Climate change to continue to year 3000 in best case scenarios: research

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New research indicates the impact of rising CO_2 levels in the Earth's atmosphere will cause unstoppable effects to the climate for at least the next 1000 years, causing researchers to estimate a collapse of the West Antarctic ice sheet by the year 3000, and an eventual rise in the global sea level of at least four metres.

The study, to be published in the Jan. 9 Advanced Online Publication of the journal *Nature Geoscience*, is the first full climate model simulation to make predictions out to 1000 years from now. It is based on best-case, 'zero-emissions' scenarios constructed by a team of researchers from the Canadian Centre for Climate Modelling and Analysis (an Environment Canada research lab at the University of Victoria) and the University of Calgary.

"We created 'what if' scenarios," says Dr. Shawn Marshall, Canada Research Chair in Climate Change and University of Calgary geography professor. "What if we completely stopped using fossil fuels and put no more CO_2 in the atmosphere? How long would it then take to reverse current climate change trends and will things first become worse?" The research team explored zero-emissions scenarios beginning in 2010 and in 2100.

The Northern Hemisphere fares better than the south in the computer simulations, with patterns of climate change reversing within the 1000-year timeframe in places like Canada. At the same time parts of North Africa experience desertification as land dries out by up to 30

percent, and ocean warming of up to 5°C off of Antarctica is likely to trigger widespread collapse of the West Antarctic ice sheet, a region the size of the Canadian prairies.

Researchers hypothesize that one reason for the variability between the North and South is the slow movement of ocean water from the North Atlantic into the South Atlantic. "The global ocean and parts of the Southern Hemisphere have much more inertia, such that change occurs more slowly," says Marshall. "The inertia in intermediate and deep ocean currents driving into the Southern Atlantic means those oceans are only now beginning to warm as a result of CO_2 emissions from the last century. The simulation showed that warming will continue rather than stop or reverse on the 1000-year time scale."

Wind currents in the Southern Hemisphere may also have an impact. Marshall says that winds in the global south tend to strengthen and stay strong without reversing. "This increases the mixing in the ocean, bringing more heat from the atmosphere down and warming the ocean."

Researchers will next begin to investigate more deeply the impact of atmosphere temperature on ocean temperature to help determine the rate at which West Antarctica could destabilize and how long it may take to fully collapse into the water.

More information: The paper "Ongoing climate change following a complete cessation of carbon dioxide emissions" by Nathan P. Gillett, Vivek K. Arora, Kirsten Zickfeld, Shawn J. Marshall and William J. Merryfield will be available online at www.nature.com/ngeo/index.html

Provided by University of Calgary