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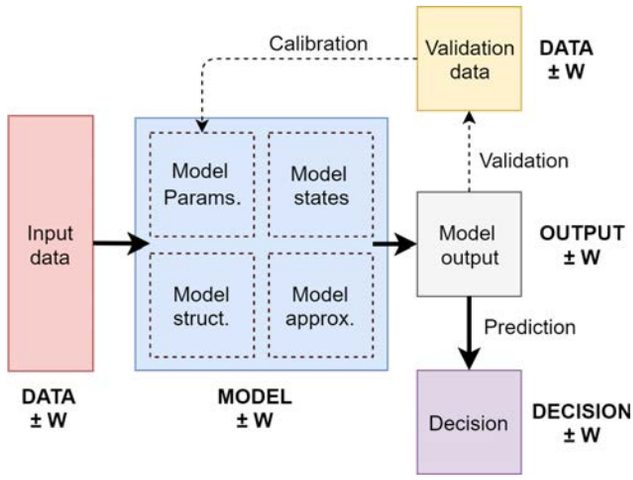
Management of Uncertainty for Ecosystem Modelling in ECOPOTENTIAL

Uncertainty in Modelling

Physically based numerical models are often used for predicting a system's future status. Such models are based on various assumptions to simplify the complex natural systems, e.g. in the input data, boundary conditions, and process parameters, introducing uncertainties and structural errors.
Reducing these uncertainties can be done by performing model calibration/validation, increasing the temporal and/or spatial model resolution, and increasing the precision of the input data.



Uncertainty propagation in system observation and decision-making

Uncertainty Estimation Methods

Various sources of uncertainty exits in numerical modelling but unfortunately no universal uncertainty estimation method is available which could be used to assess all of them. The following methods are a few examples of uncertainty estimation approaches.

- Monte Carlo methods
- Bayesian methods
- Data based approaches
- Generalised Likelihood Estimation
- Probability theory
- Multiple models
- Sensitivity analysis

Uncertainty Quantification in ECOPOTENTIAL

Within ECOPOTENTIAL, the management of uncertainty is addressed by providing scientifically grounded measurement outcomes from numerical and statistical modelling, Remote Sensing, and in-situ monitoring.
Different methodologies and tools were developed and applied to quantify and visualize uncertainty to help Protected Area (PA) managers in their decision-making process.

Tools used to address modelling uncertainty in ECOPOTENTIAL

- Bayesian Belief Networks
- Ensemble prediction systems
- Uncertainty quantification of Remote Sensing products
- Scenarios and Serious Games
- Probabilistic risk maps
- 3-D visualization of uncertainty

ECOPOTENTIAL
FACT SHEET

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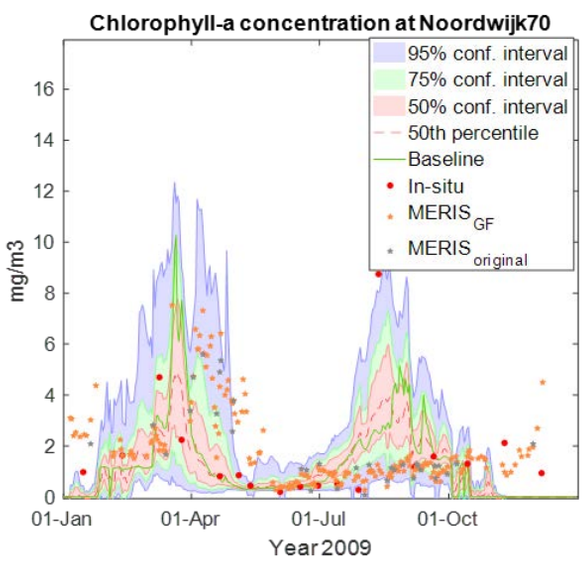
Application Uncertainty Modelling in ECOPOTENTIAL

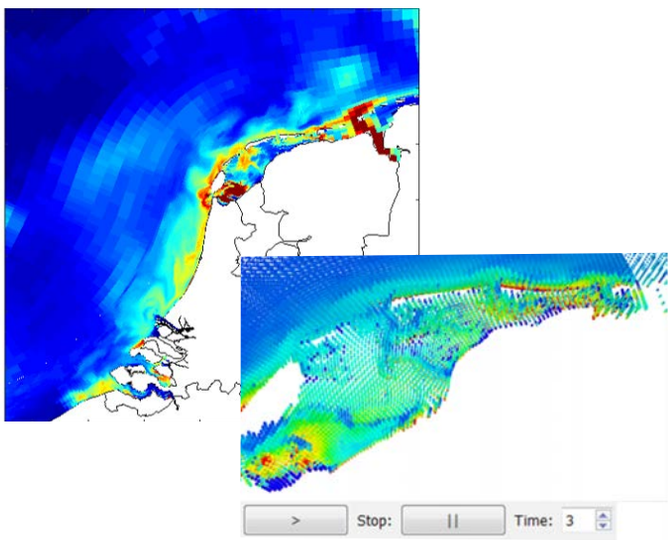
Probabilistic Water Quality Prediction

In ECOPOTENTIAL, probabilistic water quality predictions have been produced for the Dutch coastal zone (North Sea), using the Delft3D Water Quality modelling instrument (https://www.deltares.nl/en/software/module/d-water-quality/), and compared with conventional deterministic predictions in order to assess their benefits (Meszaros, 2018).



Probabilistic water quality prediction at the Dutch coast validated against in-situ and satellite observations

Uncertainty maps of turbidity and Chlorophyll-a concentration in the Dutch Wadden Sea and along the North Sea were produced to help decision makers for strategic planning.



Chlorophyll-a and turbidity uncertainty estimation visualization in 2D and 3D

Serious Games

An Ecosystem Service Game was developed to challenge players by simulating realistic problems of the Dutch Wadden Sea. The games encouraged discussions between participants and the exchange of information, promoted teamwork and allowed players to understand better the uncertainties that are involved in decision making.

A serious game focusing on Ecosystem Services in the Dutch Wadden Sea, developed in ECOPOTENTIAL

References

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- Van De Vries, C., 2016. *Uncertainty in a SPM model as a driving force for a GEM/BLOOM model*, Deltares & Delft University of Technology

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