Climate Change, Can We Untie The Confusion?

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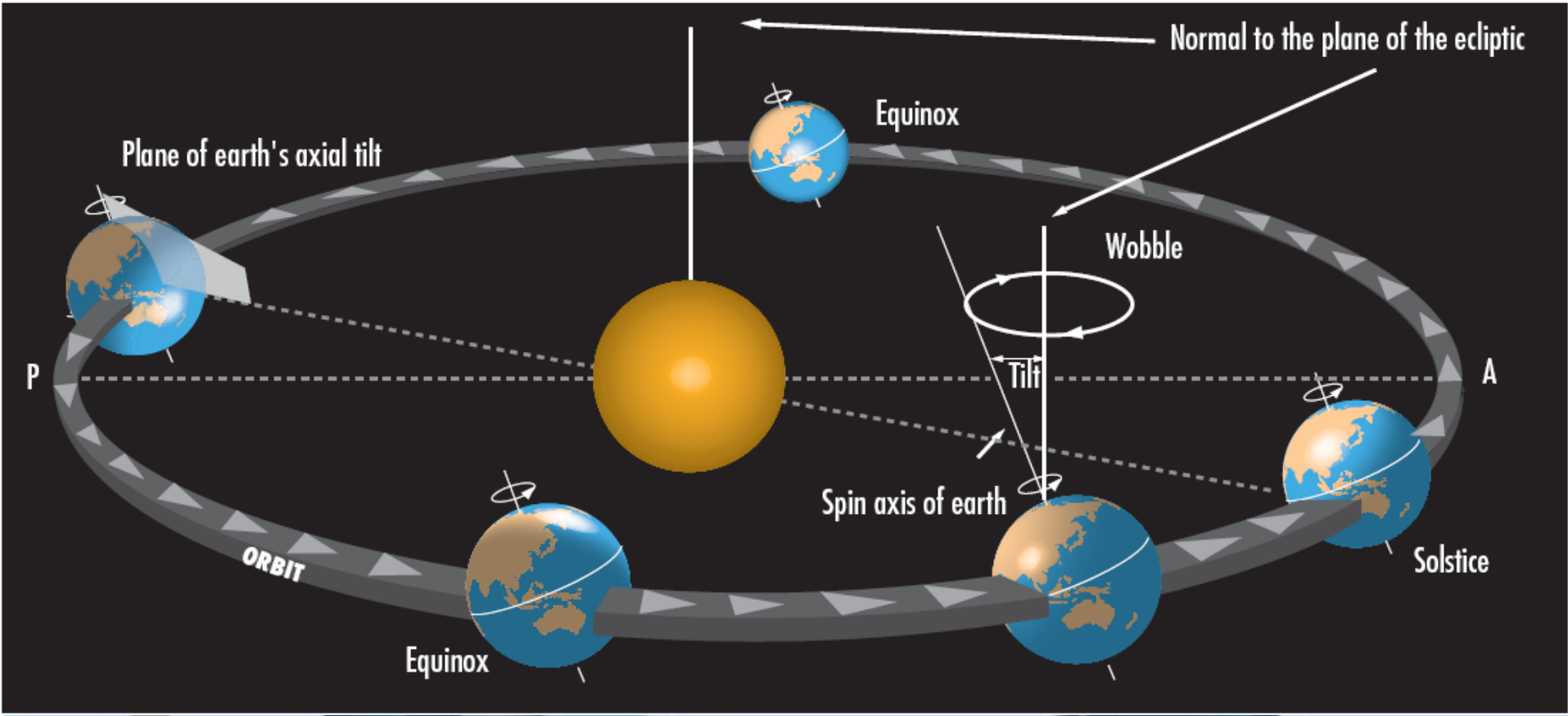
Outline

- What controls our climate
- What has the past climate been
- Past, present and future climatic models, what can they do?
- What current models cannot do
- Modelling uncertainty and risk analysis
- How can we reduce this uncertainty
- Conclusion

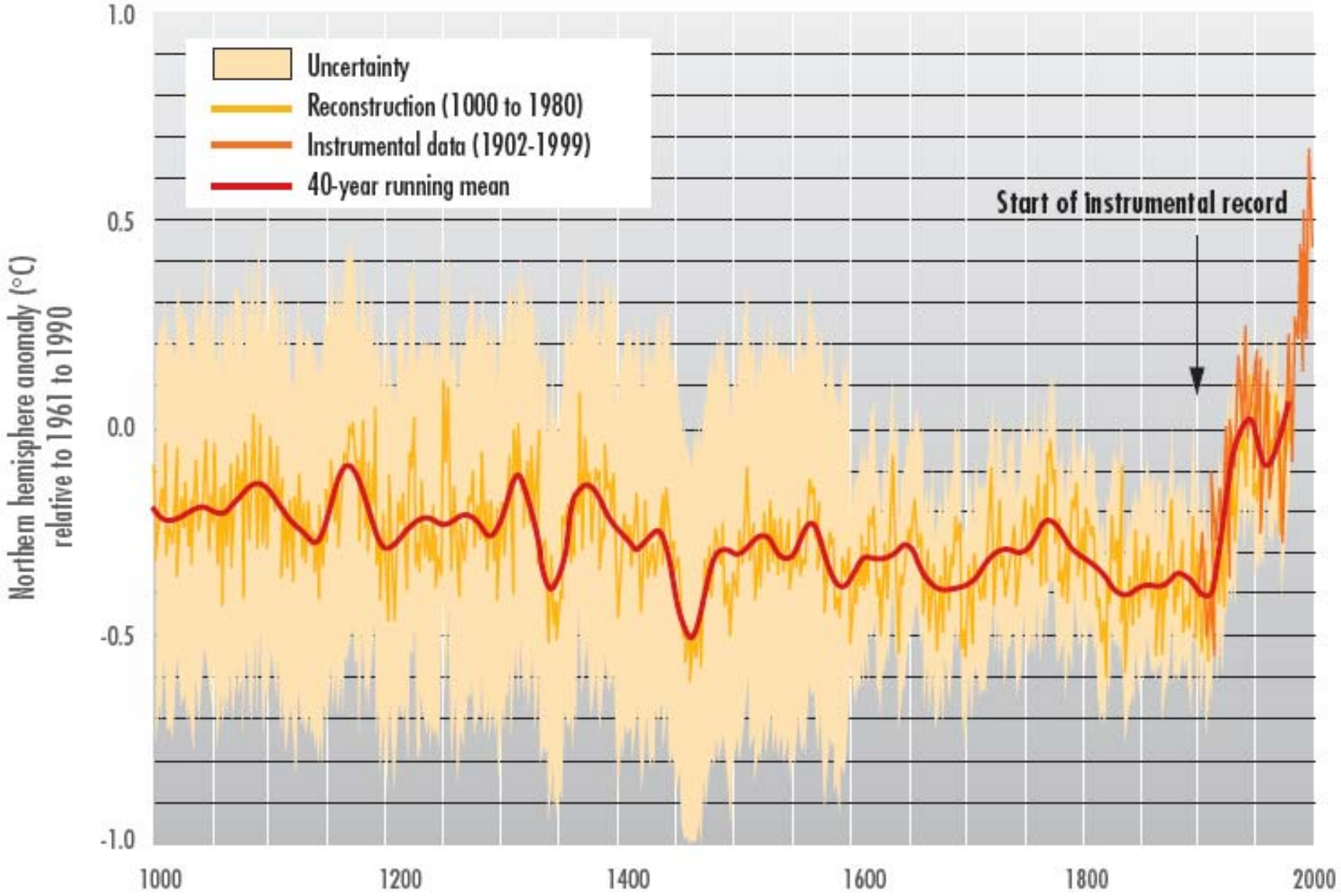
What Controls Our Climate

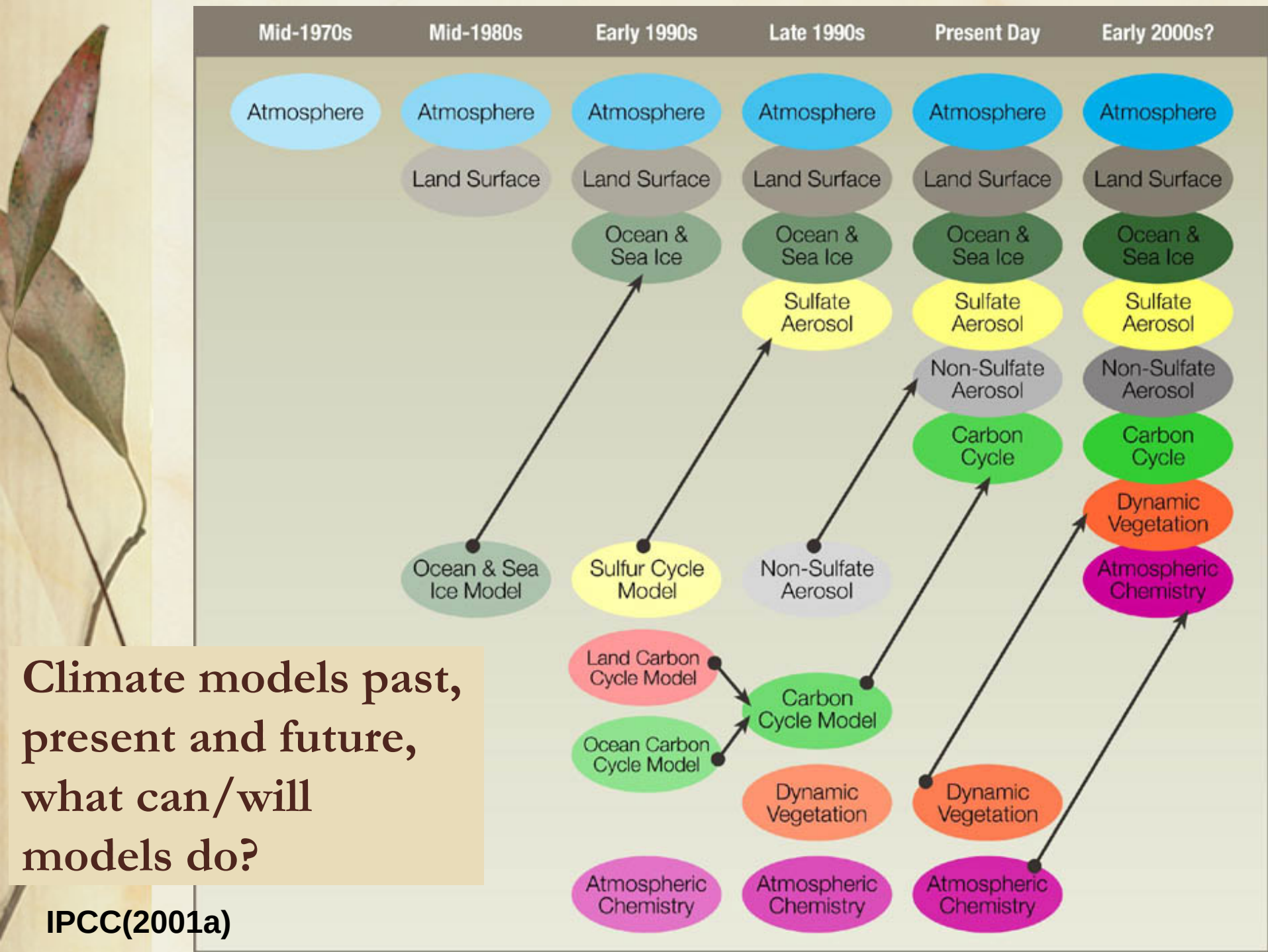


Cold deep salty current

From BoM booklet: "The greenhouse effect and climate change", 2004.

What Does the Past Tell Us?





Climate models past, present and future, what can/will models do?

IPCC(2001a)

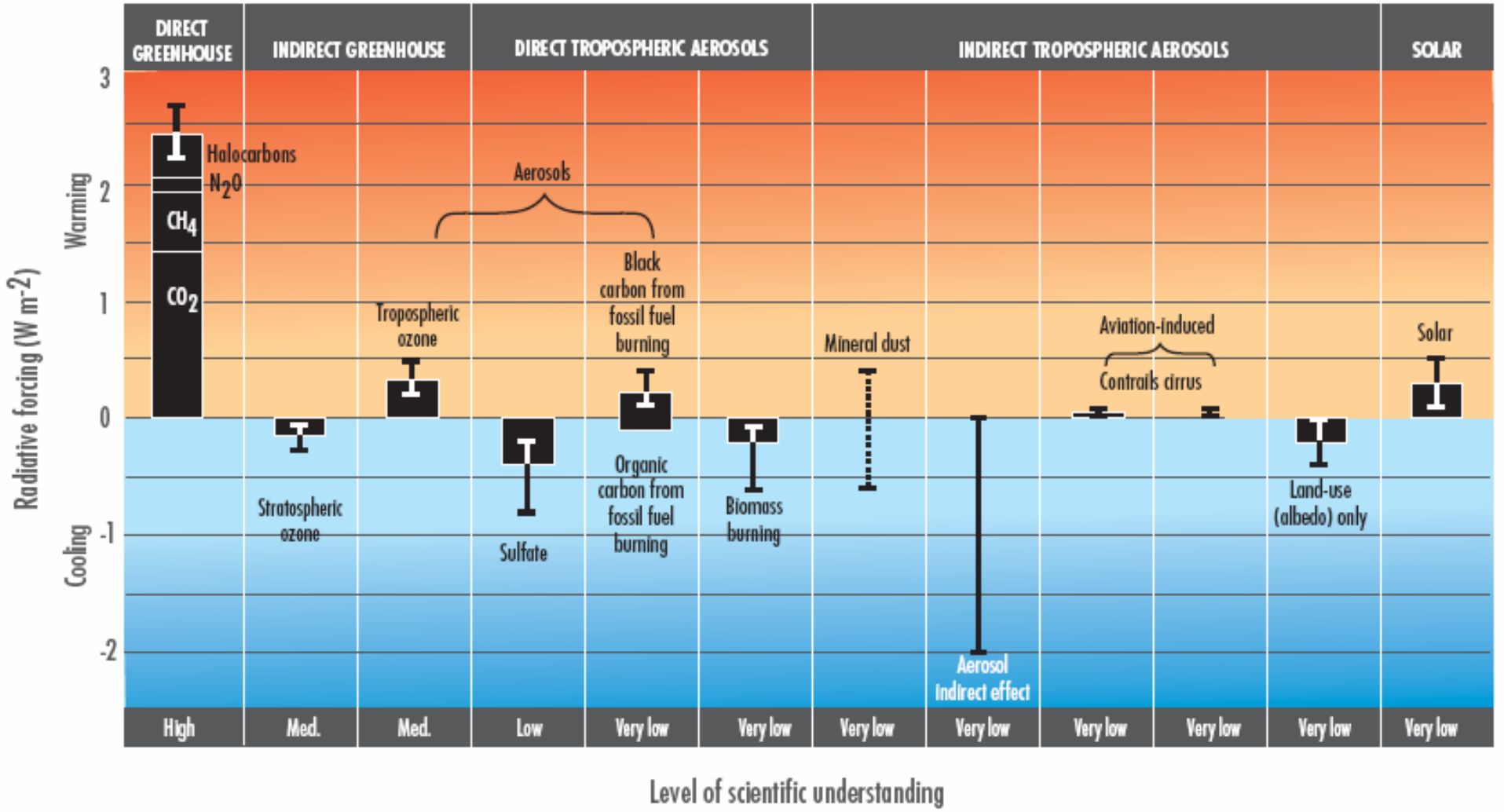
What Current Models Cannot Do

- Critical ocean phenomena remain as key challenges to understand, assess, and model
- Atmospheric convection, the hydrological cycle, and cloud radiative forcing processes are inadequately represented
- Although changes in solar radiation are small relative to changes forced by greenhouse gases there is evidence that feedbacks within the climate system may magnify these effects
- ***Source IPCC , 2001a.***

- Since 2001 models have become more complex and progress (albeit slow) is being made, some decisions can still be made based on current models. More work is required.

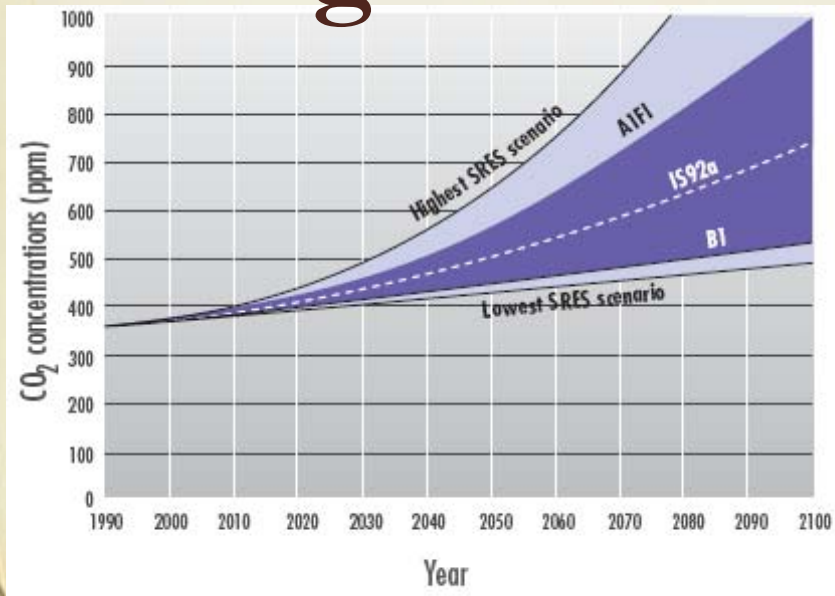
***From: Present-Day Atmospheric Simulations Using ISS ModelE: Comparison to In Situ, Satellite, and Reanalysis Data*, 2005,** SCHMIDT, A., et al.

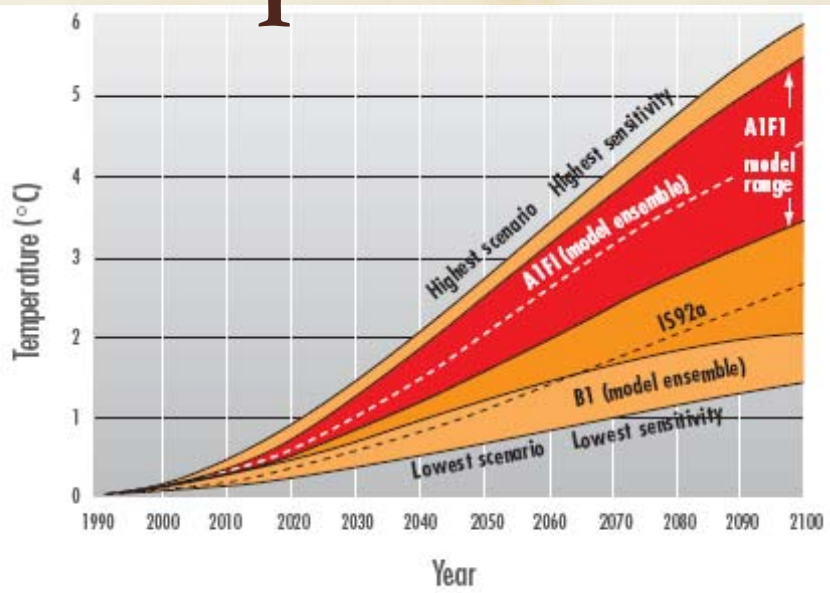
How Well Do We Understand For Example Atmospheric influences?

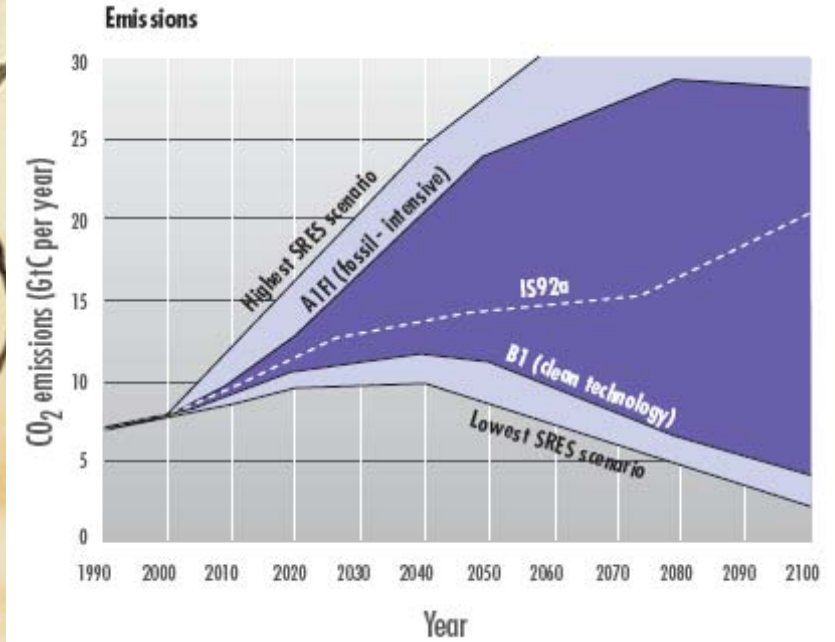


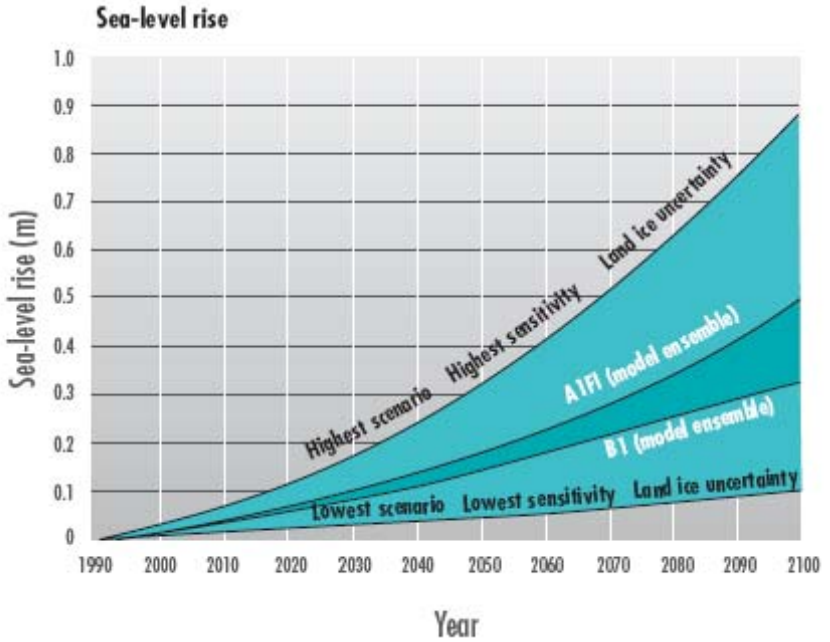
From BoM booklet: "The greenhouse effect and climate change", 2004.

Range in Emission Spectra









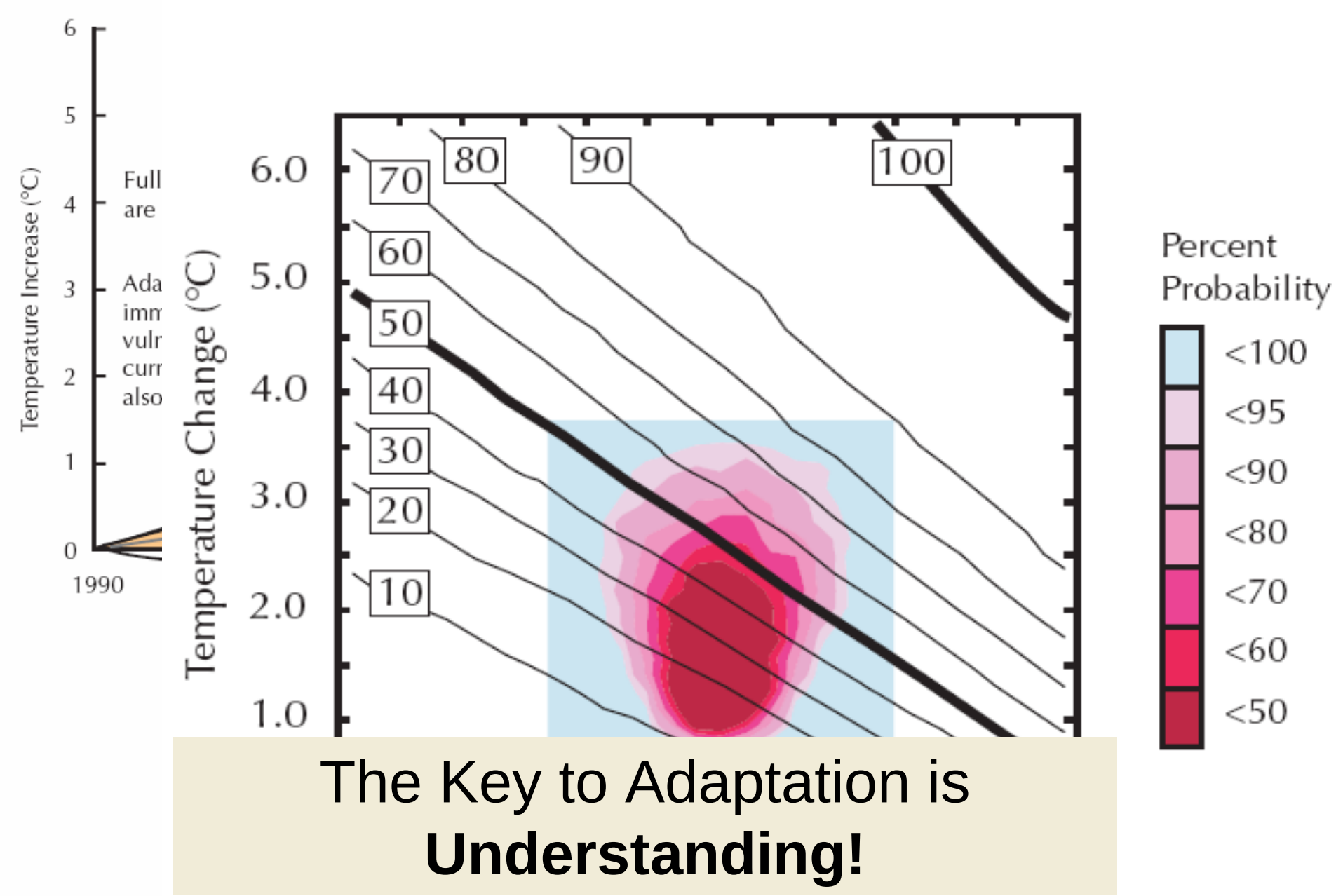
From BoM booklet: "The greenhouse effect and climate change", 2004.

The only Certainty is … Uncertainty

- Climate system feedbacks produced by clouds, water vapour, atmospheric convection, ocean circulation, ice albedo, and vegetation etc all produce large uncertainties
- These feedbacks can dampen or magnify the direct response of changes in greenhouse gas concentrations, solar variability, or land-cover changes etc
- Many of these must currently be accounted for in modelling by best estimates to achieve calibration
- There is a huge range in potential future emissions
- Current models are still useful but need to be used the right way not by focussing on one of the possible outcomes (even if it is the most likely)
- Uncertainty needs to be more transparently described and presented in **all** modelling not just climate
- Current levels of uncertainty are fostering huge differences in opinion, but some modelling techniques can help

So, how do we make our existing models useful?

- Present bandwidths of scenarios and predictions
- Don't focus on extremes (but bear them in mind)
- The exercise of building a model often shows what we do and don't know
- Models need well structured investigations and high quality data!
- The more you feed them the better they get
- Once you build a model don't assume it right, try and make it fail … push it and validate it
- **Always** do uncertainty analysis



The Key to Adaptation is **Understanding!**

Jones, R.N., 2003: Managing climate change risks (using bottom-up methods). In: *Estimating the Benefits of Climate Change Policies*. Working Party on Global and Structural Policies, Environment Directorate, OECD (in press).

How Do We Reduce Uncertainty?

- Arrest the decline of observational networks
- Expand the available observational data
- Accelerate research on climate forcing, responses, and feedbacks
- Address more completely the patterns of long-term climate variability
- Develop the next generation of global climate models - more representation of natural processes
- Foster model comparison with observations
- Improve short-term climate predictions through model initialization with enhanced observational data

From the US, National Research Council Review of the Strategic Platform of the Climate Change Science Program, 2004 and the IPCC Third Assessment Report (TAR)

Conclusions