

**DATA AUGMENTATION FOR A BAYESIAN SPATIAL MODEL
INVOLVING CENSORED OBSERVATIONS**

by

Brooke L. Fridley and Philip Dixon
Mayo Clinic and Iowa State University

June 2006

ABSTRACT

Spatial environmental data sometimes include below detection limit observations (i.e. censored values reported as less than a level of detection). Historically, the most common practice for analysis of such data has been to replace the censored observations with some function of the level of detection (*LOD*), like *LOD/2*. We show that estimates and standard errors found using this single substitution method are biased. In particular, the spatial variance and variability in estimation is underestimated. We develop a measurement error Bayesian spatial model for the analysis of spatial data with censored values. Parameter estimation and predictions at observed and unobserved locations are computed using a data augmentation method using a Markov chain Monte Carlo algorithm. The data augmentation method is illustrated using data from a dioxin contaminated site in Missouri. We also use simulation to investigate the small sample properties of predictions and parameter estimates and the robustness of the data augmentation method.