Study finds early warning signals of abrupt climate change

December 8 2014

Credit: Tiago Fioreze / Wikipedia

A new study by researchers at the University of Exeter has found early warning signals of a reorganisation of the Atlantic oceans' circulation which could have a profound impact on the global climate system.

The research, published today in the journal *Nature Communications*, used a simulation from a highly complex model to analyse the Atlantic

Meridional Overturning Circulation (AMOC), an important component of the Earth's climate system.

It showed that early warning signals are present up to 250 years before it collapses, suggesting that scientists could monitor the real world overturning circulation for the same signals.

The AMOC is like a conveyor belt in the ocean, driven by the salinity and temperature of the water. The system transports heat energy from the tropics and Southern Hemisphere to the North Atlantic, where it is transferred to the atmosphere.

Experiments suggest that if the AMOC is 'switched off' by extra freshwater entering the North Atlantic, surface air temperature in the North Atlantic region would cool by around 1-3°C, with enhanced cooling of up to 8°C in the worst affected regions.

The collapse would also encourage drought in the Sahel - the area just south of the Sahara desert - and dynamic changes in sea level of up to 80cm along the coasts of Europe and North America.

"We found that natural fluctuations in the circulation were getting longer-lived as the collapse was approached, a phenomenon known as critical slowing down," said lead author Chris Boulton.

"We don't know how close we are to a collapse of the circulation, but a real world early warning could help us prevent it, or at least prepare for the consequences" adds co-author Professor Tim Lenton.

The study is the most realistic simulation of the climate system in which this type of early warning signal has been tested.

"The best early warning signals in the model world are in places where major efforts are going into monitoring the circulation in the real world - so these efforts could have unexpected added value' adds Professor Lenton.

More information: 'Early warning signals of Atlantic Meridional Overturning Circulation collapse in a fully coupled climate model' by Chris Boulton, Lesley Allison and Timothy Lenton is published today in the journal *Nature Communications*.

Provided by University of Exeter