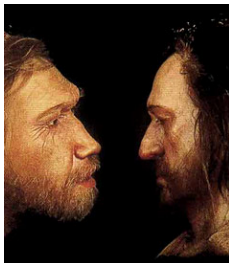


Evolution de la population d'Homo Néanderthal

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INSA Lyon - Bioinformatique et Modélisation

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Contexte biologique

Présentation des modèles étudiés

Cadre général

Modèle général

$$\frac{\partial u(t, x)}{\partial t} = f(u(t, x)) + d\Delta u(t, x), \quad t \in \mathbb{R}, x \in \mathbb{R} \quad (1)$$

$u(t, x)$: Densité de population $\in [0, 1]$

d : Constante de diffusion

Présentation des modèles étudiés

Croissance logistique

Croissance Logistique

$$\frac{\partial u(t, x)}{\partial t} = f(u(t, x)) + d\Delta u(t, x)$$

$$f(u(t, x)) = \alpha u \left(1 - \frac{u}{K}\right)$$

K : Capacité de transport

α : Taux de croissance maximum

Présentation des modèles étudiés

Modèle Allee

Modèle Allee

$$\frac{\partial u(t, x)}{\partial t} = f(u(t, x)) + d\Delta u(t, x)$$

$$f(u(t, x)) = ku(1 - u)(u - A)$$

k : Taux de croissance normalisé constant

A : Densité critique

$$k = \frac{4}{(1 - A)^2}$$

Présentation des modèles étudiés

Système de Lotka-Volterra

Modèle de compétition

$$\begin{cases} \frac{\partial u(t,x)}{\partial t} = f(u, v) + d_1 \Delta u \\ \frac{\partial v(t,x)}{\partial t} = g(u, v) + d_2 \Delta v \end{cases}$$

$$f(u, v) = \alpha_1 u \left(1 - \frac{u}{K_1} - \gamma_1 \frac{v}{K_1} \right), \quad g(u, v) = \alpha_2 v \left(1 - \frac{v}{K_2} - \gamma_2 \frac{u}{K_2} \right)$$

$u(t,x)$: Densité de population des Hommes Modernes

$v(t,x)$: Densité de population des Hommes de Néanderthal

K_1 et K_2 : Capacités d'accueil du milieu

γ_1 et γ_2 : Coefficients de compétition

α_1 et α_2 : Taux de croissance

Analyse mathématique

Croissance logistique

Analyse mathématique

Effet Allee

Analyse mathématique

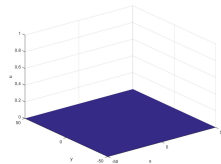
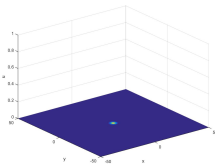
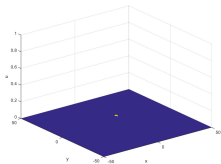
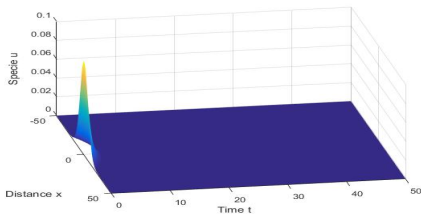
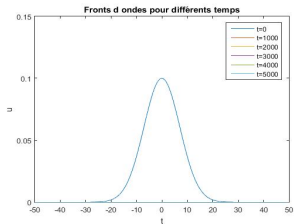
Système de Lotka Volterra

Simulations Numériques

Croissance logistique

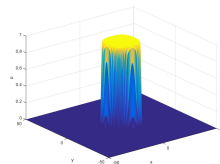
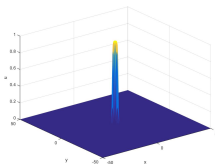
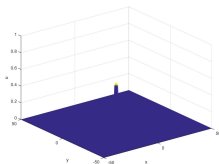
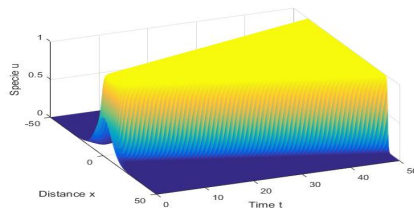
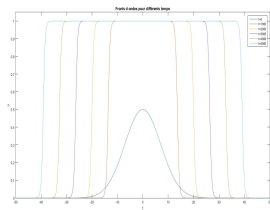
Simulations Numériques

Modèle Allee : $d = 0.5$, $A = 0.25 (k = 64)$, $u_0 = 0.1$



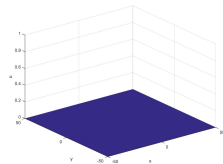
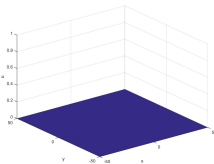
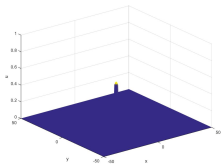
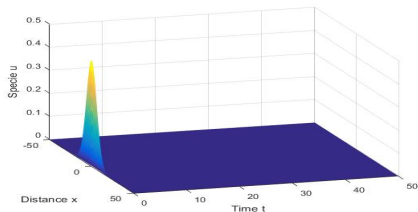
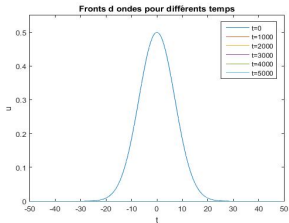
Simulations Numériques

Modèle Allee : $d = 0.5$, $A = 0.25$ ($k = 64$), $u_0 = 0.5$



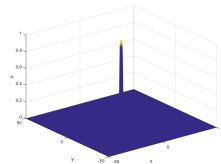
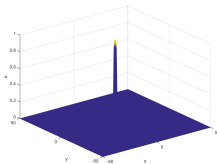
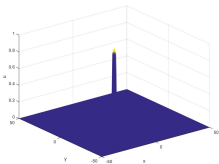
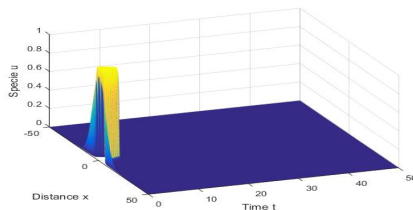
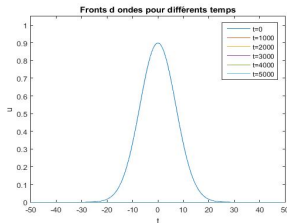
Simulations Numériques

Modèle Allee : $d = 0.5, A = 0.75 (k = 7.1), u_0 = 0.5$



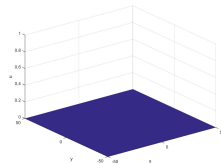
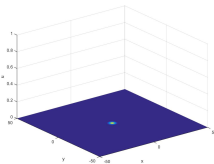
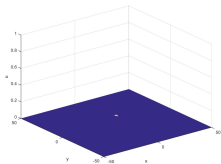
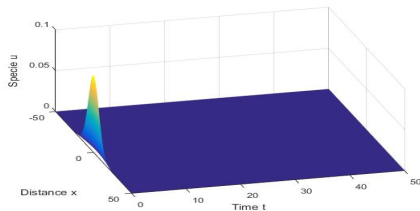
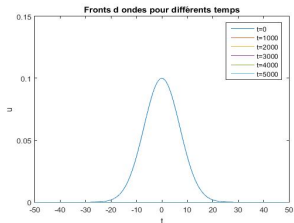
Simulations Numériques

Modèle Allee : $d = 0.5, A = 0.75 (k = 7.1), u_0 = 0.9$



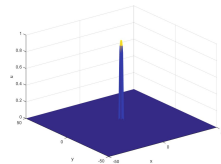
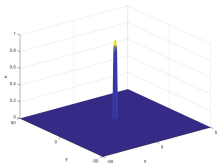
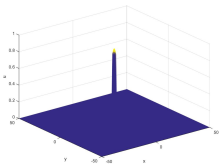
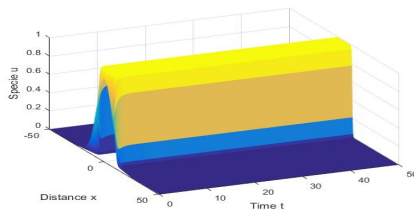
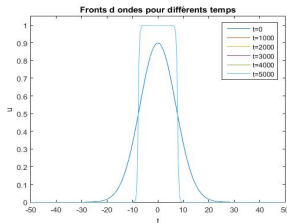
Simulations Numériques

Modèle Allee : $d = 0.5, A = 0.5(k = 16), u_0 = 0.1$



Simulations Numériques

Modèle Allee : $d = 0.5$, $A = 0.5(k = 16)$, $u_0 = 0.9$



Simulations Numériques

Système de Lotka Volterra