

Adaptive tapers for space-time geostatistics

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Abstract

We propose a class of nonseparable space-time compactly supported correlation functions, termed here quasi-tapers, to mean that such correlations can be dynamically compactly supported over space or time. An important feature of the quasi-taper is given by a spatial (temporal) compact support being a decreasing function of the temporal lag (spatial distance), so that the spatial (temporal) compact support becomes smaller when the temporal (spatial) dependence becomes weaker. We propose general classes as well as some examples that generalize the Wendland tapers to the space-time setting. Then a non separable space-time taper with spatial and temporal compact support is obtained as tensor product of quasi-tapers. Our space-time taper includes all the known constructions as special cases and will be shown to have great exhibity. Covariance tapering is then explored as an alternative to maximum likelihood when estimating the covariance model of a space-time Gaussian random field in the case of large datasets. The proposed quasi and space-time tapers allows to perform covariance tapering when dealing with data that are densely observed in time (space) but sparse in space (time) or densely observed both in time and space. The statistical and computational properties of the space-time covariance tapering is addressed under increasing domain asymptotics. A simulation study and two real data examples illustrate the statistical and computational performances of the covariance tapering with respect to the maximum likelihood method using the space-time tapers proposed.

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