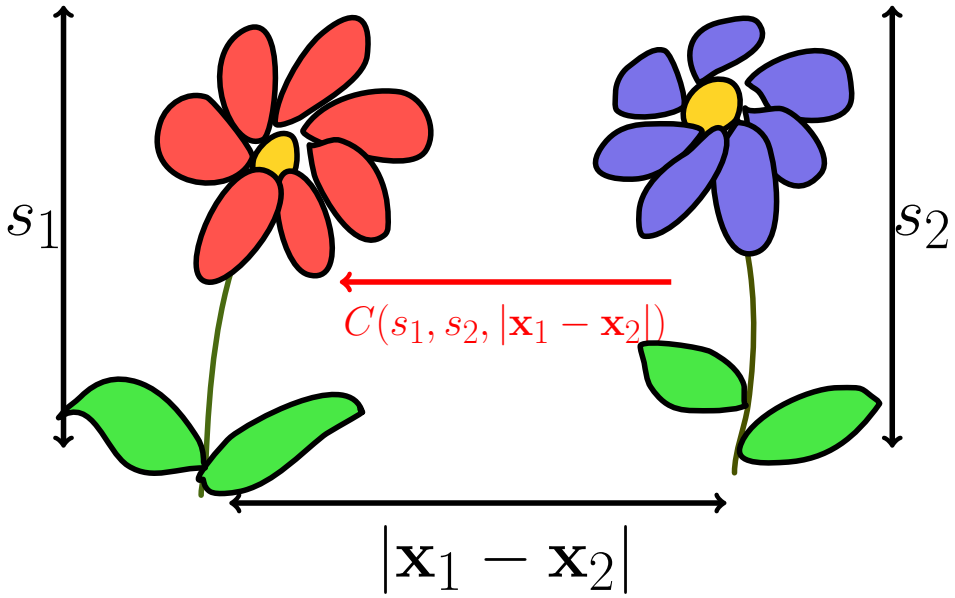
Simulation of the mean field distribution of a heterogeneous population with interactions - Antonin Della Noce, MICS, Centralsupelec, Univ. Paris-Saclay

Model of plant growth with competition



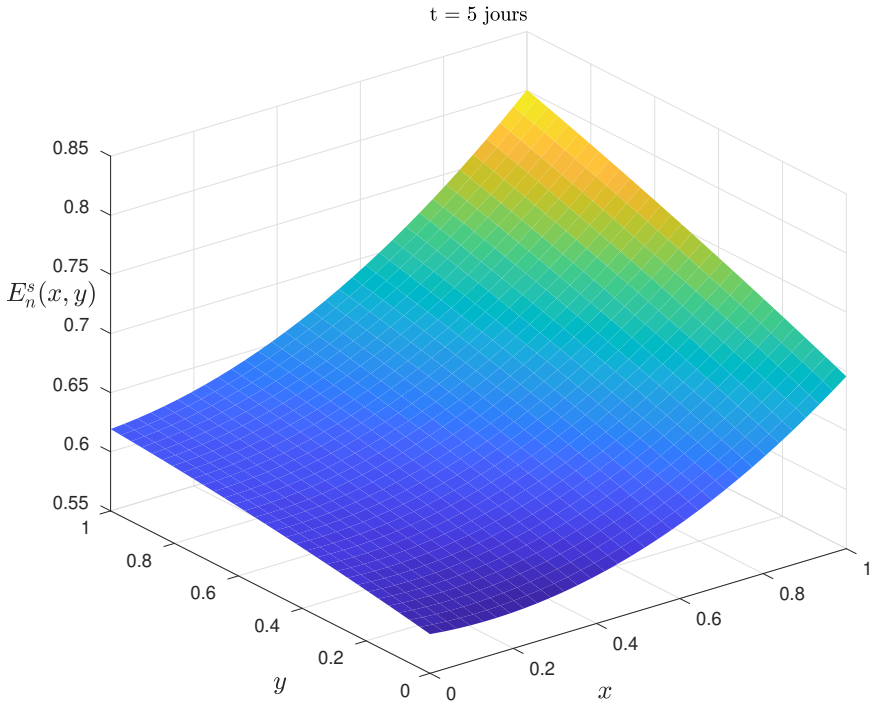
Dynamics of foliage volume, mean field density

$$\begin{cases} f(0, s, \theta) = f_0(s, \theta) \\ \dfrac{\partial f}{\partial t}(t, s, \theta) + \mathrm{div}_s \left(f(t, s, \theta) \displaystyle\int_{\mathcal{S}\times\Theta} g(s, \theta, s', \theta') f(t, s', \theta') \lambda^{\otimes d_z}(\mathrm{d}s', \mathrm{d}\theta') \right) = 0 \end{cases}$$

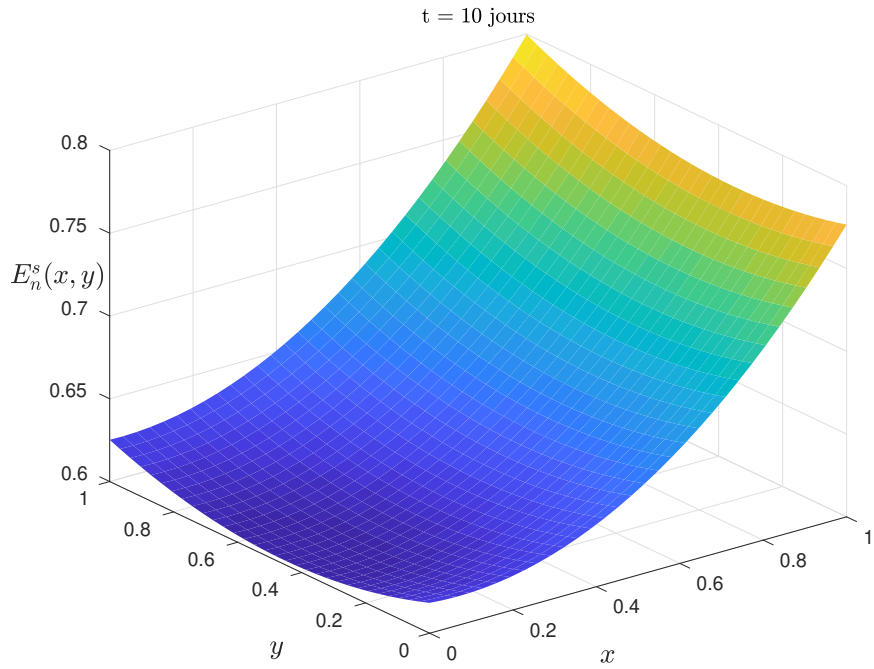
Growth of a single plant interacting with a continuum of other plants

$$\begin{cases} s(0,\theta) = s^0 \\ \dfrac{\partial s}{\partial t}(t,\theta) = \displaystyle\int_\Theta g(s(t,\theta),\theta,s(t,\theta'),\theta')p_0^\theta(\theta')\lambda^{\otimes 4}(\mathrm{d}\theta') \end{cases}$$

Average size of the population, computed with Gaussian process regression



(a) $t = 5$ days



(b) $t = 10$ days