

Reflections of Data Collection and Modeling

SAMSI Undergraduate Workshop 2007

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“We must be careful not to confuse data with the
abstractions we use to analyze them.”

William James

Questions

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- ▶ Mathematics is the language of change
- ▶ The use of mathematics to describe a system's behavior.
- ▶ “A representation of the essential aspects of an existing system (or system to be constructed) which presents knowledge of that system in usable form” Eykhoff (1974)

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- ▶ To analyze a system to be controlled or optimized
- ▶ To hypothesize about how a system works
- ▶ To make predictions

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These can have a mathematical component, and there are many other possible types of models.

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- ▶ variables

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- ▶ equations
- ▶ This is the most basic description.

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- ▶ Invalid Assumptions

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How do we assess if a mathematical model is a fair reflection of a phenomenon or what is observed i.e data that we collect?

- ▶ Is fidelity to the data of most importance (sampling error)?
- ▶ What difference is there between the data we collect and the phenomenon of interest?
- ▶ This is a huge field of research

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- ▶ We can create a purely descriptive model with few assumptions, but this has limited usefulness
- ▶ We want to model for either inference or prediction
- ▶ These models are more difficult to construct and rely on more assumptions, but are more useful.

What do we do once we choose a model - do we stick to it for eternity?

Gathering Data

Why do we need to collect or gather data?

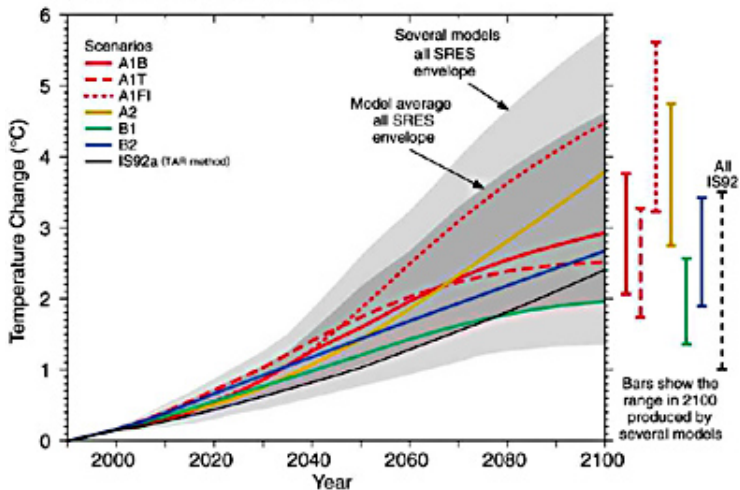
How much data should we collect ?

What do we do if some of the data we collected is missing or corrupted?

- ▶ In recent weeks, global warming has taken centre stage in international and local news .
- ▶ A contentious issue is that different climate models (with large mathematical components) tend to give different answers regarding climate change.
- ▶ For instance different models may predict different rates of climate change, or may measure climate change differently.
- ▶ A good point here is that while most people have a visceral understanding of climate change, they have no scientific understanding of it.

- ▶ What would you do in this case when different models give different answers?
- ▶ What could be the reason that they are giving different projections ?
- ▶ Are there different inputs/assumptions etc.?
- ▶ How could one reconcile them - what preliminary ideas can you think of ?

(d) Temperature change



http://www.ucsusa.org/global_warming/science/projections-of-climate-change.html