False Discovery Rates to Detect Signals from Incomplete, Spatially Aggregated Data

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This presentation considers testing for the absence/presence of a spatial signal, where the data are defined on (irregular) small areas resulting from aggregation of fine-resolution pixels. When all pixels are observed, there are a number of ways to test for the presence of a signal in the spatial domain; the one we shall focus on is a powerful nonparametric hypothesis-testing procedure called Enhanced False Discovery Rate (EFDR). However, this EFDR methodology relies on data defined on a rectangular spatial domain with regular pixels. In this research, the methodology is generalised so that all irregularities in the small areas can be handled, where the idea is to augment EFDR with a Monte Carlo method in spatial statistics known as conditional simulation (CS). In this talk, EFDR-CS is applied to two data sets, one where aggregation and incompleteness are introduced into temperature-change data in the Asia-Pacific, and the other where remotely sensed carbon-dioxide data over a region of the Middle East, Afghanistan, and the western part of Pakistan are obtained from NASA's Orbiting Carbon Observatory-2 satellite. This research is forthcoming in 2021 in the Journal of Computational and Graphical Statistics, with co-authors Hsin-Cheng Huang, Andrew Zammit-Mangion, and Guowen Huang.