



Press release of the Max Planck Institute for Meteorology and the German Climate Computing Centre

From the Past into the Future: New Climate Simulations for Science and Society

“Two-degree target could be still achieved”

Hamburg, 23.02.2012 Scientists from the Max Planck Institute for Meteorology (MPI-M) and the German Climate Computing Centre (DKRZ) have carried out new climate simulations using MPI-M's new climate model. The results indicate that the two-degree target could be still achieved if carbon dioxide emissions would be reduced significantly. Within an international model intercomparison project researchers were able to simulate the complex carbon cycle as well as vegetation dynamics in climate projections for the 21st century. In case of an increase in CO₂ emissions the simulations suggest not only an increase in temperature but also a rapid progression of ocean acidification. Oceanic calcifying organisms will be particularly affected. In addition to long-term projections, more detailed climate predictions spanning the next ten years were performed for the first time. The new climate scenario simulations were carried out on DKRZ's supercomputer and occupied one quarter of total computing capacity over a period of two years.

Through dissemination of the current data sets the scientists have fired the starting shot for the interpretation of results by the climate research community. Furthermore, the findings represent the basis for socio-political discussions about possible impacts of climate change and the call for action resulting of it. The new model calculations are part of the World Climate Research Programme (WCRP). Within the framework of this programme the coordinated calculations of the global coupled climate models are compared with each other. The project is funded with more than 3 Mio Euros by the Federal Ministry of Education and Research (BMBF).

In the event of continuously increasing emissions of carbon dioxide, as assumed in the least favorable scenario, scientists expect a rise in the global mean temperature by up to 4°C by 2100. The impacts of global warming are manifold and have different implications in different regions.

“We would have more frequent and intense heat waves on a global scale”, says Prof. Dr. Jochem Marotzke, Director at the MPI-M and vice-chair of the World Climate Research Programme. “Our results demonstrate the possibility to limit global warming to below two degrees Celsius throughout this century. But it requires a drastic reduction of carbon dioxide emissions.”

According to recent calculations Arctic summer sea ice melts faster than predicted. With a smaller sea ice cover, more sunlight is absorbed by the dark open water of the

polar ocean. This water therefore warms efficiently during summer, which leads to additional melting of sea ice and even more open water. This feedback loop can in principle cause the loss of Arctic sea ice to become at some point self-amplified and hence independent of the prevailing climate conditions. The melting rate of sea ice is directly connected with global warming. “Our current calculations show a higher correlation with observations of Arctic sea ice over the past decades than ever before”, explains Dr. Johann Jungclaus, ocean expert at the MPI-M.

Climate scientists from the MPI-M have shown for the first time that the strength of the Atlantic Meridional Overturning Circulation at 26.5 °N can be predicted accurately for up to four years. By using current observational data it has been achieved to define and integrate a consistent starting point into an ocean model. It is now possible to predict climatic anomalies for the next five to ten years.

“Recent data indicate that, due to carbon dioxide pollution, ocean acidification has increased by 30 percent compared to pre-industrial times. Scientists doubt that many organisms will be able to cope with environmental change. Oceanic calcifying organisms like shells and corals are particularly affected”, says Jungclaus.

As a result of the Millennium simulations (calculating past 800-1000 years) researchers were able to show that human impact on the atmospheric CO₂ concentration started much earlier than with the industrial revolution. Anthropogenic land cover change such as conversion of forests to croplands and pastures has significantly influenced the carbon cycle since 1750.

The new climate simulations were carried out at the German Climate Computing Centre (DKRZ), one of the world's largest computing centres specialised in climate simulations. „With a peak performance of 158 trillion TeraFlops/s (floating point operations per second), our scientists simulated 13.000 years of climate history in more than 350 experiments“, says Prof. Dr. Thomas Ludwig, Director at DKRZ. „This computing performance corresponds to 30 million processing hours of conventional computers.“

Hamburg's climate scientists were pioneers in developing one of the first three-dimensional coupled atmosphere-ocean models. The MPI-M is among the world's leading institutes for climate research and has made many major contributions since its foundation in 1975. Founding Director Prof. Dr. Klaus Hasselmann and his team proved in 1996 that global warming is attributed to human activities with a probability of more than 95 percent.

The World Climate Research Programme (WCRP) was established in 1980, under the joint sponsorship of the International Council for Science, the Intergovernmental Oceanic Commission and the World Meteorological Organization (WMO). The main objectives of the WCRP are to determine the predictability of climate and to define the effect of human activities on climate. Climate modeling and climate predictions are major components of the World Climate Research Programme.

The recent results of Hamburg's climate model calculations will be integrated into the fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC).



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