

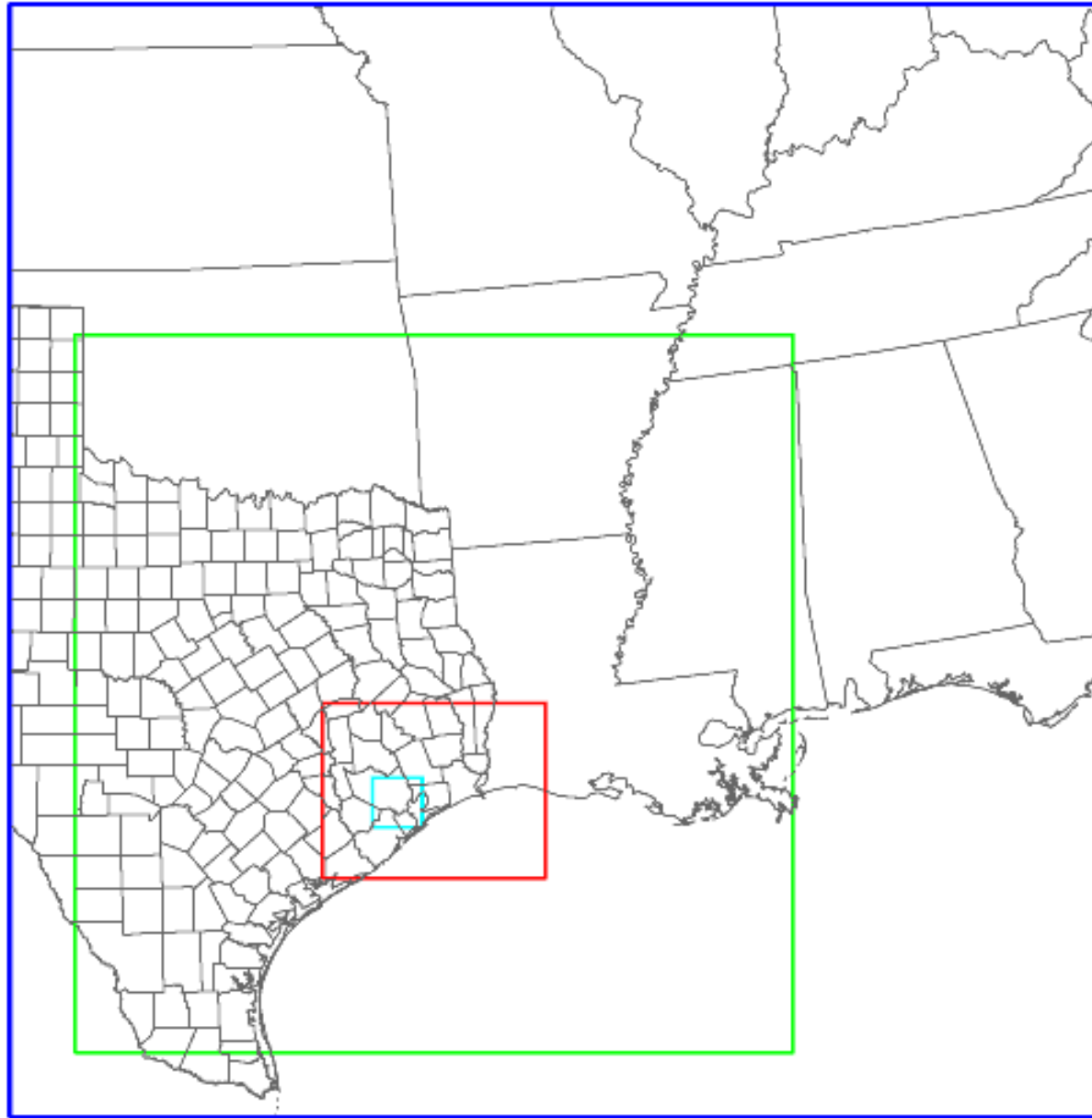
# Improved data for biogenic emission modeling

Mark Estes, Jim Smith, and Fernando  
Mercado

Texas Commission on Environmental  
Quality

# Meteorological input data needed for biogenic emissions modeling

- Photosynthetically-active solar radiation
- Temperature
- Hourly data needed for an expansive region, gridded to match the photochemical modeling domain



Regional Domain

East Texas Subdomain

HGBPA Subdomain

HG Subdomain

# Possible sources of temperature data

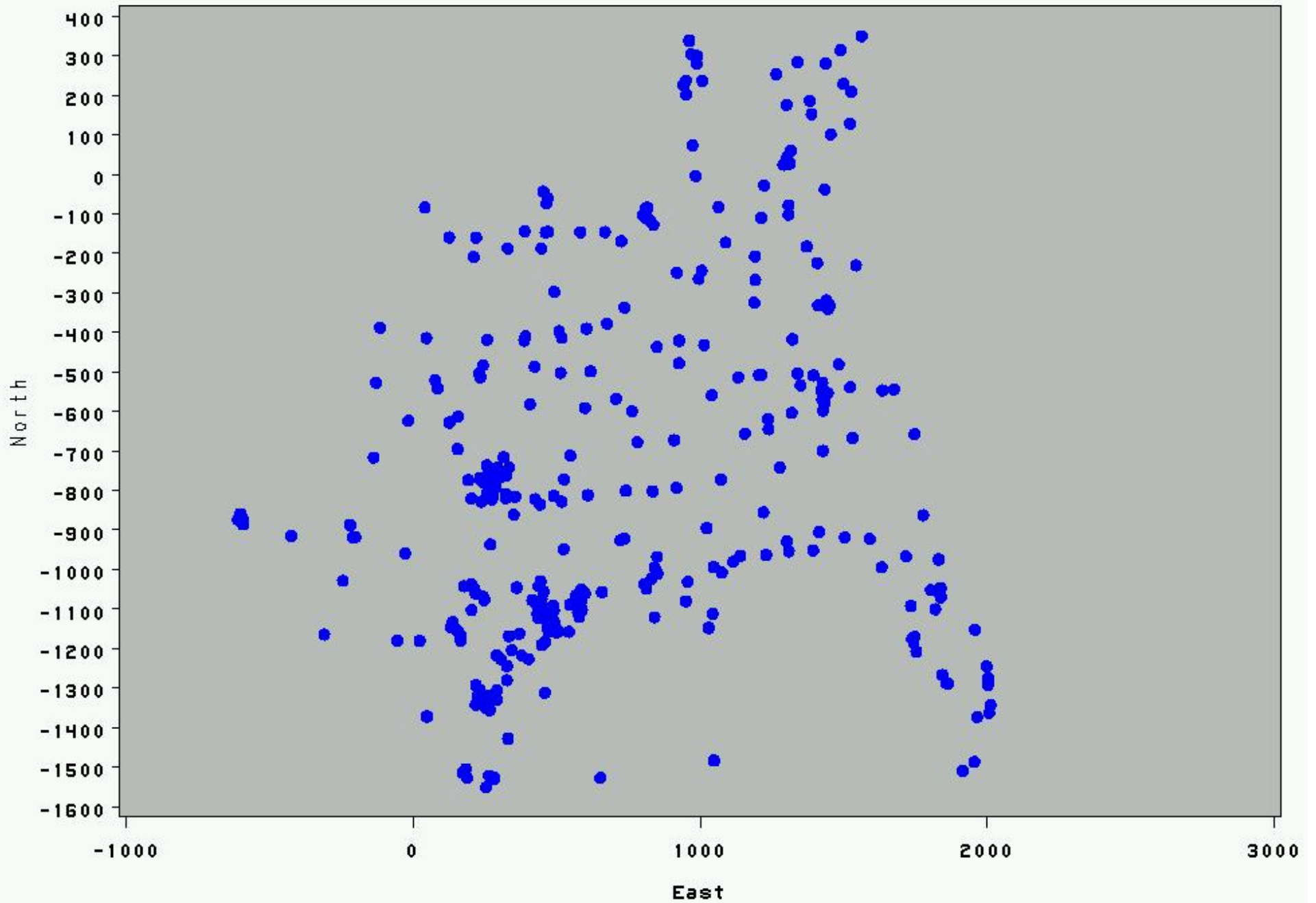
- Mesoscale meteorological model. In this case, MM5 is used in photochemical modeling, temperature data can be extracted from its output.
- Interpolation of ground observations. Most effective if there are many observation sites.

# Hourly temperature data

Used data from over 100 stations, including data from:

- National Weather Service
- EPA/state agency monitoring sites
- Texas Crop Weather Program
- Conrad Blucher Institute Texas Coastal Observation Network
- National Automated Buoy Data

# Scatter Plot of All Locations for 04Sep00



# Kriging

- A statistical technique which interpolates based upon the tendency of observations that are close together to be more similar than observations that are far apart.
- Spatial correlation is displayed with a semi-variogram, which shows how quickly observations diverge from each other as a function of distance.

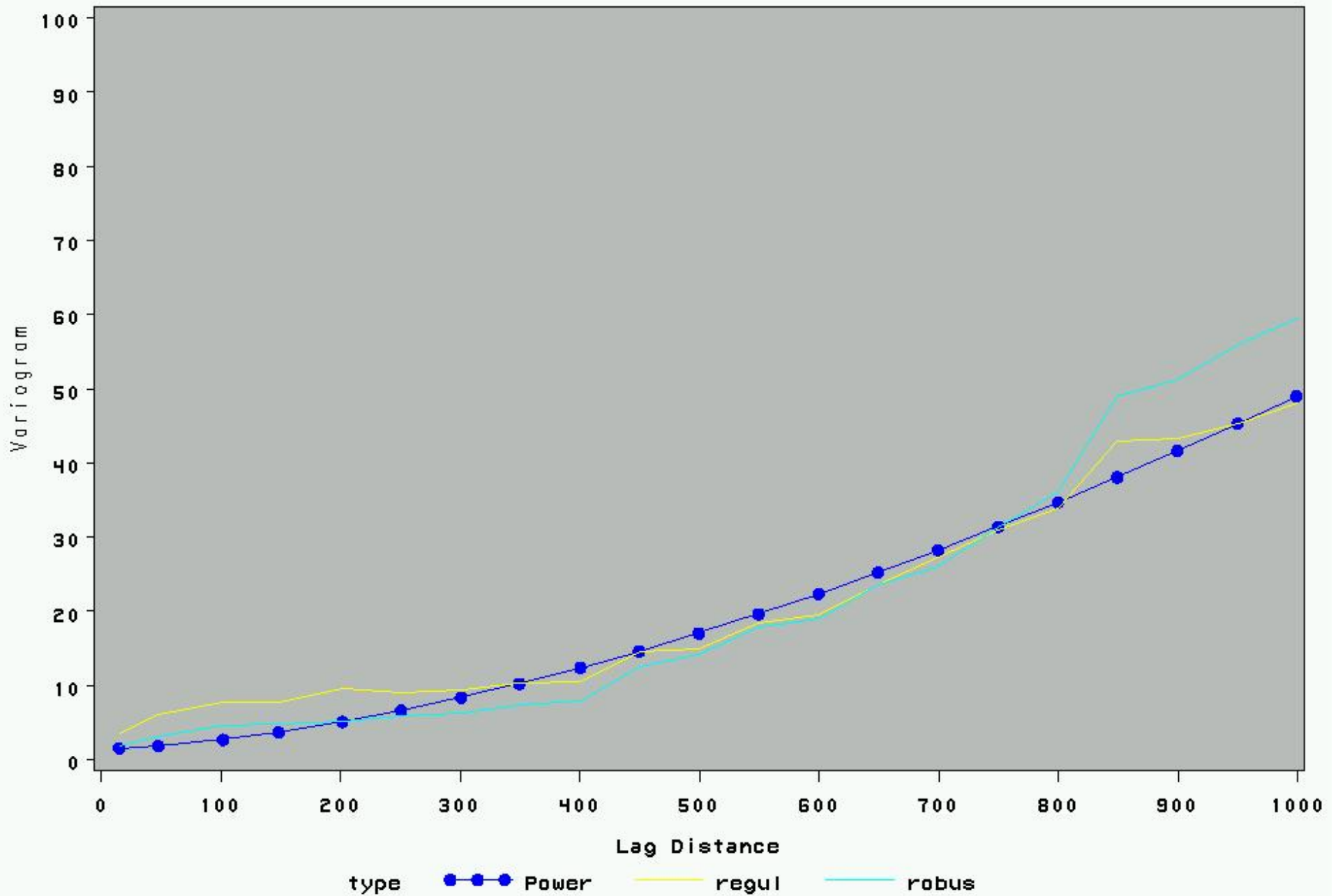
# Fitting the semi-variogram for each hour

- Default Surfer method: linear semi-variogram. However, some hours, the semi-variogram is clearly not linear.
- New method fits the semi-variogram for each hour using a power function.



# Theoretical and Sample Semivariogram for Air Temperature Data

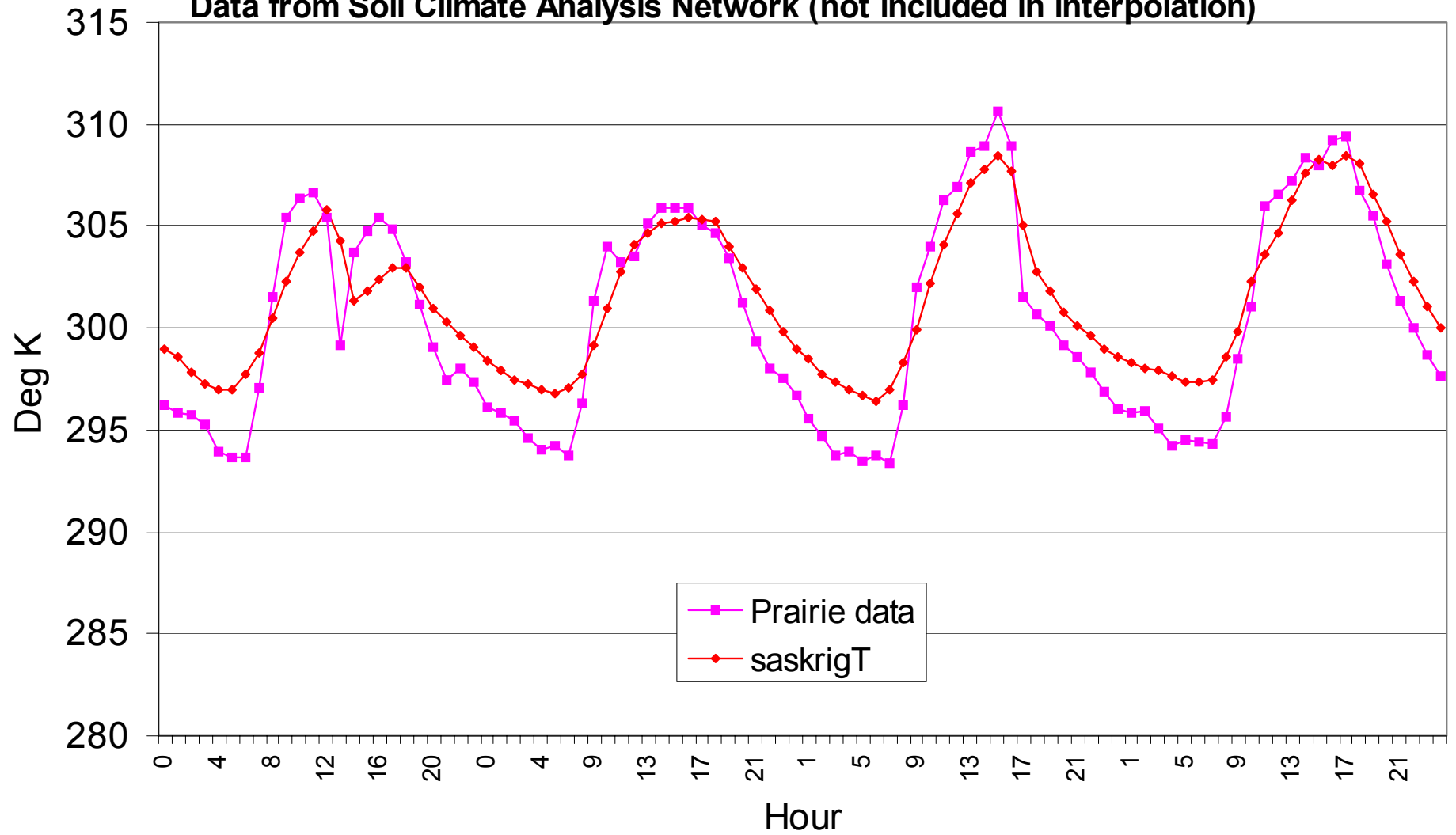
04Sep00, Hour 14



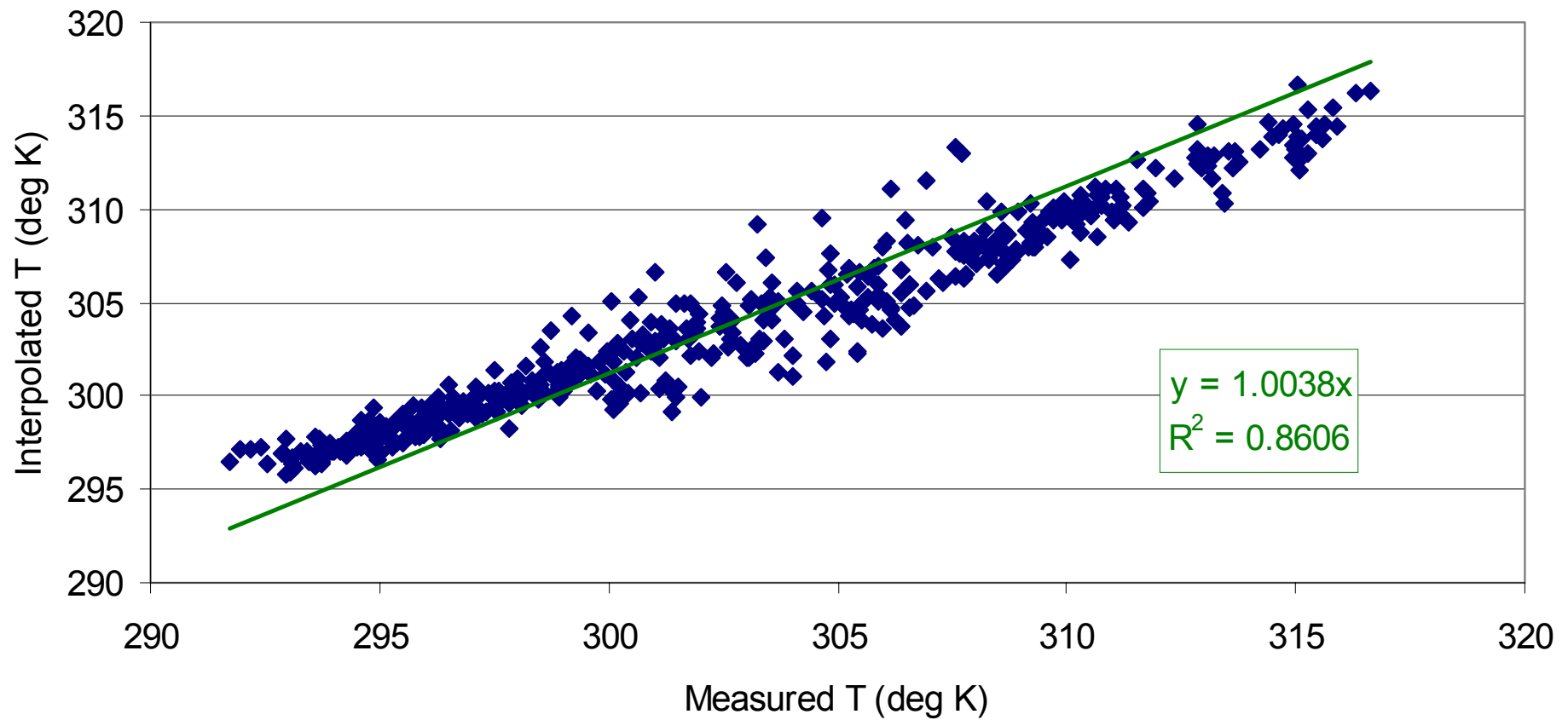
**Prairie View, observed T vs kriged T**

**August 22-25, 2000**

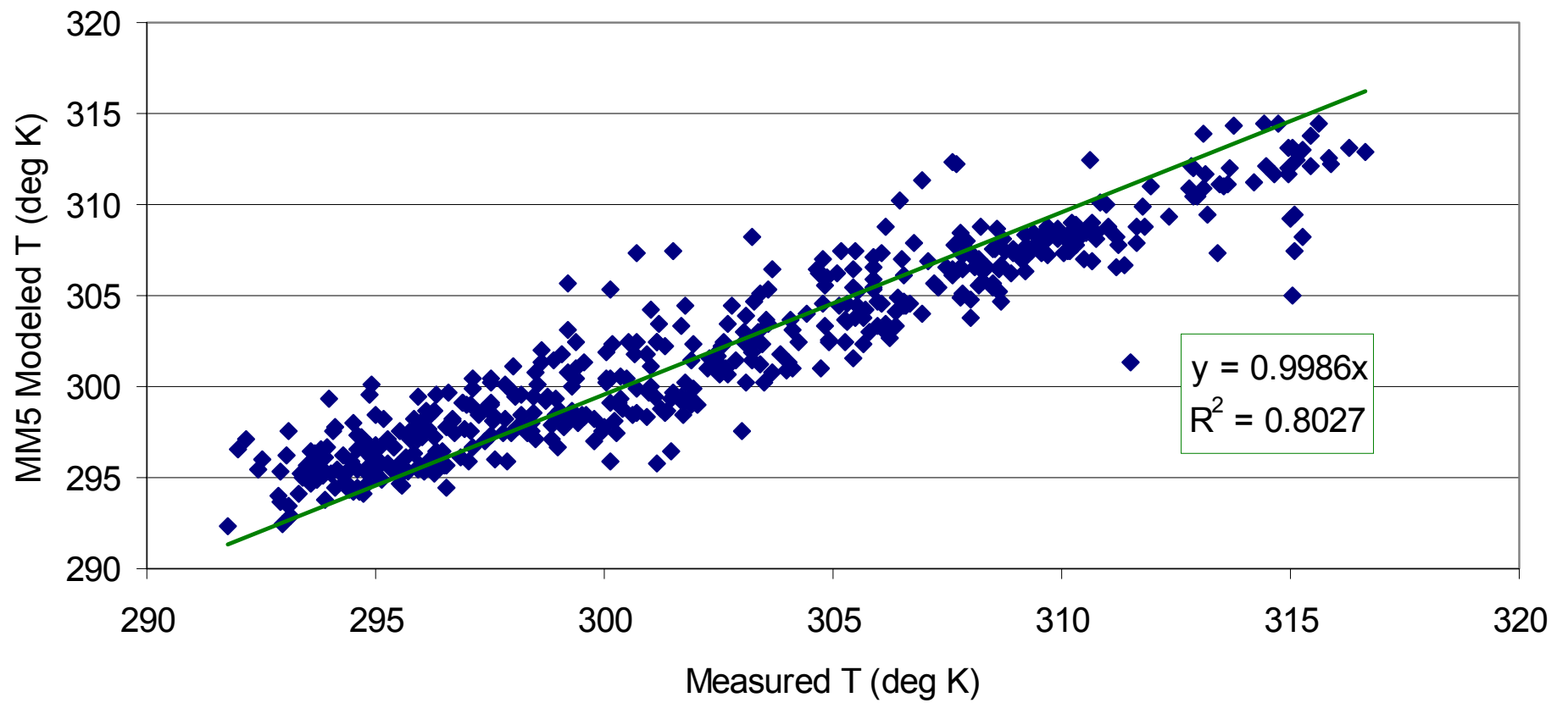
**Data from Soil Climate Analysis Network (not included in interpolation)**



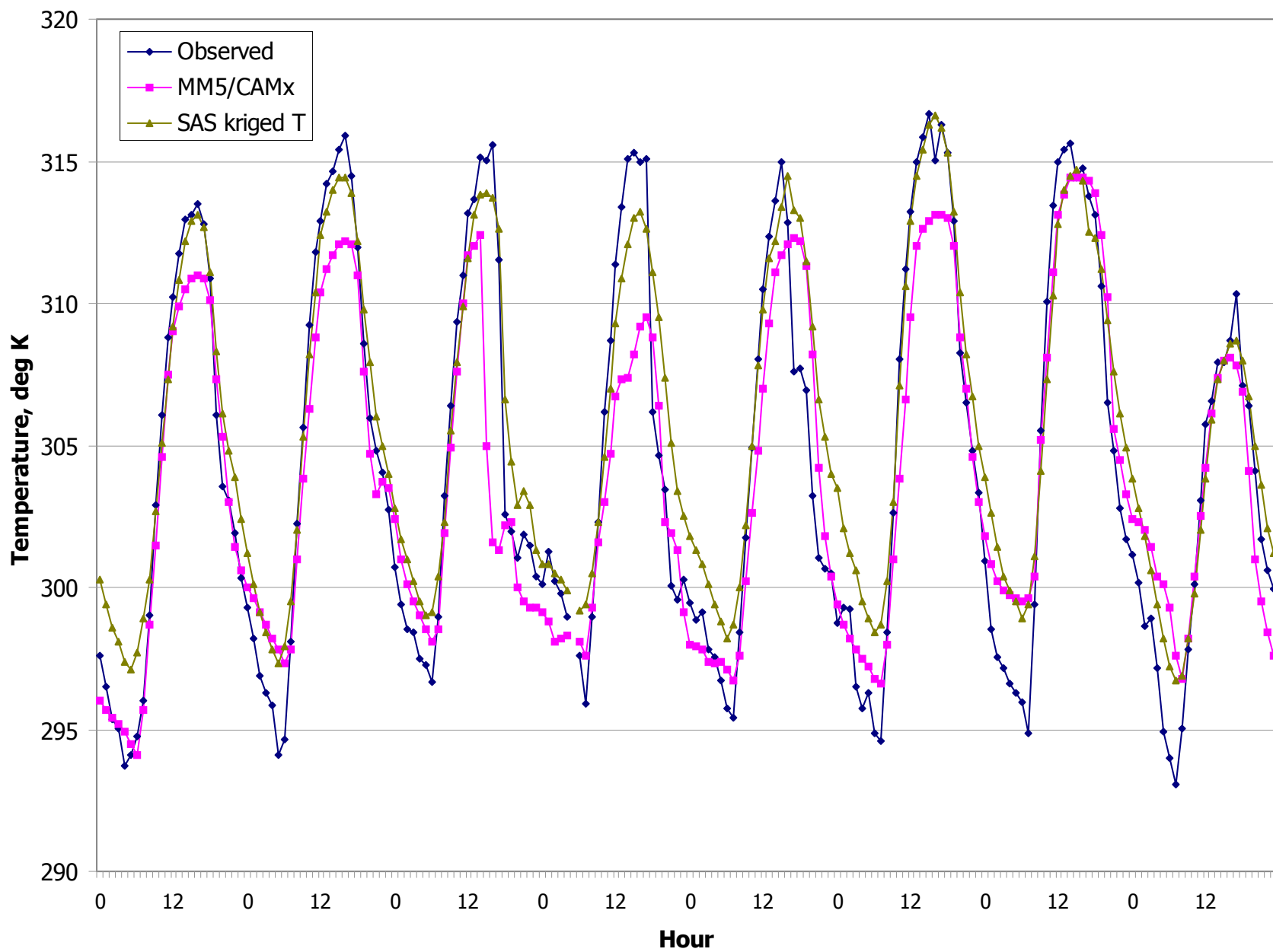
Prairie View Aug 18 - Sept 6, 2000  
Comparison of interpolated T and measured T  
Data from Soil Climate Analysis Network, which were not included in interpolation



Prairie View Aug 18-Sept 6, 2000  
Comparison of MM5 modeled T and measured T  
Data from Soil Climate Analysis Network

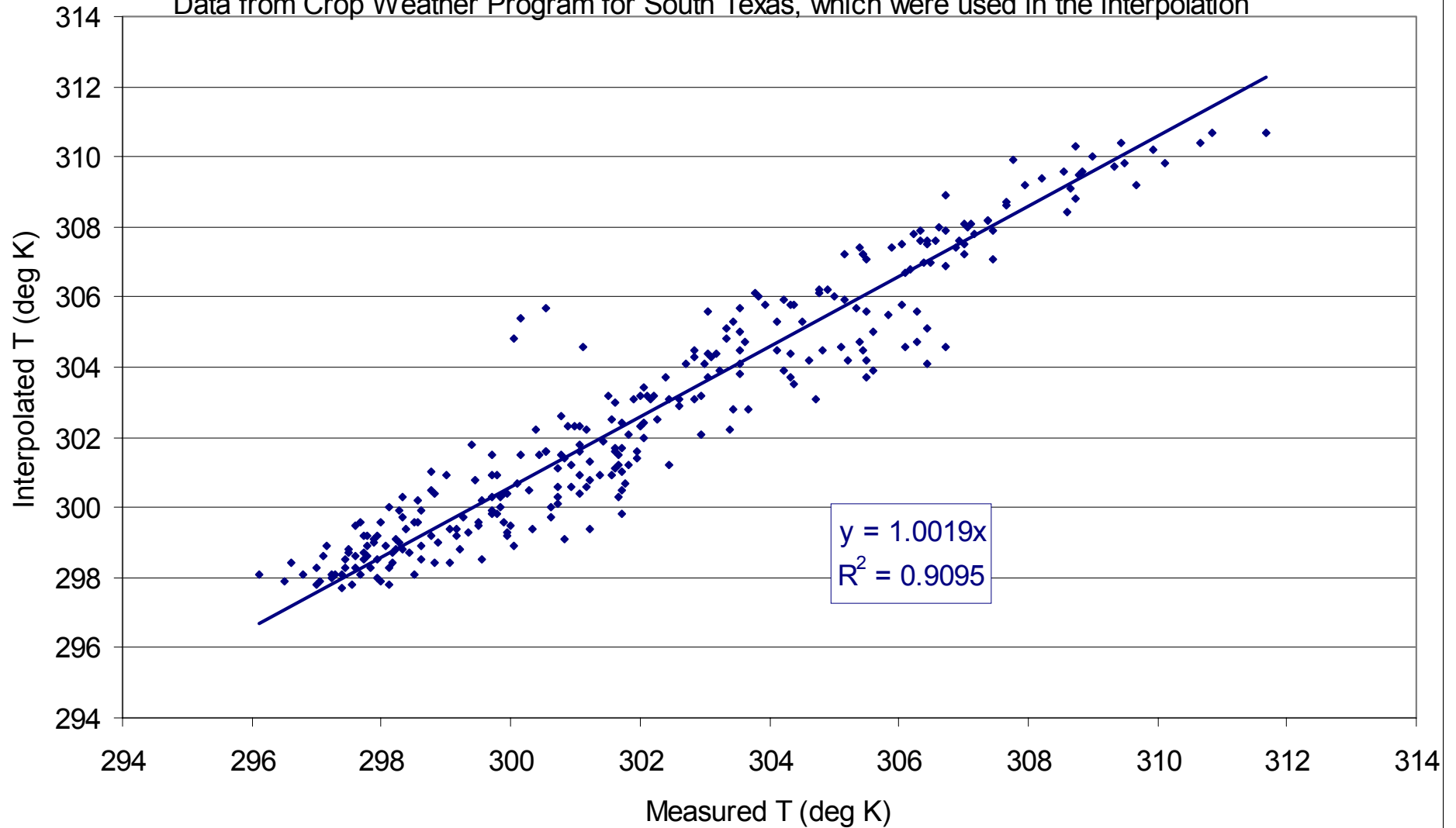


**Prairie View Aug 30-Sept 6, 2000**  
**Comparison of Observed and Modeled Temperatures**



Matagorda 4km interpolated T comparison  
Aug 22 - Sept 2, 2000

Data from Crop Weather Program for South Texas, which were used in the interpolation



# Hourly photosynthetically active solar radiation (PAR)

- GOES satellite acquires cloud imagery every hour.
- Radiation model can be used to derive ground-level solar radiation data over a wide area, e.g. using methods of

Pinker, R.T. and I. Laszlo, 1992. Modeling surface solar irradiance for satellite applications on a global scale. *J. Appl. Meteor.*, 31, 194-211.

- Can compare satellite PAR to ground-based broadband solar and PAR measurements.

# On-line satellite PAR data

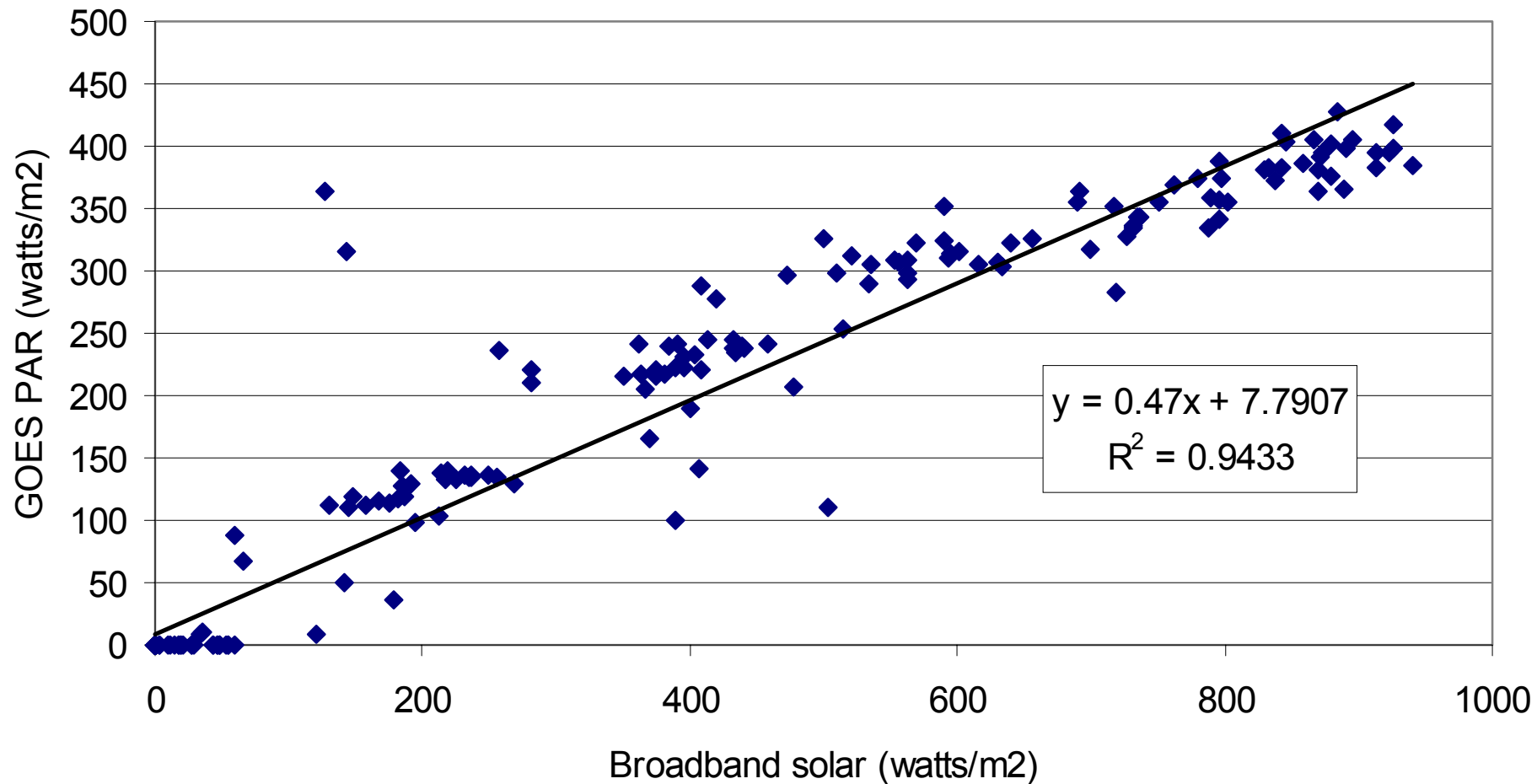
- GOES-derived half-degree satellite data available on-line from University of Maryland at:  
[www.atmos.umd.edu/~srb/gcip/cgi-bin/historic.cgi](http://www.atmos.umd.edu/~srb/gcip/cgi-bin/historic.cgi)
- GOES-derived 1/16 degree (approx. 4km) satellite data developed by R. Pinker, et al., University of Maryland



# Ground monitoring data

- Texas Solar Radiation Database (UT)
- TCEQ solar data
- Crop Weather Program solar data (TAMU)
- SURFRAD data (NOAA)—these are the only sites with measured PAR, but none are located in Texas
- Soil Climate Analysis Network data

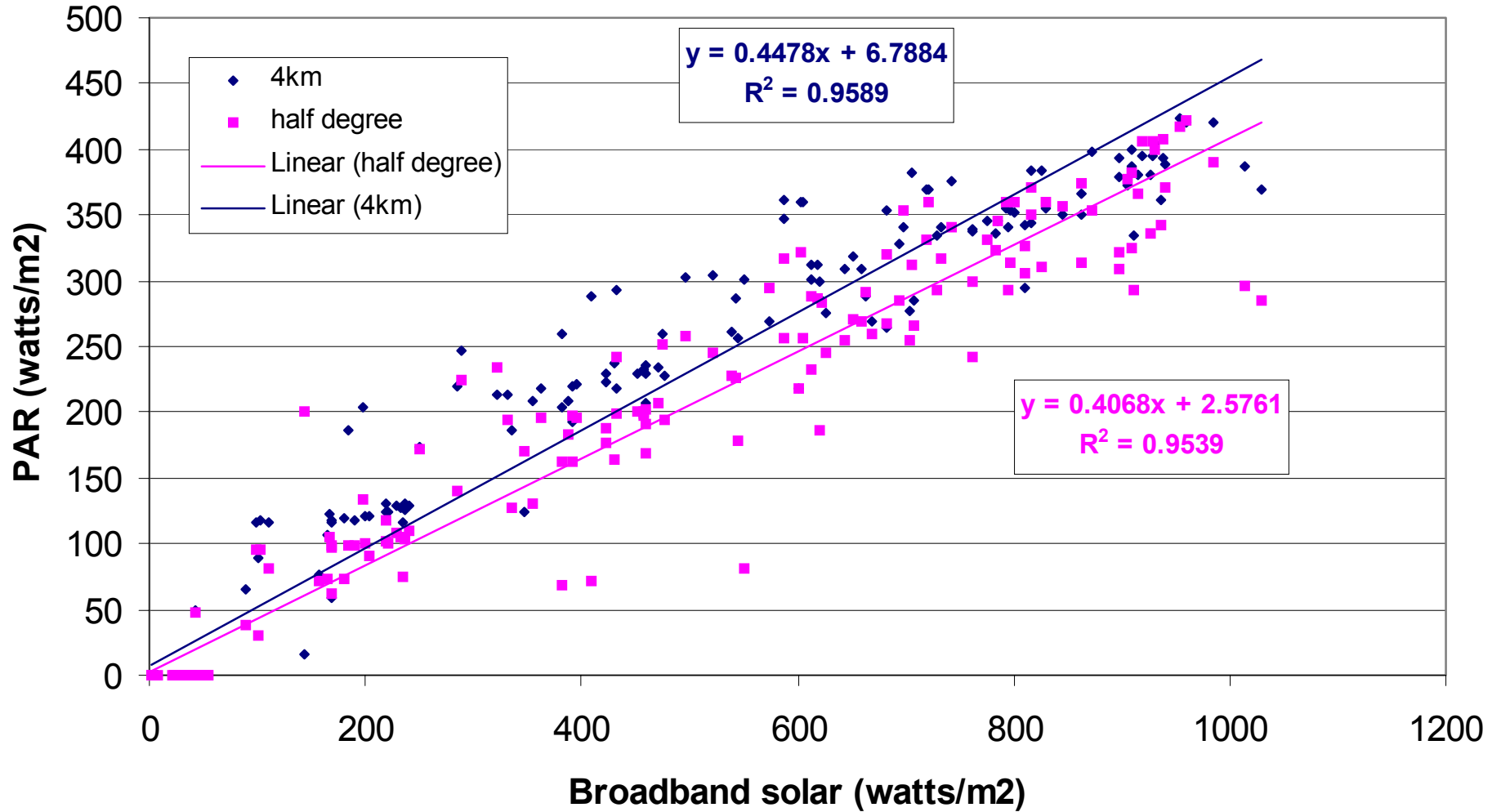
Clear Lake, TX broadband solar vs. 4km GOES PAR  
8/19-8/31, 2000  
Data from Texas Solar Radiation Database, Univ. Texas



# Prairie View comparison of 4km and half degree satellite PAR

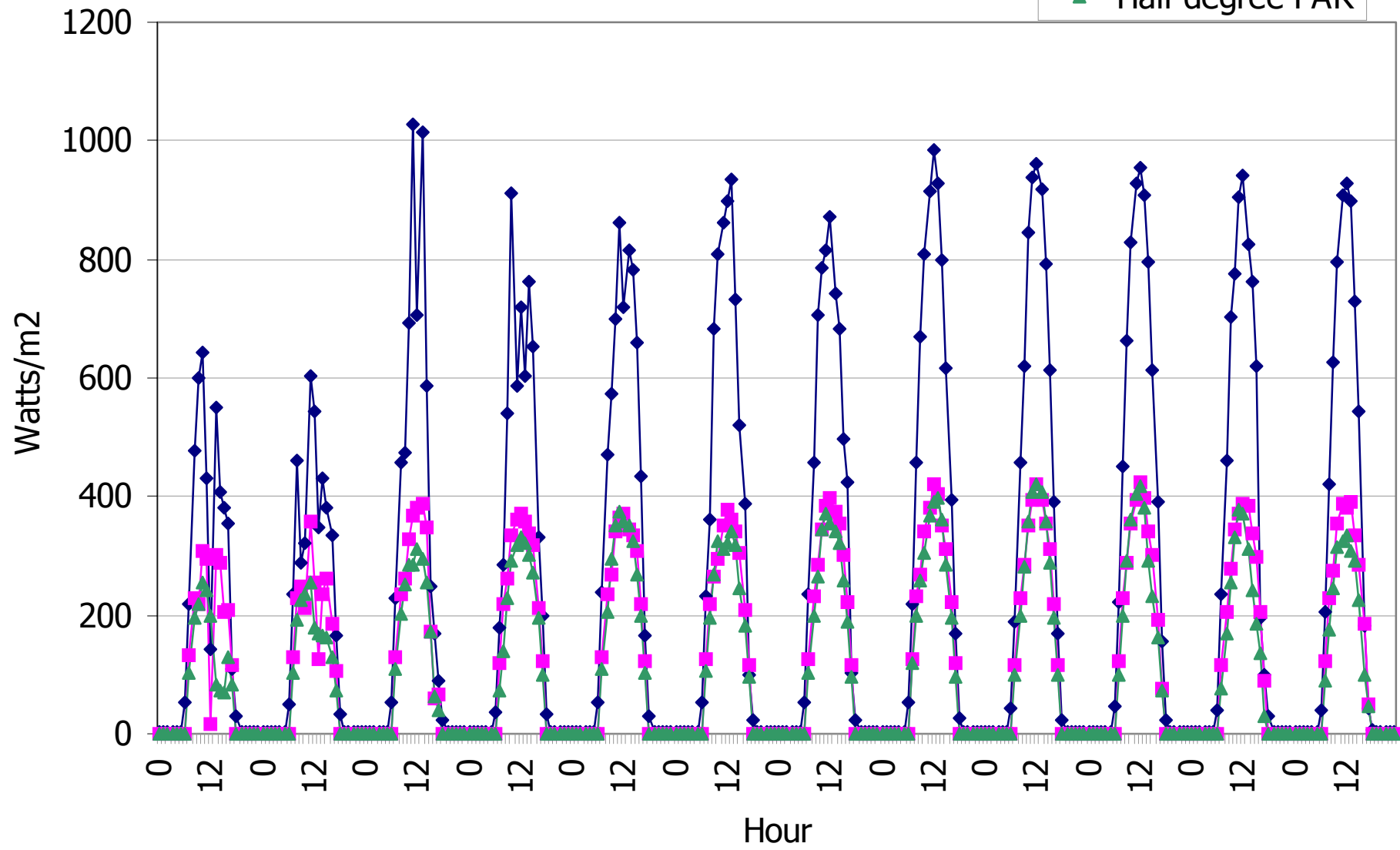
Aug 22 - Sept 2, 2000

Data from Soil Climate Analysis Network

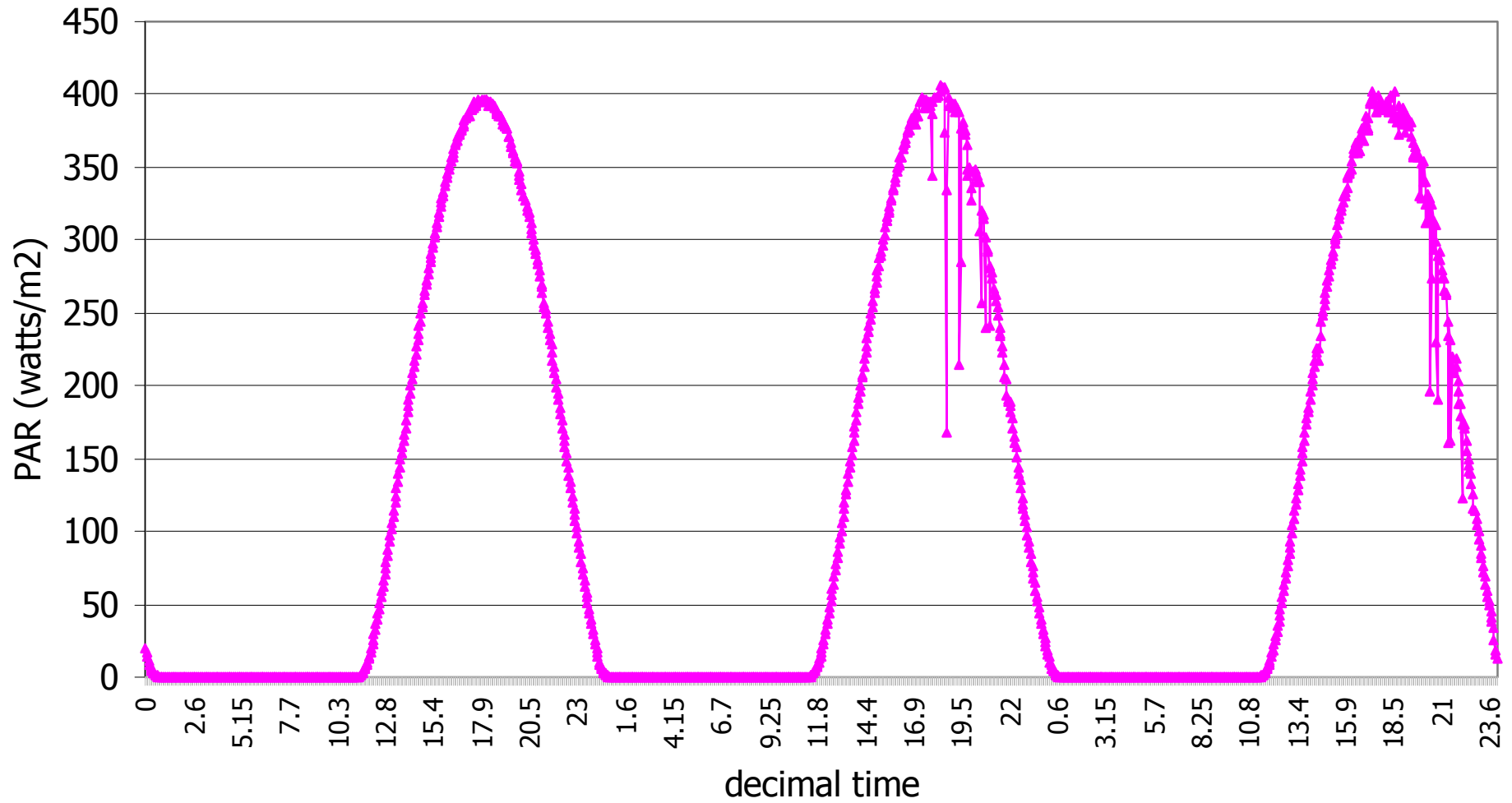


Prairie View solar data comparison  
Aug 22 - Sept 2, 2000

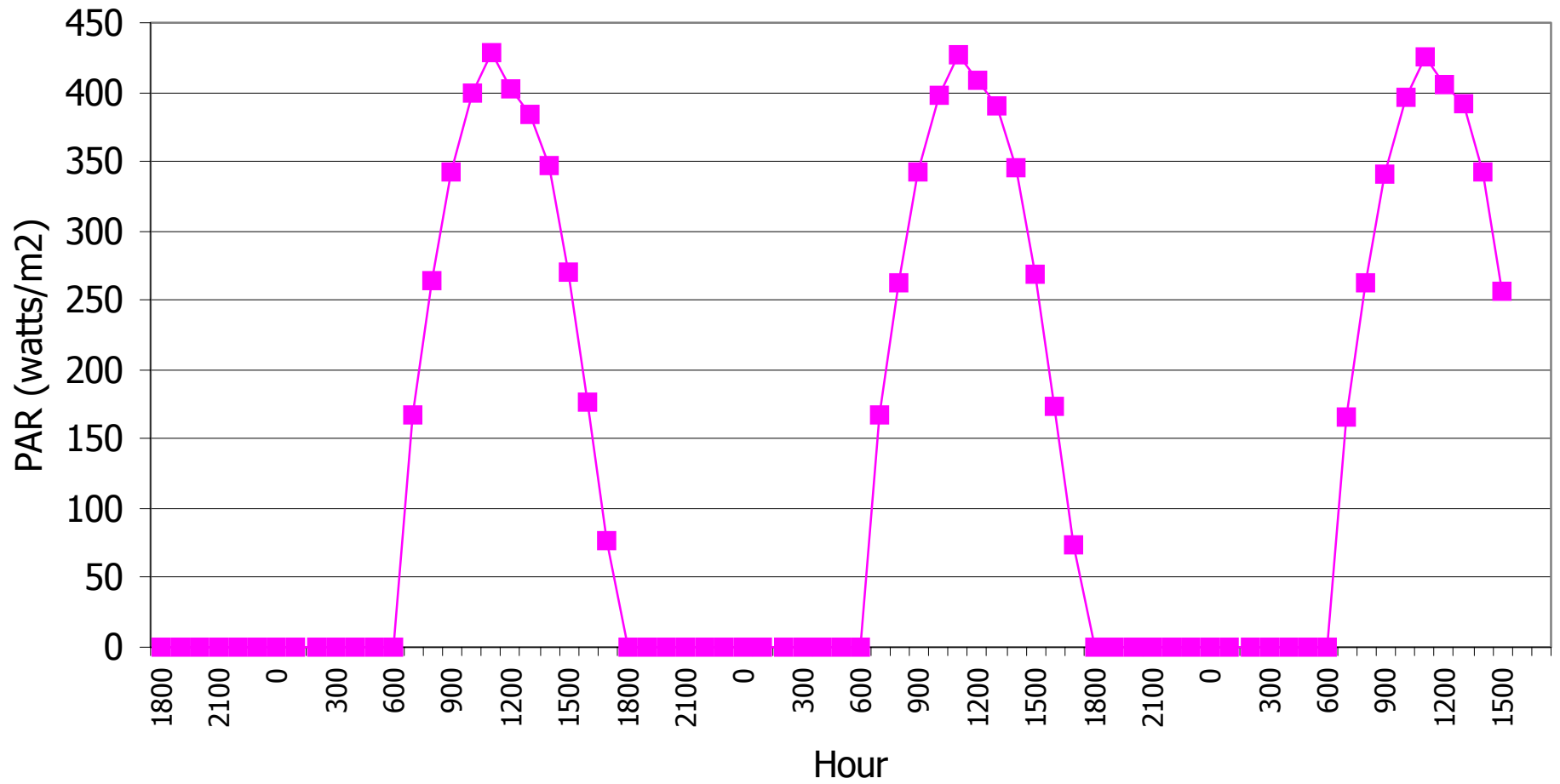
- ◆ Broadband solar
- 4km PAR
- ▲ Half degree PAR



Goodwin Creek, MS  
Measured PAR, 8/29 - 8/31  
Data from NOAA SURFRAD Network



Goodwin Creek, MS  
Satellite-derived PAR, 8/29-8/31, gridded to 12km



# Conclusions

- Kriging is an effective method of interpolating temperatures, but the method used here tends to overestimate at night.
- MM5 temperature data isn't necessarily better than interpolated temperatures.
- GOES satellite-derived PAR matches ground-level measurements very well.

# Web pages with useful data

- Soil Climate Analysis Network:  
[www.wcc.nrcs.usda.gov/scan/](http://www.wcc.nrcs.usda.gov/scan/)
- SURFRAD Network, NOAA:  
[www.srrb.noaa.gov/surfrad/sitepage.html](http://www.srrb.noaa.gov/surfrad/sitepage.html)
- Texas Solar Radiation Database:  
[www.me.utexas.edu/~solarlab/tsrdb/](http://www.me.utexas.edu/~solarlab/tsrdb/)
- Conrad Blucher Institute, Division of Nearshore Research, Texas A&M-Corpus Christi:  
[dnr.cbi.tamucc.edu/Main/HomePage](http://dnr.cbi.tamucc.edu/Main/HomePage)



# Web pages with useful data, continued

- The Crop Weather Program (Texas A&M)

[cwp.tamu.edu/cgi-  
bin/start.cgi/content/home.html](http://cwp.tamu.edu/cgi-bin/start.cgi/content/home.html)

- Louisiana Agriclimatic Information:

[www.agctr.lsu.edu/subjects/weather/](http://www.agctr.lsu.edu/subjects/weather/)