

Multiresolution models for nonstationary spatial covariance functions

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Abstract

Many geophysical and environmental problems depend on estimating a spatial process that has nonstationary structure. A nonstationary model is proposed based on the spatial field being a linear combination of a multiresolution (wavelet) basis functions and random coefficients. The key is to allow for a limited some number of correlations among coefficients and also to use a wavelet basis that is smooth. When approximately 6 % nonzero correlations are enforced, this representation gives a good approximation to a family of Matern covariance functions. This sparseness is important not only for model parsimony but also has implications for the efficient analysis of large spatial data sets. The covariance model is successfully applied to ozone model output and results in a nonstationary but smooth estimate.

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