LA County temperature spatial-temporal simulation

— A comparison between Kriging and EBK regression

Linhui FU

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USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

Spatial Sciences Institute

Project Overview

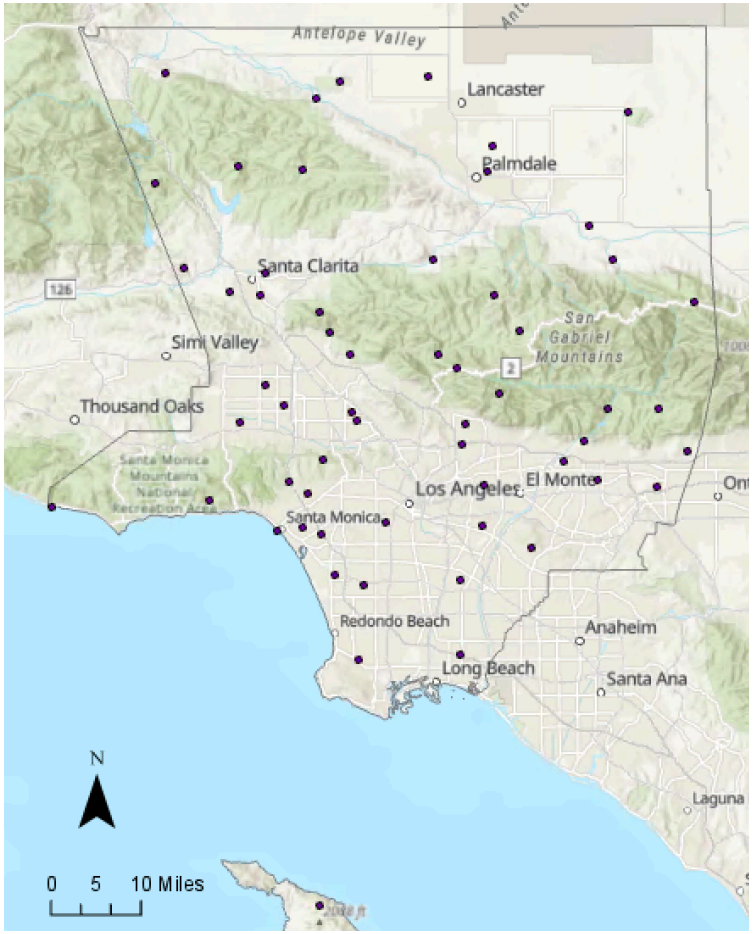
- **Research interest:**
  Area — LA County
  Time period — year 2010

- **Research question:**
  1. Modeling temperature spatial-temporal trend
  2. Discover how elevation affects local temperature

- **Platform:**
  Temperature data retrieving — Python (Jupyter Notebook)
  GIS analysis — ArcGIS Pro

- **Coordinate system:**
  NAD 1983 StatePlane California V

LA Weather Dataset



2010 LA County monthly temperature average(TAVG):

- 58 Station Points in total, about 40 stations provided available records each month
- Covers mountain area, inner area, costal area, and Catalina Island

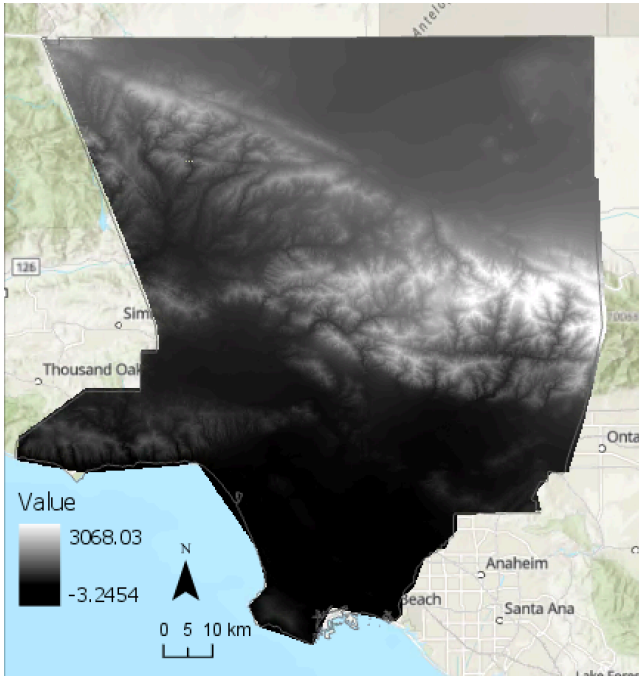
2010_1.csv

Field: Add Delete Calculate | Selection: Zoom To Switch Clear Delete Copy

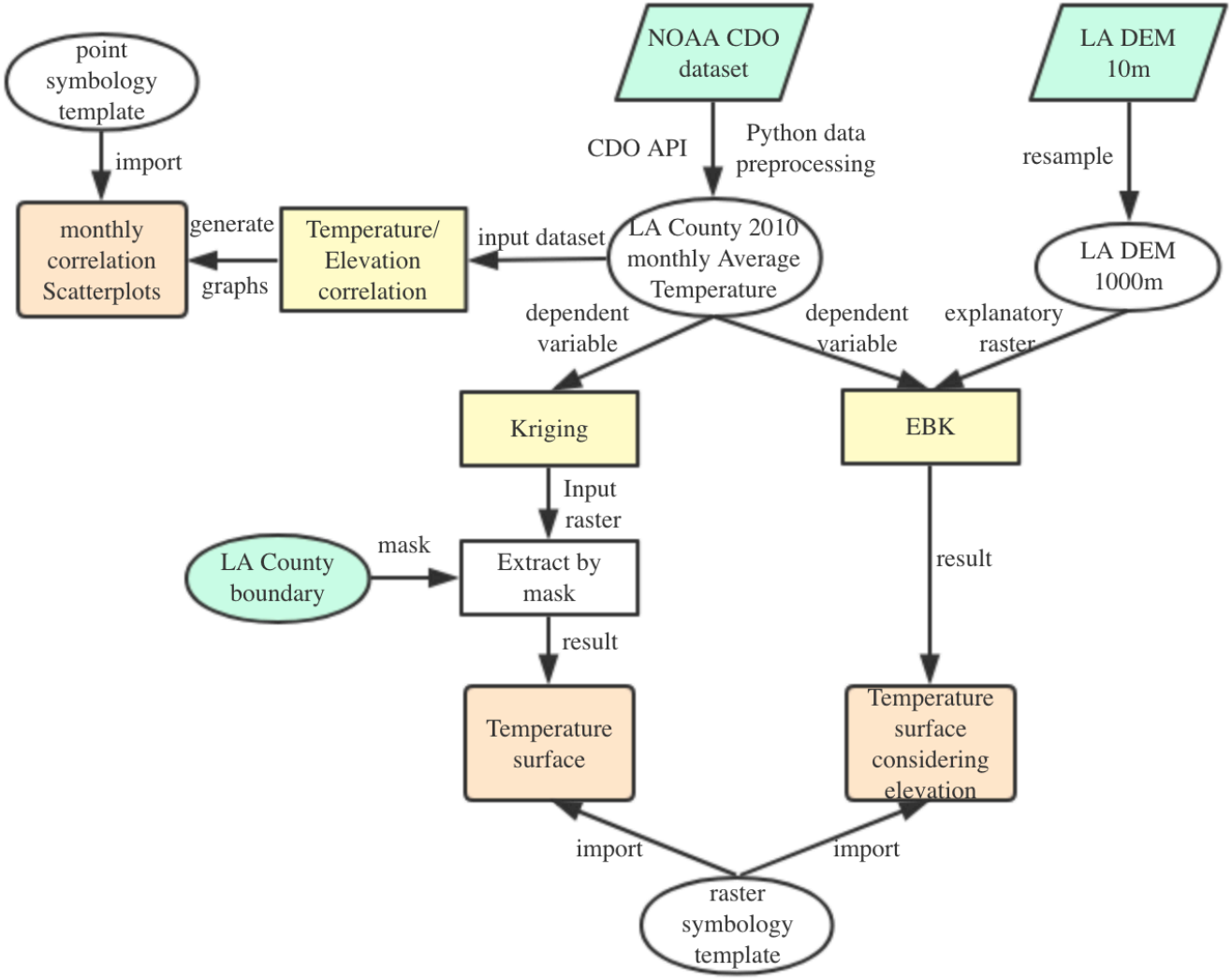
Field1	datatype	date	station	value	stationid	elevation	elevationUnit	latitude	longitude	name
0	TAVG	2010-01-01T00:00:00	GHCND:USC00043392	15.2	31	340.5	METERS	34.0869	-118.4794	GETTY CENTER, CA US
1	TAVG	2010-01-01T00:00:00	GHCND:USC00046006	8.25	33	1740.4	METERS	34.2308	-118.0711	MOUNT WILSON CB...
2	TAVG	2010-01-01T00:00:00	GHCND:USC00046161	12.78	34	538	METERS	34.3933	-118.5938	NEWHALL 5 NW, CA...
3	TAVG	2010-01-01T00:00:00	GHCND:USC00046263	14	36	275.5	METERS	34.2447	-118.525	NORTHRIDGE CAL ST...
4	TAVG	2010-01-01T00:00:00	GHCND:USC00046624	7.94	38	796.1	METERS	34.5883	-118.0938	PALMDALE, CA US
5	TAVG	2010-01-01T00:00:00	GHCND:USC00046719	14.74	39	263.3	METERS	34.1483	-118.1447	PASADENA, CA US
6	TAVG	2010-01-01T00:00:00	GHCND:USC00046773	7.92	40	945.2	METERS	34.5025	-117.8969	PEARBLOSSOM, CA US
7	TAVG	2010-01-01T00:00:00	GHCND:USC00047785	14.28	44	110.6	METERS	34.0842	-118.1003	SAN GABRIEL FIRE D...
8	TAVG	2010-01-01T00:00:00	GHCND:USC00047953	15.12	45	4.3	METERS	34.0075	-118.49972	SANTA MONICA PIE...
9	TAVG	2010-01-01T00:00:00	GHCND:USC00049152	16	47	131.1	METERS	34.0697	-118.4427	U C L A, CA US
10	TAVG	2010-01-01T00:00:00	GHCND:USR0000CACT	9.43	49	792.5	METERS	34.4458	-118.2	ACTON CALIFORNIA...
11	TAVG	2010-01-01T00:00:00	GHCND:USR0000CBIP	4.52	51	2108.3	METERS	34.3789	-117.6919	BIG PINES CALIFORN...
12	TAVG	2010-01-01T00:00:00	GHCND:USR0000CCHI	8.33	52	1661.2	METERS	34.3317	-118.0303	CHILAO CALIFORNI...
13	TAVG	2010-01-01T00:00:00	GHCND:USR0000CCLA	12.46	53	501.4	METERS	34.1369	-117.7069	CLAREMONT CALIF...
14	TAVG	2010-01-01T00:00:00	GHCND:USR0000CCLE	14.8	54	914.4	METERS	34.2711	-118.1525	CLEAR CREEK CALIF...

Supplementary Datasets

- 10m LA County DEM
- LA County boundary Shapefile

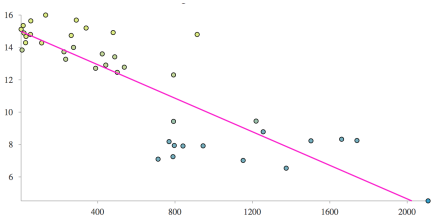


Analysis Workflow



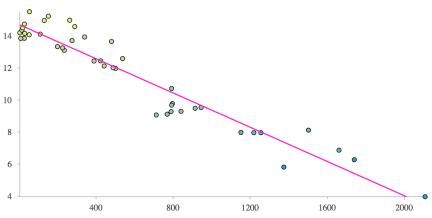
Temperature/Elevation Correlation

JAN



R2 = 0.71

FEB



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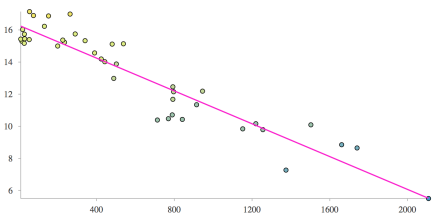
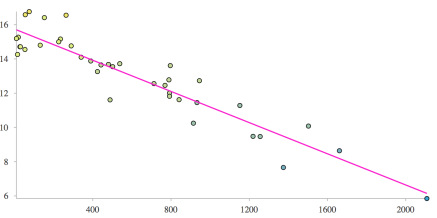
MAR



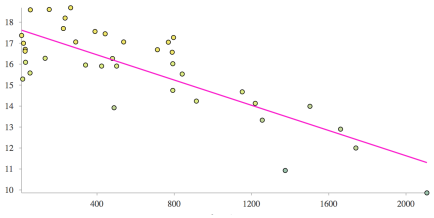
R2 = 0.88

APR



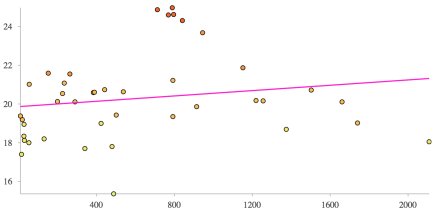
R2 = 0.87

MAY



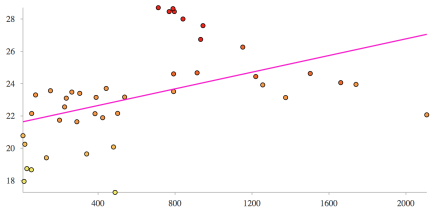
R2 = 0.65

JUN



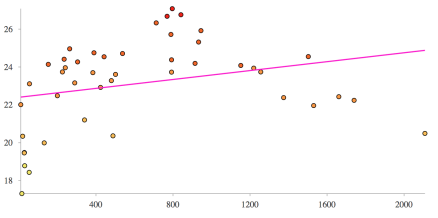
R2 = 0.03

JUL



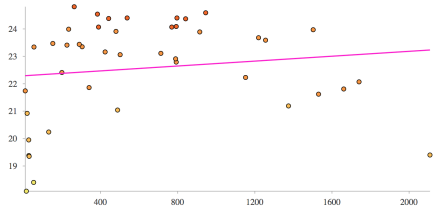
R2 = 0.21

AUG



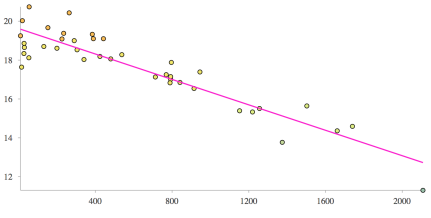
R2 = 0.07

SEP



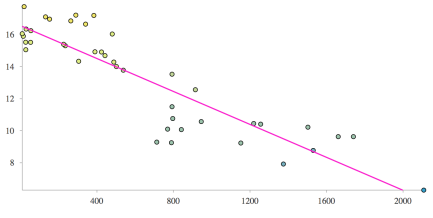
R2 = 0.02

OCT



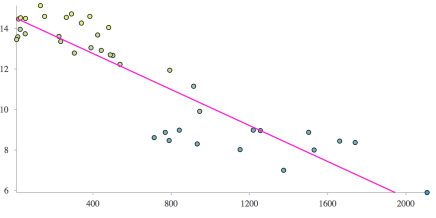
R2 = 0.84

NOV



R2 = 0.79

DEC



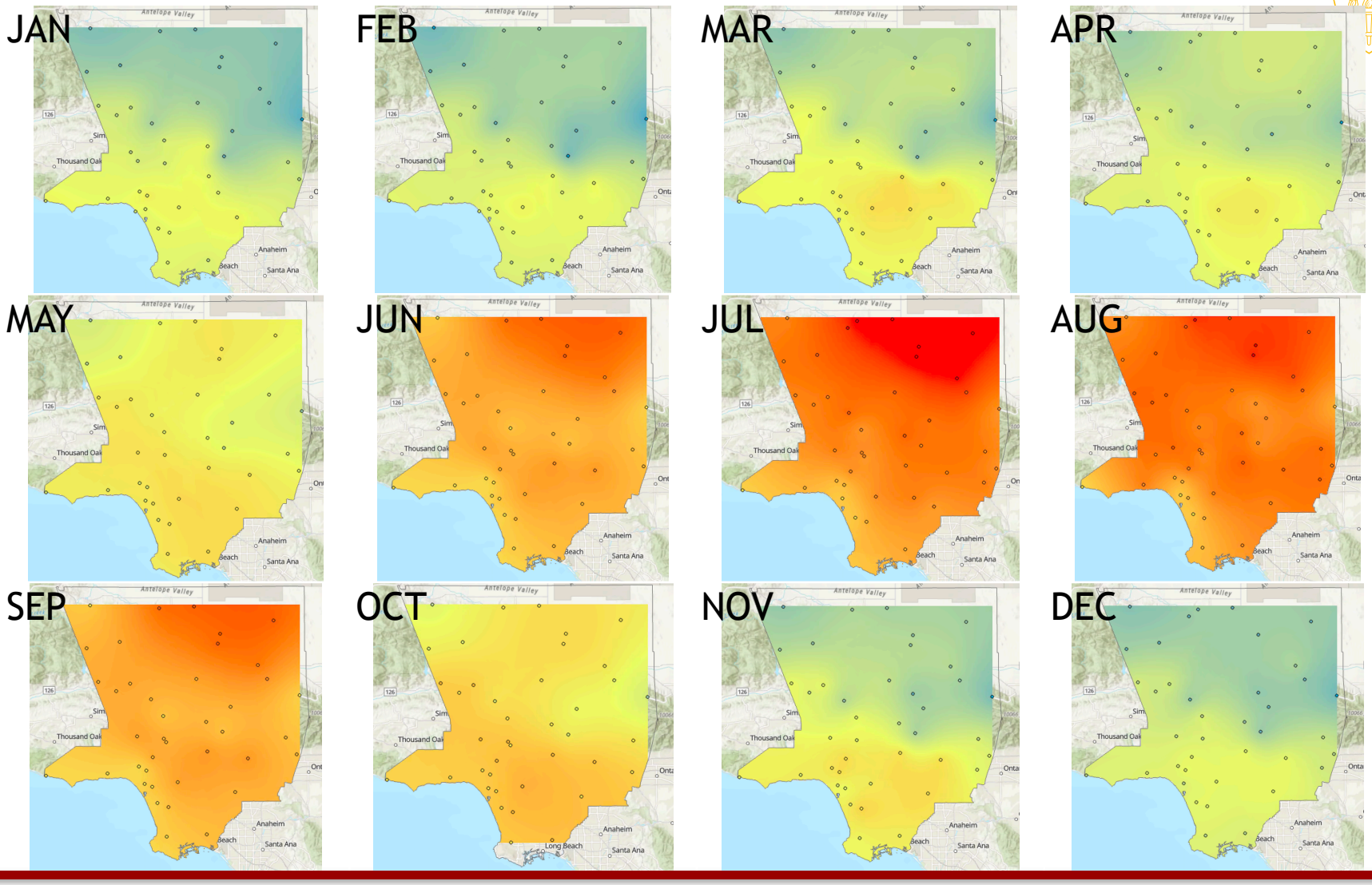
R2 = 0.81

value

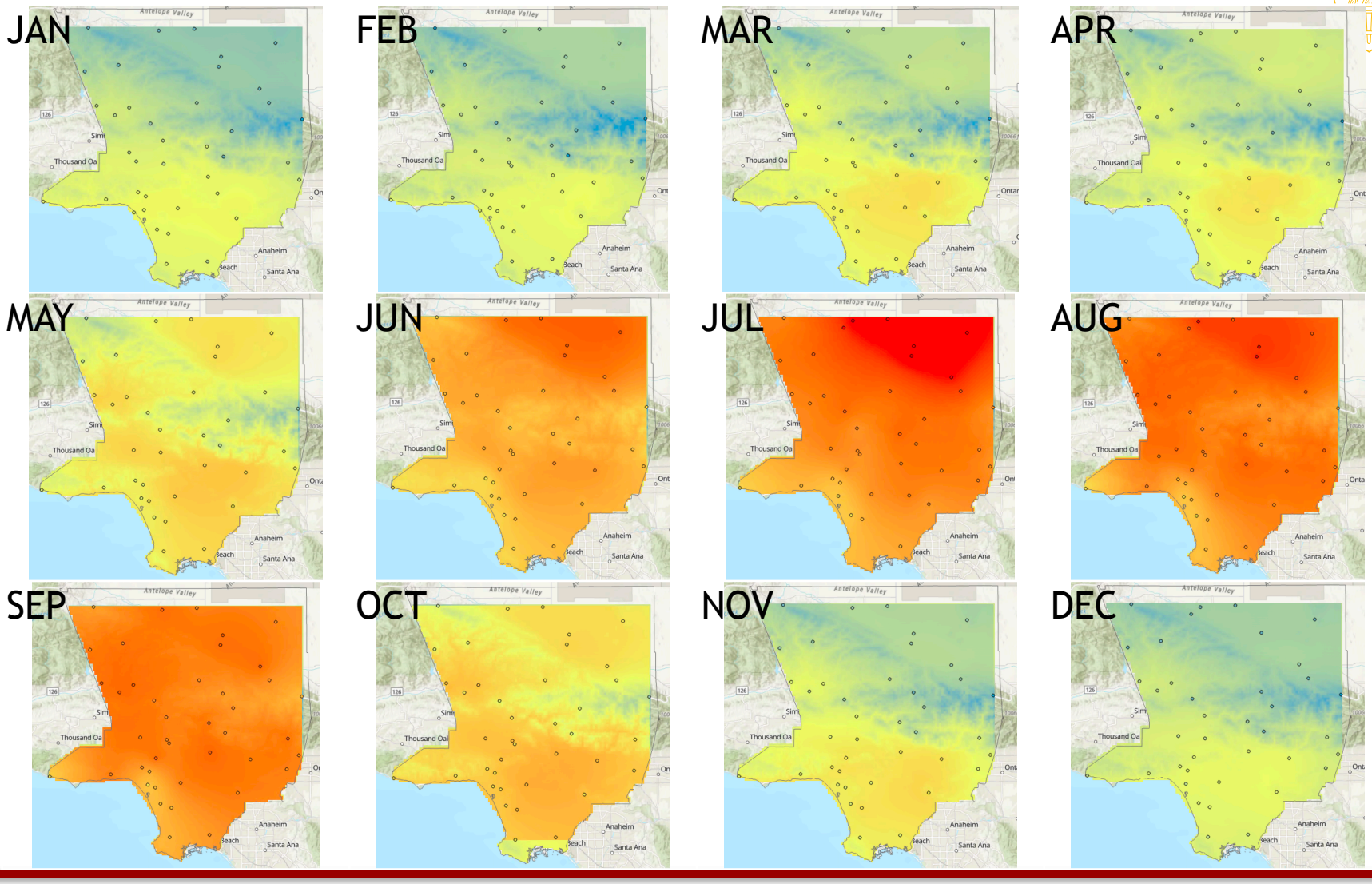
- ≤6.5
- 6.5-9
- 9-11.5
- 11.5-14
- 14-16.5
- 16.5-19
- 19-21.5
- 21.5-24
- 24-26.5
- 26.5-29

X axis - elevation
Y axis - Temperature

Kriging Interpolation



EBK Regression



From scatterplot:

- The Temperature/Elevation Correlation is obvious in most months of the year except for the summer season (from June to September)
- General Trend: As elevation increases, temperature goes down. Temperature decreases for 6-8 degrees per 1km's increase in altitude.

From Kriging surface:

- The relative position to the Rocky Mountains, distance to the coast, and latitude are also important factors that affect local temperature.
- The coastal climate is more comfortable than the inland area.

Comparison of Kriging and EBK results:

- EBK provides a much more detailed temperature surface.
- Elevation do affects local temperature a lot.(The mountain area is cooler that both sides in the whole year!)

Future work:

- Make the result charts and maps into dynamic graphs to dynamically/ interactively show LA county temperature change trend throughout a year.

- Further explore the influence of ①latitude, ②distance to coast, and ③the relative position to the Rocky Mountains on local temperature

- Build a temperature prediction model for LA county considering elevation, latitude, distance to coast, and relative position to the Rocky Mountains

References

1. McGuire, Chris R., César R. Nufio, M. Deane Bowers, and Robert P. Guralnick. "Elevation-dependent temperature trends in the Rocky Mountain Front Range: changes over a 56-and 20-year record." *PloS one* 7, no. 9 (2012): e44370.

2. Webster, Melissa Faith [Author]. Spatial and Temporal Patterns of Long-Term Temperature Change in Southern California from 1935 to 2014. Los Angeles, California [Place of publication (of the original version)], December 11, 2015.