Slide 1

UNIVERSITEIT GENT

BIOMATH
Department of Applied Mathematics, Biometrics and Process Control

Potential of Ecological Informatics in Geo-Referencing Probabilistic Risk Assessment of Chemicals in Rivers

Frederik Verdonck
C. Janssen, P.A. Vanrolleghem

NecoV 2002, Gent, November 6 2002

RUG-Biomath, Coupure 653, 9000 Gent, Belgium (e-mail frederik.verdonck@rug.ac.be)
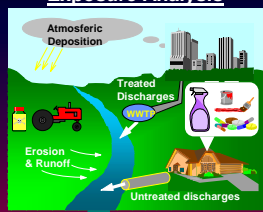
Slide 2

Outline

- Introduction
  - What is risk assessment?
  - What is probabilistic risk assessment?
  - What is geo-referenced probabilistic risk assessment?

- Ecological Informatics in Geo-Effects
  - Potential use
  - Potential drawbacks
- Case study (Rupel basin)

- Conclusions

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Slide 3

Ecological risk assessment

Exposure Analysis

Atmosferic Deposition

Treated Discharges
WWTP

Erosion & Runoff

Untreated discharges

Effects Analysis

Laboratory- and fieldstudies
(toxicity tests)

Environmental Concentration (EC)

No Effect Concentration (Species Sensitivity: SS)

YES, potential risk

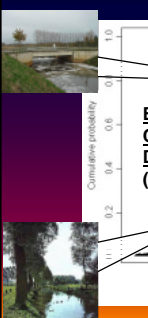F. Verdonck   BIOMATH

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Introduction

- Current risk analysis approaches are:
  - not so realistic & transparant
  - don't stimulate further research
  - don't distinguish between uncertainty and variability
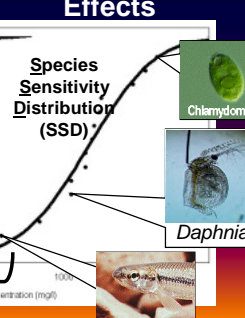
>> Use of probabilistic approaches

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Probabilistic risk assessment

Exposure   **Effects**

Species Sensitivity Distribution (SSD)

Chlamydomonas

Environmental Concentration Distribution (ECD)

Daphnia

Cumulative probability

LAS-concentration (mg/l)

Pimephales

% risk

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Slide 6
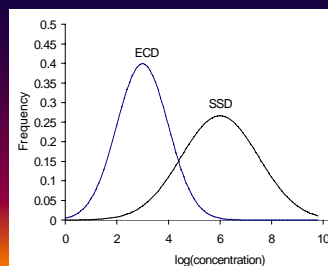
Problem formulation

> spatial variation is quite high
> large variances >> RISK = P(EC > SS)

ECD

SSD

Frequency

log(concentration)

(European) risk = 33%
+
90% confidence interval: 25-52%

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Introduction

- Current risk analysis approaches are:
  - not so realistic & transparent
  - don't stimulate further research
  - don't distinguish between uncertainty and variability

>> Use of probabilistic approaches

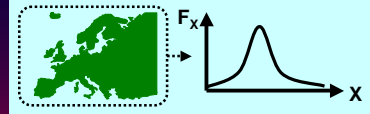 - A lot of spatial variability (e.g. on a European level)

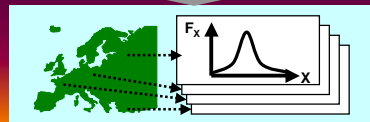**>> Use of geo-referenced probabilistic framework**

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Geo-referencing X

Variability represented in distribution:

F_X

X

- spatial
- temporal
- other…

F_X

X

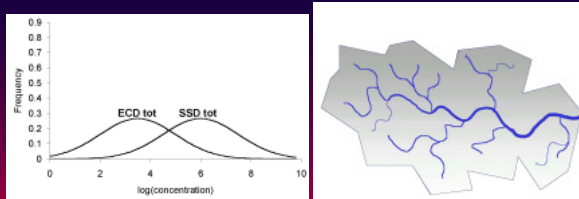- temporal
- other...

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Geo-risk

- Risk = P(EC > SS)

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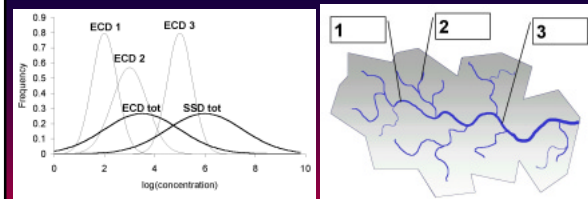

Geo-risk

- Risk = P(EC > SS)

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Geo-Risk

- Geo-risk is only useful when both exposure (ECD) and effects (SSD) are geo-referenced.

- Problem: Geo-referencing effects (Species Sensitivity Distribution) is still a large, **unexplored** area.

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Geo-effects?

- Influencing factors:
  - Species presence: physico-chemical environmental circumstances create ecological niches resulting in different communities, biodiversity.
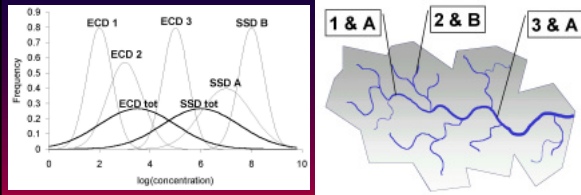 - Physico-chemical characteristics are also determining the bioavailability and toxicity of chemicals.
  - …

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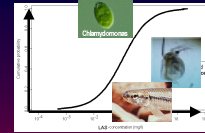
Geo-risk

- Risk = P(EC > SS)

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Ecological Informatics Potential

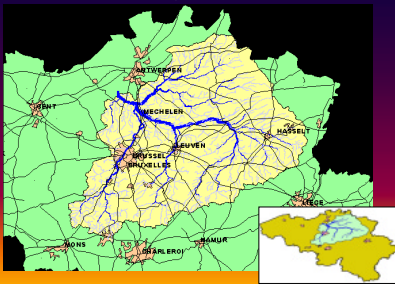- could help in geo-effects by estimating species presence/absence

BUT,
- Realistic / scientific?
- Feasible?
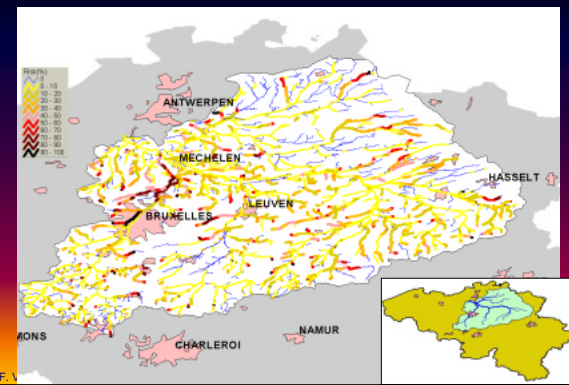- Assumptions (e.g. on mixture toxicity)?
- …

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Case study

- New, detergent chemical for widespread use
- Rupel basin (Belgium)

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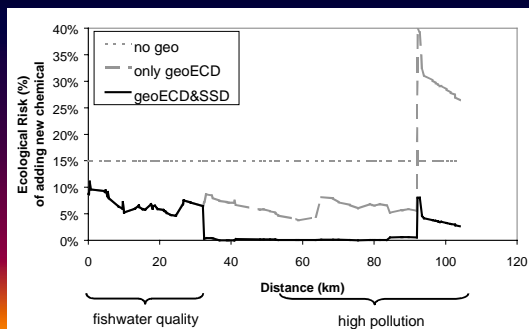## Geo-risks in the Rupel basin (B)

Ecological risk river profile plot

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Conclusions

- Geo-referencing makes the probalistic risk of chemicals towards aquatic environment **more realistic** as spatial information is explicitly accounted for.

- Geo-referencing effects (species sensitivity distribution) is now still a largely unexplored area.

- Ecological Informatics has potential to « fill this gap », even when considering several issues.

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