Maximum likelihood inference of a non stationary anisotropical SPDE model of bathymetry

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Résumé

Investigating spatial structures is well established for euclidean spaces where a given spatial direction gets the same meaning all over the study area. This is no longer the case for phenomenon with a strong radial organization like bathymetry around an island or for ecological or environmental studies where the spatial continuity does not reduced to single directions all over the study area but rather follows some curves. In addition, bathymetry is non stationary as depth increases slowly perpendicular to the coast, up to the shelf-edge, where it starts to drop sharply after.

In this paper we develop a SPDE formulation for the bathymetry. Non-stationary anisotropical parameters are estimated by maximum likelihood. A third of the data are used to perform a cross validation opposing the anisotropical model to a more simple isotropical model.

Depth measurements were collected by echo-sounder along transects. The resolution of the echo-sounder was such that the number of observations was quite high ($N =$ 1 900 000). Numerical issues were thus a concern and SPDE confirmed to be very efficient in this regards.

Mots-Clés: SPDE, maximum likelihood

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