



GEOG2123 Geographical modeling

[30h+30h exercises] 5 credits

Teacher(s): Eric Deleersnijder, Isabelle Reginster (supplée null)
Language: French
Level: Second cycle

Aims

Knowledge:

Enhance the knowledge of modeling techniques using the comprehension of geographical processes. Specifically models based on:

- spatio-temporal analysis using SIG-type technology
- the dynamic approaches using differential equations
- on fractals

Skills:

- Complex analysis of SIG
- Modeling software of dynamic systems
- Mathematical methods in geography

Main themes

Prerequisite:

GEOG 2151 - Geographical information systems

GEOG 2150 - Quantitative geographical analysis methods

Sufficient knowledge in mathematics

Magistral course:

Themes

Introduction

Objectives and course structure

Different types of models

Terminology and definitions, etc.

Student work (theory + PW) : 4

SIG models

Simple spatio-temporal models

Diffusion models (migration and innovation) based on the logistic curb

Spatio-temporal models of neighbouring

Life game

Cellular automates applied to the urbanisation and suburbanisation

Häberstrand "revisited"

Student work (theory + PW) : 12

Transport models

Transport demand

"Variational inequalities"

Student work (theory + TP) : 4

Differential models

Generalities

State variables, parameters

Initial conditions, limit conditions, etc.

Ordinary linear differential models

General solutions

Balance points (stability, instability, oscillations)

Conservation/dissipation of energy

Exemple (Mururoa Lagoon)

Ordinary non-linear differential models

Balance points (stability, instability, oscillations)

Conservation/dissipation of energy

Qualitative notions of bifurcation

Qualitative notions on chaos and predicatbility

Examples (logistic curb, Prey/predator, etc.)

Models with temporal and spatial dependance

Differential equations in partial derivatives

Application to the field of interest

Approximation by the "box-model"

Example (Exxon Valdez, Alaska)

Optimizing parameters, validation and analysis of sensibility

Student work (theory + PW) : 30

Analysis of geographical systems

Self-organization of human systems

Dynamics of urban centers

Intra-urban models

Case study: modeling the evolution of the USA (1950-1970)

Student work (theory + PW) : 10

TOTAL 60 (30+30)

Assisted work:

Themes

TD1 SIG models

Spatio-temporal models, diffusion, cellular automates

Student work : 7 hrs

TD2 Differential models

(modélisation et optimisation in ModelMaker)

- ordinary

- spatio-temporal

Student work : 18 hrs

TD3 Geographical systems

- urban dynamics

Student work : 5 hrs

Personnal work:

60 hrs of personnal work (report and exam preparation).

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Prerequisites: the course GEOG 2151 "Systèmes d'information géographique".

Other credits in programs

GEOG22	Deuxième licence en sciences géographiques	(5 credits)	Mandatory
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