36-315: Statistical Graphics and Visualization

Handout 20
Date: April 7, 2003

Map smoothing and interpolation

A widespread problem in spatial statistics: How to go from spatially aggregated data (e.g. counties or census tracts) to a smooth, high-resolution surface. For example, in ecology, pollution, disease, crime, politics.

Choropleth map—Assume value is constant in each region.

- Gives illusion of homogeneity within regions and sharp breaks between regions.
- An extreme value affects the region as a whole.
- Cannot handle missing values.
- Cannot compare data aggregated different ways.

Smooth surface maps

- Sharp breaks occur as needed, not just at boundaries of data-collection regions.
- Can represent extremes without distorting whole area.
- Can fill in missing values.
- Can combine data aggregated in different ways.

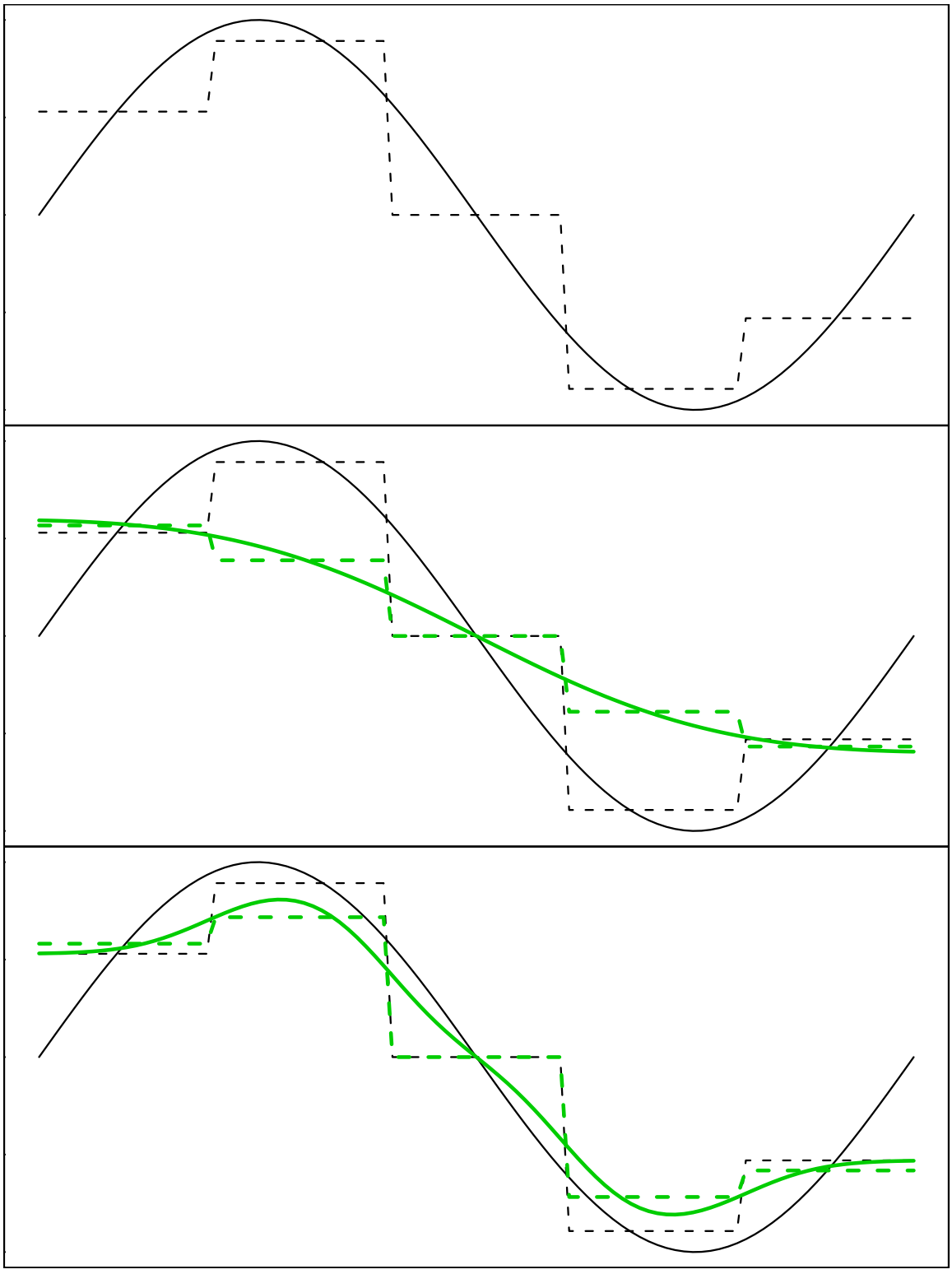
Centroid smoothing—Assume the area data is actually point data, concentrated at center of each region. Fit a smooth surface to these points. This method ignores the region shapes.

Area smoothing—The height of the surface at point x is the weighted average of nearby region values. The weight is the percentage of x's neighborhood contained in that region. Does incorporate region shapes.

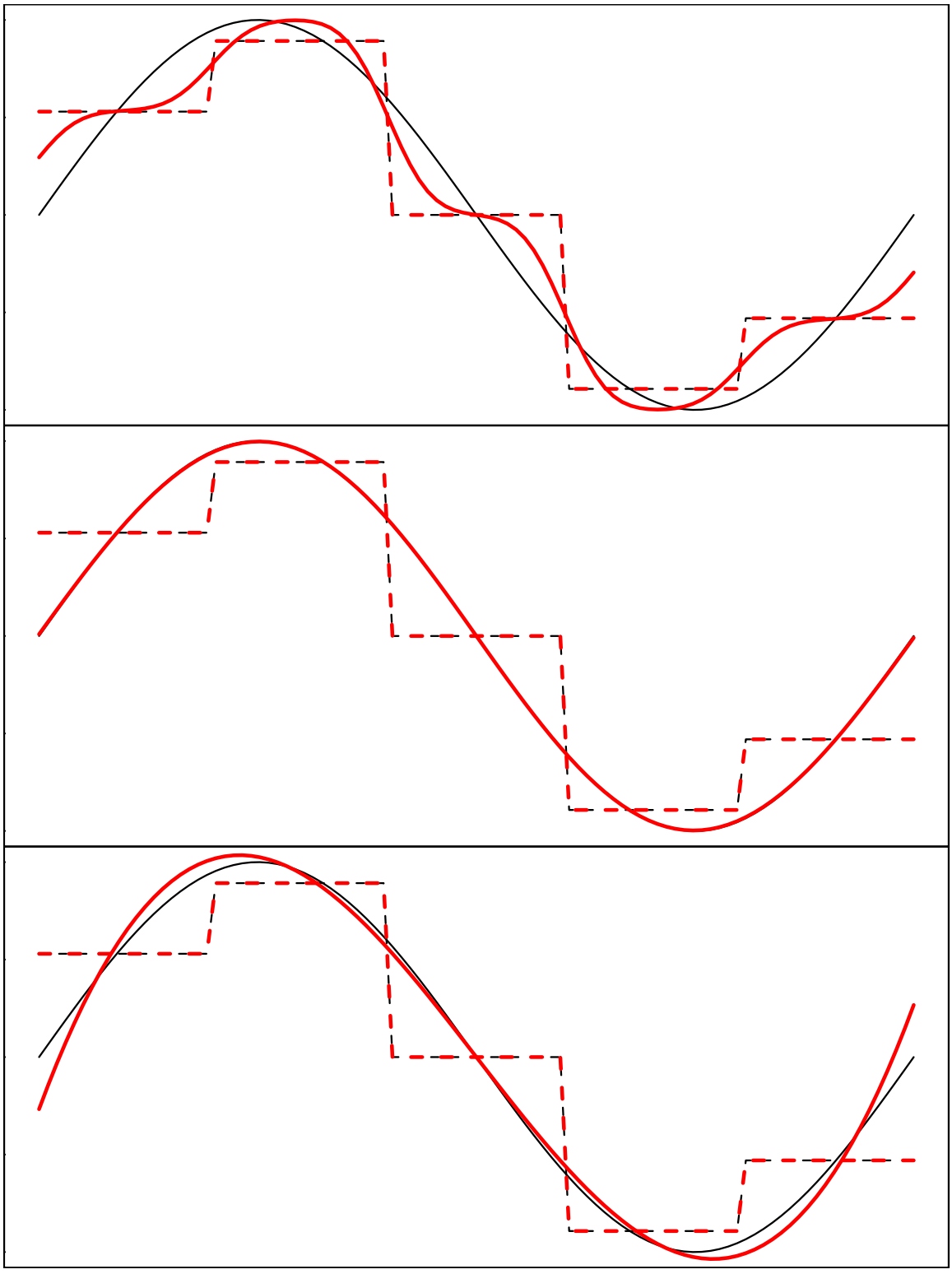
Both methods smooth the data; they remove information. Aggregating (summing) the surface will not necessarily give back the original data.

Mass-preserving interpolation—A smooth surface whose sums must match the data. Instead of smoothing the data, it de-blurs the data, like enhancing a blurred picture.

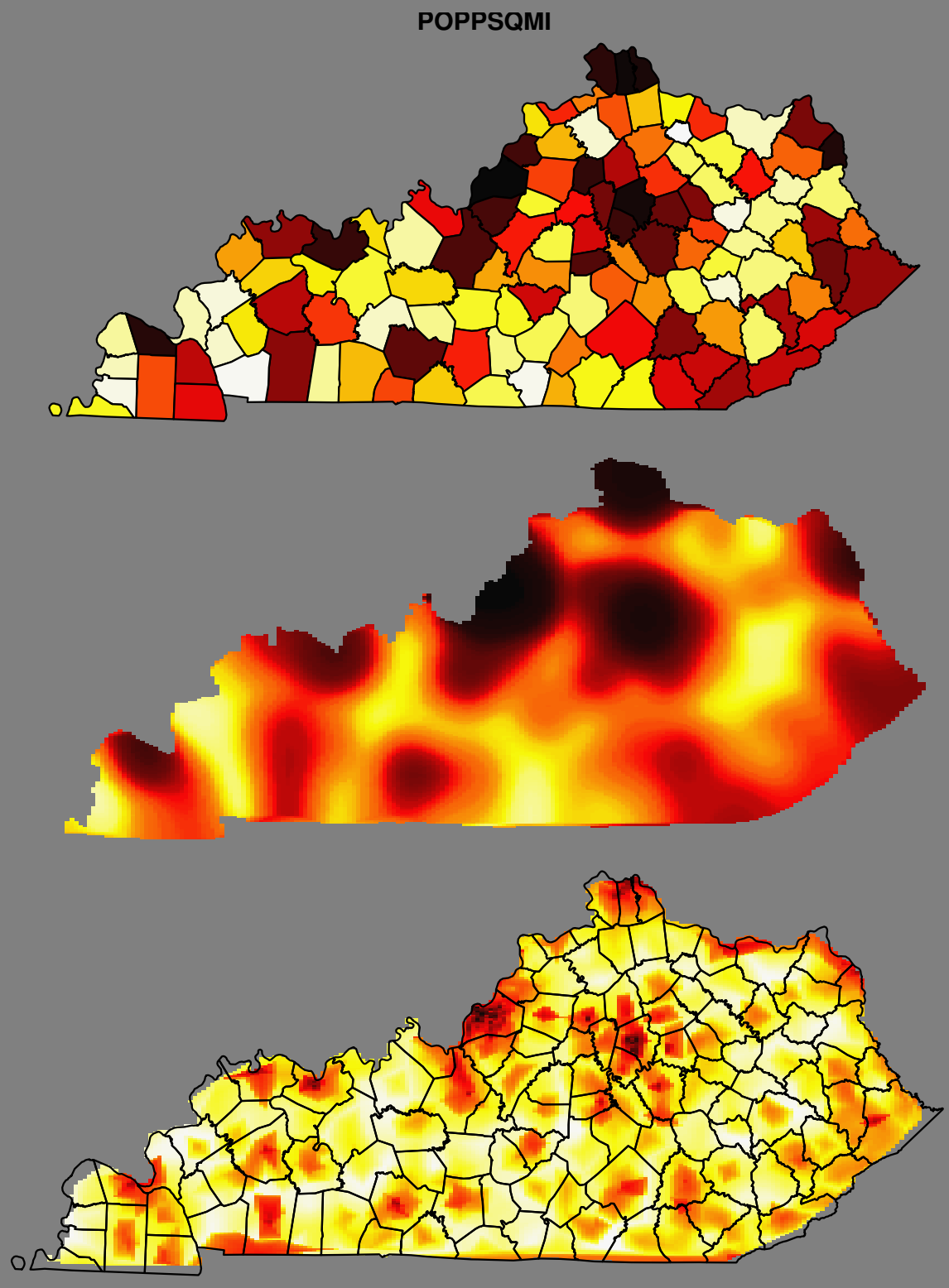
More advanced methods also take related variables into account. For example, to estimate population, use presence of roads (known at high-resolution).



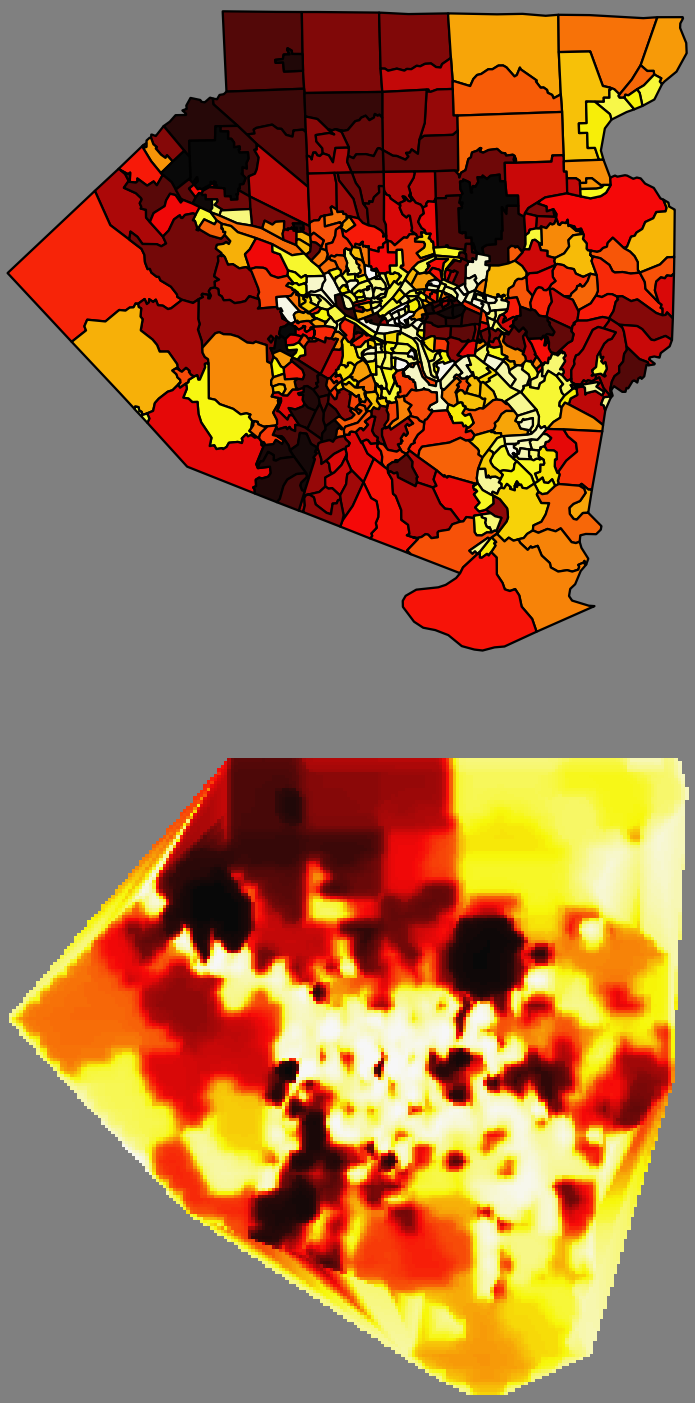
(a) Original surface, with region averages
(b,c) Two different area smoothes, with region averages



Three different mass-preserving interpolations, with region averages

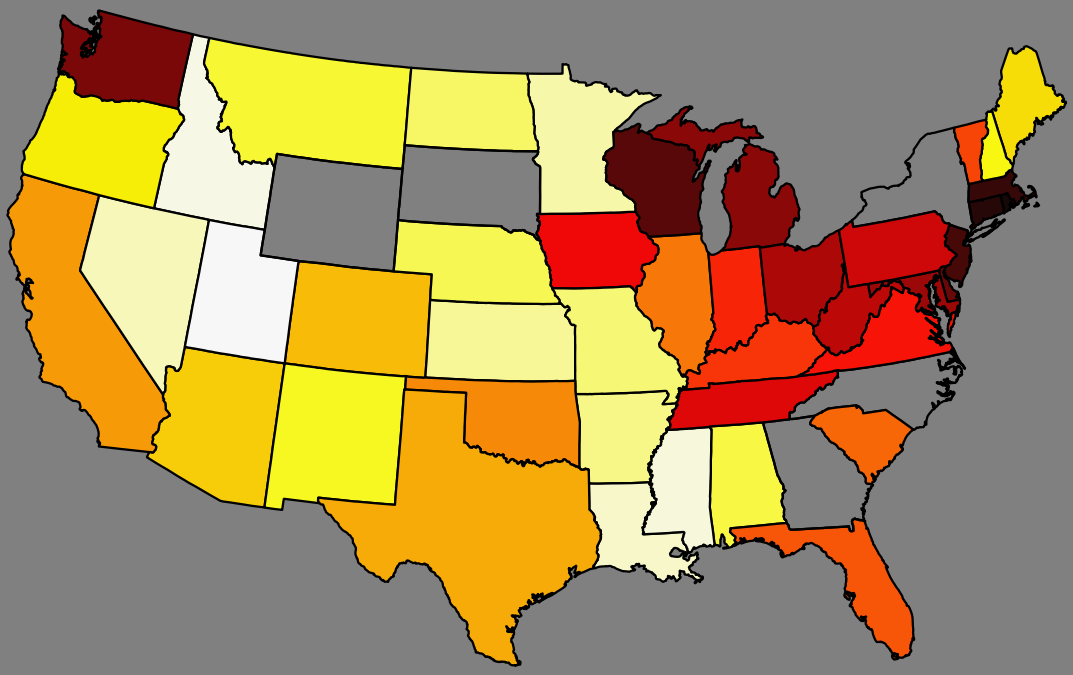


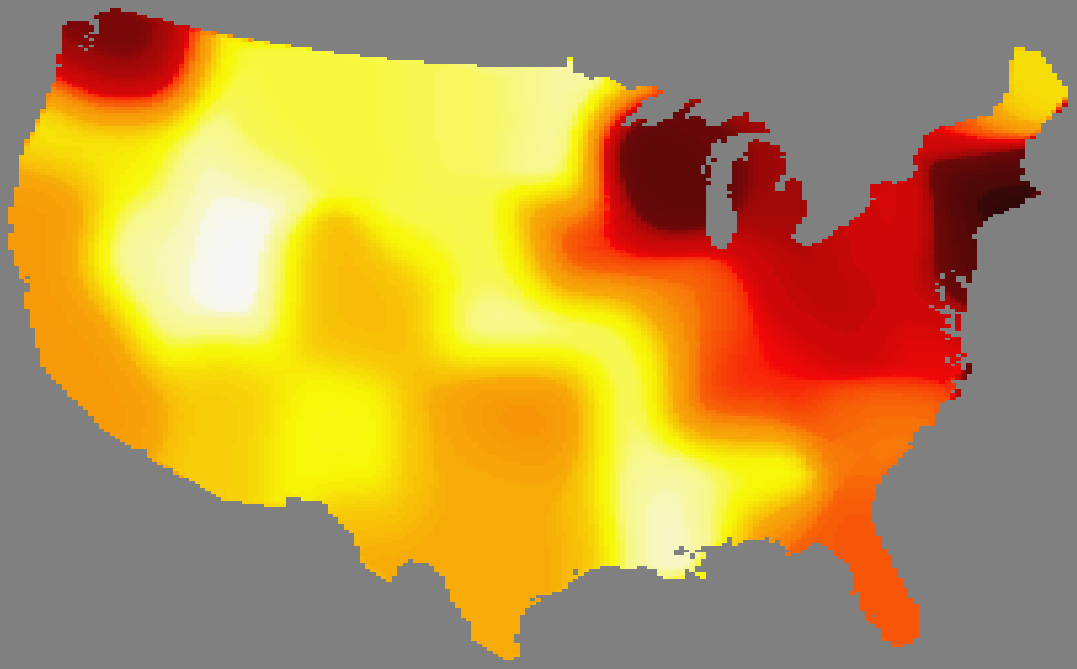
(a) Choropleth of counties
(b) Area smooth of counties
(c) Centroid smooth of tracts, showing true detail



(a) Choropleth of tracts
(b) Mass-preserving interpolation

Mumps April 1970





smooth