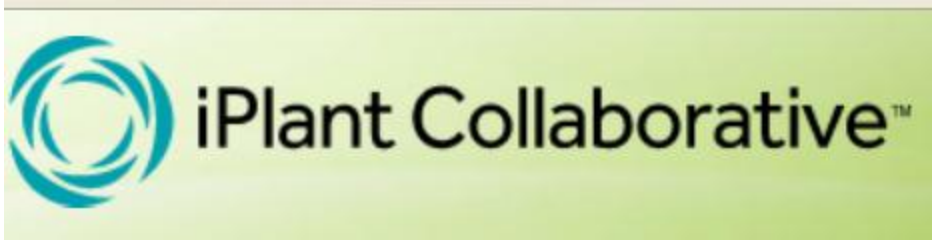
ENVIRONMENTAL LAYERS MEETING
IPLANT TUCSON
2012-07-24

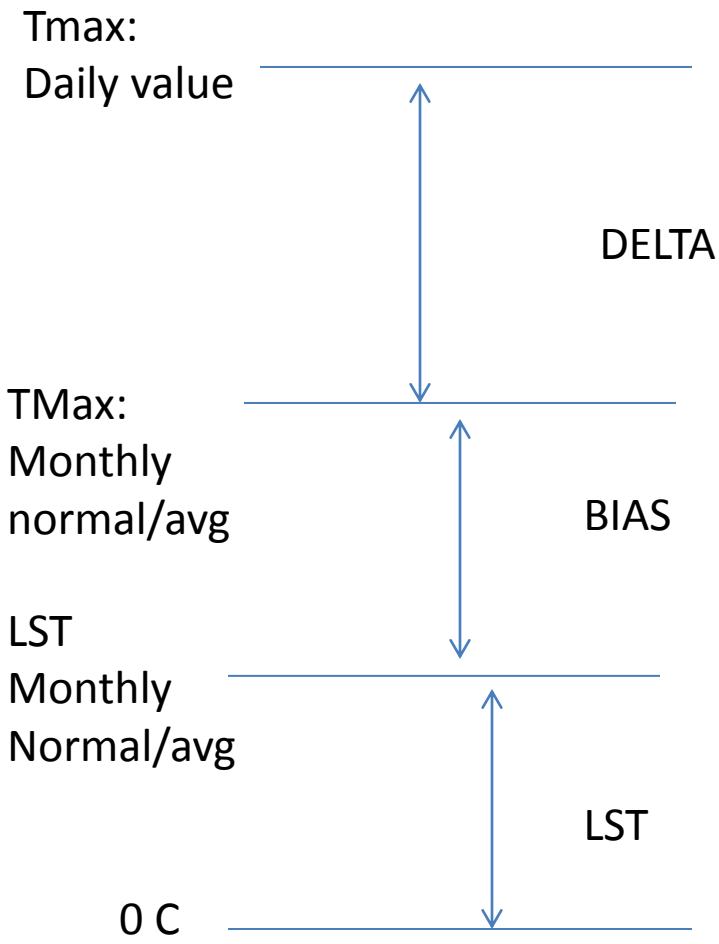
Roundup
Benoit Parmentier



1. FUSION METHOD-RASTER PREDICTION

Climatology Aided Interpolation through fusion

Strategy: divide the variability in a long term component and a daily component.
→ Similar to Willmott and Robeson 1995 and Haylock et al. 2008 but using additional steps and LST bias surface.



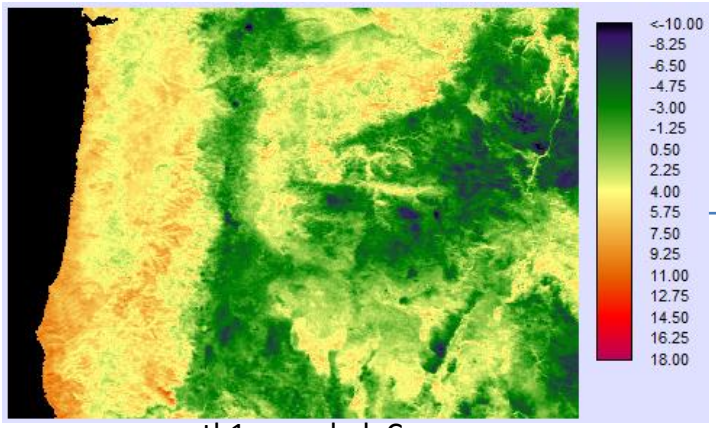
Harder to predict with static covariates: auto-interpolation seems appropriate

Variability may be due to daily weather phenomena (air masses and front, local convection)

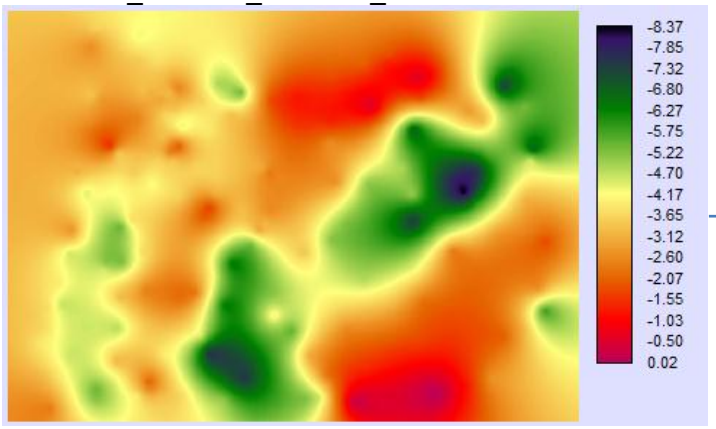
Variability may be due to diff between skin and air temp. This is the long term component of tmax.

May plug in modeling of surface through elevation and other covariates that are static??

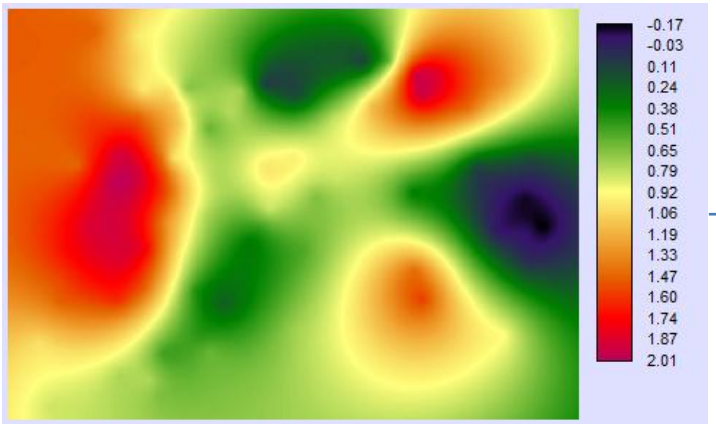
Tmax(daily)=LST(month)+LST_bias(month)+tmax_delta(daily)



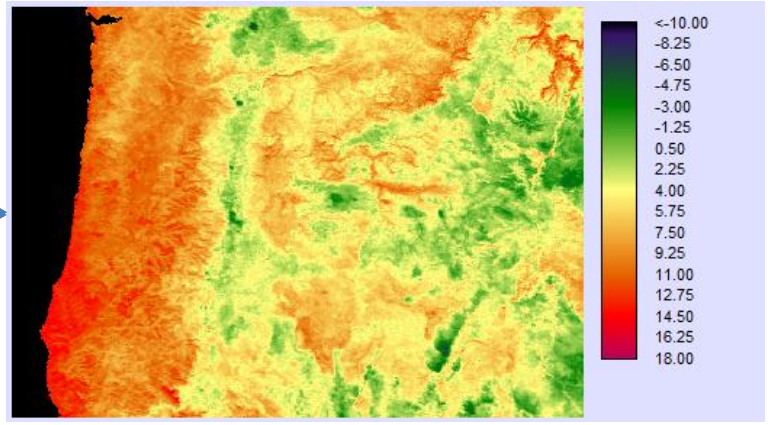
mean_month1_rescaled_C



fusion_bias_LST_20100101_07192012_365d_GAM_fusion3.rst



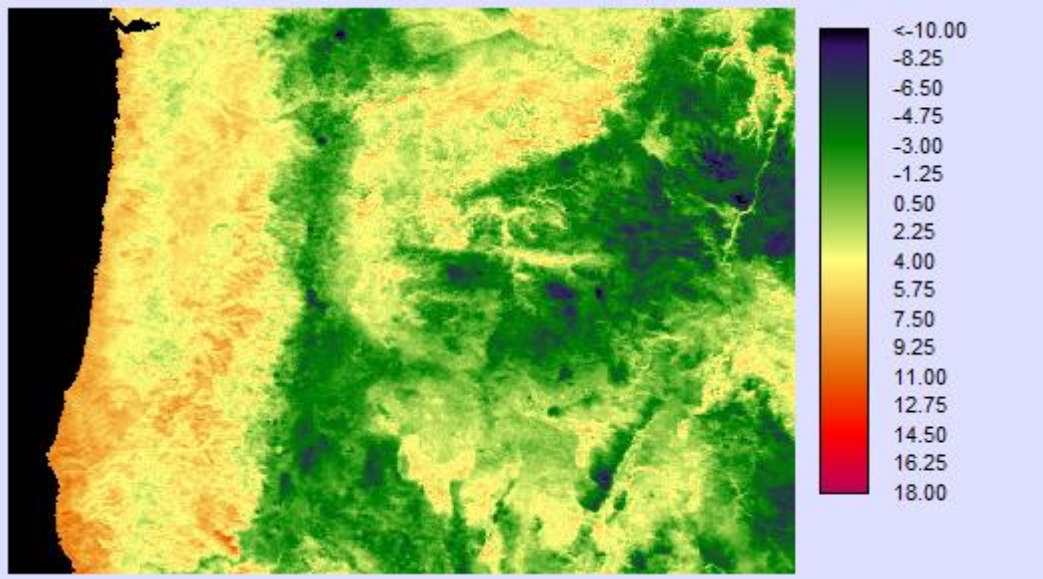
fusion_daily_delta_LST_20100101_07192012_365d_GAM_fusion3.rst



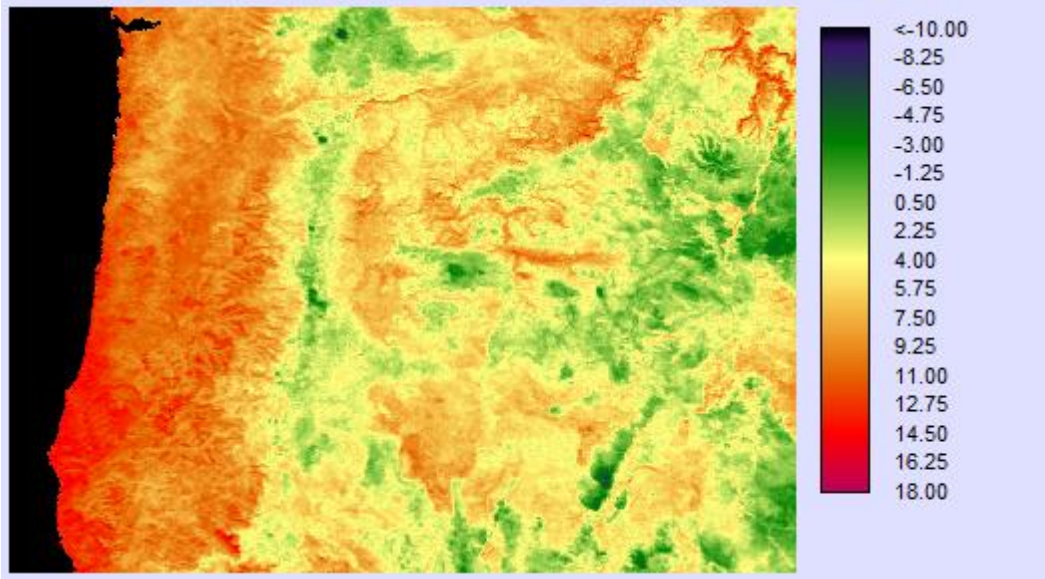
fusion_tmax_predicted_20100101_07192012_365d_GAM_fusion3

SUM OF THREE SURFACES

FUSION PREDICTION, JANUARY 1, 2010



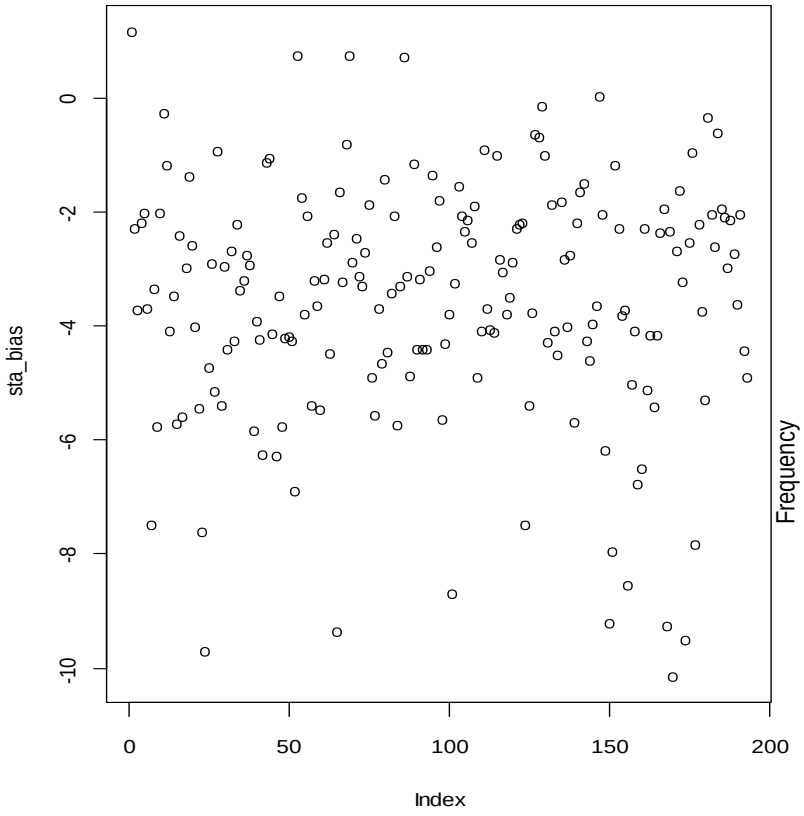
mean_month1_rescaled_C

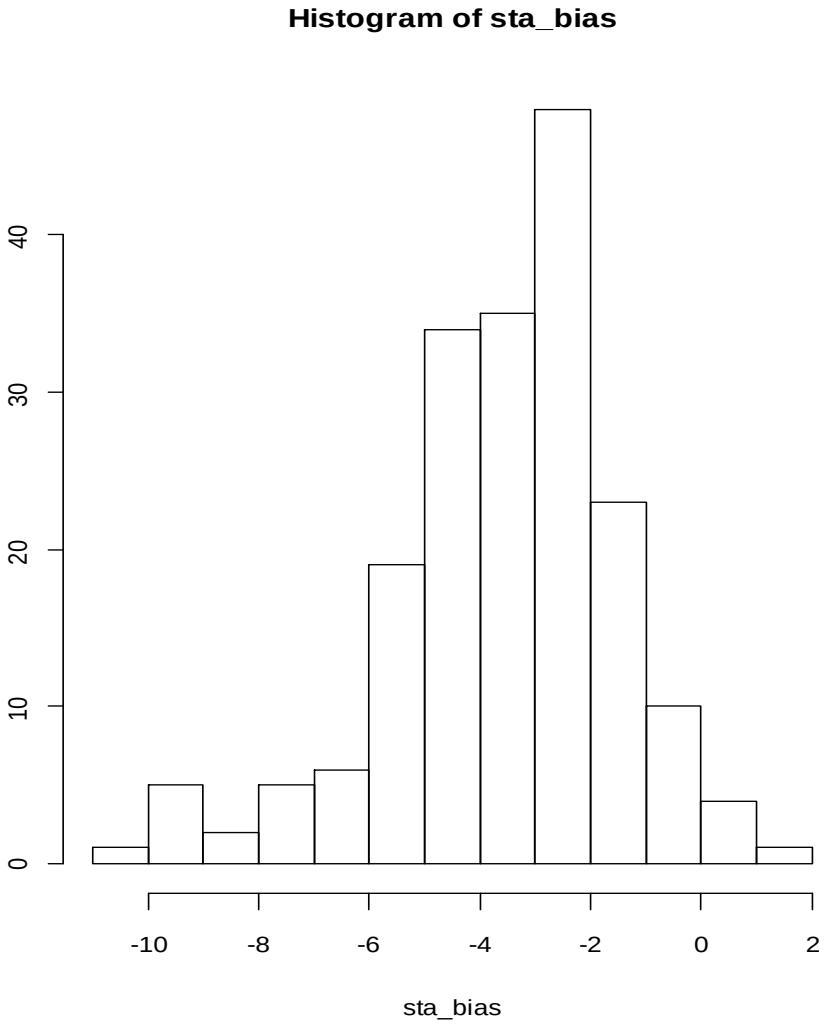


fusion_tmax_predicted_20100101_07192012_365d_GAM_fusion3

LST BIAS FOR JANUARY

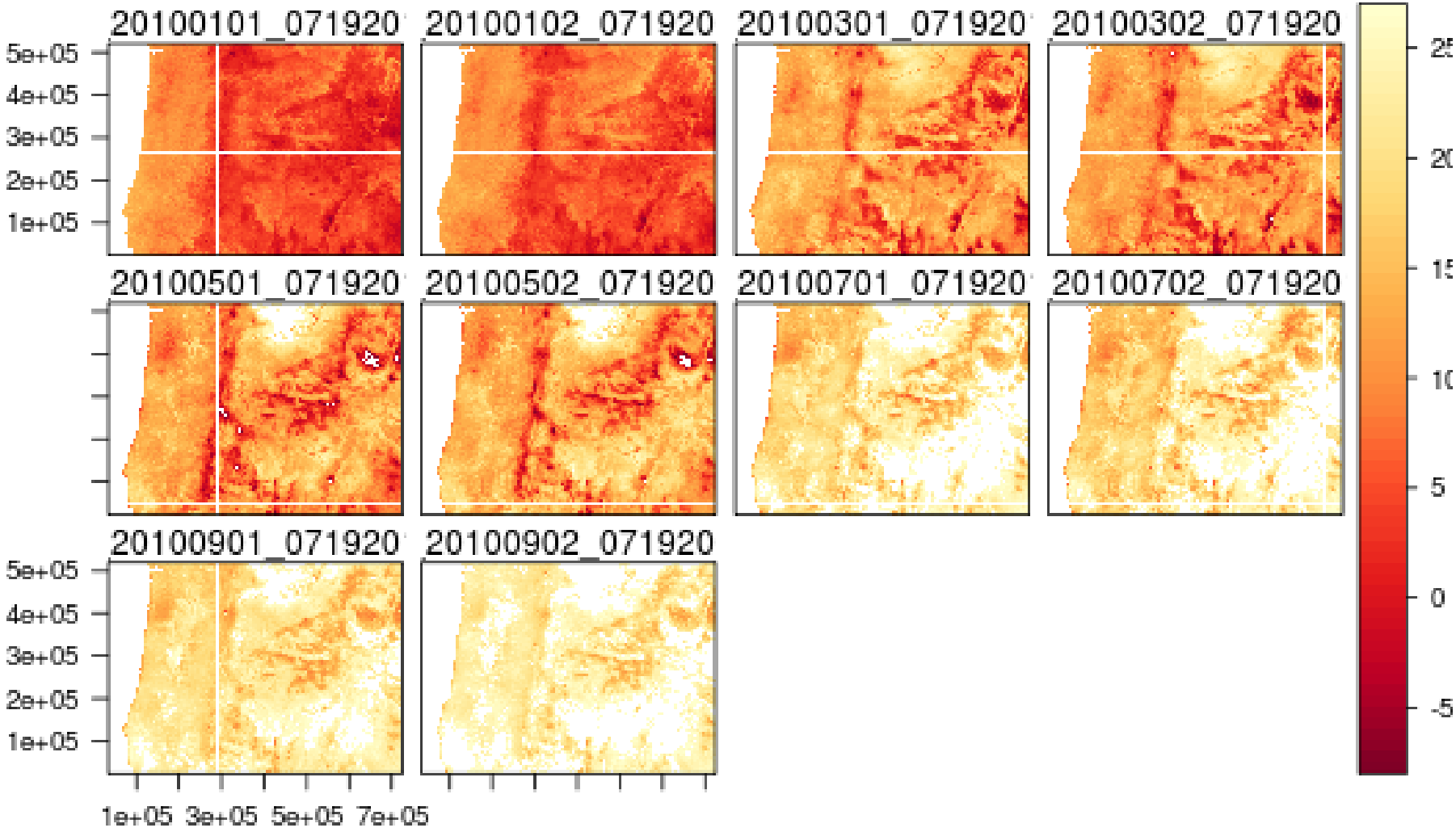
There are 193 unique stations





The mean bias is: -3.5C for January

RASTER FUSION PREDICTION FOR OREGON
10 dates sequence



2. GAM: RASTER PREDICTION

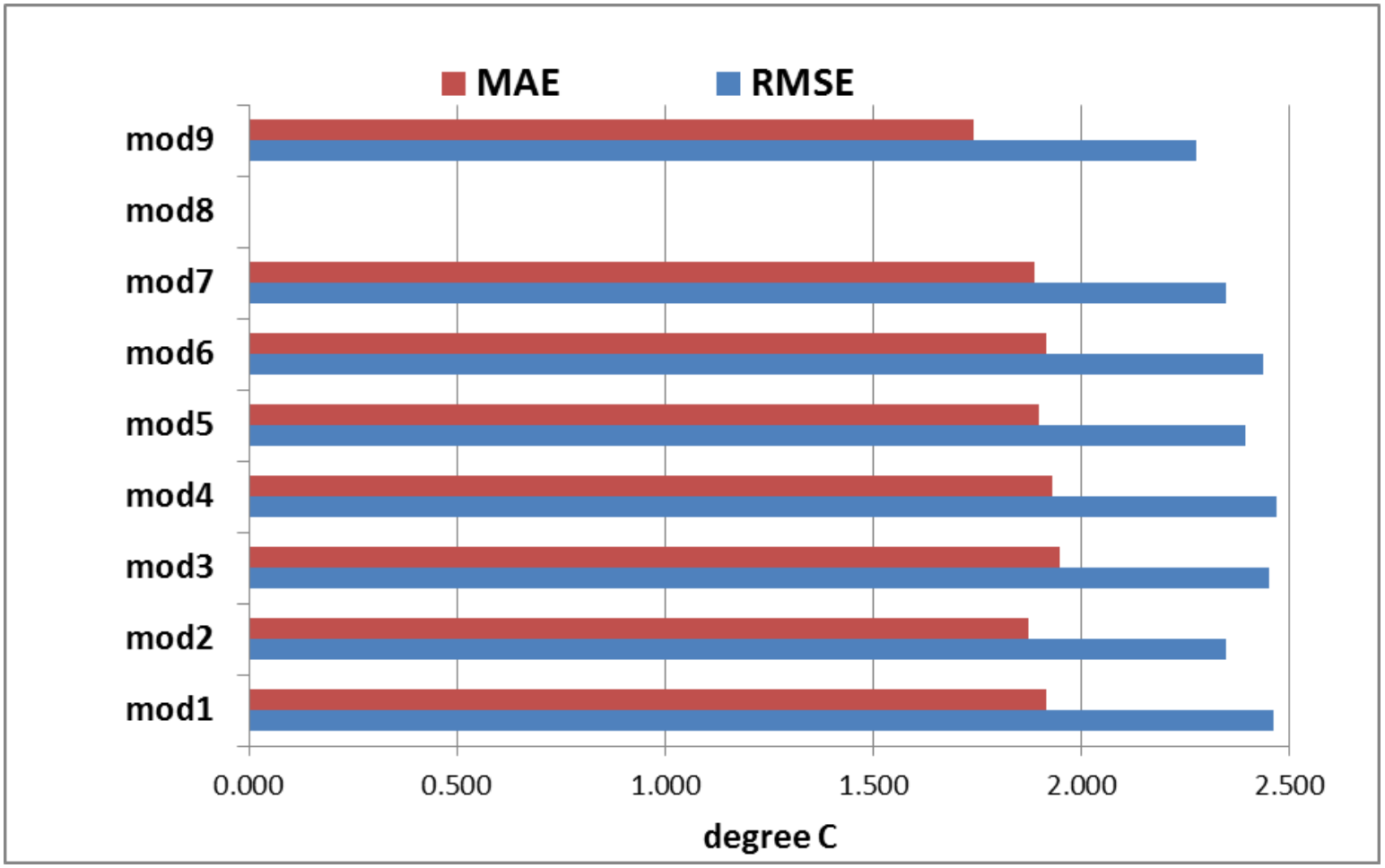
GAM MODELING USED IN THE BIAS

Modeling the LST BIAS using GAM models with environmental covariates.

```
mod1<- y_var~ s(lat) + s (lon) + s (ELEV_SRTM)
mod2<- y_var~ s(lat,lon)+ s(ELEV_SRTM)
mod3<- y_var~ s(lat) + s (lon) + s (ELEV_SRTM) +  s (Northness)+ s (Eastness) + s(DISTOC)
mod4<- y_var~ s(lat) + s (lon) + s(ELEV_SRTM) + s(Northness) + s (Eastness) + s(DISTOC) + s(LST)
mod5<- y_var~ s(lat,lon) +s(ELEV_SRTM) + s(Northness,Eastness) + s(DISTOC) + s(LST)
mod6<- y_var~ s(lat,lon) +s(ELEV_SRTM) + s(Northness,Eastness) + s(DISTOC) + s(LST)+s(LC1)
mod7<- y_var~ s(lat,lon) +s(ELEV_SRTM) + s(Northness,Eastness) + s(DISTOC) + s(LST)+s(LC3)
mod8<- y_var~ s(lat,lon) +s(ELEV_SRTM) + s(Northness,Eastness) + s(DISTOC) + s(LST) + s(LC1,LC3)
```

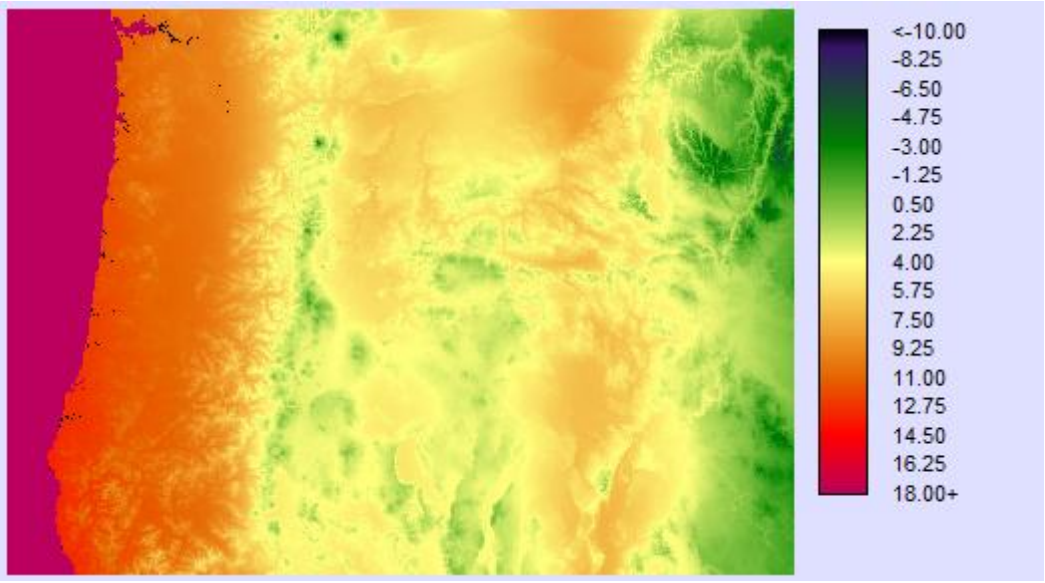
→Model 8 has an interactive term between LC1 and LC3. There were an insufficient number of observations to calculate GAM parameters.

GAM AND FUSION MODEL



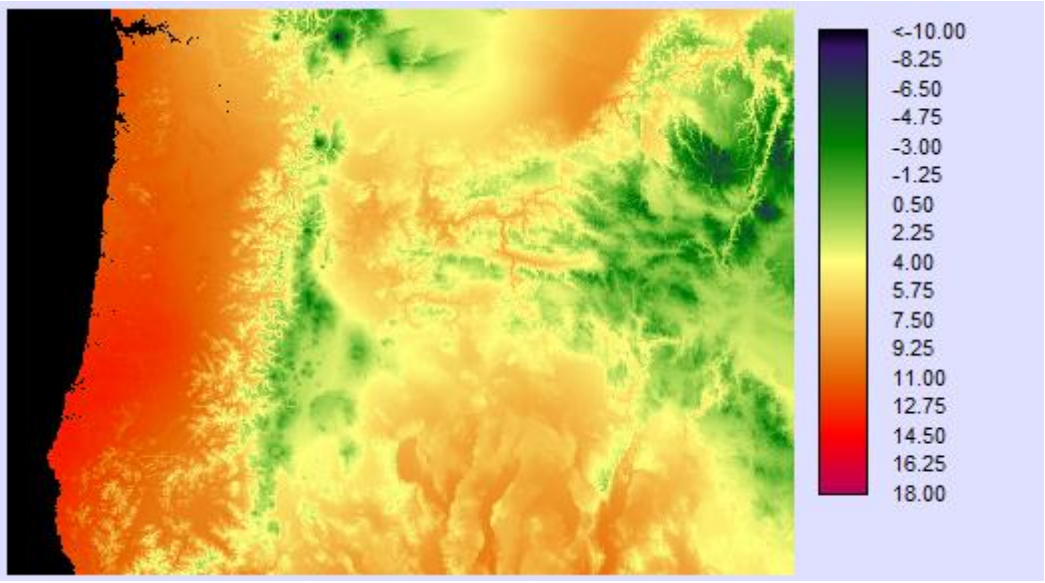
RMSE	mod1	mod2	mod3	mod4	mod5	mod6	mod7	mod8	mod9
mean	2.461	2.348	2.452	2.468	2.395	2.437	2.348	#DIV/0!	2.274
median	2.247	2.255	2.240	2.270	2.180	2.296	2.307	#NUM!	2.114
sd dev	0.688	0.636	0.704	0.621	0.636	0.623	0.382	#DIV/0!	0.599

RASTER GAM PREDICTION FOR OREGON



GAM_predicted_mod1_20100101_07192012_365d_GAM_fusion3.rst

mod1<-
y_var~ s(lat) + s (lon) + s (ELEV_SRTM)

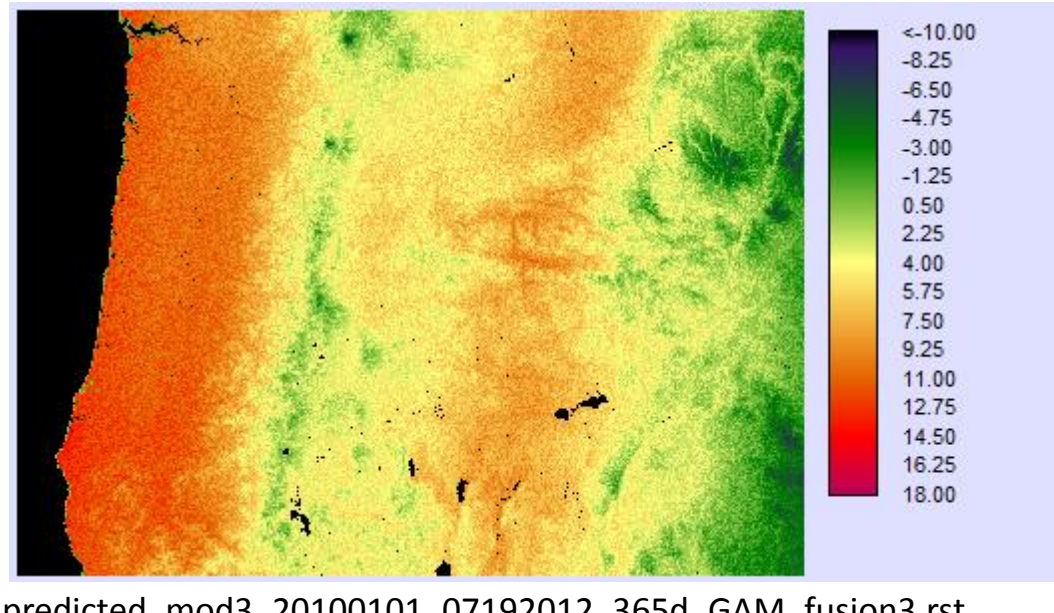


GAM_predicted_mod2_20100101_07192012_365d_GAM_fusion3.rst

mod2<-
y_var~ s(lat,lon)+ s(ELEV_SRTM)

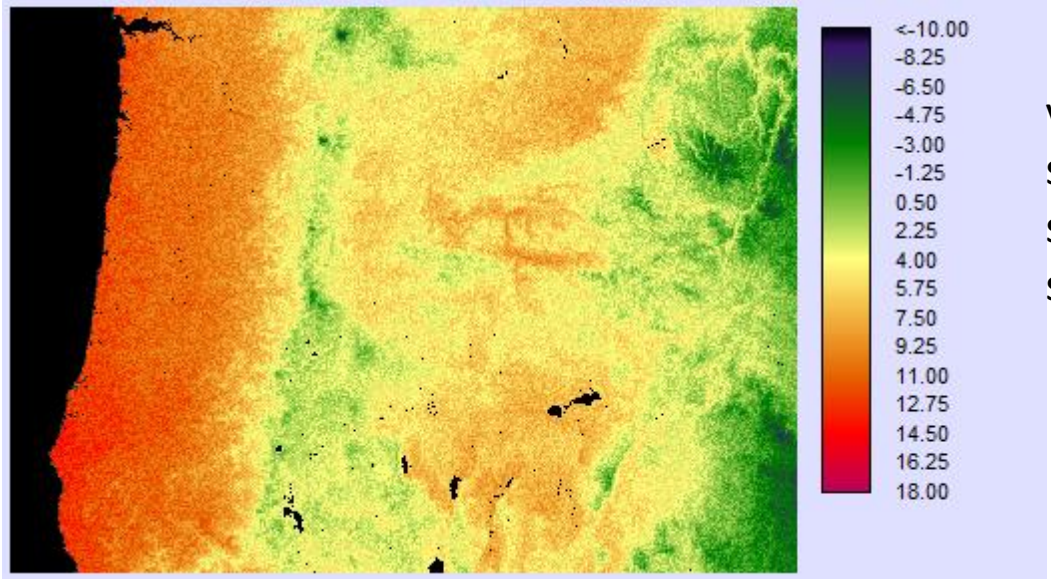
Mod 2 is the second best model After fusion with a value of RMSE=2.348.

RASTER GAM PREDICTION FOR OREGON



mod3<-
y_var~
s(lat) + s (lon) + s (ELEV_SRTM) +
s (Northness)+ s (Eastness) + s(DISTOC)

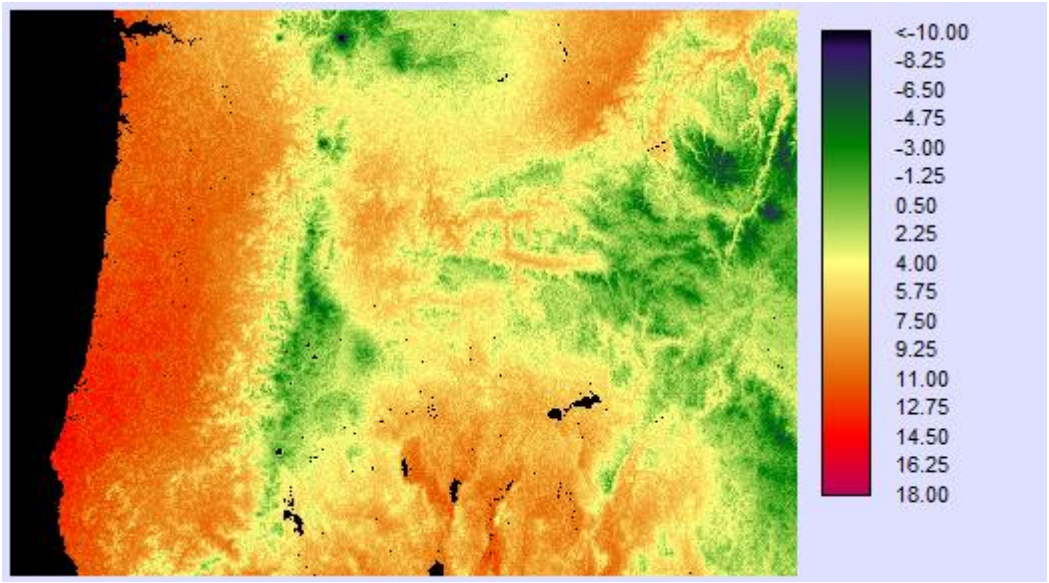
GAM_predicted_mod3_20100101_07192012_365d_GAM_fusion3.rst



mod4<-
y_var~
s(lat) + s (lon) + s(ELEV_SRTM) +
s(Northness) + s (Eastness) +
s(DISTOC) + s(LST)

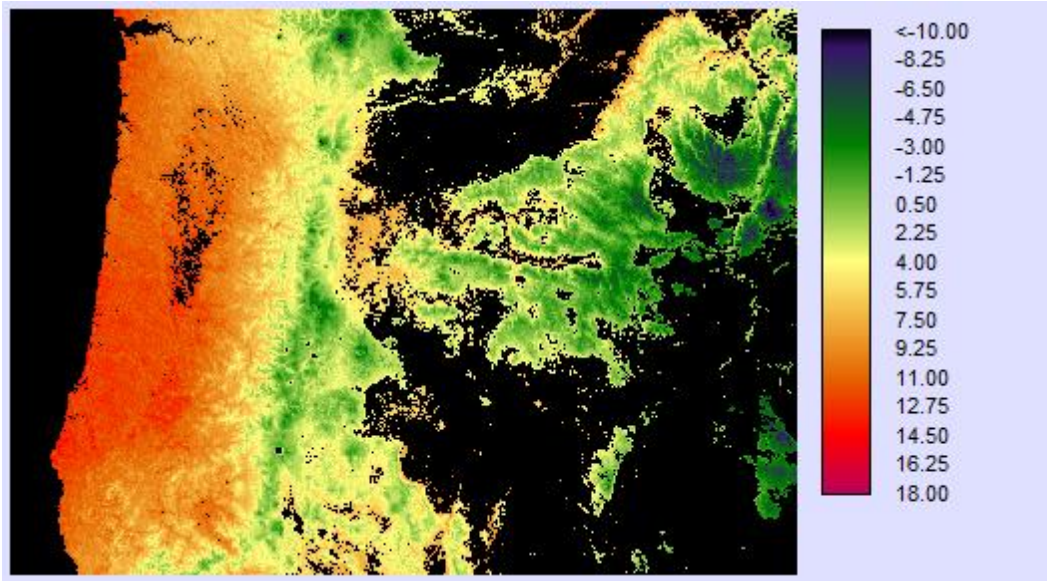
GAM_predicted_mod4_20100101_07192012_365d_GAM_fusion3.rst

RASTER GAM PREDICTION FOR OREGON



mod5<-
y_var~
s(lat,lon) +s(ELEV_SRTM) +
s(Northness,Eastness) +
s(DISTOC) + s(LST)

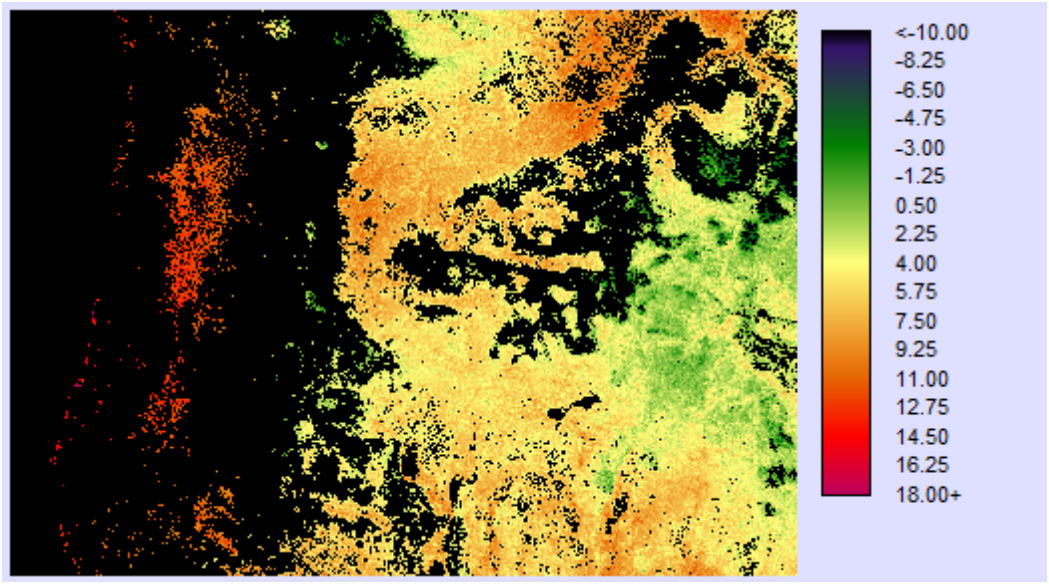
GAM_predicted_mod5_20100101_07192012_365d_GAM_fusion3.rst



mod6<-
y_var~
s(lat,lon) +s(ELEV_SRTM) +
s(Northness,Eastness) + s(DISTOC) +
s(LST)+s(LC1)

GAM_predicted_mod6_20100101_07192012_365d_GAM_fusion3.rst

RASTER GAM PREDICTION FOR OREGON



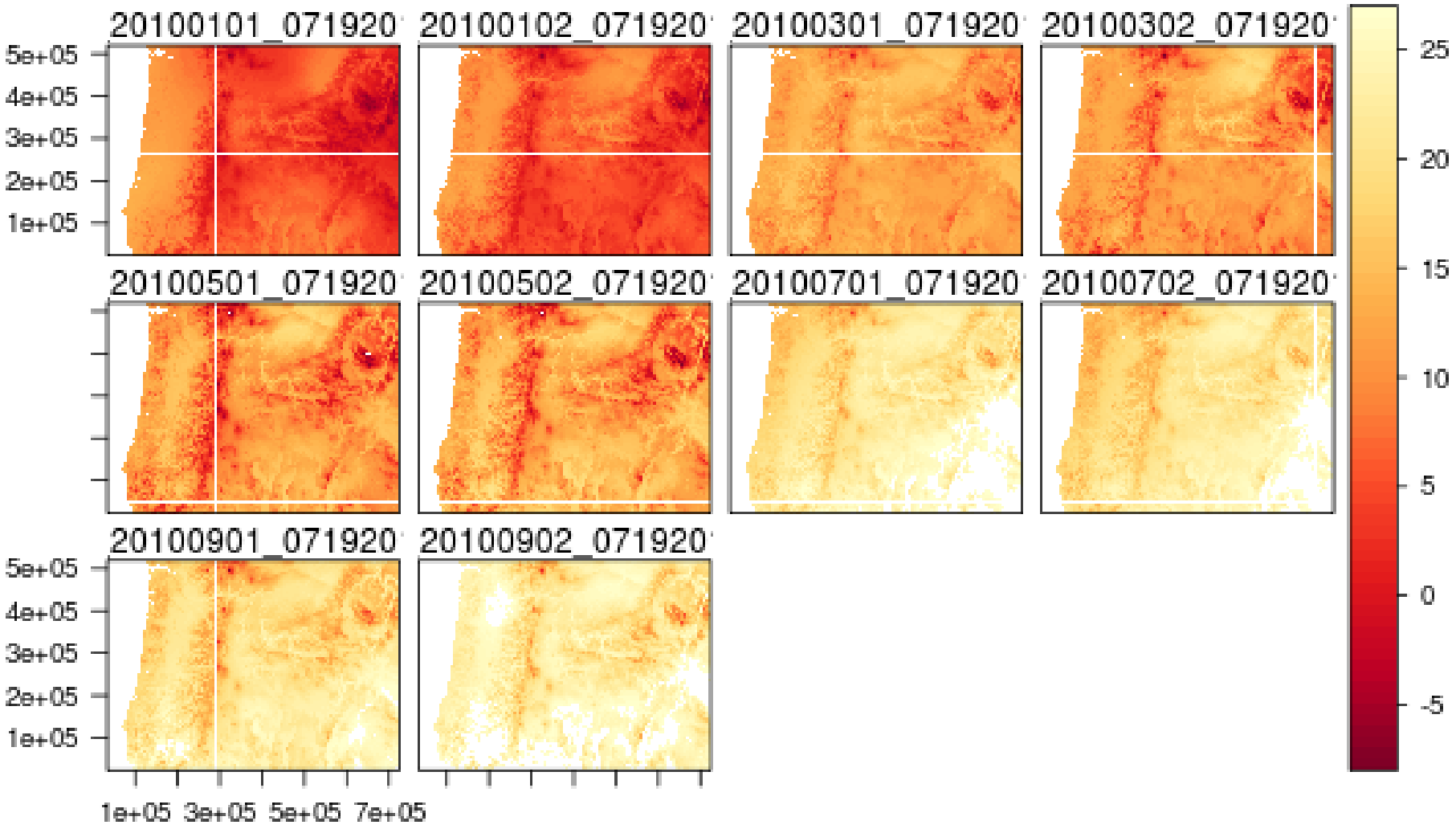
GAM_predicted_mod7_20100101_07192012_365d_GAM_fusion3.rst

mod7<-
y_var~ s(lat,lon) +s(ELEV_SRTM) + s(Northness,Eastness) + s(DISTOC) + s(LST)+s(LC3)

mod8<-
y_var~ s(lat,lon) +s(ELEV_SRTM) + s(Northness,Eastness) + s(DISTOC) + s(LST,LC1)

No prediction for mod8 because there are not enough data points to fit the spline.

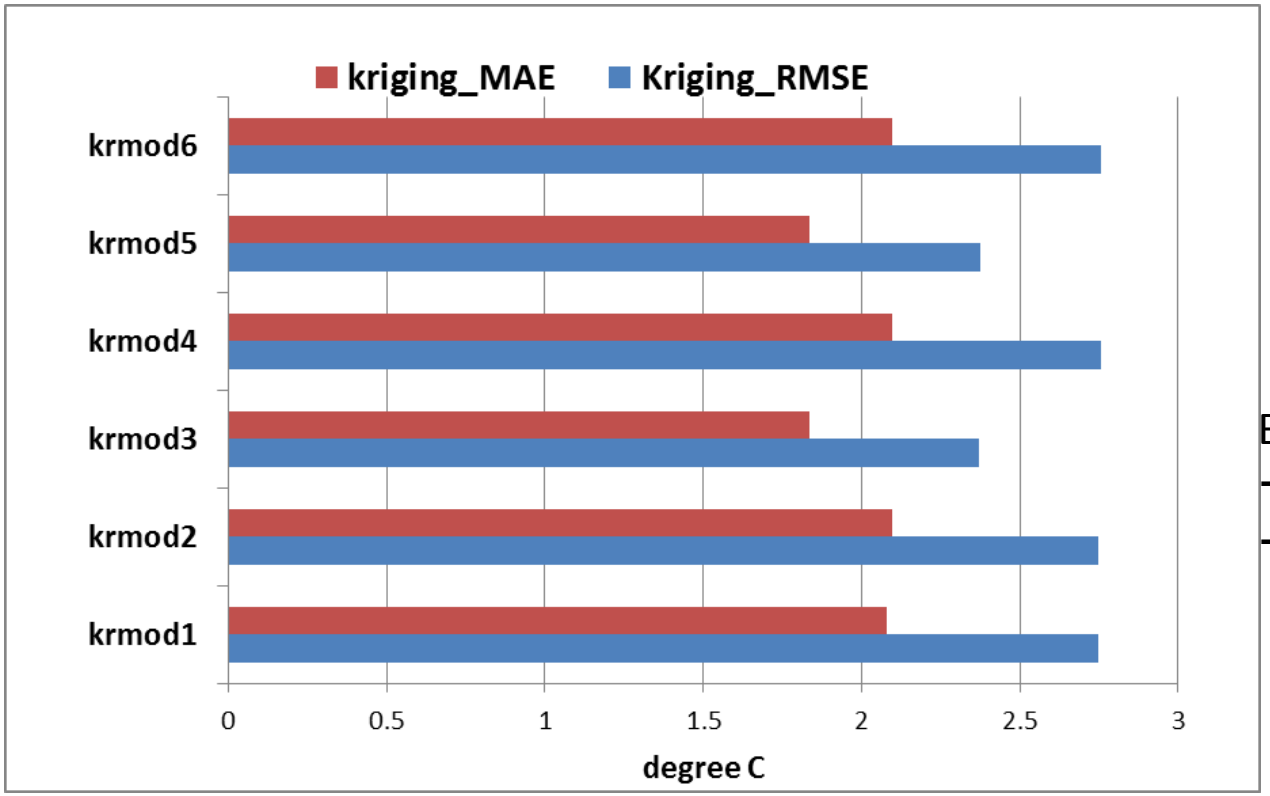
RASTER GAM PREDICTION FOR OREGON
10 dates sequence



3. KRIGING: RASTER PREDICTION

KRIGING MODELS

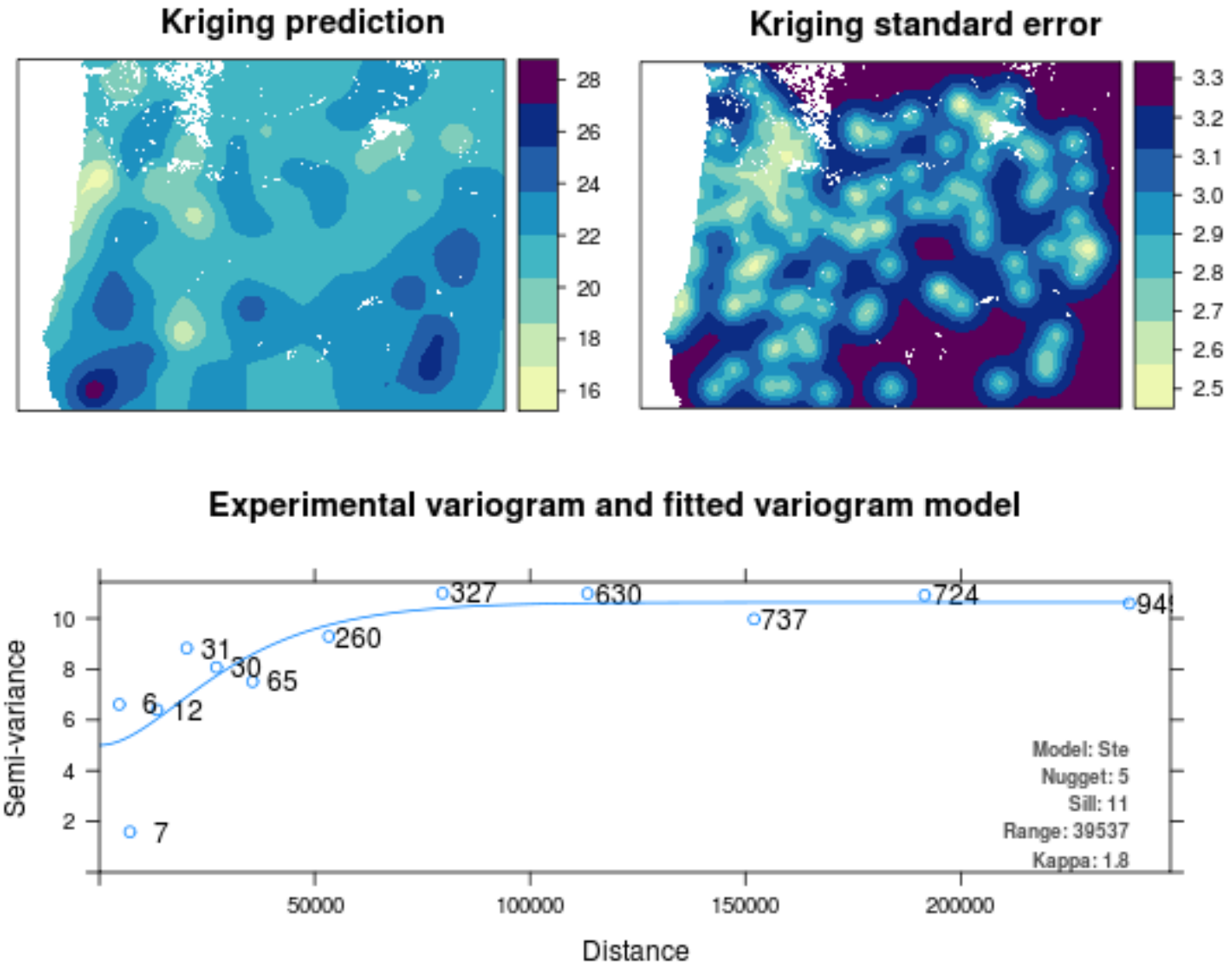
krmod1<- tmax~1,
krmod2<- tmax~x_OR83M+y_OR83M
krmod3<- tmax~x_OR83M+y_OR83M+ELEV_SRTM
krmod4<- tmax~x_OR83M+y_OR83M+DISTOC
krmod5<- tmax~x_OR83M+y_OR83M+ELEV_SRTM+DISTOC
krmod6<- tmax~x_OR83M+y_OR83M+Northness+Eastness



Best models;
→ Krmod3
→ Krmod5

RME	krmod1	krmod2	krmod3	krmod4	krmod5	krmod6
mean	2.747	2.750	2.370	2.756	2.374	2.756
median	2.464	2.435	2.364	2.435	2.369	2.455

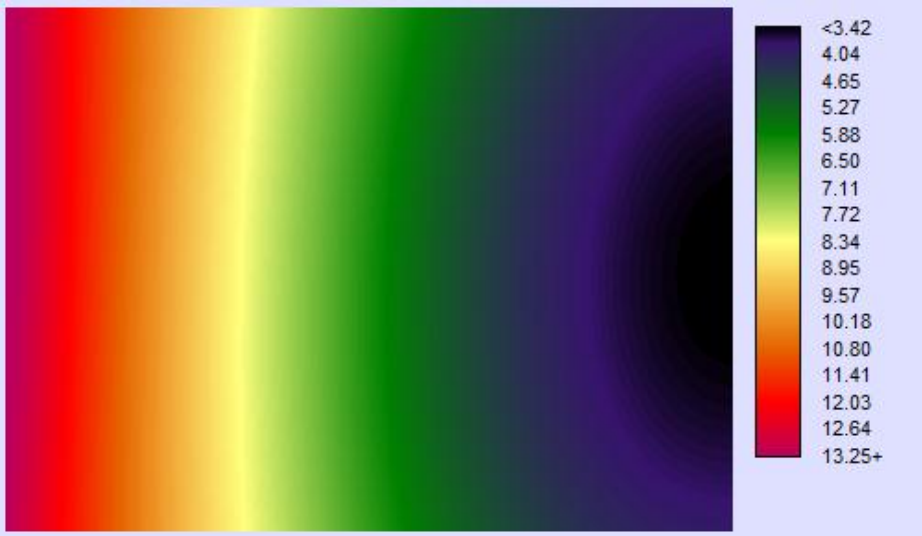
KRIGING WITH AUTOMATED FITTING OF VARIOGRAM



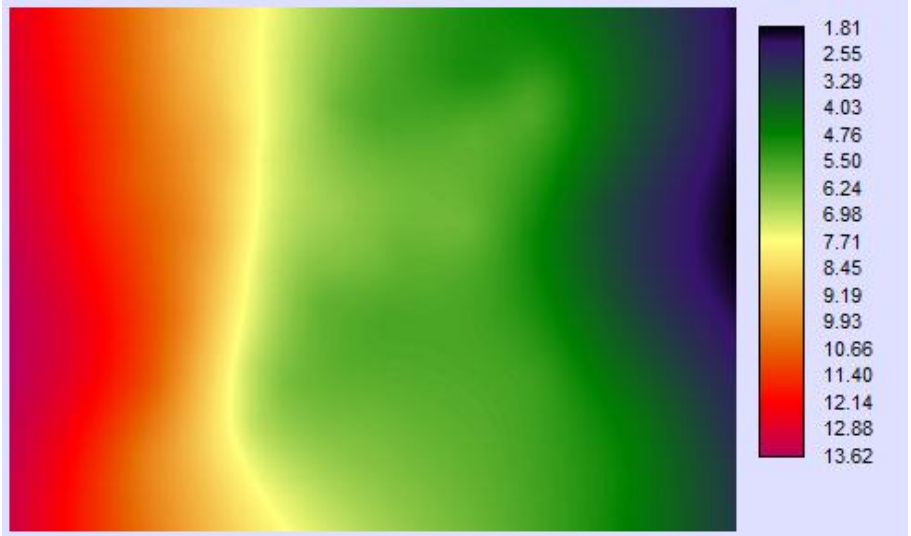
Date9: 20100901

Range=40 km

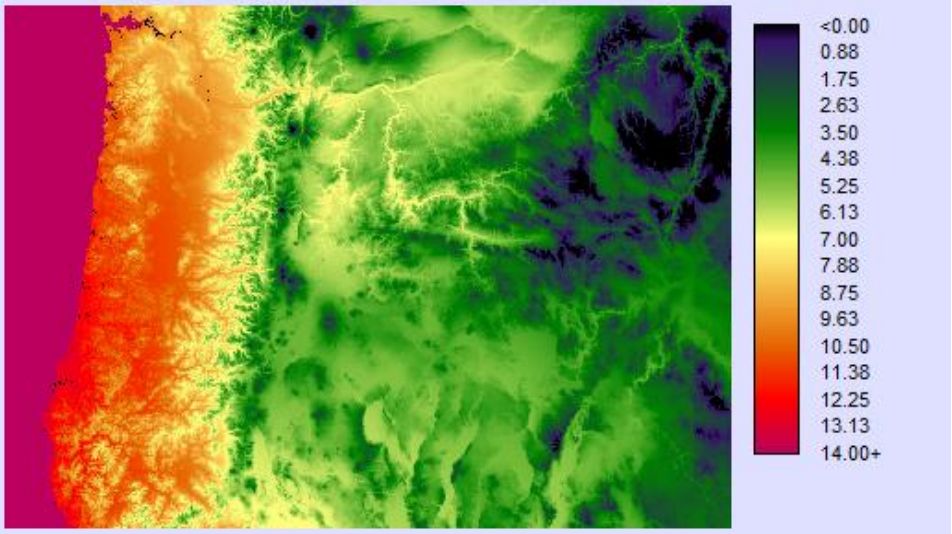
KRIGING PREDICTIONS: JANUARY FIRST



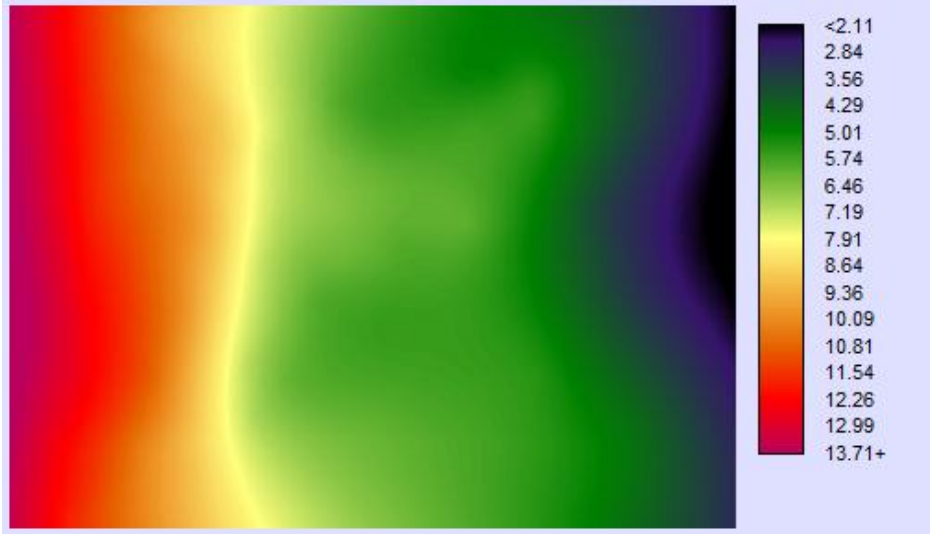
krmod_mod1_20100101_07192012_auto_krig_.rst



krmod_mod2_20100101_07192012_auto_krig_.rst

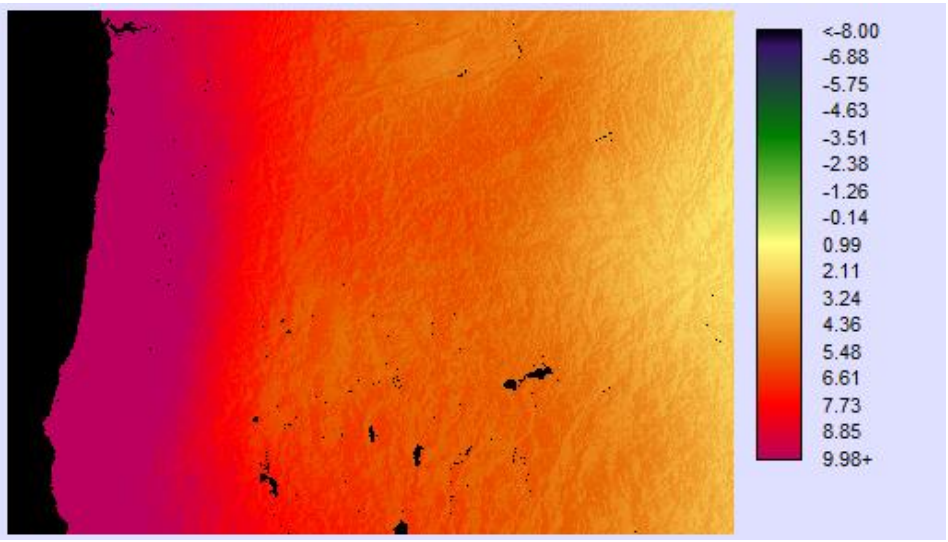


krmod_mod3_20100101_07192012_auto_krig_.rst

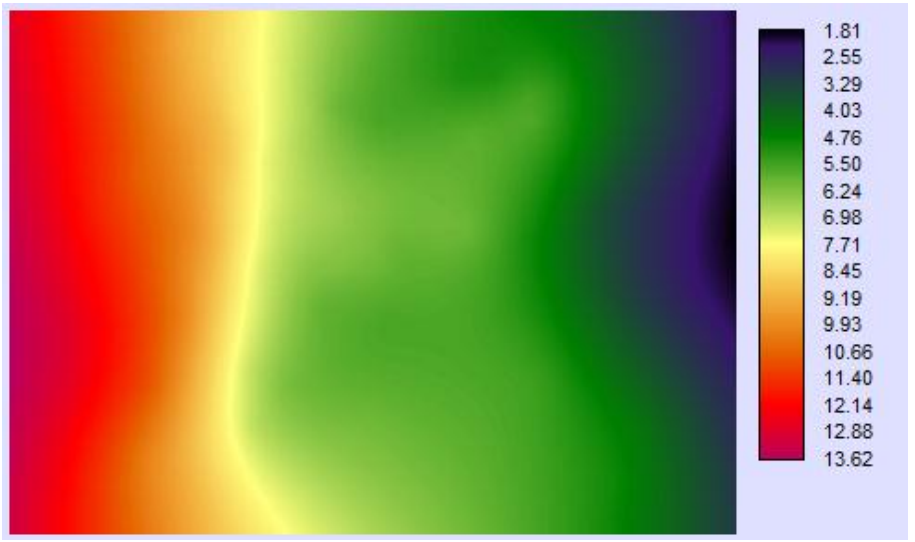


krmod_mod4_20100101_07192012_auto_krig_.rst

KRIGING PREDICTIONS: JANUARY FIRST



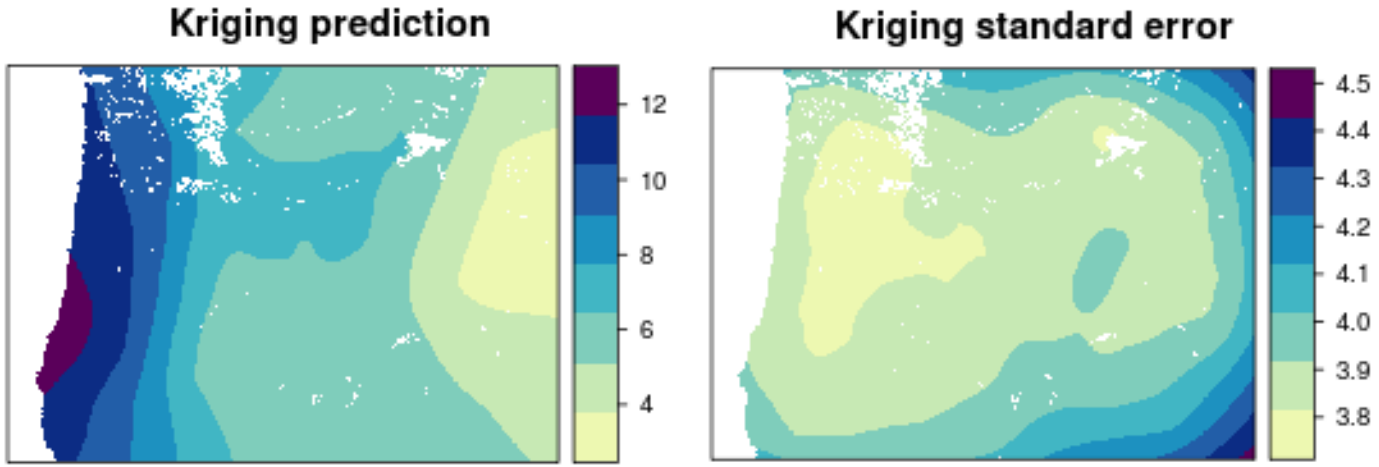
krmod_mod5_20100101_07192012_auto_krig_.rst

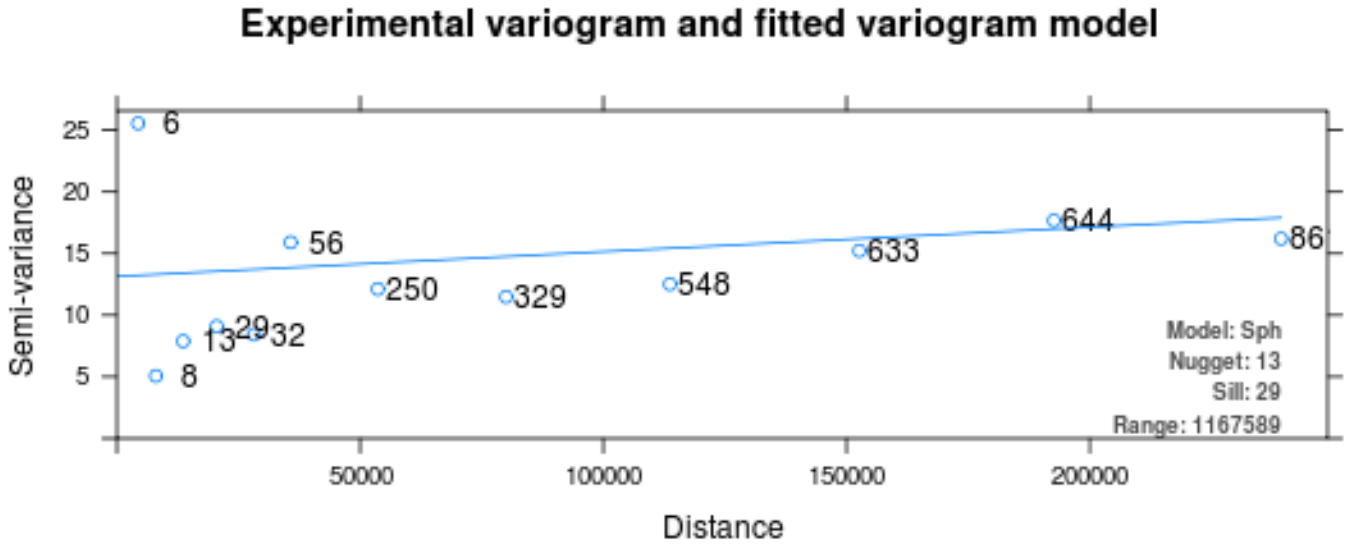


krmod_mod6_20100101_07192012_auto_krig_.rst

→January prediction has very little autocorrelation structure…

KRIGING WITH AUTOMATED FITTING OF VARIOGRAM



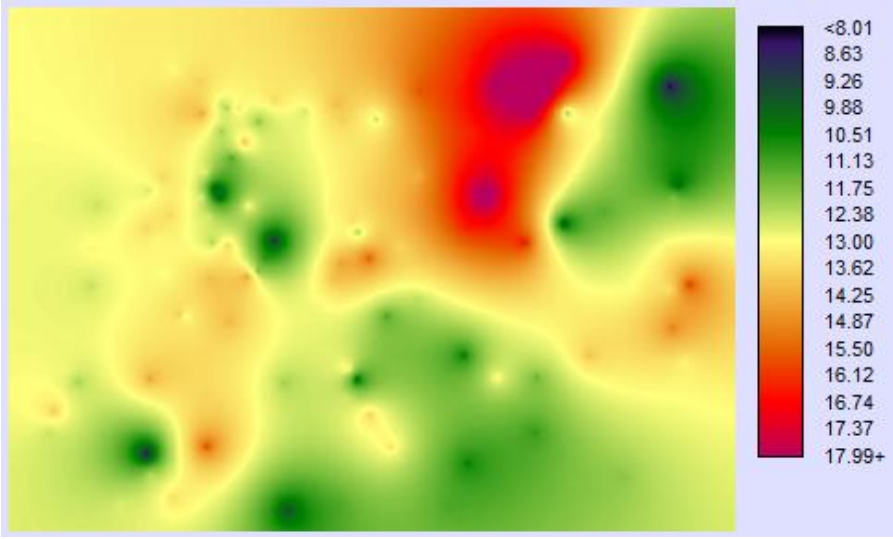


Hiemstra et al. 2008

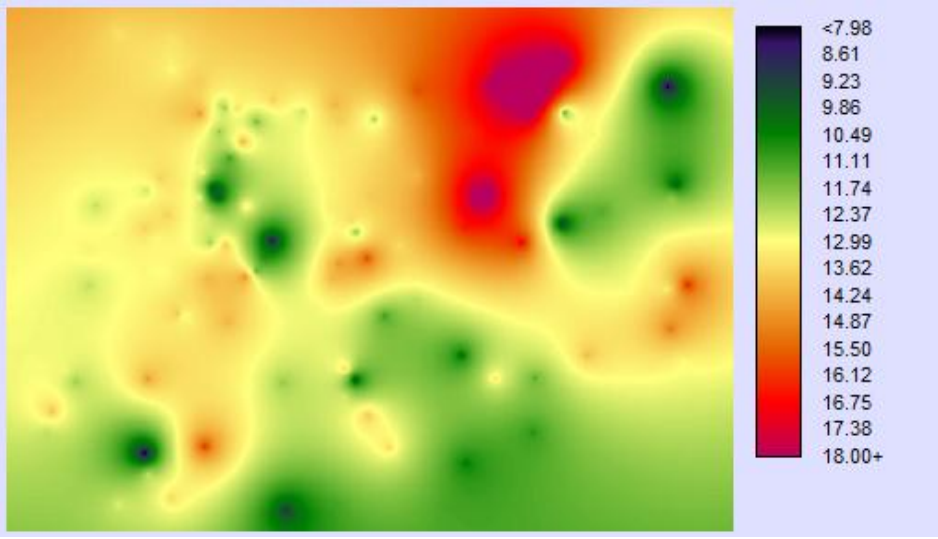
Date1: 20120101

Range=1167km

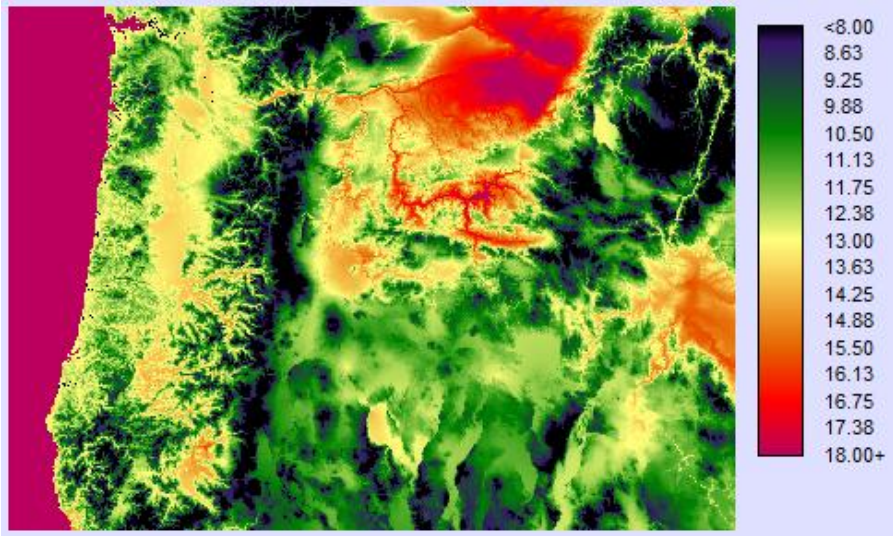
KRIGING PREDICTIONS: MARCH 2, 2010



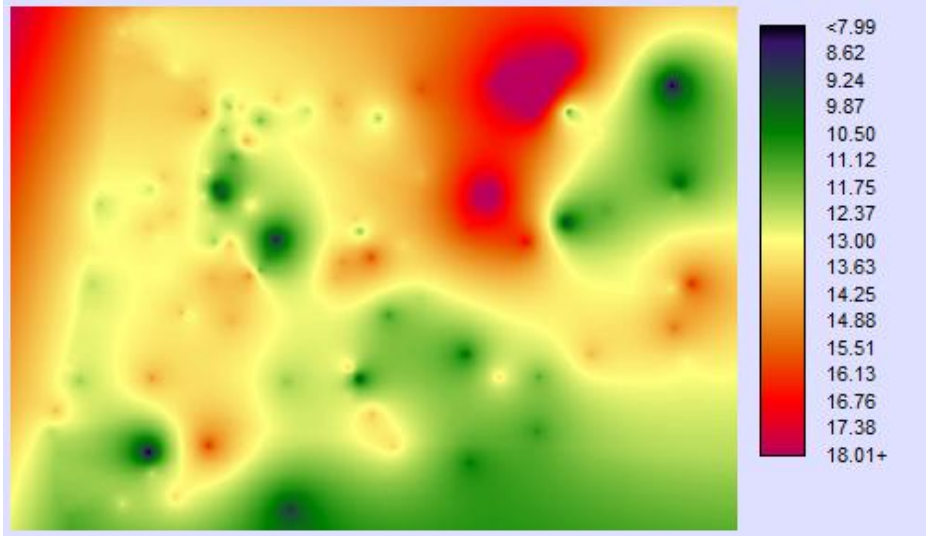
krmod_mod1_20100302_07192012_auto_krig_.rst



krmod_mod2_20100302_07192012_auto_krig_.rst

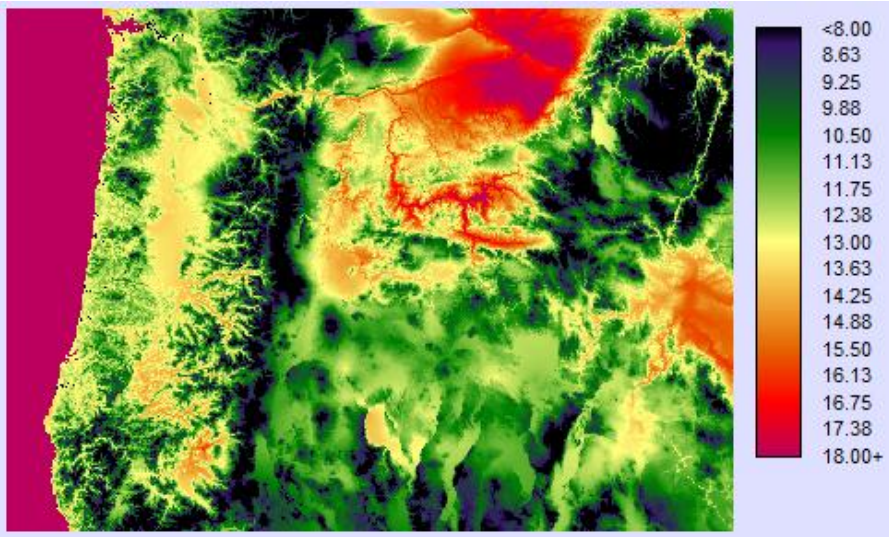


krmod_mod3_20100302_07192012_auto_krig_.rst

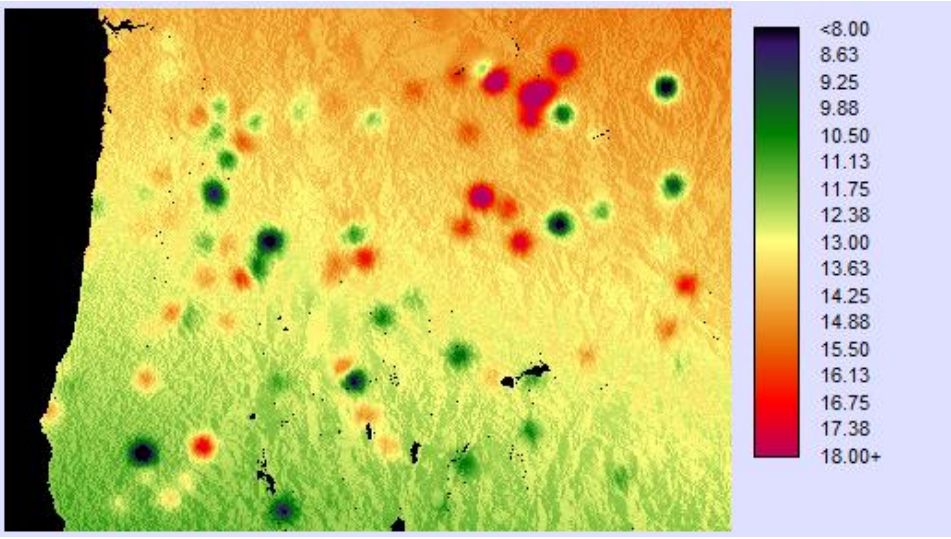


krmod_mod4_20100302_07192012_auto_krig_.rst

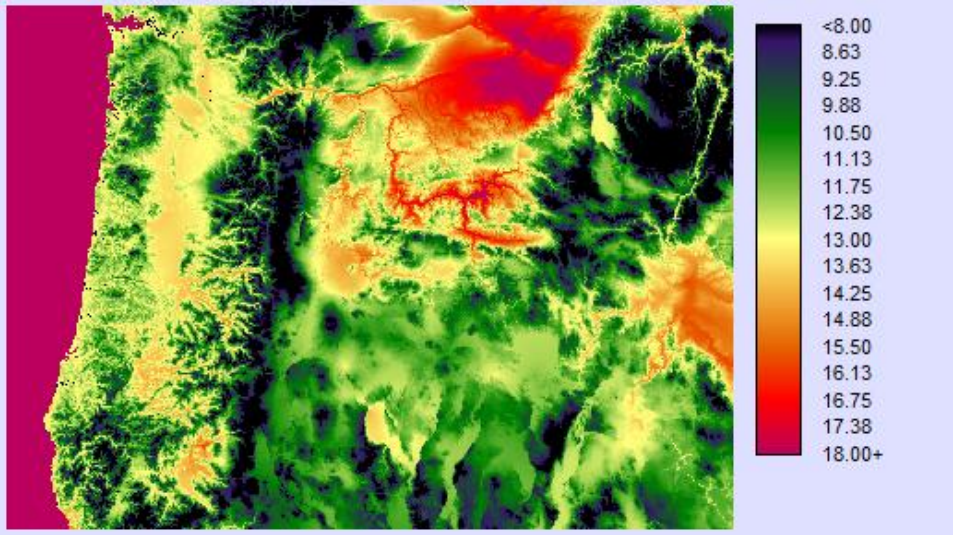
KRIGING PREDICTIONS: MARCH 2, 2010



krmod_mod5_20100302_07192012_auto_krig_.rst



krmod_mod6_20100302_07192012_auto_krig_.rst



krmod_mod3_20100302_07192012_auto_krig_.rst

A lot of similarity between mod3 and mod5…→ ELEV_SRTM term