



NERC ADVANCED
TRAINING



Evaluating climate-like models

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- Not enough data
 - timescale of desired (detailed) prediction is longer than timescale of (detailed) observational record
- Changing underlying conditions
 - old data may not even be relevant if the system is in a new/changing state
 - how can we define what we are measuring?
- Complex dynamical system
 - can suffer from severe predictability constraints

- Is it feasible to make predictions that are longer-term than your observational record?
 - hurricanes, sea ice, ...
- What gives confidence in model results?
 - agreement with past observations
 - agreement with physical principles
 - agreement with other models

- Statistics:
 - What parameters are you trying to estimate?
 - Will they remain the same?
- Dynamics:
 - What physical relationships are you trying to understand?
 - Will they remain the same?

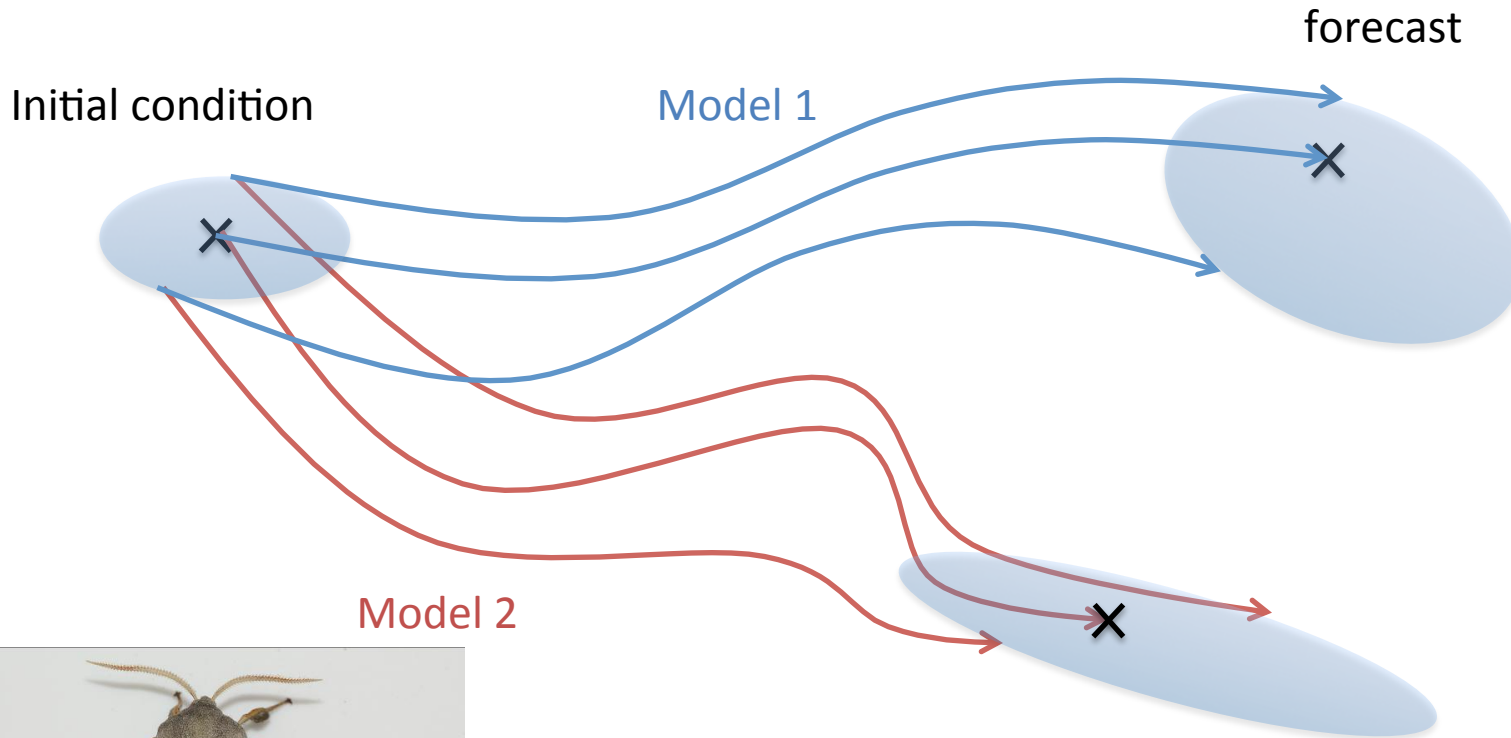
- Initial condition uncertainty:



“the butterfly effect”



- Structural uncertainty:



“the Hawkmoth effect”

How valid are my assumptions?

- Some assumptions may be tested against data
- Some require subjective assessment (“expert judgement”)
- Expert judgement is an entirely valid approach
- However... it may lead to disagreements

Confronting imperfect models with data



Models



Confronting imperfect models with data

Imperfect models DO provide useful info

Imperfect models DON'T tell us everything

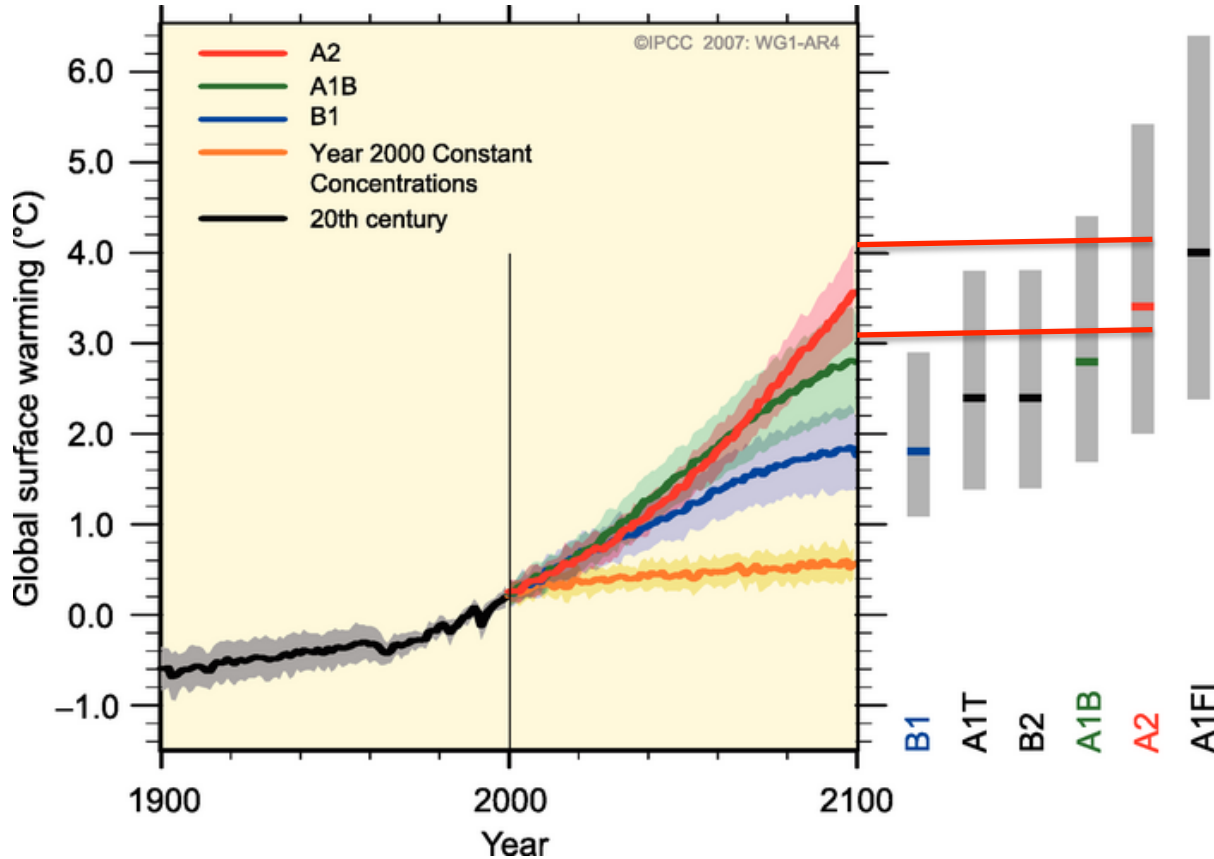
Reality

Statistical methods **MUST** account for structural uncertainty

This is very difficult

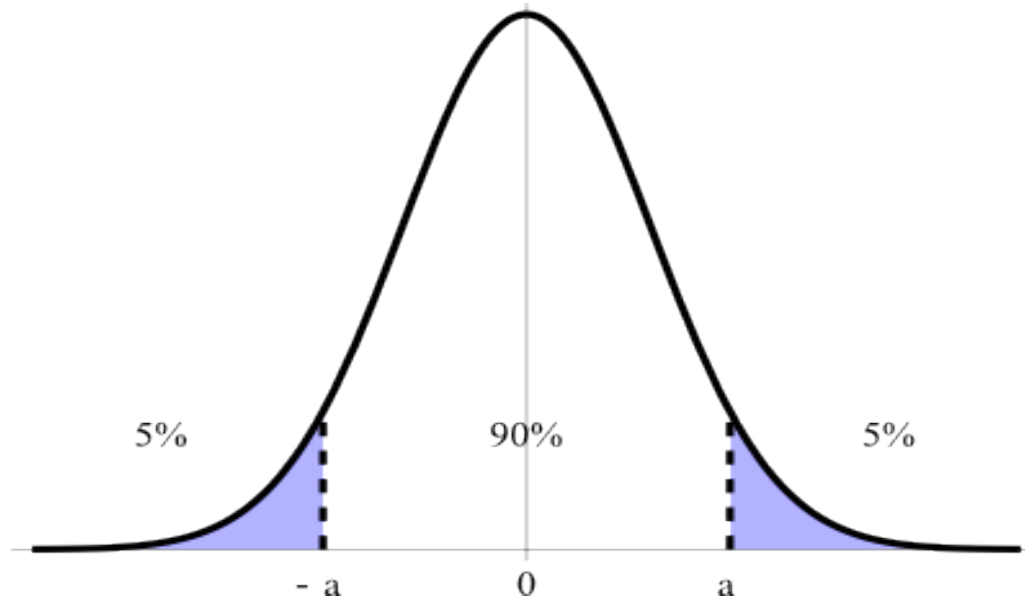


IPCC methods (2007)



“Likely” (>66%) assessment ranges:
 Add 60% to multi-model mean
 Subtract 40% from multi-model mean

- AR5 (recently published) changes strategy:
 - Find “*very likely*” (>90%) range of models, based on Gaussian assumption
 - Downgrade probability to “*likely*” (>66%)



- Some aspects of model evaluation can be done with reference to data, where available
(Follow Emma's methods)
- Some aspects are inevitably subjective
 - Is the model good *enough*?
 - Is the assumption good *enough*?
- Physical insight (“expert judgement”) is not an optional extra, it is required
 - Must be done systematically, and justified clearly