

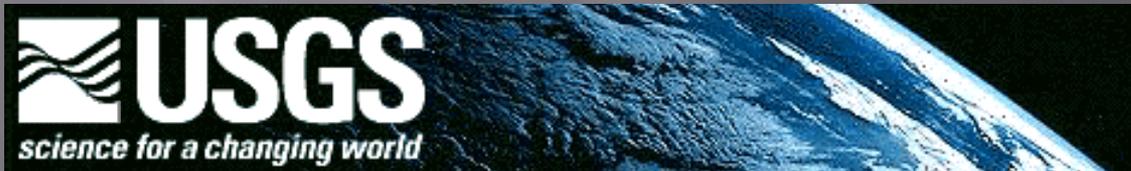
HOW WE RESOLVED CHALLENGES WITH PRMS CLIMATE DISTRIBUTION

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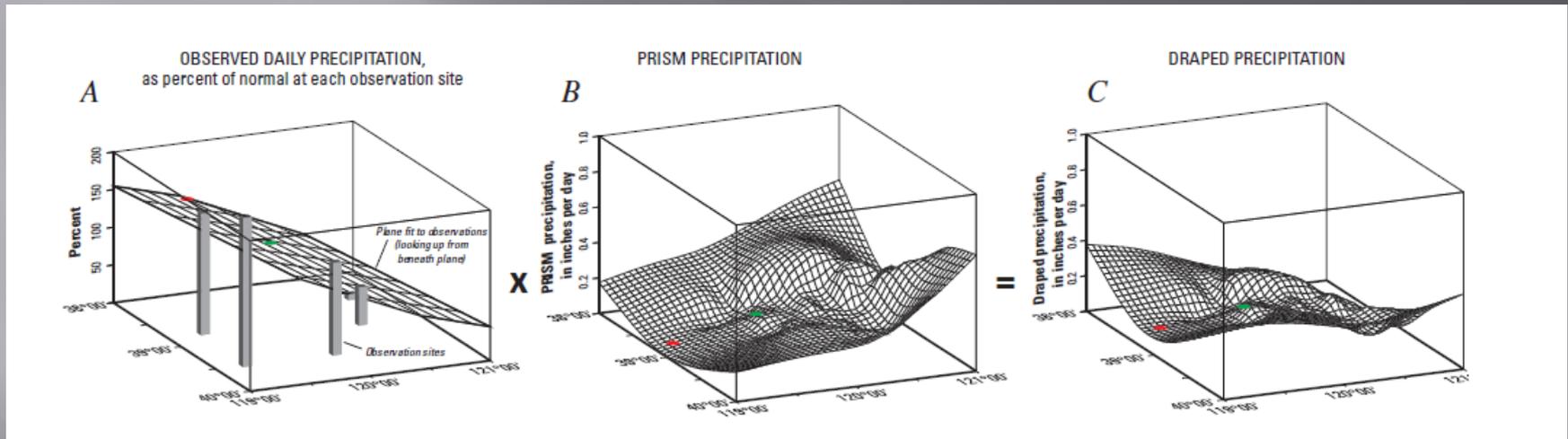


Precipitation Runoff Modeling System (PRMS) requires daily climate data inputs for each HRU

- ▣ Data Needed:
 - daily precipitation
 - daily maximum temperature
 - daily minimum temperature

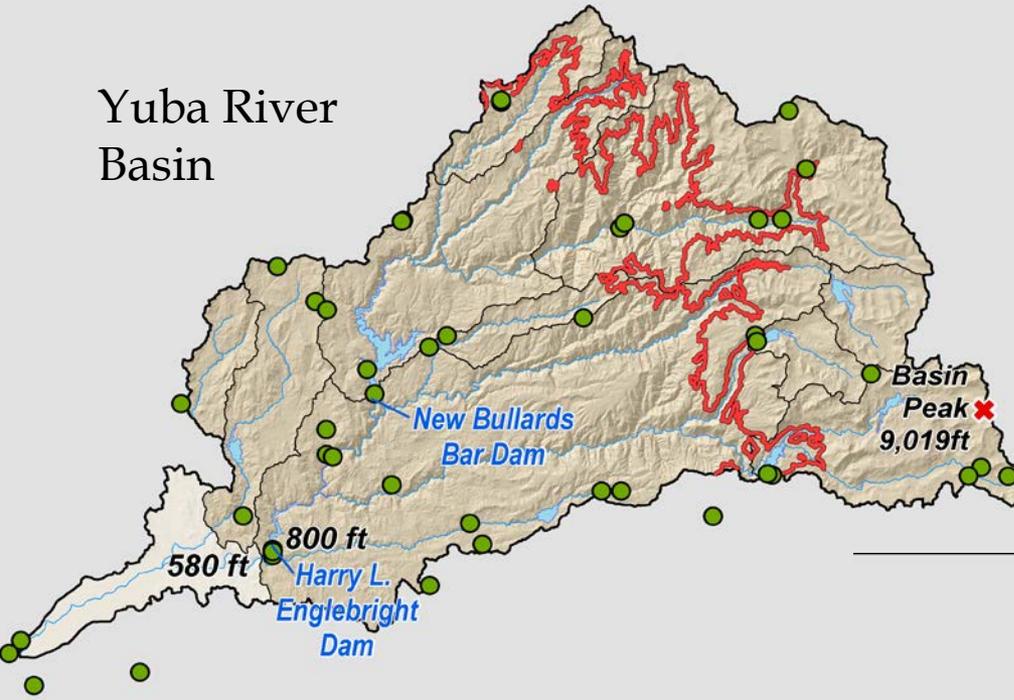
- ▣ PRMS modules used:
 - Temperature: (Merced1) temp_1sta, **climate_hru**
 - Precipitation: **climate_hru**

Preprocessing Data: DRAPER Climate Distribution Tool

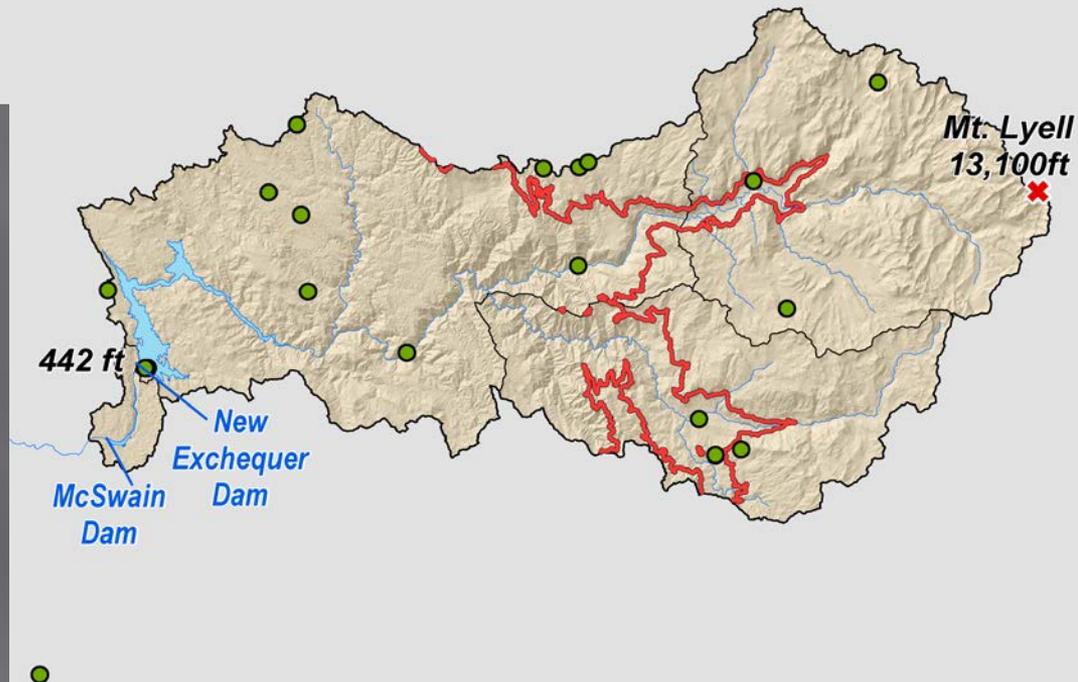


- Input data:
 - HRU centroid lat/long
 - Climate station lat/long and daily data
 - 30-year mean-monthly PRISM averages for HRU areas.
- Output:
 - Daily precipitation by HRU
 - Daily maximum temperature by HRU
 - Daily minimum temperature by HRU

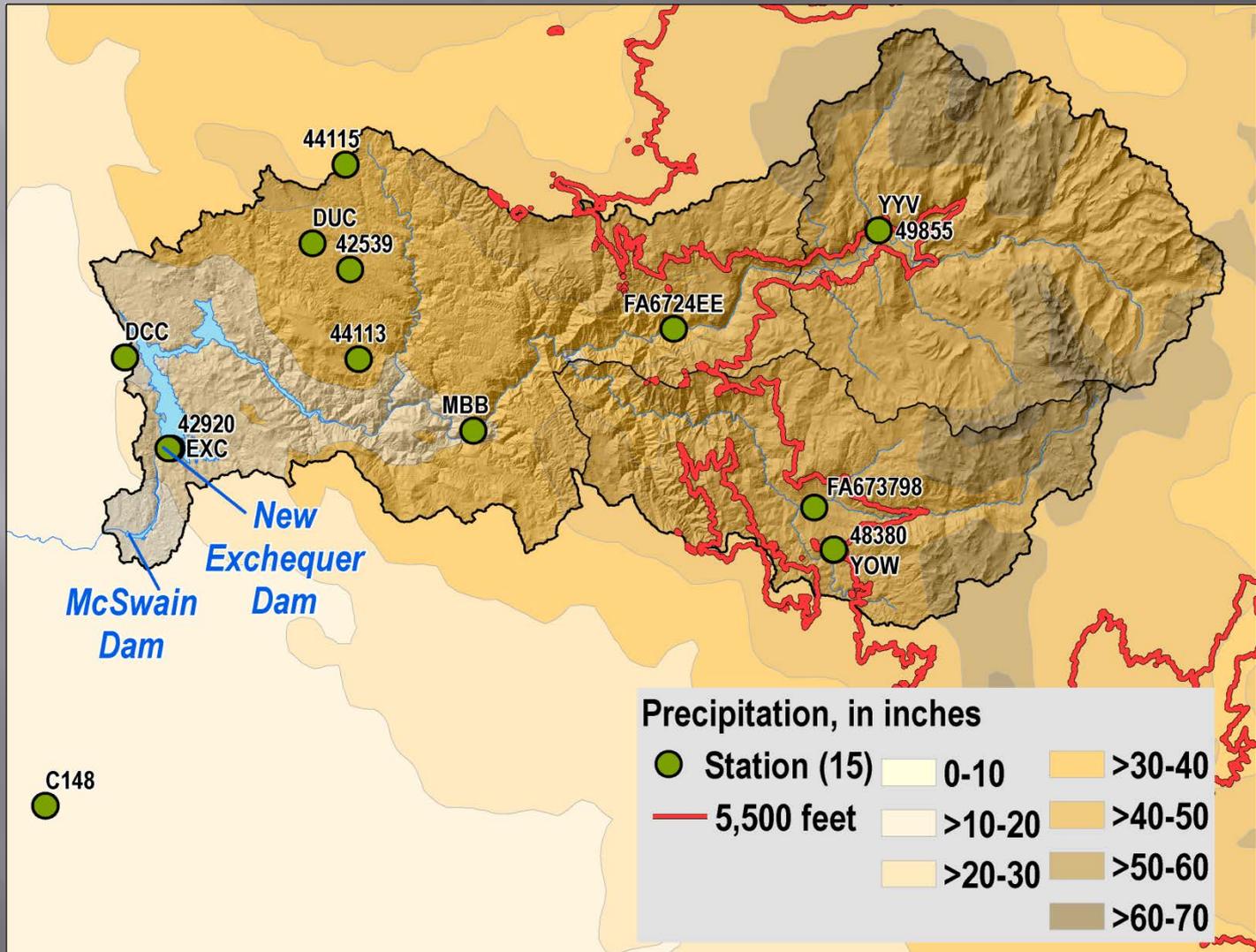
Yuba River Basin



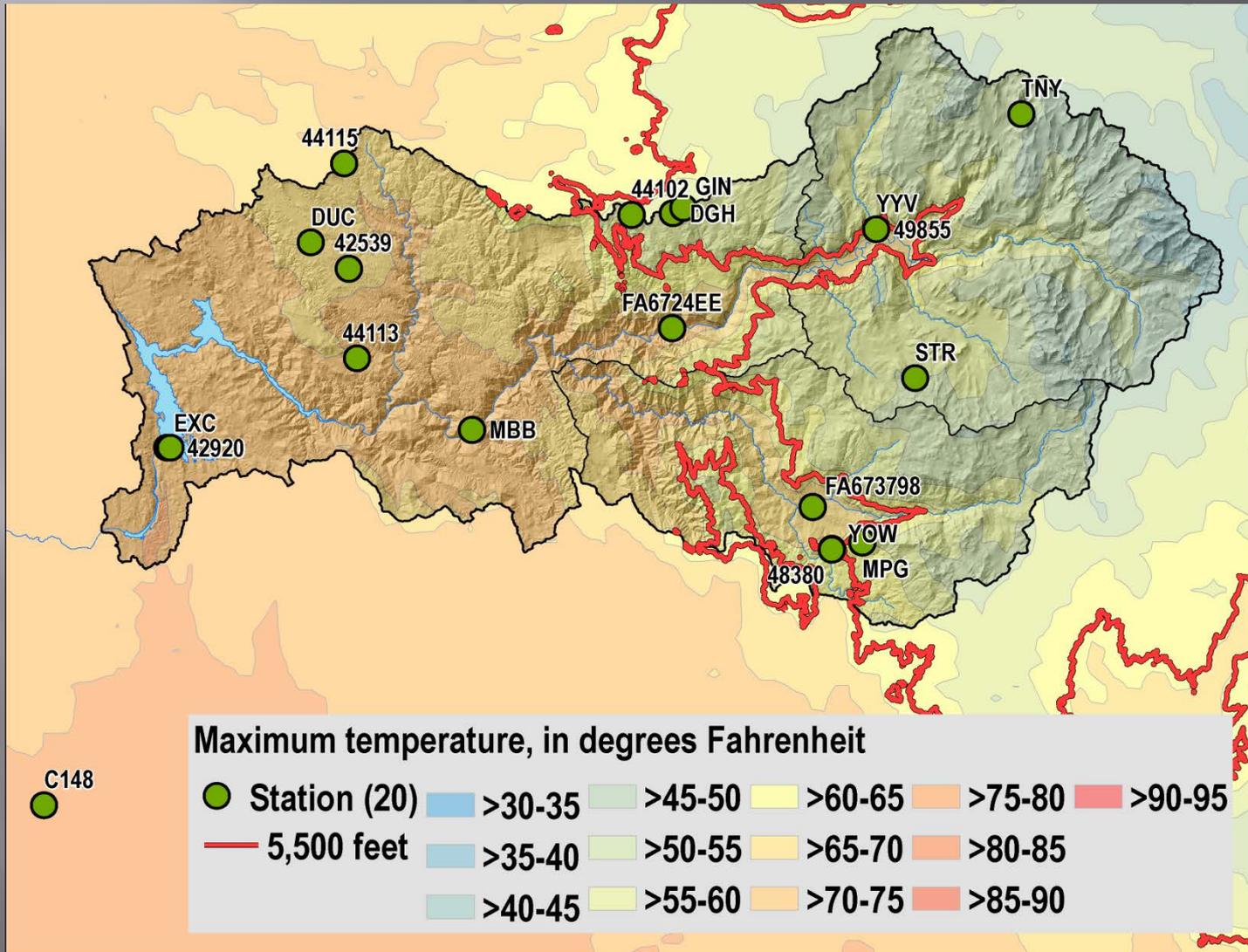
Climate Stations, topography and elevations



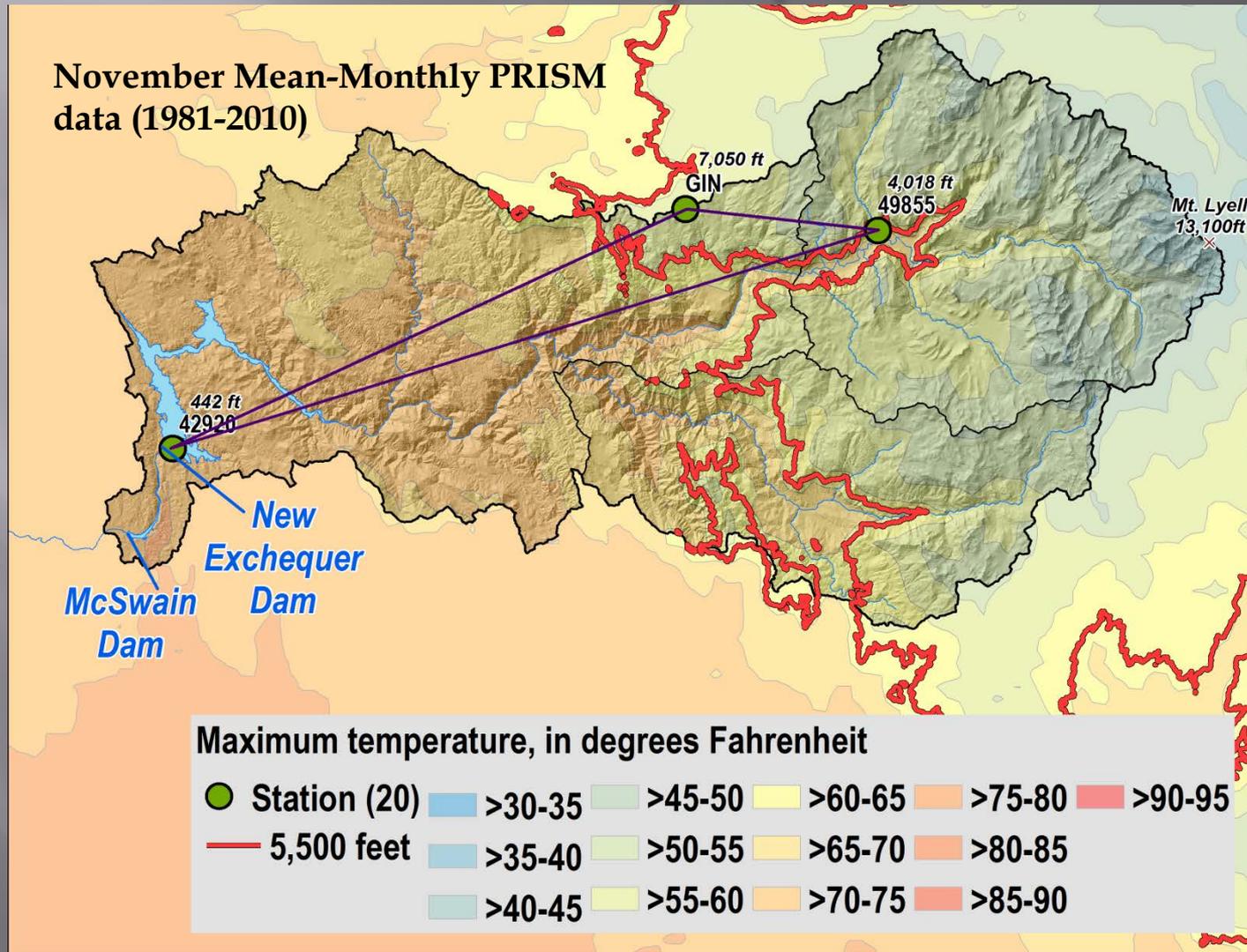
Merced Mean-Annual PRISM Data (1981-2010)



Merced Mean-Annual PRISM Data (1981-2010)



Merced Active Temperature Stations 11/8/1985



DRAPER output: Note: 11/8/1985

```
TextPad - G:\Merced_db\PRESENTATIONS\CCSS_NORTH_LAKE_TAHOE_11_2014\MERCED_DRAPER_TMAX.data_example
Find incrementally Match case
File Edit Search View Tools Macros Configure Window Help
MERCED_DRAPER_TMAX.data_exa...
MERCED_DR...
DRAPER RESULTS for 659 HRUS, from (TMAX stations)
// Using Merced PRISM TMAX 1981-2010 30-year mean-monthly daily averages. Units = Fahrenheit.
// Units = degrees F
//
// -----
// DRAPER revision 20140425
// Run executed at 2014/11/03 15:00:09
// Input read from MERCED/TMAX as monthly averages
// Total Period of Record: 10/1/1948-9/30/2013
// Normalizing Period of Record: 10/1/1948-9/30/2010
TMAX 659
*****
1985 11 1 0 0 0 3 5 8 10 6 7 7 8 11 10 13 11 12 11 15 10
1985 11 2 0 0 0 74 72 71 72 72 73 75 71 71 73 68 67 70 73 74 64
1985 11 3 0 0 0 55 55 55 56 55 56 58 55 56 57 54 53 56 57 60 51
1985 11 4 0 0 0 50 50 50 51 50 51 52 50 51 52 49 48 51 52 54 46
1985 11 5 0 0 0 94 91 88 88 91 92 94 88 88 91 82 82 86 90 90 79
1985 11 6 0 0 0 55 54 54 55 54 55 57 54 55 56 53 52 55 56 59 50
1985 11 7 0 0 0 55 54 54 55 54 55 57 54 55 56 53 52 55 56 58 49
1985 11 8 0 0 0 148 142 136 135 141 142 145 135 133 139 122 124 130 136 133 120
1985 11 9 0 0 0 47 46 45 45 45 45 47 43 43 46 42 42 43 45 45 39
1985 11 10 0 0 0 48 47 46 46 47 47 48 45 45 47 43 43 44 46 46 41
1985 11 11 0 0 0 31 31 30 30 30 30 31 29 29 31 29 28 29 30 30 26
1985 11 12 0 0 0 30 30 29 29 29 29 30 28 28 30 28 28 28 29 29 25
```

Range checks: annual or monthly bounds

If *input* exceeds bounds, then DRAPER stops and alerts operator.

If *output* exceeds bounds, then DRAPER reverts to other methods.

```
// MERCED PPT month ranges, lower and upper  
bounds of expected daily total precipitation, inches
```

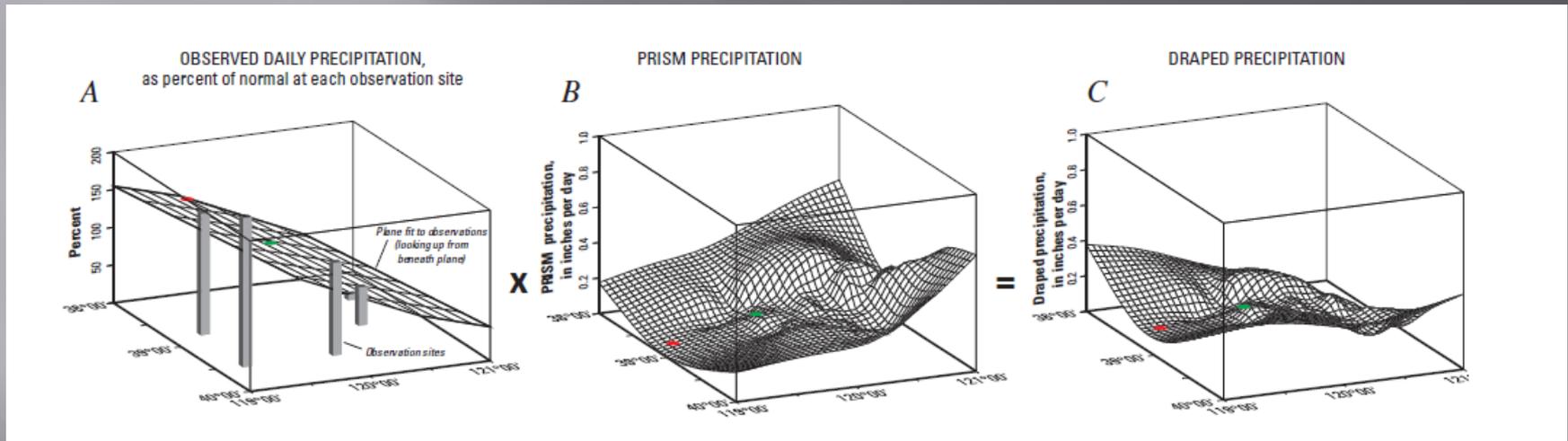
```
0 0 0 0 0 0 0 0 0 0 0
```

```
9 8 8 9 6 4 4 3 5 9 9 12
```

```
// MERCED TMAX ranges, lower and upper bounds  
of expected daily maximum temperature, Fahrenheit
```

```
-31 116
```

Draper Method#1: 3 or more stations available

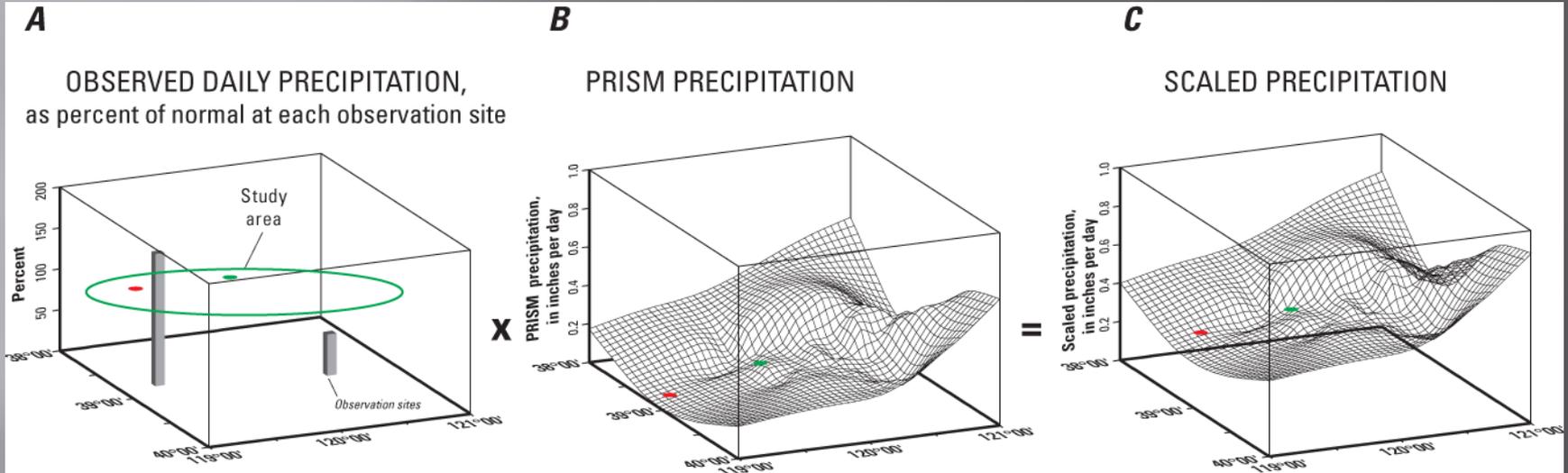


3 or more station computation (Tilt Normal Surface (Linear Regression) with Draping)

Uses $A=(X^tX)^{-1}X^tY$ (to compute percent of normal at HRU)

percent of normal @ HRU × monthly PRISM at HRU = daily precipitation @ HRU

Draper Method#2: 1-2 stations available*



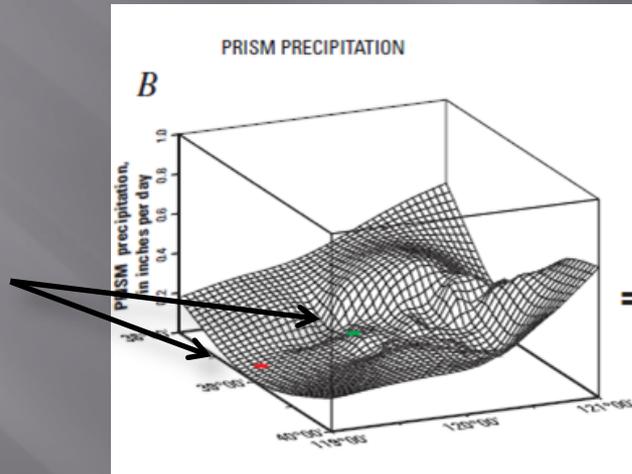
2 station computation (Scaling and Draping)

$$\frac{(\text{daily station 1} + \text{station}_2 \text{ precipitation}) / 2}{\text{monthly station precipitation}} \times \text{monthly PRISM at HRU} = \text{daily precipitation @ HRU}$$

*Use all available stations if Method#1 generates results that exceed ranges.

Draper Method#3: 0 stations available, use values sampled on the 30-year mean-monthly PRISM surface at HRU centroids*

HRU centroids

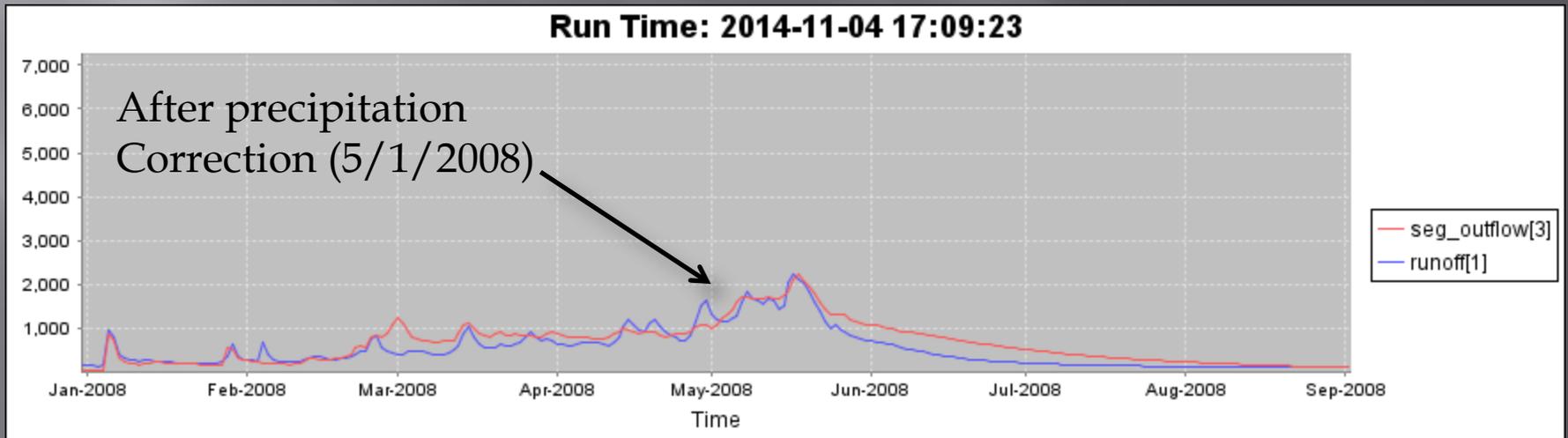
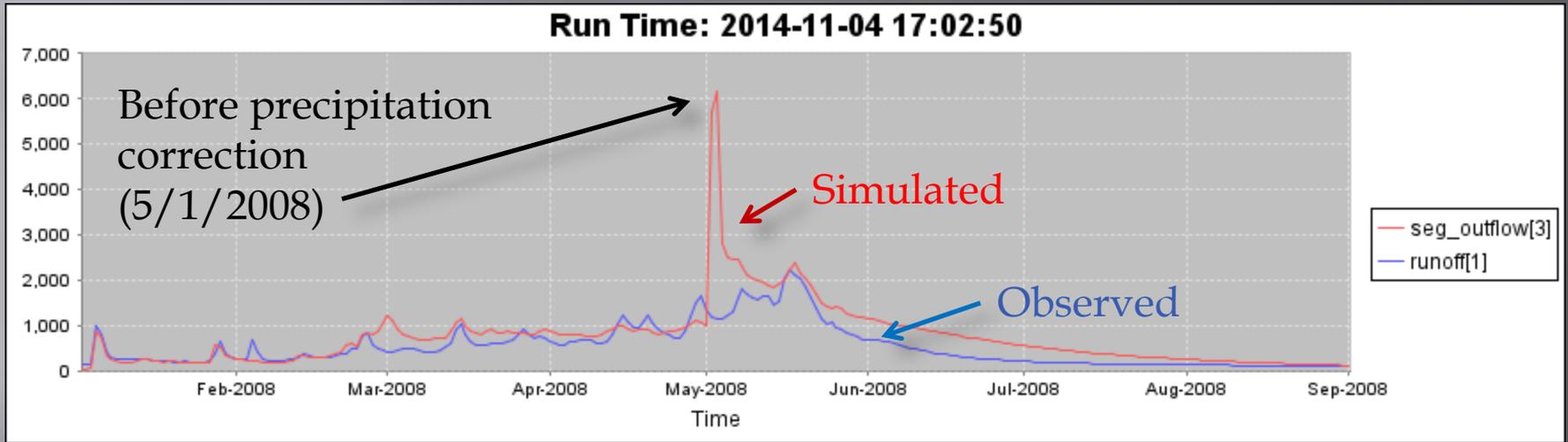


*Use if Method#1 and #2 generates results that exceed ranges.

Example of Merced_PPT_Draper_Log

```
MERCED_PPT_DRAPER_LOG x
out of range value ( 12.8) for 01/30/1998
WARNING: Output out of range ( 12.3) on 01/30/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 95.9) for 02/01/1998
WARNING: Output out of range ( 45.7) on 02/01/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 142.4) for 02/02/1998
WARNING: Output out of range ( 89.2) on 02/02/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 23.6) for 02/03/1998
WARNING: Output out of range ( 87.2) on 02/03/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 16.6) for 02/04/1998
WARNING: Output out of range ( 28.6) on 02/04/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 128.6) for 02/06/1998
WARNING: Output out of range ( 65.4) on 02/06/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 113.5) for 02/07/1998
WARNING: Output out of range ( 81.3) on 02/07/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 12.1) for 02/08/1998
WARNING: Output out of range ( 41.5) on 02/08/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 13.0) for 02/09/1998
WARNING: Output out of range ( 12.4) on 02/09/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 31.3) for 02/10/1998
WARNING: Output out of range ( 15.6) on 02/10/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 12.0) for 02/11/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 27.5) for 02/12/1998
WARNING: Output out of range ( 13.3) on 02/12/1998
WARNING: Switching to averaging method because regression plane produced
out of range value ( 23.1) for 02/13/1998
WARNING: Output out of range ( 29.5) on 02/13/1998
WARNING: Switching to averaging method because regression plane produced
```

Check Hydrographs: before and after climate correction



Summary

- ▣ Iterative process
- ▣ Always investigate hydrograph spikes between simulated and observed data
- ▣ Always check measured data
 - Are there anomalies?
 - Are your upper and lower ranges too tight or loose?
- ▣ Always question climate surfaces
 - Do they reasonably represent the study area?
 - Are there better climate surfaces?
- ▣ Does the 30-year mean-monthly data capture the same time frame as the simulations?
 - PRISM 1961-1990, 1971-2000, **1981-2010**



Questions?



Questions?



“Mad Men” Don Draper...