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A Computer-Based Application to Detect Spatial Clusters Using the DAC Statistic

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Using Spatial Statistics

- Detect disease space and time clusters;
- Increase the efficiency of the activity of health departments;
- Study the spatial pattern or distribution of a population;
- Generate individual-based models in Ecology;
- Socio-economic problems, biology, or geography.

The DAC Statistic

- Introduced for through a study by Drane, Creangă, Aldrich, and Hudson – 1995;
- Computation based on the empirical cumulative distribution function:

$$F_n(x_1, x_2) = \frac{m(x_1, x_2)}{n}$$

$m(x_1, x_2)$ is the number of points of the sample of size *n* such that $x_{1_i} \leq x_1$ and $x_{2_j} \leq x_2$.

The DAC Statistic (Continued)

- The DAC statistic is:

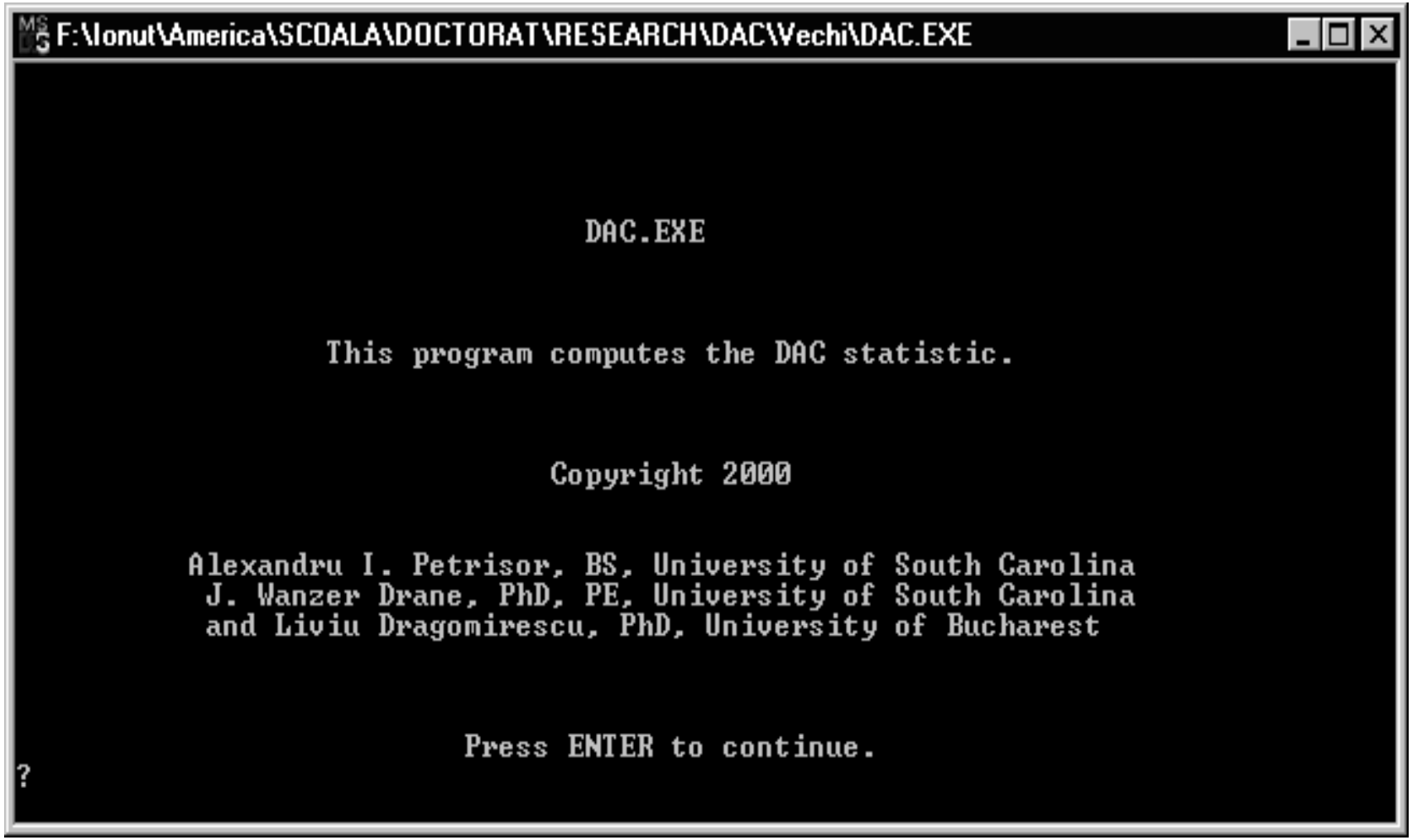
$$DAC(x_1, x_2) = F_m(x_1, x_2) - F_n(x_1, x_2)$$

- The maximum absolute value of the DAC statistic represents the Kolmogorov-Smirnov statistic for two samples

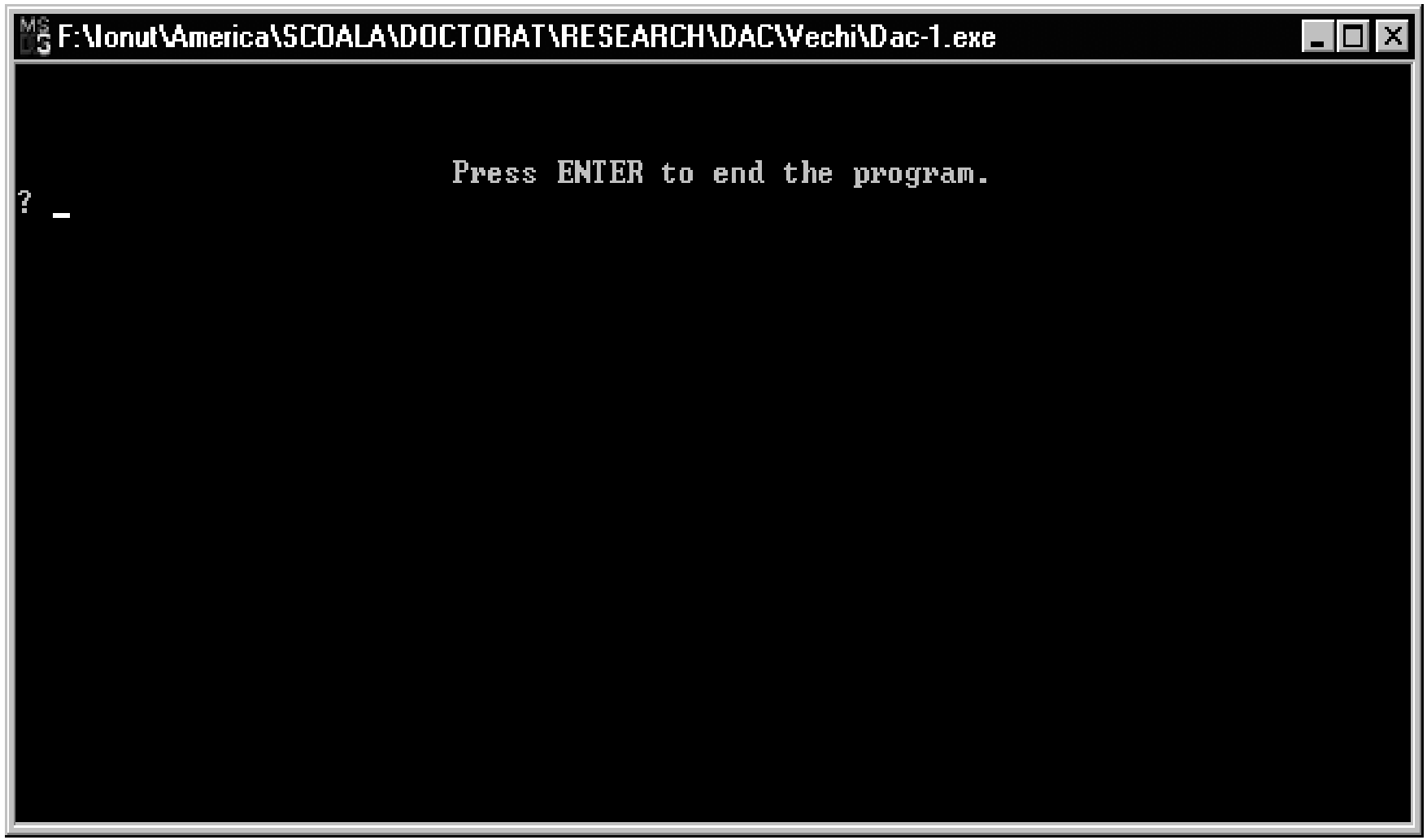
Simulation: Data

- Demonstration project sponsored by the Robert Woods Johnson Foundation;
- 6434 geo-coded live births in Spartanburg County, SC for the period 1989-1992;
- 591 low birth weight babies (less than or equal to 2500 grams) were the cases;
- Variables: a counter, the actual latitude and longitude, and the infant's birth weight;
- 1,000 samples of size 400.

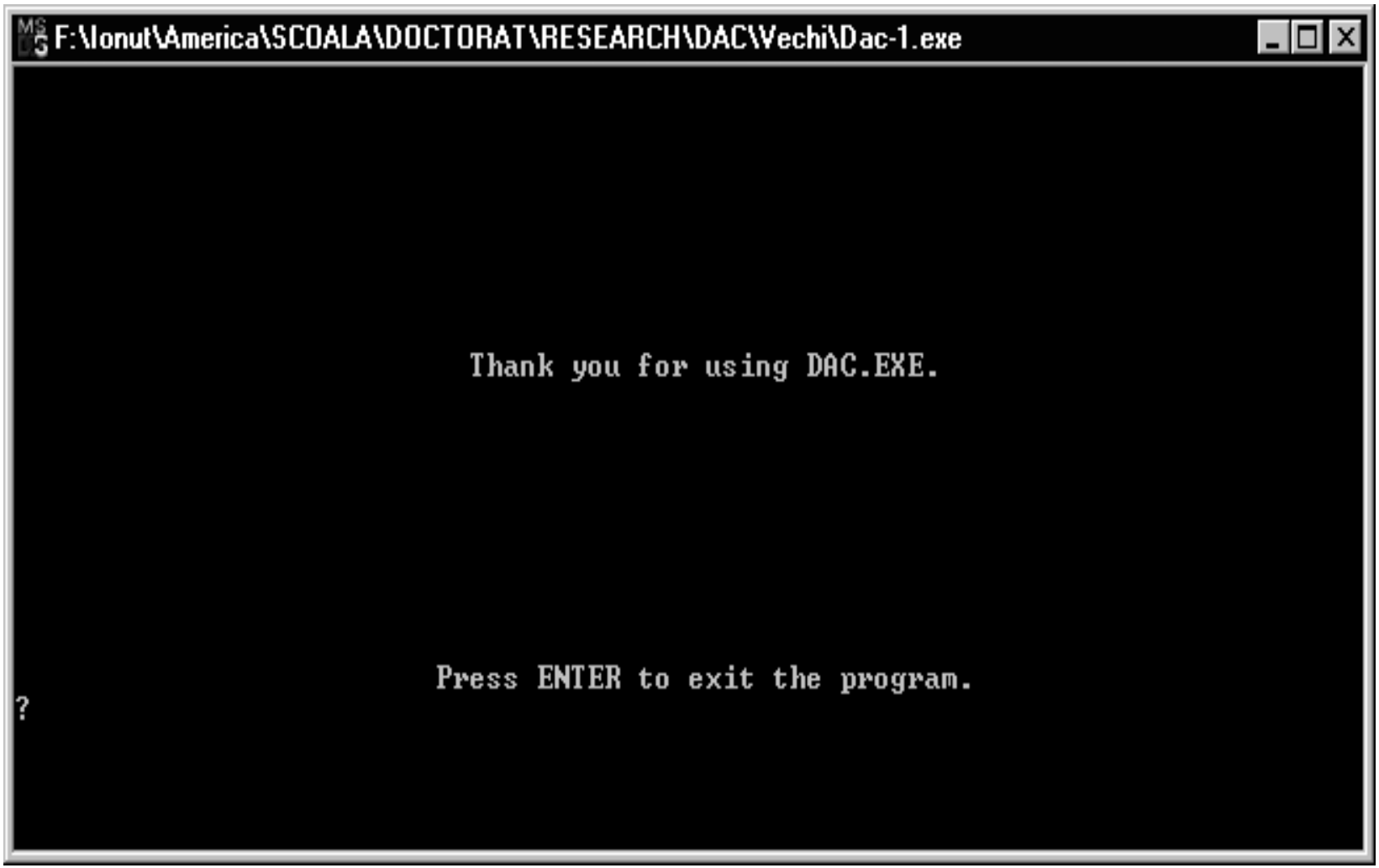
The Program: Interface



The Program: Interface (Continued)

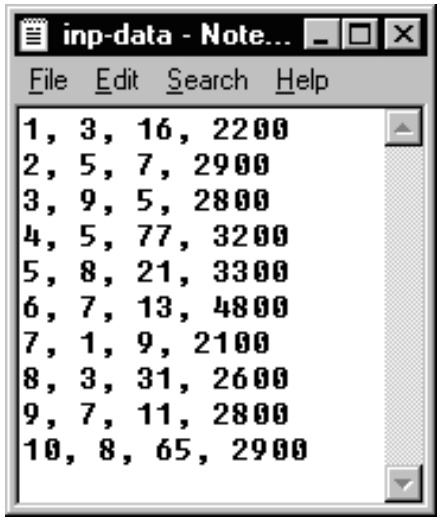


The Program: Interface (Continued)



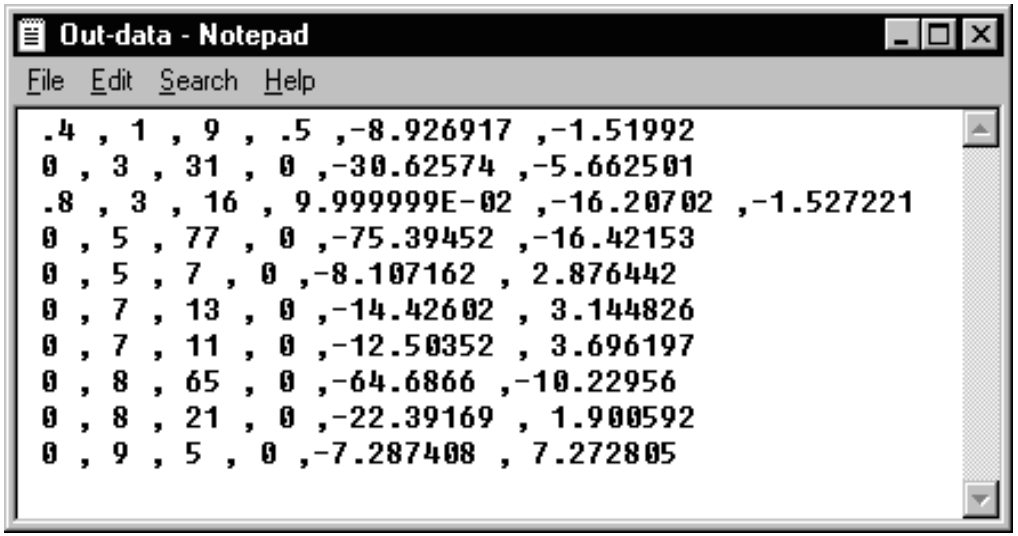
The Program: Input and Output

INPUT



- Count
- Longitude
- Latitude
- Birth weight

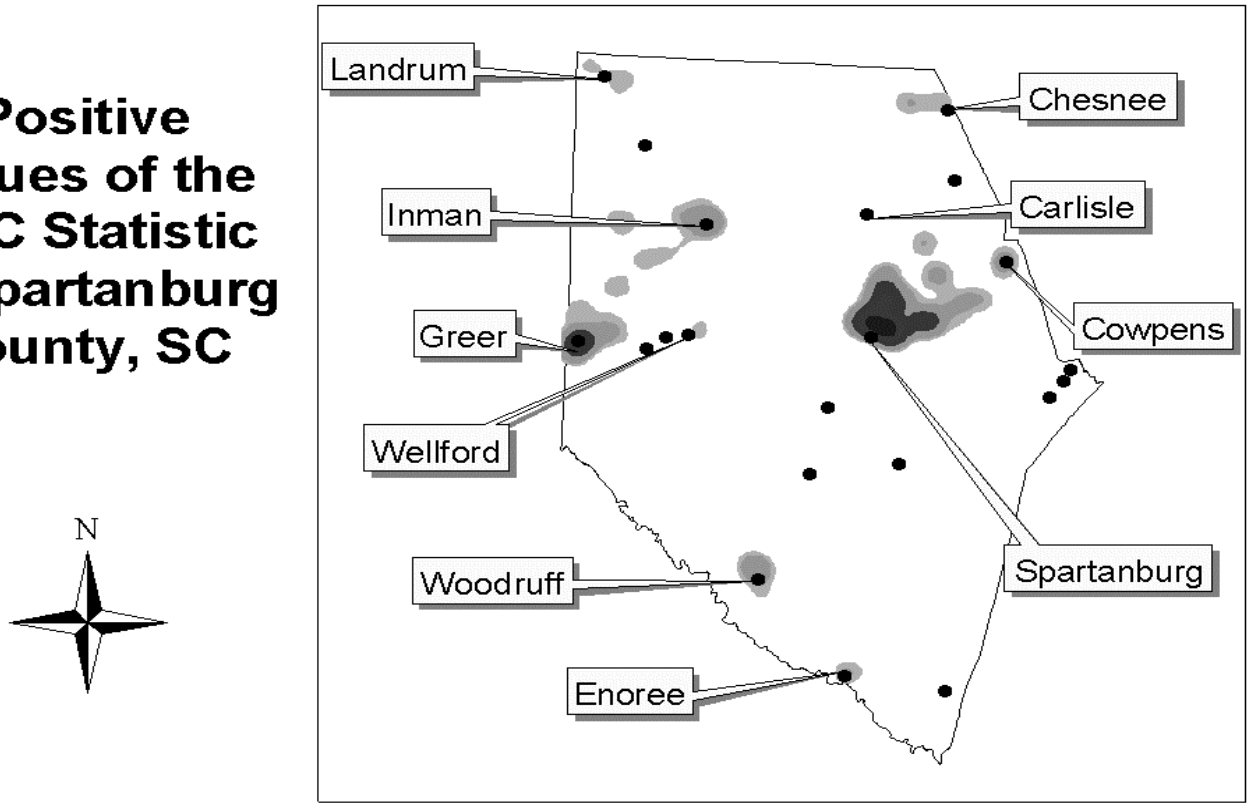
OUTPUT



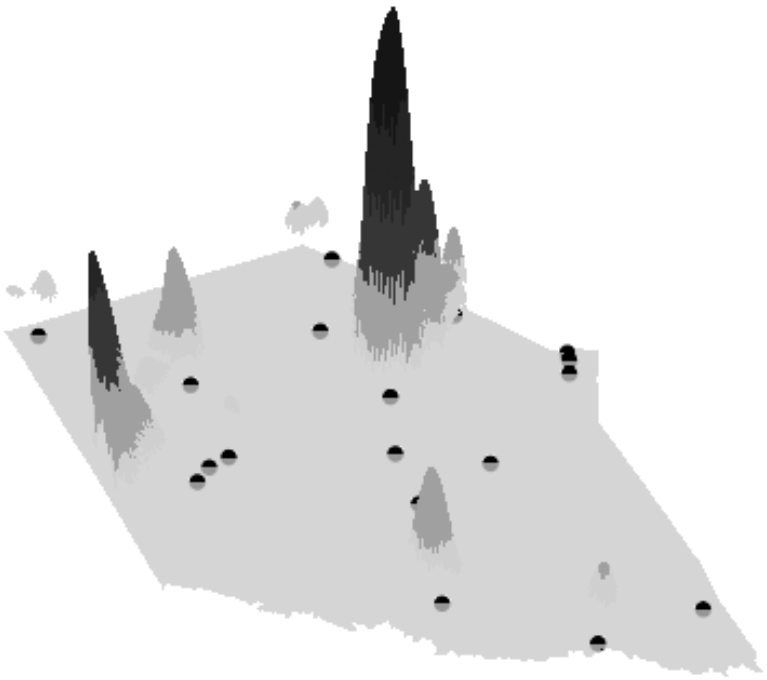
- DAC for the original sample
- Longitude in the original sample
- Latitude in the original sample
- DAC after rotation
- Longitude after rotation, in original coordinates
- Latitude after rotation, in original coordinates

Results

Positive Values of the DAC Statistic in Spartanburg County, SC



Results (continued)



Discussion and Conclusions

- In this example, the maximum DAC statistic appears to be a reliable instrument in detecting spatial clusters independently of the orientation of axes.
- The DAC statistic may be a reliable instrument in detecting spatial or temporal clusters.
- Necessity for more and deeper research.