

Comment on Article by Page and Quintana*

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We congratulate Page and Quintana for this new approach to nonstationary spatial modeling. This new model is based on a spatial clustering, whereby the underlying clusters are defined using spatial structure, and these clusters help drive the correlations between the observations. Here we discuss several related models that are derived from regional partitions or neighborhood structures. We also note that this work falls under the much larger rubric of nonstationary spatial modeling, and there are quite a number of other approaches that are related in that context.

1 Regional Partition Models

A related approach in the literature is to define regional partitions, rather than potentially overlapping clusters. A proper partitioning can be computationally simpler, in that the combinatoric possibilities are substantially more limited than for a clustering approach. The advantage of a clustering approach is additional flexibility in defining the clusters, including the allowance of irregular shapes and overlapping clusters. Thus the key trade-off is whether the additional computational cost is justified by the need for modeling flexibility.

Given the opening example in Figure 1 of the paper, of spatial fields that change across rectangular regions, we were surprised that there is no mention of treed Gaussian process (TGP) models (Gramacy and Lee, 2008), as they fit this example exactly. A TGP model considers a tree-based partitioning of the space and fits independent Gaussian process models within each partition. By allowing the partition structure to also be a random variable inferred simultaneously, Bayesian model averaging can result in smooth predictions when the data are smooth (as is the typical case), yet can provide for sharp jumps if warranted by the data (such as in Figure 1). With the inherent flexibility of the Gaussian process, just a little nonstationarity is usually enough to provide a really good fit to data, and this partitioning approach provides that sufficient amount of nonstationarity without invoking the massive computational burdens of fully nonstationary models. Open source software is provided in the `tgp` package (Gramacy, 2007; Gramacy and Taddy, 2010) for R (R Core Team, 2015).

Other examples of regional partition-based models are tessellations and partitioned process convolutions. Kim et al. (2005) developed a model that partitioned the space using a tessellation, and then fit independent Gaussian processes within each of those partitions. This provides additional flexibility beyond the treed partitioning approach,

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