ChimERA: Coupling exposure and effects into a predictive integrated framework for risk assessment

Frederik De Laender[1], Karel P.J. Viaene[1], Antonio Di Guardo[2], Hans Baveco[3] and Paul van den Brink[3,4]

[1]Laboratory of Environmental Toxicology and Aquatic Ecology, Ghent University, Belgium, frederik.delaender@UGent.be;
[2]Department of Chemical and Environmental Sciences, University of Insubria, Italy
[3]Aquatic Ecology and Water Quality Management Group, Wageningen University, Wageningen University and Research center, The Netherlands;
[4]Alterra, Wageningen University and Research center, The Netherlands;

Introduction

Current ecological risk assessments (ERA)
- Environmental realism?
- Ecological relevance?
- Methodological accuracy?

Challenges for current ERA practices
- Exposure not constant in time and space
- Multiple stressors
- Recovery
- Interactions between species

Modelling can play a key role in meeting these challenges

Objectives

Current models
- Not directly linked to fate and exposure models
- Focus on one population

ChimERA
Integrate exposure and effect models for into a new ecological risk assessment tool

- Test **key processes** with multi-species experiments
- Test **ChimERA** with available micro- and mesocosm data
- Use **ChimERA** to identify ecological scenarios with highest **risk**
- **Involve** end users

Approach

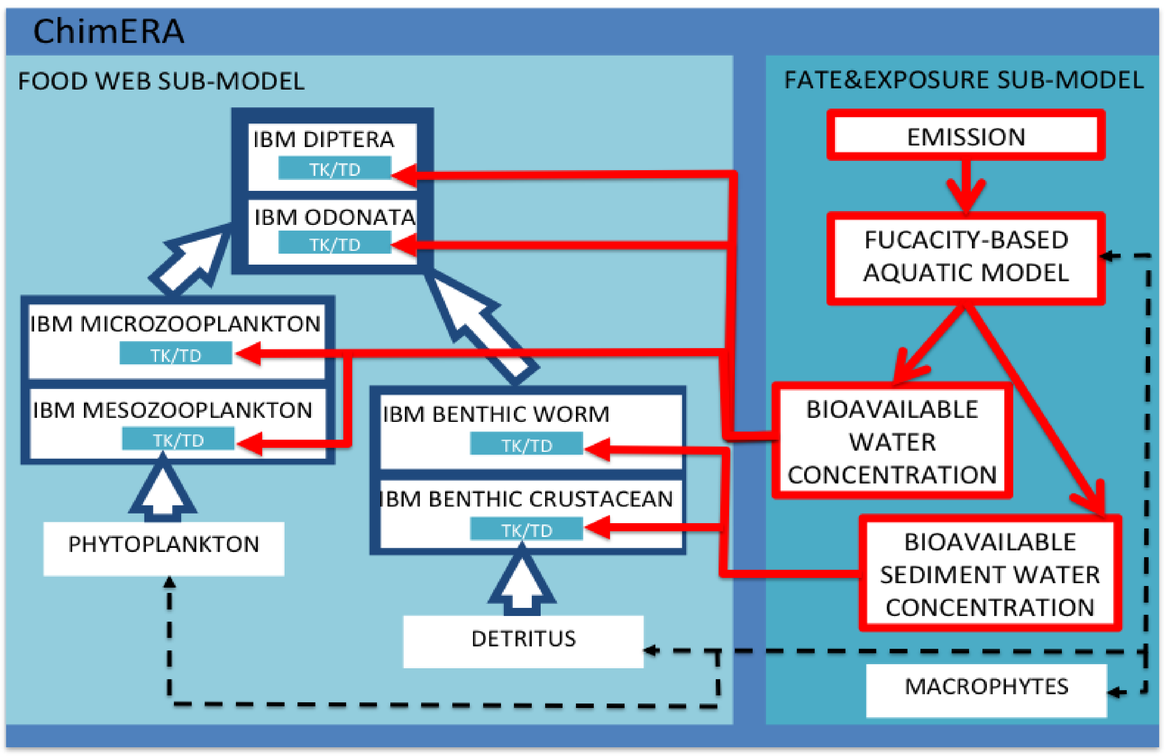

Figure 1: Structure of the integrated ERA model 'ChimERA', composed of sub-models for chemical fate&exposure, and individual (TK/TD), population (IBM) and community-level (food web model) effects. Red arrows represent contaminant flows, white arrows are mass/individual flows and black dashed lines indicate dependence during computation.

1. **Development** of ChimERA: **Coupling** of
   - Multimedia **Fate and Exposure** model
   - Multiple **population** models

2. **Testing and Calibration**
   - Key processes ← **Dedicated experiments**
   - ChimERA model ← **Mesocosm data**

3. **Scenario analysis and risk assessment**
   - Simulations of environmentally realistic **stressor mixtures**
     - Continuous discharges
     - Continuous discharges + pulse
     - …
   - Identification of **scenarios** that lead to **highest risk**
   - Input from experts through **workshop** series

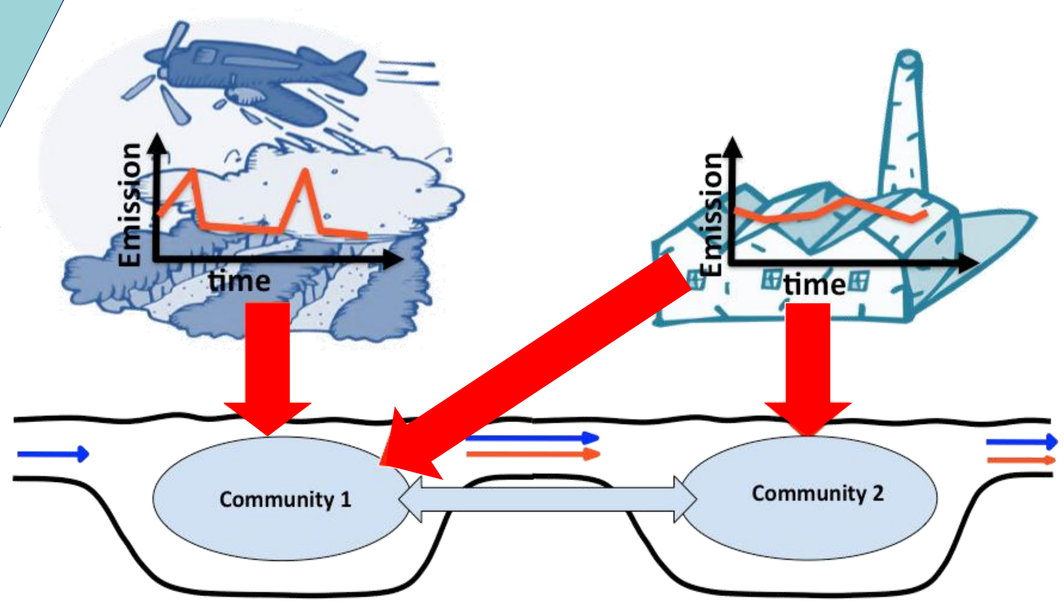

Figure 2: Scenario analysis in WP4: Red arrows are chemical fluxes, dark blue arrows are water fluxes, light blue arrow is migration.

Acknowledgements: This work is part of an ECO19 project granted to Ghent University, Alterra and Wageningen University, and the University of Insubria by the Cefic LRI program.
Frederik De Laender is a postdoctoral research fellow from the Research Foundation Flanders (FWO)