What is ECOBAS?

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1. Modelling and documentation, basic concepts

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- complete,
- correct and
- consistent

mathematical formulations of ecological processes.

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From scientific understanding *a model is a hypothesis* about (functions, structure and) behaviour of a system. But the core element of a scientific hypothesis is its capability of being proven false (*falsification*)[1].

Thus it is necessary that a scientific hypothesis is

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- as easy as possible to understand and
- the requirements above (complete, correct and consistent) are fulfilled.

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[1]For example, the hypothesis that “atoms move because they are pushed by small, invisible, immaterial demons” is pseudo-science since the existence of the demons cannot be proven false (i.e. cannot be tested at all).
[source: http://zebu.uoregon.edu/~js/glossary/principle_of_falsification.html]

An ecological model is more than a mathematical model!

... because we need not only

- the declaration of variables,
- the equations and the
- the definition of values.

(this is only sufficient for a mathematical model)

... but also information about

- the units,
- the ranges of validity,
- the meaning of the variables,
- the used measuring methods and
- the ecological context as well.

to satisfy the scientific requirements of

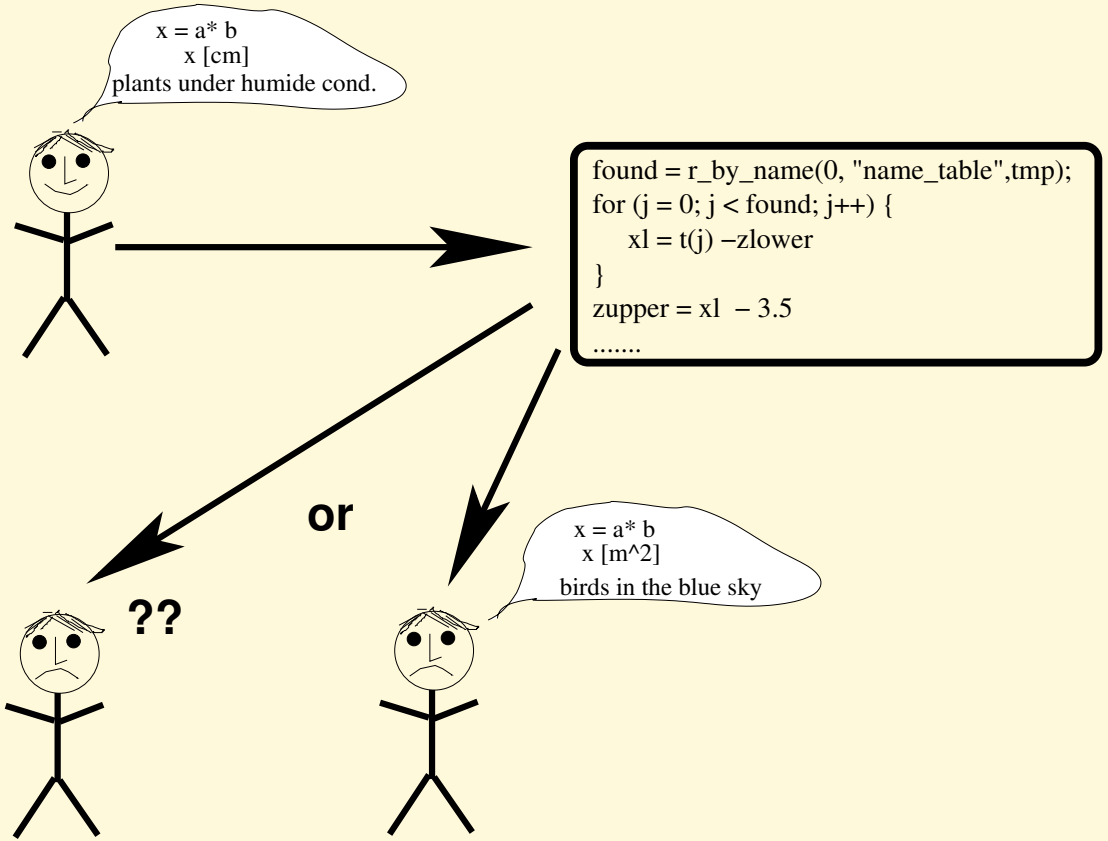
- reproducibility,
- falsification of hypothesis

and the

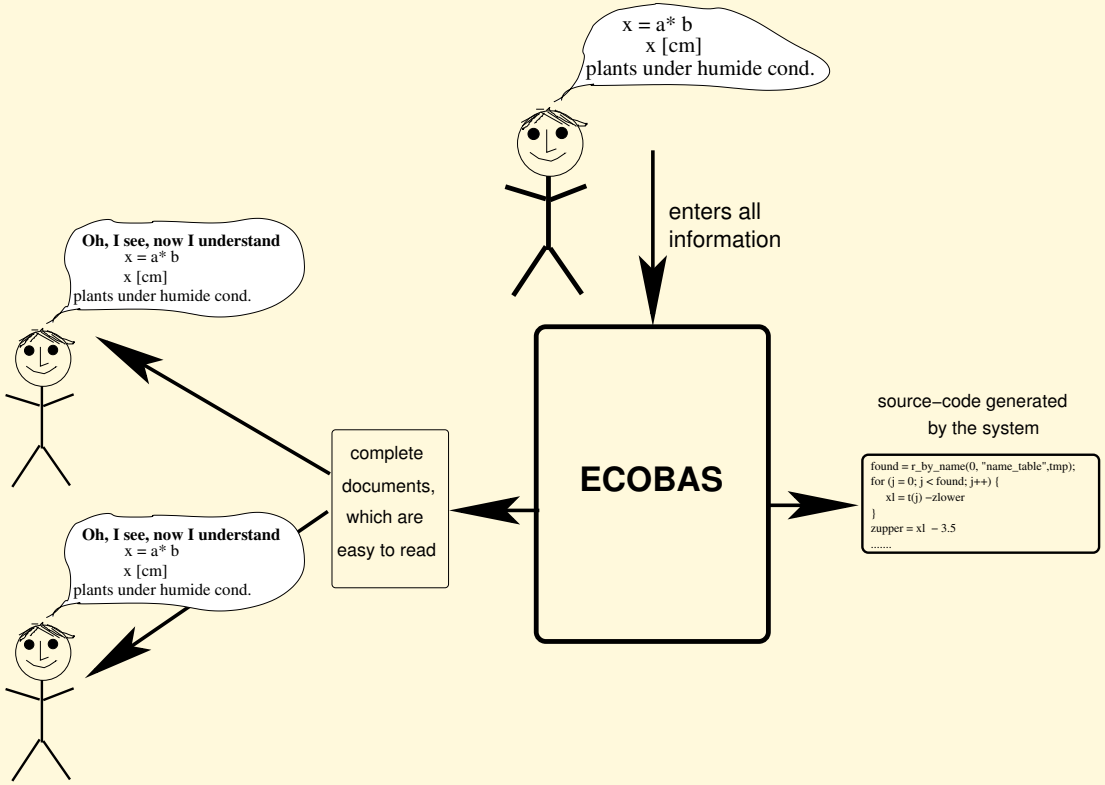
- assessment of the range of validity/application

at the level of ecology.

practical situations are often like this:



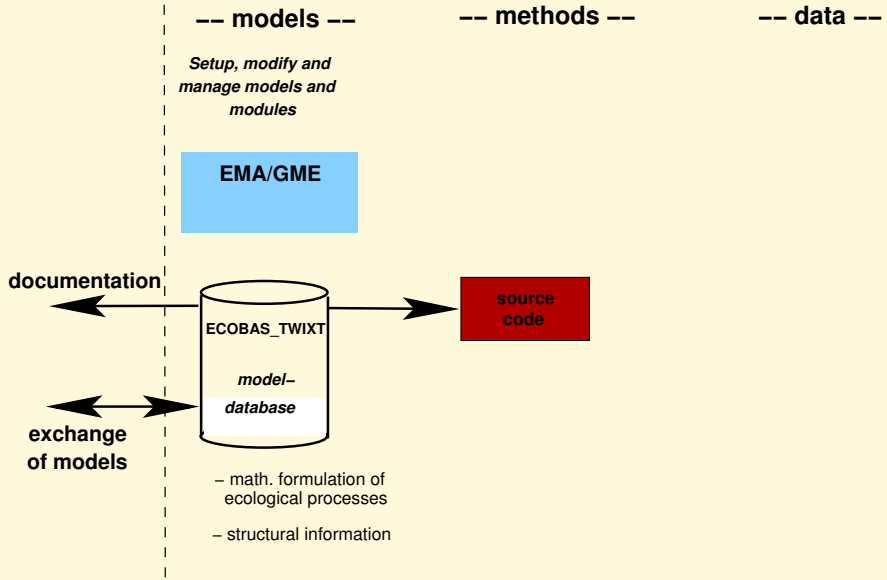
an improvement of this situation can be achieved



2. ECOBAS and EMA (ECOBAS Modelling Assistant)

ECOBAS consists of

- a database (ECOBAS_TWIXT) and
- an user interface (ECOBAS Modelling Assistant)



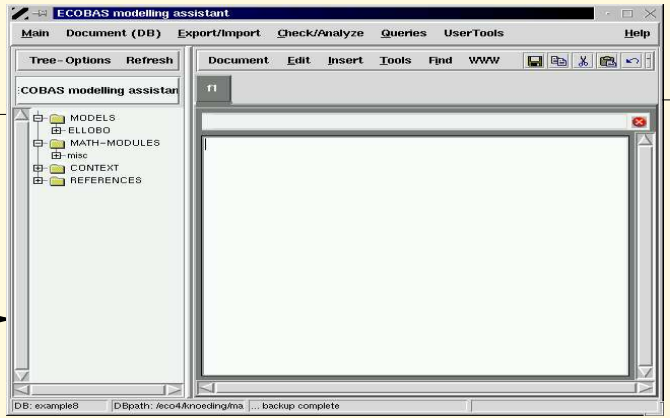
the main tasks of EMA are:

Presentation
Text processing

– TeX (postscript,pdf)
– HTML

Export/Import
Exchange

– ECOBAS XML
– SQL



Simulation

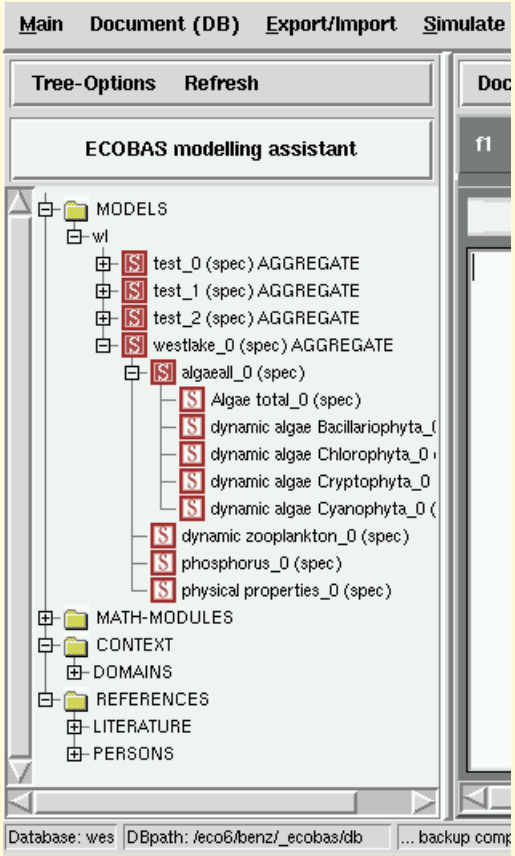
– SIMUL

Setup, modify and manage models and modules

- **Database**
  – Create, delete and select a database
- **Navigation in a database**
- **Models/Modules**
  – Create, insert, delete and edit models/modules
- **Check/Analyze**
  – Completeness, Syntax, Consistency
  – *Compatibility, Modularization, ...*
- **Database queries**

2.1. Navigation in the database

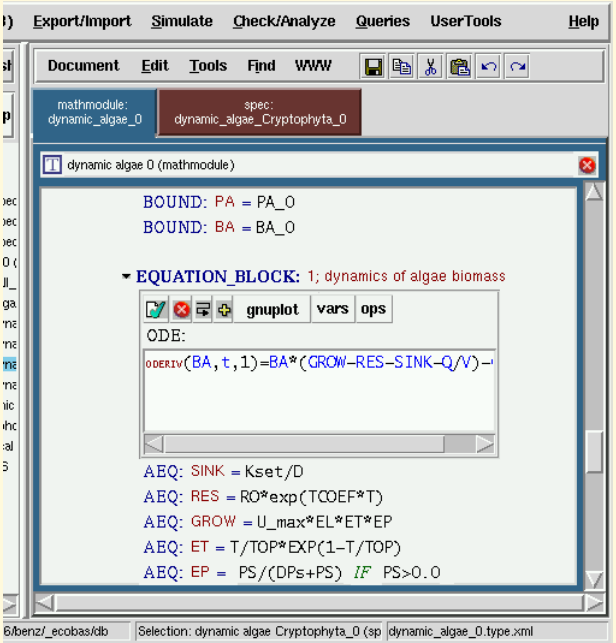
To specify models or sub-models (modules) 10 different document types in 3 main groups (Models, MATH-modules, Context and References) are defined in ECOBAS[a]. All documents are stored in ECOBAS model database. The user can navigate in the content of the database using the tree view in the left frame of EMA.



[a] more detailed information about modularization in ECOBAS can be found in: *Modularization of ecological models*

2.2. Create or modify modules

To create or modify ECOBAS modules the right frame of EMA can be used. This is an easy-to-use and comfortable XML-Editor. The underlying format of all documents is ECOBAS_XML[a]



[a] see: Document Type Definition of ECOBAS_XML http://eco.wiz.uni-kassel.de/ecobas/new_db/mif.dtd.txt

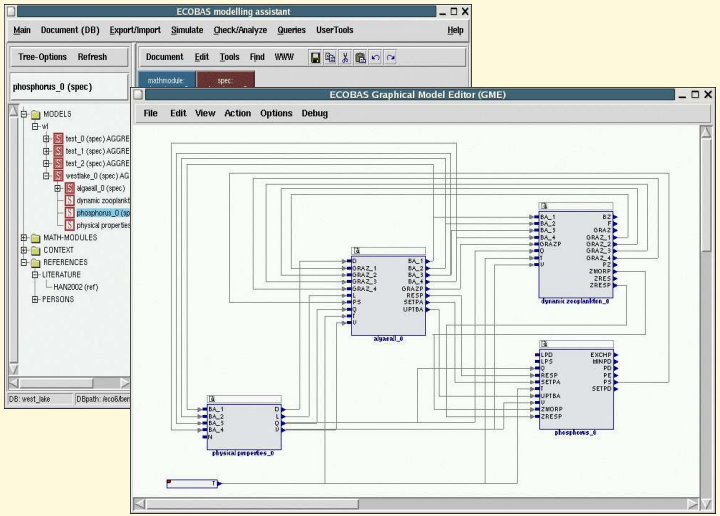
the following mathematical concepts (types of equations) can be used in ECOBAS:

- algebraic equations
  (including piecewise defined functions)
- tabular functions
- ordinary differential equations
- time events
- state events
- *if then else* rules

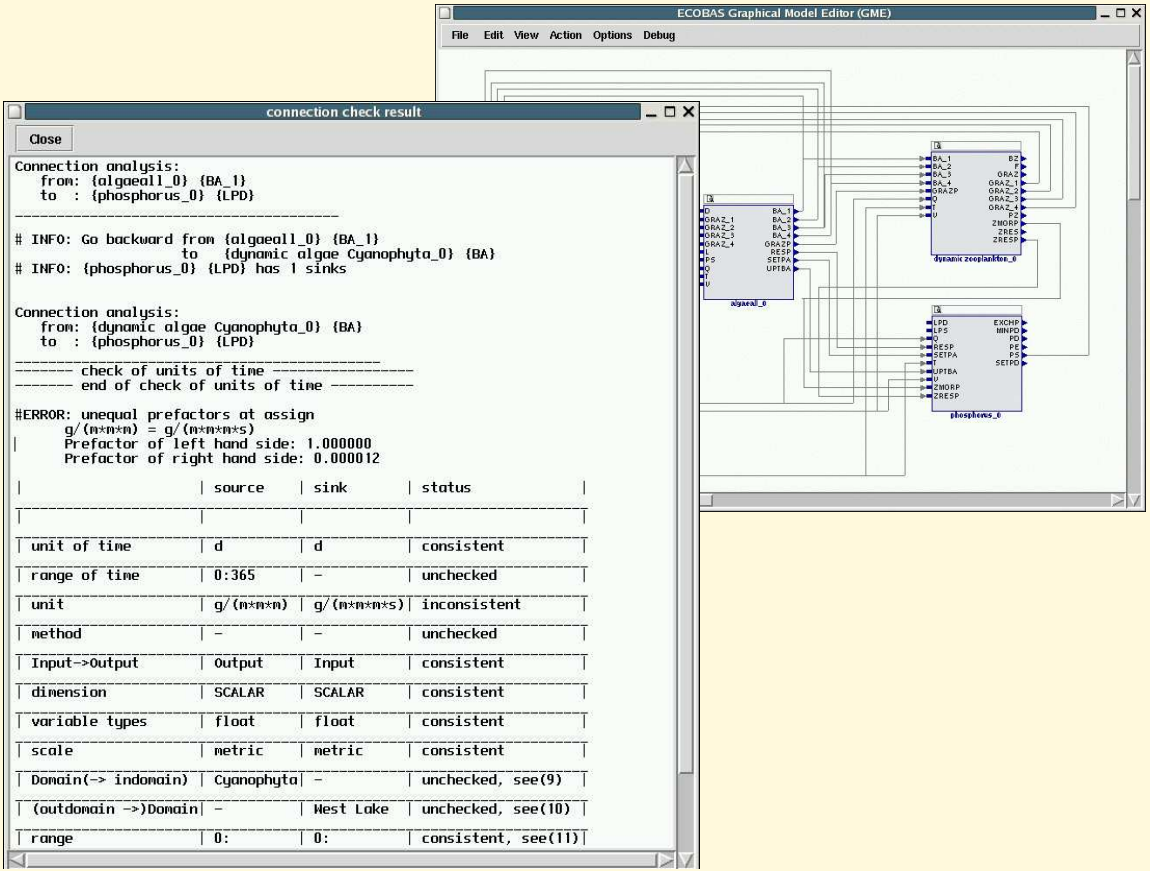
(partial differential equations and coupled PDE-ODE systems are under development)

2.3. Structural information (AGGREGATES)

So far we have dealt with ecological base-processes and how they can be entered into ECOBAS as generic modules. Meaningful ecological models or sub-models generally require that we connect several base-process modules to form more comprehensive systems. To enter or modify this *structural information*, the tool **ECOBAS Graphical Model Editor** (GME), is applied. GME is started from the main menu of EMA and modules can be copied from the tree-view onto the GME canvas.

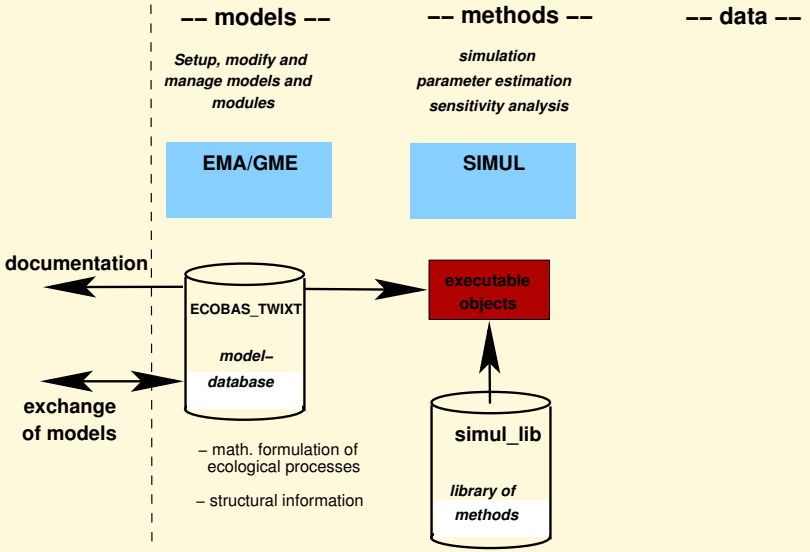


Comprehensive checks are done to proof if a certain connection between two modules is valid or not.

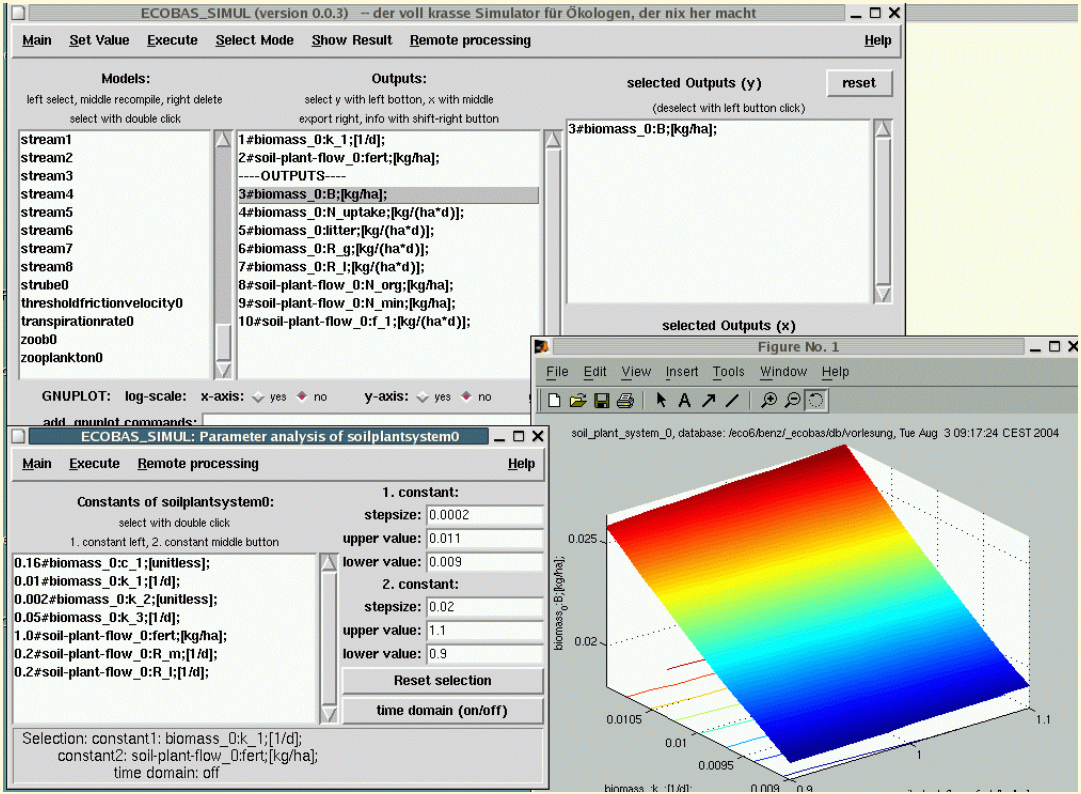


3. Simulation (SIMUL)

Finally the main aim of modelling is *simulation* and *analysis of systems behaviour*. For this task ECOBAS provides **ECOBAS SIMUL** (simulation system).

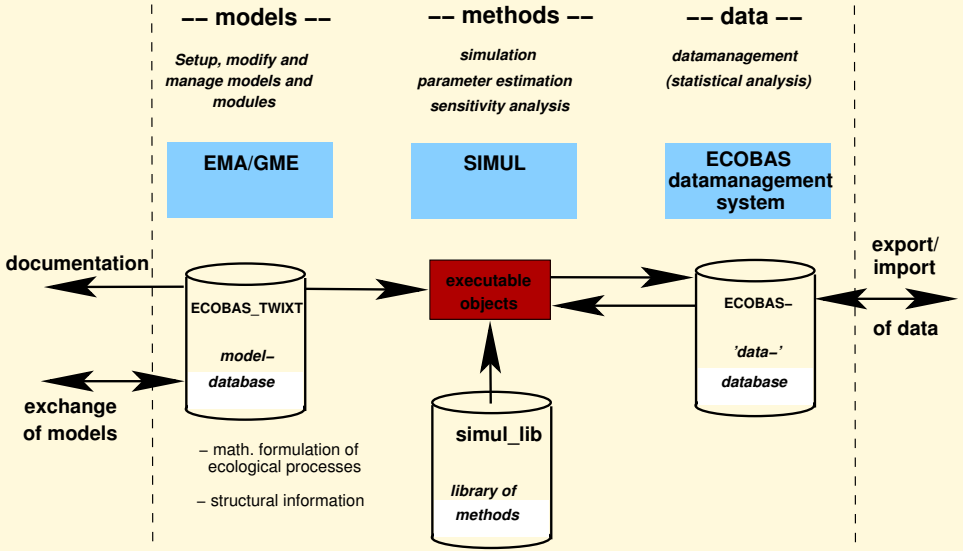


Not only simulation can be done with SIMUL. Also functions are implemented to do ***parameter analysis***, ***parameter estimation*** and ***sensitivity analysis***.



4. Simulation and Data

In many cases we have to provide data (e.g. input time series). In particular if we want to do parameter estimation, verification or validation for certain boundary conditions, we have to provide time series of measured data. Also it is advantageous to store the results of simulations for analysis and presentation, which we will do later. Therefore ECOBAS provides a subsystem for data management.



ECOBAS data management system is still under development and in an experimental state yet.