poly(glorad, 3)1	2.070e+02	2.672e+01	7.744
poly(glorad, 3)2	1.082e+02	1.994e+01	5.424
poly(glorad, 3)3	6.647e+01	8.299e+00	8.010
poly(0temp, 3)1	-6.025e+02	2.561e+02	-2.353
poly(0temp, 3)2	-6.286e+02	1.769e+02	-3.553
poly(0temp, 3)3	-3.239e+02	8.625e+01	-3.755
poly(wv2, 3)1	2.148e+01	2.430e+01	0.884
poly(wv2, 3)2	-4.939e+00	1.937e+01	-0.255
poly(wv2, 3)3	1.434e+01	9.048e+00	1.585
poly(glorad.lag1, 3)1	-2.611e+01	1.811e+01	-1.442
poly(glorad.lag1, 3)2	4.989e+01	1.574e+01	3.170
poly(glorad.lag1, 3)3	7.245e+00	7.492e+00	0.967
poly(0temp.lag1, 3)1	8.492e+02	3.295e+02	2.577
poly(0temp.lag1, 3)2	-1.383e+01	2.482e+02	-0.056
poly(0temp.lag1, 3)3	4.383e+02	1.535e+02	2.855
poly(wv2.lag1, 3)1	-2.075e+01	2.845e+01	-0.729
poly(wv2.lag1, 3)2	-3.762e+01	2.607e+01	-1.443
poly(wv2.lag1, 3)3	-2.015e+00	1.002e+01	-0.201
poly(0temp.lag2, 3)1	2.774e+02	2.571e+02	1.079
poly(0temp.lag2, 3)2	1.623e+03	2.488e+02	6.523
poly(0temp.lag2, 3)3	-2.145e+01	9.539e+01	-0.225
plot10	-3.232e-02	5.017e-02	-0.644
plot11	-1.173e-02	5.019e-02	-0.234
plot12	-2.788e-03	5.017e-02	-0.056
plot13	-7.764e-03	5.008e-02	-0.155
plot14	-1.240e-02	4.994e-02	-0.248
plot15	3.634e-04	4.984e-02	0.007
plot16	-1.384e-02	5.170e-02	-0.268
plot2	3.609e-03	4.967e-02	0.073
plot3	-6.376e-03	4.971e-02	-0.128

## plot4	-1.653e-02	4.980e-02	-0.332
## plot5	-1.699e-02	4.994e-02	-0.340
## plot6	-4.033e-02	4.998e-02	-0.807
## plot7	-2.485e-02	5.007e-02	-0.496
## plot8	-3.530e-02	5.015e-02	-0.704
## plot9	-5.152e-02	5.211e-02	-0.989
## poly(glorad, 3)1:poly(0temp, 3)1	5.656e+03	2.276e+03	2.485
## poly(glorad, 3)2:poly(0temp, 3)1	-5.919e+03	1.232e+03	-4.806
## poly(glorad, 3)3:poly(0temp, 3)1	3.200e+02	9.569e+02	0.334
## poly(glorad, 3)1:poly(0temp, 3)2	7.069e+02	1.745e+03	0.405
## poly(glorad, 3)2:poly(0temp, 3)2	-3.528e+01	1.068e+03	-0.033
## poly(glorad, 3)3:poly(0temp, 3)2	-1.385e+02	7.203e+02	-0.192
## poly(glorad, 3)1:poly(0temp, 3)3	1.444e+02	1.493e+03	0.097
## poly(glorad, 3)2:poly(0temp, 3)3	-6.435e+02	7.247e+02	-0.888
## poly(glorad, 3)3:poly(0temp, 3)3	-1.680e+03	5.552e+02	-3.026
## poly(glorad, 3)1:poly(wv2, 3)1	-5.364e+03	9.496e+02	-5.648
## poly(glorad, 3)2:poly(wv2, 3)1	-3.051e+03	5.601e+02	-5.447
## poly(glorad, 3)3:poly(wv2, 3)1	-1.614e+03	3.678e+02	-4.388
## poly(glorad, 3)1:poly(wv2, 3)2	9.279e+02	6.717e+02	1.382
## poly(glorad, 3)2:poly(wv2, 3)2	8.071e+01	4.093e+02	0.197
## poly(glorad, 3)3:poly(wv2, 3)2	1.924e+03	2.332e+02	8.249
## poly(glorad, 3)1:poly(wv2, 3)3	-2.155e+03	6.420e+02	-3.356
## poly(glorad, 3)2:poly(wv2, 3)3	-3.243e+03	3.316e+02	-9.782
## poly(glorad, 3)3:poly(wv2, 3)3	-3.779e+02	1.856e+02	-2.036
## poly(glorad, 3)1:poly(glorad.lag1, 3)1	-1.136e+04	1.863e+03	-6.100
## poly(glorad, 3)2:poly(glorad.lag1, 3)1	-1.133e+04	1.144e+03	-9.900
## poly(glorad, 3)3:poly(glorad.lag1, 3)1	-3.393e+03	5.784e+02	-5.866
## poly(glorad, 3)1:poly(glorad.lag1, 3)2	4.633e+03	1.042e+03	4.446
## poly(glorad, 3)2:poly(glorad.lag1, 3)2	5.035e+03	7.975e+02	6.314
## poly(glorad, 3)3:poly(glorad.lag1, 3)2	3.256e+03	3.176e+02	10.253
## poly(glorad, 3)1:poly(glorad.lag1, 3)3	-2.014e+03	5.901e+02	-3.413
## poly(glorad, 3)2:poly(glorad.lag1, 3)3	-2.052e+03	3.169e+02	-6.475
## poly(glorad, 3)3:poly(glorad.lag1, 3)3	-1.969e+01	1.122e+02	-0.176
## poly(glorad, 3)1:poly(0temp.lag1, 3)1	6.296e+02	4.069e+03	0.155
## poly(glorad, 3)2:poly(0temp.lag1, 3)1	-4.375e+01	2.418e+03	-0.018
## poly(glorad, 3)3:poly(0temp.lag1, 3)1	1.693e+03	1.649e+03	1.027
## poly(glorad, 3)1:poly(0temp.lag1, 3)2	-1.492e+04	3.270e+03	-4.562
## poly(glorad, 3)2:poly(0temp.lag1, 3)2	-3.078e+03	1.917e+03	-1.606
## poly(glorad, 3)3:poly(0temp.lag1, 3)2	-1.530e+03	1.333e+03	-1.148
## poly(glorad, 3)1:poly(0temp.lag1, 3)3	7.818e+03	2.584e+03	3.025
## poly(glorad, 3)2:poly(0temp.lag1, 3)3	2.542e+03	1.265e+03	2.009
## poly(glorad, 3)3:poly(0temp.lag1, 3)3	3.569e+03	8.737e+02	4.086
## poly(glorad, 3)1:poly(wv2.lag1, 3)1	7.326e+03	1.038e+03	7.061
## poly(glorad, 3)2:poly(wv2.lag1, 3)1	4.900e+03	6.088e+02	8.048
## poly(glorad, 3)3:poly(wv2.lag1, 3)1	1.205e+03	3.689e+02	3.268
## poly(glorad, 3)1:poly(wv2.lag1, 3)2	-3.056e+03	8.198e+02	-3.727
## poly(glorad, 3)2:poly(wv2.lag1, 3)2	-1.787e+03	4.503e+02	-3.969
## poly(glorad, 3)3:poly(wv2.lag1, 3)2	-1.196e+03	2.511e+02	-4.764
## poly(glorad, 3)1:poly(wv2.lag1, 3)3	3.386e+03	7.153e+02	4.733
## poly(glorad, 3)2:poly(wv2.lag1, 3)3	2.559e+03	3.489e+02	7.335
## poly(glorad, 3)3:poly(wv2.lag1, 3)3	9.955e+02	1.849e+02	5.383
## poly(glorad, 3)1:poly(0temp.lag2, 3)1	-4.486e+03	3.057e+03	-1.467
## poly(glorad, 3)2:poly(0temp.lag2, 3)1	9.146e+03	2.050e+03	4.462
## poly(glorad, 3)3:poly(0temp.lag2, 3)1	-2.604e+03	1.110e+03	-2.345

## poly(glorad, 3)1:poly(0temp.lag2, 3)2	1.054e+04	2.477e+03	4.257
## poly(glorad, 3)2:poly(0temp.lag2, 3)2	1.909e+03	1.601e+03	1.192
## poly(glorad, 3)3:poly(0temp.lag2, 3)2	3.710e+02	9.494e+02	0.391
## poly(glorad, 3)1:poly(0temp.lag2, 3)3	-4.629e+03	1.936e+03	-2.391
## poly(glorad, 3)2:poly(0temp.lag2, 3)3	1.453e+03	1.021e+03	1.423
## poly(glorad, 3)3:poly(0temp.lag2, 3)3	-2.876e+03	5.134e+02	-5.603
## poly(0temp, 3)1:poly(wv2, 3)1	4.035e+02	2.170e+03	0.186
## poly(0temp, 3)2:poly(wv2, 3)1	-1.240e+04	1.743e+03	-7.116
## poly(0temp, 3)3:poly(wv2, 3)1	8.806e+02	1.267e+03	0.695
## poly(0temp, 3)1:poly(wv2, 3)2	1.345e+03	1.961e+03	0.686
## poly(0temp, 3)2:poly(wv2, 3)2	-1.316e+04	1.659e+03	-7.928
## poly(0temp, 3)3:poly(wv2, 3)2	1.024e+03	9.870e+02	1.038
## poly(0temp, 3)1:poly(wv2, 3)3	1.487e+03	1.623e+03	0.916
## poly(0temp, 3)2:poly(wv2, 3)3	-6.683e+03	1.203e+03	-5.555
## poly(0temp, 3)3:poly(wv2, 3)3	3.468e+01	7.672e+02	0.045
## poly(0temp, 3)1:poly(glorad.lag1, 3)1	-2.203e+02	1.993e+03	-0.111
## poly(0temp, 3)2:poly(glorad.lag1, 3)1	2.950e+03	1.594e+03	1.851
## poly(0temp, 3)3:poly(glorad.lag1, 3)1	-4.011e+03	1.379e+03	-2.908
## poly(0temp, 3)1:poly(glorad.lag1, 3)2	1.076e+03	1.092e+03	0.985
## poly(0temp, 3)2:poly(glorad.lag1, 3)2	5.865e+03	9.643e+02	6.083
## poly(0temp, 3)3:poly(glorad.lag1, 3)2	-2.435e+03	7.066e+02	-3.447
## poly(0temp, 3)1:poly(glorad.lag1, 3)3	-1.376e+03	9.272e+02	-1.484
## poly(0temp, 3)2:poly(glorad.lag1, 3)3	2.598e+03	7.276e+02	3.570
## poly(0temp, 3)3:poly(glorad.lag1, 3)3	3.181e+02	5.248e+02	0.606
## poly(0temp, 3)1:poly(0temp.lag1, 3)1	2.562e+05	3.955e+04	6.478
## poly(0temp, 3)2:poly(0temp.lag1, 3)1	6.184e+04	1.979e+04	3.125
## poly(0temp, 3)3:poly(0temp.lag1, 3)1	3.801e+04	6.669e+03	5.699
## poly(0temp, 3)1:poly(0temp.lag1, 3)2	-9.035e+04	2.053e+04	-4.401
## poly(0temp, 3)2:poly(0temp.lag1, 3)2	-9.905e+04	1.967e+04	-5.035
## poly(0temp, 3)3:poly(0temp.lag1, 3)2	1.360e+03	3.879e+03	0.351
## poly(0temp, 3)1:poly(0temp.lag1, 3)3	1.167e+05	2.173e+04	5.372
## poly(0temp, 3)2:poly(0temp.lag1, 3)3	-1.465e+03	4.449e+03	-0.329
## poly(0temp, 3)3:poly(0temp.lag1, 3)3	2.509e+02	2.311e+02	1.086
## poly(0temp, 3)1:poly(wv2.lag1, 3)1	-1.631e+03	1.988e+03	-0.821
## poly(0temp, 3)2:poly(wv2.lag1, 3)1	1.391e+04	1.578e+03	8.819
## poly(0temp, 3)3:poly(wv2.lag1, 3)1	-2.717e+02	1.204e+03	-0.226
## poly(0temp, 3)1:poly(wv2.lag1, 3)2	-3.562e+03	1.820e+03	-1.957
## poly(0temp, 3)2:poly(wv2.lag1, 3)2	1.461e+04	1.543e+03	9.467
## poly(0temp, 3)3:poly(wv2.lag1, 3)2	-2.301e+03	1.100e+03	-2.093
## poly(0temp, 3)1:poly(wv2.lag1, 3)3	-7.512e+03	1.498e+03	-5.014
## poly(0temp, 3)2:poly(wv2.lag1, 3)3	1.003e+04	1.128e+03	8.895
## poly(0temp, 3)3:poly(wv2.lag1, 3)3	-1.931e+03	7.825e+02	-2.467
## poly(0temp, 3)1:poly(0temp.lag2, 3)1	-1.244e+05	1.537e+04	-8.097
## poly(0temp, 3)2:poly(0temp.lag2, 3)1	-8.301e+03	9.345e+03	-0.888
## poly(0temp, 3)3:poly(0temp.lag2, 3)1	-2.242e+04	5.293e+03	-4.235
## poly(0temp, 3)1:poly(0temp.lag2, 3)2	3.242e+04	9.033e+03	3.589
## poly(0temp, 3)2:poly(0temp.lag2, 3)2	5.077e+04	8.147e+03	6.232
## poly(0temp, 3)3:poly(0temp.lag2, 3)2	-1.001e+03	3.838e+03	-0.261
## poly(0temp, 3)1:poly(0temp.lag2, 3)3	-6.234e+04	7.939e+03	-7.852
## poly(0temp, 3)2:poly(0temp.lag2, 3)3	-4.981e+01	4.245e+03	-0.012
## poly(0temp, 3)3:poly(0temp.lag2, 3)3	-8.193e+02	4.842e+02	-1.692
## poly(wv2, 3)1:poly(glorad.lag1, 3)1	5.414e+03	8.457e+02	6.401
## poly(wv2, 3)2:poly(glorad.lag1, 3)1	-1.802e+03	6.516e+02	-2.765
## poly(wv2, 3)3:poly(glorad.lag1, 3)1	1.638e+03	6.230e+02	2.630

## poly(wv2, 3)1:poly(glorad.lag1, 3)2	2.487e+03	4.972e+02	5.002
## poly(wv2, 3)2:poly(glorad.lag1, 3)2	1.350e+02	3.827e+02	0.353
## poly(wv2, 3)3:poly(glorad.lag1, 3)2	1.624e+03	3.276e+02	4.957
## poly(wv2, 3)1:poly(glorad.lag1, 3)3	1.786e+03	3.568e+02	5.004
## poly(wv2, 3)2:poly(glorad.lag1, 3)3	-2.158e+03	2.686e+02	-8.033
## poly(wv2, 3)3:poly(glorad.lag1, 3)3	-9.033e+02	2.074e+02	-4.355
## poly(wv2, 3)1:poly(0temp.lag1, 3)1	4.963e+03	3.877e+03	1.280
## poly(wv2, 3)2:poly(0temp.lag1, 3)1	-6.167e+03	3.460e+03	-1.782
## poly(wv2, 3)3:poly(0temp.lag1, 3)1	-3.227e+03	2.899e+03	-1.113
## poly(wv2, 3)1:poly(0temp.lag1, 3)2	1.720e+04	2.940e+03	5.849
## poly(wv2, 3)2:poly(0temp.lag1, 3)2	1.804e+04	2.746e+03	6.570
## poly(wv2, 3)3:poly(0temp.lag1, 3)2	1.300e+04	1.996e+03	6.514
## poly(wv2, 3)1:poly(0temp.lag1, 3)3	-3.578e+03	2.156e+03	-1.659
## poly(wv2, 3)2:poly(0temp.lag1, 3)3	-3.576e+03	1.648e+03	-2.170
## poly(wv2, 3)3:poly(0temp.lag1, 3)3	5.763e+02	1.277e+03	0.451
## poly(wv2, 3)1:poly(wv2.lag1, 3)1	3.338e+03	2.997e+03	1.114
## poly(wv2, 3)2:poly(wv2.lag1, 3)1	-1.539e+03	1.669e+03	-0.922
## poly(wv2, 3)3:poly(wv2.lag1, 3)1	3.120e+02	8.404e+02	0.371
## poly(wv2, 3)1:poly(wv2.lag1, 3)2	2.881e+03	2.054e+03	1.403
## poly(wv2, 3)2:poly(wv2.lag1, 3)2	-1.034e+03	1.491e+03	-0.694
## poly(wv2, 3)3:poly(wv2.lag1, 3)2	8.087e+02	3.740e+02	2.162
## poly(wv2, 3)1:poly(wv2.lag1, 3)3	7.565e+02	9.438e+02	0.802
## poly(wv2, 3)2:poly(wv2.lag1, 3)3	-1.665e+03	3.863e+02	-4.311
## poly(wv2, 3)3:poly(wv2.lag1, 3)3	-3.044e+01	1.035e+02	-0.294
## poly(wv2, 3)1:poly(0temp.lag2, 3)1	-2.949e+03	2.312e+03	-1.275
## poly(wv2, 3)2:poly(0temp.lag2, 3)1	3.640e+03	1.983e+03	1.836
## poly(wv2, 3)3:poly(0temp.lag2, 3)1	1.638e+03	1.600e+03	1.024
## poly(wv2, 3)1:poly(0temp.lag2, 3)2	-4.990e+02	1.618e+03	-0.308
## poly(wv2, 3)2:poly(0temp.lag2, 3)2	-2.979e+03	1.435e+03	-2.075
## poly(wv2, 3)3:poly(0temp.lag2, 3)2	-4.075e+03	1.054e+03	-3.866
## poly(wv2, 3)1:poly(0temp.lag2, 3)3	2.339e+03	1.273e+03	1.837
## poly(wv2, 3)2:poly(0temp.lag2, 3)3	-5.953e+02	9.972e+02	-0.597
## poly(wv2, 3)3:poly(0temp.lag2, 3)3	-2.367e+03	7.375e+02	-3.209
## poly(glorad.lag1, 3)1:poly(0temp.lag1, 3)1	-6.795e+03	3.548e+03	-1.915
## poly(glorad.lag1, 3)2:poly(0temp.lag1, 3)1	5.030e+02	2.325e+03	0.216
## poly(glorad.lag1, 3)3:poly(0temp.lag1, 3)1	1.928e+03	1.676e+03	1.151
## poly(glorad.lag1, 3)1:poly(0temp.lag1, 3)2	-5.975e+03	2.852e+03	-2.095
## poly(glorad.lag1, 3)2:poly(0temp.lag1, 3)2	-7.509e+03	1.797e+03	-4.178
## poly(glorad.lag1, 3)3:poly(0temp.lag1, 3)2	-6.927e+03	1.400e+03	-4.948
## poly(glorad.lag1, 3)1:poly(0temp.lag1, 3)3	-2.212e+03	2.159e+03	-1.024
## poly(glorad.lag1, 3)2:poly(0temp.lag1, 3)3	3.472e+03	1.343e+03	2.585
## poly(glorad.lag1, 3)3:poly(0temp.lag1, 3)3	-2.365e+03	9.203e+02	-2.570
## poly(glorad.lag1, 3)1:poly(wv2.lag1, 3)1	-4.966e+03	9.302e+02	-5.339
## poly(glorad.lag1, 3)2:poly(wv2.lag1, 3)1	-2.406e+03	5.419e+02	-4.440
## poly(glorad.lag1, 3)3:poly(wv2.lag1, 3)1	-1.614e+03	3.742e+02	-4.312
## poly(glorad.lag1, 3)1:poly(wv2.lag1, 3)2	1.889e+03	7.871e+02	2.399
## poly(glorad.lag1, 3)2:poly(wv2.lag1, 3)2	7.230e+02	4.384e+02	1.649
## poly(glorad.lag1, 3)3:poly(wv2.lag1, 3)2	1.709e+03	2.948e+02	5.797
## poly(glorad.lag1, 3)1:poly(wv2.lag1, 3)3	-2.392e+03	6.849e+02	-3.492
## poly(glorad.lag1, 3)2:poly(wv2.lag1, 3)3	-1.422e+03	3.430e+02	-4.145
## poly(glorad.lag1, 3)3:poly(wv2.lag1, 3)3	-7.458e+02	2.088e+02	-3.572
## poly(glorad.lag1, 3)1:poly(0temp.lag2, 3)1	8.624e+03	2.864e+03	3.011
## poly(glorad.lag1, 3)2:poly(0temp.lag2, 3)1	-4.648e+03	2.167e+03	-2.145
## poly(glorad.lag1, 3)3:poly(0temp.lag2, 3)1	-9.899e+02	1.252e+03	-0.791

```

## poly(glorad.lag1, 3)1:poly(0temp.lag2, 3)2  5.175e+03  2.216e+03  2.336
## poly(glorad.lag1, 3)2:poly(0temp.lag2, 3)2  2.402e+03  1.598e+03  1.503
## poly(glorad.lag1, 3)3:poly(0temp.lag2, 3)2  5.649e+03  1.031e+03  5.480
## poly(glorad.lag1, 3)1:poly(0temp.lag2, 3)3  6.813e+03  1.572e+03  4.334
## poly(glorad.lag1, 3)2:poly(0temp.lag2, 3)3 -3.512e+03  1.123e+03 -3.126
## poly(glorad.lag1, 3)3:poly(0temp.lag2, 3)3  9.022e+02  5.770e+02  1.564
## poly(0temp.lag1, 3)1:poly(wv2.lag1, 3)1 -2.198e+03  3.716e+03 -0.592
## poly(0temp.lag1, 3)2:poly(wv2.lag1, 3)1 -1.627e+04  2.917e+03 -5.578
## poly(0temp.lag1, 3)3:poly(wv2.lag1, 3)1  1.944e+03  2.078e+03  0.935
## poly(0temp.lag1, 3)1:poly(wv2.lag1, 3)2  4.278e+03  3.408e+03  1.255
## poly(0temp.lag1, 3)2:poly(wv2.lag1, 3)2 -2.055e+04  2.839e+03 -7.238
## poly(0temp.lag1, 3)3:poly(wv2.lag1, 3)2  2.387e+03  1.830e+03  1.305
## poly(0temp.lag1, 3)1:poly(wv2.lag1, 3)3  1.077e+04  2.739e+03  3.931
## poly(0temp.lag1, 3)2:poly(wv2.lag1, 3)3 -1.406e+04  1.978e+03 -7.108
## poly(0temp.lag1, 3)3:poly(wv2.lag1, 3)3  2.715e+03  1.282e+03  2.117
## poly(0temp.lag1, 3)1:poly(0temp.lag2, 3)1 -2.356e+05  5.514e+04 -4.273
## poly(0temp.lag1, 3)2:poly(0temp.lag2, 3)1  5.125e+04  1.992e+04  2.573
## poly(0temp.lag1, 3)3:poly(0temp.lag2, 3)1 -1.547e+05  2.667e+04 -5.803
## poly(0temp.lag1, 3)1:poly(0temp.lag2, 3)2 -3.493e+04  1.950e+04 -1.792
## poly(0temp.lag1, 3)2:poly(0temp.lag2, 3)2  1.472e+05  2.855e+04  5.156
## poly(0temp.lag1, 3)3:poly(0temp.lag2, 3)2  2.708e+03  4.995e+03  0.542
## poly(0temp.lag1, 3)1:poly(0temp.lag2, 3)3 -1.829e+04  1.144e+04 -1.598
## poly(0temp.lag1, 3)2:poly(0temp.lag2, 3)3 -1.835e+03  4.798e+03 -0.382
## poly(0temp.lag1, 3)3:poly(0temp.lag2, 3)3 -6.282e+02  3.349e+02 -1.876
## poly(wv2.lag1, 3)1:poly(0temp.lag2, 3)1  2.815e+03  2.362e+03  1.192
## poly(wv2.lag1, 3)2:poly(0temp.lag2, 3)1 -1.902e+03  2.161e+03 -0.880
## poly(wv2.lag1, 3)3:poly(0temp.lag2, 3)1 -3.680e+03  1.591e+03 -2.313
## poly(wv2.lag1, 3)1:poly(0temp.lag2, 3)2  1.690e+03  1.769e+03  0.955
## poly(wv2.lag1, 3)2:poly(0temp.lag2, 3)2  6.657e+03  1.693e+03  3.933
## poly(wv2.lag1, 3)3:poly(0temp.lag2, 3)2  5.442e+03  1.133e+03  4.802
## poly(wv2.lag1, 3)1:poly(0temp.lag2, 3)3 -1.338e+03  1.262e+03 -1.060
## poly(wv2.lag1, 3)2:poly(0temp.lag2, 3)3  8.414e+01  1.121e+03  0.075
## poly(wv2.lag1, 3)3:poly(0temp.lag2, 3)3  4.205e+02  7.516e+02  0.559
## Pr(>|t|)
## (Intercept) 5.56e-12 ***
## poly(glorad, 3)1 1.10e-14 ***
## poly(glorad, 3)2 6.02e-08 ***
## poly(glorad, 3)3 1.34e-15 ***
## poly(0temp, 3)1 0.018656 *
## poly(0temp, 3)2 0.000384 ***
## poly(0temp, 3)3 0.000174 ***
## poly(wv2, 3)1 0.376807
## poly(wv2, 3)2 0.798756
## poly(wv2, 3)3 0.113074
## poly(glorad.lag1, 3)1 0.149282
## poly(glorad.lag1, 3)2 0.001530 **
## poly(glorad.lag1, 3)3 0.333550
## poly(0temp.lag1, 3)1 0.009984 **
## poly(0temp.lag1, 3)2 0.955578
## poly(0temp.lag1, 3)3 0.004315 **
## poly(wv2.lag1, 3)1 0.465835
## poly(wv2.lag1, 3)2 0.149012
## poly(wv2.lag1, 3)3 0.840641
## poly(0temp.lag2, 3)1 0.280700

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## poly(0temp.lag2, 3)2          7.39e-11 ***
## poly(0temp.lag2, 3)3          0.822135
## plot10                        0.519395
## plot11                        0.815230
## plot12                        0.955677
## plot13                        0.876804
## plot14                        0.803858
## plot15                        0.994183
## plot16                        0.788884
## plot2                         0.942081
## plot3                         0.897933
## plot4                         0.739908
## plot5                         0.733712
## plot6                         0.419734
## plot7                         0.619631
## plot8                         0.481527
## plot9                         0.322875
## poly(glorad, 3)1:poly(0temp, 3)1 0.012967 *
## poly(glorad, 3)2:poly(0temp, 3)1 1.57e-06 ***
## poly(glorad, 3)3:poly(0temp, 3)1 0.738049
## poly(glorad, 3)1:poly(0temp, 3)2 0.685386
## poly(glorad, 3)2:poly(0temp, 3)2 0.973650
## poly(glorad, 3)3:poly(0temp, 3)2 0.847474
## poly(glorad, 3)1:poly(0temp, 3)3 0.922962
## poly(glorad, 3)2:poly(0temp, 3)3 0.374636
## poly(glorad, 3)3:poly(0temp, 3)3 0.002491 **
## poly(glorad, 3)1:poly(wv2, 3)1    1.69e-08 ***
## poly(glorad, 3)2:poly(wv2, 3)1    5.30e-08 ***
## poly(glorad, 3)3:poly(wv2, 3)1    1.16e-05 ***
## poly(glorad, 3)1:poly(wv2, 3)2    0.167168
## poly(glorad, 3)2:poly(wv2, 3)2    0.843691
## poly(glorad, 3)3:poly(wv2, 3)2    < 2e-16 ***
## poly(glorad, 3)1:poly(wv2, 3)3    0.000795 ***
## poly(glorad, 3)2:poly(wv2, 3)3    < 2e-16 ***
## poly(glorad, 3)3:poly(wv2, 3)3    0.041781 *
## poly(glorad, 3)1:poly(glorad.lag1, 3)1 1.12e-09 ***
## poly(glorad, 3)2:poly(glorad.lag1, 3)1 < 2e-16 ***
## poly(glorad, 3)3:poly(glorad.lag1, 3)1 4.68e-09 ***
## poly(glorad, 3)1:poly(glorad.lag1, 3)2 8.87e-06 ***
## poly(glorad, 3)2:poly(glorad.lag1, 3)2 2.89e-10 ***
## poly(glorad, 3)3:poly(glorad.lag1, 3)2 < 2e-16 ***
## poly(glorad, 3)1:poly(glorad.lag1, 3)3 0.000645 ***
## poly(glorad, 3)2:poly(glorad.lag1, 3)3 1.02e-10 ***
## poly(glorad, 3)3:poly(glorad.lag1, 3)3 0.860653
## poly(glorad, 3)1:poly(0temp.lag1, 3)1 0.877040
## poly(glorad, 3)2:poly(0temp.lag1, 3)1 0.985562
## poly(glorad, 3)3:poly(0temp.lag1, 3)1 0.304547
## poly(glorad, 3)1:poly(0temp.lag1, 3)2 5.17e-06 ***
## poly(glorad, 3)2:poly(0temp.lag1, 3)2 0.108361
## poly(glorad, 3)3:poly(0temp.lag1, 3)2 0.250930
## poly(glorad, 3)1:poly(0temp.lag1, 3)3 0.002492 **
## poly(glorad, 3)2:poly(0temp.lag1, 3)3 0.044535 *
## poly(glorad, 3)3:poly(0temp.lag1, 3)3 4.45e-05 ***
## poly(glorad, 3)1:poly(wv2.lag1, 3)1 1.81e-12 ***

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## poly(glorad, 3)2:poly(wv2.lag1, 3)1      9.86e-16 ***
## poly(glorad, 3)3:poly(wv2.lag1, 3)1      0.001089 **
## poly(glorad, 3)1:poly(wv2.lag1, 3)2      0.000195 ***
## poly(glorad, 3)2:poly(wv2.lag1, 3)2      7.29e-05 ***
## poly(glorad, 3)3:poly(wv2.lag1, 3)2      1.93e-06 ***
## poly(glorad, 3)1:poly(wv2.lag1, 3)3      2.25e-06 ***
## poly(glorad, 3)2:poly(wv2.lag1, 3)3      2.47e-13 ***
## poly(glorad, 3)3:poly(wv2.lag1, 3)3      7.56e-08 ***
## poly(glorad, 3)1:poly(0temp.lag2, 3)1     0.142290
## poly(glorad, 3)2:poly(0temp.lag2, 3)1     8.26e-06 ***
## poly(glorad, 3)3:poly(0temp.lag2, 3)1     0.019047 *
## poly(glorad, 3)1:poly(0temp.lag2, 3)2     2.10e-05 ***
## poly(glorad, 3)2:poly(0temp.lag2, 3)2     0.233313
## poly(glorad, 3)3:poly(0temp.lag2, 3)2     0.695970
## poly(glorad, 3)1:poly(0temp.lag2, 3)3     0.016848 *
## poly(glorad, 3)2:poly(0temp.lag2, 3)3     0.154774
## poly(glorad, 3)3:poly(0temp.lag2, 3)3     2.19e-08 ***
## poly(0temp, 3)1:poly(wv2, 3)1             0.852494
## poly(0temp, 3)2:poly(wv2, 3)1             1.23e-12 ***
## poly(0temp, 3)3:poly(wv2, 3)1             0.486961
## poly(0temp, 3)1:poly(wv2, 3)2             0.492718
## poly(0temp, 3)2:poly(wv2, 3)2             2.57e-15 ***
## poly(0temp, 3)3:poly(wv2, 3)2             0.299516
## poly(0temp, 3)1:poly(wv2, 3)3             0.359711
## poly(0temp, 3)2:poly(wv2, 3)3             2.87e-08 ***
## poly(0temp, 3)3:poly(wv2, 3)3             0.963949
## poly(0temp, 3)1:poly(glorad.lag1, 3)1     0.911982
## poly(0temp, 3)2:poly(glorad.lag1, 3)1     0.064205 .
## poly(0temp, 3)3:poly(glorad.lag1, 3)1     0.003651 **
## poly(0temp, 3)1:poly(glorad.lag1, 3)2     0.324513
## poly(0temp, 3)2:poly(glorad.lag1, 3)2     1.24e-09 ***
## poly(0temp, 3)3:poly(glorad.lag1, 3)2     0.000571 ***
## poly(0temp, 3)1:poly(glorad.lag1, 3)3     0.137904
## poly(0temp, 3)2:poly(glorad.lag1, 3)3     0.000359 ***
## poly(0temp, 3)3:poly(glorad.lag1, 3)3     0.544454
## poly(0temp, 3)1:poly(0temp.lag1, 3)1     9.92e-11 ***
## poly(0temp, 3)2:poly(0temp.lag1, 3)1     0.001784 **
## poly(0temp, 3)3:poly(0temp.lag1, 3)1     1.25e-08 ***
## poly(0temp, 3)1:poly(0temp.lag1, 3)2     1.09e-05 ***
## poly(0temp, 3)2:poly(0temp.lag1, 3)2     4.89e-07 ***
## poly(0temp, 3)3:poly(0temp.lag1, 3)2     0.725824
## poly(0temp, 3)1:poly(0temp.lag1, 3)3     8.03e-08 ***
## poly(0temp, 3)2:poly(0temp.lag1, 3)3     0.741969
## poly(0temp, 3)3:poly(0temp.lag1, 3)3     0.277674
## poly(0temp, 3)1:poly(wv2.lag1, 3)1       0.411945
## poly(0temp, 3)2:poly(wv2.lag1, 3)1       < 2e-16 ***
## poly(0temp, 3)3:poly(wv2.lag1, 3)1       0.821421
## poly(0temp, 3)1:poly(wv2.lag1, 3)2       0.050383 .
## poly(0temp, 3)2:poly(wv2.lag1, 3)2       < 2e-16 ***
## poly(0temp, 3)3:poly(wv2.lag1, 3)2       0.036409 *
## poly(0temp, 3)1:poly(wv2.lag1, 3)3       5.46e-07 ***
## poly(0temp, 3)2:poly(wv2.lag1, 3)3       < 2e-16 ***
## poly(0temp, 3)3:poly(wv2.lag1, 3)3       0.013644 *
## poly(0temp, 3)1:poly(0temp.lag2, 3)1     6.60e-16 ***

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## poly(0temp, 3)2:poly(0temp.lag2, 3)1      0.374439
## poly(0temp, 3)3:poly(0temp.lag2, 3)1      2.31e-05 ***
## poly(0temp, 3)1:poly(0temp.lag2, 3)2      0.000334 ***
## poly(0temp, 3)2:poly(0temp.lag2, 3)2      4.87e-10 ***
## poly(0temp, 3)3:poly(0temp.lag2, 3)2      0.794138
## poly(0temp, 3)1:poly(0temp.lag2, 3)3      4.71e-15 ***
## poly(0temp, 3)2:poly(0temp.lag2, 3)3      0.990639
## poly(0temp, 3)3:poly(0temp.lag2, 3)3      0.090663 .
## poly(wv2, 3)1:poly(glorad.lag1, 3)1      1.64e-10 ***
## poly(wv2, 3)2:poly(glorad.lag1, 3)1      0.005701 **
## poly(wv2, 3)3:poly(glorad.lag1, 3)1      0.008569 **
## poly(wv2, 3)1:poly(glorad.lag1, 3)2      5.81e-07 ***
## poly(wv2, 3)2:poly(glorad.lag1, 3)2      0.724216
## poly(wv2, 3)3:poly(glorad.lag1, 3)2      7.34e-07 ***
## poly(wv2, 3)1:poly(glorad.lag1, 3)3      5.75e-07 ***
## poly(wv2, 3)2:poly(glorad.lag1, 3)3      1.11e-15 ***
## poly(wv2, 3)3:poly(glorad.lag1, 3)3      1.35e-05 ***
## poly(wv2, 3)1:poly(0temp.lag1, 3)1      0.200638
## poly(wv2, 3)2:poly(0temp.lag1, 3)1      0.074734 .
## poly(wv2, 3)3:poly(0temp.lag1, 3)1      0.265746
## poly(wv2, 3)1:poly(0temp.lag1, 3)2      5.16e-09 ***
## poly(wv2, 3)2:poly(0temp.lag1, 3)2      5.41e-11 ***
## poly(wv2, 3)3:poly(0temp.lag1, 3)2      7.82e-11 ***
## poly(wv2, 3)1:poly(0temp.lag1, 3)3      0.097105 .
## poly(wv2, 3)2:poly(0temp.lag1, 3)3      0.030075 *
## poly(wv2, 3)3:poly(0temp.lag1, 3)3      0.651686
## poly(wv2, 3)1:poly(wv2.lag1, 3)1      0.265423
## poly(wv2, 3)2:poly(wv2.lag1, 3)1      0.356501
## poly(wv2, 3)3:poly(wv2.lag1, 3)1      0.710448
## poly(wv2, 3)1:poly(wv2.lag1, 3)2      0.160784
## poly(wv2, 3)2:poly(wv2.lag1, 3)2      0.487956
## poly(wv2, 3)3:poly(wv2.lag1, 3)2      0.030641 *
## poly(wv2, 3)1:poly(wv2.lag1, 3)3      0.422820
## poly(wv2, 3)2:poly(wv2.lag1, 3)3      1.65e-05 ***
## poly(wv2, 3)3:poly(wv2.lag1, 3)3      0.768740
## poly(wv2, 3)1:poly(0temp.lag2, 3)1      0.202302
## poly(wv2, 3)2:poly(0temp.lag2, 3)1      0.066458 .
## poly(wv2, 3)3:poly(0temp.lag2, 3)1      0.306009
## poly(wv2, 3)1:poly(0temp.lag2, 3)2      0.757768
## poly(wv2, 3)2:poly(0temp.lag2, 3)2      0.038002 *
## poly(wv2, 3)3:poly(0temp.lag2, 3)2      0.000112 ***
## poly(wv2, 3)1:poly(0temp.lag2, 3)3      0.066221 .
## poly(wv2, 3)2:poly(0temp.lag2, 3)3      0.550534
## poly(wv2, 3)3:poly(0temp.lag2, 3)3      0.001339 **
## poly(glorad.lag1, 3)1:poly(0temp.lag1, 3)1 0.055496 .
## poly(glorad.lag1, 3)2:poly(0temp.lag1, 3)1 0.828713
## poly(glorad.lag1, 3)3:poly(0temp.lag1, 3)1 0.249875
## poly(glorad.lag1, 3)1:poly(0temp.lag1, 3)2 0.036187 *
## poly(glorad.lag1, 3)2:poly(0temp.lag1, 3)2 2.98e-05 ***
## poly(glorad.lag1, 3)3:poly(0temp.lag1, 3)2 7.68e-07 ***
## poly(glorad.lag1, 3)1:poly(0temp.lag1, 3)3 0.305679
## poly(glorad.lag1, 3)2:poly(0temp.lag1, 3)3 0.009756 **
## poly(glorad.lag1, 3)3:poly(0temp.lag1, 3)3 0.010205 *
## poly(glorad.lag1, 3)1:poly(wv2.lag1, 3)1 9.66e-08 ***

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## poly(glorad.lag1, 3)2:poly(wv2.lag1, 3)1 9.14e-06 ***
## poly(glorad.lag1, 3)3:poly(wv2.lag1, 3)1 1.64e-05 ***
## poly(glorad.lag1, 3)1:poly(wv2.lag1, 3)2 0.016446 *
## poly(glorad.lag1, 3)2:poly(wv2.lag1, 3)2 0.099124 .
## poly(glorad.lag1, 3)3:poly(wv2.lag1, 3)2 7.07e-09 ***
## poly(glorad.lag1, 3)1:poly(wv2.lag1, 3)3 0.000482 ***
## poly(glorad.lag1, 3)2:poly(wv2.lag1, 3)3 3.44e-05 ***
## poly(glorad.lag1, 3)3:poly(wv2.lag1, 3)3 0.000357 ***
## poly(glorad.lag1, 3)1:poly(0temp.lag2, 3)1 0.002616 **
## poly(glorad.lag1, 3)2:poly(0temp.lag2, 3)1 0.031956 *
## poly(glorad.lag1, 3)3:poly(0temp.lag2, 3)1 0.429173
## poly(glorad.lag1, 3)1:poly(0temp.lag2, 3)2 0.019530 *
## poly(glorad.lag1, 3)2:poly(0temp.lag2, 3)2 0.132900
## poly(glorad.lag1, 3)3:poly(0temp.lag2, 3)2 4.41e-08 ***
## poly(glorad.lag1, 3)1:poly(0temp.lag2, 3)3 1.49e-05 ***
## poly(glorad.lag1, 3)2:poly(0temp.lag2, 3)3 0.001779 **
## poly(glorad.lag1, 3)3:poly(0temp.lag2, 3)3 0.117950
## poly(0temp.lag1, 3)1:poly(wv2.lag1, 3)1 0.554130
## poly(0temp.lag1, 3)2:poly(wv2.lag1, 3)1 2.53e-08 ***
## poly(0temp.lag1, 3)3:poly(wv2.lag1, 3)1 0.349696
## poly(0temp.lag1, 3)1:poly(wv2.lag1, 3)2 0.209412
## poly(0temp.lag1, 3)2:poly(wv2.lag1, 3)2 5.06e-13 ***
## poly(0temp.lag1, 3)3:poly(wv2.lag1, 3)2 0.192057
## poly(0temp.lag1, 3)1:poly(wv2.lag1, 3)3 8.53e-05 ***
## poly(0temp.lag1, 3)2:poly(wv2.lag1, 3)3 1.30e-12 ***
## poly(0temp.lag1, 3)3:poly(wv2.lag1, 3)3 0.034285 *
## poly(0temp.lag1, 3)1:poly(0temp.lag2, 3)1 1.95e-05 ***
## poly(0temp.lag1, 3)2:poly(0temp.lag2, 3)1 0.010089 *
## poly(0temp.lag1, 3)3:poly(0temp.lag2, 3)1 6.82e-09 ***
## poly(0temp.lag1, 3)1:poly(0temp.lag2, 3)2 0.073213 .
## poly(0temp.lag1, 3)2:poly(0temp.lag2, 3)2 2.59e-07 ***
## poly(0temp.lag1, 3)3:poly(0temp.lag2, 3)2 0.587735
## poly(0temp.lag1, 3)1:poly(0temp.lag2, 3)3 0.110059
## poly(0temp.lag1, 3)2:poly(0temp.lag2, 3)3 0.702113
## poly(0temp.lag1, 3)3:poly(0temp.lag2, 3)3 0.060718 .
## poly(wv2.lag1, 3)1:poly(0temp.lag2, 3)1 0.233375
## poly(wv2.lag1, 3)2:poly(0temp.lag2, 3)1 0.378867
## poly(wv2.lag1, 3)3:poly(0temp.lag2, 3)1 0.020730 *
## poly(wv2.lag1, 3)1:poly(0temp.lag2, 3)2 0.339556
## poly(wv2.lag1, 3)2:poly(0temp.lag2, 3)2 8.47e-05 ***
## poly(wv2.lag1, 3)3:poly(0temp.lag2, 3)2 1.61e-06 ***
## poly(wv2.lag1, 3)1:poly(0temp.lag2, 3)3 0.289072
## poly(wv2.lag1, 3)2:poly(0temp.lag2, 3)3 0.940181
## poly(wv2.lag1, 3)3:poly(0temp.lag2, 3)3 0.575860
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.7459 on 6904 degrees of freedom
## Multiple R-squared:  0.9852, Adjusted R-squared:  0.9847
## F-statistic: 2045 on 225 and 6904 DF, p-value: < 2.2e-16

```

```
summary(fit2)
```

```
##
```

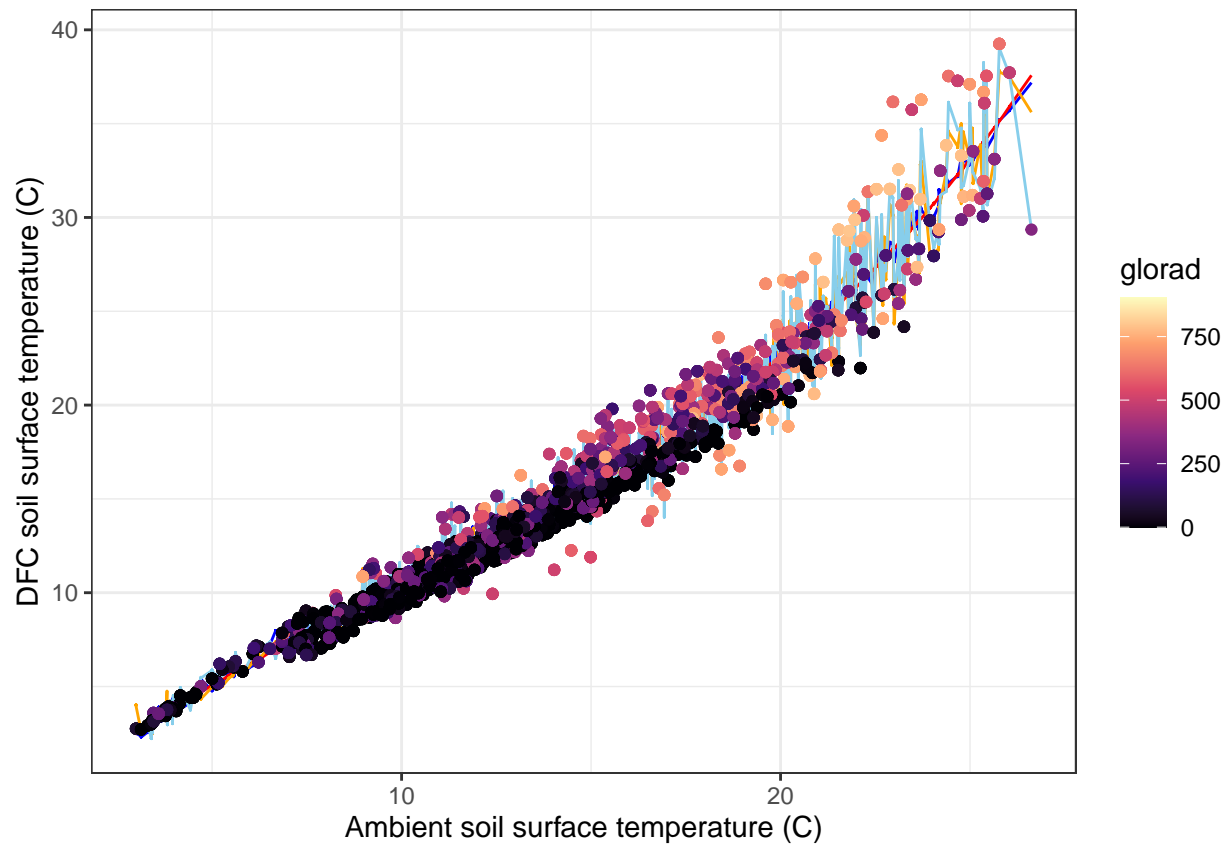
```
## Call:
## lm(formula = dtemp ~ poly(glorad, 3) + poly(0temp, 3) + poly(wv2,
##      3) + plot, data = d2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.8317 -0.5689  0.0357  0.5755  7.5907
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.127169    0.055754  20.217 < 2e-16 ***
## poly(glorad, 3)1  47.930745    1.594028  30.069 < 2e-16 ***
## poly(glorad, 3)2  -6.182799    1.246392  -4.961 7.19e-07 ***
## poly(glorad, 3)3   5.058263    1.214504   4.165 3.15e-05 ***
## poly(0temp, 3)1  80.782856    1.382576  58.429 < 2e-16 ***
## poly(0temp, 3)2  62.942758    1.238102  50.838 < 2e-16 ***
## poly(0temp, 3)3  37.858014    1.224645  30.913 < 2e-16 ***
## poly(wv2, 3)1    -0.856308    1.419662  -0.603 0.546410
## poly(wv2, 3)2    -1.136325    1.259987  -0.902 0.367164
## poly(wv2, 3)3    -4.743684    1.222402  -3.881 0.000105 ***
## plot10           0.007191    0.078847   0.091 0.927335
## plot11           0.015696    0.078891   0.199 0.842306
## plot12           0.018574    0.078891   0.235 0.813871
## plot13           0.005582    0.078891   0.071 0.943596
## plot14          -0.015785    0.078888  -0.200 0.841413
## plot15           0.004344    0.078886   0.055 0.956083
## plot16          -0.034357    0.081828  -0.420 0.674596
## plot2            0.001819    0.078842   0.023 0.981599
## plot3           -0.001051    0.078801  -0.013 0.989360
## plot4            0.003512    0.078804   0.045 0.964453
## plot5           -0.020237    0.078805  -0.257 0.797340
## plot6           -0.046848    0.078762  -0.595 0.551992
## plot7           -0.036003    0.078761  -0.457 0.647604
## plot8           -0.011158    0.078845  -0.142 0.887468
## plot9           -0.046847    0.081813  -0.573 0.566924
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.196 on 7215 degrees of freedom
## Multiple R-squared:  0.6412, Adjusted R-squared:  0.64
## F-statistic: 537.2 on 24 and 7215 DF, p-value: < 2.2e-16
```

A lot of improvement (with interactions included).

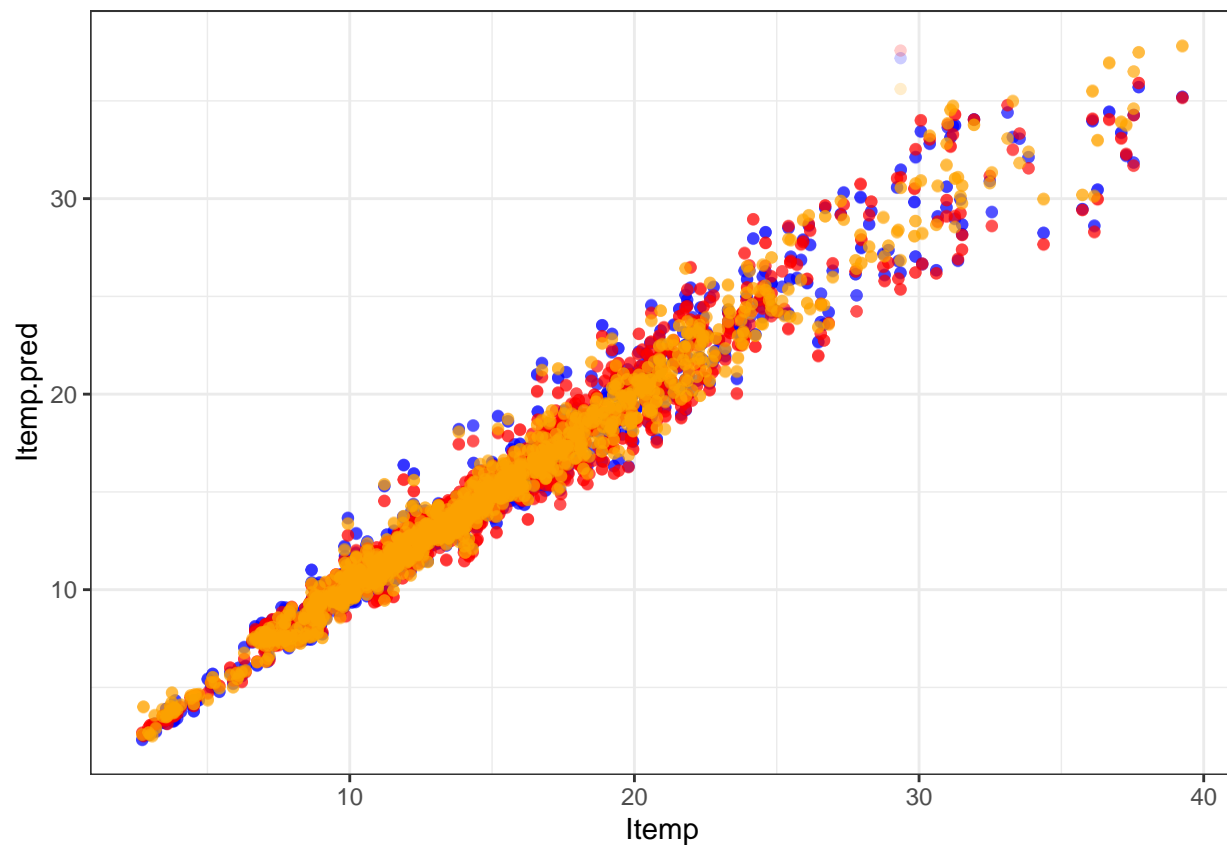
```
d2$Itemp.pred5 <- predict(fit5)
d2$Itemp.pred6 <- predict(fit6)
```

```
ggplot(d2, aes(0temp, Itemp, colour = glorad)) +
  geom_line(aes(0temp, Itemp.pred, colour = 'blue')) +
  geom_line(aes(0temp, Itemp.pred4, colour = 'red')) +
  geom_line(aes(0temp, Itemp.pred5, colour = 'orange')) +
  geom_line(aes(0temp, Itemp.pred6, colour = 'skyblue')) +
  geom_point() +
```

```
scale_color_viridis_c(option = 'magma') +
theme_bw() +
xlab('Ambient soil surface temperature (C)') + ylab('DFC soil surface temperature (C)')
```



```
ggplot(d2) +
  geom_point(aes(Items, Items.pred), colour = 'blue', alpha = 0.2) +
  geom_point(aes(Items, Items.pred4), colour = 'red', alpha = 0.2) +
  geom_point(aes(Items, Items.pred5), colour = 'orange', alpha = 0.2) +
  theme_bw()
```



```
#newdat <- expand.grid(glorad = 0:10 * 100, Otemp = 0:10 * 3, wv2 = 2)
#setDT(newdat)
#newdat$dtemp.pred5 <- predict(fit2, newdata = newdat)
#newdat[dtemp.pred5 > 5, ]
```

Looks at some subsets.

```
#newdat[dtemp.pred5 > 3, ]
#newdat[dtemp.pred5 > 5, ]
#newdat[dtemp.pred5 > 8, ]
```

How common were the high temperatures and temperature differences?

```
quantile(d2.orig$Otemp)
```

```
##          0%          25%          50%          75%         100%
##  2.99250 10.79750 13.58917 17.04000 26.62083
```

```
quantile(d2.orig$Itemp)
```

```
##          0%          25%          50%          75%         100%
##  2.710833 10.985417 14.083333 18.284167 39.250833
```

```
quantile(d2.orig$dtemp)
```

```
##           0%           25%           50%           75%           100%
## -3.0908333  0.0225000  0.6333333  1.5491667 13.4783333
```

Mean difference by plot.

```
summ <- d2[, .(dtemp.mean = mean(dtemp), dtemp.med = median(dtemp)), by = plot]
summ
```

```
##      plot dtemp.mean dtemp.med
##      <fctr>      <num>      <num>
## 1:      5  1.1243463 0.6295833
## 2:      6  1.0895574 0.6041667
## 3:      7  1.1038755 0.6266667
## 4:      8  1.1417271 0.6258333
## 5:      9  1.1792947 0.6083333
## 6:     10  1.1513668 0.6333333
## 7:     11  1.1688969 0.6333333
## 8:     12  1.1647081 0.6466667
## 9:     13  1.1472820 0.6450000
## 10:     14  1.1353537 0.6537500
## 11:     15  1.1577463 0.6608333
## 12:     16  0.9020823 0.6875000
## 13:      1  1.1643252 0.6566667
## 14:      2  1.1471979 0.6475000
## 15:      3  1.1544723 0.6408333
## 16:      4  1.1615126 0.6350000
```

```
t.test(summ$dtemp.med)
```

```
##
## One Sample t-test
##
## data:  summ$dtemp.med
## t = 126.17, df = 15, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.6288807 0.6504943
## sample estimates:
## mean of x
## 0.6396875
```

```
t.test(summ$dtemp.mean)
```

```
##
## One Sample t-test
##
## data:  summ$dtemp.mean
## t = 69.148, df = 15, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
```

```
## 95 percent confidence interval:  
## 1.096001 1.165717  
## sample estimates:  
## mean of x  
## 1.130859
```