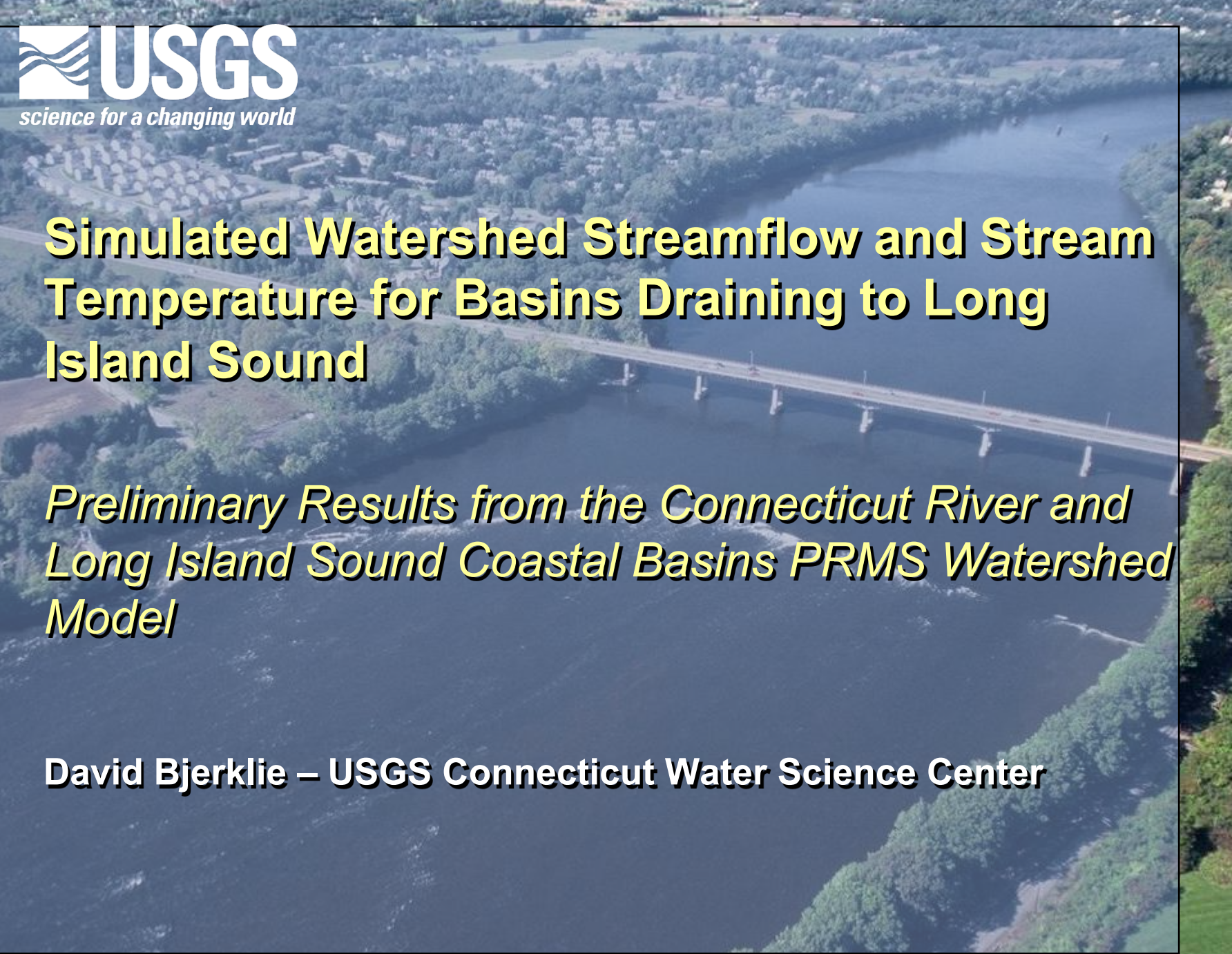


Simulated Watershed Streamflow and Stream Temperature for Basins Draining to Long Island Sound

Preliminary Results from the Connecticut River and Long Island Sound Coastal Basins PRMS Watershed Model

David Bjerklie – USGS Connecticut Water Science Center

General: PRMS Model

- The model parameters were developed based on a general approach developed in a medium sized watershed in western Connecticut, and then extrapolated to the whole region.

- The PRMS model simulates the daily water balance for 511 HUC 12 watersheds in the NAWQA CONN study area and computes the quantity of runoff from groundwater sources, subsurface sources, and surface runoff sources as well as the runoff from snowmelt versus rainfall.

USGS

Precipitation Runoff Modeling System (PRMS) Model Structure

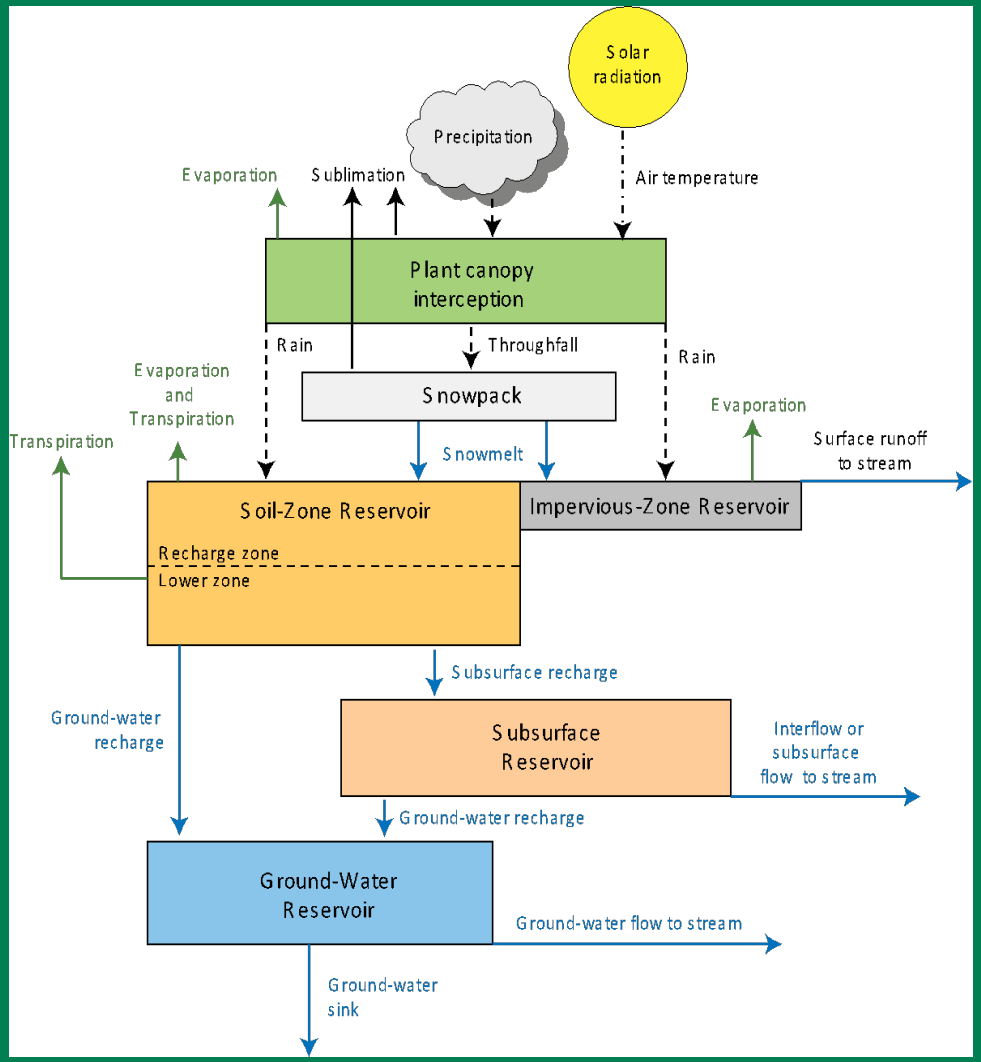
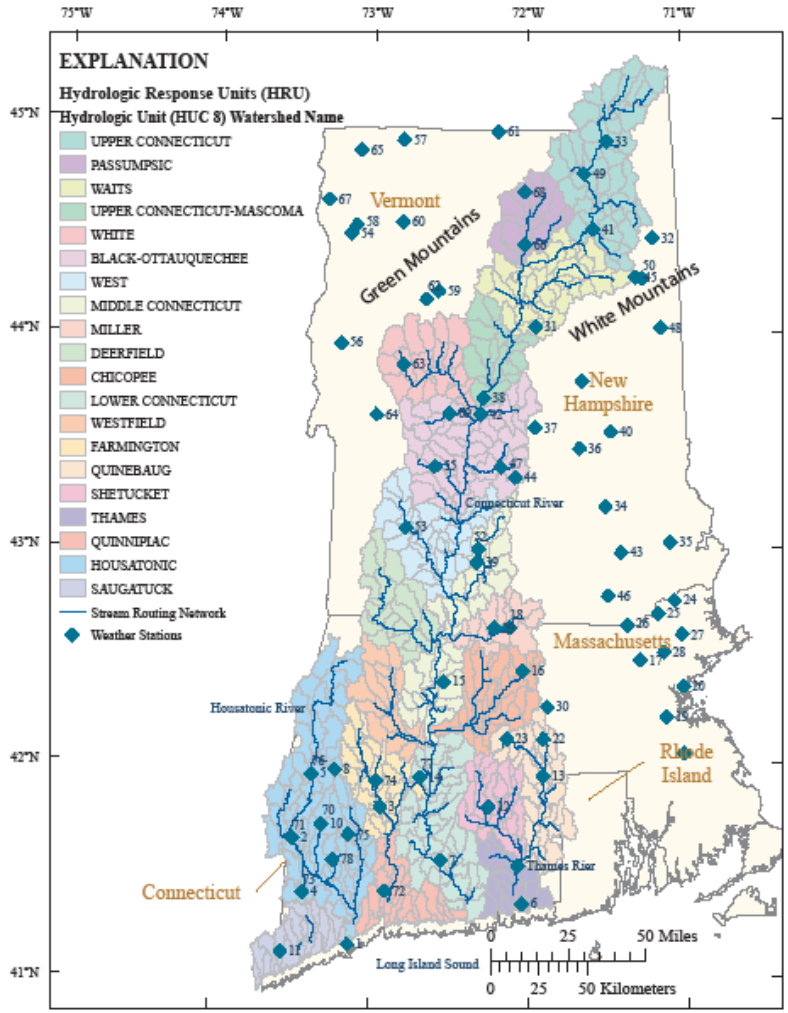


Diagram showing the hydrologic components as conceptualized in the Precipitation Runoff Modeling System (modified from Leavesley and others, 1983).

USGS

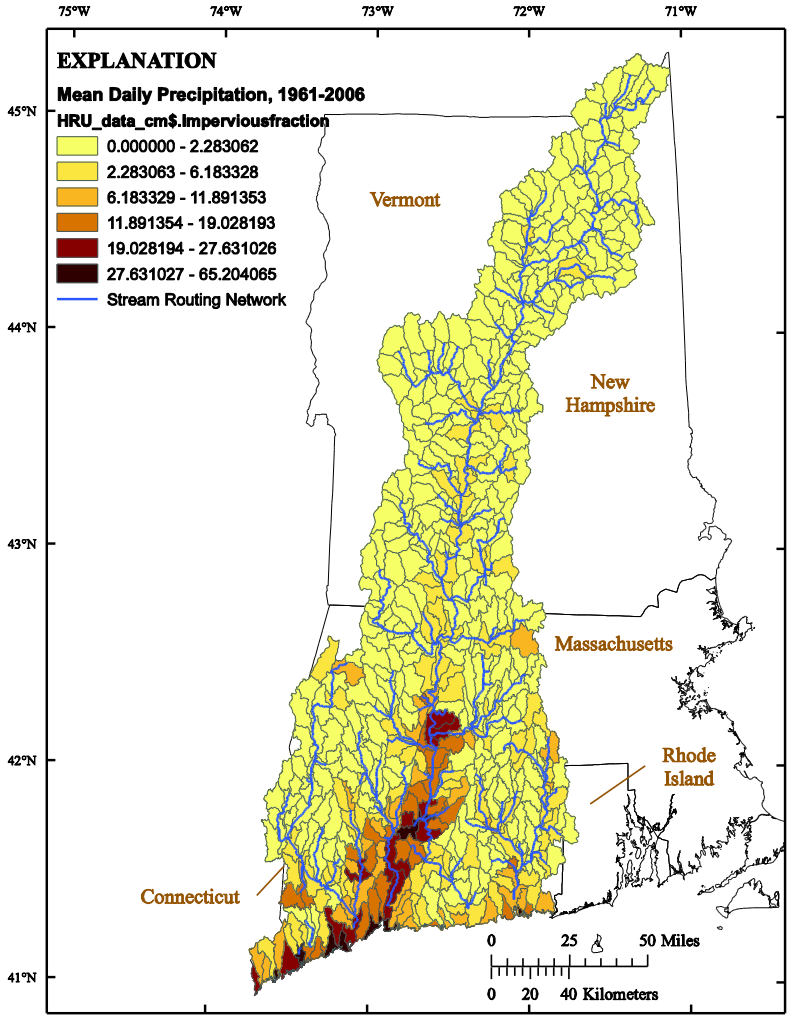
Study Area

Study area showing major basins, hydrologic response units (511) and weather stations



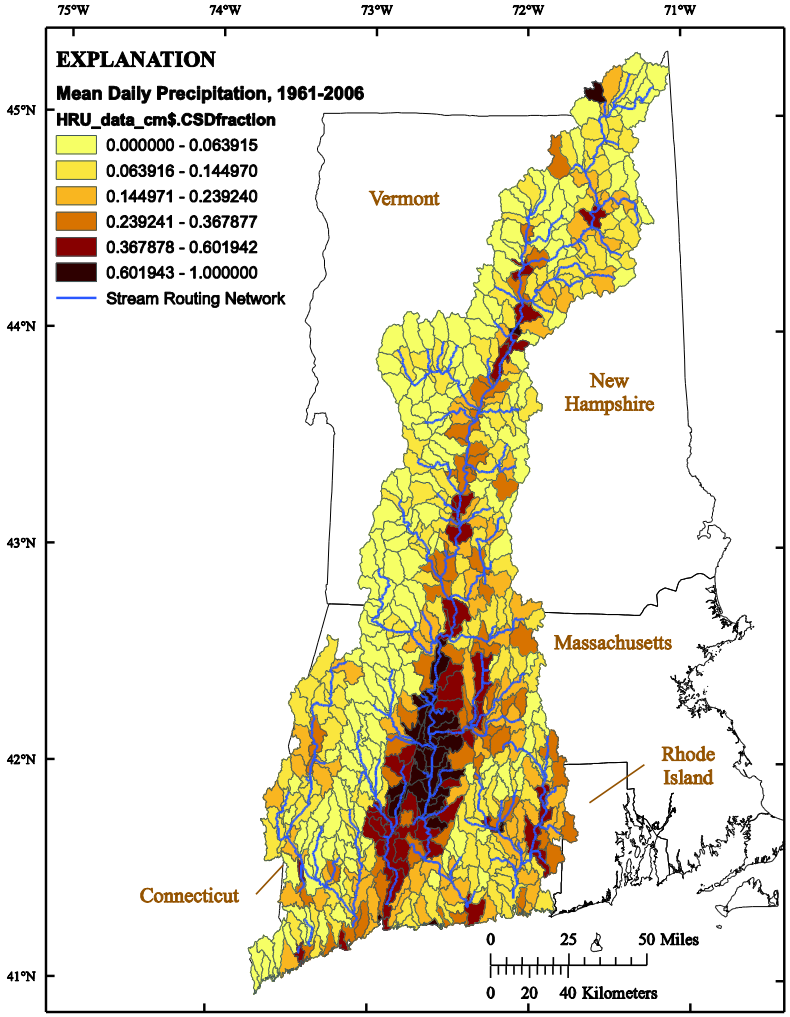
USGS

Percent Impervious Surface



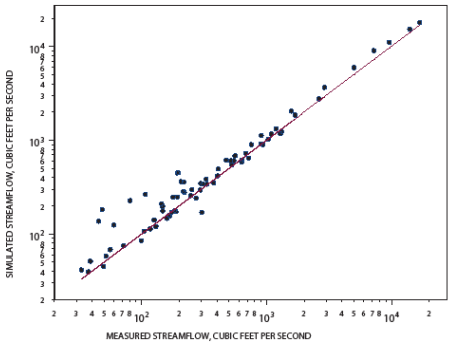
USGS

Percent Coarse Stratified Drift

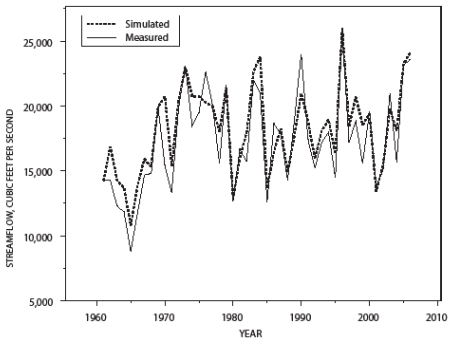


USGS

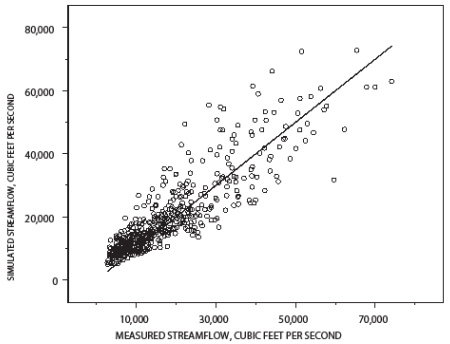
Model Calibration Results



Mean Flow 71 gaging stations



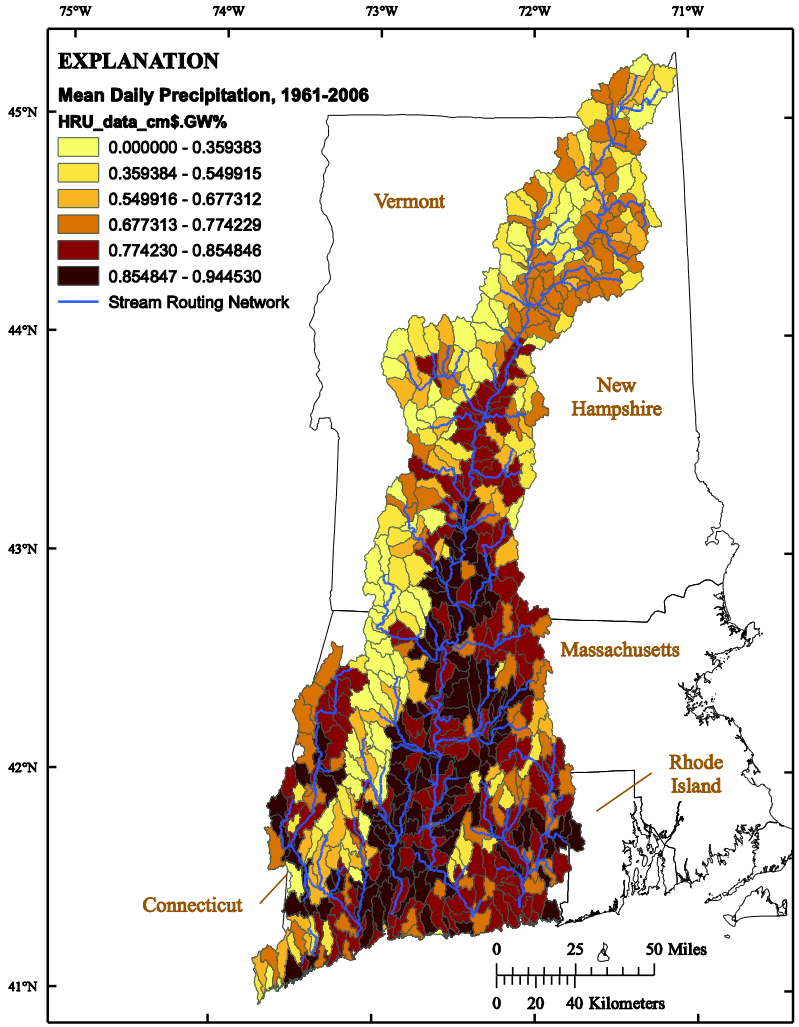
Mean Annual Flow, Connecticut River at Thompsonville



Mean Monthly Flow Simulated versus Observed Connecticut River at Thompsonville

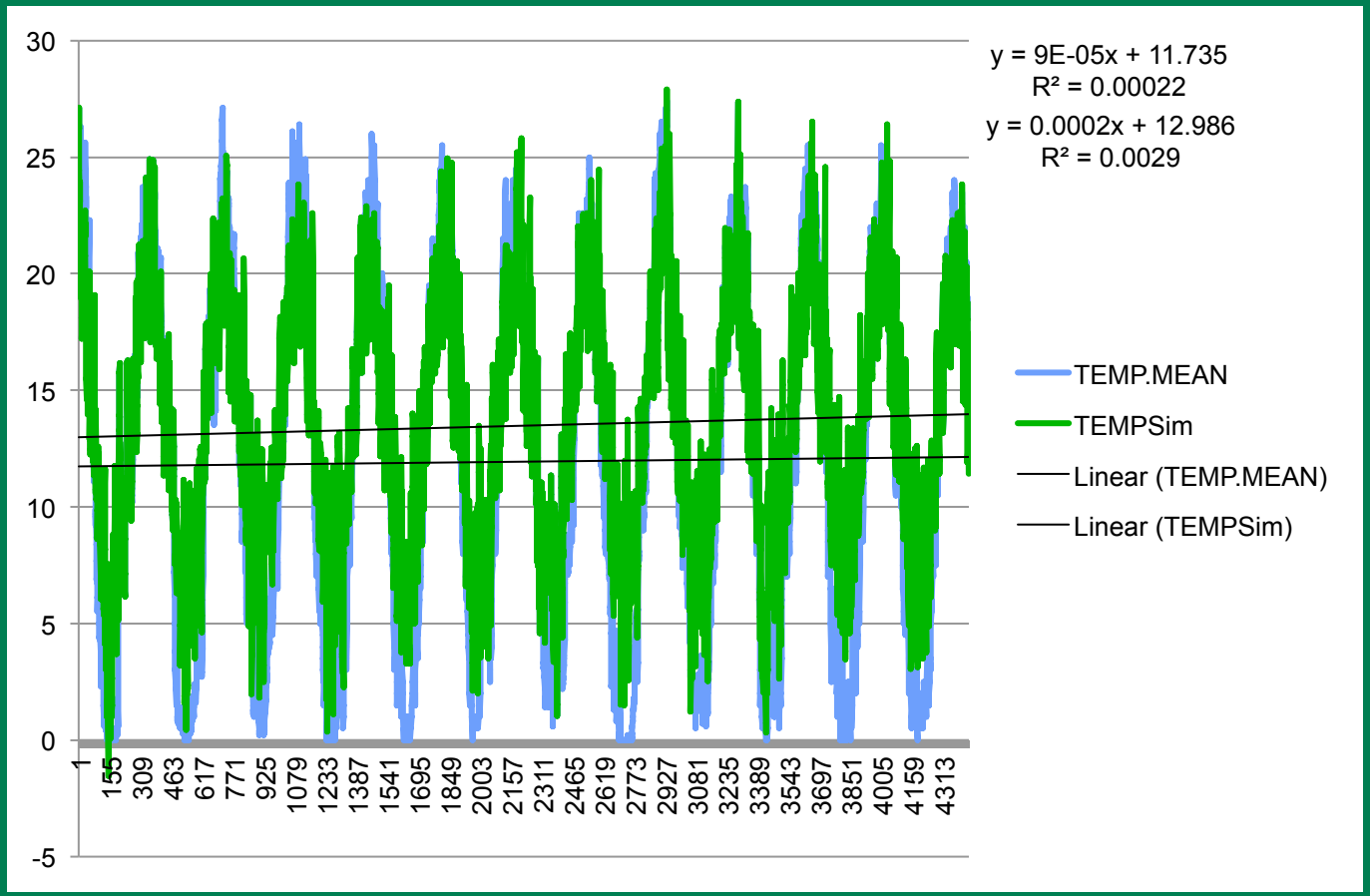
USGS

Percent Groundwater Contribution to Streamflow

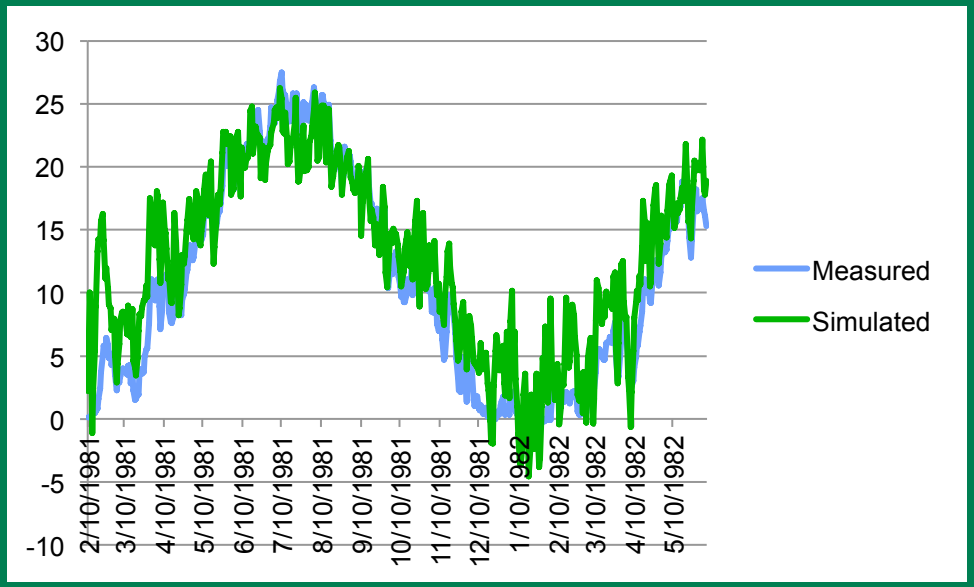


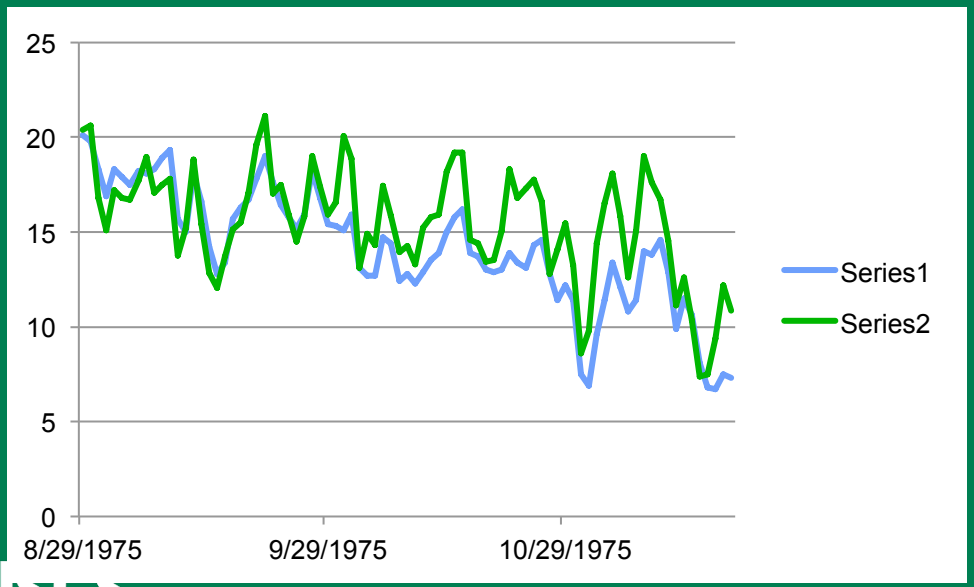
USGS

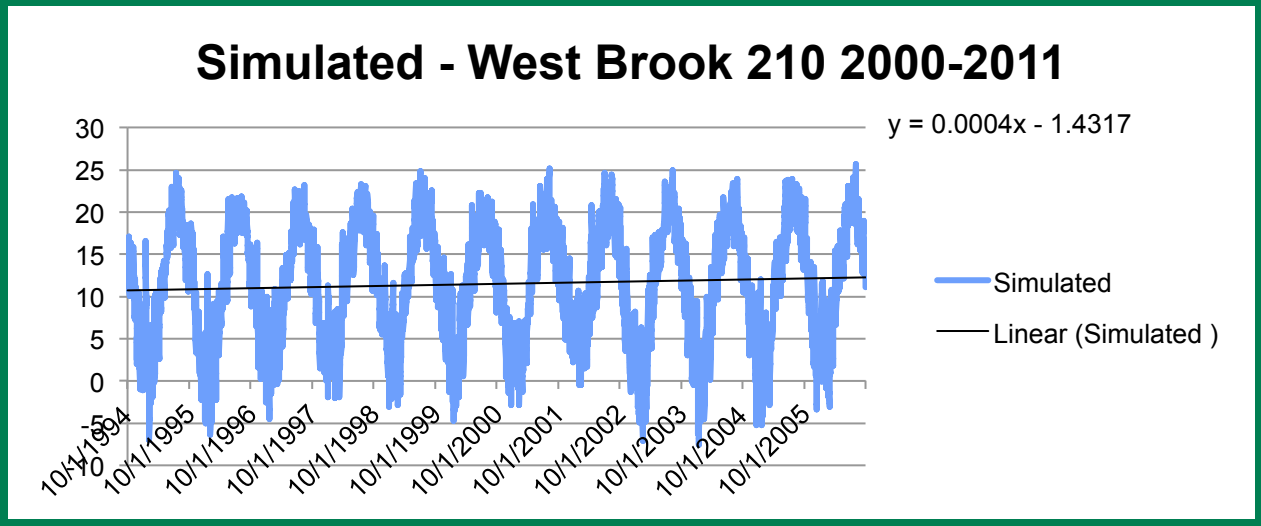
Preliminary Test – Instream Daily Temperature Shetucket River, CT – simple groundwater mxing model

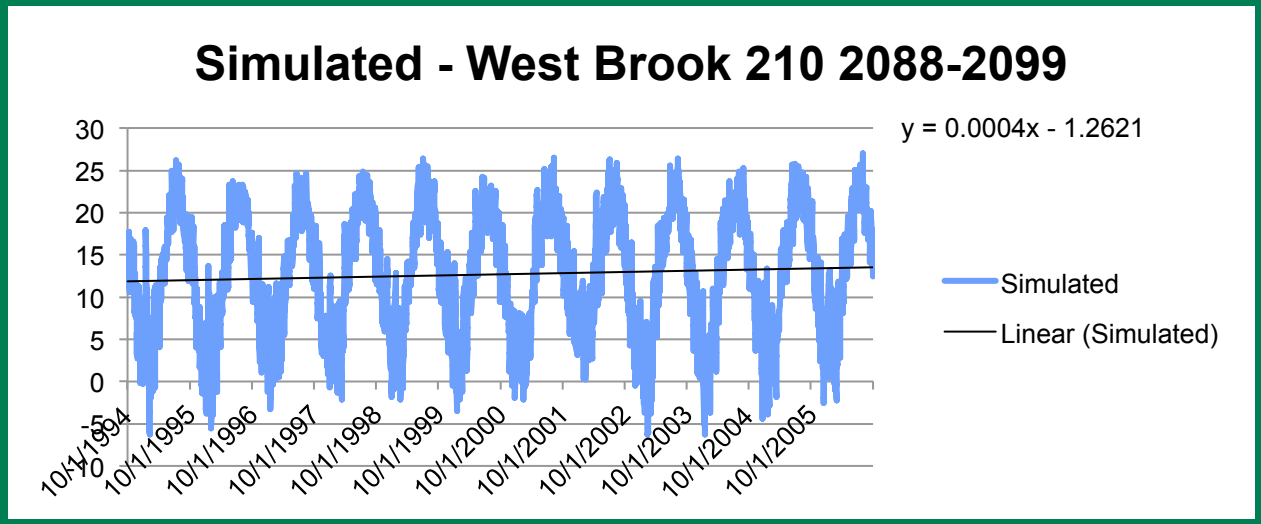


USGS

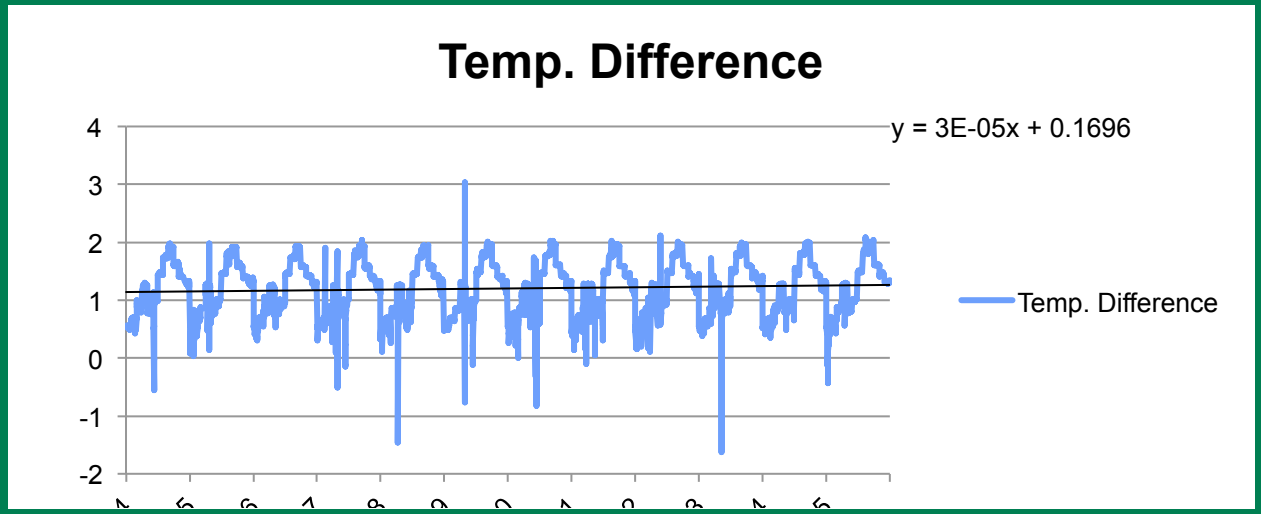

30
25
20
15
10
5
0
-5
-10
2/10/1981
3/10/1981
4/10/1981
5/10/1981
6/10/1981
7/10/1981
8/10/1981
9/10/1981
10/10/1981
11/10/1981
12/10/1981
1/10/1982
2/10/1982
3/10/1982
4/10/1982
5/10/1982
Measured
Simulated

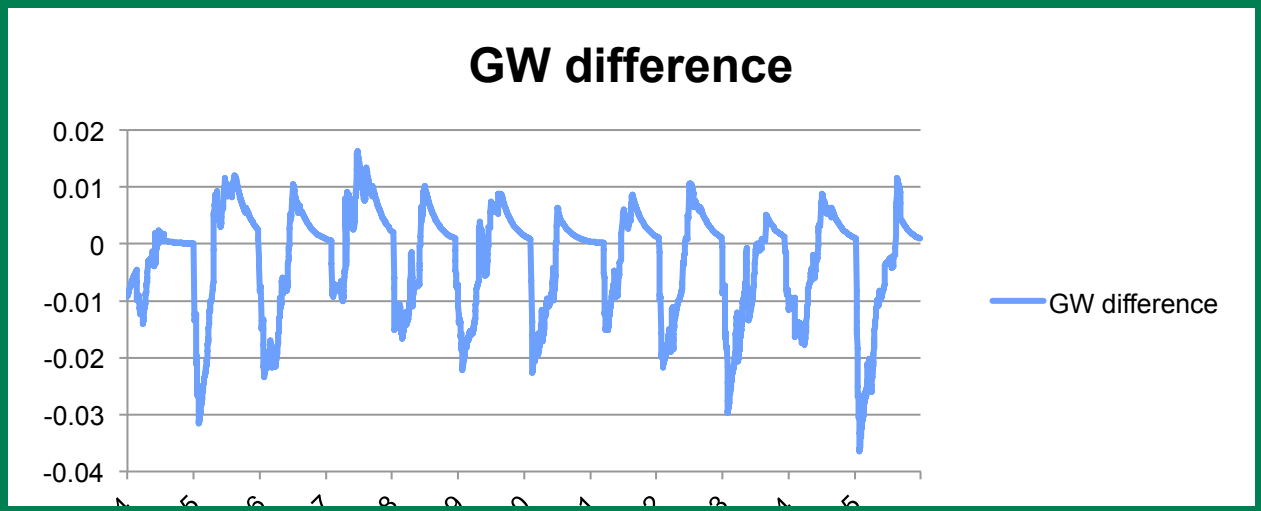

25
20
15
10
5
0
8/29/1975
9/29/1975
10/29/1975
Series1
Series2


Simulated - West Brook 210 2000-2011
y = 0.0004x - 1.4317
30
25
20
15
10
5
0
-5
-10
10/1/1994
10/1/1995
10/1/1996
10/1/1997
10/1/1998
10/1/1999
10/1/2000
10/1/2001
10/1/2002
10/1/2003
10/1/2004
10/1/2005
Simulated
Linear (Simulated)


Simulated - West Brook 210 2088-2099
y = 0.0004x - 1.2621
30
25
20
15
10
5
0
-5
-10
10/1/1994
10/1/1995
10/1/1996
10/1/1997
10/1/1998
10/1/1999
10/1/2000
10/1/2001
10/1/2002
10/1/2003
10/1/2004
10/1/2005
Simulated
Linear (Simulated)

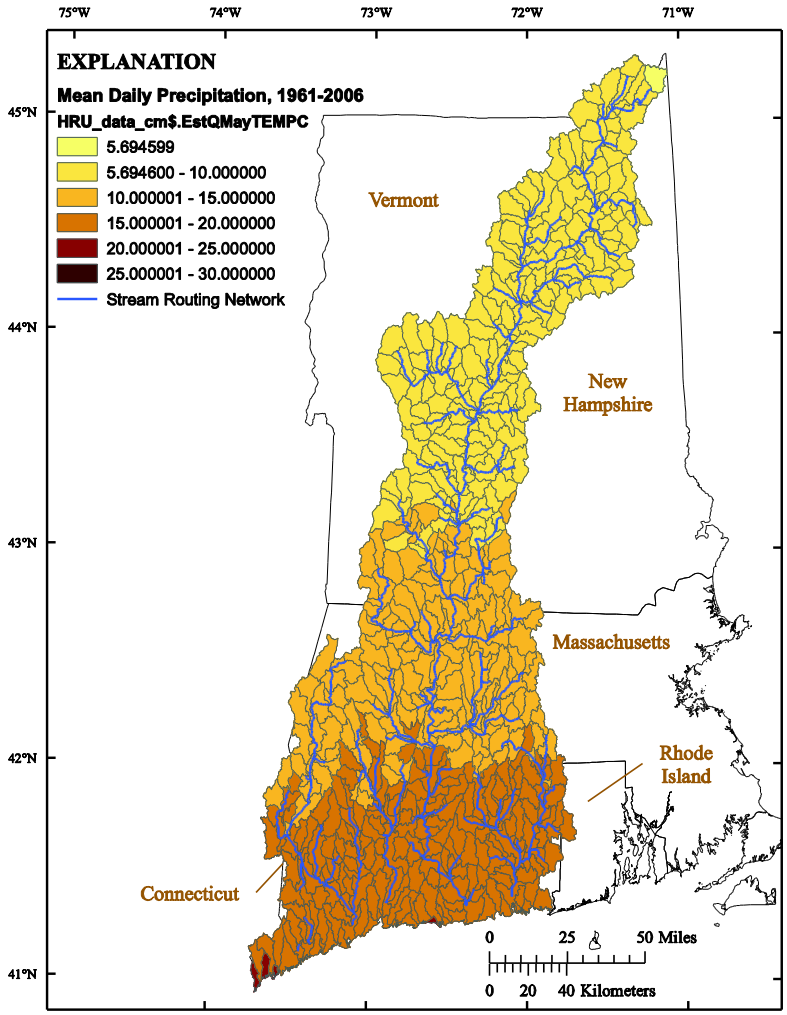
USGS


Temp. Difference
y = 3E-05x + 0.1696
4
3
2
1
0
-1
-2
Temp. Difference


GW difference
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
GW difference

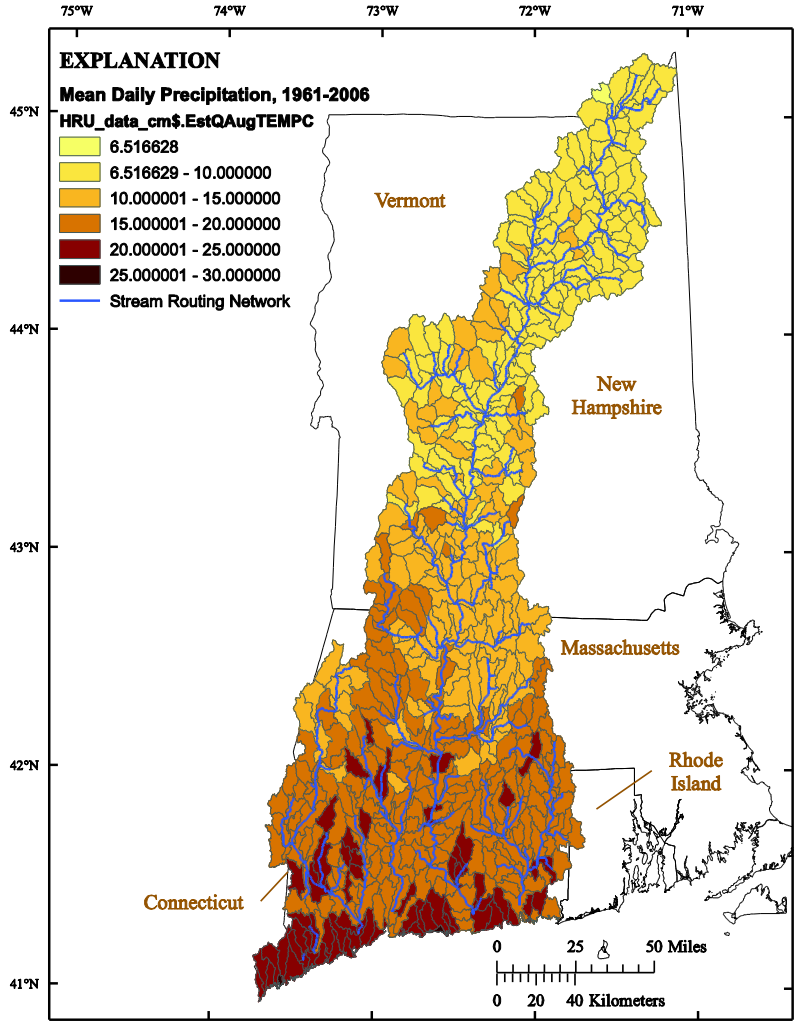
USGS

Simulated Mean Daily stream Temperature for MAY: 1961-2006 average.



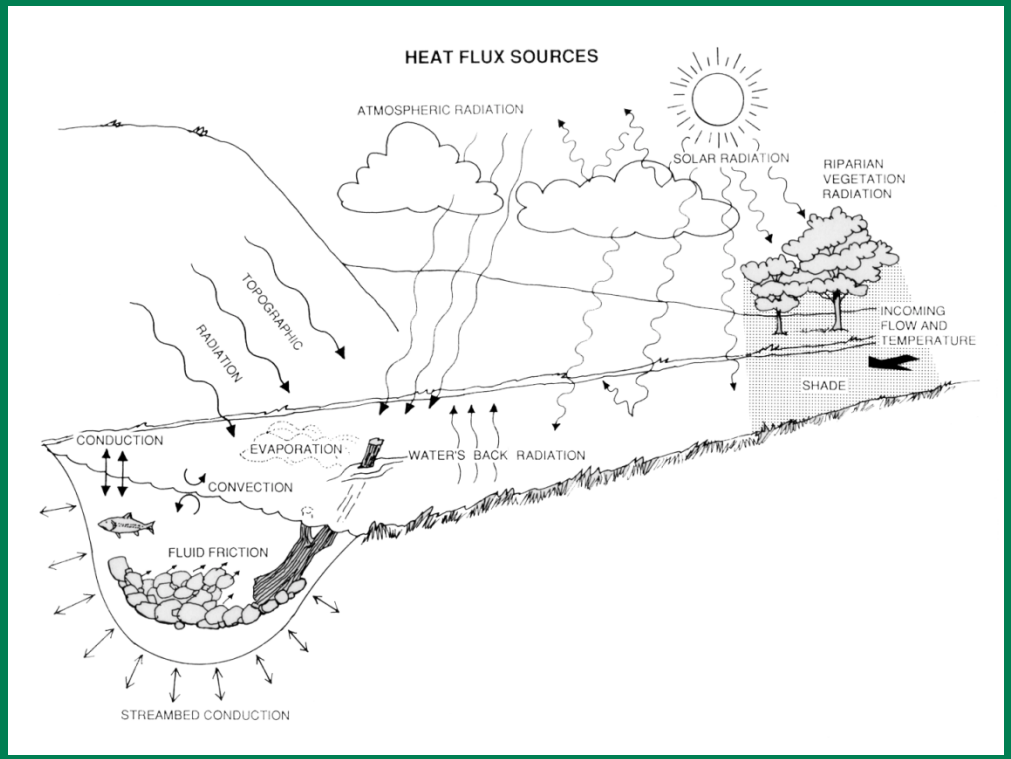
USGS

Simulated Mean Daily stream Temperature for AUGUST: 1961-2006 average.



USGS

SNTemp


HEAT FLUX SOURCES
ATMOSPHERIC RADIATION
SOLAR RADIATION
RIPARIAN VEGETATION RADIATION
TOPOGRAPHIC RADIATION
INCOMING FLOW AND TEMPERATURE
SHADE
CONDUCTION
EVAPORATION
WATER'S BACK RADIATION
CONVECTION
FLUID FRICTION
STREAMBED CONDUCTION

USGS

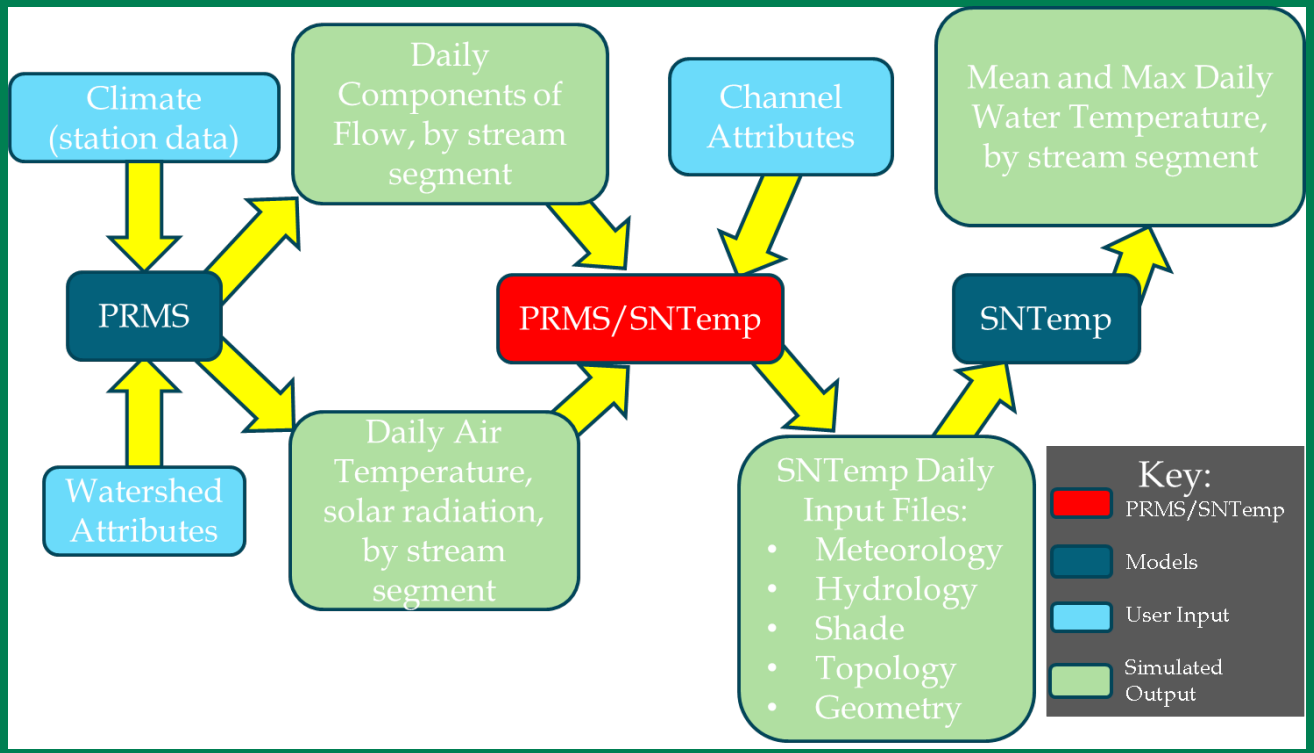


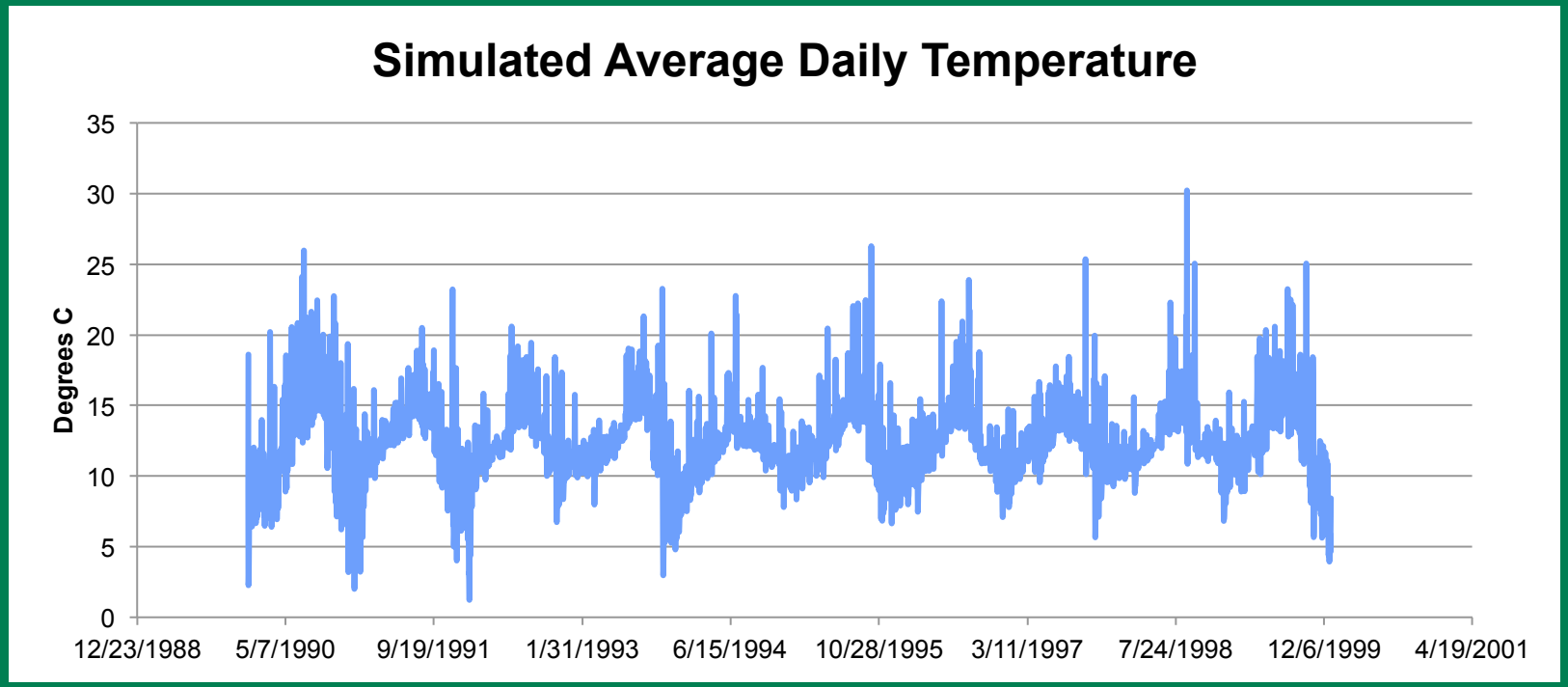
Diagram showing the information flow between the Precipitation Runoff Modeling System (PRMS), P2S, and the Stream Network Temperature Model.

USGS

PRMS Output Used in SNTEMP

- Streamflow
- Flow Components – Groundwater
  Subsurface
  Surface Runoff
- Air Temperature
- Solar Radiation

USGS



SNTemp simulated average daily stream temperature based on PRMS output.

USGS

Contacts:

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Connecticut Water Science Center
dmbjerkl@usgs.gov

Acknowledgements

Steve Markstrom, Roland Viger – USGS NRP Central Region