

abstract: This paper conducts a multivariate extension of isotropic Continuous Auto-Regressive Moving Average (CARMA) random fields on \mathbb{R}^d . Extending the definition of CARMA kernels in univariate models, we define multivariate CARMA random fields as moving averages of Lévy sheets, which provides wide varieties of multivariate parametric random fields on \mathbb{R}^d . The contributions in this paper are summarized in estimation and kriging for irregularly spaced data on \mathbb{R}^2 following multivariate CARMA random fields. We define a periodogram modified to let Whittle estimation be free from additional parameters to describe irregularity of sampling points and clarify conditions for consistency and asymptotic normality under the mixed asymptotics when sample size and sampling region diverge jointly. By the estimated CARMA random field by Whittle estimation, we propose a method to conduct kriging in a Bayesian way, regarding the CARMA random field as a spatial regression model. Finally tri-variate CARMA random fields are applied to simulated and US precipitation data to demonstrate the empirical properties, from which it is seen that the tri-variate model significantly improves univariate benchmarks in terms of kriging MSE.