Bayesian spatial quantile regression

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Tropospheric ozone is one of the six criteria pollutants regulated by the US EPA under the Clear Air Act and has been linked with several adverse health effects, including mortality. Due to the strong dependence on weather conditions, ozone may be sensitive to climate change and there is great interest in studying the potential effect of climate change on ozone, and how this change may affect public health. In this paper we develop a Bayesian spatial model to predict ozone under different meteorological conditions, and use this model to study spatial and temporal trends and to forecast ozone concentrations under different climate scenarios. We develop a spatial quantile regression model that does not assume normality and allows the covariates to affect the entire conditional distribution, rather than just the mean. The conditional distribution is allowed to vary from site-to-site and is smoothed with a spatial prior. We apply our model to summer ozone from 1997-2005 in the Eastern US, and use deterministic climate models to project ozone under future climate conditions. Our analysis suggests that holding all other factors fixed, an increase in daily average temperature will lead to the largest increase in ozone in the Industrial Midwest and Northeast.

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