

PhD project in spatial statistics

Anisotropy Characterization and modelling of spatio-temporal random fields. Application to climate variables.

Supervisors

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Motivation and Context

It is well known that Gaussian random fields, on which most statistical models for climate variables are grounded, are completely described by their covariance function. Space-time covariance functions, or classes of those, proposed in the literature focus on the space-time interaction using the concept of separability (see e.g. Gneiting, 2002). A more recent approach has been proposed, based on an explicit link between SPDEs and some Gaussian random fields (Lindgren et al., 2011). However, the literature on the concept of anisotropy in a space-time context is very sparse.

This PhD project proposes to study in detail how space-temporal anisotropy can be defined and characterized, in relation to the notion of separability.

Research Program

A first goal of the thesis will be to characterize anisotropy in a space-time context and then to propose and simulate anisotropic spatio-temporal random field models. In a second step, estimation methods for the anisotropy and separability parameters of random field models will be proposed in two cases: (i) data are collected on a grid, regular in space and time; (ii) data are irregularly located in space and time. Estimation methods will be validated on simulated data, using the proposed simulation methods. In a third step, tests for isotropy will be proposed and validated.

All methodological advances will be illustrated on climate data-sets.

Candidate profile :

Statistician with strong interest in spatial and spatio-temporal statistics. The PhD project is mainly oriented towards theory, but there will also be some application on climate variables. We seek a candidate with good theoretical knowledge of random fields theory and/or spatial statistics. A first experience of the R programming language is appreciated.

To apply, candidates should contact Denis Allard (denis.allard@inra.fr) or Céline Lacaux (celine.lacaux@univ-avignon.fr) as soon as possible, by providing a detailed CV (incl. ranks and marks), a motivation letter and a recommendation letter from at least one former supervisor/professor. The successful candidate will be selected among a short list of candidates by a selection committee of the doctoral college of the University of Avignon, to be held on June 1st, in Avignon.

The supervisors belong to the BioSP team, INRA Avignon (DA) and to the LMA, University of Avignon (CL). The successful candidate will become part of the Biostatistics and Spatial Processes lab (BioSP) of INRA Avignon (<https://informatique-mia.inra.fr/biosp/accueil>). The candidate will participate to the research network RESSTE <https://informatique-mia.inra.fr/resste/Bienvenue> and Stochastic Geometry GDR <http://gdr-geostoch.math.cnrs.fr/>