"Space and Space-Time Modeling of Directional Data"

Directional data naturally arise in many scientific fields, such as oceanography (wave direction), meteorology (wind direction), and biology (animal movement direction). Our contribution is to develop a fully model-based approach to capture structured spatial dependence for modeling directional data at different spatial locations. We build a projected Gaussian spatial process, induced from an inline bivariate Gaussian spatial process. We discuss the properties of the projected Gaussian process and show how to fit this process as a model for data, using suitable latent variables, with Markov chain Monte Carlo methods. We also show how to implement spatial interpolation and conduct model comparison in this setting. Simulated examples are provided as proof of concept. A data application arises for modeling wave direction data in the Adriatic sea, off the coast of Italy. In fact, this directional data is available across time, requiring a spatio-temporal model for its analysis. We discuss and illustrate this extension.