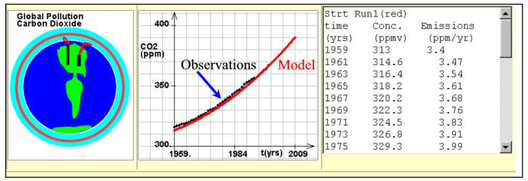

Teaching With Models: A Starting Point Resource Module

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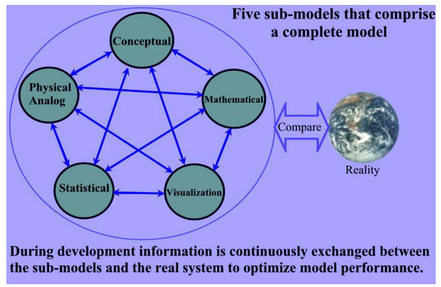
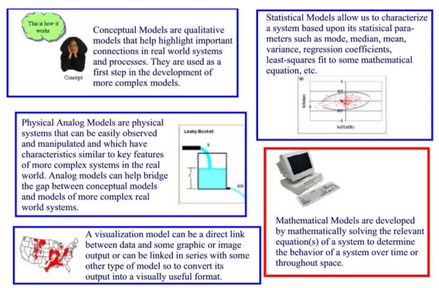
The Starting Point "Teaching with Models" module is designed for introductory geoscience faculty interested in learning about models and how they can be used effectively to enhance student learning. In addition to providing a basic background of what models are and how they can be used, this resource module intimately integrates pedagogy with examples of teaching resources.

Why are models important and useful for science students?

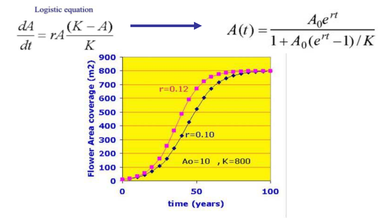
- Models are useful tools of science, therefore students should be exposed to the use and utility of models
- Models provide an environment for interactive student engagement.
- Working with models can enhance systems thinking abilities
- Models are useful for helping students learn quantitative skills such as graphing, graphical analysis, and visualization
- Preliminary results indicate that students generally enjoy using models as learning tools.

Kinds of Models





Mathematical Models

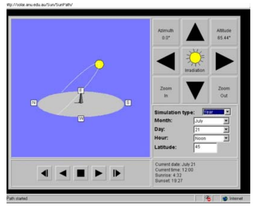


Using Mathematical Models students can:

- Explore mathematical model base animations.
- Use pre-made models to compare with or fit to experimental results.
- Use models in laboratory to help them explain their experimental results.
- Use carefully constructed modeling activities as homework.
- Participate in model construction and simulation during an interactive lecture
- View model simulations/animations in lecture or online to help them better understand a problem or concept.
- Build their own models.

Three Modeling Environments Useful for Introductory Geoscience Education

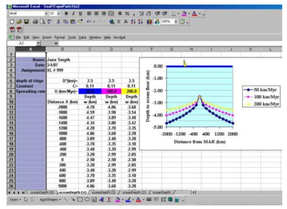
1. On-line Java or Macromedia model: SunPath



- Models are ready to use and easy to use.
- Students focus on understanding model behavior not on the details of getting the model to work.

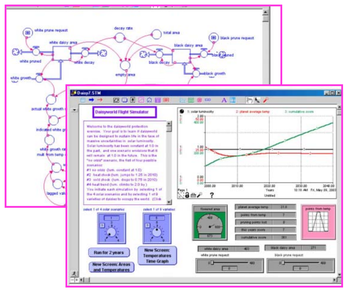
solar.anu.edu.au/Sun/SunPath/

2. Spreadsheet modeling environments: Excel example



- Use Excel as a calculator to explore mathematical equations related to the real world.
- Calculator can be pre-constructed or students can construct their own calculators
- Graphically displays equations (analytical models) and real data.
- Obtain numerical solutions to more complex math. models.
- Statistical analysis: mean, standard deviation, regression, etc.

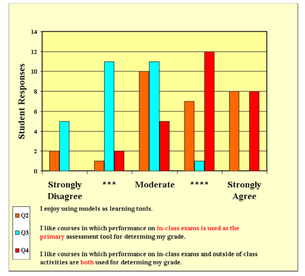
3. Stella II object oriented modeling environment



- Intuitive to use and is mathematically rigorous.
- The interface level provides easy user input with input boxes and output tables
- Students can to build their own models or explore systems with pre-made models.
- Build models ranging from simple to fairly complex systems with many non-linear connections.
- Graph observational data and compare with model predictions.

What do Students Think?

Preliminary results indicate that students generally enjoy using models as learning tools.



Tips for Success

- Care should be taken to create learning experiences which challenge and interactively engage students.
- Models are well suited for more complex topics
- Some class time should be devoted to explaining:
  - Assignment objectives
  - Modeling environment
  - Answering questions after students have tried assignment
- Assessment method depends on class size and assignment objectives but can include reports, guided activities, online quizzes, exam questions

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http://serc.carleton.edu/introgeo/models/