Spatial interpolation of winter temperature and precipitation in Oklahoma

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ABSTRACT

- To predict the unknown values of temperature and precipitation in our survey respondents' locations, we use the observation data from Mesonet stations to create the interpolated estimates. There are several spatial interpolation methods offered in ArcGIS Desktop 10.2, including Inverse Distance Weighting (IDW), Global Polynomial Interpolation (GPI), Local Polynomial Interpolation (LPI), Simple Kriging (SK) and Ordinary Kriging (OK). The cross-validation technique is applied to assess the accuracy of these methods.

DATA

- 117 Mesonet Stations' Locations (Figure 1)
- The observation data of winter temperature and precipitation from 2011 to 2014

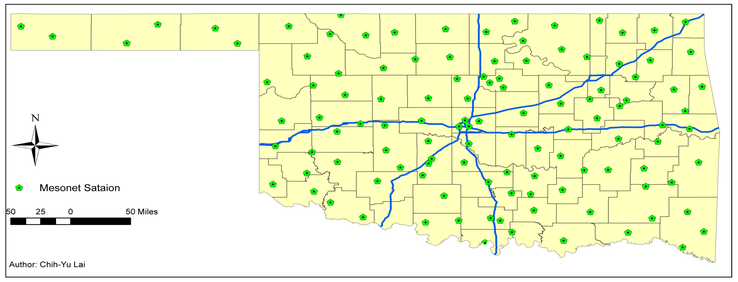

Figure 1 – Geographic locations of Mesonet stations

METHOD

- We use "Cross Validation" to evaluate and compare the performance of different spatial interpolation methods and identify the most accurate interpolated outputs by means of the difference of the predicted values to the observed values.

❑ Mean Error—the averaged difference between the measured and the predicted values.

$$ME = \frac{\sum_{i=1}^{n}[\hat{z}(s_i) - z(s_i)]}{n}$$

❑ Root Mean Square Error—this indicates how closely your model predicts the measured values.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}[\hat{z}(s_i) - z(s_i)]^2}{n}}$$

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RESULTS

Spatial Interpolation	Temperature		Precipitation	
	ME	RMSE	ME	RMSE
IDW	0.04502	0.70382	-0.01238	0.55086
IDW Weighted by Elevation	0.02181	0.71342	-0.02431	0.55080
GPI	0.00051	0.65735	-0.00884	1.04113
GPI Weighted by Elevation	0.00580	0.66151	-0.08607	1.14810
LPI	-0.04360	0.59833	0.01078	**0.52372**
LPI Weighted by Elevation	-0.01054	0.60915	0.02256	0.53431
SK With Exponential Kernel	0.02937	0.59557	0.01137	0.56947
SK With Polynomial5 Kernel	0.02547	0.56788	0.01086	0.55111
SK With Gaussian Kernel	0.02192	**0.56631**	0.00203	0.53166
OK With Exponential Kernel	-0.00831	0.57625	0.01010	0.54726
OK With Polynomial5 Kernel	-0.01228	0.57531	0.00904	0.54333
OK With Gaussian Kernel	-0.01170	0.57585	-0.00535	0.53568

COMPARISON

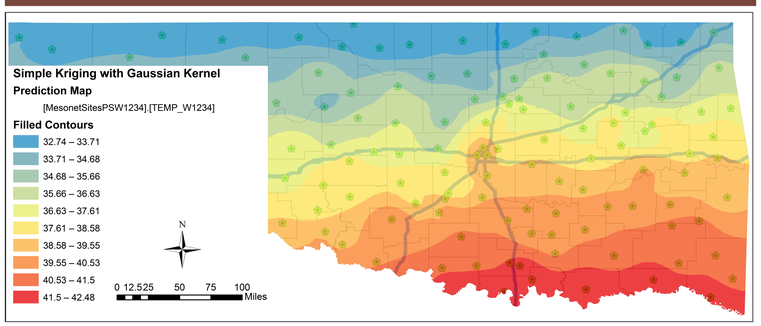


Figure 2 – Spatial interpolation of winter temperature

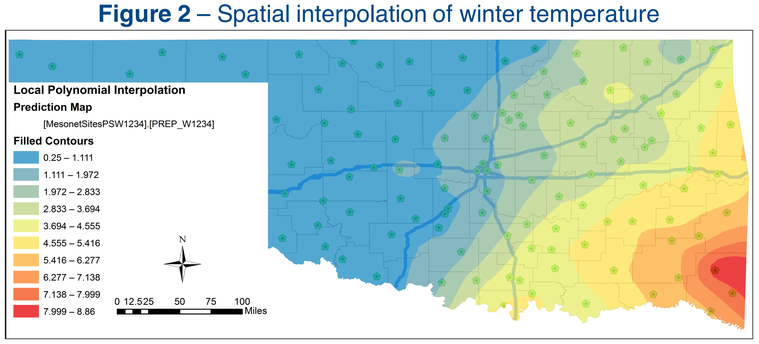
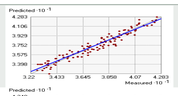
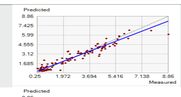
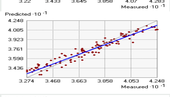
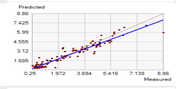
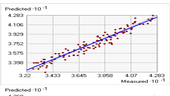
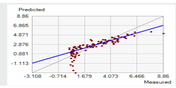
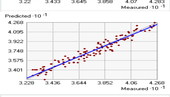
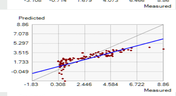
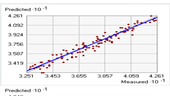
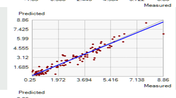
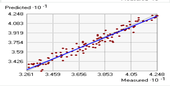
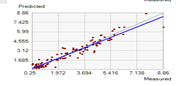
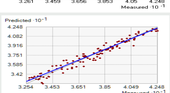
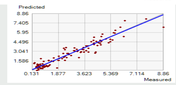
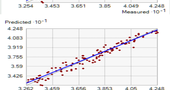
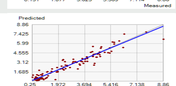
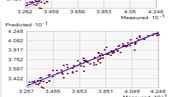
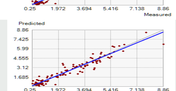
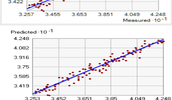
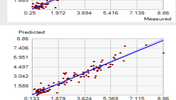
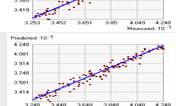
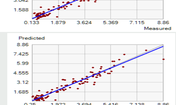
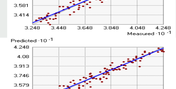
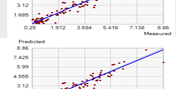


Figure 3 – Spatial interpolation of winter precipitation

RESULTS

Spatial Interpolation	Temperature	Precipitation
IDW		
IDW Weighted by Elevation		
GPI		
GPI Weighted by Elevation		
LPI		
LPI Weighted by Elevation		
SK With Exponential Kernel		
SK With Polynomial5 Kernel		
SK With Gaussian Kernel		
OK With Exponential Kernel		
OK With Polynomial5 Kernel		
OK With Gaussian Kernel		

CONCLUSION

- The smaller the RMSE value is, the better the model.
- "Simple Kriging with Gaussian Kernel" is good for the spatial interpolation of winter temperature.
- "Local Polynomial Interpolation " is good for the spatial interpolation of precipitation.

Acknowledgments
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