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Precipitation and Meteorological Data

Potomac TMDL Technical Coordination Meeting

October 23, 2003

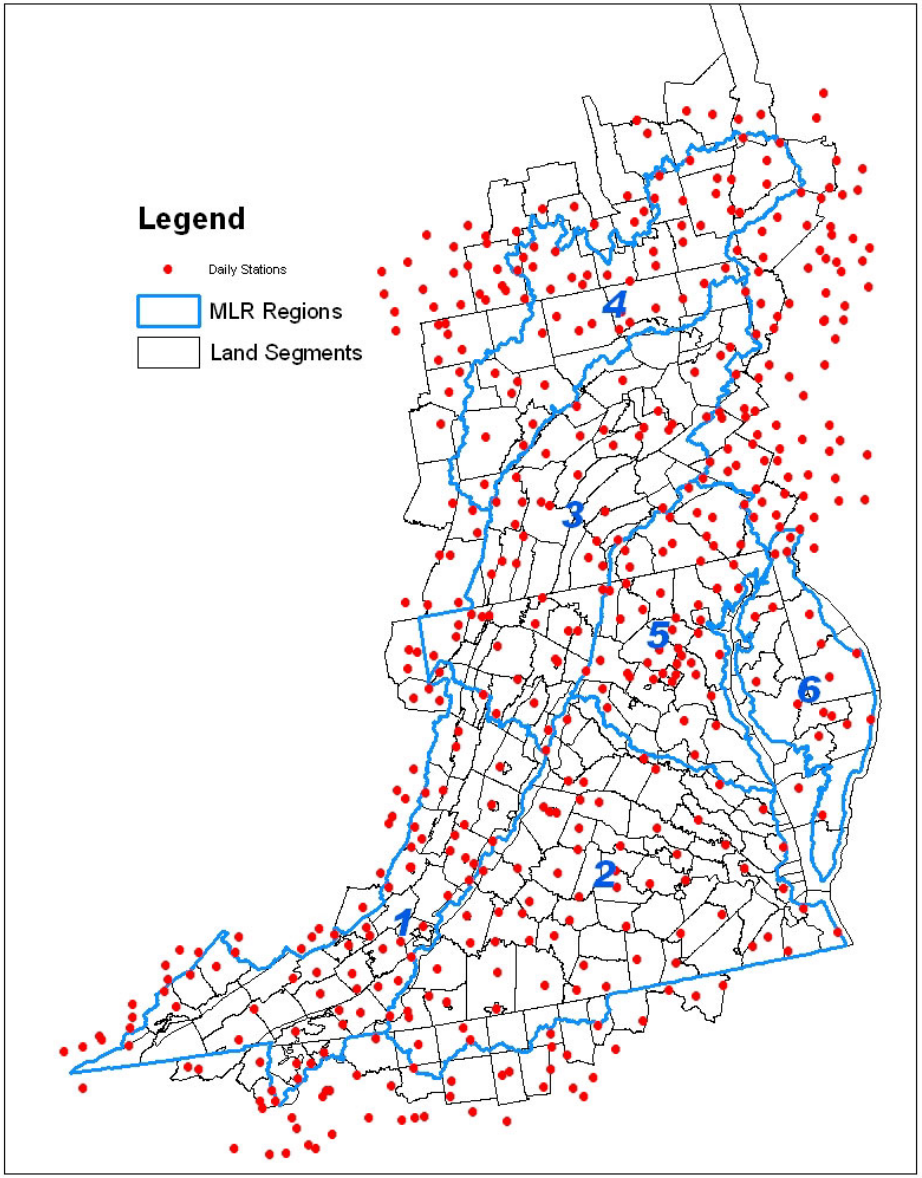
Objectives

- Spatially distribute available precipitation and temperature data to provide:
  - high-resolution, low-bias time-series
  - at an hourly time step
  - for use as input to hydrologic models
- Estimate hourly potential evapotranspiration (PET) on the same spatial scale
  - Hamon (1961) (temperature-based).

Approach

- Available data are daily and hourly recorded precipitation totals from climate stations within the study area, including a 25-km buffer around the area boundary.
  - 487 daily-data stations
  - 192 hourly-data stations (disaggregation)
- Temperature data are minimum and maximum daily temperatures from the 487 daily-data stations.

MLR Sub-regions



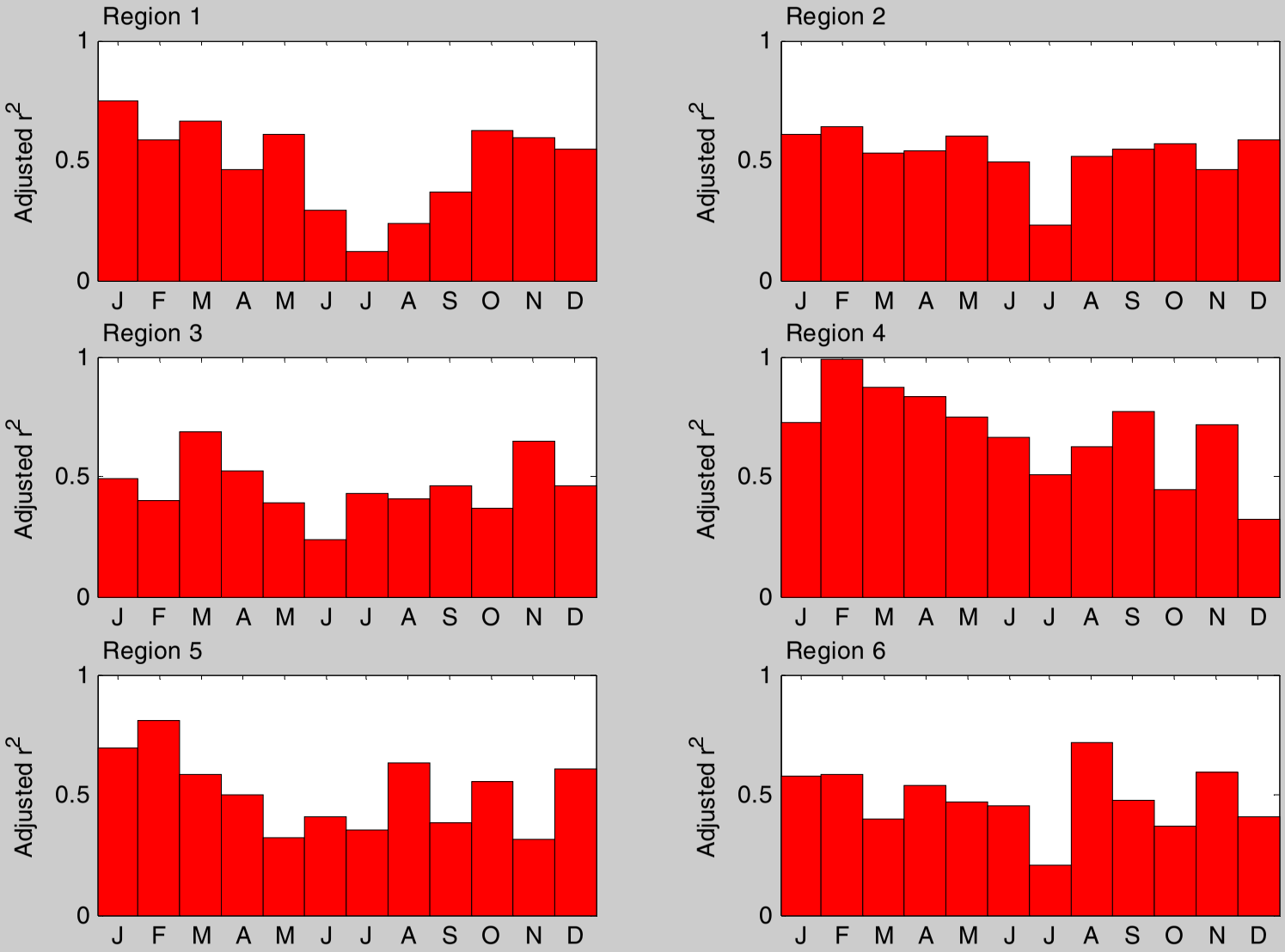
- The region was split into 6 sub-regions for MLR analysis
- Daily-data stations are shown.

xyz Methodology (Lauren Hay)

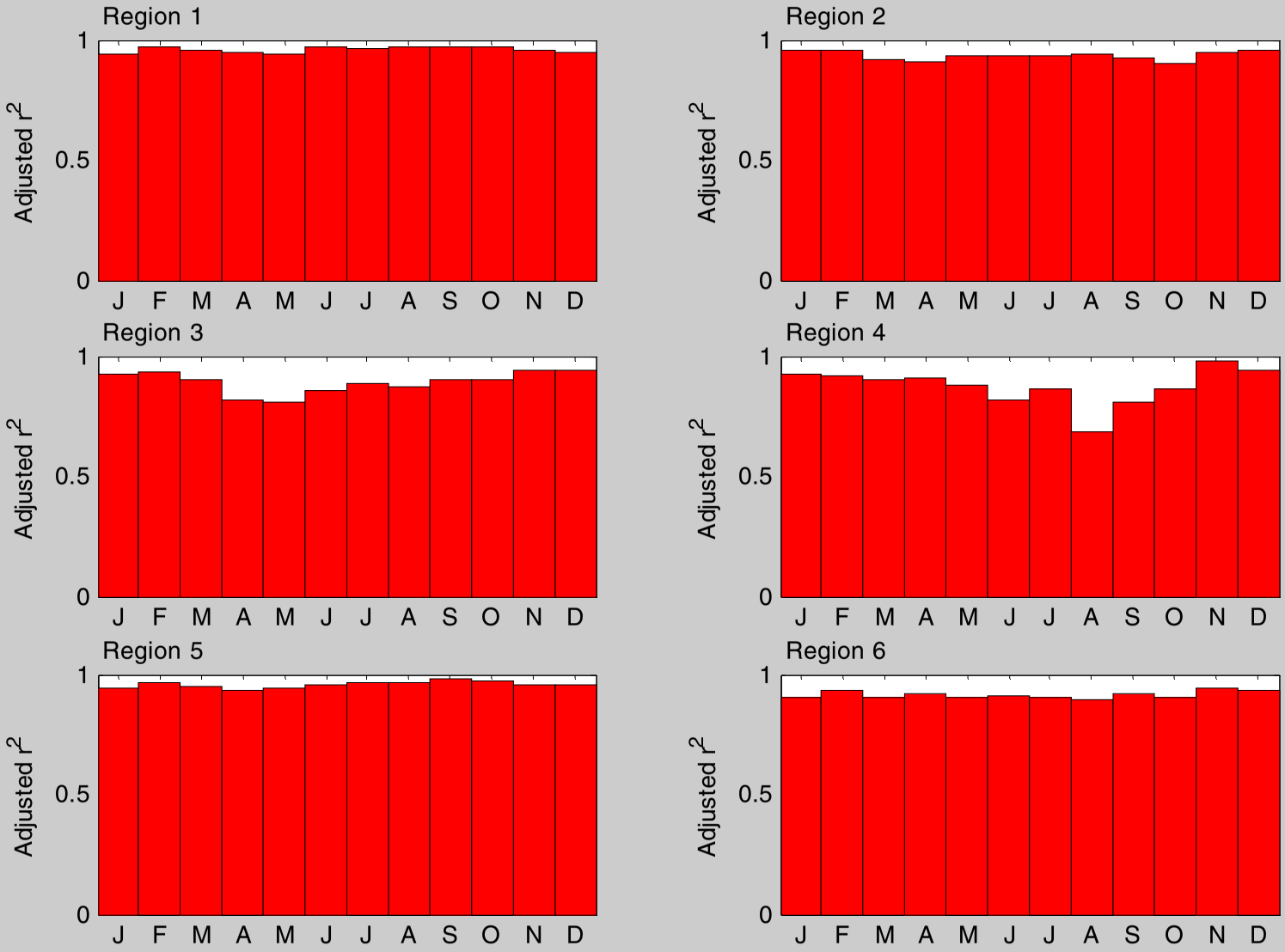
- Multiple linear regression (MLR) equations are developed for daily precipitation (*p*) in each of six sub-regions using independent variables *x*, *y*, and *z* from climate stations in each sub-region.
- The general form of the MLR equation is:

$$p = b_0 + b_1 x + b_2 y + b_3 z$$

MLR Results: Precipitation



MLR Results: Temperature



xyz Methodology

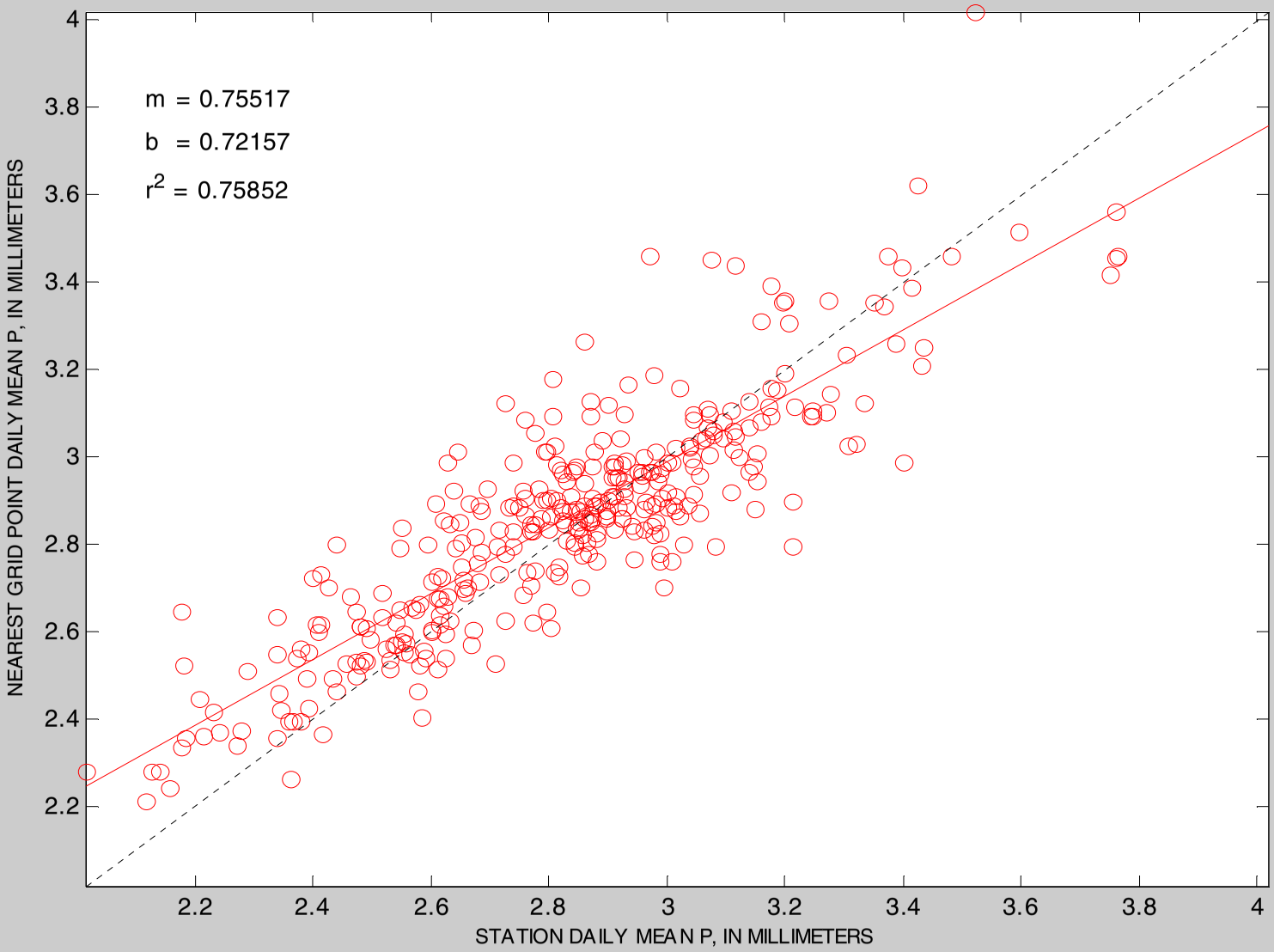
To estimate daily *p* for each grid cell within the study area:

- Mean daily *p* and corresponding *x*-*y*-*z* values from a selected daily station subset are used with "lapse rates" (b_1, b_2, b_3) of monthly MLRs to compute a unique b_0 value for that day.
- Equation is solved for daily *p* using the *x*-*y*-*z* values of each grid cell and the b_i values.

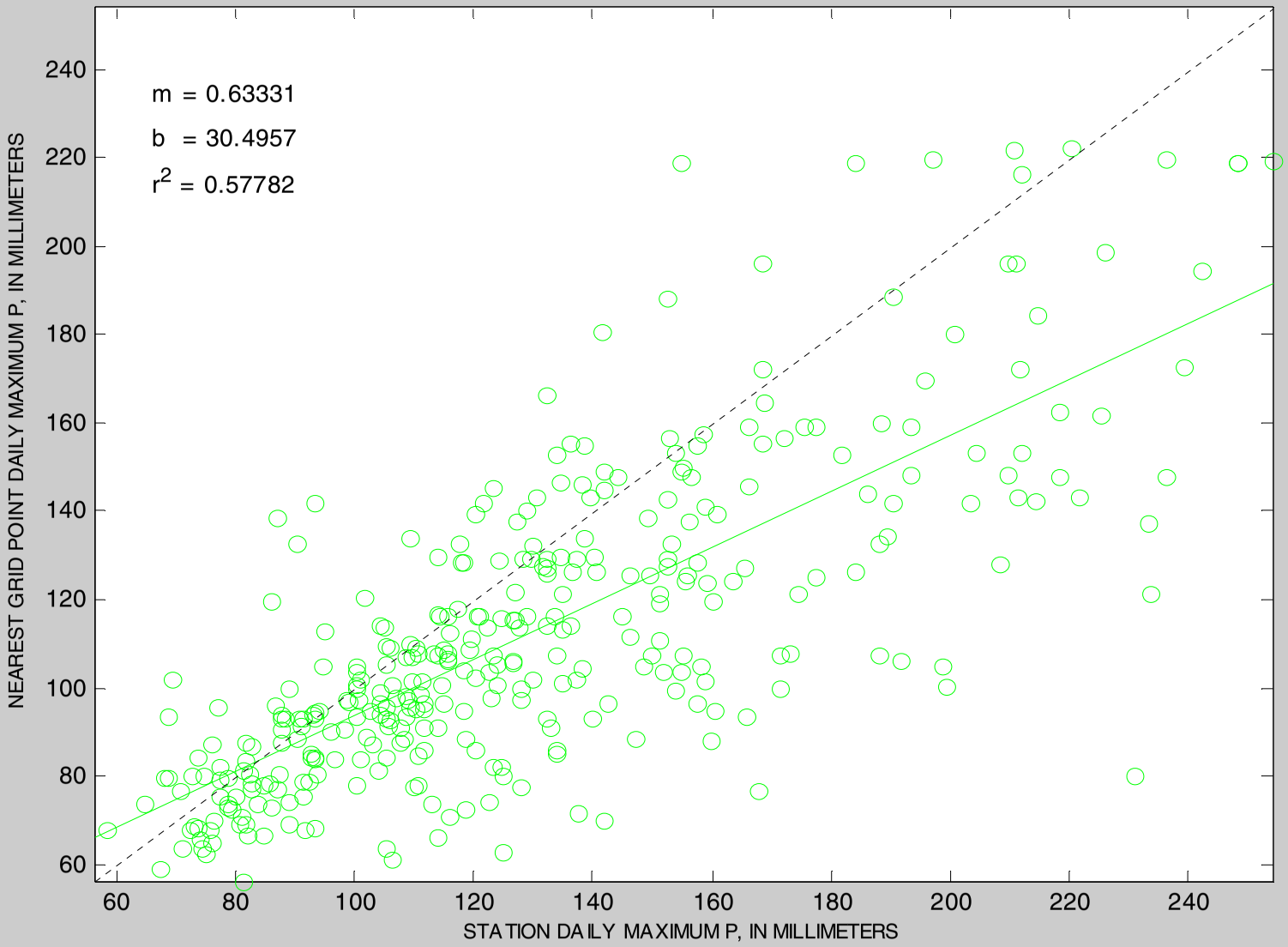
Model Run Options

```
1 1 1        1. OUTPUT              prcp (0=No, 1=Yes), temp (0=No, 1=Yes), pet (0=No, 1=Yes)

19840101     2. BEGINNING DATE:     yyyymmdd (earliest hourly data is 19840101)

19991231     3. ENDING DATE:        yyyymmdd (latest 19991231)

1            4. MLR ANCHOR:         Mean (1) or max (2)

75.          5. HOURLY %:           Percent of daily volume to match

1000000.     6. DISTANCE            Distance (m) that you will search for that volume

3            7. OUTPUT FORMAT:      Daily (1), daily and hourly (2), or just hourly (3)

1            8. OUTPUT FORMAT2:     FIPS (1), GRIDDED (2), FIPS and GRIDDED (3)

0.0055       9. HAMON COEFFICIENT:  Coefficient used in Hamon PET computations

2           10. PET HOURLY:         Disagregation method (1=Daily/24, 2=distribute during daylight hours)


 Statistics printed to file: STATS

 MODEL FINISHED RUNNING............

  69. % of time hourly station was located     1000000.m
   from daily station with ppt volume within  75.% of calculated daily
```

Comparison with Stations



Comparison with Stations



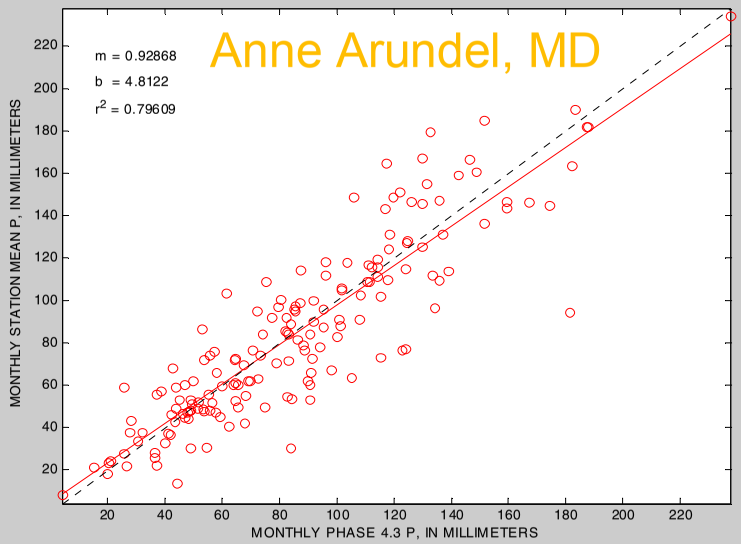
Scope

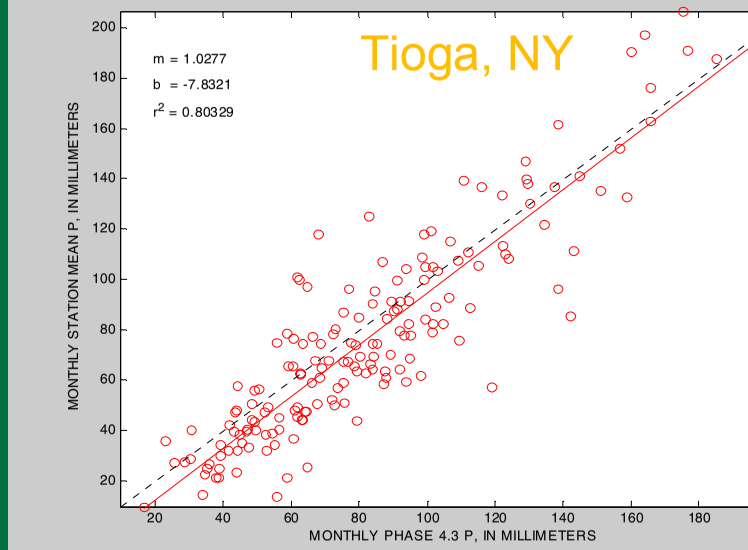
- Daily precipitation values are estimated for 5-km square grid points throughout the model region.
- Daily precipitation for each land segment within the model region is computed as a weighted average of the estimates from grid points within each land segment.

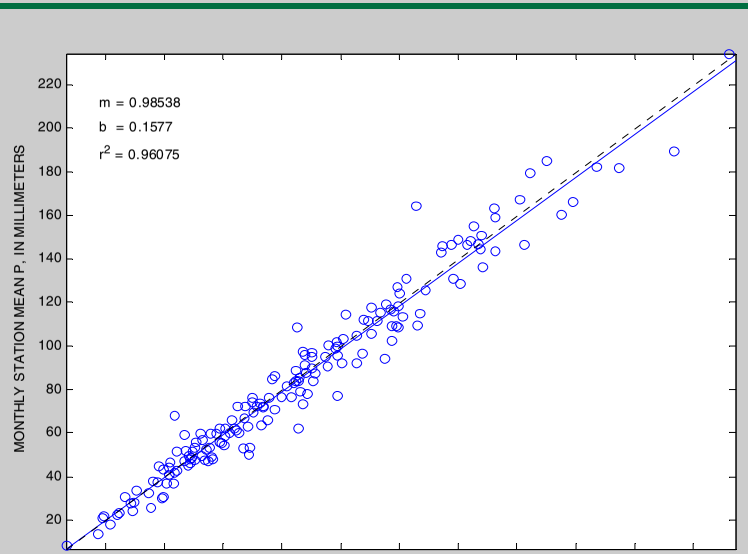
Scope

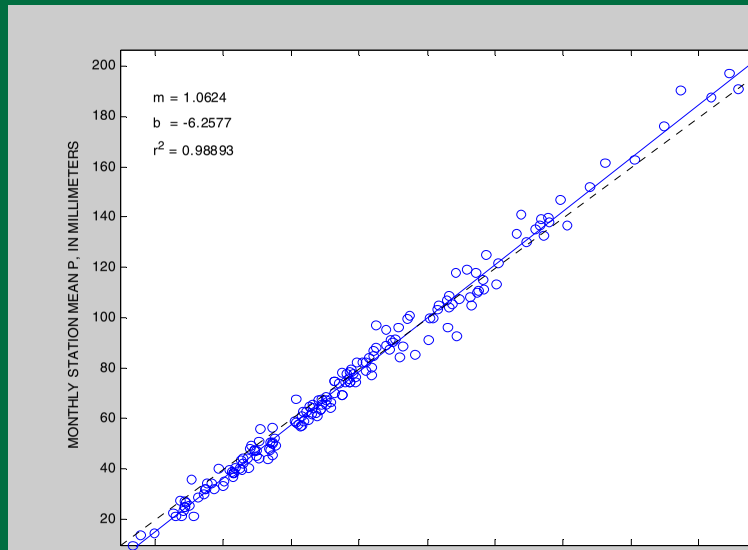
- Estimated daily precipitation data are disaggregated into hourly data using:
  - recorded hourly precipitation from the nearest climate station with similar precipitation volume, or
  - Mean-hourly precipitation by month and MLR region.
- Estimated daily precipitation totals are preserved during disaggregation.

Comparison with Phase 4.3

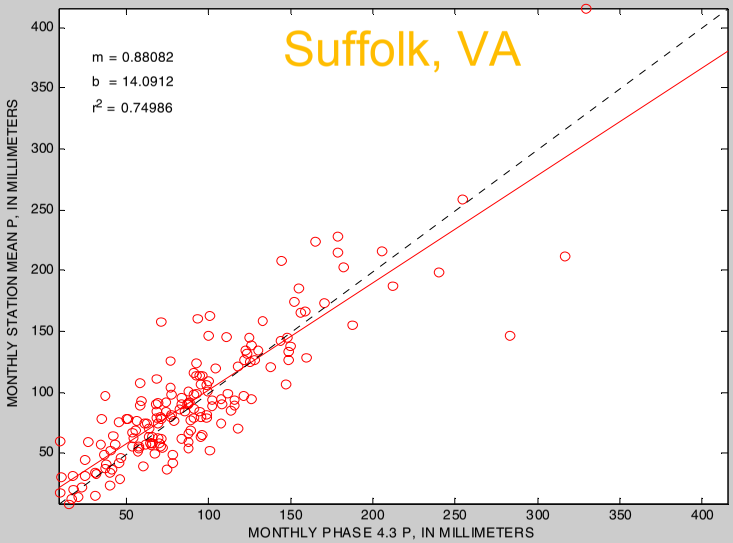


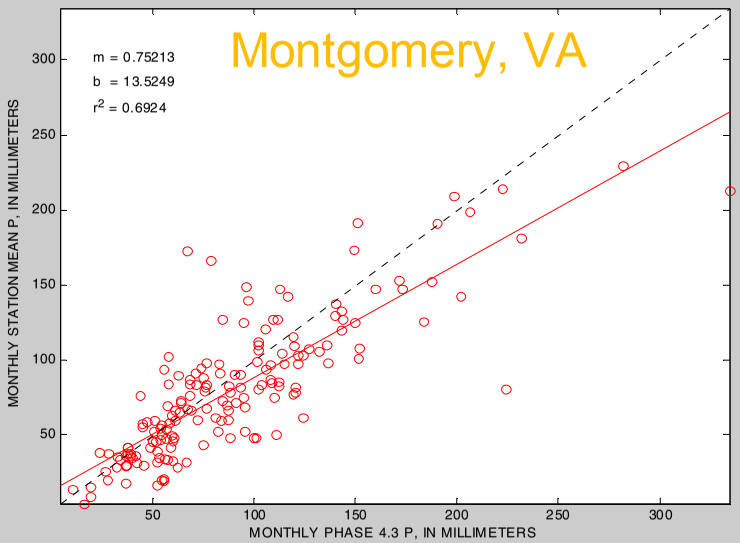


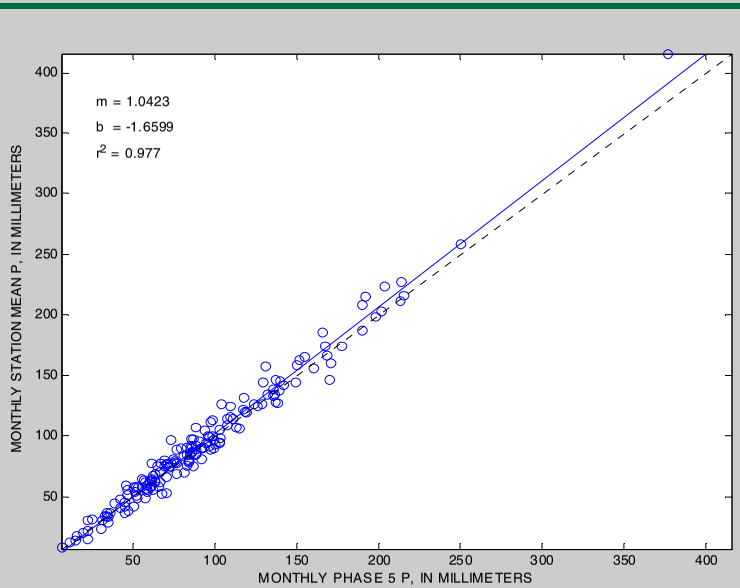


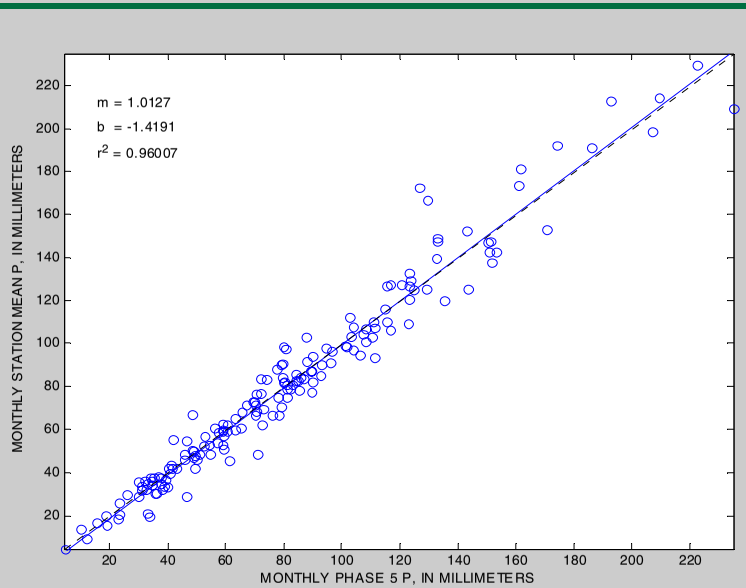


Comparison with Phase 4.3

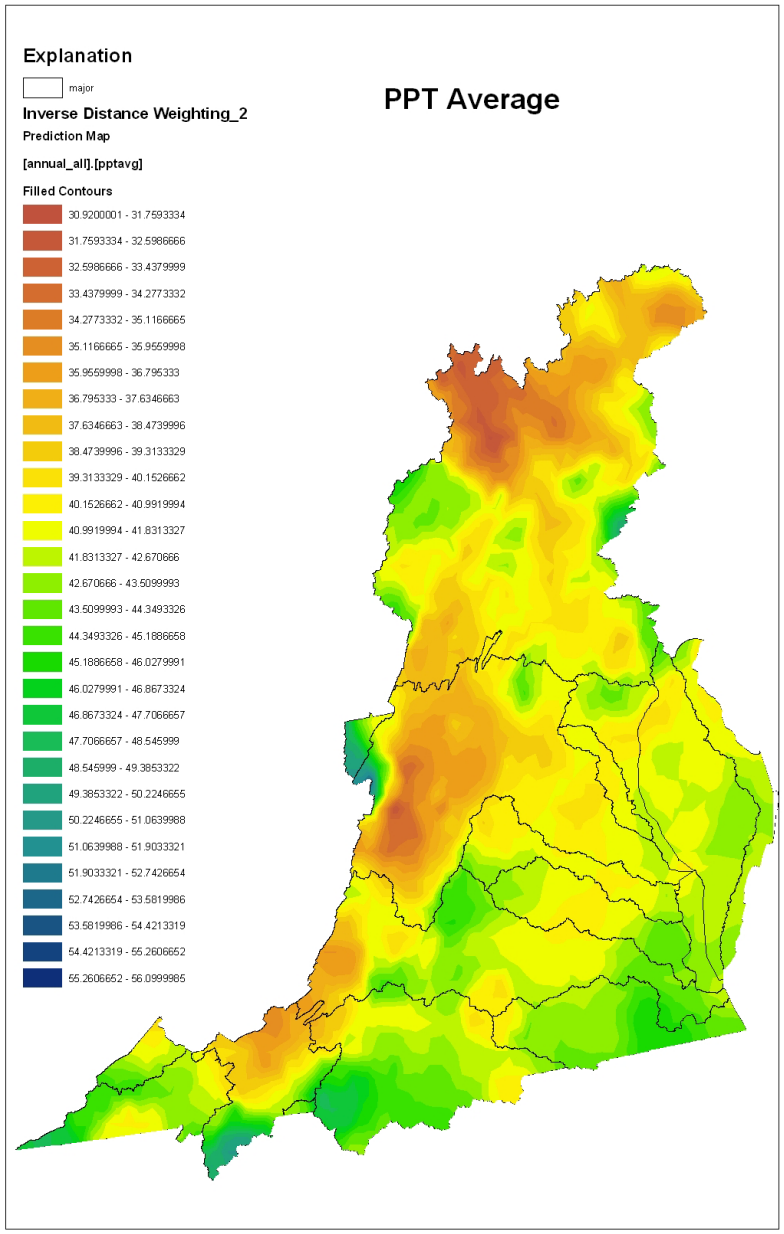


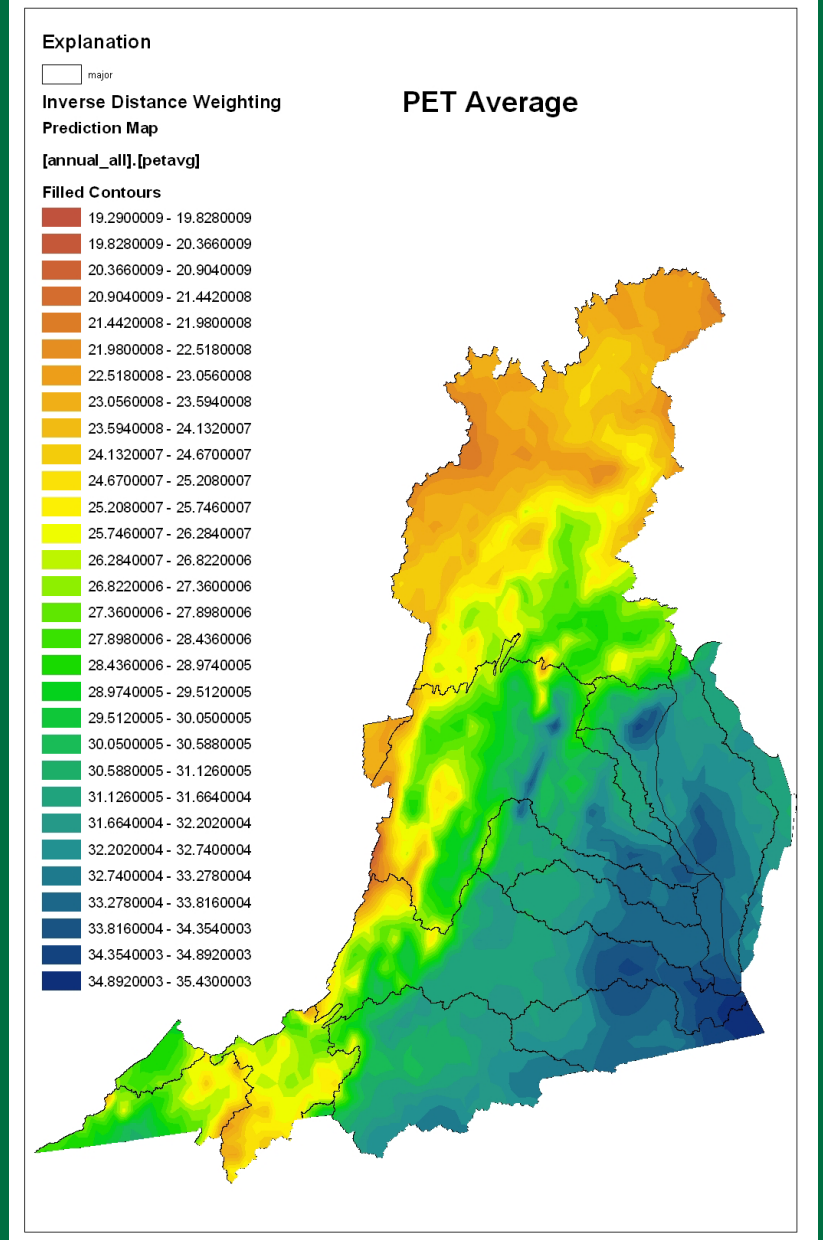






Spatial Detail





Summary

- Hourly precipitation, temperature, and potential evapotranspiration have been modeled using spatial regression
- Estimates for model land segments have been compiled into WDM files
- The correlation between station monthly precipitation and estimated precipitation in the land segments is significantly improved over Phase 4.3