Madyson L Bradford

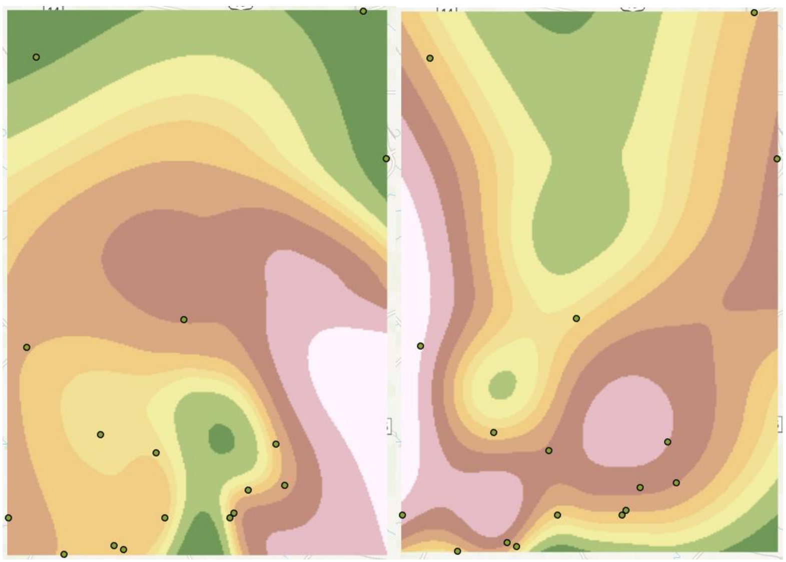
25 February 2021

475 – 504

Representation and Spatial Interpolation

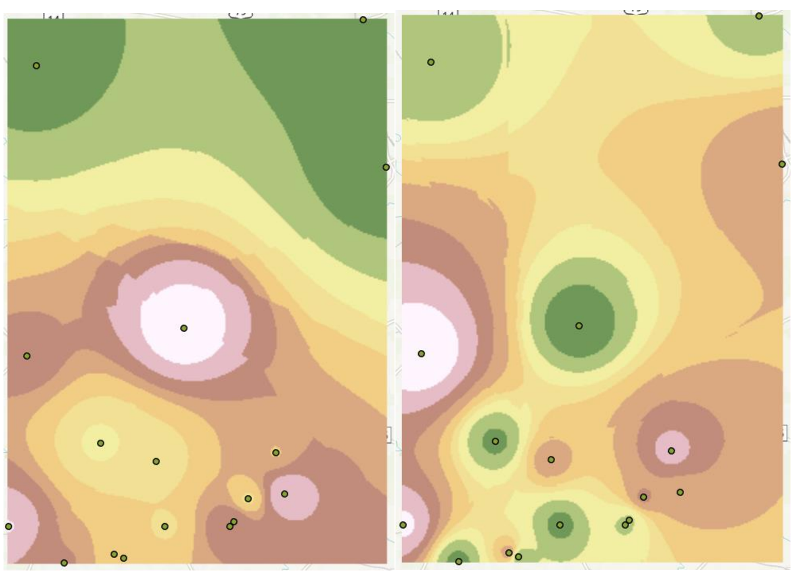
Point Interpolation

Spline



Spline_Tavg (left), Spline_Prcp (right)

IDW



IDW_Tavg (left), IDW_Prcp (right)

RMSE:

OBJECTID *	Shape *	Object_ID	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	CDSD	PRCP	TAVG	TMAX	TMIN	RASTERVALU	Error
1	Point	2	USC00411045	BREMOND	31.16	-96.68	143.3	0	0.24	70.4	0	0	0.240014	0
2	Point	3	USC00411048	BRENHAM	30.16	-96.4	95.4	0	0.13	73.1	85.5	60.7	0.13045	0
3	Point	8	US1TXWA0005	BRENHAM 7.2 SW	30.09	-96.49	114	0	0.22	73.3	0	0	0.220651	0
4	Point	6	US1TXWA0006	BRENHAM 8.0 E	30.16	-96.26	75	0	0.27	72.9	0	0	0.35061	0.006498
5	Point	14	US1TXWA0021	BRENHAM 8.2 WSW	30.1	-96.51	110	0	0.77	73.4	0	0	0.769692	0
6	Point	7	US1TXWA0017	BRENHAM 9.9 N	30.3	-96.42	88.4	0	0.78	72.8	0	0	0.779767	0
7	Point	12	US1TXWA0001	BURTON 6.9 SSW	30.08	-96.62	134.1	0	0.15	73.6	0	0	0.150264	0
8	Point	4	USC00411314	CALDWELL	30.53	-96.7	111.3	0	1.9	73.7	0	0	1.899921	0
9	Point	9	US1TXWA0015	CARMINE 3.1 WNW	30.16	-96.74	134.7	0	1.49	74.2	0	0	1.489761	0
10	Point	1	USC00411596	CENTERVILLE	31.26	-95.97	97.5	2438	0.31	69.6	83	56.2	0.31001	0
11	Point	5	US1TXWA0009	CHAPPELL HILL 1.0 NW	30.16	-96.26	71.9	0	0.35	73.8	0	0	0.35061	0
12	Point	13	US1TXWA0010	CHAPPELL HILL 1.8 N	30.17	-96.25	75.9	0	0.37	73.7	0	0	0.370168	0
13	Point	16	USW00003904	COLLEGE STATION EA...	30.59	-96.36	93	3151	0	74.8	86.1	63.6	0.000154	0
14	Point	10	US1TXWA0003	HEMPSTEAD 10.0 NNW	30.23	-96.14	75	0	0.73	74.2	0	0	0.730012	0
15	Point	18	USC00415477	MADISONVILLE	30.94	-95.92	76.8	2533	0.8	69.9	83.7	56.1	0.799997	0
16	Point	17	USC00418446	SOMERVILLE DAM	30.34	-96.54	80.2	2905	0.16	72.6	88.5	56.8	0.160081	0
17	Point	11	US1TXWA0014	WASHINGTON 8.6 SSW	30.22	-96.22	70.7	0	0.86	73.1	0	0	0.85909	0.000001
18	Point	15	USC00419491	WASHINGTON STATE...	30.32	-96.16	65.5	0	1.21	73.4	89.4	57.3	1.209884	0

IDW Precipitation with Default Parameters.

OBJECTID *	Shape *	Object_ID	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	CDSD	PRCP	T	T	T	RASTERVALU	Error
1	Point	2	USC00411045	BREMOND	31.16	-96.68	143.3	0	0.24	.4	0	0	70.40006	0
2	Point	3	USC00411048	BRENHAM	30.16	-96.4	95.4	0	0.13	.1	.5	.7	73.10032	0
3	Point	8	US1TXWA0005	BRENHAM 7.2 SW	30.09	-96.49	114	0	0.22	.3	0	0	73.30013	0
4	Point	6	US1TXWA0006	BRENHAM 8.0 E	30.16	-96.26	75	0	0.27	.9	0	0	73.79829	306925
5	Point	14	US1TXWA0021	BRENHAM 8.2 WSW	30.1	-96.51	110	0	0.77	.4	0	0	73.39995	0
6	Point	7	US1TXWA0017	BRENHAM 9.9 N	30.3	-96.42	88.4	0	0.78	.8	0	0	72.80028	0
7	Point	12	US1TXWA0001	BURTON 6.9 SSW	30.08	-96.62	134.1	0	0.15	.6	0	0	73.59994	0
8	Point	4	USC00411314	CALDWELL	30.53	-96.7	111.3	0	1.9	.7	0	0	73.69998	0
9	Point	9	US1TXWA0015	CARMINE 3.1 WNW	30.16	-96.74	134.7	0	1.49	.2	0	0	74.19982	0
10	Point	1	USC00411596	CENTERVILLE	31.26	-95.97	97.5	2438	0.31	.6	13	.2	69.60005	0
11	Point	5	US1TXWA0009	CHAPPELL HILL 1.0 NW	30.16	-96.26	71.9	0	0.35	.8	0	0	73.79829	000003
12	Point	13	US1TXWA0010	CHAPPELL HILL 1.8 N	30.17	-96.25	75.9	0	0.37	.7	0	0	73.70168	000003
13	Point	16	USW00003904	COLLEGE STATION EA...	30.59	-96.36	93	3151	0	.8	.1	.6	74.79968	0
14	Point	10	US1TXWA0003	HEMPSTEAD 10.0 NNW	30.23	-96.14	75	0	0.73	.2	0	0	74.19969	0
15	Point	18	USC00415477	MADISONVILLE	30.94	-95.92	76.8	2533	0.8	.9	.7	.1	69.90002	0
16	Point	17	USC00418446	SOMERVILLE DAM	30.34	-96.54	80.2	2905	0.16	.6	.5	.8	72.60011	0
17	Point	11	US1TXWA0014	WASHINGTON 8.6 SSW	30.22	-96.22	70.7	0	0.86	.1	0	0	73.1017	000003
18	Point	15	USC00419491	WASHINGTON STATE...	30.32	-96.16	65.5	0	1.21	.4	.4	.3	73.40005	0

IDW Average Temperature with Default Parameters

OBJECTID *	Shape *	Object_ID	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	CDSD	PRCP	TAVG	TMAX	TMIN	RASTERVALU	Error
1	Point	2	USC00411045	BREMOND	31.16	-96.68	143.3	0	0.24	70.4	0	0	0.2493	0.000086
2	Point	3	USC00411048	BRENHAM	30.16	-96.4	95.4	0	0.13	73.1	85.5	60.7	0.111036	0.00036
3	Point	8	US1TXWA0005	BRENHAM 7.2 SW	30.09	-96.49	114	0	0.22	73.3	0	0	0.23052	0.000111
4	Point	6	US1TXWA0006	BRENHAM 8.0 E	30.16	-96.26	75	0	0.27	72.9	0	0	0.256759	0.000175
5	Point	14	US1TXWA0021	BRENHAM 8.2 WSW	30.1	-96.51	110	0	0.77	73.4	0	0	0.7693	0
6	Point	7	US1TXWA0017	BRENHAM 9.9 N	30.3	-96.42	88.4	0	0.78	72.8	0	0	0.785337	0.000028
7	Point	12	US1TXWA0001	BURTON 6.9 SSW	30.08	-96.62	134.1	0	0.15	73.6	0	0	0.160411	0.000108
8	Point	4	USC00411314	CALDWELL	30.53	-96.7	111.3	0	1.9	73.7	0	0	1.908687	0.000075
9	Point	9	US1TXWA0015	CARMINE 3.1 WNW	30.16	-96.74	134.7	0	1.49	74.2	0	0	1.474614	0.000237
10	Point	1	USC00411596	CENTERVILLE	31.26	-95.97	97.5	2438	0.31	69.6	83	56.2	0.312104	0.000004
11	Point	5	US1TXWA0009	CHAPPELL HILL 1.0 NW	30.16	-96.26	71.9	0	0.35	73.8	0	0	0.256759	0.008694
12	Point	13	US1TXWA0010	CHAPPELL HILL 1.8 N	30.17	-96.25	75.9	0	0.37	73.7	0	0	0.355569	0.000208
13	Point	16	USW00003904	COLLEGE STATION EA...	30.59	-96.36	93	3151	0	74.8	86.1	63.6	0.010005	0.0001
14	Point	10	US1TXWA0003	HEMPSTEAD 10.0 NNW	30.23	-96.14	75	0	0.73	74.2	0	0	0.734641	0.000022
15	Point	18	USC00415477	MADISONVILLE	30.94	-95.92	76.8	2533	0.8	69.9	83.7	56.1	0.800445	0
16	Point	17	USC00418446	SOMERVILLE DAM	30.34	-96.54	80.2	2905	0.16	72.6	88.5	56.8	0.17017	0.000103
17	Point	11	US1TXWA0014	WASHINGTON 8.6 SSW	30.22	-96.22	70.7	0	0.86	73.1	0	0	0.868232	0.000068
18	Point	15	USC00419491	WASHINGTON STATE...	30.32	-96.16	65.5	0	1.21	73.4	89.4	57.3	1.20648	0.000012

Spline Precipitation with Default Parameters

Extract_Idw_Tavg Extract_Idw_Prcp Extract_Spline_Tavg Extract_Spline_Prcp

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete

OBJECTID *	Shape *	Object_ID	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	CDSD	PRCP	TAVG	TMAX	TMIN	RASTERVALU	Error
1	Point	2	USC00411045	BREMOND	31.16	-96.68	143.3	0	0.24	70.4	0	0	70.40355	)00013
2	Point	3	USC00411048	BRENHAM	30.16	-96.4	95.4	0	0.13	73.1	85.5	60.7	73.0581	)01756
3	Point	8	US1TXWA0005	BRENHAM 7.2 SW	30.09	-96.49	114	0	0.22	73.3	0	0	73.30244	)00006
4	Point	6	US1TXWA0006	BRENHAM 8.0 E	30.16	-96.26	75	0	0.27	72.9	0	0	72.80235	)09536
5	Point	14	US1TXWA0021	BRENHAM 8.2 WSW	30.1	-96.51	110	0	0.77	73.4	0	0	73.40126	)00002
6	Point	7	US1TXWA0017	BRENHAM 9.9 N	30.3	-96.42	88.4	0	0.78	72.8	0	0	72.78922	)00116
7	Point	12	US1TXWA0001	BURTON 6.9 SSW	30.08	-96.62	134.1	0	0.15	73.6	0	0	73.59766	)00005
8	Point	4	USC00411314	CALDWELL	30.53	-96.7	111.3	0	1.9	73.7	0	0	73.70015	0
9	Point	9	US1TXWA0015	CARMINE 3.1 WNW	30.16	-96.74	134.7	0	1.49	74.2	0	0	74.20016	0
10	Point	1	USC00411596	CENTERVILLE	31.26	-95.97	97.5	2438	0.31	69.6	83	56.2	69.59135	)00075
11	Point	5	US1TXWA0009	CHAPPELL HILL 1.0 NW	30.16	-96.26	71.9	0	0.35	73.8	0	0	72.80235	)95306
12	Point	13	US1TXWA0010	CHAPPELL HILL 1.8 N	30.17	-96.25	75.9	0	0.37	73.7	0	0	73.60986	)08125
13	Point	16	USW00003904	COLLEGE STATION EA...	30.59	-96.36	93	3151	0	74.8	86.1	63.6	74.78474	)00233
14	Point	10	US1TXWA0003	HEMPSTEAD 10.0 NNW	30.23	-96.14	75	0	0.73	74.2	0	0	74.19225	.00006
15	Point	18	USC00415477	MADISONVILLE	30.94	-95.92	76.8	2533	0.8	69.9	83.7	56.1	69.90214	)00005
16	Point	17	USC00418446	SOMERVILLE DAM	30.34	-96.54	80.2	2905	0.16	72.6	88.5	56.8	72.60201	)00004
17	Point	11	US1TXWA0014	WASHINGTON 8.6 SSW	30.22	-96.22	70.7	0	0.86	73.1	0	0	73.07304	)00727
18	Point	15	USC00419491	WASHINGTON STATE...	30.32	-96.16	65.5	0	1.21	73.4	89.4	57.3	73.4173	)00299

Spline Average Temperature with Default Parameters

(After Extract Value to Point was completed for each raster)

Extract_Spline_Prcp RMSE: sqrt[(0.00057742474)] = 0.02402966375

Extract_Spline_Tavg RMSE: sqrt[(0.0564592363)] = 0.23761152392

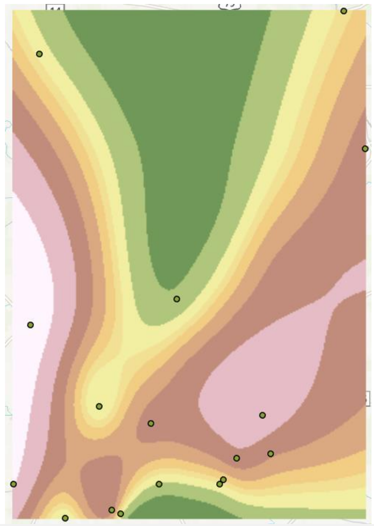
Extract_Idw_Prcp RMSE: sqrt[(0.0003611214)] = 0.01900319446

Extract_Idw_Tavg RMSE: sqrt[(0.0448296676)] = 0.2117301764

Compare and contrast interpolated precipitation and temperature values for the interpolation algorithms. What was the RMS error associated with each algorithm using default parameter values? Can you explain why each algorithm produced the magnitude of error it did?

The interpolated values done by the Spline algorithm are a lot smoother than those interpolated using the IDW algorithm. This is seen for both precipitation and average temperature data. The values interpolated by the Spline algorithm also get much smaller than those interpolated by the IDW, since Spline can output negative values if they satisfy the cubic polynomial. Using the default parameters, the resultant RMSE is list above for each algorithm and attribute. The magnitude of error is similar for both algorithms, although the Spline algorithm had slightly higher RMSE for both data sets. This is probably because Spline forces interpolated points to pass through all control points, unlike IDW, so the interpolation method slightly less ideal although still effective. IDW also works better when the control points are more clustered rather than sparse, and these climate stations are not very evenly distributed.

Did modification of the input parameters for a specific algorithm modify the RMSE?



Extract_Spline_Prcp_TypeTension

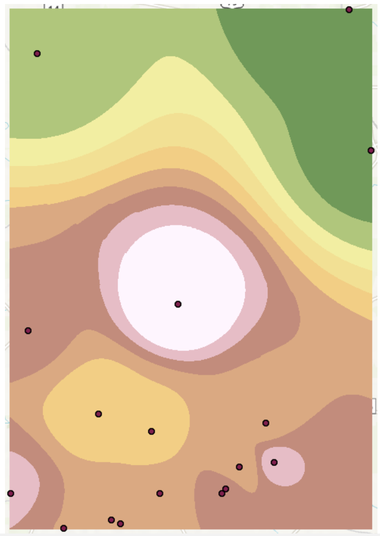
Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete

OBJECTID *	Shape *	Object_ID	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	CDSD	PRCP	TAVG	TMAX	TMIN	RASTERVALU	Error
1	Point	2	USC00411045	BREMOND	31.16	-96.68	143.3	0	0.24	70.4	0	0	0.244988	0.000025
2	Point	3	USC00411048	BRENHAM	30.16	-96.4	95.4	0	0.13	73.1	85.5	60.7	0.119918	0.000102
3	Point	8	US1TXWA0005	BRENHAM 7.2 SW	30.09	-96.49	114	0	0.22	73.3	0	0	0.232171	0.000148
4	Point	6	US1TXWA0006	BRENHAM 8.0 E	30.16	-96.26	75	0	0.27	72.9	0	0	0.258651	0.000129
5	Point	14	US1TXWA0021	BRENHAM 8.2 WSW	30.1	-96.51	110	0	0.77	73.4	0	0	0.774602	0.000021
6	Point	7	US1TXWA0017	BRENHAM 9.9 N	30.3	-96.42	88.4	0	0.78	72.8	0	0	0.781942	0.000004
7	Point	12	US1TXWA0001	BURTON 6.9 SSW	30.08	-96.62	134.1	0	0.15	73.6	0	0	0.15205	0.000004
8	Point	4	USC00411314	CALDWELL	30.53	-96.7	111.3	0	1.9	73.7	0	0	1.904116	0.000017
9	Point	9	US1TXWA0015	CARMINE 3.1 WNW	30.16	-96.74	134.7	0	1.49	74.2	0	0	1.484849	0.000027
10	Point	1	USC00411596	CENTERVILLE	31.26	-95.97	97.5	2438	0.31	69.6	83	56.2	0.311034	0.000001
11	Point	5	US1TXWA0009	CHAPPELL HILL 1.0 NW	30.16	-96.26	71.9	0	0.35	73.8	0	0	0.258651	0.008345
12	Point	13	US1TXWA0010	CHAPPELL HILL 1.8 N	30.17	-96.25	75.9	0	0.37	73.7	0	0	0.35501	0.000225
13	Point	16	USW00003904	COLLEGE STATION EA...	30.59	-96.36	93	3151	0	74.8	86.1	63.6	0.005093	0.000026
14	Point	10	US1TXWA0003	HEMPSTEAD 10.0 NNW	30.23	-96.14	75	0	0.73	74.2	0	0	0.733818	0.000015
15	Point	18	USC00415477	MADISONVILLE	30.94	-95.92	76.8	2533	0.8	69.9	83.7	56.1	0.800713	0.000001
16	Point	17	USC00418446	SOMERVILLE DAM	30.34	-96.54	80.2	2905	0.16	72.6	88.5	56.8	0.161421	0.000002
17	Point	11	US1TXWA0014	WASHINGTON 8.6 SSW	30.22	-96.22	70.7	0	0.86	73.1	0	0	0.86885	0.000078
18	Point	15	USC00419491	WASHINGTON STATE...	30.32	-96.16	65.5	0	1.21	73.4	89.4	57.3	1.20751	0.000006

Spline Precipitation parameter Type changed to Tension (table); Spline Interpolation with parameter Type changed to Tension (above)

Extract_Spline_Prcp_TypeTension RMSE: sqrt[(0.0005096712)] = 0.02257589865

Modification of input parameters for Spline from type Regularized (default) to type Tension reduced the RMSE for the spline algorithm precipitation data, from 0.02402966375 to 0.02257589865. Although changing the type to Tension may produce coarser results, the interpolated points are more closely weighted to the control points than they are in type Regularized.



Extract_Idw_Tavg_power4

Field: Add Calculate Selection: Select By Attributes Zoom To Switch Clear Delete

OBJECTID *	Shape *	Object_ID	STATION	NAME	LATITUDE	LONGITUDE	ELEVATION	CDSD	PRCP	TAVG	TMAX	TMIN	RASTERVALU	Error
1	Point	2	USC00411045	BREMOND	31.16	-96.68	143.3	0	0.24	70.4	0	0	70.4	0
2	Point	3	USC00411048	BRENHAM	30.16	-96.4	95.4	0	0.13	73.1	85.5	60.7	73.1	0
3	Point	8	US1TXWA0005	BRENHAM 7.2 SW	30.09	-96.49	114	0	0.22	73.3	0	0	73.3	0
4	Point	6	US1TXWA0006	BRENHAM 8.0 E	30.16	-96.26	75	0	0.27	72.9	0	0	73.79999	0.809982
5	Point	14	US1TXWA0021	BRENHAM 8.2 WSW	30.1	-96.51	110	0	0.77	73.4	0	0	73.4	0
6	Point	7	US1TXWA0017	BRENHAM 9.9 N	30.3	-96.42	88.4	0	0.78	72.8	0	0	72.8	0
7	Point	12	US1TXWA0001	BURTON 6.9 SSW	30.08	-96.62	134.1	0	0.15	73.6	0	0	73.6	0
8	Point	4	USC00411314	CALDWELL	30.53	-96.7	111.3	0	1.9	73.7	0	0	73.7	0
9	Point	9	US1TXWA0015	CARMINE 3.1 WNW	30.16	-96.74	134.7	0	1.49	74.2	0	0	74.2	0
10	Point	1	USC00411596	CENTERVILLE	31.26	-95.97	97.5	2438	0.31	69.6	83	56.2	69.6	0
11	Point	5	US1TXWA0009	CHAPPELL HILL 1.0 NW	30.16	-96.26	71.9	0	0.35	73.8	0	0	73.79999	0
12	Point	13	US1TXWA0010	CHAPPELL HILL 1.8 N	30.17	-96.25	75.9	0	0.37	73.7	0	0	73.70006	0
13	Point	16	USW00003904	COLLEGE STATION EA...	30.59	-96.36	93	3151	0	74.8	86.1	63.6	74.8	0
14	Point	10	US1TXWA0003	HEMPSTEAD 10.0 NNW	30.23	-96.14	75	0	0.73	74.2	0	0	74.2	0
15	Point	18	USC00415477	MADISONVILLE	30.94	-95.92	76.8	2533	0.8	69.9	83.7	56.1	69.9	0
16	Point	17	USC00418446	SOMERVILLE DAM	30.34	-96.54	80.2	2905	0.16	72.6	88.5	56.8	72.6	0
17	Point	11	US1TXWA0014	WASHINGTON 8.6 SSW	30.22	-96.22	70.7	0	0.86	73.1	0	0	73.1	0
18	Point	15	USC00419491	WASHINGTON STATE...	30.32	-96.16	65.5	0	1.21	73.4	89.4	57.3	73.4	0

IDW Average Temperature power parameter changed to 4 (table); IDW Interpolation with power parameter changed to 4 (above)

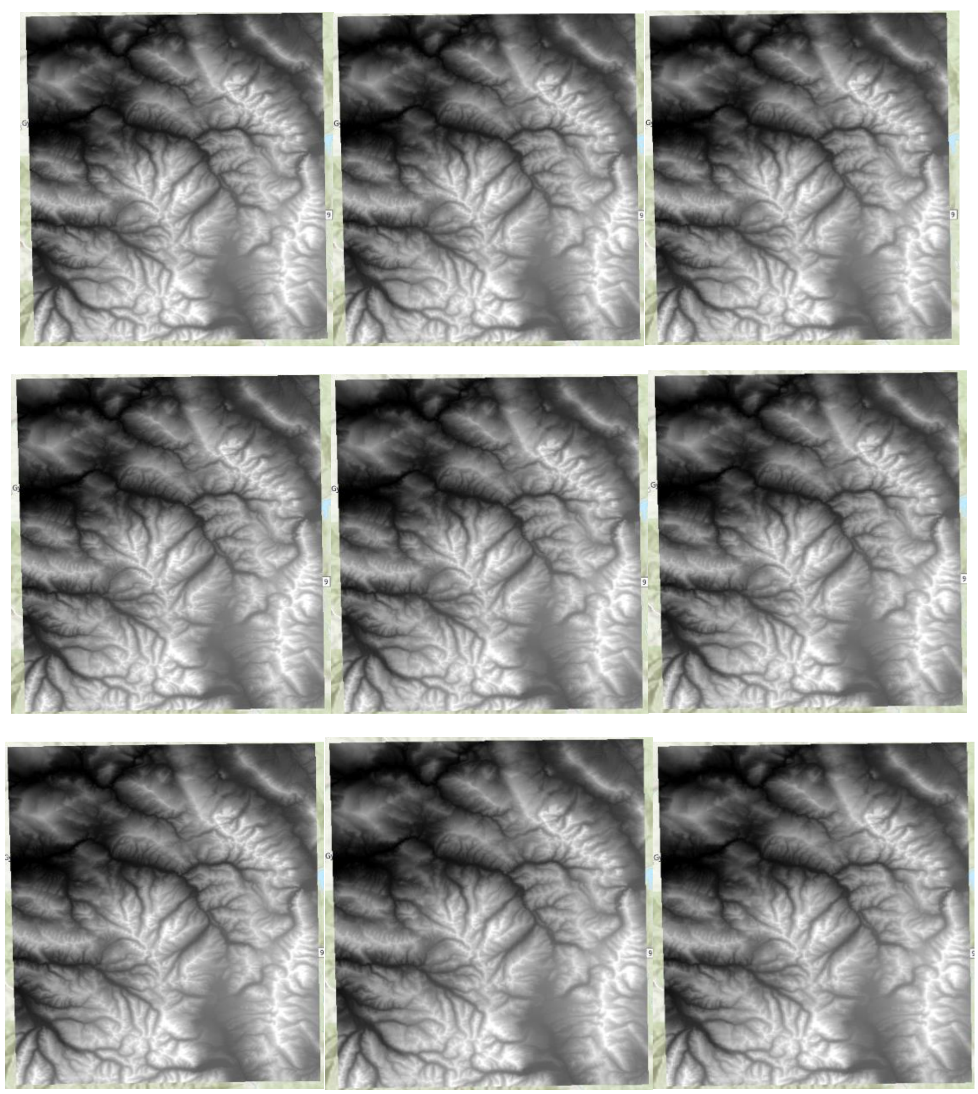
Extract_Idw_Tavg_power4 RMSE: sqrt[(0.0449990002)] = 0.21212967779

Modification of input parameters for IDW from a power parameter of 2 (default) to a power parameter of 4 raised RMSE from 0.2117301764 to 0.21212967779. Raising the power parameter reduces the influence of more distance points on the interpolation results, and since these climate stations are not close together, the error increased. With more data, changing the power parameter may be more useful. In this case with little data, the more distance points play a key role in interpolation.

Did different algorithms produce a different spatial distribution of precipitation and temperature? How did you determine if the spatial patterns and magnitudes were different?

Different algorithms produced vastly different spatial distributions of precipitation and temperature. For precipitation, the Spline algorithm raster is much smoother and has a larger range of values than the IDW algorithm precipitation raster. You can look at the IDW raster and see the rough edges and circular focus around the control points, while the spline values pass smoothly through the control points. The difference in magnitude can be seen in the classification ranges of each algorithm, with the Spline having a much larger range of values and therefore a wider distribution. This same trend can be seen when comparing the interpolation of temperature by each algorithm. For temperature, the Spline is again much smoother and values pass through all the control points, rather than the distribution surrounding the control points with IDW. In this case, the magnitude for IDW is also less than Spline, and Spline interpolated much higher values than the IDW algorithm did.

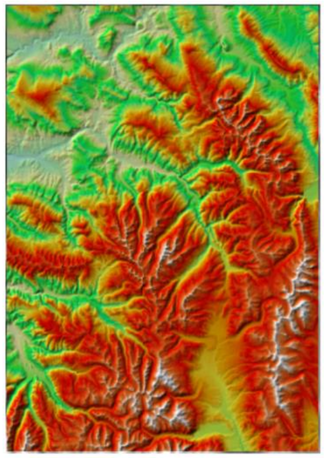
<u>Raster Resampling</u>



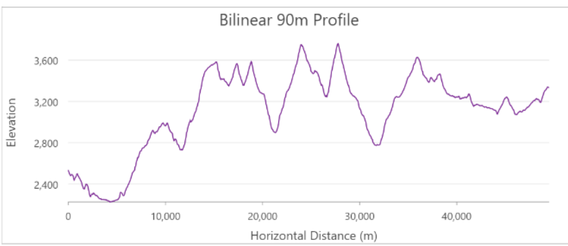
Row 1: *Nearest Neighbor Resampling: 90m, 150m, and 250m (left to right).*

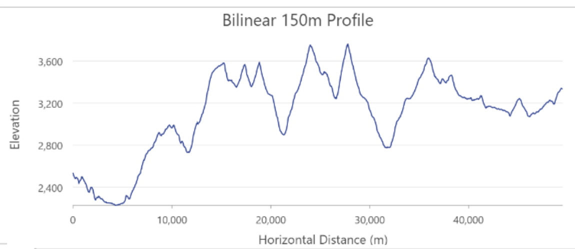
Row 2: *Bilinear Resampling: 90m, 150m, and 250m (Left to Right)*

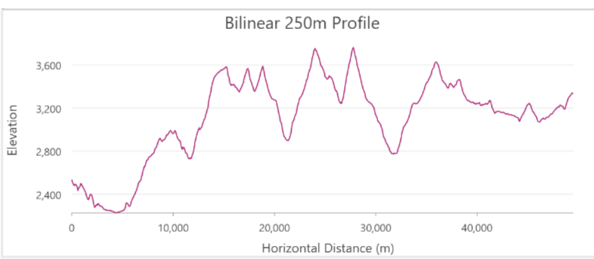
Row3: *Cubic Convolution Resampling: 90m, 150m, and 250m (left to right)*

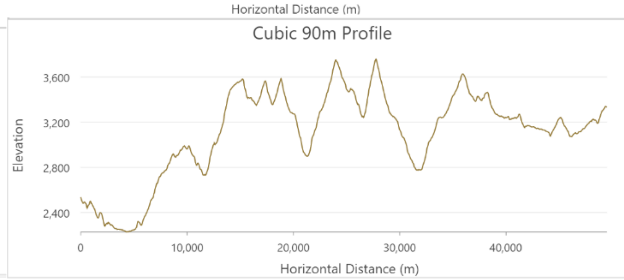


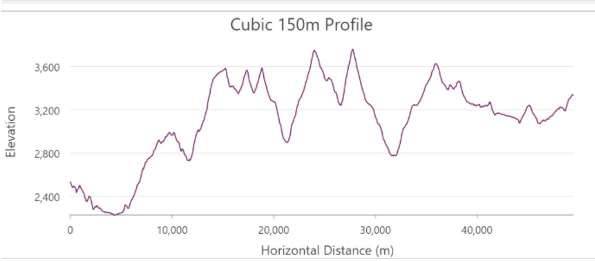
Shaded Relief of Original

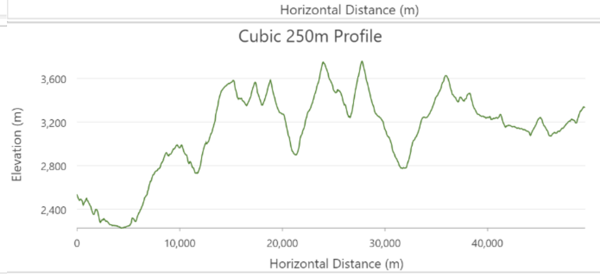


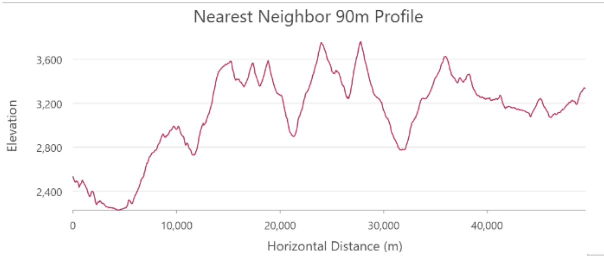


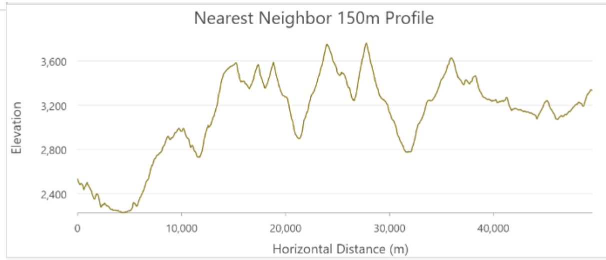


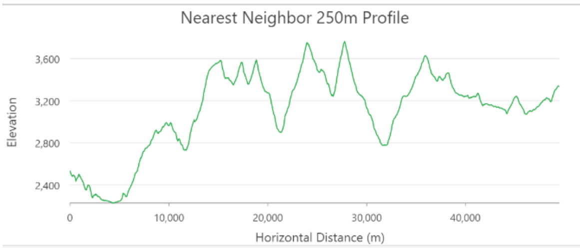


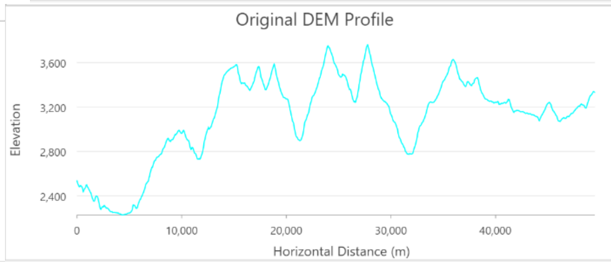












Examine the topography at grid cell scales of 30m, 90m, 150m and 250m. You may need to use shaded-relief images to examine the spatial patterns in the topography. Describe how the topography is represented compared to the 30meter DEM.

Compared to a 30m DEM, the resolution appears only slightly different. You can barely see how the 90m and 150m DEM resolutions are coarser, with more pixilation between the same features. The spatial patterns exhibit a tiny difference in spatial complexity, with 90m having higher spatial variability than 150m and subsequently 250m.

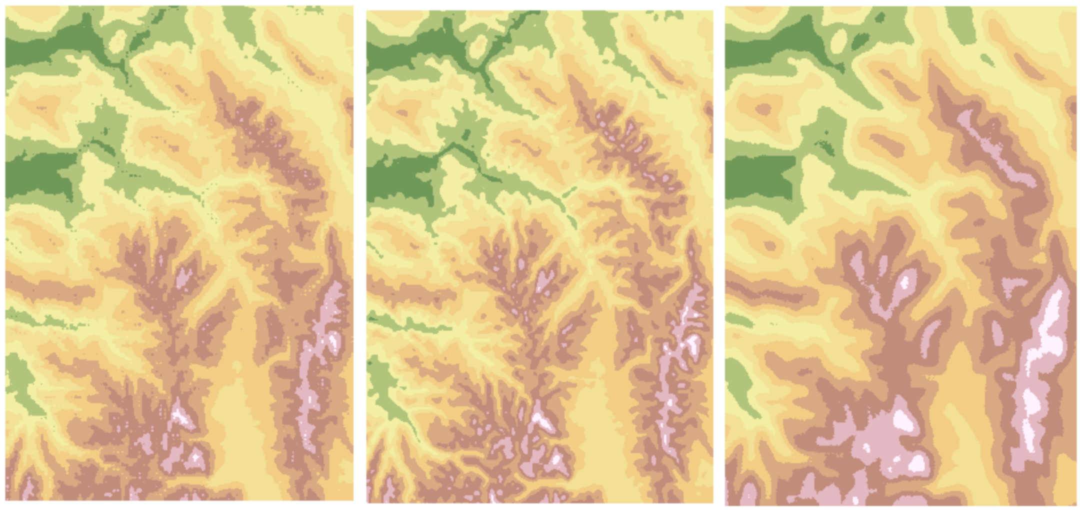
Compare and contrast the DEMs at a particular scale generated using different interpolation algorithms. Does the type of interpolation algorithm at a particular scale influence the nature of the topography depicted in the shaded-relief images?

Using different interpolation algorithms, it's very difficult to see an actual visible difference between the interpolations at different scales. However, it appears that the IDW is slightly less topographically varied than the bilinear, and the bilinear is slightly less precise than the cubic interpolation. This is only because the colours appear to get darker as you go down the rows of different interpolation algorithms. The shadows seem sharper as you go up in polynomials levels.

Compare and contrast the interpolation algorithms that were used to generate topographic profiles. Do this for all three grid-cell scales. Which algorithm is most accurate? How did you determine this? Can you produce quantitative evidence?

The most accurate interpolation appears to be the Cubic one, mostly because of it's high spatial variability compared to the other algorithms. For quantitative evidence, the standard deviation of the cubic convolution is a little higher, but there is nothing statistically significant about the different profiles. I mainly determined this by attempting to find a difference in the profile graphs.

<u>Spatial Interpolation Algorithms</u>



IDW done on DEM Fishnet Extract, Cubic Spline done on DEM Fishnet Extract, and Kriging done on DEM Fishnet Extract.

Compare and contrast the results from the IDW algorithm to the original data. Did the use of different parameter settings influence the results to any degree? Did different parameter settings generate different spatial patterns in topography? Was there a difference in terms of the global RMSE?

The IDW is different from the original data in how to spatial distribution of topography varies more because of the interpolation that was performed. The different parameters settings had a great influence on the spatial distribution of phenomena as well, since power parameter increasing reduced influence of distant points. This made the interpolation more concentrated with less variation related to non-central points. In terms of global RMSE, there was a general reduction in error as the power parameters was raised because only the most correlated control points were considered for interpolation.

Compare and contrast interpolation results using the cubic spline algorithm. Did the use of different parameter settings influence the results to any degree? Did different parameter settings generate different spatial patterns in topography? Was there a difference in terms of the global RMSE?

Using the cubic spline algorithm, the changing of the tension parameters did change the spatial topography. When I changed the tension parameters, the spatial distribution seemed to revolve more around the control points obtained from the fishnet extraction. With a lower parameter, there was more variability in the raster. For global RMSE, the tension parameter lowered RMSE as it increased, since more focus was on control points rather than unknown, interpolated data points.

Compare and contrast interpolation results using the Kriging algorithm. Did the use of different parameter settings influence the results to any degree? Did different parameter settings generate different spatial patterns in topography? Was there a difference in terms of the global RMSE? How do you know what variogram model to use? Do you see a

potential problem with this approach if it is based upon only one variogram model (i.e., could the scale-dependent variance structure be different in different locations?)?

With the kriging algorithm, different parameters did influence the results in a small degree. There was an increase in spatial variation as the model was based off of higher polynomials. This is what made the complexity change, since less autocorrelation means more spatial complexity. In terms of global RMSE, parameters that would closer to the original data had the least amount of error. To know what variogram model to use, you have to consider the degree of autocorrelation already present in the data, as well as the amount of relief displacement in your DEM. This does run into a problem when you have high topographic variability in your data, since different areas of the DEM have different levels of relief displacement that are likely integrated with error in the data. Smaller sections of the image might make for better analysis, rather than assuming homogeneity across large areas.

Which algorithm produced the best results? How did you determine this?

In my opinion, kriging produced the best results. Just from the interpolated raster images, the kriging algorithm does the best job of showing topographical variation in the study area in a way that mirrors the original DEM. It highlights the important relief displacement of the original DEM without over-doing it. This way, there is not too many detailed assumptions made about the original DEM.

If the sampling of the points from the original DEM were closer together or further away from each other, do you think that the same algorithm would produce the best results? If you think this is so, would you use the same parameters? If not, explain why?

If the points from the original DEM were closer together or further away, the same algorithm would not produce the same results. IDW, for example, is based a lot on the distance of points relative to each other. A more clustered dataset would be better for IDW, so the results would be more accurate and RMSE would likely go down. You wouldn't want to use the same parameters either, since distance and homogeneity are more reliable in this case. You could use fewer extreme parameters, and definitely consider far off points relative to other points more extensively if the distance was not that great.

Knowing what you now know, how would you produce the best interpolation results for the climate data that you worked with earlier (don't do the work, just describe what you could do differently to produce better results). Be sure to justify the reasons for your decision?

Knowing what I know now, with the climate data I would test more algorithms to determine which had the lowest RMSE and then pick the ideal one. To produce different results, I could choose better transects to consider spatial variation better, and maybe split the study area into smaller parcels. It would also be better if I systemically checked RMSE at each scale for each algorithm, and did the same sort of topographical profiles on the original DEM before deciding on any algorithm. To produce better results, writing my own code to help speed up this analysis so I could focus more on tiny details would definitely have helped.