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A spatial second-order non-stationary interpolation method for large area mapping

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Abstract:

The accuracy of the interpolation algorithm depends on our understanding of spatial heterogeneity. Spatial second-order stationarity is an important assumption of kriging interpolation. However, this assumption may not be valid at larger scales. Spatial stratified heterogeneity is widespread in geographic space, and stratified non-homogeneous surfaces can be divided into several stationary layers with high variance between each other. Geographic variables within the same layer are mainly autocorrelated with each other, while those between different layers are mainly heterogeneous with each other. Based on this principle, we propose a new interpolation algorithm, which assumes that the value of any point is influenced by other observations within the same region and every other region as a whole. Thus, for any position to be interpolated, the sum of the weights of all observations within the same zone and all other zones is 1 (Figure 1). There are two steps to conduct the model. First, the whole study area is divided into several zones according to spatial stratified heterogeneity using the machine learning method. Second, the algorithm maintains unbiased estimation when performing interpolation. The weights of observation points within the same zone are solved using point to point kriging, the weights of other zones are solved using the area to point kriging, and the weights between different zones are solved using the area to area kriging. Compared with the traditional spatial heterogeneity model, our algorithm fully takes into account the widespread spatial hierarchical heterogeneity in a large scale range and performs unbiased estimation based on it. The algorithm is expected to improve large-scale interpolation accuracy and deepen our understanding of the spatial heterogeneity of geographic variables. However, this algorithm relies on spatial heterogeneity based zoning, so the zoning method may affect the interpolation accuracy. At the edges of different zones, the value may not be smooth. In addition, if there is a spatial zone with a large area, when interpolating the points inside it, considering the influence of other zones may affect the interpolation accuracy.

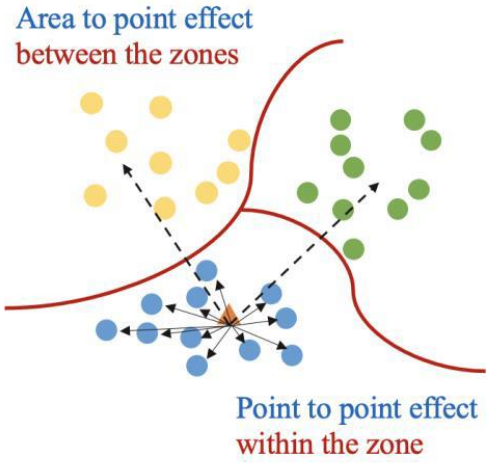

Figure 1. Interpolation process considering the spatial stratified heterogeneity.

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