



Climate system elements could reach point of no return this century

Key elements of the earth's climate system could pass their 'tipping point' this century, according to new research. The research explored the views of world experts on climate change and sought to define those aspects of climate change that are most affected by human activity, and that could be relevant to current policy on global warming.

The term 'tipping point' is used to describe a critical threshold at which a small change in human activity can have large, potentially irreversible effects on the Earth's climate system. Climate change may appear to be a slow and gradual process in human scales, but in some regions human activity could force abrupt and permanent change.

Nine tipping elements were identified that are relevant to current policy and which experts believe could reach a critical state within the next hundred years. These include:

- the melting of Arctic summer sea-ice
- the decay of the Greenland ice-sheet
- the collapse of the West Antarctic ice-sheet
- the collapse of the Atlantic thermohaline circulation
- an increase in the amplitude of the El Nino Southern Oscillation
- the die-back of Boreal (high latitude) forest
- the destruction of the Amazon rainforest
- the collapse of the West African monsoon
- a shift in the Indian summer monsoon

These nine elements were categorised according to the degree of sensitivity to global warming and the likelihood that they would take place. For example, the melting of Arctic sea-ice, which could result in ice-free summers within ten years, and the decay of the ice-sheet in Greenland are both highly sensitive to global warming, and were the most likely to occur. Scientists were less certain about the future behaviour of the Western Antarctic ice-sheet, which may be less sensitive to climate change and was placed in a second category of tipping elements. This category also includes the Amazon rainforest, the Boreal forest, the El Nino phenomenon and the West African and Indian summer monsoons. However, these elements could soon reach a tipping point. In the third category, with lower sensitivity to climate change and a moderate degree of uncertainty over its likelihood were changes to the Atlantic thermohaline circulation which is given a ten percent probability of undergoing a large transition this century.

Given the potentially dramatic impact of these tipping elements, the researchers call for stronger global warming mitigation policies and changes to behaviour that go beyond small incremental approaches. This means that a detailed study of the tipping elements in human socio-economic systems is also needed, to predict at what point and under which conditions mankind could make the transition to a low-carbon society.

Source: Lenton, T. M., Held H., Kriegler, E., *et al* (2008). Tipping Elements in the Earth's climate system. *Proceedings of the National Academy of Sciences*. 105 (6): 1786-1793.

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