IPLANT UPDATE

INTERPOLATED CLIMATE LAYERS FOR USE IN SPECIES MODELING:

06-18-2013

Benoit Parmentier

PRESENTATION - TABLE OF CONTENT

Maximum air temperature predictions:

I. GAM DAILY OREGON TMAX

"GAM_DAILY" method refers to the use of General Additive Models at the daily time scale. Models for air maximum air temperature are fitted to training datasets drawn randomly for every day of the year. These results pertain to the Oregon case study using the new revised script.

Out_prefix:_365d_GAM_fus_all_lst_06032013

Out_path:
/home/parmentier/Data/IPLANT_project/Oregon_interpolation/Oregon_03142013/output_data_365d_GAM_fus_all_lst_06032013

Maximum air temperature models
And average accuracy metrics

Models

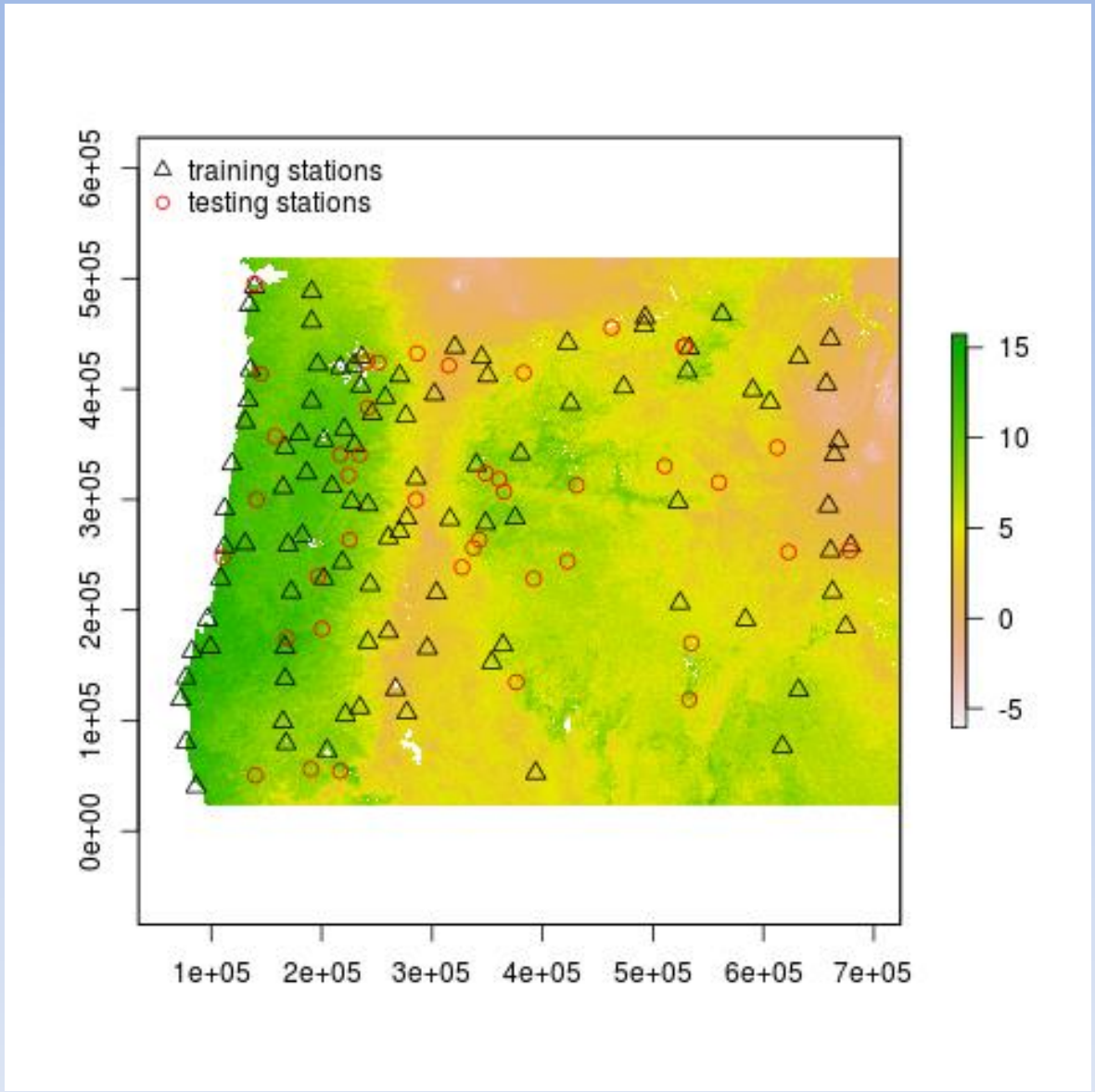
```
> raster_prediction_obj$method_mod_obj[[1]]$formulas
[1] "y_var ~ s(elev_s)"
[2] "y_var ~ s(LST)"
[3] "y_var ~ s(elev_s,LST)"
[4] "y_var ~ s(lat) + s(lon)+ s(elev_s)"
[5] "y_var ~ s(lat,lon,elev_s)"
[6] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST)"
[7] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(LC2)"
[8] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(LC6)"
[9] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(DISTOC)"
```

Averages

```
> raster_prediction_obj$summary_metrics_v
$avg
  pred_mod      mae      rmse           me         r           m50 run_samp   n
1     mod1 2.602439 3.317630 -0.01830567 0.4638650 -0.134106849         1 365
2     mod2 2.580890 3.253979 -0.05369378 0.5041187 -0.165505540         1 365
3     mod3 2.383087 3.023642 -0.05034041 0.5873415 -0.074256961         1 365
4     mod4 2.023460 2.574561 -0.01071567 0.7139629 -0.013868729         1 365
5     mod5 1.924246 2.427034  0.31654094 0.7085531  0.349247551         1   3
6     mod6 2.024779 2.595266 -0.02855916 0.7156357  0.004353219         1 365
7     mod8 2.088721 2.697137 -0.03148013 0.6979056  0.016723228         1 365
8     mod9 2.017169 2.589539 -0.02522673 0.7173096  0.018123789         1 365
```

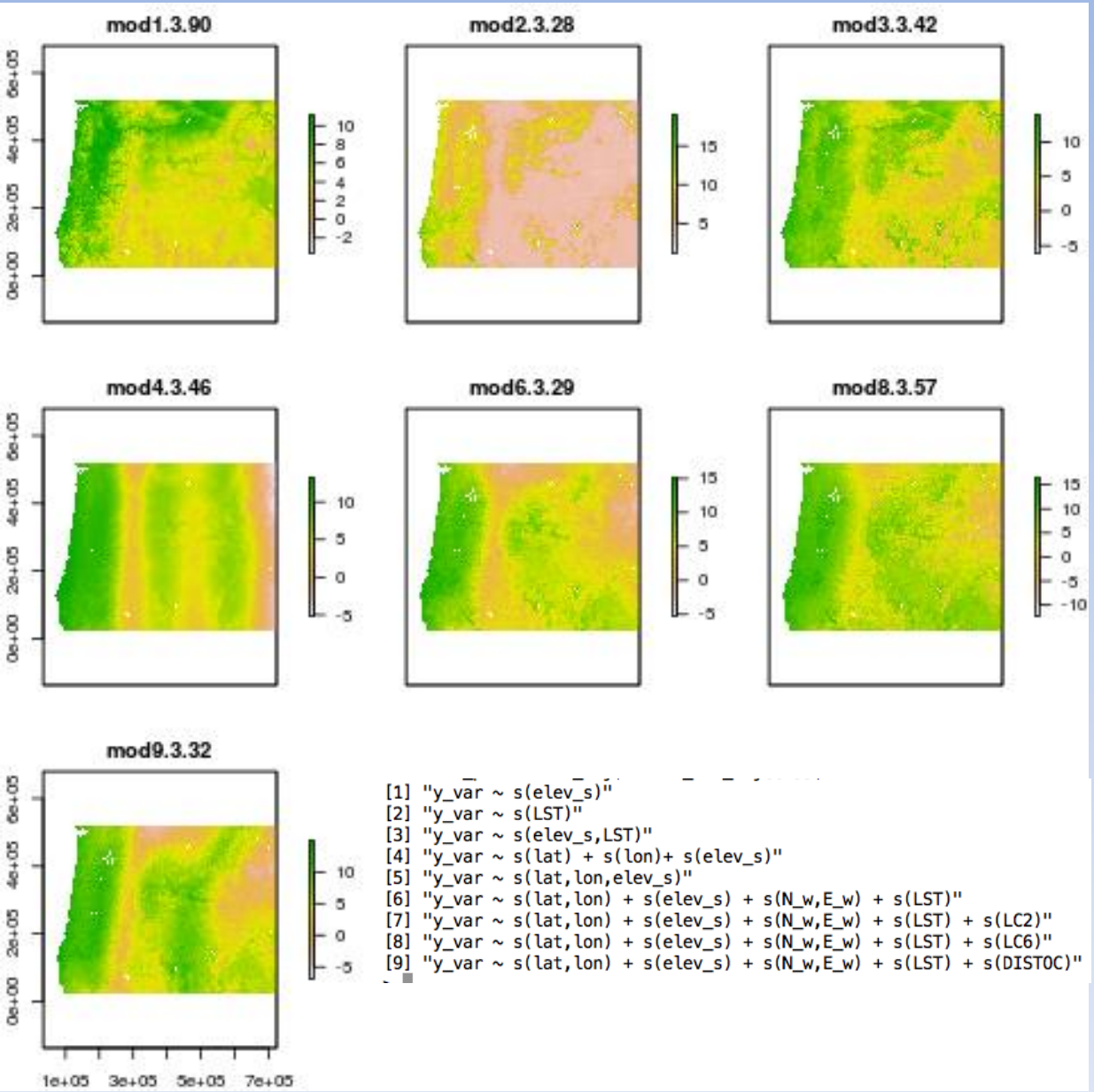
Average accuracy for 9 models using GAM models fitted at a daily time scale.
Averages were calculated over 365 days in 2010.

Training and testing on January 1, 2010



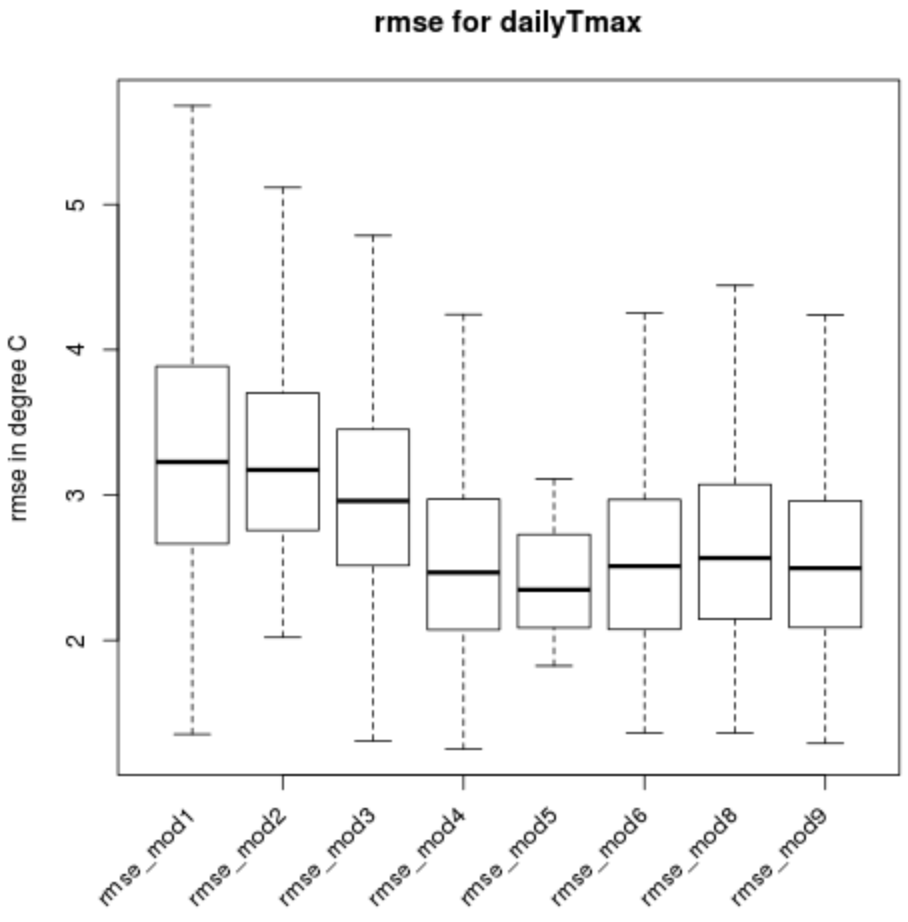
Stations for January 1, 2010 predictions were randomly selected for testing and training.

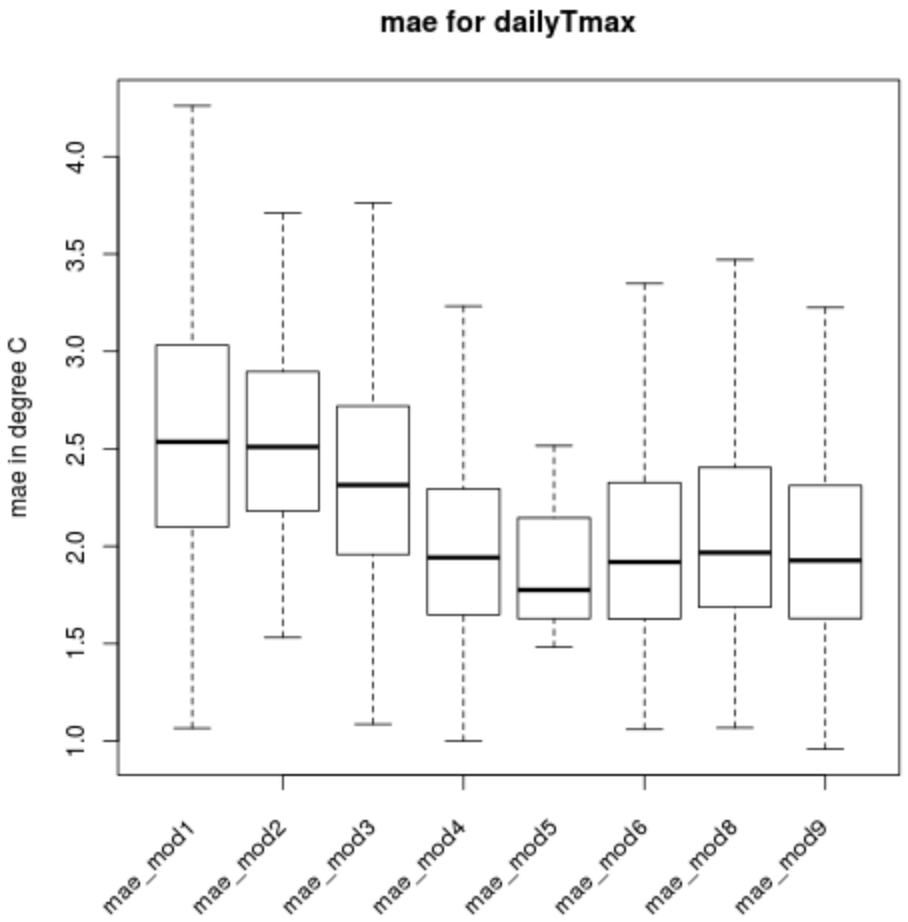
Maximum air temperature on January 1, 2010



Maximum air temperature predictions for 9 daily GAM_DAY models with RMSE (Celsius degree).

Maximum air temperature models
RMSE BOXPLOT FOR YEAR 2010

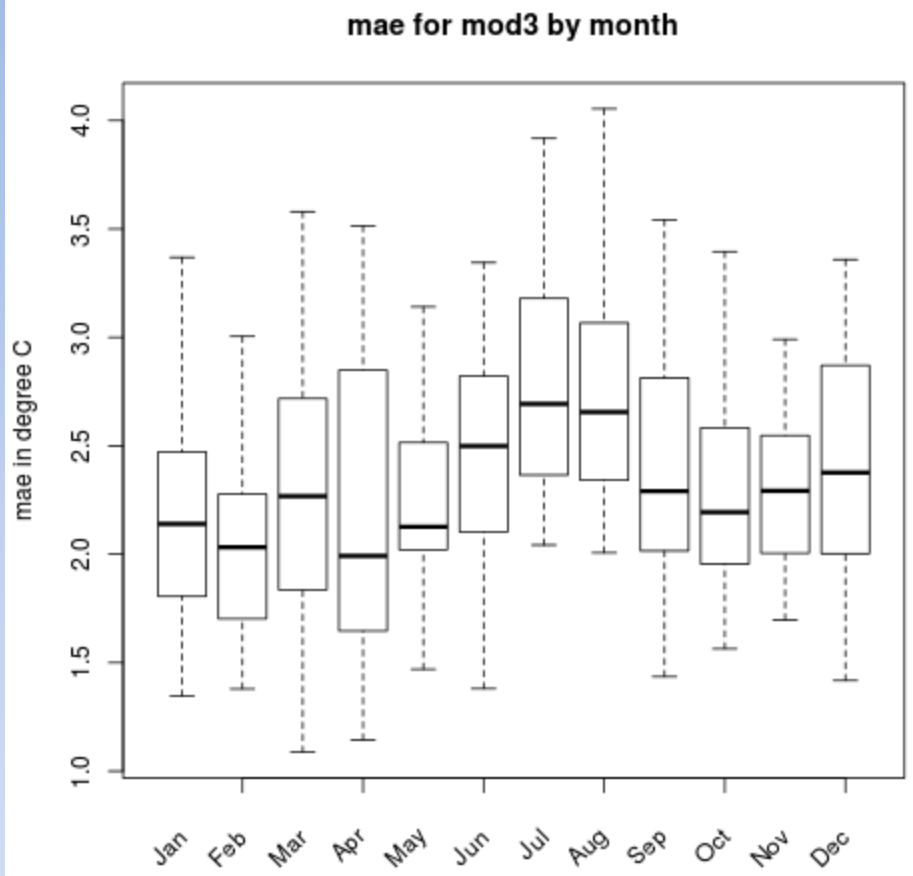


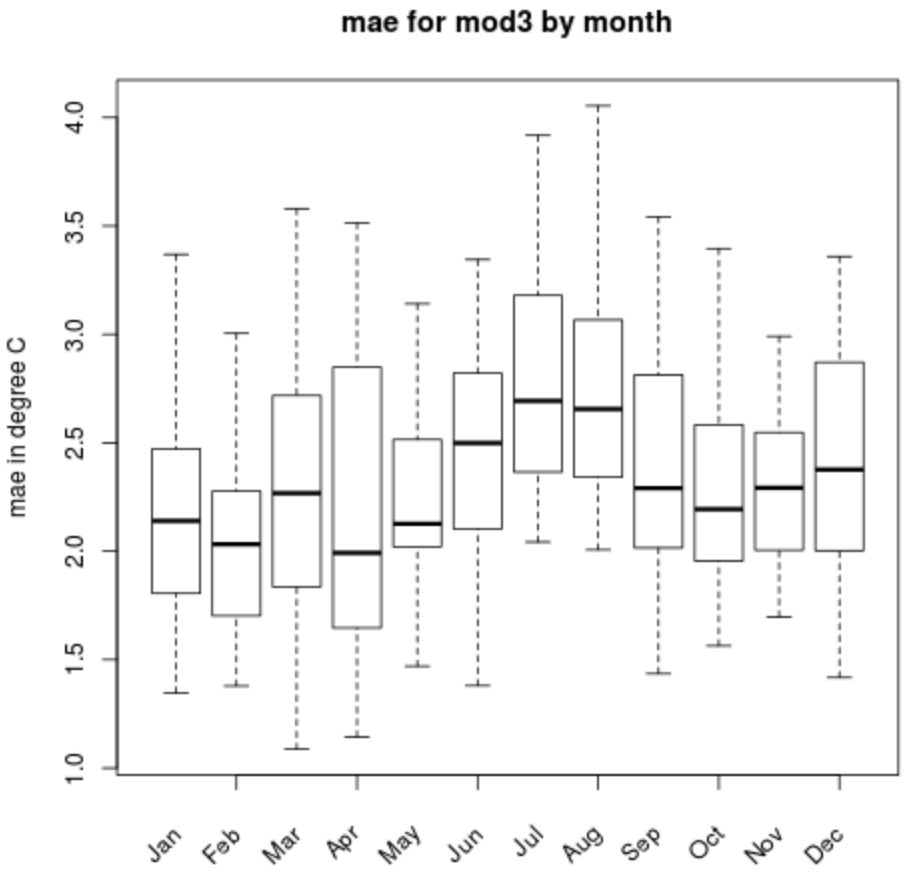



```
[1] "y_var ~ s(elev_s)"
[2] "y_var ~ s(LST)"
[3] "y_var ~ s(elev_s,LST)"
[4] "y_var ~ s(lat) + s(lon)+ s(elev_s)"
[5] "y_var ~ s(lat,lon,elev_s)"
[6] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST)"
[7] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(LC2)"
[8] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(LC6)"
[9] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(DISTOC)"
```

Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

OREGON-maximum air temperature models
RMSE MONTHLY BOXPLOT FOR YEAR 2010

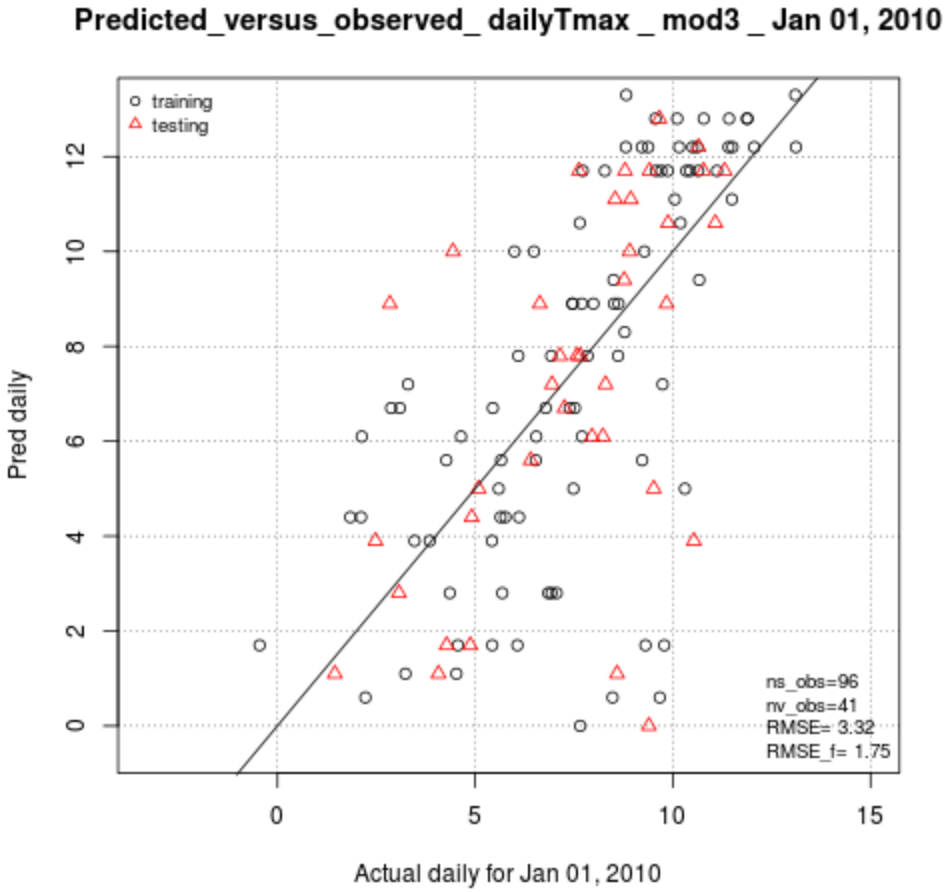


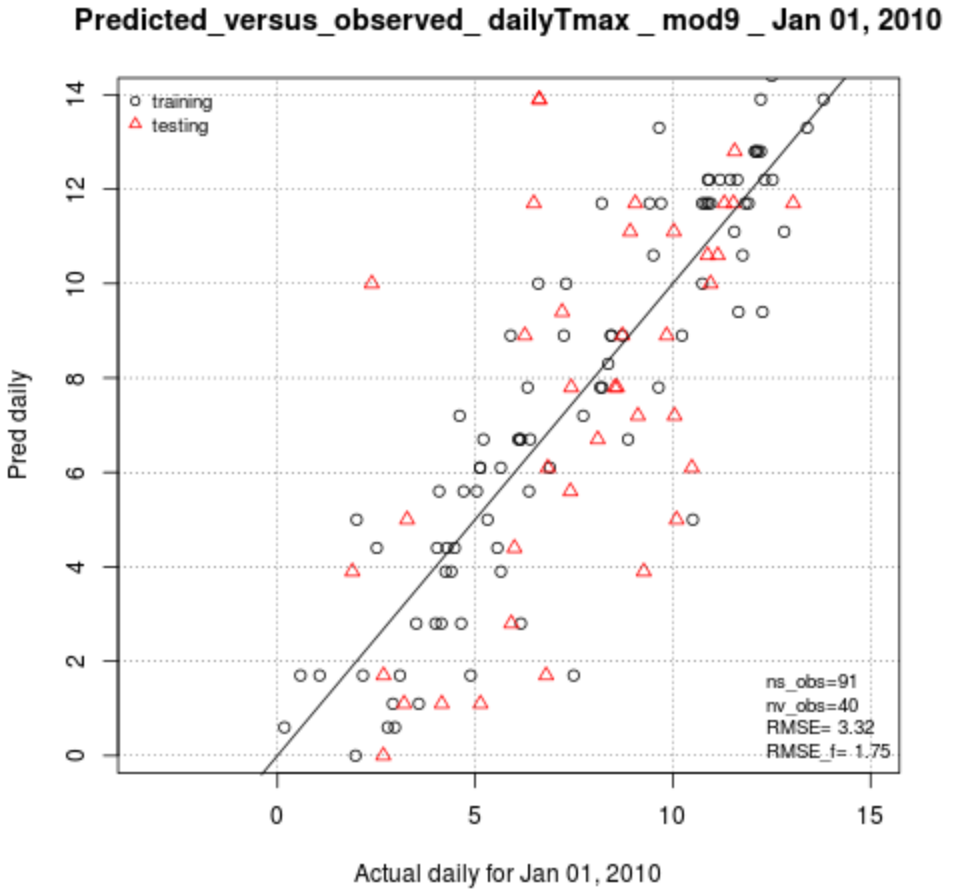



```
[1] "y_var ~ s(elev_s)"
[2] "y_var ~ s(LST)"
[3] "y_var ~ s(elev_s,LST)"
[4] "y_var ~ s(lat) + s(lon)+ s(elev_s)"
[5] "y_var ~ s(lat,lon,elev_s)"
[6] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST)"
[7] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(LC2)"
[8] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(LC6)"
[9] "y_var ~ s(lat,lon) + s(elev_s) + s(N_w,E_w) + s(LST) + s(DISTOC)"
```

Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

GAM DAILY-Maximum air temperature models
PREDICTED VERSUS OBSERVED YEAR 2010



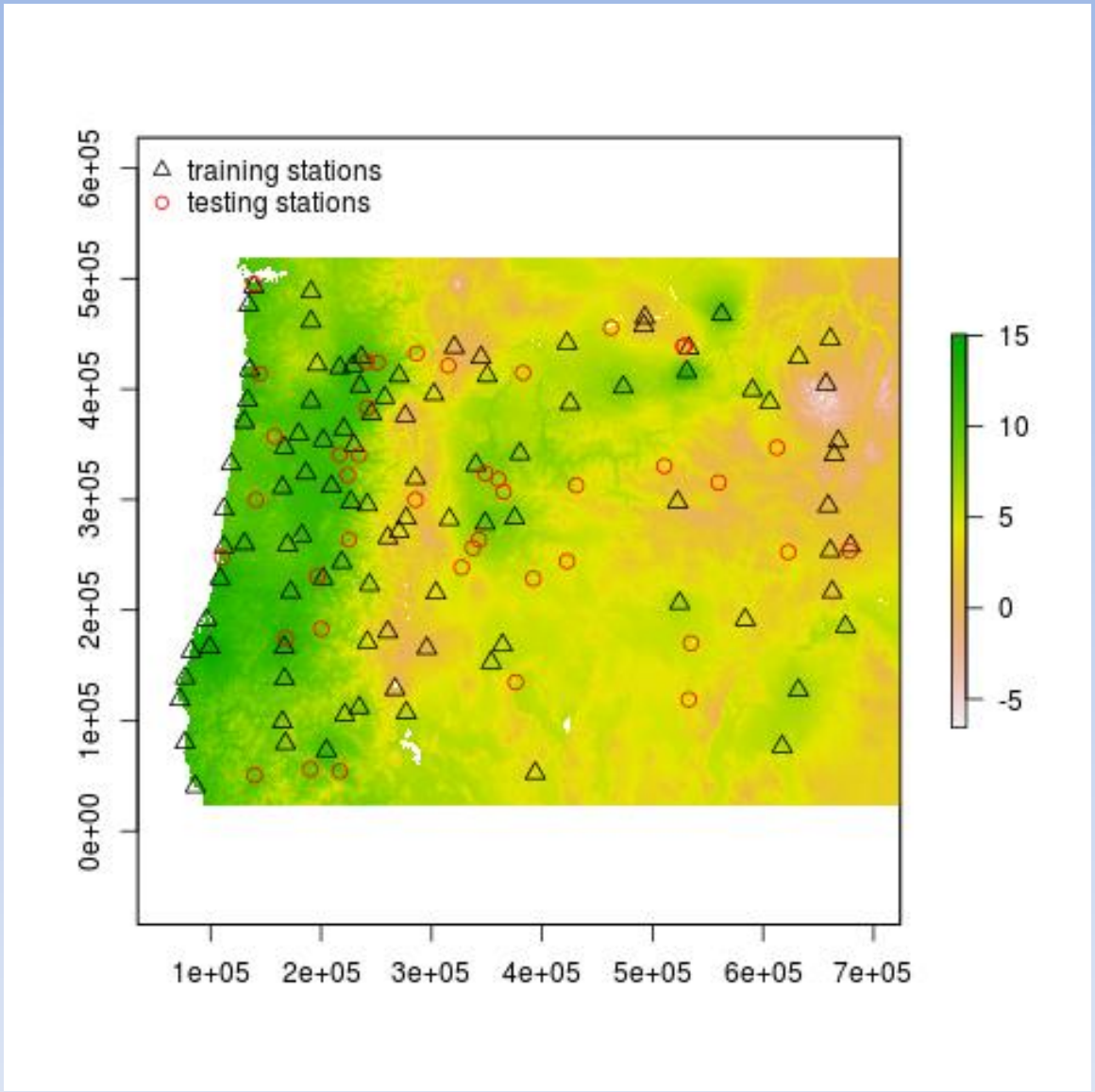


II. KRIGING_DAILY OREGON TMAX

“KRIGING_DAILY” method refers to the use of Kriging at the daily time scale. Models for air maximum air temperature are fitted to training datasets drawn randomly for every day of the year. These results pertain to the Oregon case study using the new revised script.

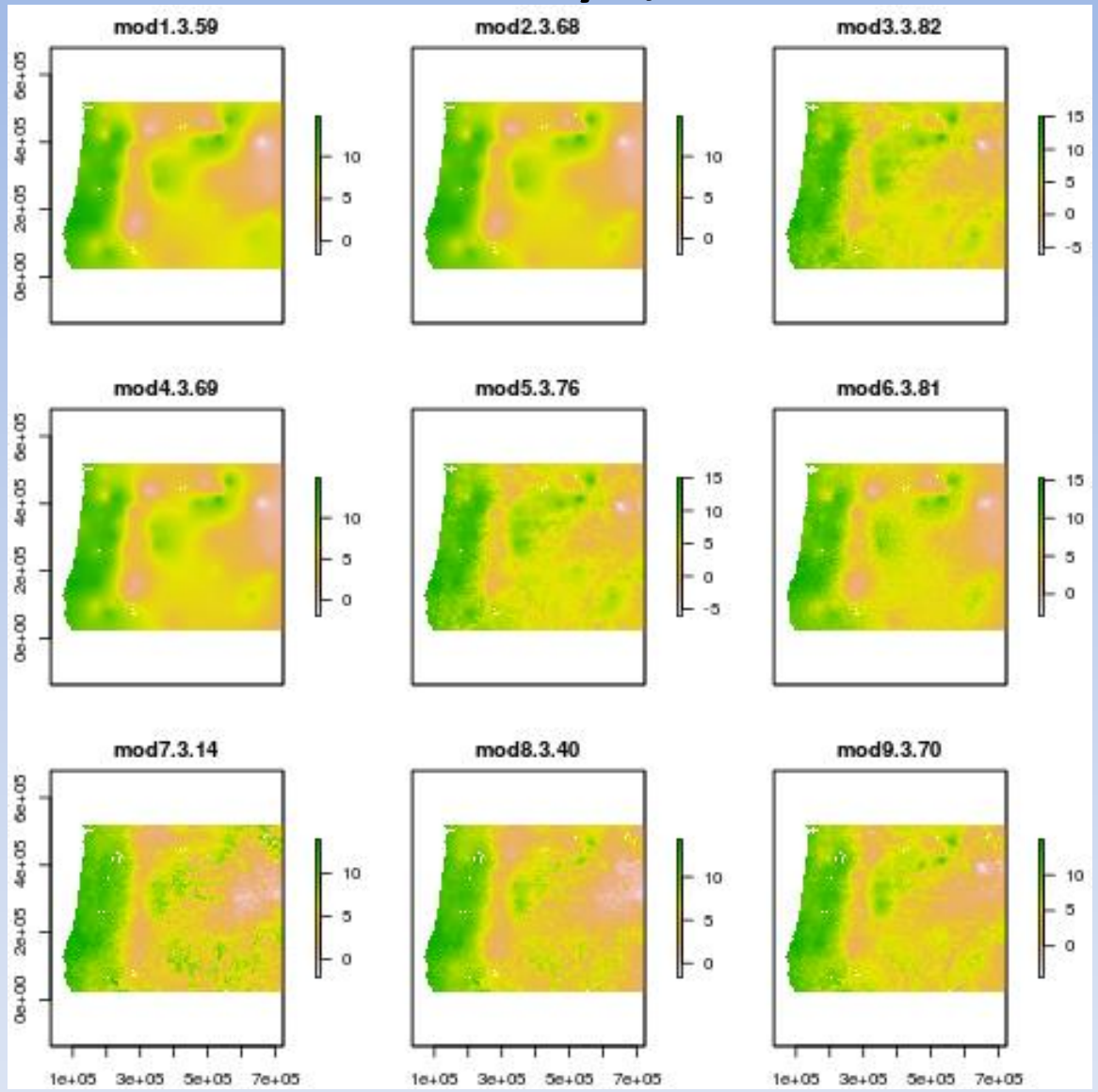
Out_prefix: _365d_kriging_day_lst_06052013
Out_path:
/home/parmentier/Data/IPLANT_project/Oregon_interpolation/Oregon_03142013/output_data_365d_kriging_day_lst_06052013

Training and testing on January 1, 2010



Stations for January 1, 2010 predictions were randomly selected for testing and training.

Kriging_DAILY-Maximum air temperature on January 1, 2010



Maximum air temperature predictions for 9 daily Kriging_Daily models with RMSE (Celsius degree).

Kriging_daily-maximum air temperature models and average accuracy metrics (Oregon)

Models:

```
[1] "y_var ~ 1"                          "y_var ~ x + y"                  "y_var ~ x + y + elev_s"          "y_var ~ x + y + DISTOC"
[5] "y_var ~ x + y + elev_s + DISTOC" "y_var ~ x + y + N_w + E_w"      "y_var ~ LST"                     "y_var ~ x + y + LST"
[9] "y_var ~ x + y + elev_s + LST"
```

Averages:

$avg

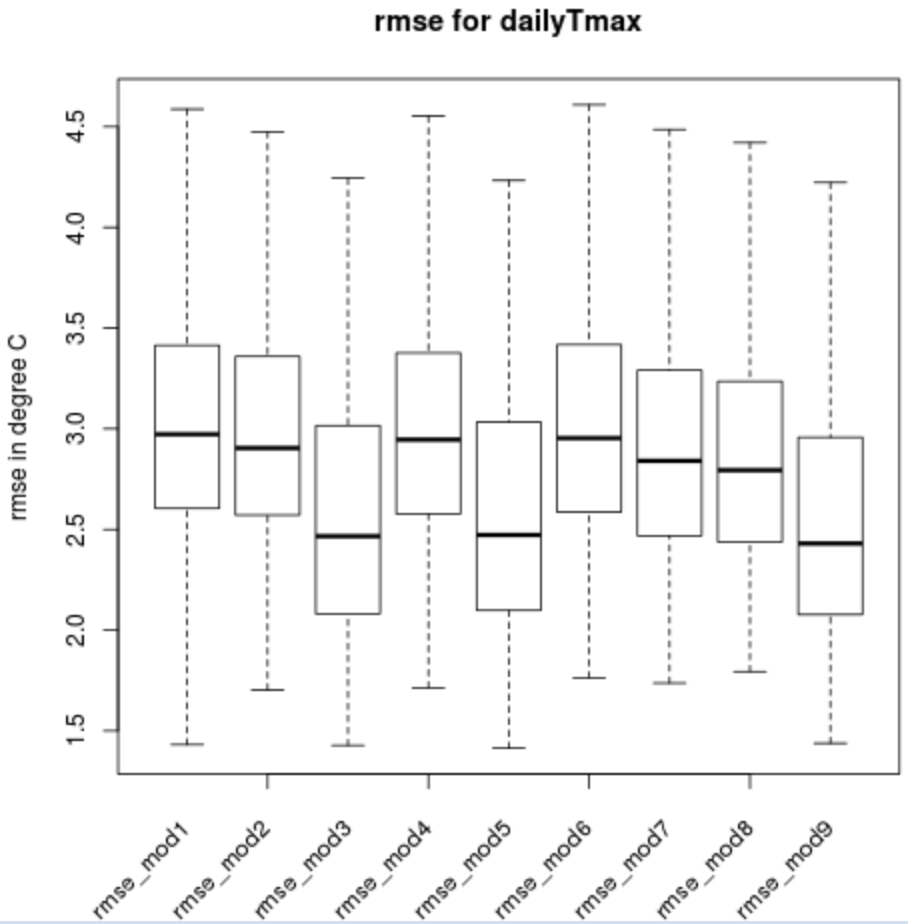
	pred_mod	mae	rmse	me	r	m50	run_samp	n	var_interp
1	mod1	2.345806	3.060044	-0.009580522	0.5411526	-0.1508033444	1	365	dailyTmax
2	mod2	2.297154	3.005433	-0.010782331	0.5758823	-0.1249743611	1	365	dailyTmax
3	mod3	2.031326	2.603200	-0.009192593	0.7084028	-0.0218630895	1	365	dailyTmax
4	mod4	2.307716	3.020729	-0.011316330	0.5714429	-0.1403583471	1	365	dailyTmax
5	mod5	2.040509	2.616262	-0.009734255	0.7054614	-0.0231077885	1	365	dailyTmax
6	mod6	2.340504	3.043255	-0.007533485	0.5518876	-0.1617311595	1	365	dailyTmax
7	mod7	2.287111	2.932236	-0.050683388	0.6053481	-0.1183495324	1	365	dailyTmax
8	mod8	2.242668	2.882303	-0.043564345	0.6267431	-0.0975969467	1	365	dailyTmax
9	mod9	2.021582	2.575974	-0.026328868	0.7172192	0.0009920078	1	365	dailyTmax

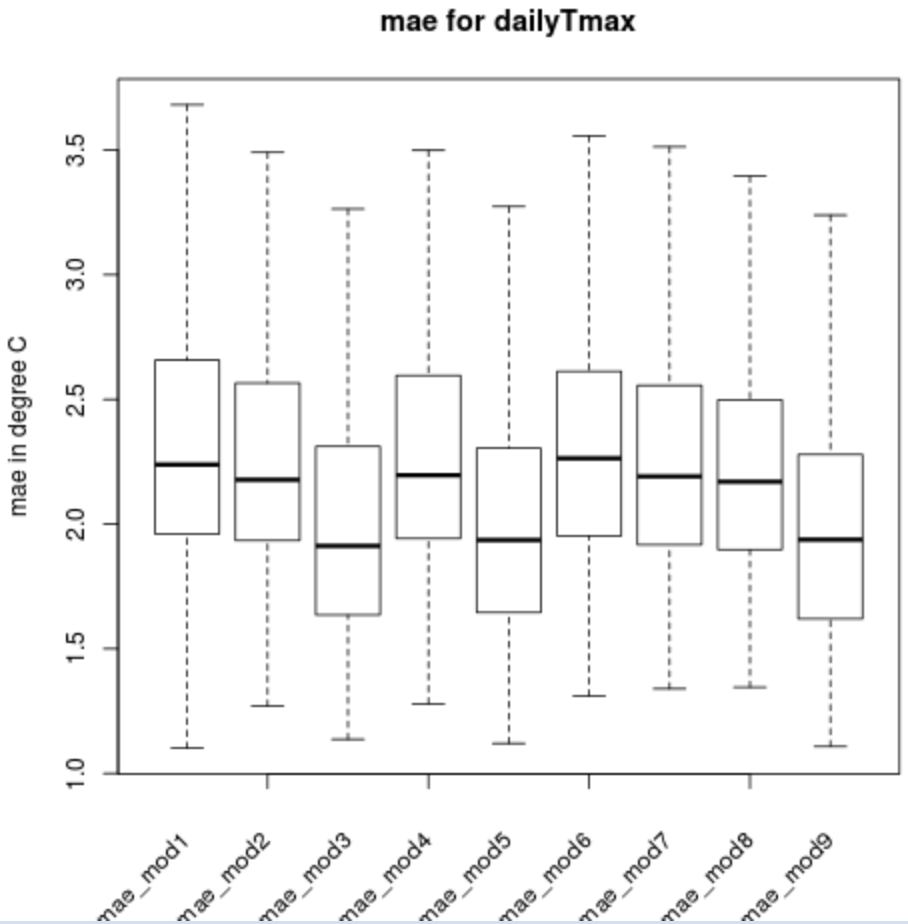
$median

	pred_mod	mae	rmse	me	r	m50	run_samp	n	var_interp
1	mod1	2.238535	2.972674	-0.0047146250	0.5682641	-0.123008156	1	365	NA
2	mod2	2.177533	2.904166	0.0011987368	0.5970219	-0.142899323	1	365	NA
3	mod3	1.912349	2.466571	0.0001161176	0.7441312	0.006669617	1	365	NA
4	mod4	2.195842	2.945937	-0.0093563165	0.5947334	-0.152039719	1	365	NA
5	mod5	1.935766	2.472317	-0.0096724843	0.7381077	-0.006430054	1	365	NA
6	mod6	2.263760	2.953403	0.0002945466	0.5652771	-0.171062422	1	365	NA
7	mod7	2.191219	2.840581	-0.0440149489	0.6399113	-0.102521133	1	365	NA
8	mod8	2.169833	2.794265	-0.0188513135	0.6469521	-0.133819199	1	365	NA
9	mod9	1.937275	2.429720	-0.0488789422	0.7495894	-0.017290115	1	365	NA

Average accuracy for three models using GWR models fitted at a daily time scale.
Averages were calculated over 365 days in 2010 for the Oregon region.

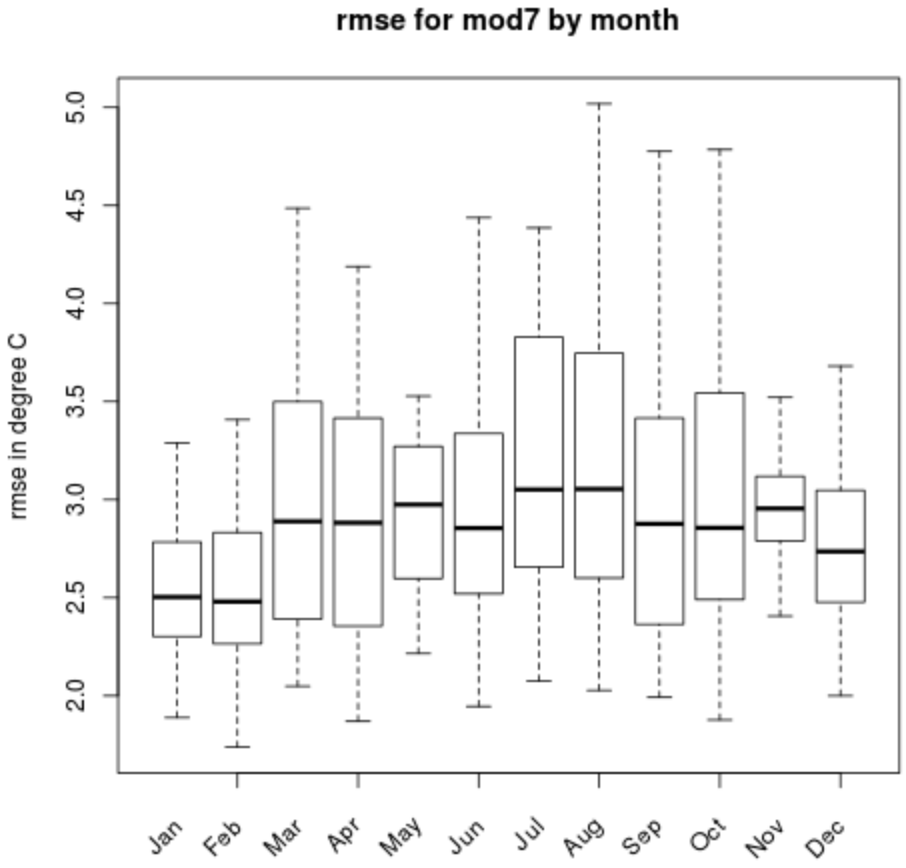
OREGON- maximum air temperature models
KRIGING_DAILY- RMSE BOXPLOT FOR YEAR 2010

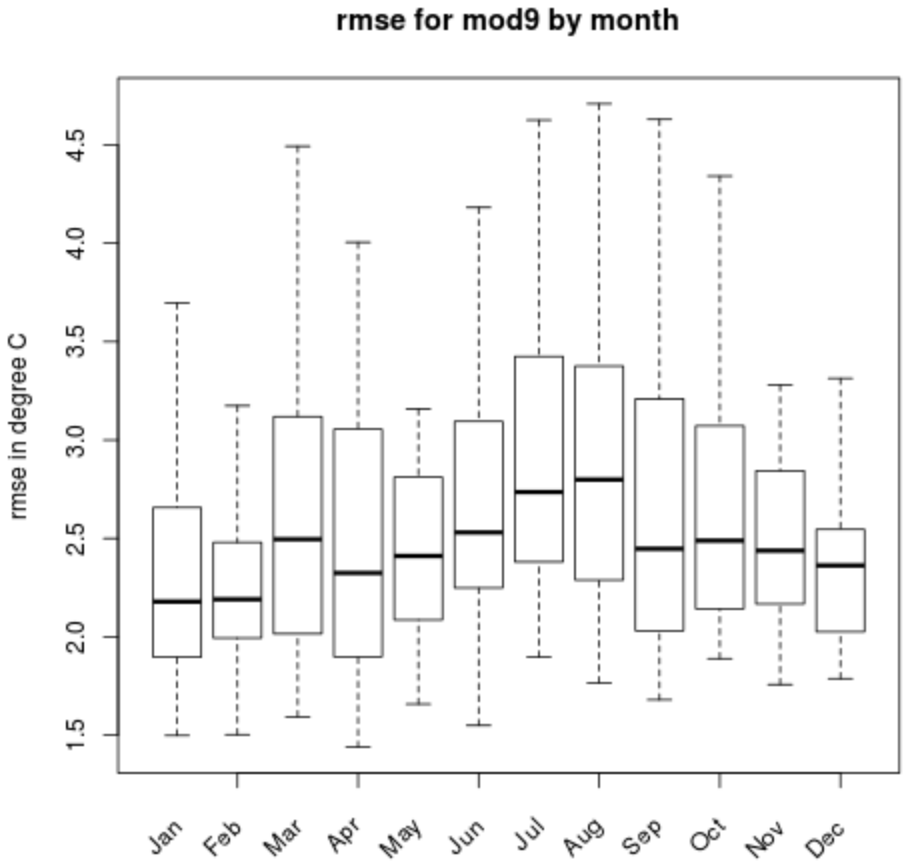




Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

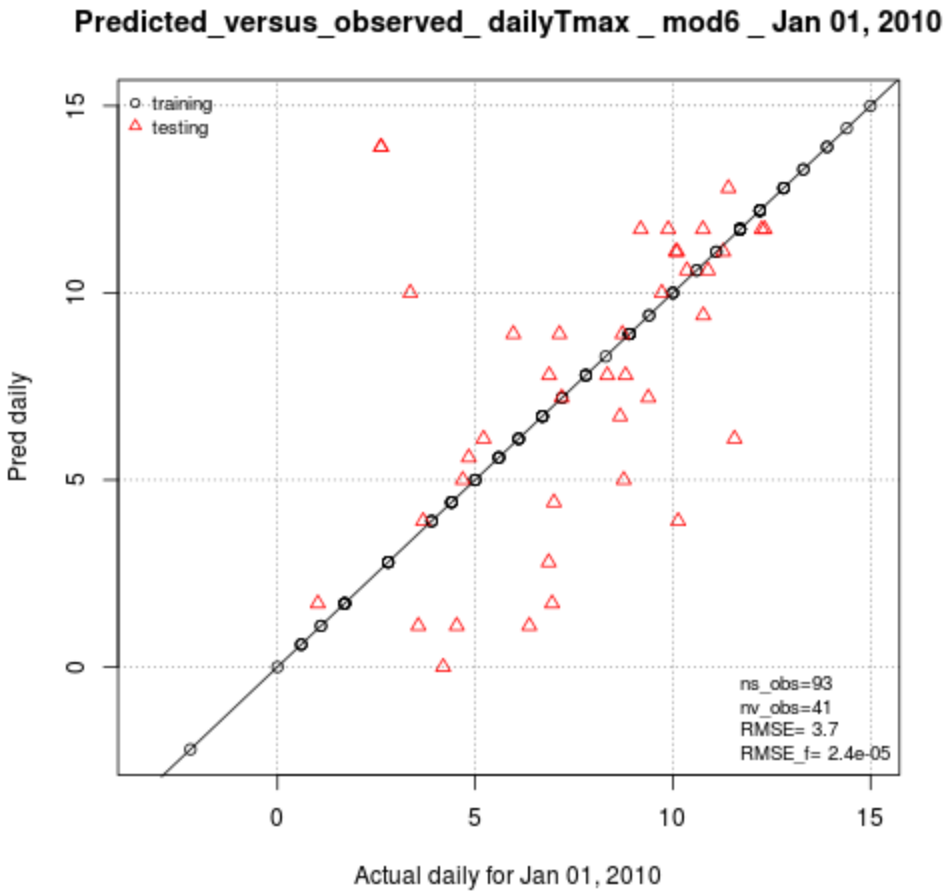
OREGON-maximum air temperature models
KRIGING_DAILY-RMSE MONTHLY BOXPLOT FOR YEAR 2010

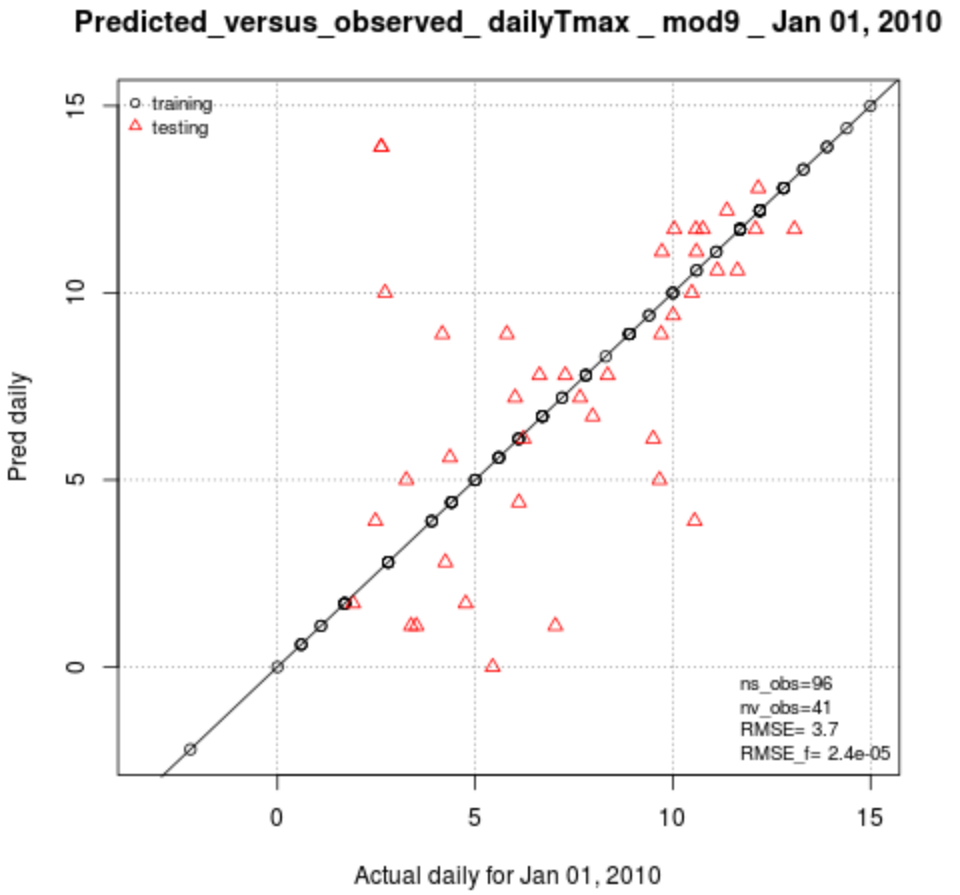




Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

KRIGING DAILY-Maximum air temperature models
PREDICTED VERSUS OBSERVED YEAR 2010





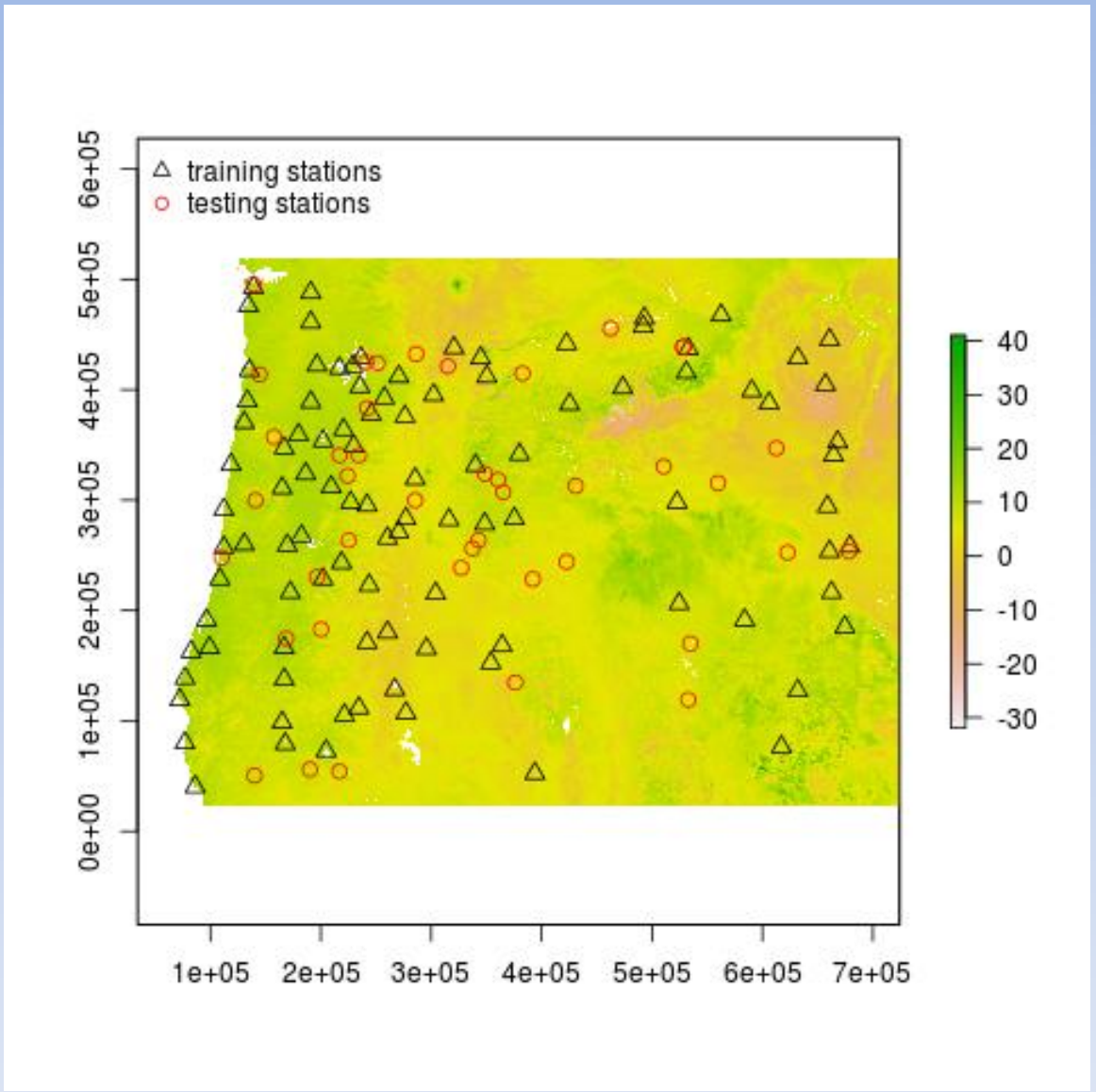

```
[1] "y_var ~ 1"                          "y_var ~ x + y"                "y_var ~ x + y + elev_s"       "y_var ~ x + y + DISTOC"
[5] "y_var ~ x + y + elev_s + DISTOC" "y_var ~ x + y + N_w + E_w"      "y_var ~ LST"                  "y_var ~ x + y + LST"
[9] "y_var ~ x + y + elev_s + LST"
```

III. GWR DAY OREGON TMAX

"GWR_DAY" method refers to the use of Geographically weighted Regression at the daily time scale. Models for air maximum air temperature are fitted to training datasets drawn randomly for every day of the year. These results pertain to the Oregon case study using the new revised script.

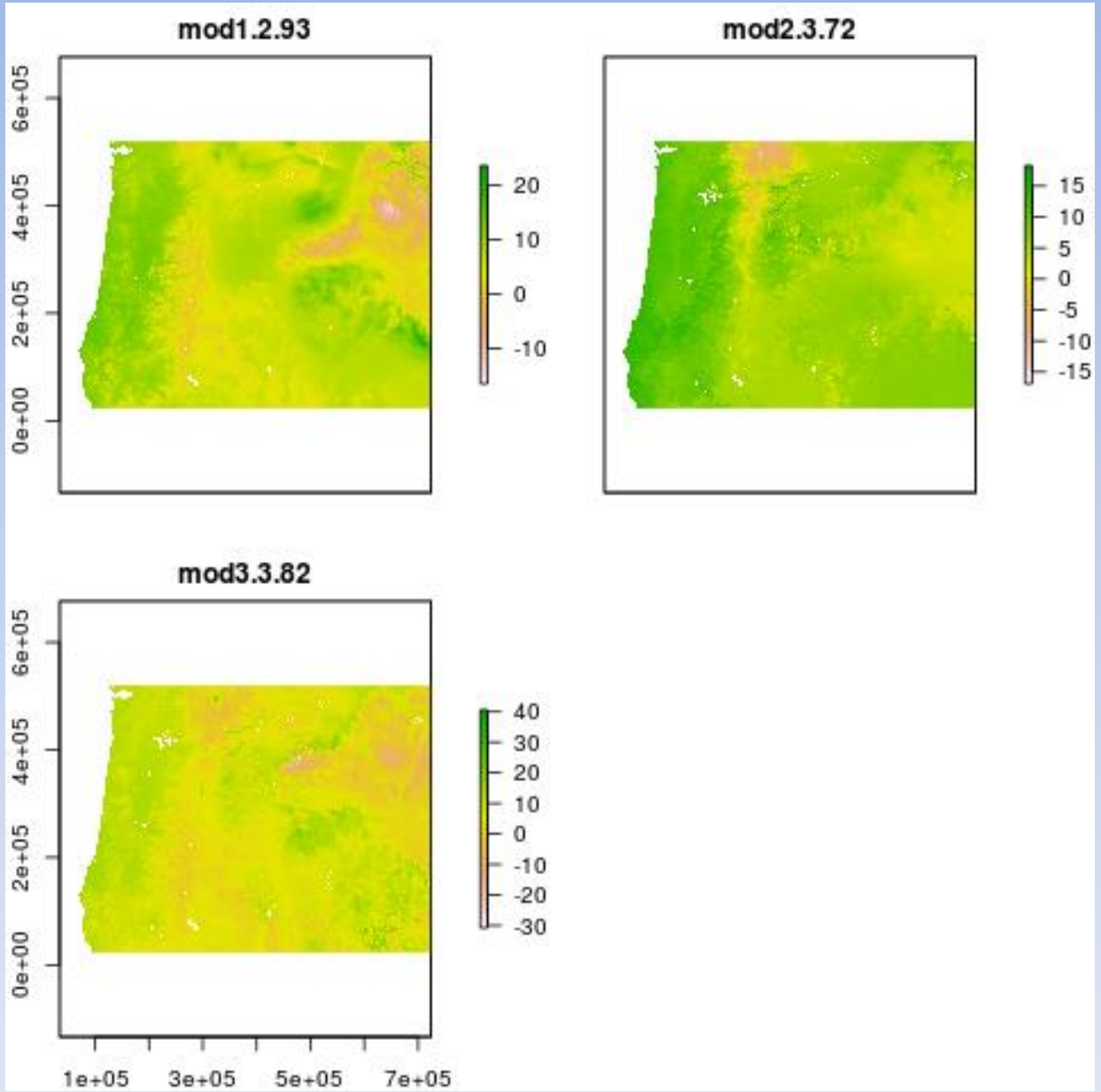
Out_prefix: _365d_gwr_day_lst_06082013
Out_path:
/home/parmentier/Data/IPLANT_project/Oregon_interpolation/Oregon_03142013/output_data_365d_gwr_day_lst_06082013

Training and testing on January 1, 2010



Stations for January 1, 2013 predictions were randomly selected for testing and training.

Maximum air temperature on January 1, 2010



Maximum air temperature predictions for 9 daily GWR_DAY models with RMSE (Celsius degree).

Maximum air temperature models and average accuracy metrics (Oregon)

Models:

```
"y_var ~ elev_s"     "y_var ~ LST"     "y_var ~ elev_s*LST"
```

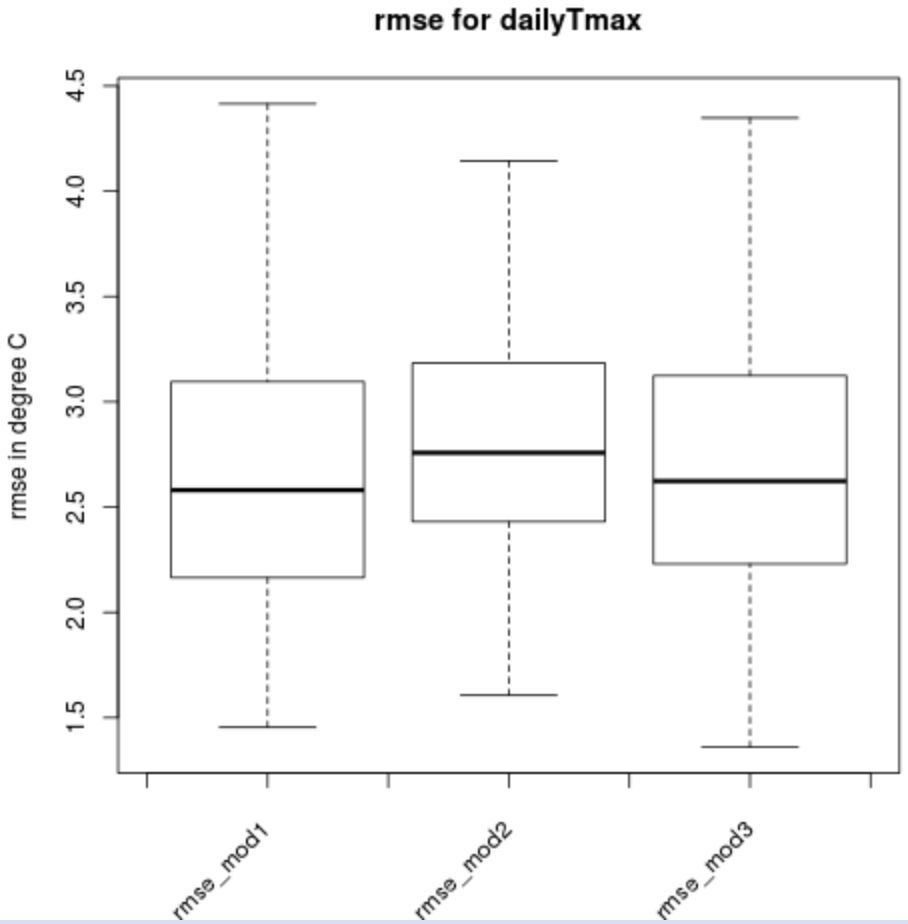
Averages

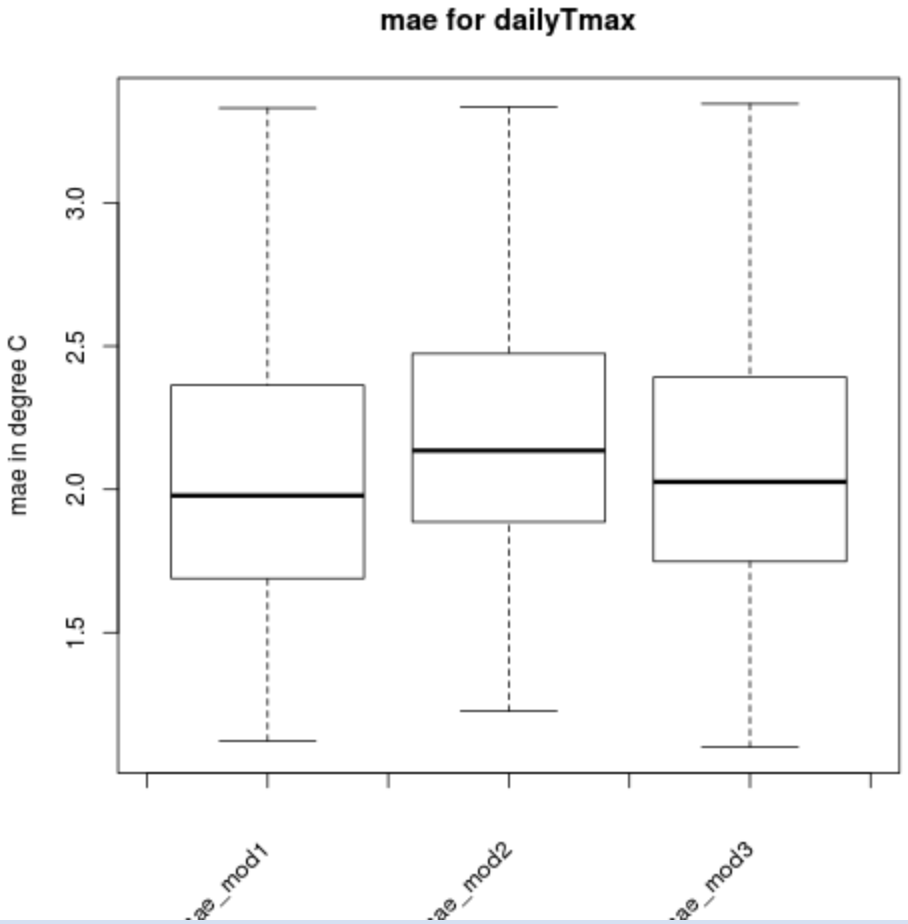
```
> raster_prediction_obj$summary_metrics_v
$avg
  pred_mod      mae     rmse           me         r          m50 run_samp   n
1     mod1 2.082025 2.711471  0.006396793 0.6872802 -0.03926207        1 365
2     mod2 2.215395 2.860984 -0.051507509 0.6366022 -0.11174789        1 365
3     mod3 2.106854 2.726493 -0.060958318 0.6769263 -0.06061046        1 365
```

raster_prediction_obj_gwr_daily_dailyTmax_365d_gwr_day_lst_06082013.RData

Average accuracy for three models using GWR models fitted at a daily time scale. Averages were calculated over 365 days in 2010 for the Oregon region.

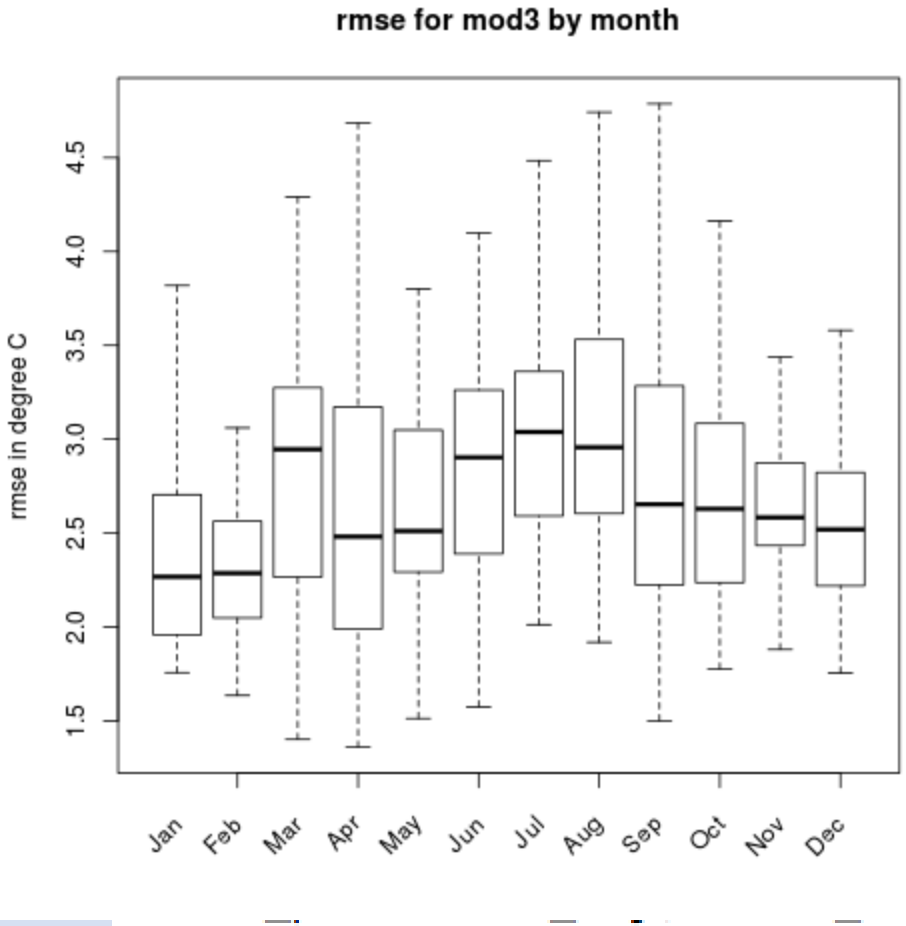
OREGON- maximum air temperature models
GWR_DAILY- RMSE BOXPLOT FOR YEAR 2010

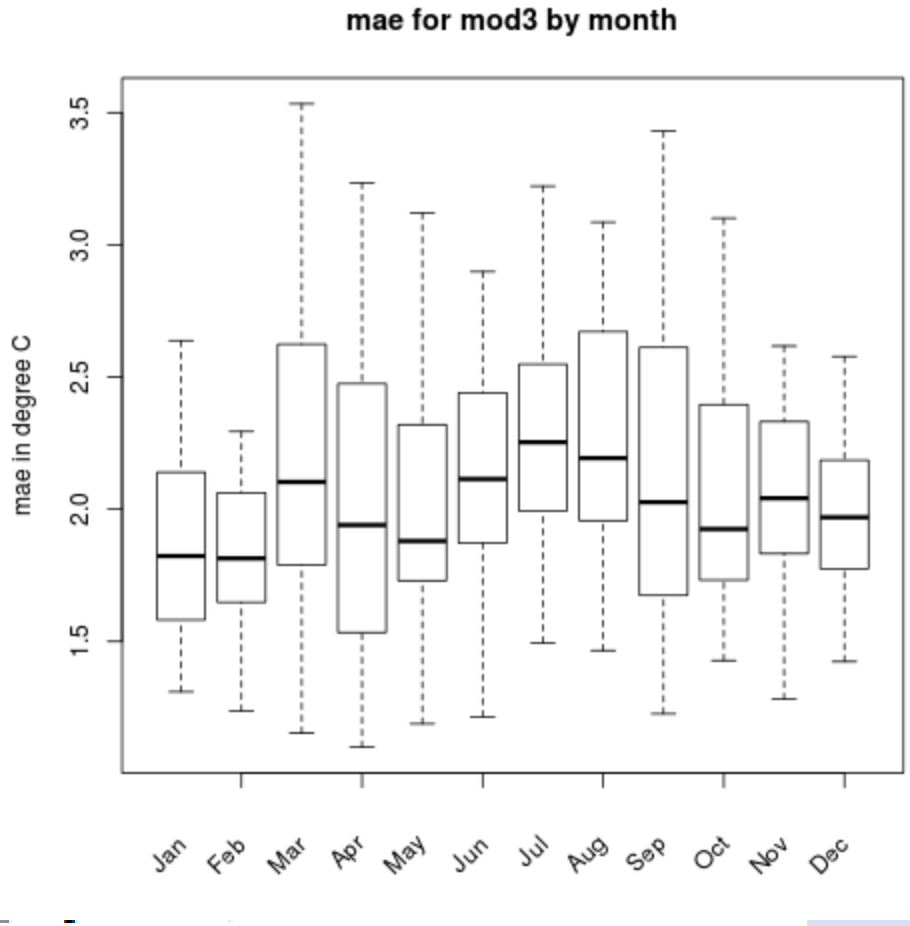




Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

OREGON-maximum air temperature models
GWR_DAY-RMSE MONTHLY BOXPLOT FOR YEAR 2010

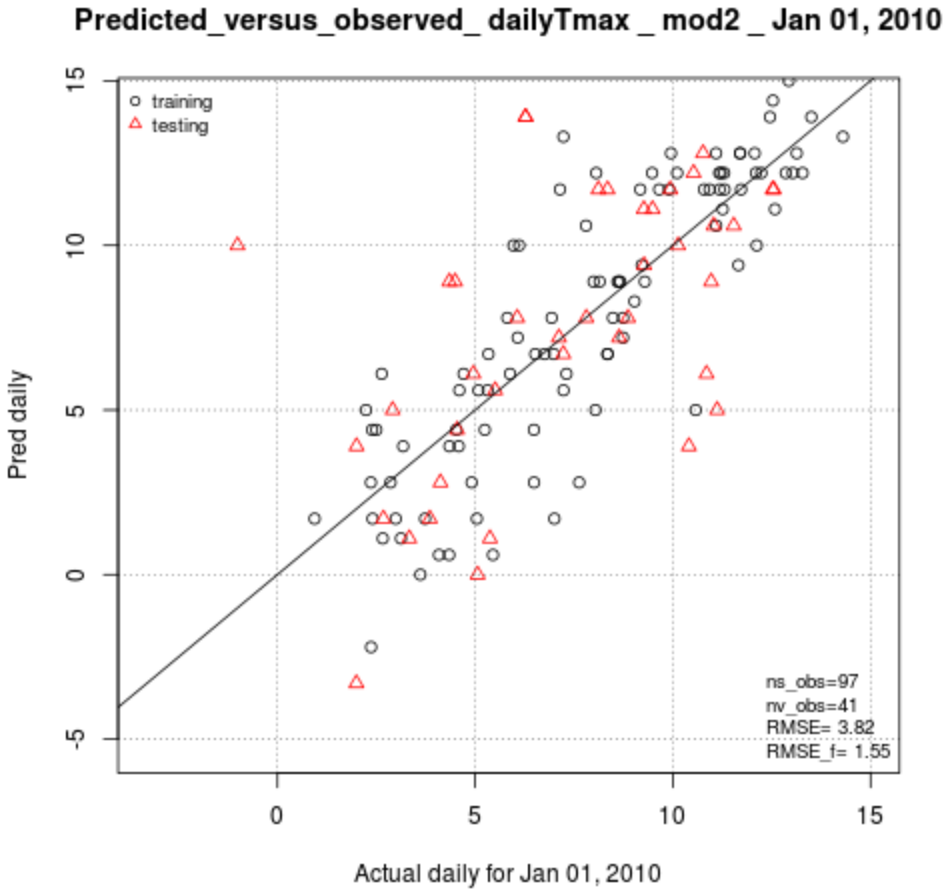


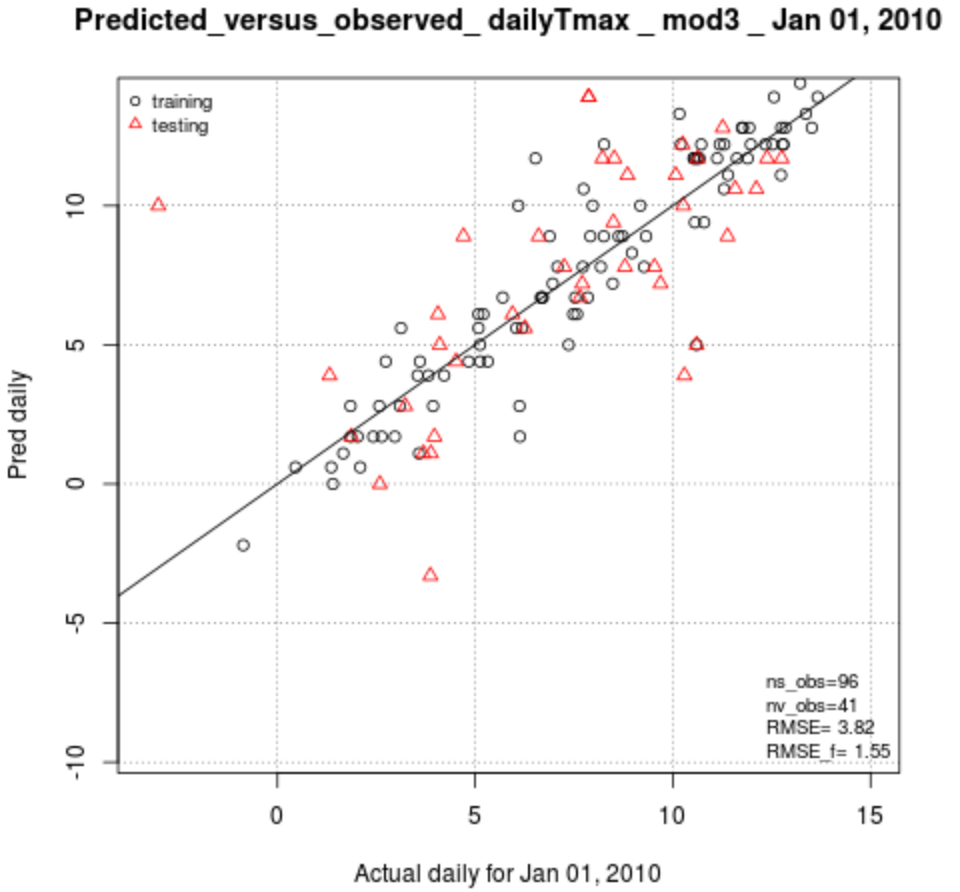


"y_var ~ elev_s" "y_var ~ LST" "y_var ~ elev_s*LST"

Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

GWR DAILY-Maximum air temperature models
PREDICTED VERSUS OBSERVED YEAR 2010





IV. QUEENLAND GAM_FUSION

“GAM_FUSION” method refers to the use of General Additive Models at the monthly time scale. Models for air maximum air temperature biases are fitted to monthly datasets for every month of the year. These results pertain to the Queensland case study using the new revised script. These results are the first presented concerning Queensland.

Out_prefix: “_365d_GAM_fus_all_lst_06112013”
Out_path:
/home/parmentier/Data/IPLANT_project/Queensland_interpolation/output_data_365d_GAM_fus_all_lst_06112013

Maximum air temperature models and average accuracy metrics (Queensland)

Models

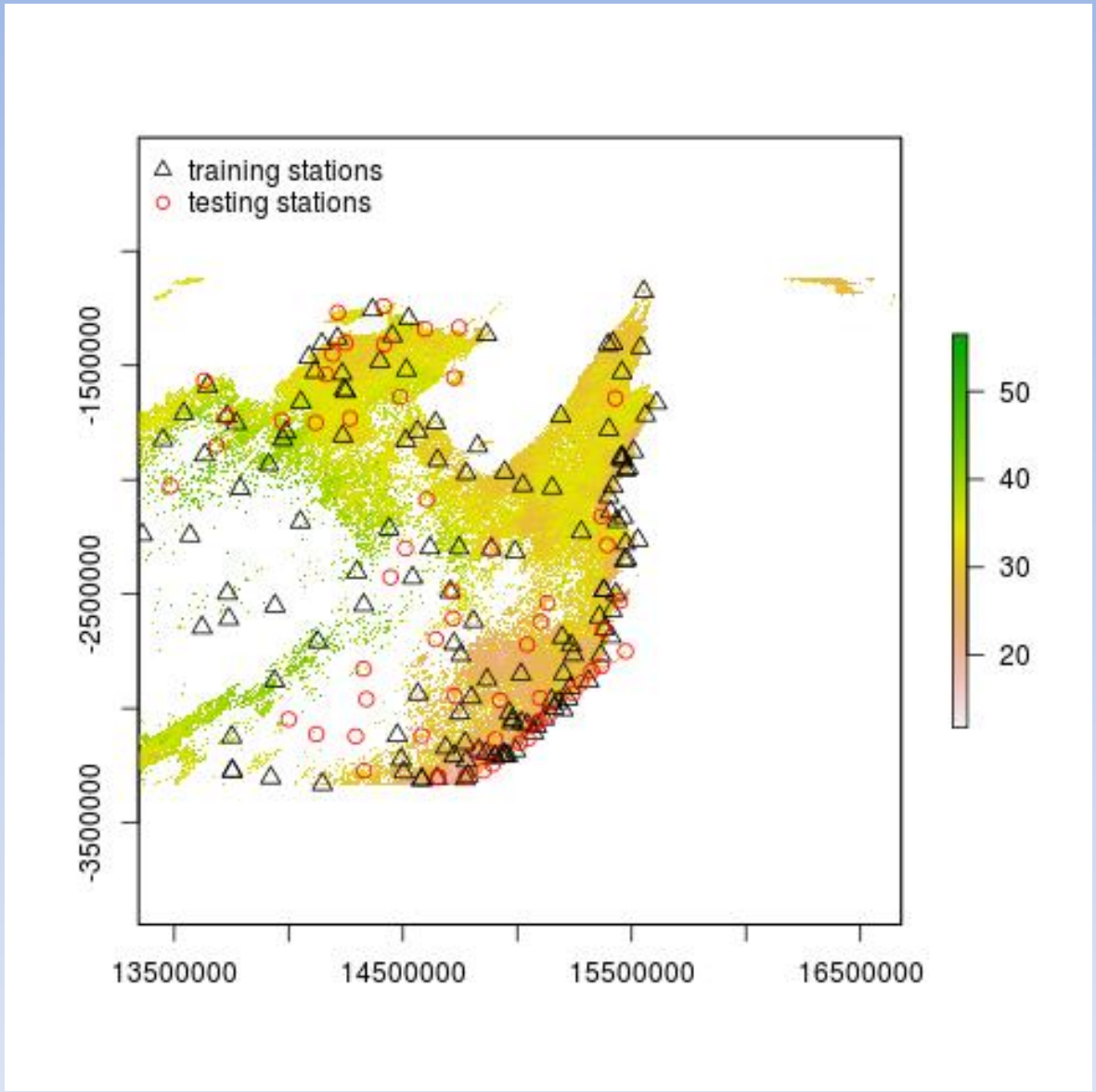
```
[[1]]
y_var ~ s(elev_s)

[[2]]
y_var ~ s(LST)

[[3]]
y_var ~ s(elev_s, LST)
```

Averages

```
$avg
  pred_mod      mae     rmse           me         r         m50 run_samp   n var_interp
1     mod1 2.121633 2.680743  0.001199616 0.8240659 0.13169657        1 365  dailyTmax
2     mod2 1.761114 2.219619  0.003422534 0.8275688 0.01302715        1 365  dailyTmax
3     mod3 1.569805 1.970825  0.021784390 0.8709752 0.09038059        1 365  dailyTmax
4   mod_kr 1.356755 1.749286 -0.026162981 0.9048629 0.01207369        1 365  dailyTmax

$median
  pred_mod      mae     rmse           me         r          m50 run_samp   n var_interp
1     mod1 2.096900 2.659248  0.001729133 0.8623714 0.101709366        1 365         NA
2     mod2 1.772075 2.214764  0.017086297 0.8666458 0.013891792        1 365         NA
3     mod3 1.576578 1.960244  0.017797686 0.8962503 0.079714966        1 365         NA
4   mod_kr 1.337508 1.726477 -0.032625307 0.9316321 0.008362579        1 365         NA
```

Average accuracy for 9 models using GAM models fitted at the monthly time scale. Averages were calculated over 365 days in 2010 for the Queensland area.

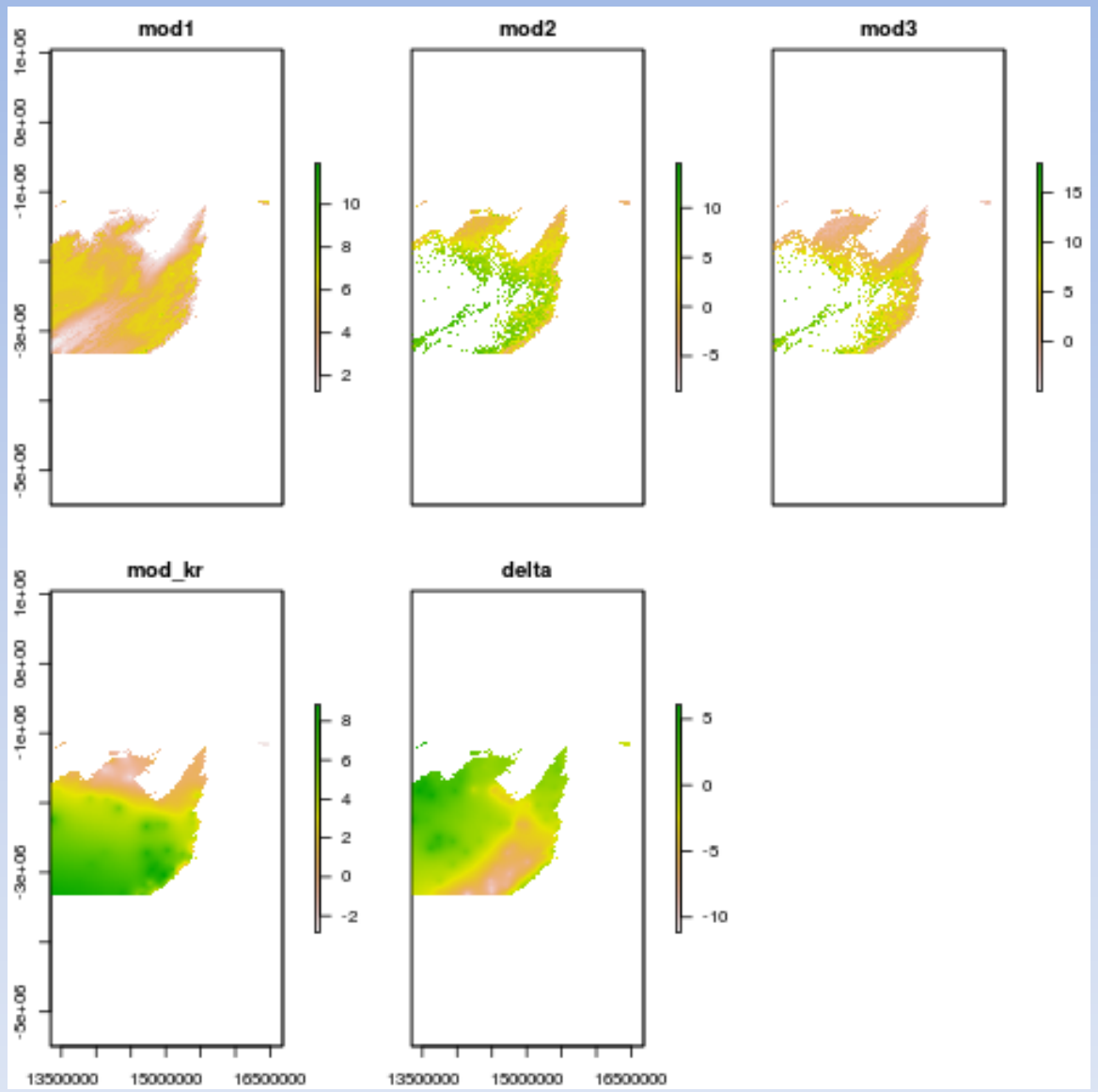
QUEENLAND Training and testing on January 1, 2010



Stations for January 1, 2013 predictions were randomly selected for testing and training.

BIAS and Delta surfaces maximum air temperature on QUEENSLAND, January 2010

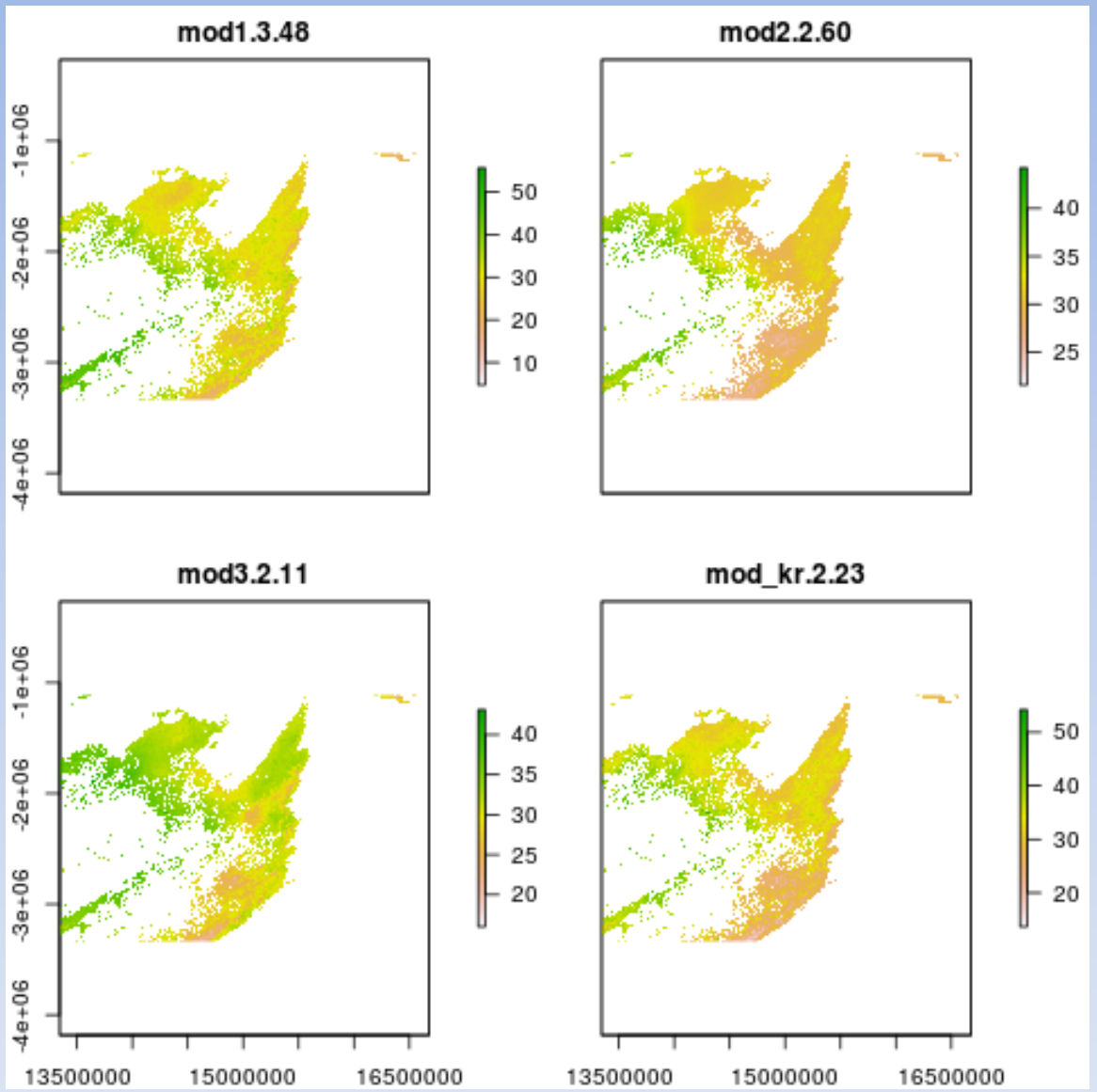
```
[[1]]
y_var ~ s(elev_s)

[[2]]
y_var ~ s(LST)

[[3]]
y_var ~ s(elev_s, LST)
```



Bias and delta surfaces for Maximum air temperature predictions for four models using GAM fusion models.

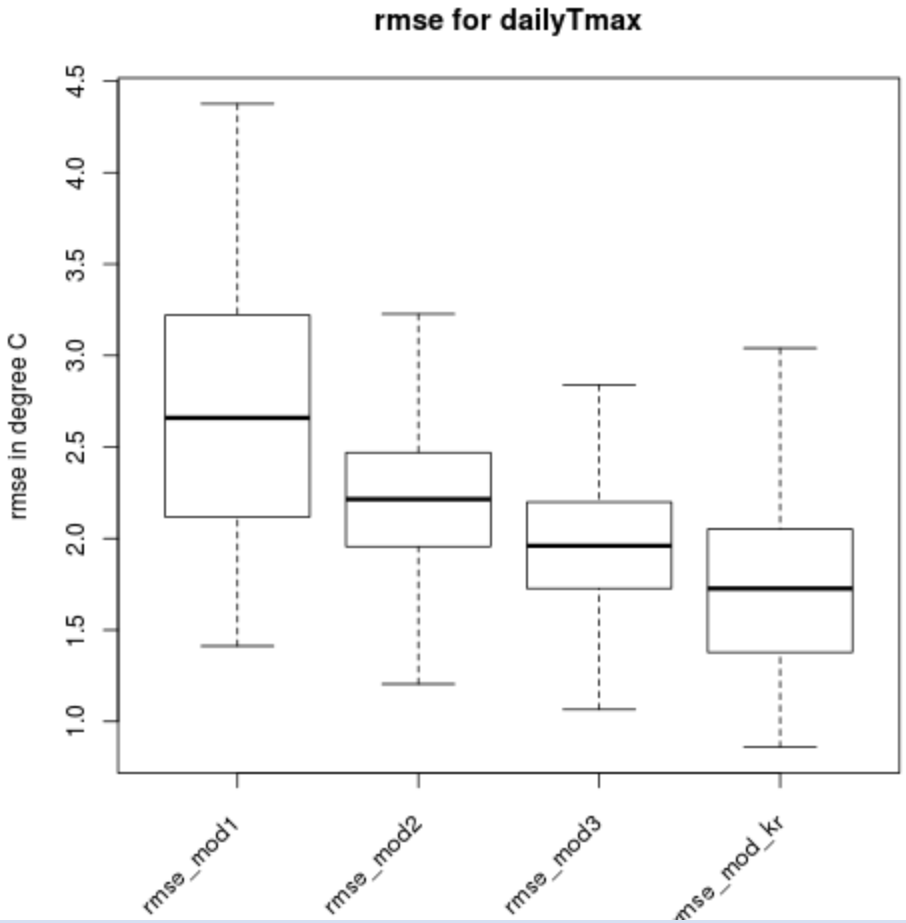
Maximum air temperature on January 1, 2010

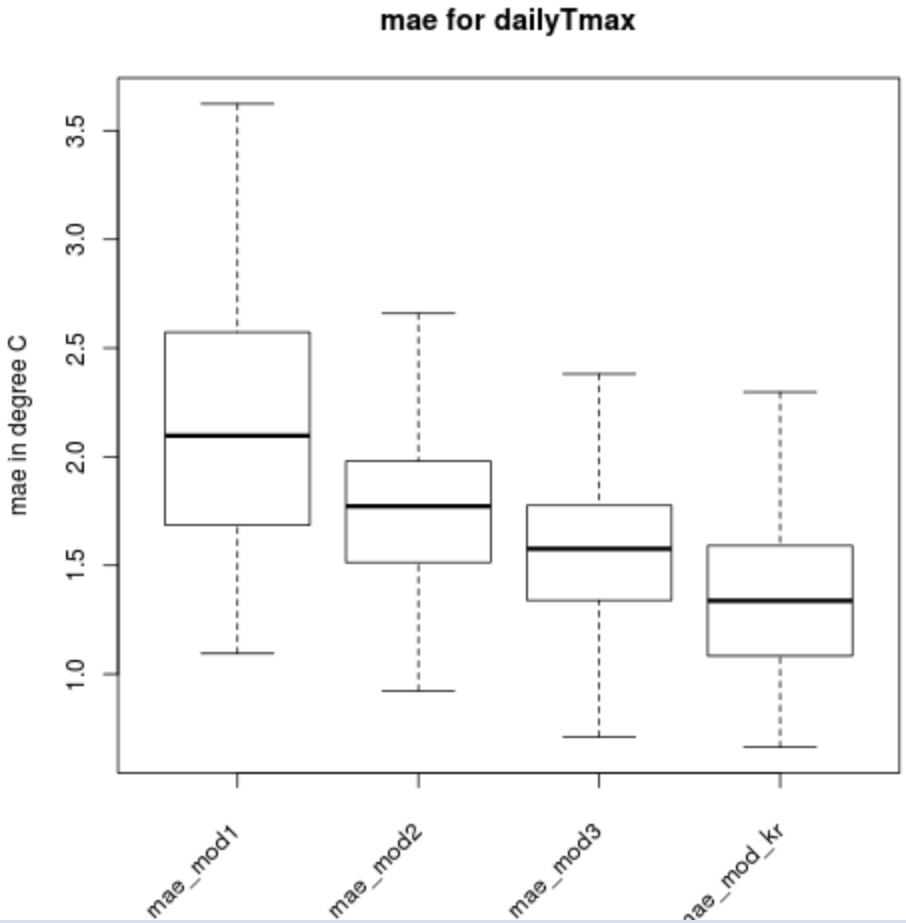
```
[[1]]
y_var ~ s(elev_s)

[[2]]
y_var ~ s(LST)

[[3]]
y_var ~ s(elev_s, LST)
```



Maximum air temperature predictions for 9 daily GAM_DAY models with RMSE (Celsius degree).

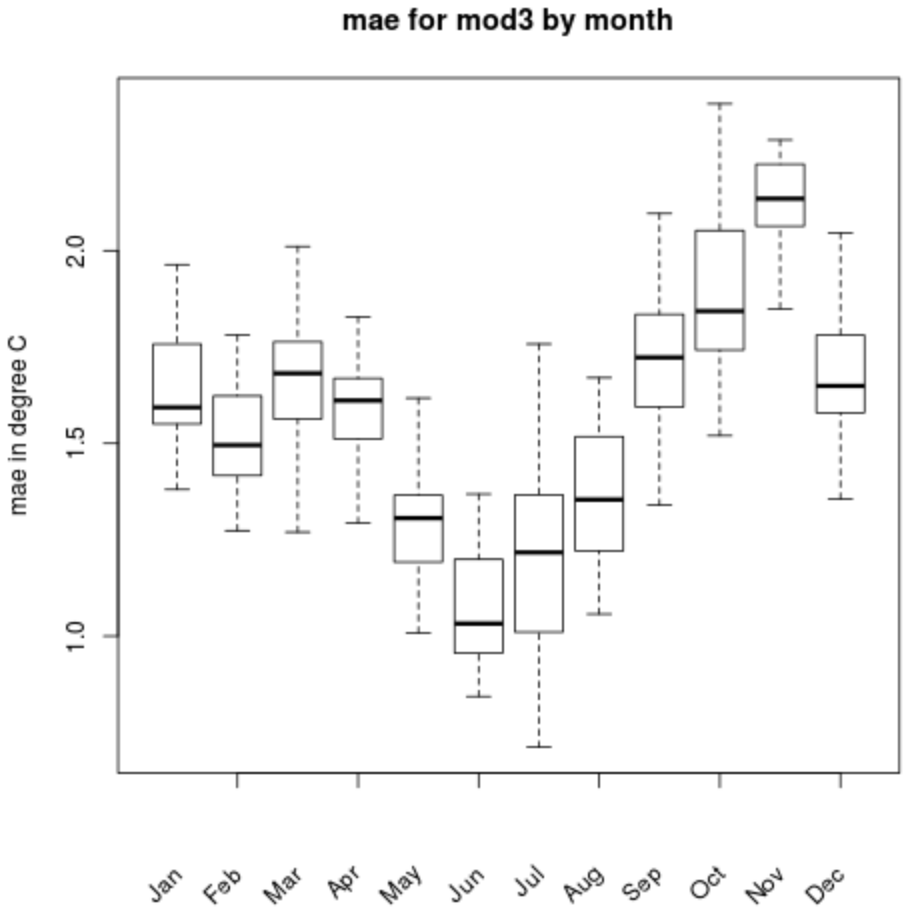
QUEENSLAND-maximum air temperature models
RMSE BOXPLOT FOR YEAR 2010

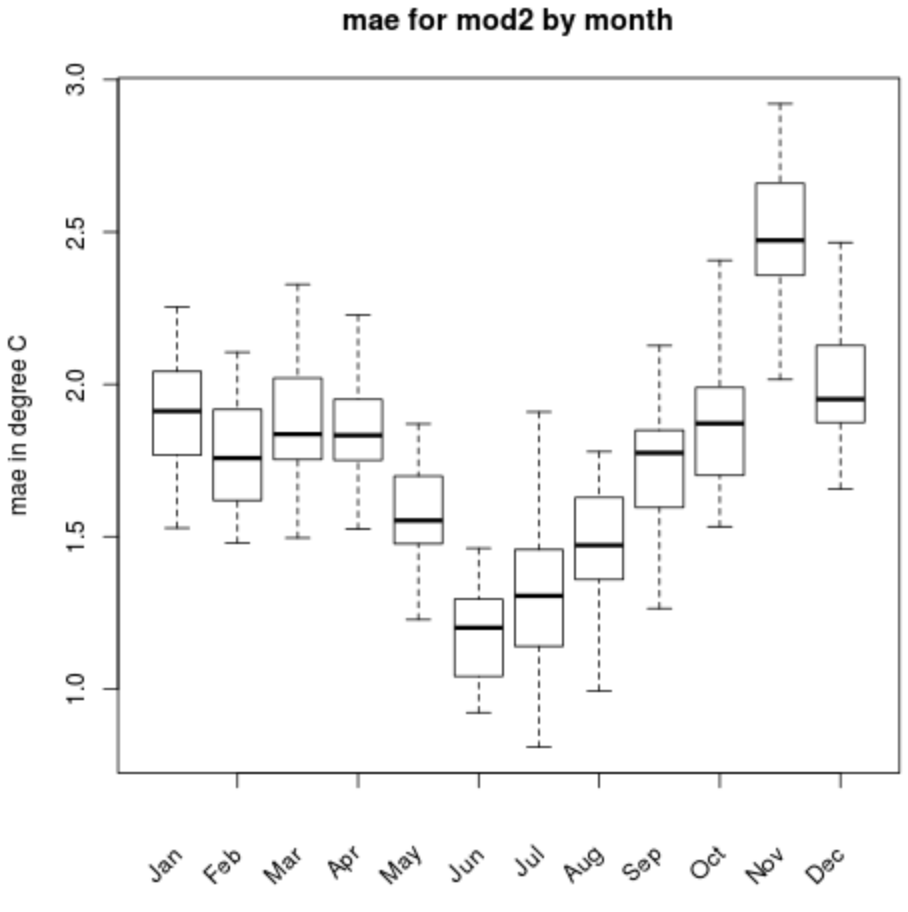




Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

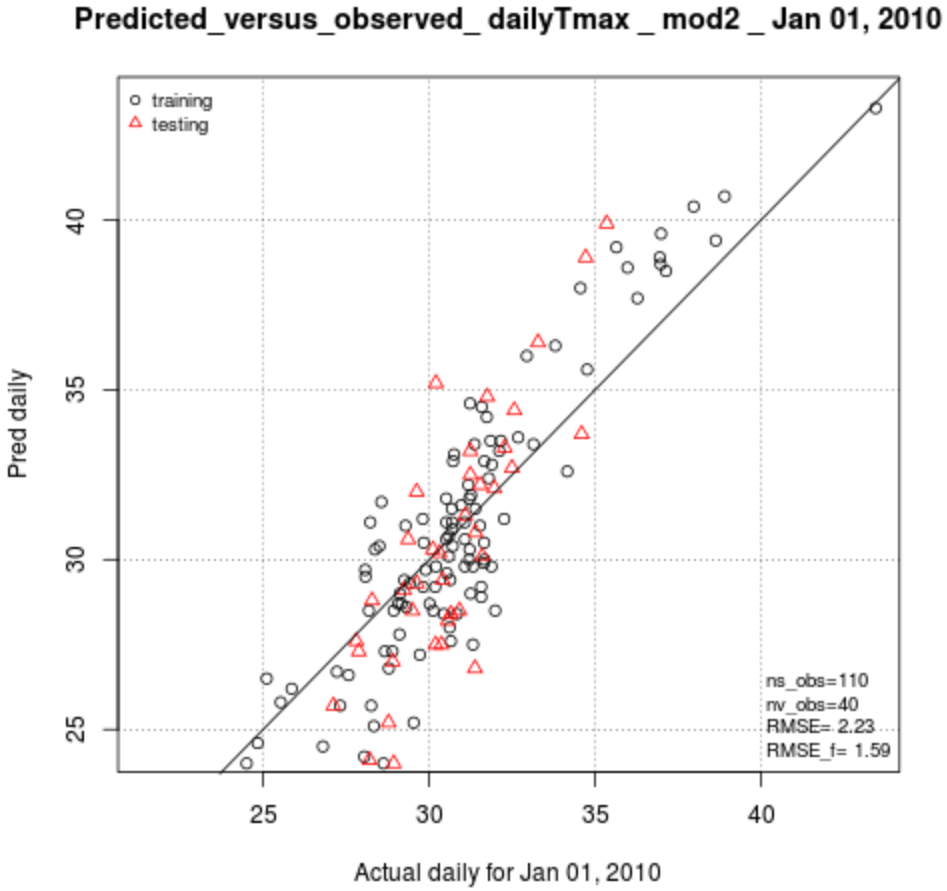
Maximum air temperature models
RMSE MONTHLY BOXPLOT FOR YEAR 2010

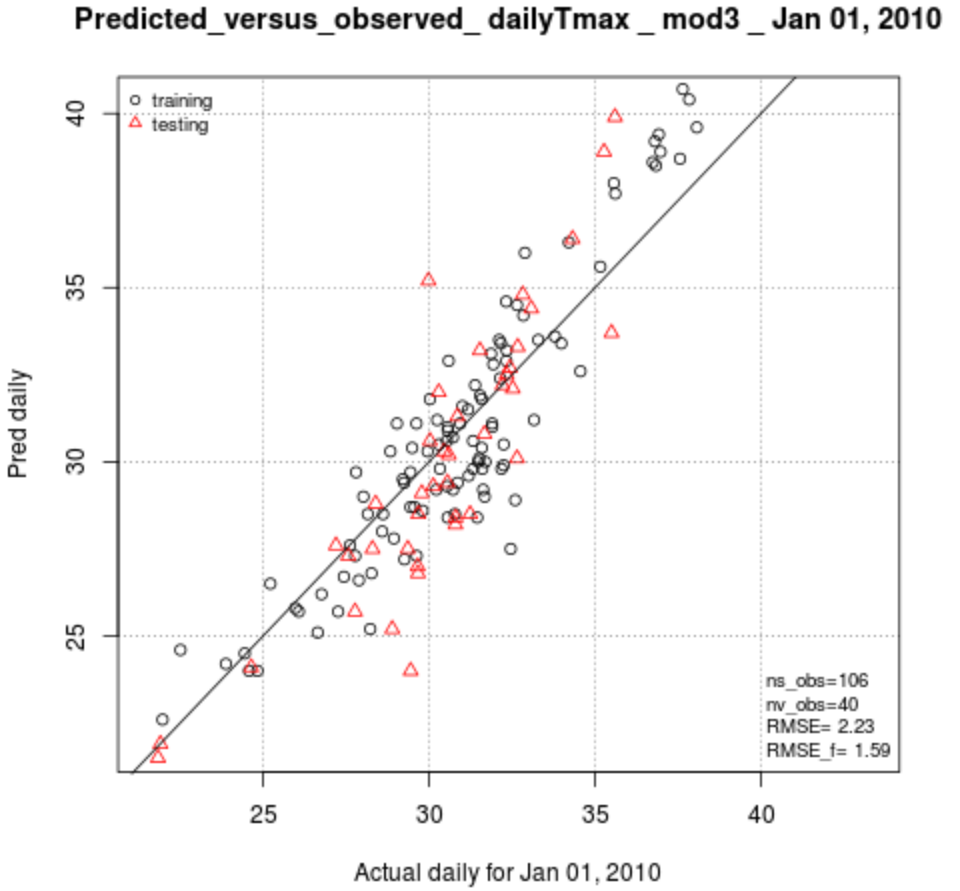




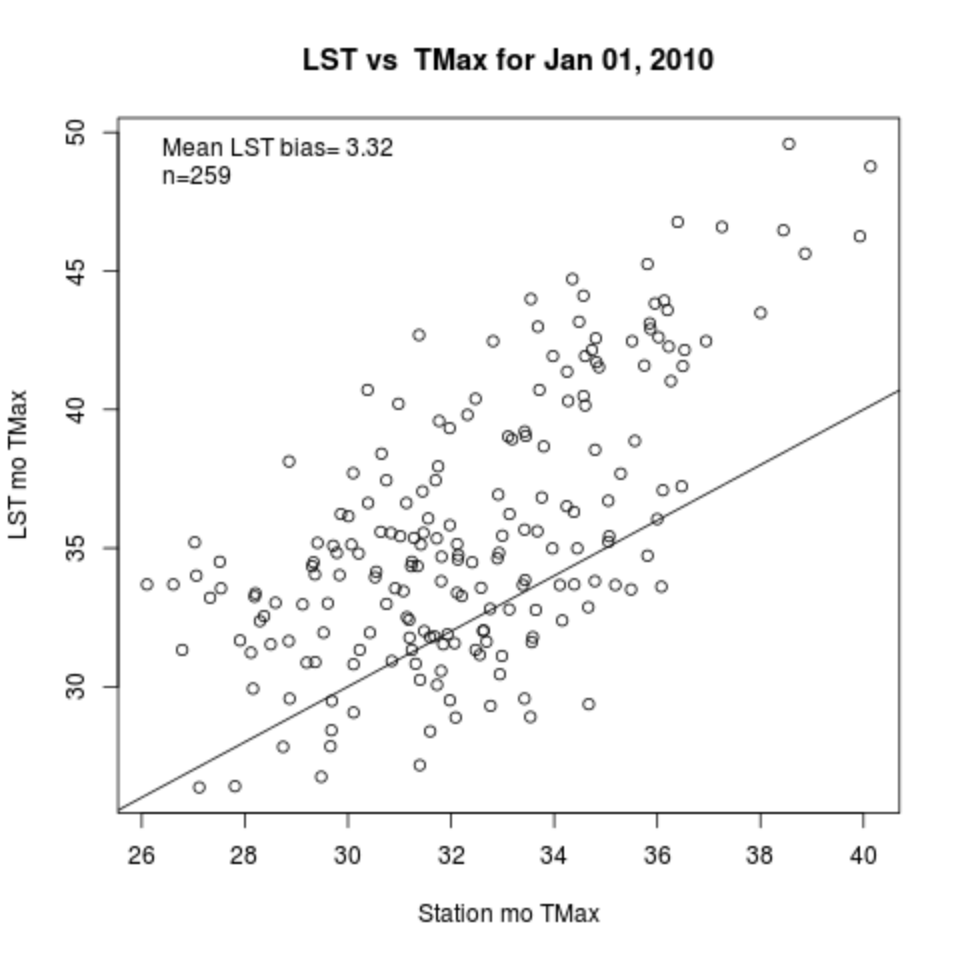
Stations were randomly selected for testing and training. Average accuracy is calculated from the RMSE values for every day for year 2010.

GAM FUSION-Maximum air temperature models
PREDICTED VERSUS OBSERVED YEAR 2010





GAM FUSION-Maximum air temperature models
MONTHLY LST VERSUS MONTHLY TMAX
QUEENSLAND, JANUARY 2010



LST_TMax_scatterplot_20100101_30_1_365d_GAM_fus_all_lst_06112013.png