# Improved modelling approaches

WORKSHOP Methodologies for prioritising hazardous chemicals in European waters: the state of play and the need for improvement

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7 juli 2014

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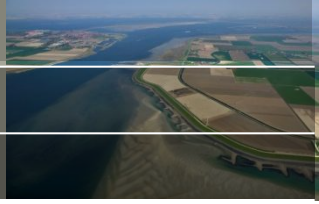


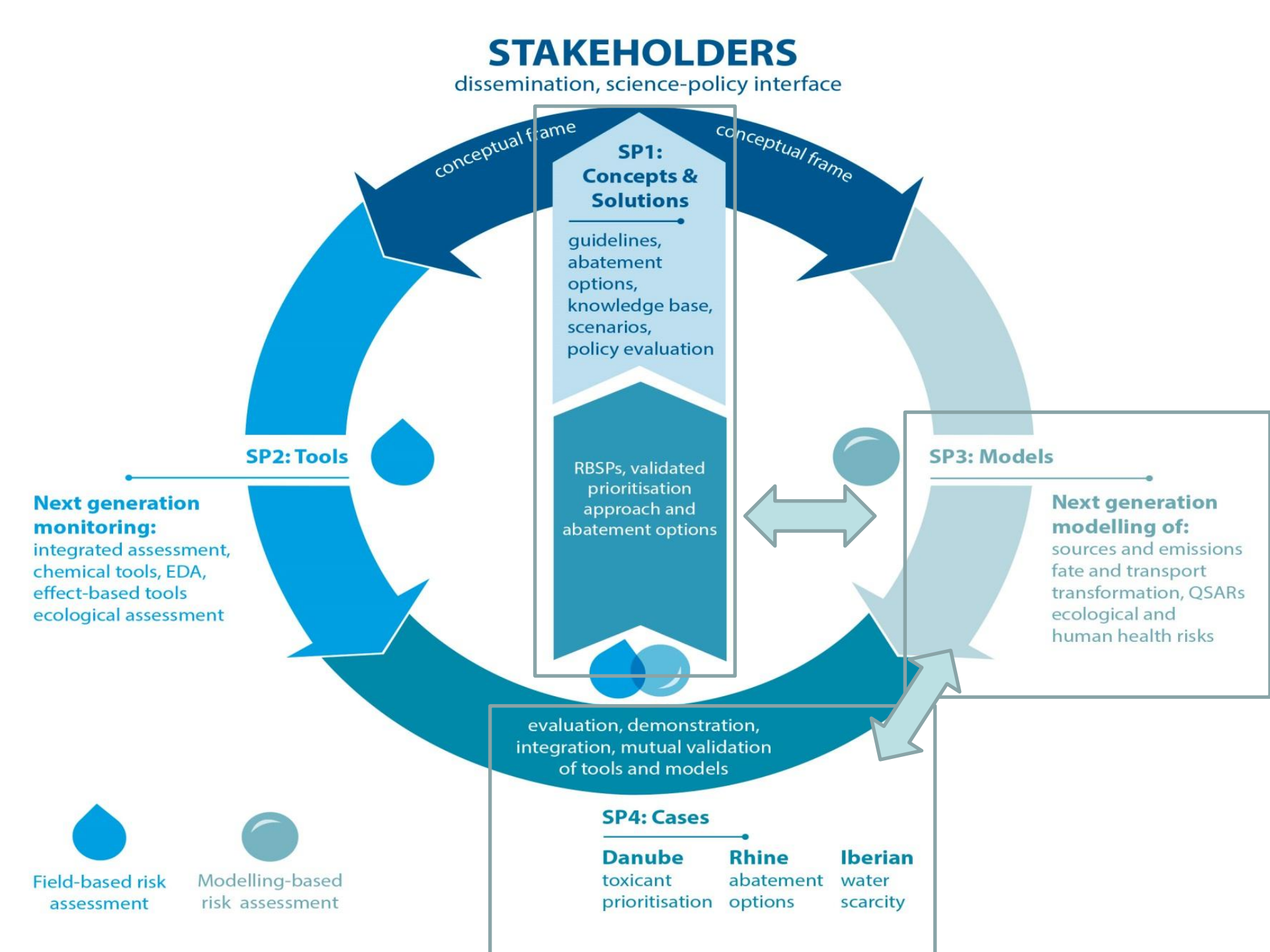
Short Introduction & Objectives

Approach

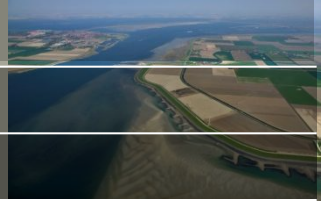
Potential Use for Prioritisation

Innovative Aspects

Gaps & Barriers


STAKEHOLDERS
dissemination, science-policy interface
conceptual frame
conceptual frame
SP1: Concepts & Solutions
guidelines, abatement options, knowledge base, scenarios, policy evaluation
RBSPs, validated prioritisation approach and abatement options
SP2: Tools
Next generation monitoring:
integrated assessment, chemical tools, EDA, effect-based tools ecological assessment
SP3: Models
Next generation modelling of:
sources and emissions fate and transport transformation, QSARs ecological and human health risks
evaluation, demonstration, integration, mutual validation of tools and models
SP4: Cases
Danube
toxicant prioritisation
Rhine
abatement options
Iberian
water scarcity
Field-based risk assessment
Modelling-based risk assessment

# Our objectives



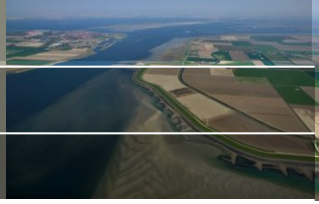
1. The realisation of an integrated system of models and databases that can

a. be used to enhance our understanding, and

b. support solutions in environmental & water policies related to the identification, quantification, prioritisation and prediction of the impact and risk of mixtures of (emerging) pollutants on European water resources and ecosystems, and human health.

2. The evaluation of this system, exploiting monitoring and project field data on a European scale and for case studies in the Rhine, Danube and Ebro basins.

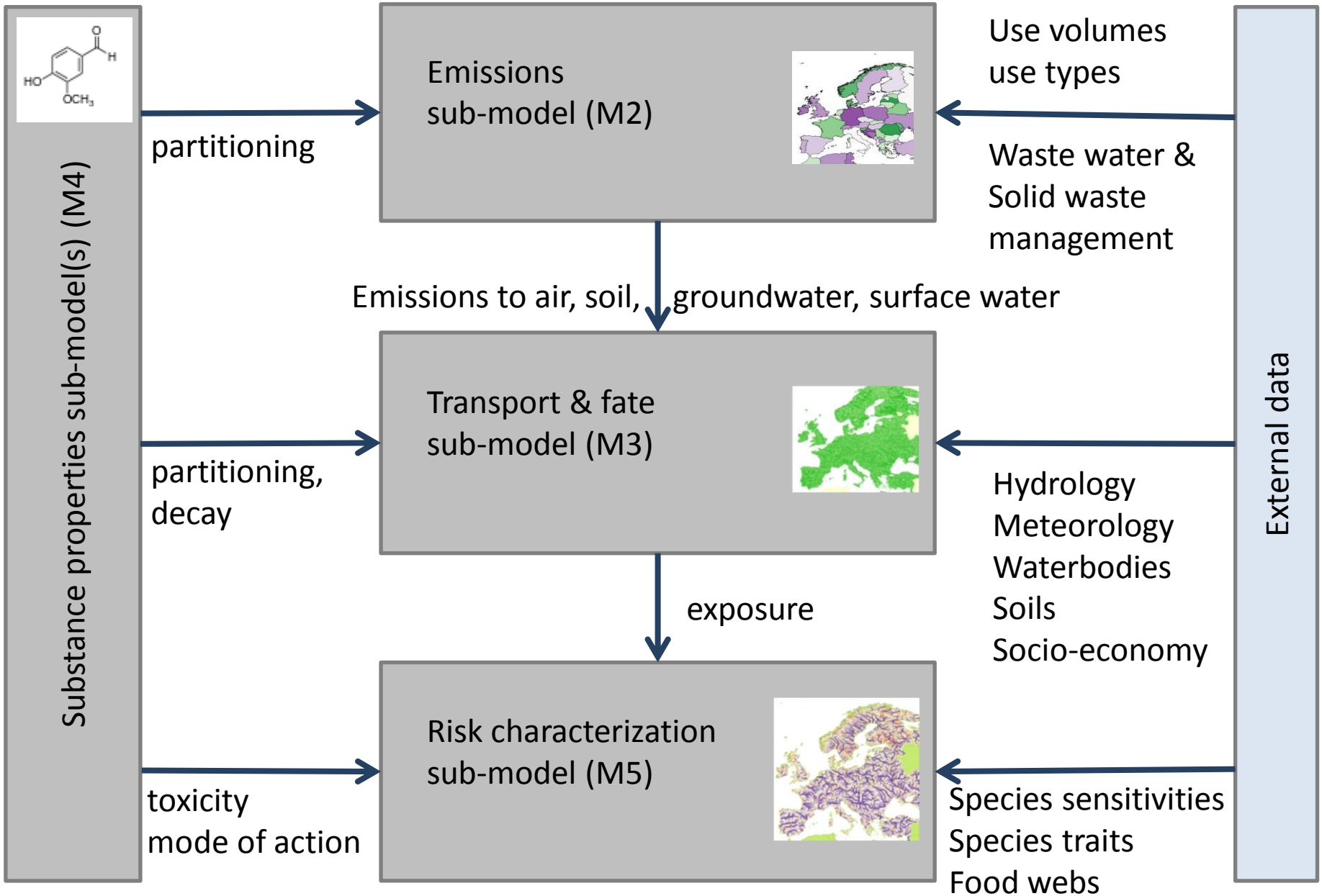
# Our objectives



3. The application of this system to all significant European catchments, including the abovementioned case studies to understand the implications of the variability of European conditions.
4. The application of this system in support to

a. novel substance prioritisation approaches,

b. the assessment of the effectiveness of control measures and abatement options in meeting the environmental objectives of the Water Framework Directive.


Substance properties sub-model(s) (M4)
partitioning
Emissions
sub-model (M2)
Use volumes
use types
Waste water &
Solid waste
management
Emissions to air, soil, groundwater, surface water
partitioning,
decay
Transport & fate
sub-model (M3)
Hydrology
Meteorology
Waterbodies
Soils
Socio-economy
exposure
toxicity
mode of action
Risk characterization
sub-model (M5)
Species sensitivities
Species traits
Food webs
External data

# M2 - Sources and emission model

Substance production – export + import

Use categories

Release model

Locator maps, per product category:
- population
- Production (per sector)
- land use
- road traffic density
- ship traffic density

Abatement maps
- buffer zones

Emissions to environment, per use category

Regionalisation

Waste water flow

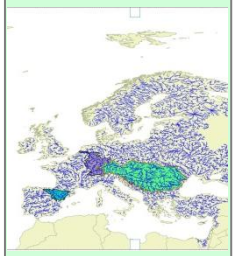
Waste water management maps:
- % sewered
- WWTP locations, capacity, treatment
- sludge management (landfills, agriculture)

Waste Water Model + Regionalisation

Solid waste flow

Solid waste management maps:
- landfill locations, technology
- Incineration plants, technology

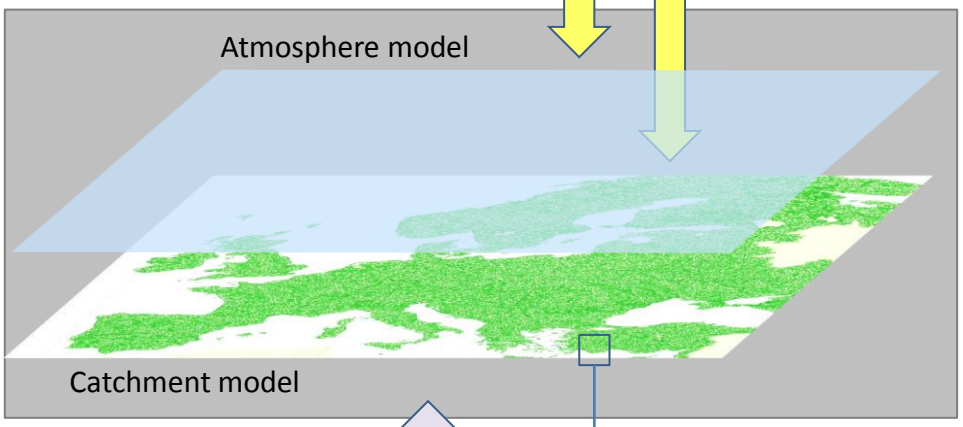
Solid Waste Model + Regionalisation



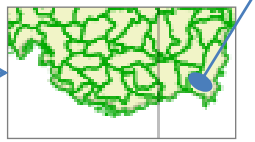
Spatially distributed emissions to:
air
soil
groundwater
surfacewater

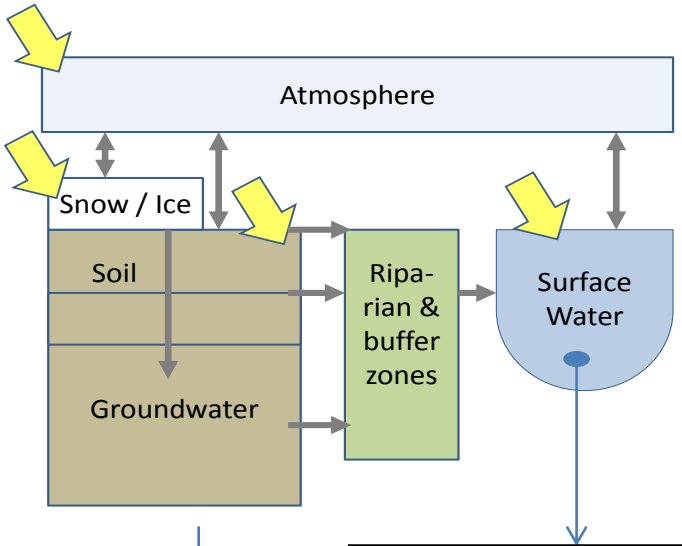
# M3 - Fate and transport modelling

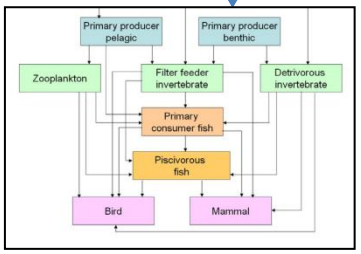
Spatially distributed emissions to: air, soil, groundwater, surfacewater




E-Hype hydrological model output (f(t))



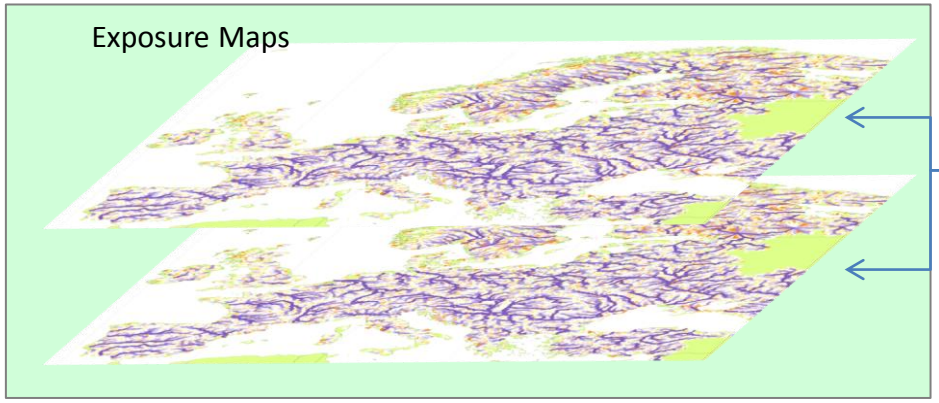


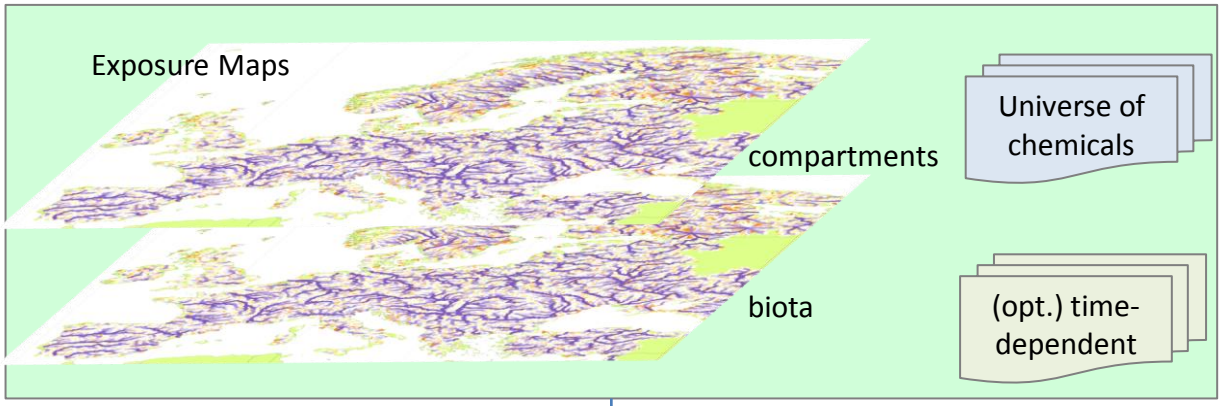

Aquatic foodweb

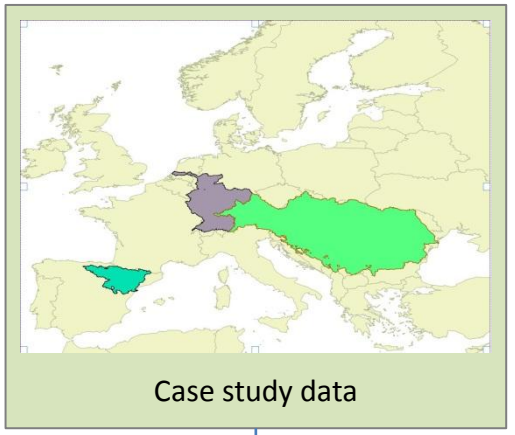
Simulated concentrations in environmental compartments and biota (f(t))

Time statistics (mean, max ..)



# M5 Human and ecological risk modelling of pollutant mixtures



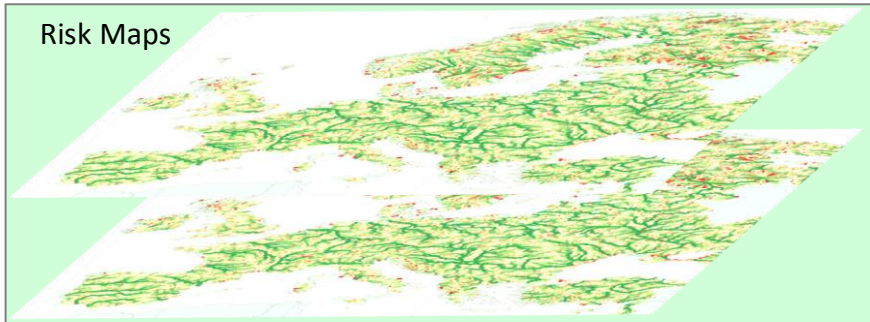




Purification of raw drinking water

Cumulative Risk Assessment
(Human RA and Ecological RA)
Hazard indices, Mixture Toxicity concepts

Tiered Ecological Risk Assessment
Species sensitivity distributions
Population models, IBM, TK/TD
Foodweb vulnerability assessment

Knowledge base




Chemical foot prints - Planetary boundaries

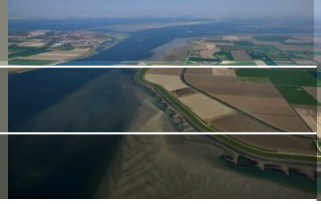
Mode-of-action specific stress

Risk to Biological Quality Elements

Population impacts & recovery

Impacts on traits (ecosystem services)

# Planning

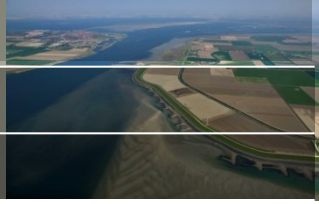


- First application, European scale, focus on Danube: autumn 2014
- Model evaluation – improvements (autumn 2016)
- Applications and further improvements (mid 2018)

# Potential for use in prioritisation approaches

- Hybrid model & data based approaches are not new
- The potential of modelling is evident:
  - Cover all substances, also those that have not been investigated in lab and field
  - Specifically useful for risk assessment of emerging compounds (monitoring-based approaches discourage monitoring)
- We want to make optimal use of models:
  - All European basins & all chemicals we can handle (our ambition: ~10,000):
    - More information
    - More understanding => rapid assessment (first tier) approaches, representative for full complexity
    - Better grip on (un-)certainty

# Innovative aspects

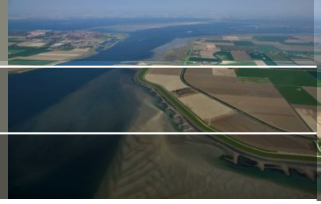


- Comprehensive modelling
- Applicability to emerging compounds
  - Emission modelling
  - Substance properties modelling (incl. metabolites)
- Spatial variability (environment, society)
- Temporal variability (pesticides)
- Expand to effects on human health and aquatic ecosystems

(and:

- Not only priority substances, but priority effects
- Mixture effects)

# Gaps and barriers



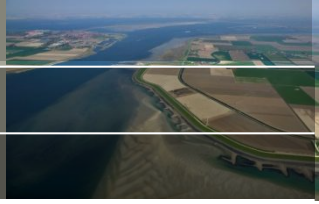
It has to make sense! QED
(we have a five year comprehensive research project)

We will make full use of guiding principles

- Mass balances & water balances
- Lessons learned from nutrient management

We want to look evaluate our models for as many substances as possible:

- Not: the error is X for substance Y in basin Z
- But: if we provide an assessment for a substance, we know the expected accuracy (possibly differentiated for basins / ecoregions)



Thanks for your attention

Your questions are welcome (time allowing ..)