Research indicates ocean current shutdown may be gradual

July 16 2009

The findings of a major new study are consistent with gradual changes of current systems in the North Atlantic Ocean, rather than a more sudden shutdown that could lead to rapid climate changes in Europe and elsewhere.

The research, based on the longest experiment of its type ever run on a "general circulation model" that simulated the Earth's climate for 21,000 years back to the height of the last Ice Age, shows that major changes in these important ocean current systems can occur, but they may take place more slowly and gradually than had been suggested.

The newest findings, to be published Friday in the journal *Science*, are consistent with other recent studies that are moving away from the theory of an abrupt "tipping point" that might cause dramatic atmospheric temperature and ocean circulation changes in as little as 50 years.

"Research is now indicating that this phenomenon may happen, but probably not as a sudden threshold we're crossing," said Peter Clark, a professor of geosciences at Oregon State University. "For those who have been concerned about extremely abrupt changes in these ocean current patterns, that's good news.

"In the past it appears the ocean did change abruptly, but only because of a sudden change in the forcing," he said. "But when the ocean is forced gradually, such as we anticipate for the future, its response is gradual.

That would give ecosystems more time to adjust to new conditions."

The findings do not change broader concerns about global warming. Temperatures are still projected to increase about four to 11 degrees by the end of this century, and the study actually confirms that some of the world's most sophisticated climate models are accurate.

"The findings from this study, which also match other data we have on recorded climate change, are an important validation of the global climate models," Clark said. "They seem to be accurately reflecting both the type and speed of changes that have taken place in the past, and that increases our ability to trust their predictions of the future."

The intensity of computation on this experiment, involving a quadrillion calculations each second, was so great that it took more than a year to run, Clark said. It was the longest such study of its type that ever examined past climate in such detail and complexity. The research was supported by the National Science Foundation and other agencies.

It included the height of the last Ice Age about 21,000 years ago, the emergence of the Earth from that Ice Age around 14,000 years ago, and some other fairly sudden warming and cooling events during those periods that are of considerable interest to paleoclimatologists.

The period when the Earth emerged from its last Ice Age actually had amounts of natural warming similar to those that may be expected in the next century or two, with some of the same effects - melting of ice sheets, sea level rise, increases in atmospheric carbon dioxide. Studies of those periods, researchers say, will provide valuable insights into how the Earth may respond to its current warming.

A particular concern for some time has been the operation of an ocean current pattern called the Atlantic meridional overturning circulation, or

AMOC. This current system is part of what keeps Europe much warmer than it would otherwise be, given its far northern latitudes, and there is evidence that it has "shut down" with some regularity in Earth's past - apparently in response to large influxes of fresh water, and sometimes quite rapidly.

"Our data still show that current is slowing, and may decline by 30 percent by the end of this century," Clark said. "That's very significant, and it could cause substantial climate change. But it's not as abrupt as some concerns that it could shut down within a few decades."

Climate changes, Clark said, are actually continuing to occur somewhat more rapidly than had been predicted in recent years. Arctic Sea ice is both thinning and shrinking, and atmospheric carbon dioxide levels are going up faster than had been projected by the Intergovernmental Panel on Climate Change.

Source: Oregon State University (news : web)