THE IPCC CLIMATE CHANGE SCENARIOS

SUMMARY

In 2001, the Intergovernmental Panel on Climate Change (IPCC) considered two types of scenarios:

- *Scenarios excluding explicit policies* to reduce emissions, described in the Special Report on Emission Scenarios (SRES). These demonstrated that a warming of 1.4-5.8°C could occur without mitigation.
- *Scenarios including actions* to significantly reduce carbon dioxide (CO_2) emissions and stabilise CO_2 concentrations in the atmosphere. These demonstrated that mitigation could slow global warming.

Emphasis on non-mitigation scenarios may have been appropriate in the past, when the public and decision-makers were not as aware of the global warming issue. However, there is now a need to shift the focus to how much mitigation would be needed to reduce the risk of 'dangerous climate change' and what types of adaptation might be needed to manage residual impacts.

The Intergovernmental Panel on Climate Change (IPCC, 2001a) produced climate change scenarios for the 21st century. Scenarios are not predictions or forecasts – they are plausible descriptions of how the future may develop based on clear assumptions. Uncertainty in scenarios comes from three sources:

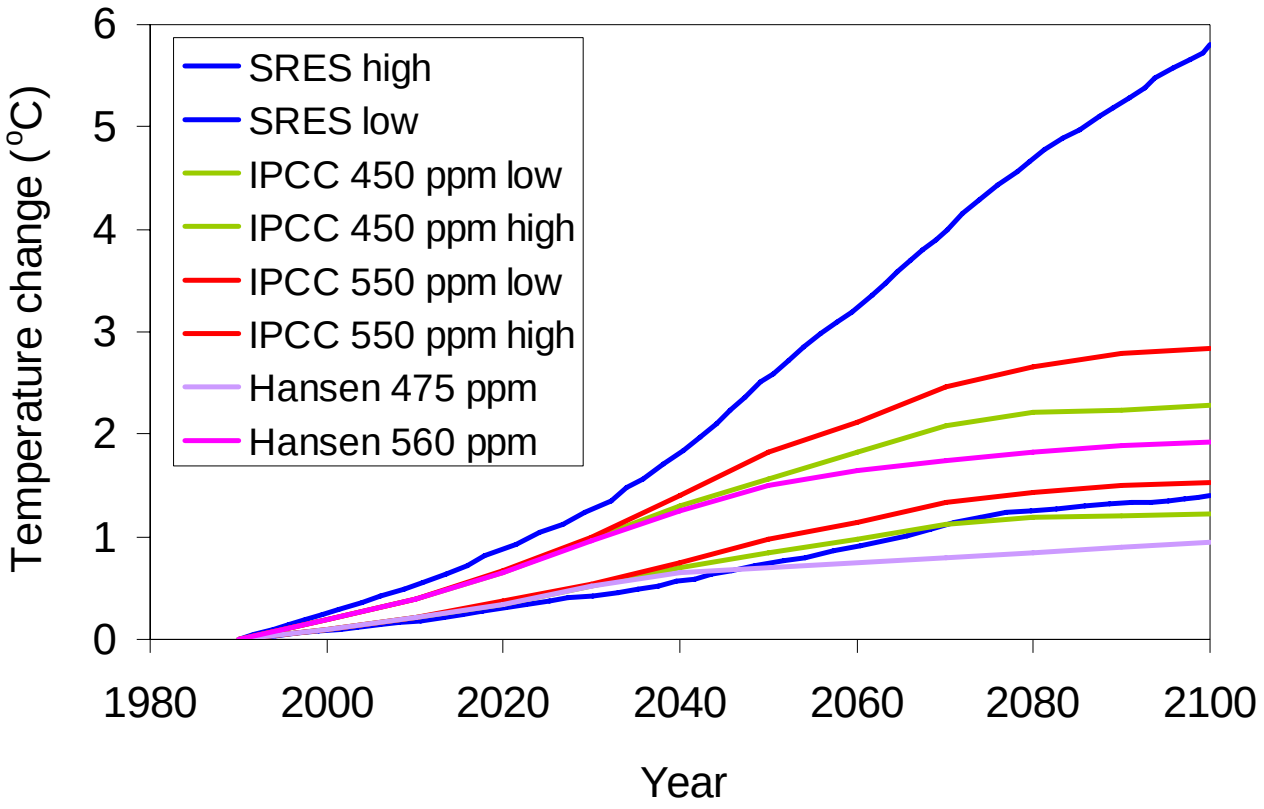
1. The wide range of assumptions about future demographic change, economic growth and technological change that underpin scenarios of greenhouse gas and aerosol emissions. Some assumptions are very optimistic and some are very pessimistic. In assessing uncertainties about future greenhouse gases, it would be wrong to exclude pessimistic or optimistic scenarios (Grübler *et al*., 2004).
2. The range of global warming sensitivity simulated by climate models in response to the emission scenarios. The range is estimated as 1.5 to 4.5°C for a doubling of carbon dioxide concentration.
3. Differences between climate models in their regional response to climate change.

Within the first source of uncertainty, there has been debate about the method used to estimate economic growth and whether the resulting emission scenarios are realistic (Castles and Henderson 2003a,b,2005; Nakicenovic *et al*. 2003; Grübler *et al*. 2004; Pant and Fisher 2004; Ryten 2004; Schiermeier 2006). While this debate is unresolved, the choice of economic method appears to have a limited effect on the range of projected global warming (Manne and Richels (2003), McKibbin *et al*. (2004)). Moreover, there are many other factors that contribute to uncertainty. For example, the global warming sensitivity may be 2.6-4.0°C (Kerr, 2004) or as high as 2.4 to 5.4°C (Murphy *et al*., 2004).

The Intergovernmental Panel on Climate Change (IPCC, 2001a) considered two types of greenhouse gas emission scenarios:

- *Scenarios excluding explicit policies* to reduce emissions, described in the Special Report on Emission Scenarios (SRES, 2000). These demonstrated that a warming of 1.4-5.8°C could occur without mitigation.

- *Scenarios including actions* to significantly reduce carbon dioxide (CO_2) emissions and stabilise CO_2 concentrations in the atmosphere at some level above the year 2000 value of 370 parts per million (ppm). These demonstrated that mitigation could slow global warming. For example, the 450 ppm stabilisation scenario may limit global warming to 1.2 to 2.3°C by 2100, provided that CO_2 emissions peak around 2010, and fall to about 40 per cent below present by 2050 and about 70 per cent below present by 2100. These and other stabilisation scenarios are described in IPCC (2001a,b) and Hansen (2003).



Comparison of projected global warming based on various assumptions about greenhouse gas emissions: The unmitigated IPCC SRES scenarios, IPCC scenarios for CO_2 stabilisation at 550 and 450 ppm, and the Hansen (2003) 'alternative' scenarios for CO_2 stabilisation at 560 and 475 ppm.

While a large range of scenarios is possible, the lowest are the most likely to be exceeded and the highest are the least likely to be reached. Even the most optimistic CO_2 stabilisation scenarios lead to a warming of 1 to 3°C by the year 2100, which may still cause 'dangerous climate change' in some areas.

Emphasis on non-mitigation scenarios may have been appropriate in the past, when the public and decision-makers were less aware of the global warming issue. However, there is now a need to shift the focus to how much mitigation would be needed to reduce the risk of 'dangerous climate change' and what types of adaptation might be needed to manage residual impacts. This is where most research effort should be concentrated.

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