

Tipping elements remain a 'hot' issue

August 24 2009



(PhysOrg.com) -- Research published by climate scientists at the University of East Anglia (UEA) has been named one of the most highly-cited in its field in the last two years.

The article, 'Tipping elements in the Earth's climate system', appeared in the journal *Proceedings of the National Academy of Sciences* in February 2008 and was this month named a 'New Hot Paper' by Thomson Reuters.

"The article captures the zeitgeist of a growing group of climate scientists who perceive that human activities are already pushing Earth's climate past regional tipping points," said lead author Prof Tim Lenton of UEA's School of Environmental Sciences.

Prof Lenton's team worked closely on the research with the Potsdam Institute for Climate Impact Research (PIK) in Germany.

The researchers introduced the term "tipping element" to describe large-scale components of the Earth system that may be pushed past critical thresholds by anthropogenic forcing of the [climate system](#). On the verge of tipping, tiny perturbations could have large long-term consequences on human and ecological systems.

The work has profound economic and political implications and was named Research Project of the Year 2008 by the Times Higher Education newspaper.

"Our paper has sensitized the public to the possibility of highly nonlinear reactions of nature to human interference with the climate system," said Prof Hans Joachim Schellnhuber, director of PIK.

An example of a tipping element is the Arctic sea-ice. As sea-ice melts, it exposes a much darker ocean surface, which absorbs more radiation from the sun. This in turn amplifies the warming, decreases ice formation in winter, and causes more rapid melting in summer. The long-term trend in summer ice extent indicates a decline of 3.3 per cent for the last three decades. As reported in the Tipping Elements paper, there could be a nonlinear transition to a new stable state with no [arctic sea-ice](#) during summer within a few decades. The critical threshold global mean warming may be between 0.5 to 2 degrees Celsius and could already have been passed. Earth is about to lose the cooling white reflector for arctic summer sunlight and this could enhance global warming.

[For daily image update from National Snow and Ice Data Center, click here: <http://nsidc.org/arcticseaicenews/>]

"We have been living under the illusion that climate change will be a smooth process. Our paper shatters that illusion," said Prof Lenton.

"Large regions of the planet may undergo profound changes in state that in some cases are rapid and often are irreversible, with impacts on many millions of people."

Prof Schellnhuber added: "I guess we have added a relevant piece to the now compelling scientific evidence that one needs to confine global warming to two degrees Celsius if you wish to have a fair chance of avoiding unmanageable climate risks."

The researchers identified the common dynamics underlying nine of these tipping elements, including tropical monsoons, the Amazon rainforest, ocean circulation, and the great ice sheets of Greenland and West Antarctica.

"This helps bring together the interests and concerns of specialists in quite different fields including climatology, ecology, oceanography and glaciology," said Prof Lenton.

Hans Joachim Schellnhuber had introduced the overall tipping-points concept into the scientific community. The specific research generating the paper began with a workshop at the British Embassy in Berlin in October 2005, which brought together UK and German scientists to debate and begin to identify the potential tipping points in the climate system. A process led by co-authors Elmar Kriegler and Jim Hall of eliciting responses from more international experts continued through the following year. Tim Lenton led a comprehensive review of the literature.

"The greatest challenge along the way was reconciling the inputs from a diverse group of co-authors, an even wider pool of expert opinions, and a huge body of literature," Lenton and Schellnhuber stated in an interview published on the Thomson Reuters 'Science Watch' website today.

More information: Lenton, T., H. Held, E. Kriegler, J. Hall, W. Lucht, S. Rahmstorf, and H. J. Schellnhuber, 2008: Tipping elements in the Earth's climate system. [Proceedings of the National Academy of Sciences](#), 105, 1786-1793.

Source: University of East Anglia

Citation: Tipping elements remain a 'hot' issue (2009, August 24) retrieved 27 April 2024 from <https://phys.org/news/2009-08-elements-hot-issue.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.