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Spatio-temporal stochastic models: anisotropy and simulation

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In spatial or spatio-temporal modeling, a classical assumption was to assume that the studied phenomena are isotropic, i.e. that their statistical properties are the same whatever the direction one looks at. However, in practice such assumption is very restrictive: as examples, it is a serious drawback to model bones in medicine, the topography of faults in geophysics, aquifer in hydrology, to take into account the interaction between space and time in climatology,… Hence, since several years, we observe an important demand for anisotropic models, even for theoretical purposes in image synthesis. The literature around anisotropy property is then growing up, combining theoretical and practical studies. Comparing to isotropic models, it is more tricky to build anisotropic models, to estimate their parameters, to synthesize them and to study their theoretical properties (e.g. their smoothness, the set on which the studied phenomena exceed a critical value,…).

This presentation is only an introduction to anisotropic (Gaussian) models. In particular, it presents some types of anisotropy used in geostatistics, and also an anisotropy linked to a scale invariance. If time allows, the particular case of spatio-temporal models and simulation will be discussed.