Spatio-temporal modeling of fine particulate matter.

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Studies indicate that even short-term exposure to high concentrations of fine atmospheric particulate matter (PM2.5) can lead to long-term health effects. In this paper, we propose a random effects model for PM2.5 concentrations. In particular, we anticipate urban/rural differences with regard to both mean levels and variability. Hence we introduce two random effects components, one for rural or background levels and the other as a supplement for urban areas. These are specified in the form of spatio-temporal processes. Weighting these processes through a population density surface results in nonstationarity in space. We analyze daily PM2.5 concentrations in three Midwestern U.S. states for the year 2001. A fully Bayesian model is implemented, using MCMC techniques, which enables full inference with regard to process unknowns as well as predictions in time and space, including location-specific probabilities of non-compliance in terms of proposed air quality standards.

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