SBI

Simulations : Efficient methods for spatio-temporal models estimation

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1 Model 1

2D Gaussian field

Initially, this model was a **temporary solution**

Simulates **spatio-temporal** data (1D space + 1D time for faster computation)

Examples : Solar radiation, air pollution

Data : Observations $y(x_i)$ at some points $(x_1, ..., x_n)$.

Model : Observations are realizations of a random variables

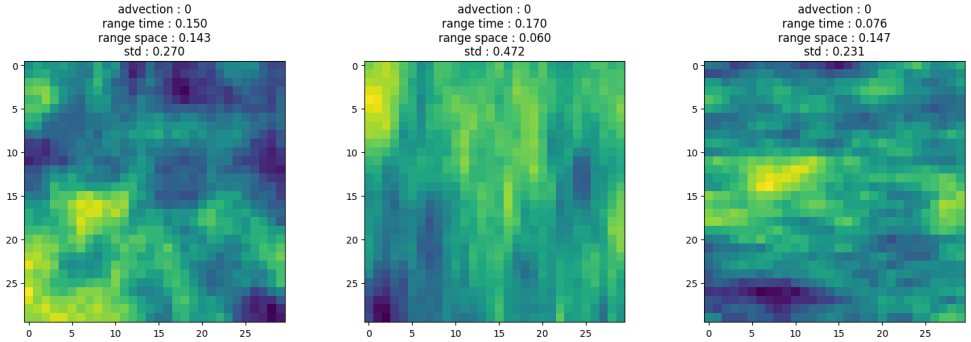
$$Y(x_i) = \mu(x_i) + Z(x_i) + \tau\varepsilon_i,\ \tau > 0$$

- μ: Fixed effect (regression covariates)
  - 0 in my simulation
- $Z \sim \mathcal{N}(0, \Sigma)$: Gaussian Random field
  - Matérn covariance in my simulation
- $\varepsilon_1, ..., \varepsilon_n \sim \mathcal{N}(0, 1)$ iid noise

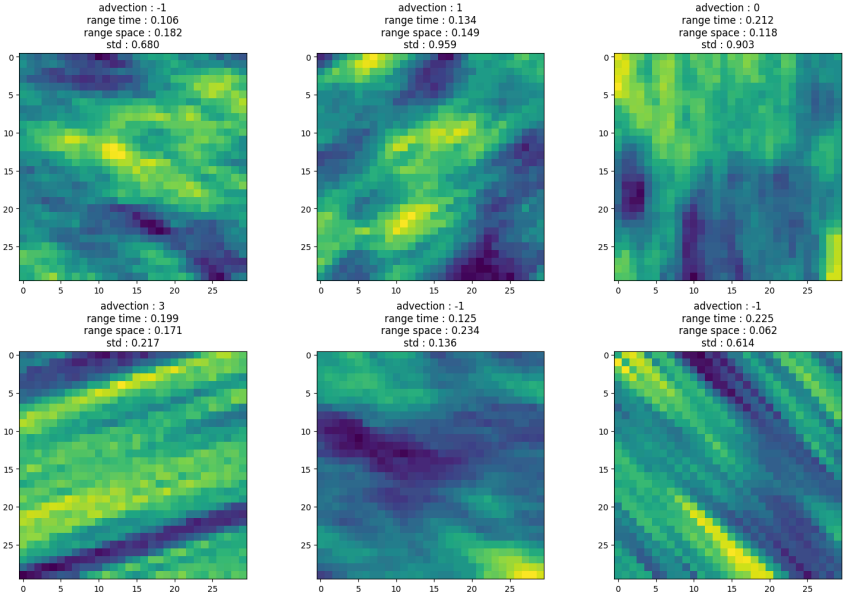
Matérn covariance

$$C_\nu(d) = \sigma^2 \frac{2^{1-\nu}}{\Gamma(\nu)} \left(\sqrt{2\nu} \frac{d}{\rho} \right)^\nu K_\nu \left(\sqrt{2\nu} \frac{d}{\rho} \right)$$

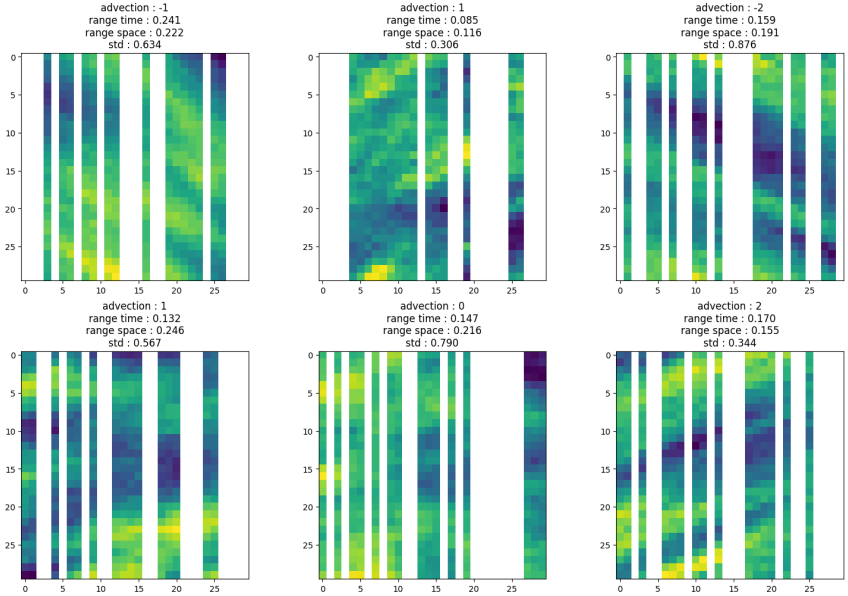
- ν is fixed
- The goal is to find the range ρ and the sill σ^2 (+ advection !)



Examples with advection



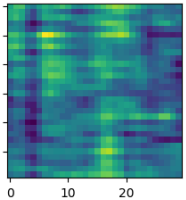
Examples with missing values



2 Model 2

Example images

[0.15087784 1.76634852 4.34370943 0.44364371]



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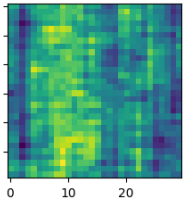

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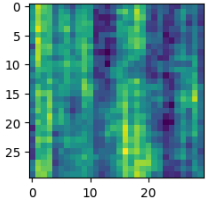

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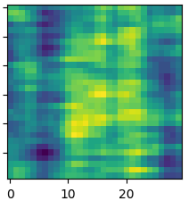

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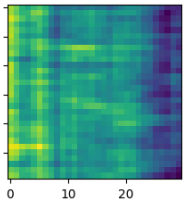

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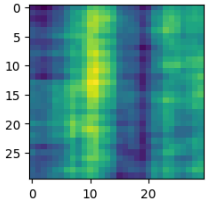

Example images (ii)

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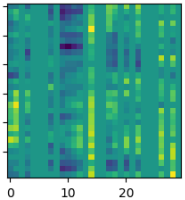

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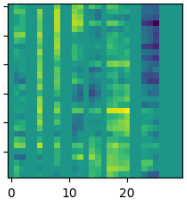

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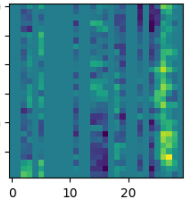

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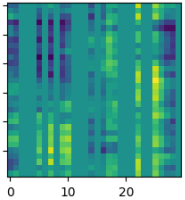

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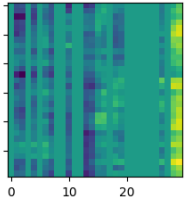
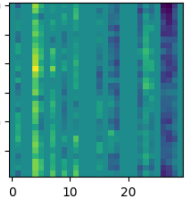
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