

Exceedence Diagnostics

BMTRY 763



Exceedence

- Parameter Estimates from models can be assessed for average value (posterior mean or median)
- They can also be assessed for their variability (posterior sd or variance)
- The marginal posterior distribution of parameters also contains information about how likely extreme values are to arise.
- A posterior sample contains all this information
- What if we want to check whether a parameter exceeds a given fixed value?

Exceedence Probability

- In a disease mapping context we might want to examine how the relative risk estimates behave and how extreme they are.
- For instance, one measure of how extreme a risk is is given by

$$\text{Pr}(\theta_i > c)$$

- This can be estimated easily (and approximately) from posterior samples

Posterior sample estimates

- An approximation to this probability is given by

$$\hat{\Pr}(\theta_i > c) = \sum_{g=1}^G I(\theta_i^g > c) / G$$

where $I()$ is an indicator function.

- This is just a measure of how often in the sample the parameter exceeds the limit c .
- It is an approximation to the tail integral of the marginal distribution.



Implementation

- Implementation on WinBUGS/OpenBUGS is simple
- step() function allows the indicator to be implemented
- GeoBUGS also has an automatic facility to map any spatial object WRT exceedence
- For spatial data this provides a way to detect HOT SPOT clusters of risk via the fitting Bayesian disease mapping models

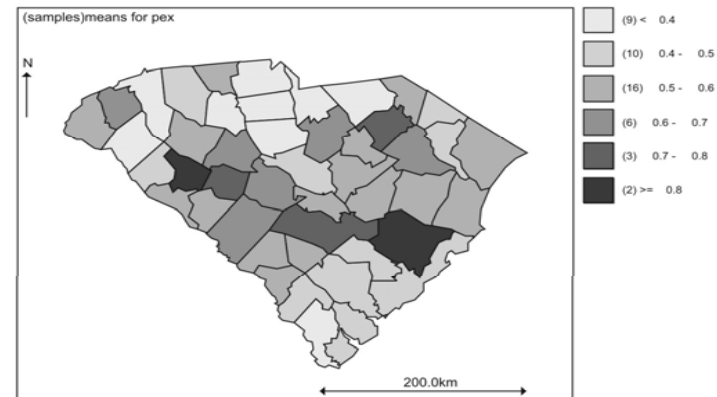
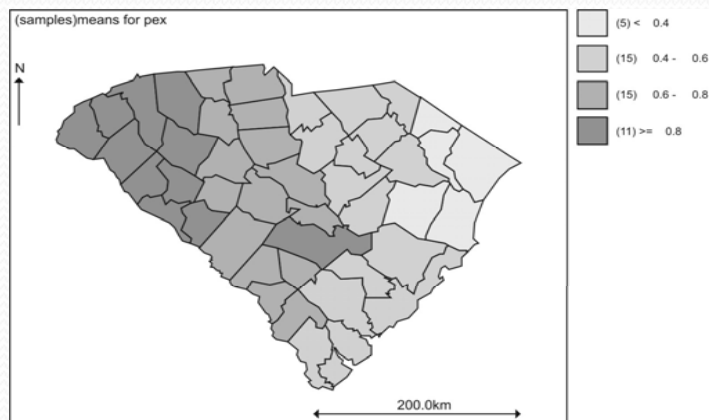


Demo

- Map_modelWB_pred.txt
- This includes the step function
- Data in R2WB_runfile_pred.txt
- Uses SC county data and so you need the SC county map in GEOBUGS

Cautionary Example (BDM13 ch 6)

- SC congenital mortality 1990 data
- Left panel: trend model
 - DIC= 171.81, pD=2.85



- Right panel: convolution model
 - DIC= 174.46, pD= 11.57