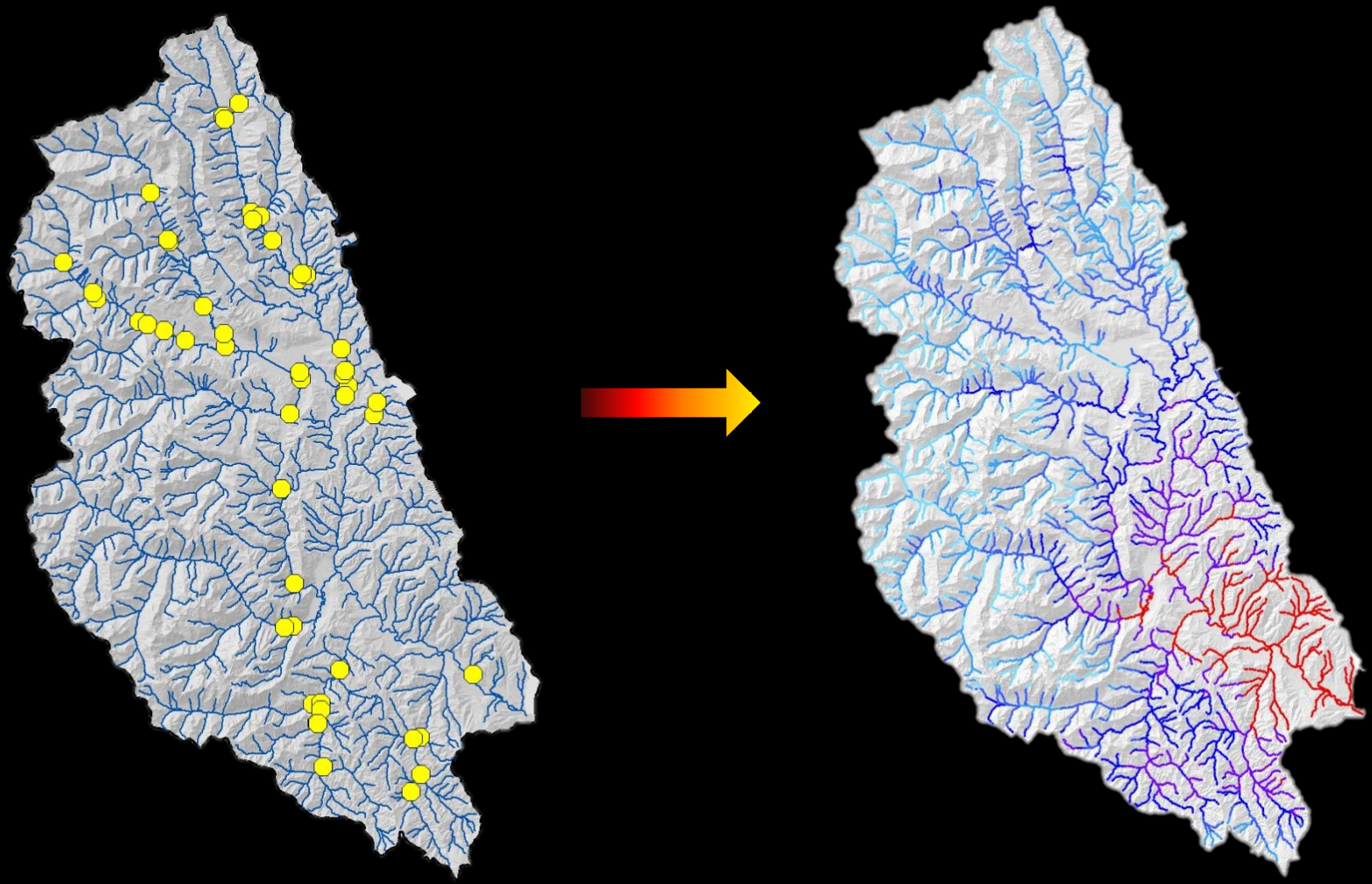
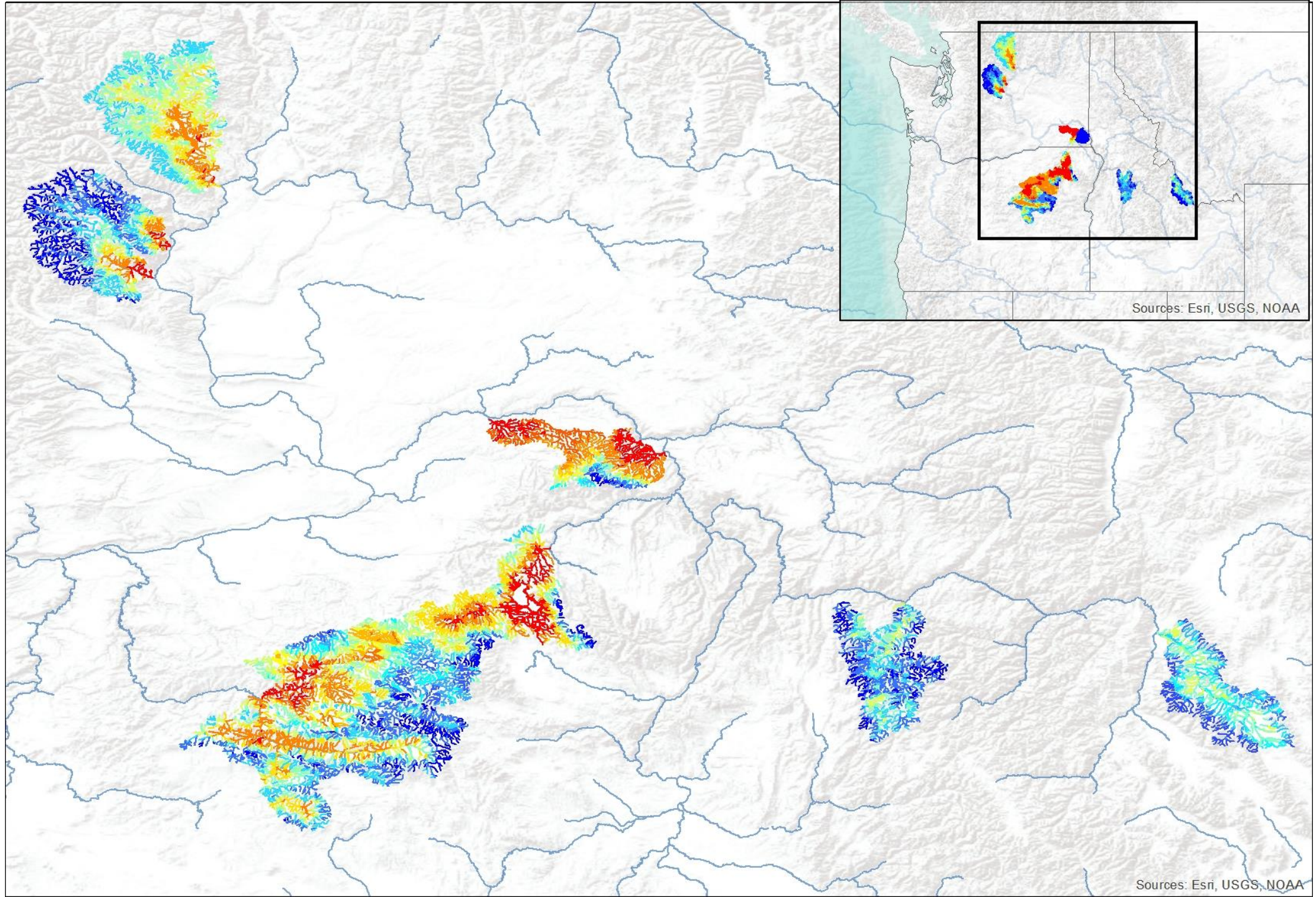
CHaMP Stream Temperature Models



Kris McNyset, South Fork Research
kristina.mcnyset@noaa.gov

2 June 2015


Sources: Esri, USGS, NOAA
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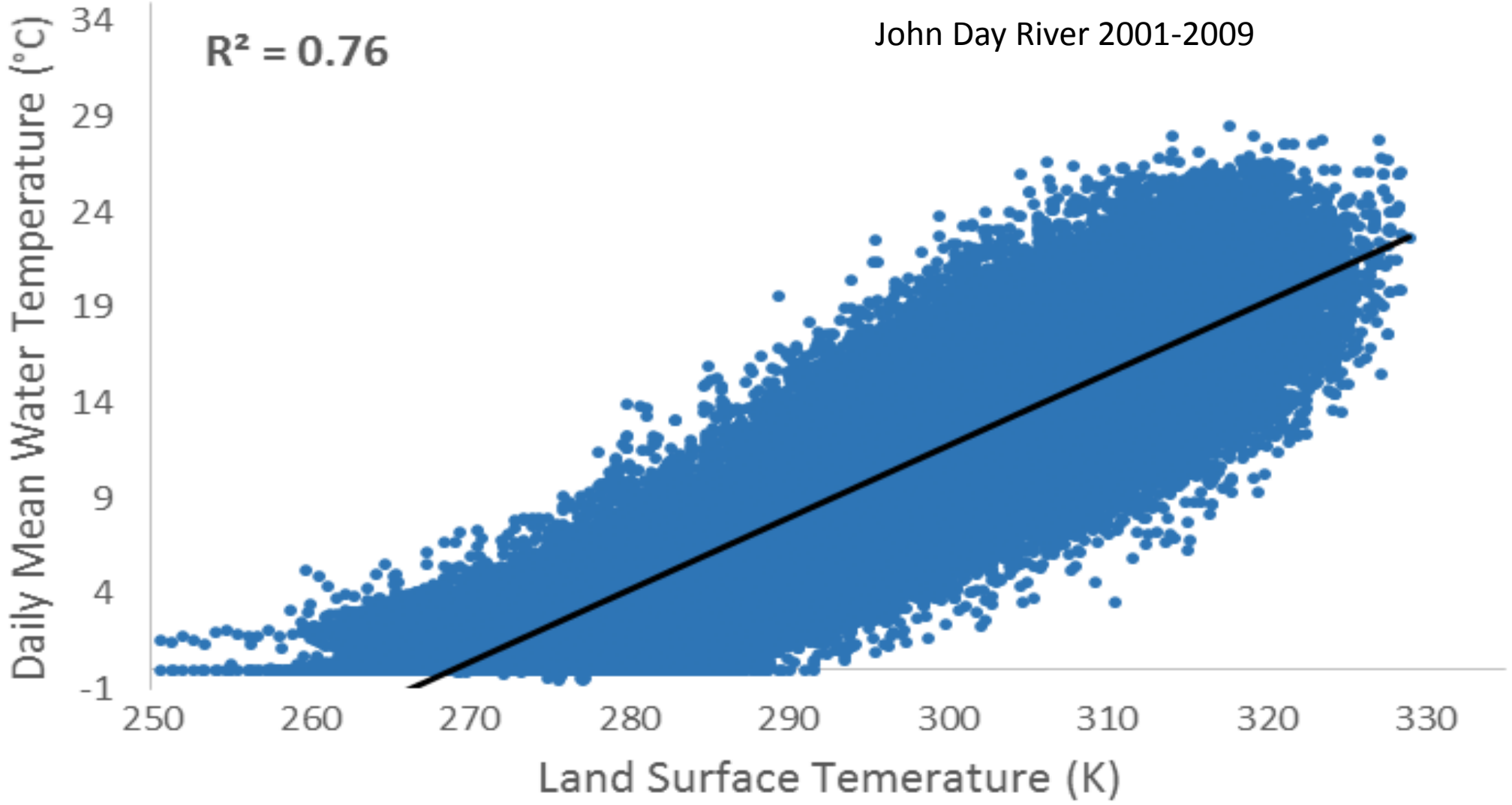
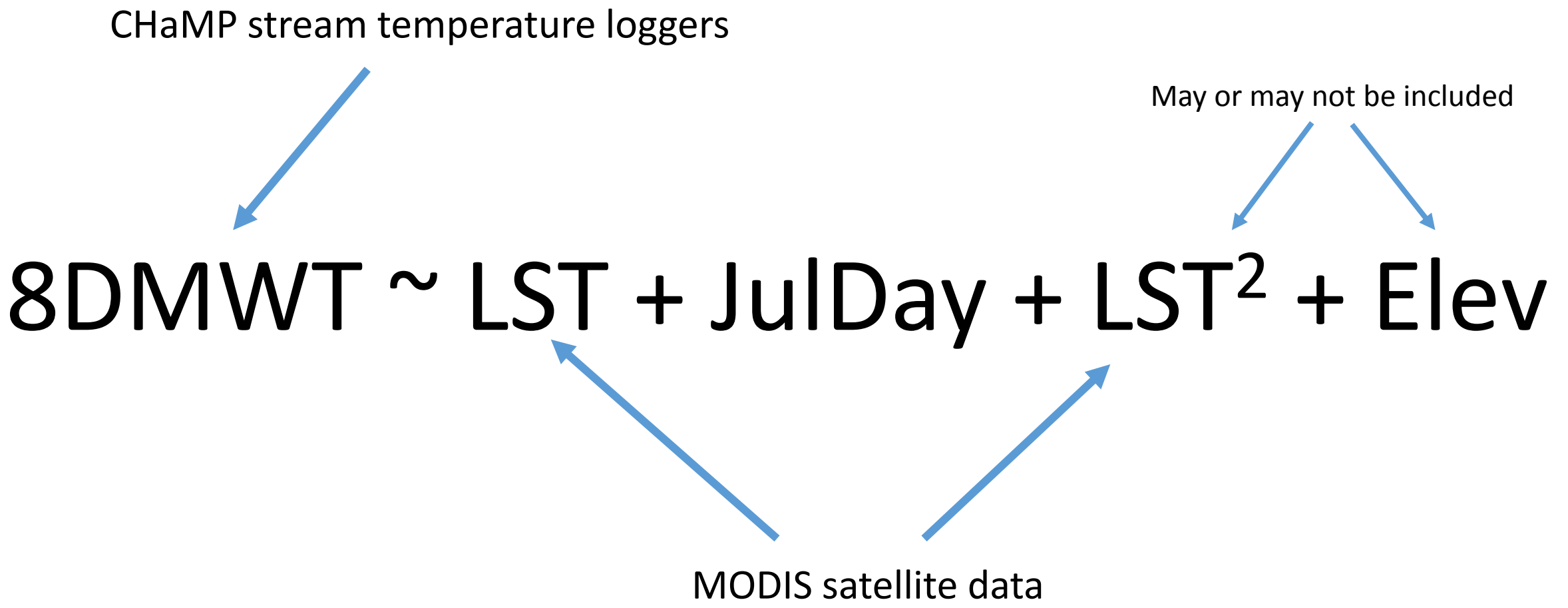
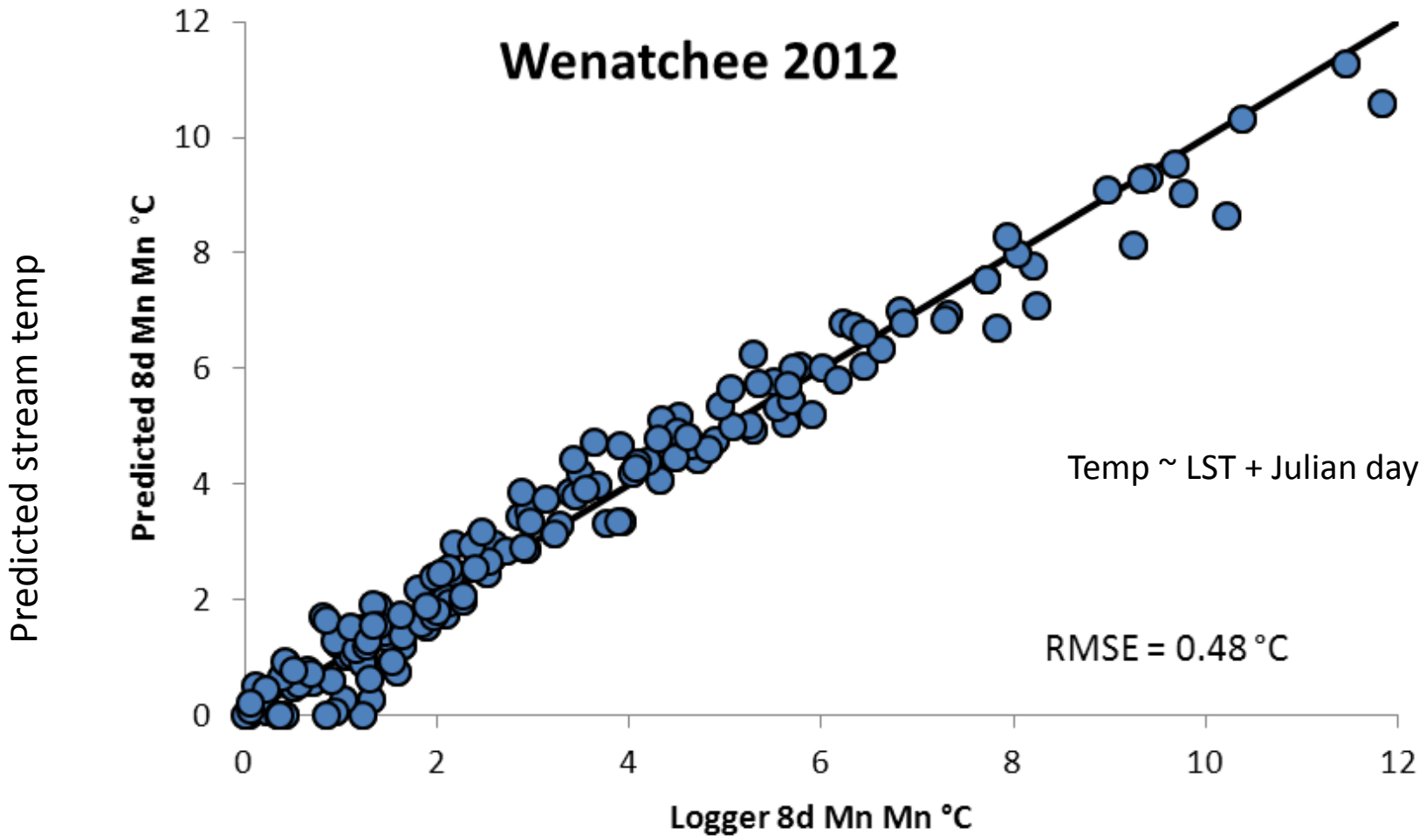
Relationship between remotely-sensed Land Surface Temperature and stream temperature




CHaMP stream temperature loggers
May or may not be included
8DMWT ~ LST + JulDay + LST² + Elev
MODIS satellite data

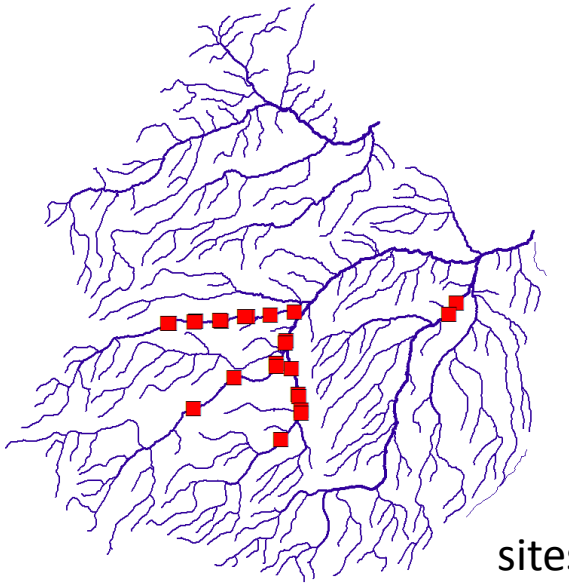
Predicted Water Temperature



Predicted stream temp

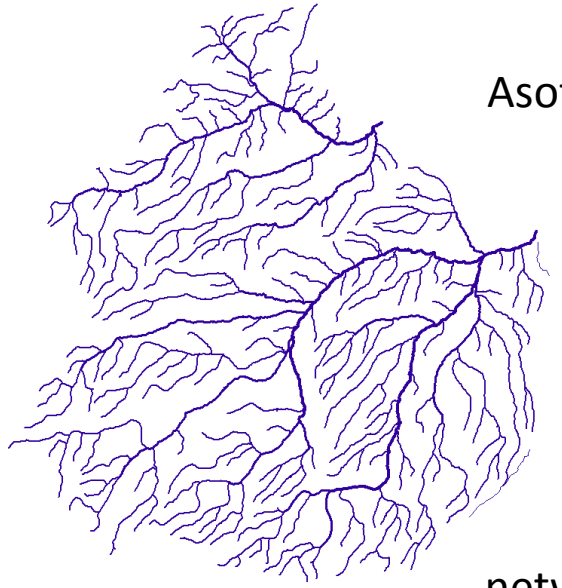
Measured stream temp

Modeling process



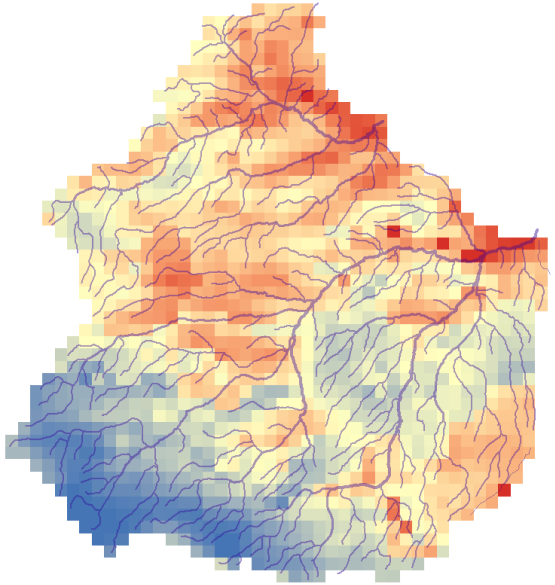
sites

Spatial data



Asotin

network

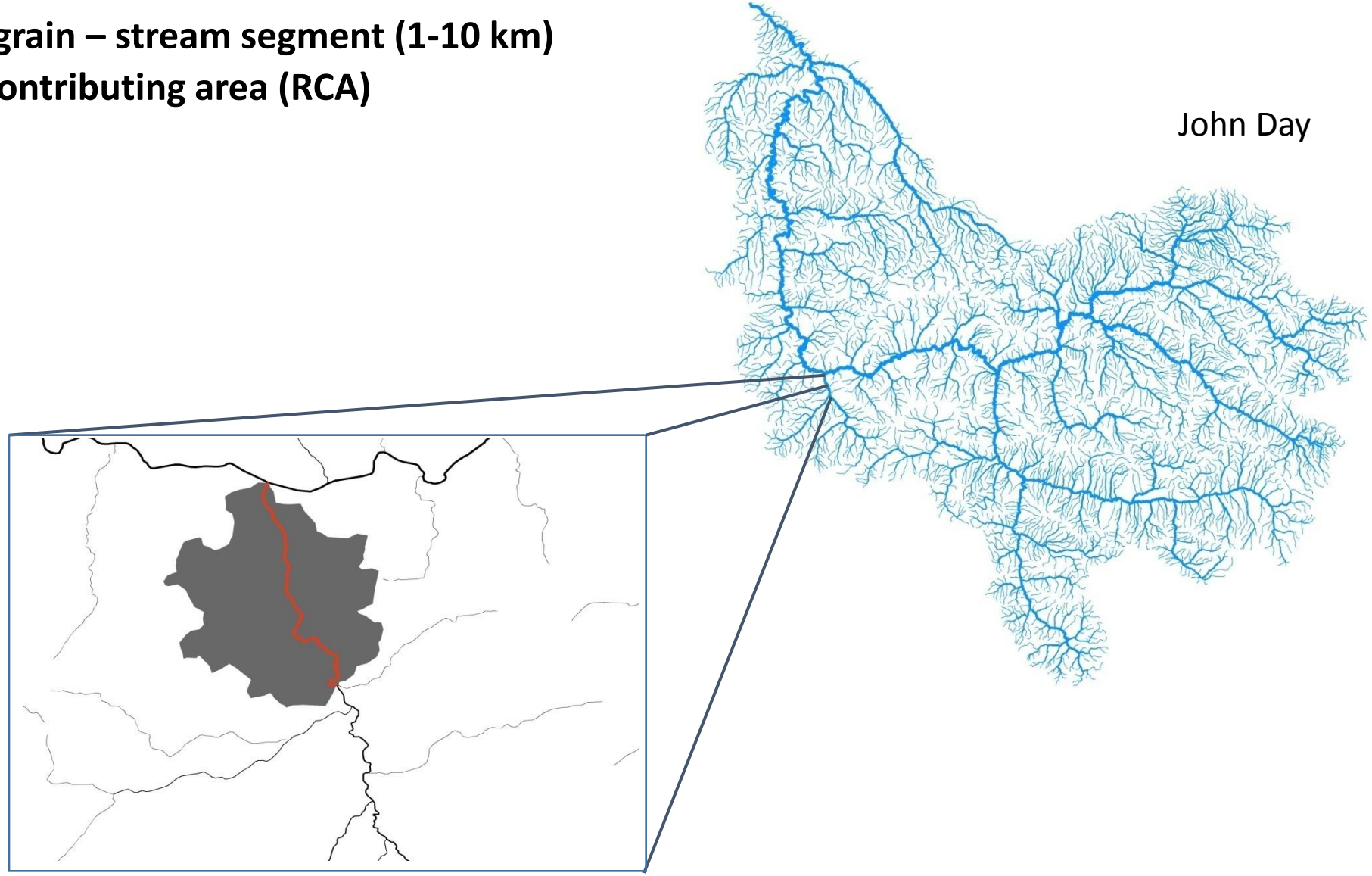


Satellite data

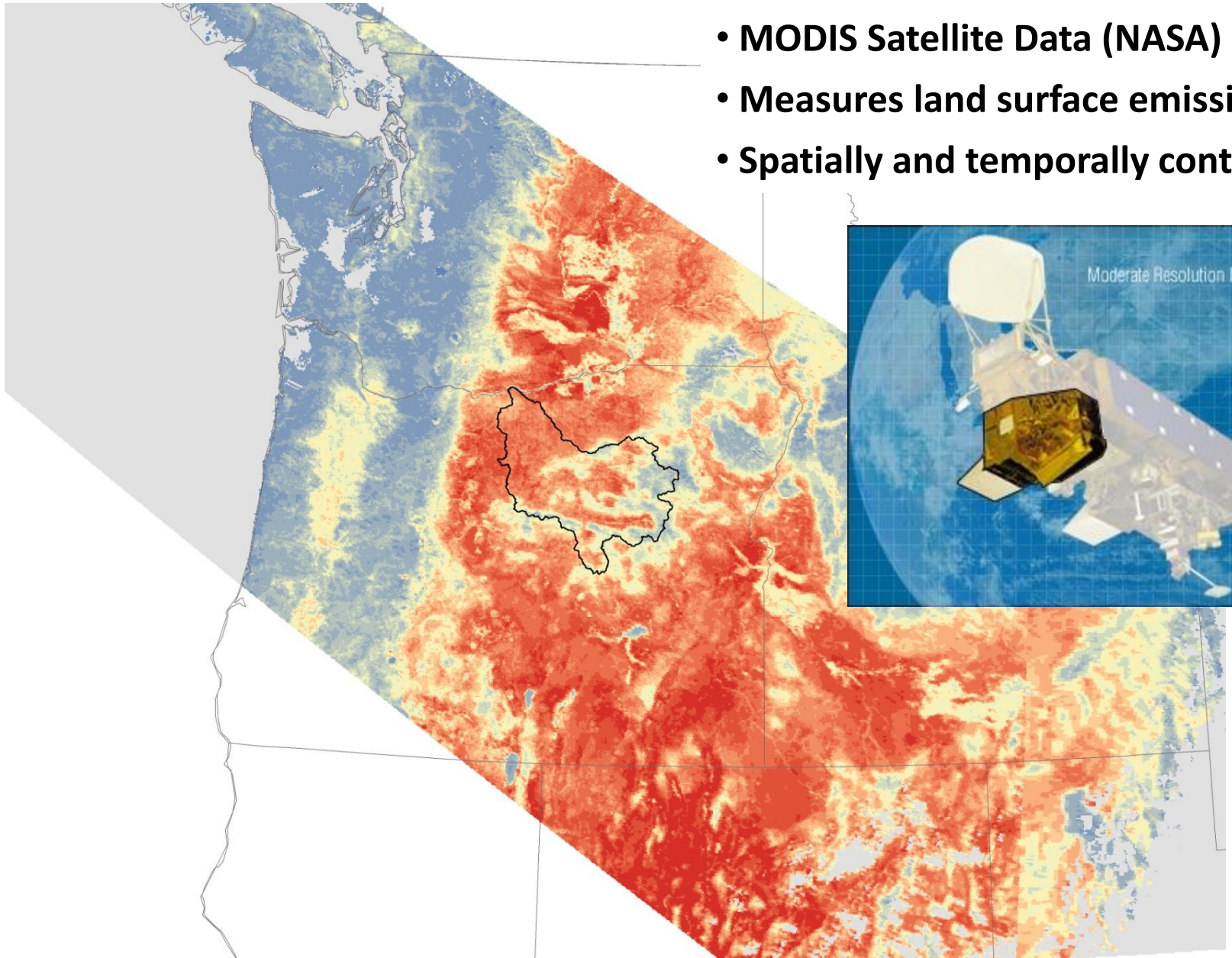
Spatial resolution

Stream Network

- **Spatial grain – stream segment (1-10 km)**
- **Reach contributing area (RCA)**



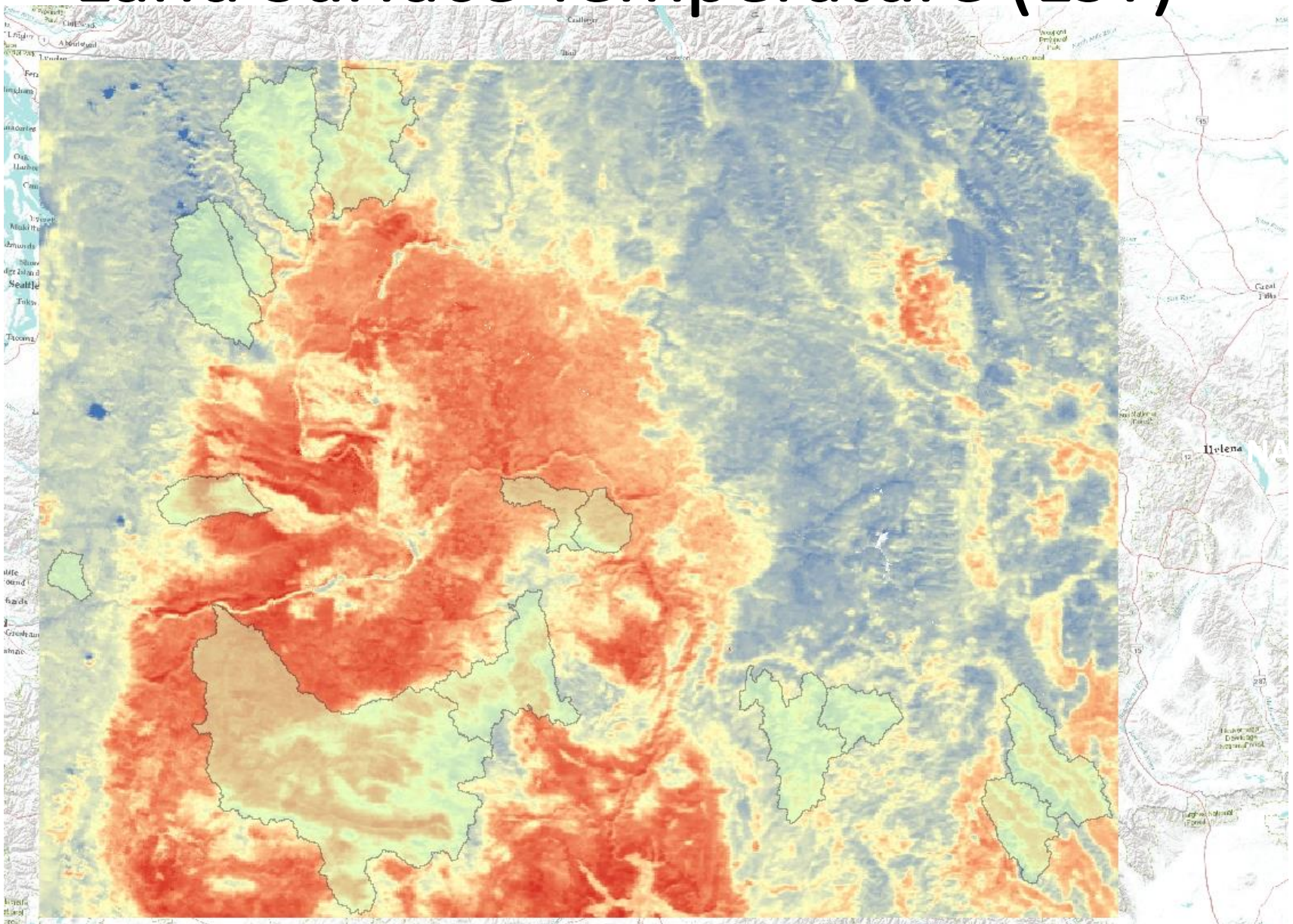
Land Surface Temperature (LST)



- **MODIS Satellite Data (NASA)**
- **Measures land surface emissivity (LST)**
- **Spatially and temporally continuous**

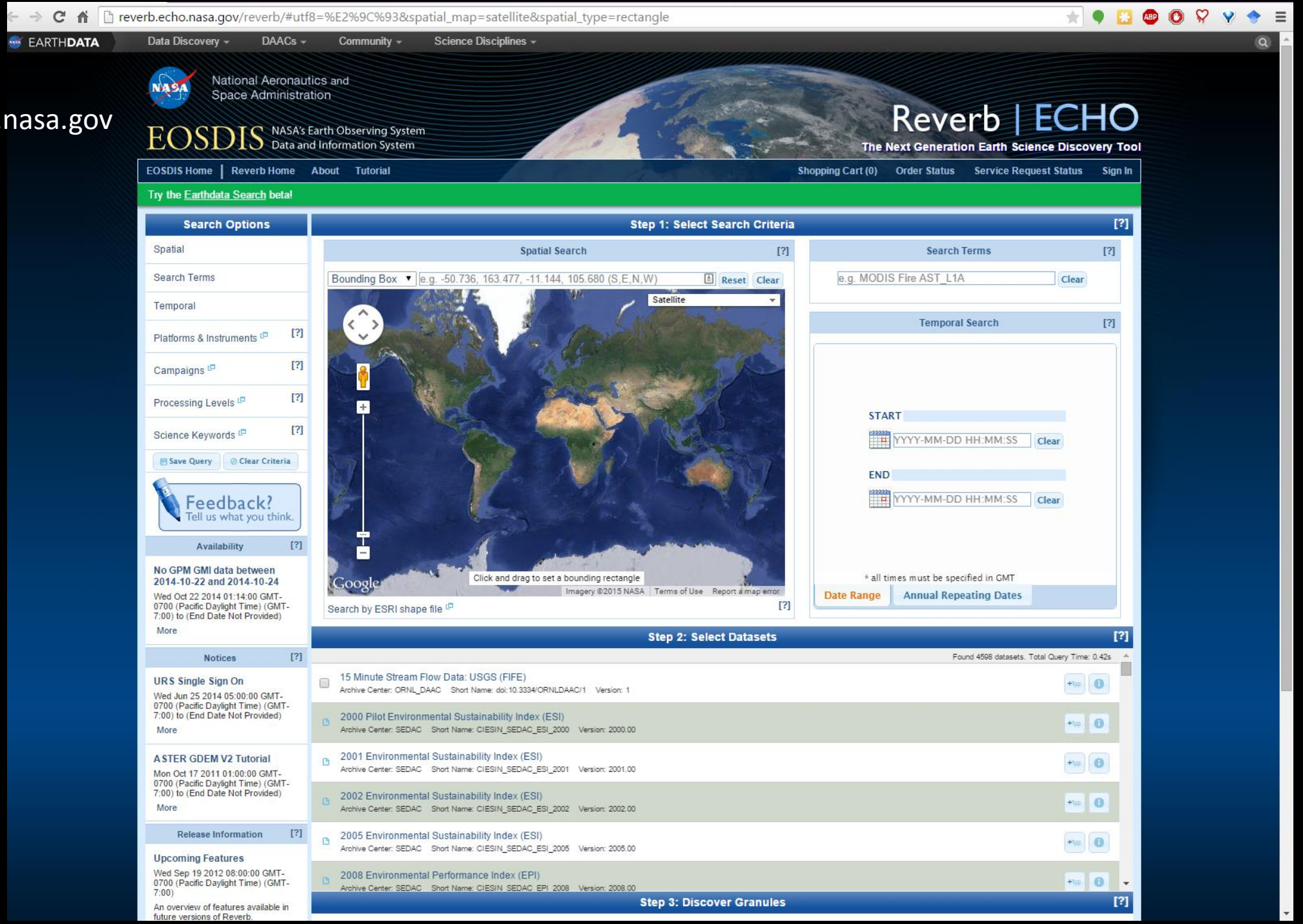
July 26, 2001

Land Surface Temperature (LST)



July 26, 2001

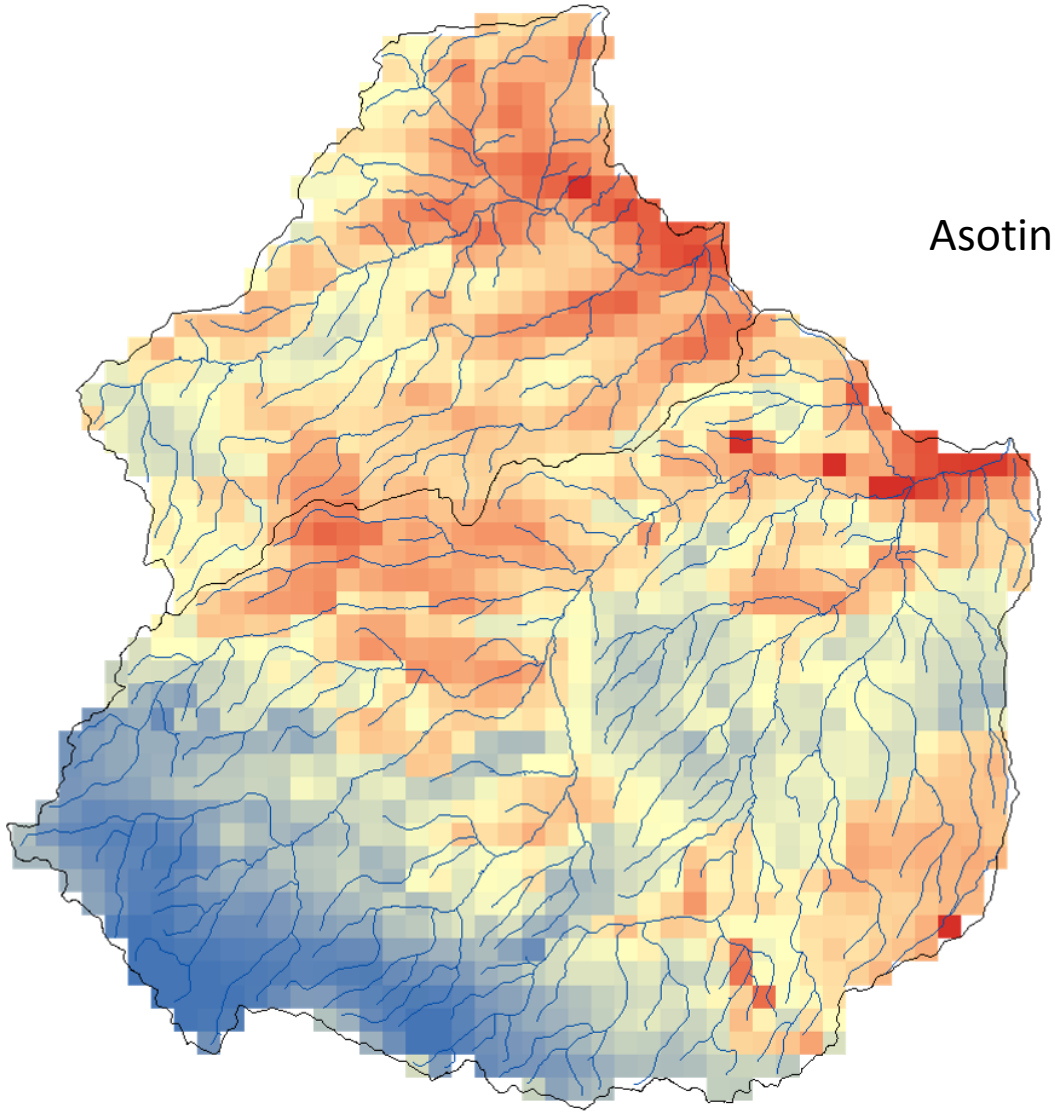
reverb.echo.nasa.gov



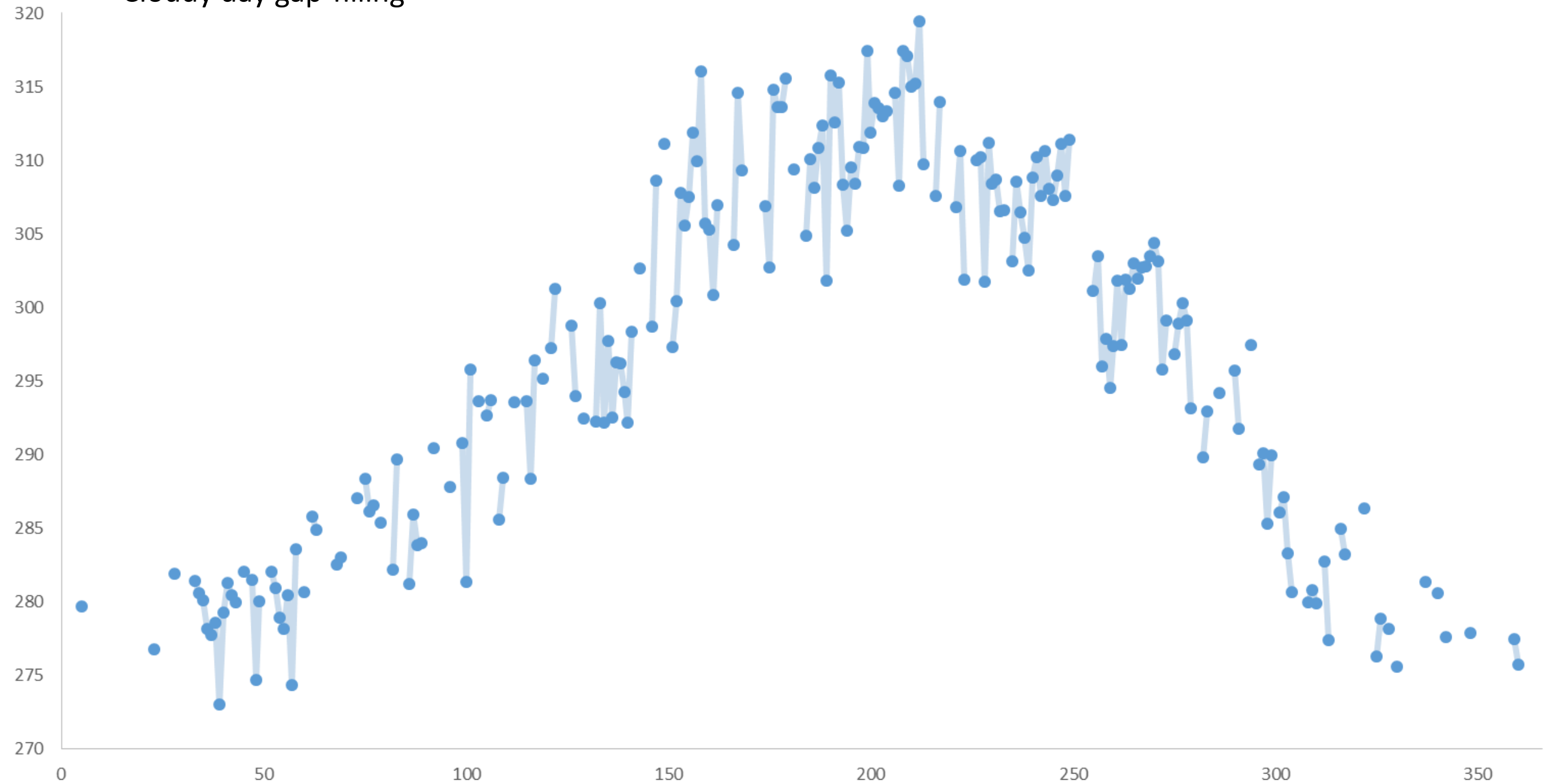
Hierarchical Data Format [HDF]: Scientific Data Set [SDS]: LST_Day_1km

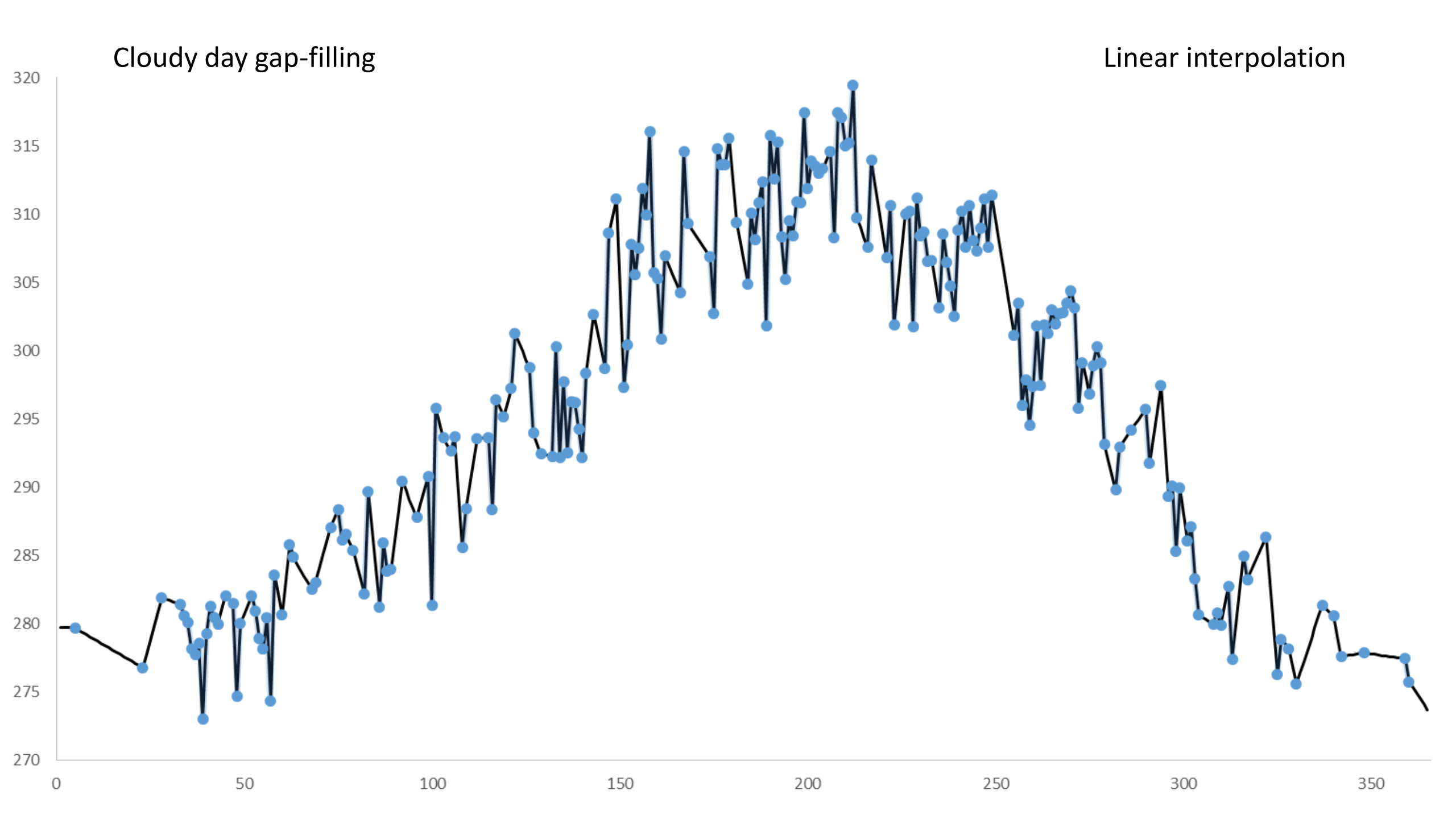
Extract, Project, & Clip

Marine
Geospatial
Ecology
Tools



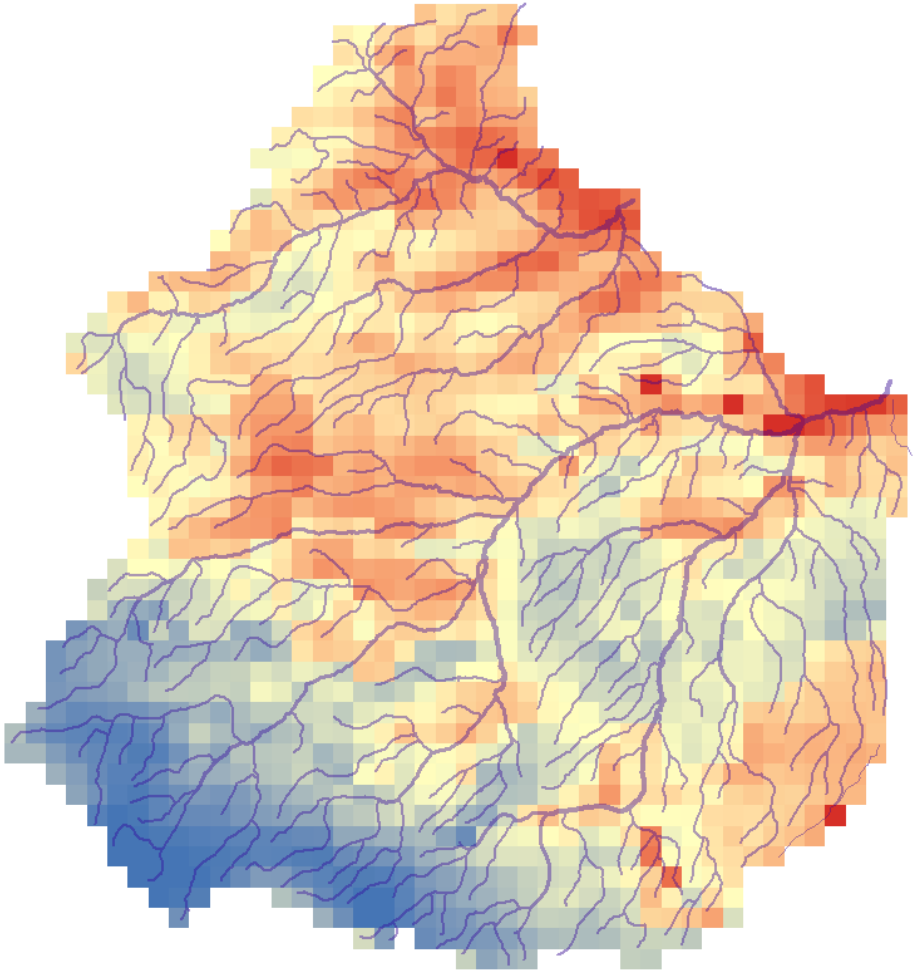
Cloudy day gap-filling



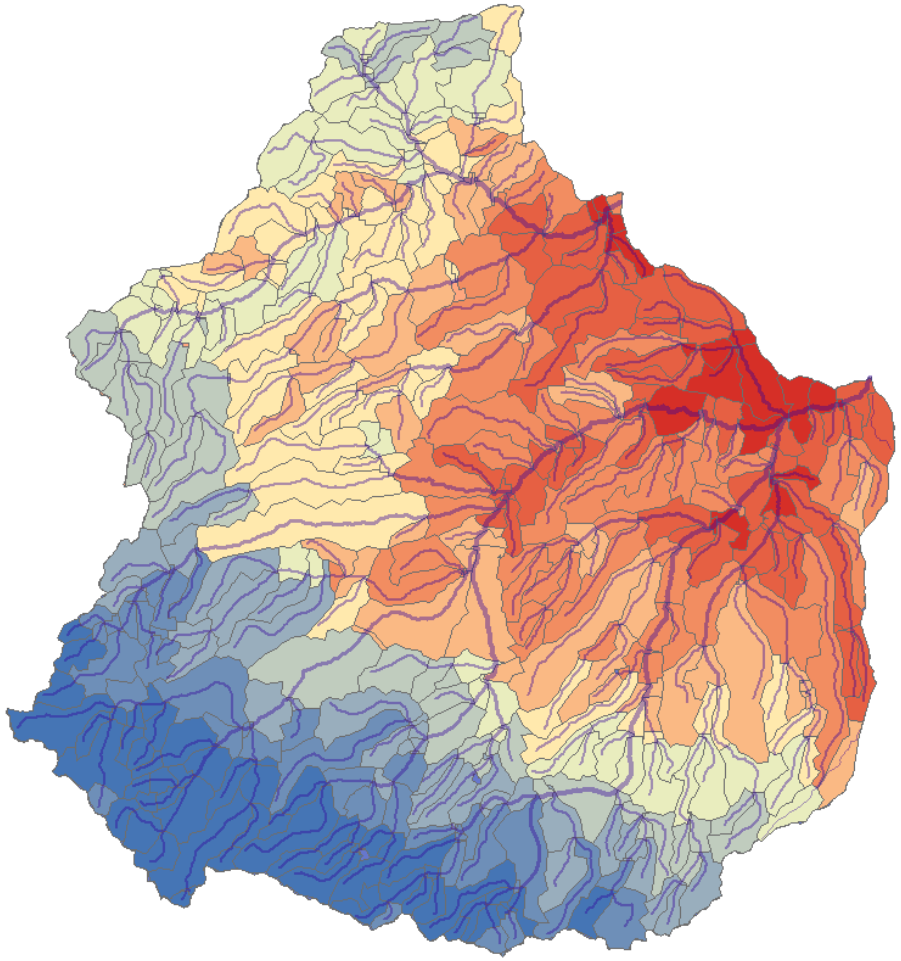

Cloudy day gap-filling
Linear interpolation
320
315
310
305
300
295
290
285
280
275
270
0
50
100
150
200
250
300
350

1km^2 grid

RCA polygons

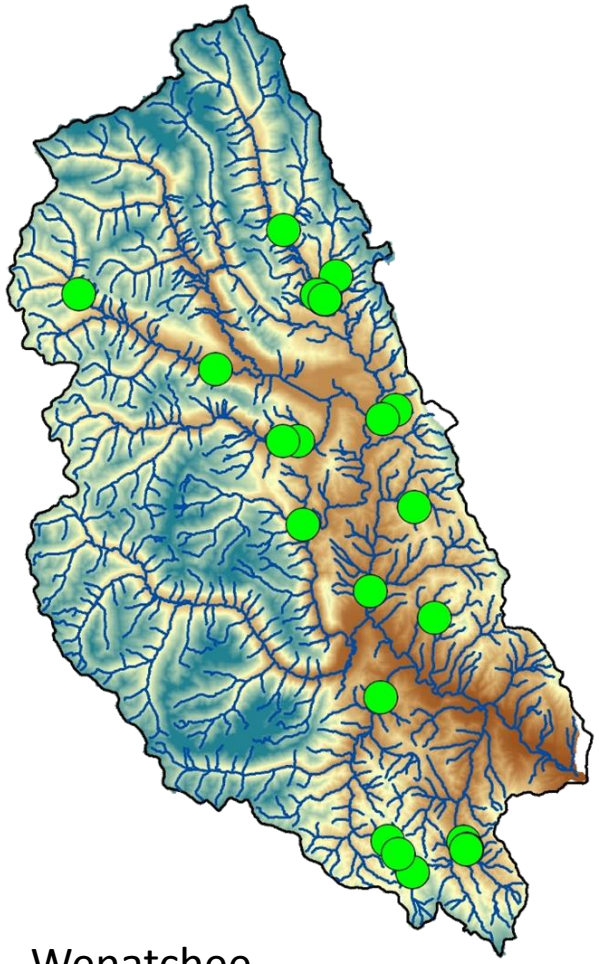


Area weighted mean



Asotin

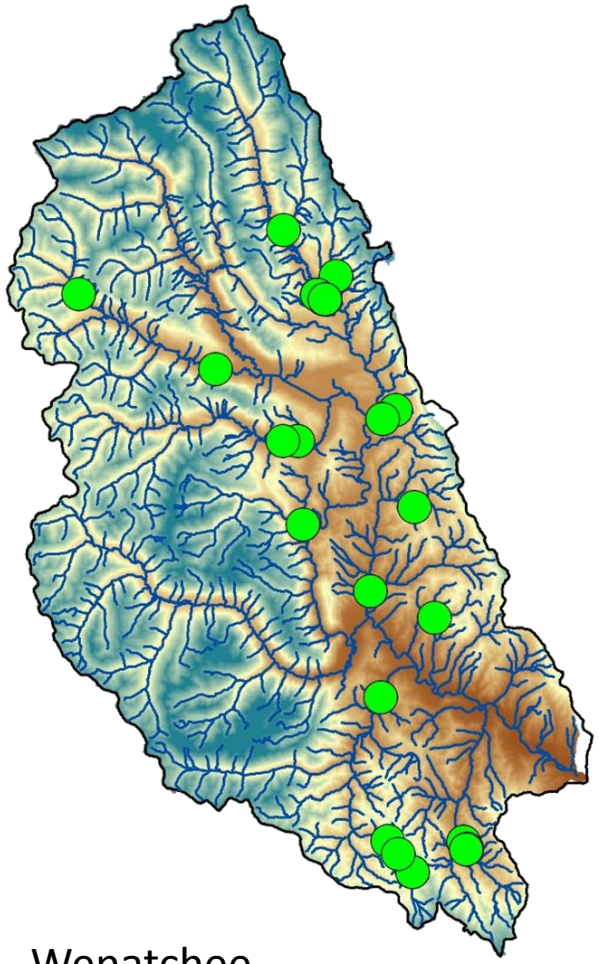
Julian day 137



Wenatchee

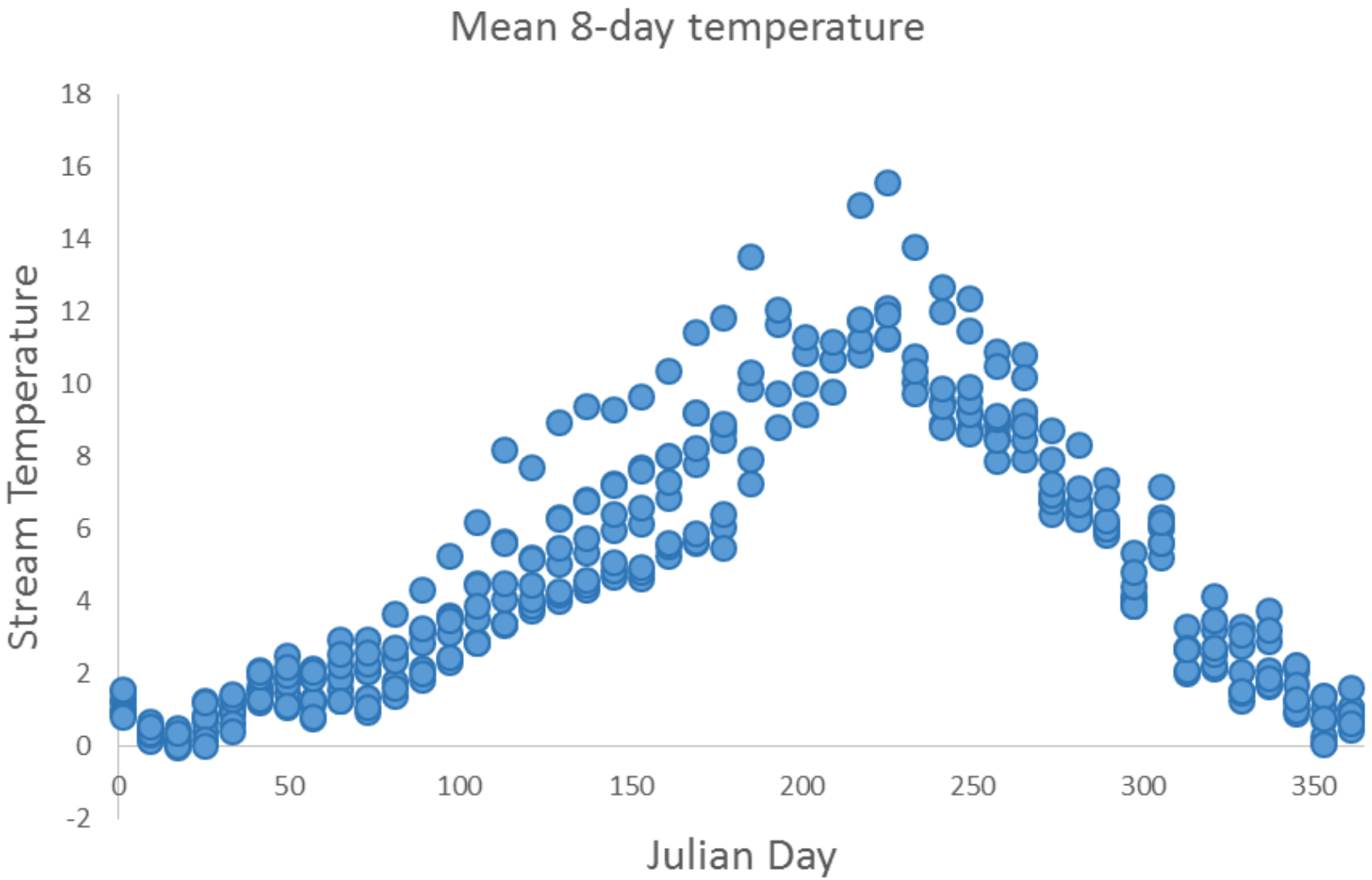
Site data: stream temperature loggers and physiography

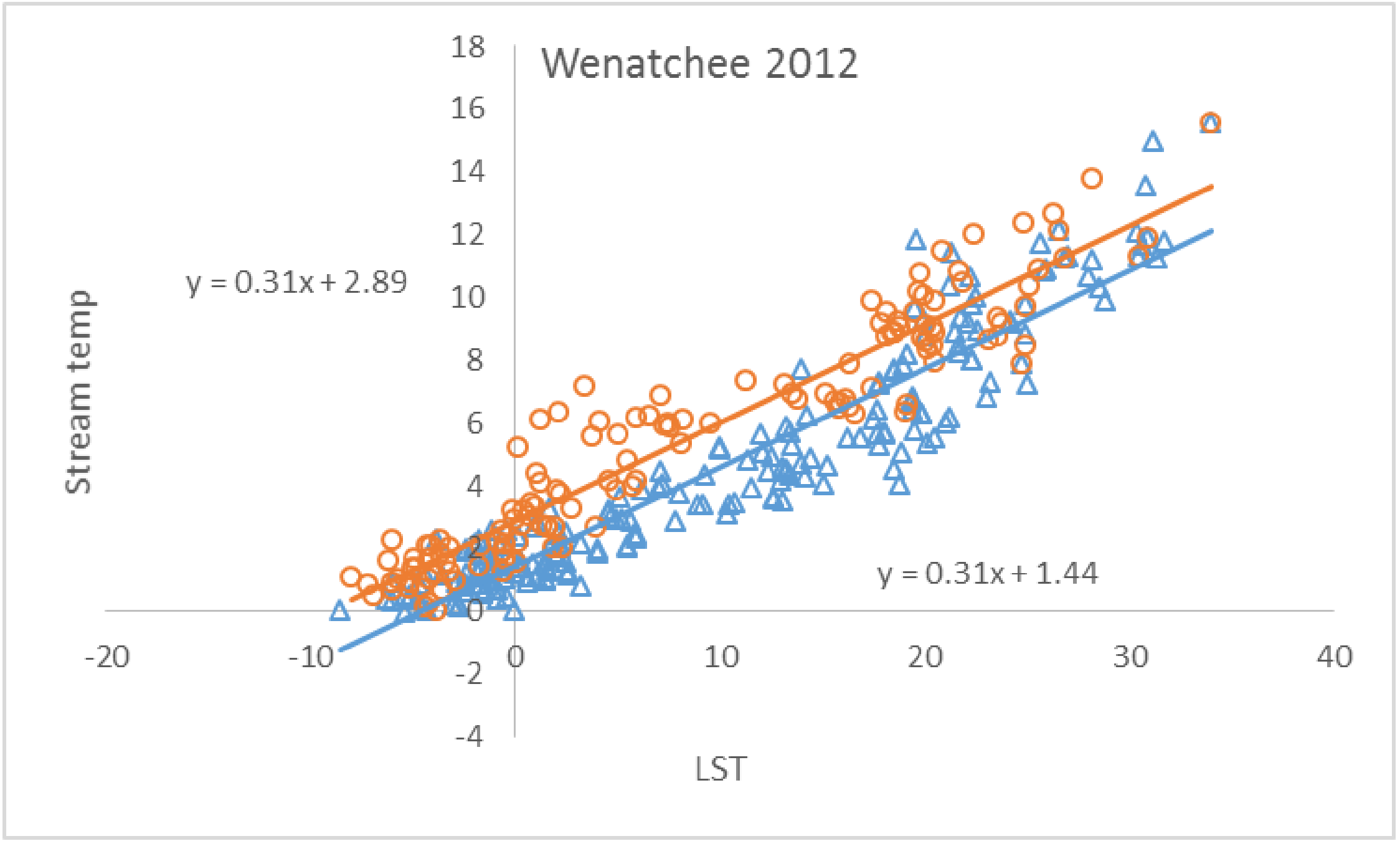
JulDay	Elev	ProgramSi	SiteName	WatershedName	CountDay	StartRang	EndRange	Avg8Day	JulianDate
1	800.8	61785	CBW05583-492715	Wenatchee	8	1-Jan-12	8-Jan-12	1.311	12001
1	376.9	67946	WC503432-000042	Wenatchee	8	1-Jan-12	8-Jan-12	1.227	12001
1	567.3	67951	WC503432-000049	Wenatchee	8	1-Jan-12	8-Jan-12	1.033	12001
1	575.3	67979	WENMASTER-000037	Wenatchee	8	1-Jan-12	8-Jan-12	0.964	12001
1	754.3	67994	WENMASTER-000071	Wenatchee	8	1-Jan-12	8-Jan-12	0.937	12001
1	728.8	68020	WENMASTER-000195	Wenatchee	8	1-Jan-12	8-Jan-12	0.849	12001
1	943.9	68036	WENMASTER-000269	Wenatchee	8	1-Jan-12	8-Jan-12	1.541	12001
1	897.8	67937	WC503432-000029	Wenatchee	8	1-Jan-12	8-Jan-12	1.586	12001
9	800.8	61785	CBW05583-492715	Wenatchee	8	9-Jan-12	16-Jan-12	0.506	12009
9	376.9	67946	WC503432-000042	Wenatchee	8	9-Jan-12	16-Jan-12	0.413	12009
9	567.3	67951	WC503432-000049	Wenatchee	8	9-Jan-12	16-Jan-12	0.21	12009
9	575.3	67979	WENMASTER-000037	Wenatchee	8	9-Jan-12	16-Jan-12	0.163	12009
9	754.3	67994	WENMASTER-000071	Wenatchee	8	9-Jan-12	16-Jan-12	0.347	12009
9	728.8	68020	WENMASTER-000195	Wenatchee	8	9-Jan-12	16-Jan-12	0.373	12009
9	943.9	68036	WENMASTER-000269	Wenatchee	8	9-Jan-12	16-Jan-12	0.683	12009
9	897.8	67937	WC503432-000029	Wenatchee	8	9-Jan-12	16-Jan-12	0.57	12009
17	800.8	61785	CBW05583-492715	Wenatchee	8	17-Jan-12	24-Jan-12	0.122	12017
17	376.9	67946	WC503432-000042	Wenatchee	8	17-Jan-12	24-Jan-12	0.035	12017
17	567.3	67951	WC503432-000049	Wenatchee	8	17-Jan-12	24-Jan-12	0.232	12017
17	575.3	67979	WENMASTER-000037	Wenatchee	8	17-Jan-12	24-Jan-12	0.211	12017



Wenatchee

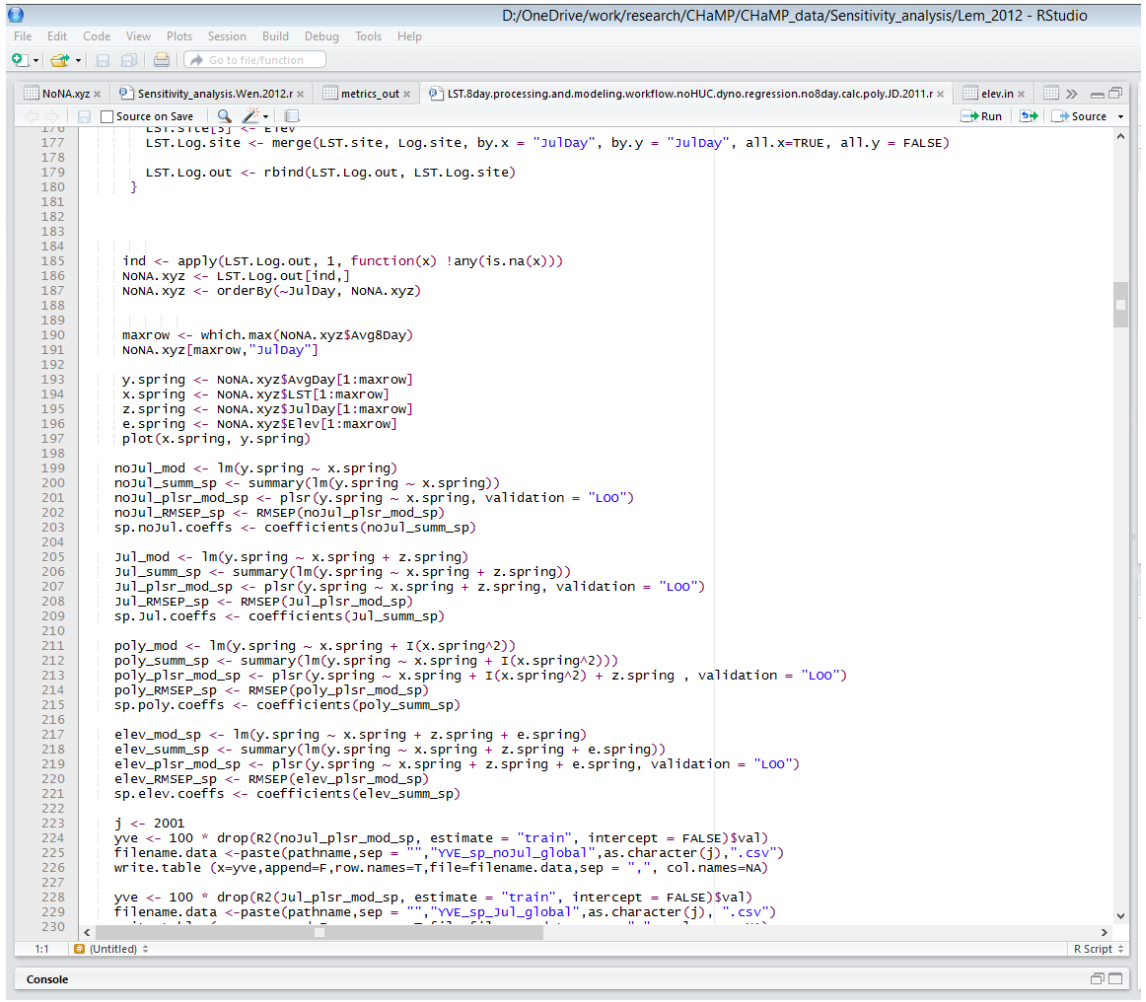
Site data: stream temperature loggers




Wenatchee 2012
y = 0.31x + 2.89
y = 0.31x + 1.44
Stream temp
LST
18
16
14
12
10
8
6
4
2
0
-2
-4
-20
-10
0
10
20
30
40

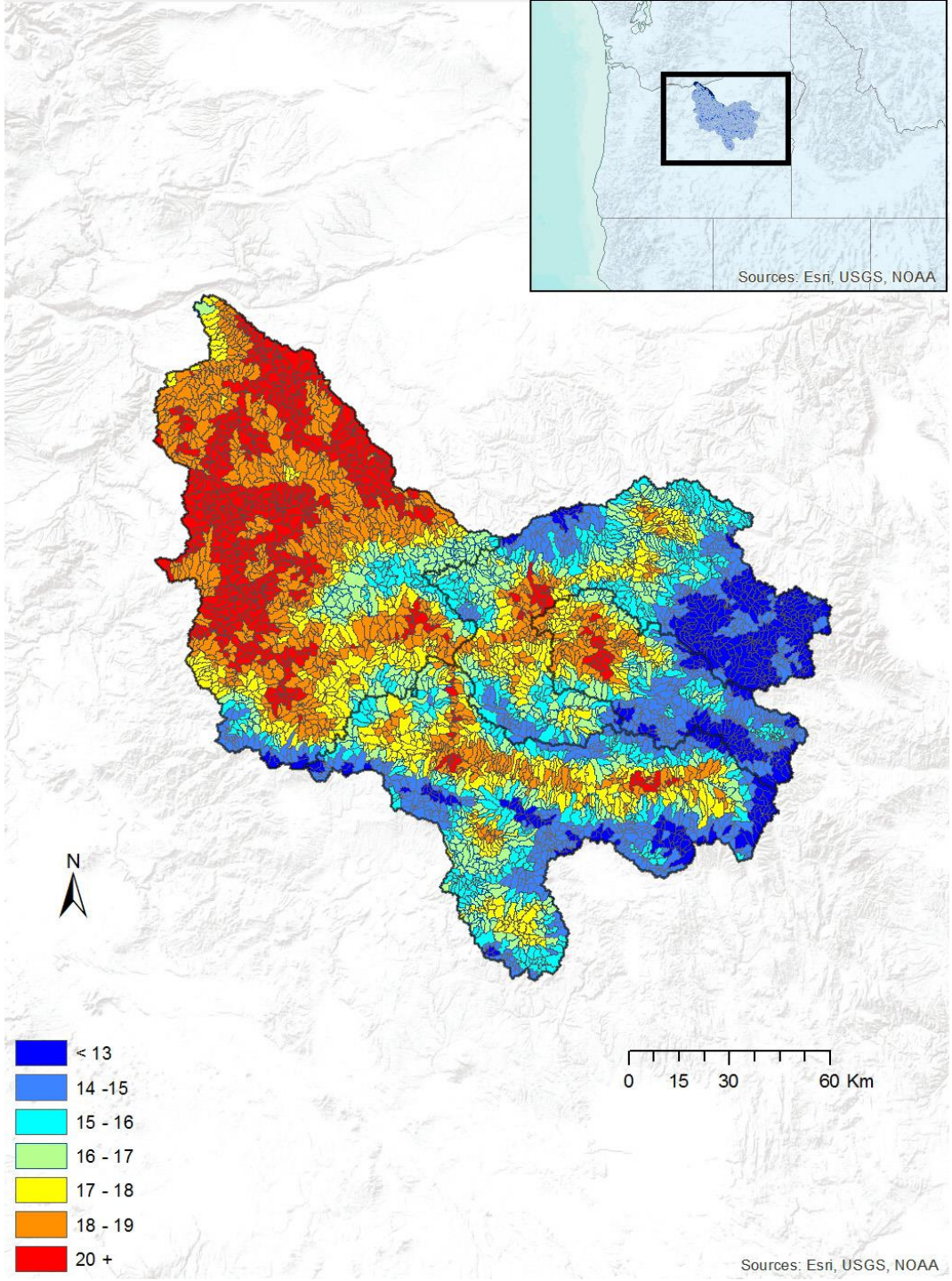
R script

- Parses data into spring/fall set
- Finds “best” model structure
  - L-O-O PRESS Statistic
  - RMSEP
  - AIC
- Parameterizes model
- Estimates stream temp in unsampled reaches



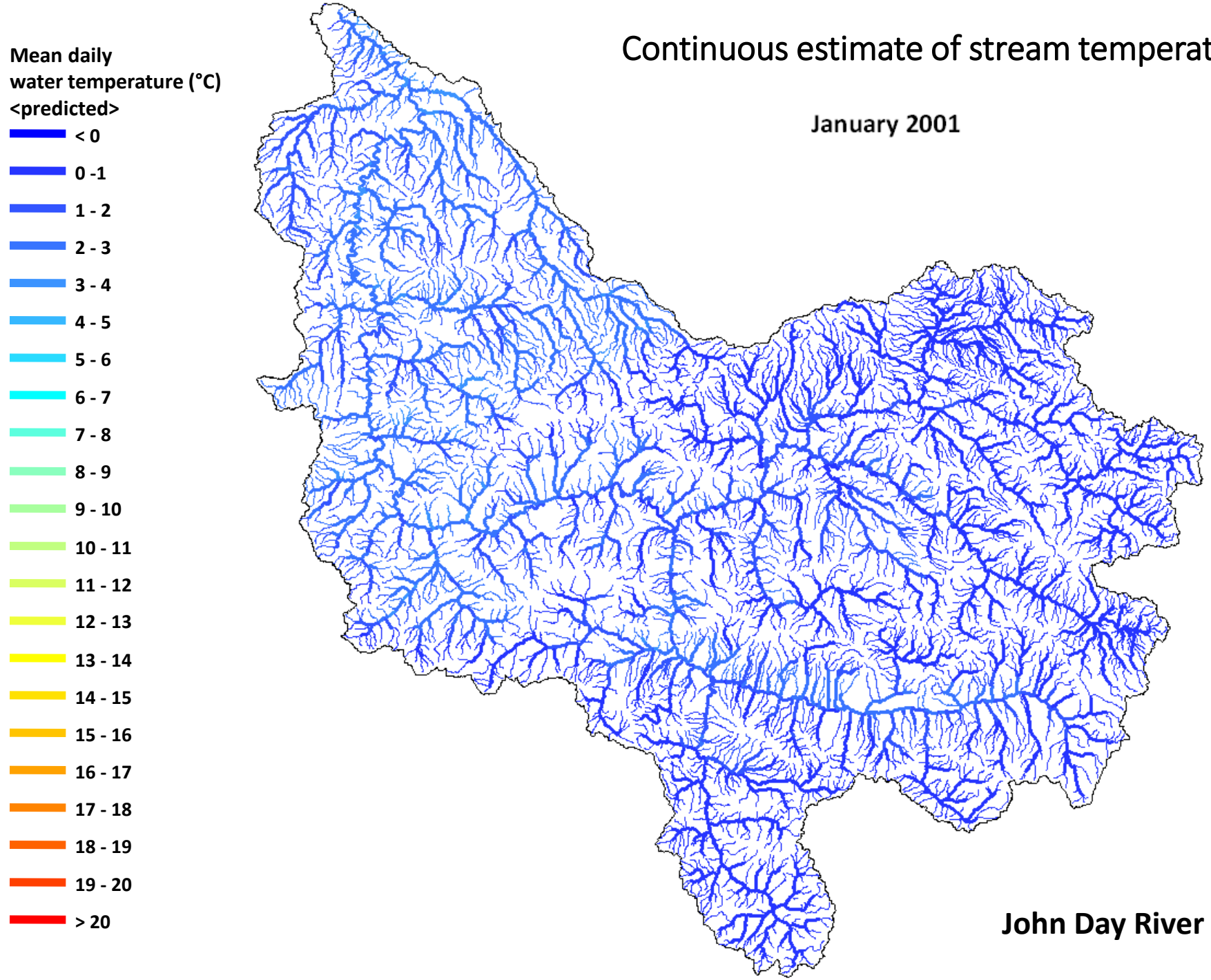
Model output

Spatially continuous estimate of stream temperature



Continuous estimate of stream temperature

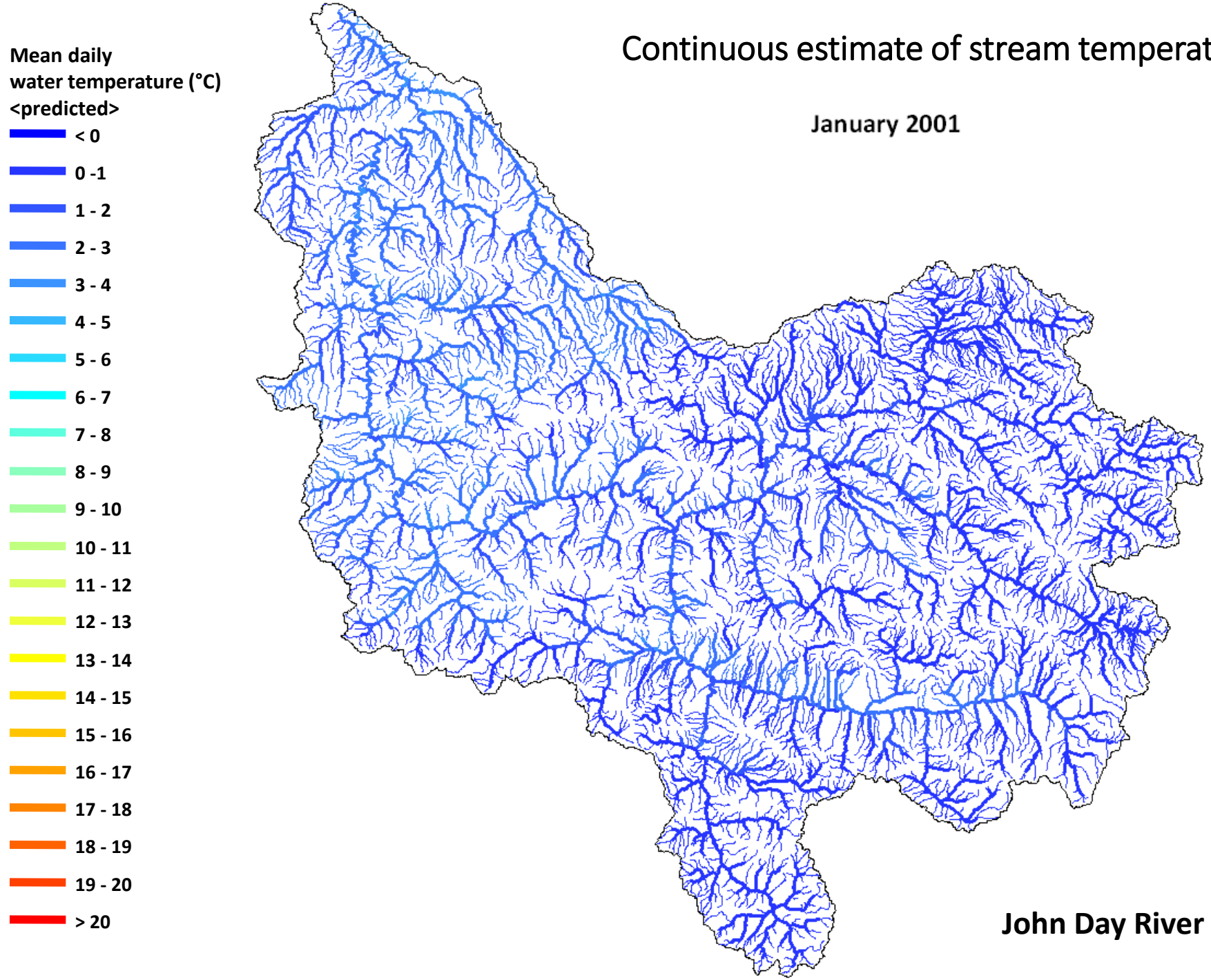
January 2001



John Day River basin

Continuous estimate of stream temperature

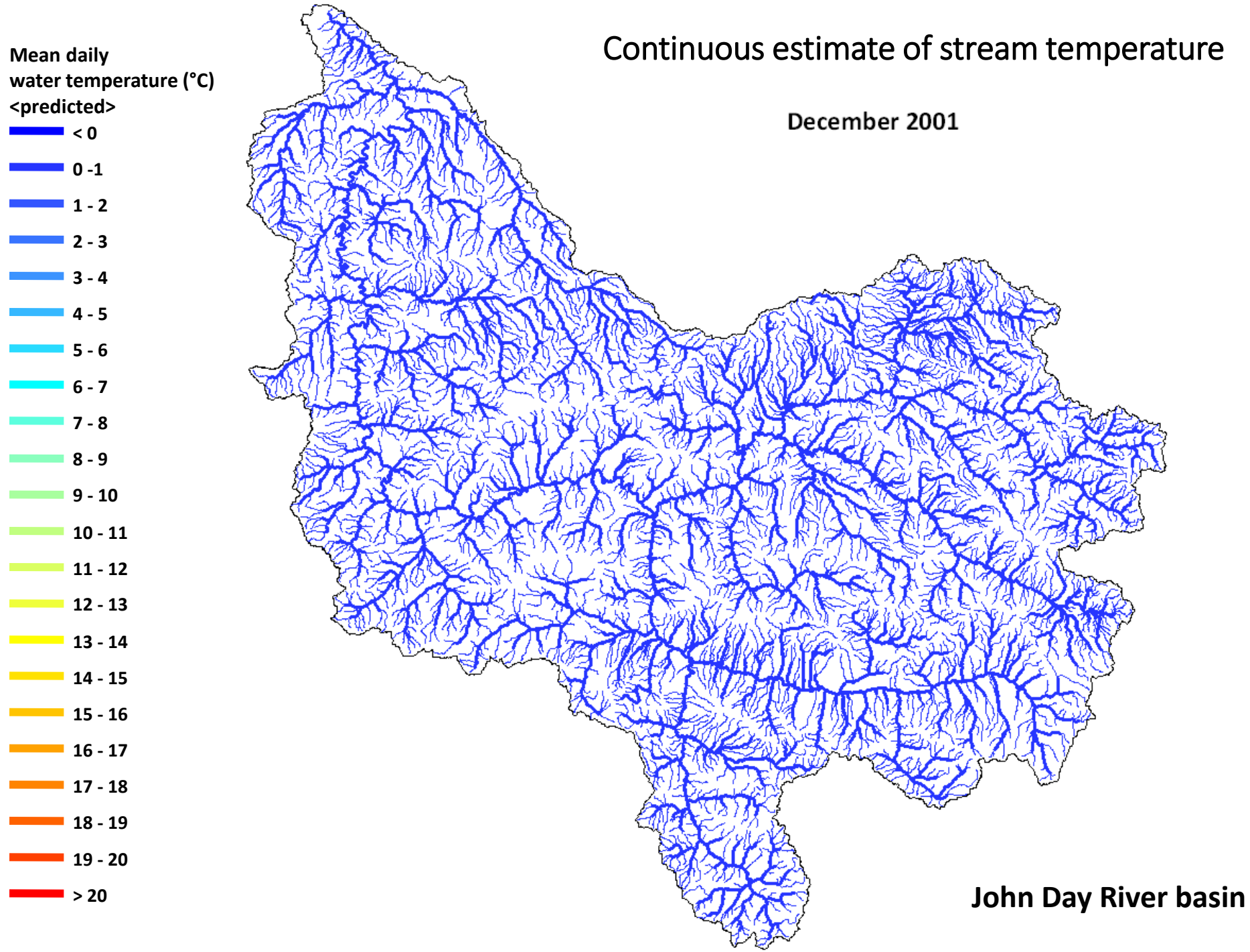
January 2001



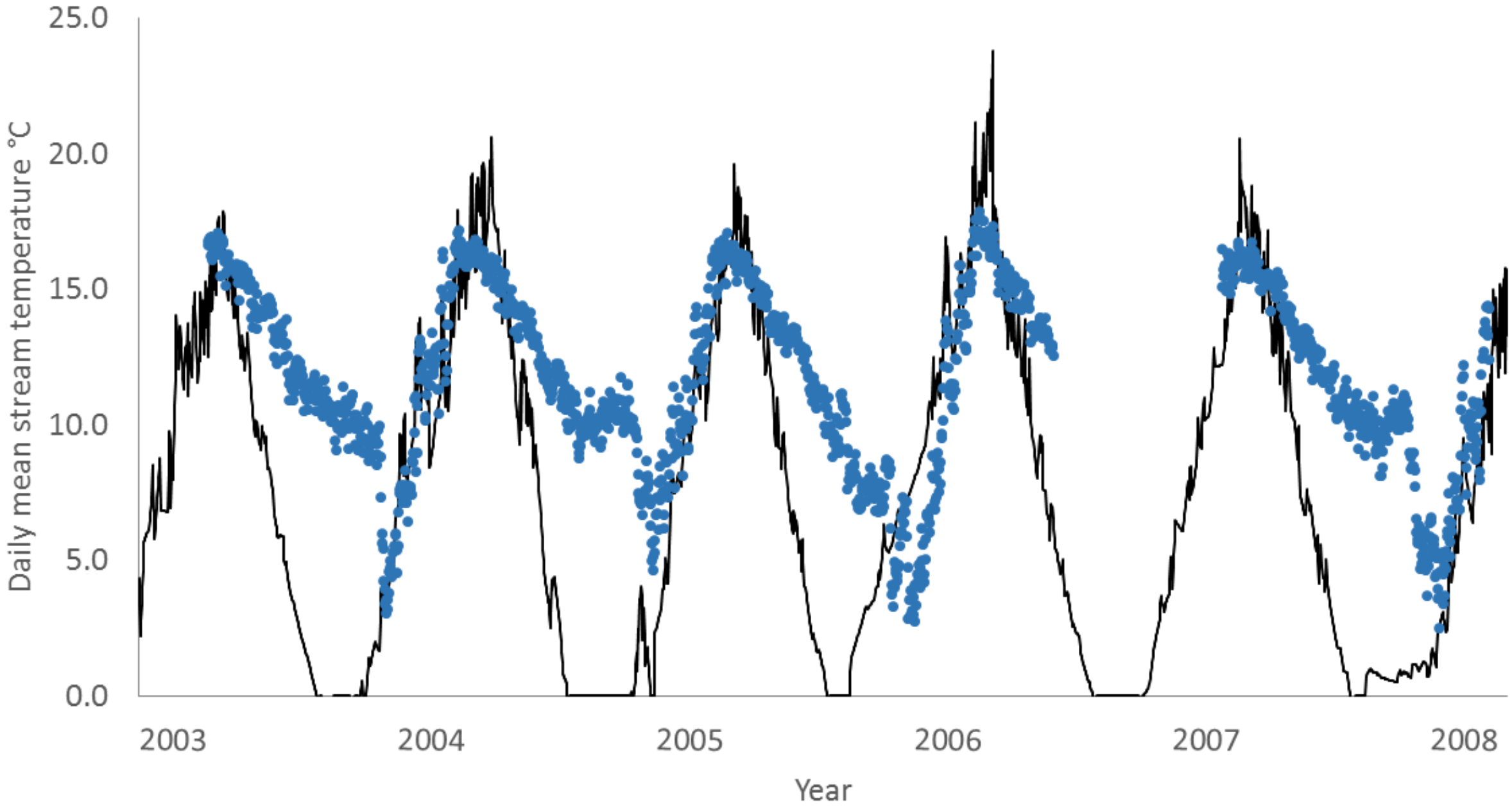
John Day River basin

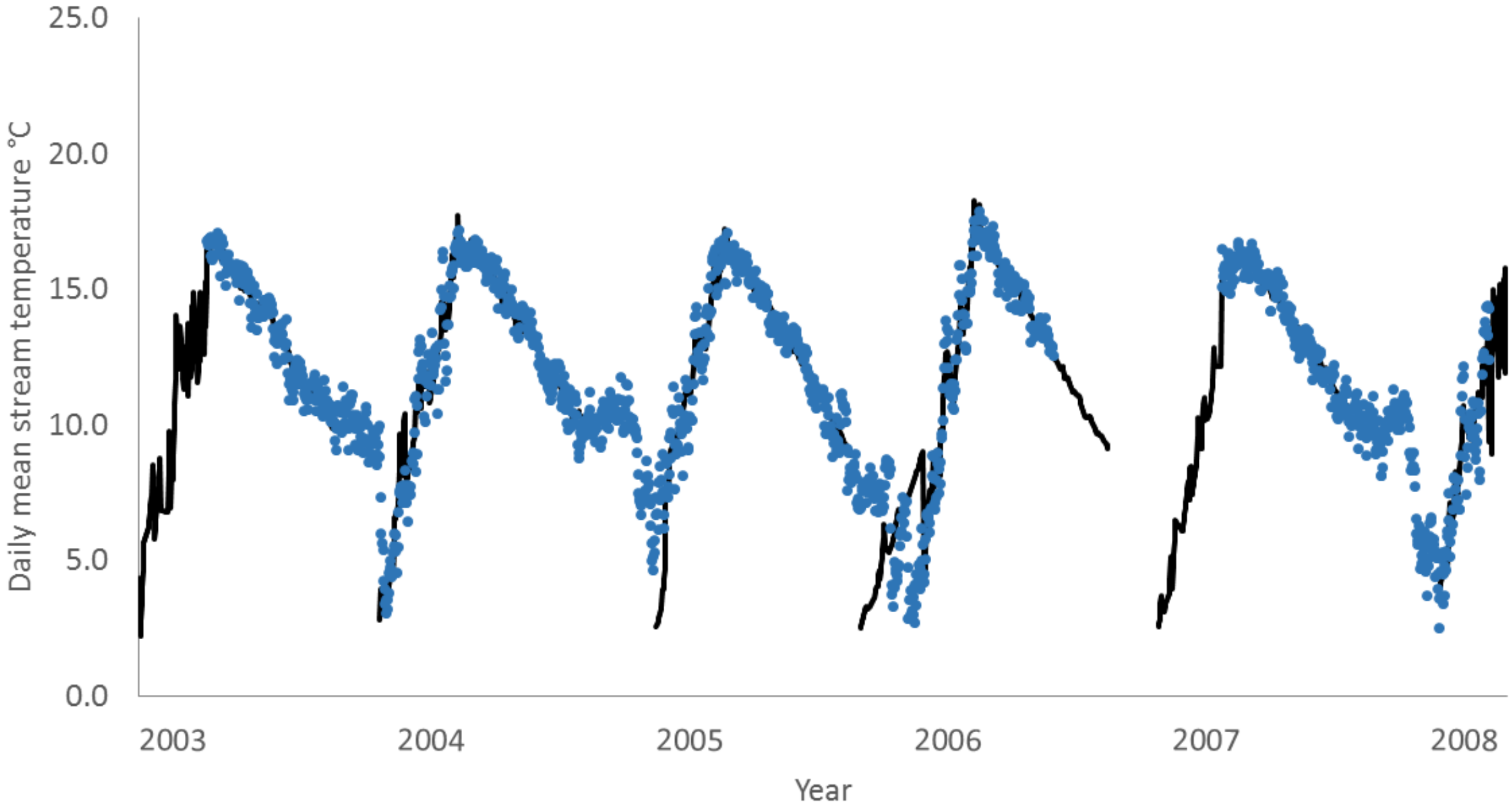
Continuous estimate of stream temperature

December 2001



John Day River basin


25.0
20.0
15.0
10.0
5.0
0.0
Daily mean stream temperature °C
2003
2004
2005
2006
2007
2008
Year


25.0
20.0
15.0
10.0
5.0
0.0
Daily mean stream temperature °C
2003
2004
2005
2006
2007
2008
Year

How many (or few) sites are needed?