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Introduction

Water quality standards were always put forward as fixed values over time and location. There exist however models which can predict water quality standards as a function of water characteristics determining bioavailability: in this case a Biotic Ligand Model (BLM) for copper and the organism *Daphnia Magna* was used which calculated a No Observed Effect Concentration (NOEC).

Objectives

The goal of this research was to bring into account the temporal and geographical variation in the No Observed Effect Concentration (NOEC), as calculated by a chronic BLM through the application of a Geographical Information System (GIS) and Monte - Carlo simulations.

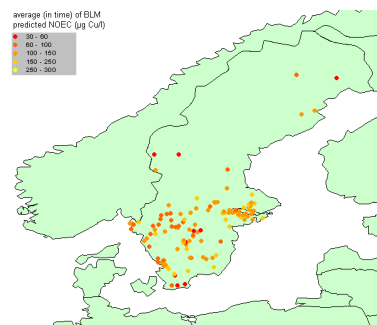
Developed methodology

•Taking into account geographical variability: GIS

•Tables containing water characteristics (e.g Dissolved Organic Carbon) determining bioavailability are geo - referenced through coordinates and thus water quality standards are also geo - referenced.

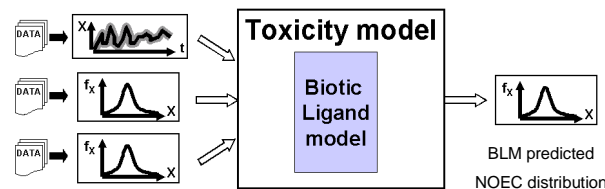
location number	location - X	location - Y	Date	pH	DOC(mg/l)	...
1	17.58	59.22	1/2/99	7.2	12	...
			1/5/99	6.9	10	...
			1/8/99	7	14	...
...
5	17.55	58.92	1/2/99	6.6	10	...
			1/5/99	7	8	...
			1/8/99	7.1	7	...
...

Presentation of BLM calculated NOEC values as averages in time on each location.

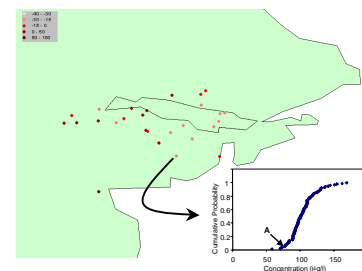


•Taking into account temporal variability: Monte Carlo

- A selection of locations (province of Svealand) was made to apply Monte - Carlo simulations.
 - Input variables are substituted by their probability distributions.
 - Every location is characterised by other input - distributions.
- every location has different water characteristics.



New type of map: geographic variation of the mean of the BLM predicted NOEC distribution around the overall mean for Svealand (100 µg/l Cu)



Point A indicates that in 90% of the time, the BLM NOEC prediction will exceed 70 µg/l

Future Applications

- Initial localisation of possible problematic spots for metal toxicity.
- Application for a whole country and determining a sensitivity for a whole community instead of one species (*Daphnia Magna*): a global tool for ...
 - ...risk assessment: comparing species sensitivity distributions with environmental exposure distributions.
- Comparing input with output of a model in a geo - referenced way (e.g. influence DOC on BLM calculated NOEC predictions).

Take home message

Using models to account for bioavailability and using statistical techniques like a Monte Carlo simulation to account for temporal variability significantly improves risk assessment and water quality standard estimation procedures. Representing these results in a GIS allows to locate possible problematic spots.