

DKRZ - HPC Resources for the German IPCC Simulations

Michael Böttinger / DKRZ

IPCC and Climate projections

For each of the four Assessment Reports published by the IPCC (Intergovernmental Panel on Climate Change) in 1990, 1995, 2001 and 2007, extensive greenhouse gas scenario simulations have been carried out by the world's leading climate modeling groups.

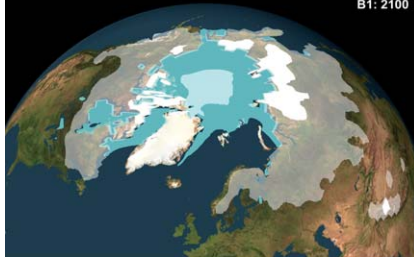
The German simulations, which contributed to this effort, were performed on DKRZ supercomputers, with models developed by the Max Planck-Institute for Meteorology. In 2004, 25% of the DKRZ HPC resources (24 Node NEC SX-6 Supercomputer) were exclusively used for the IPCC AR4 simulations with the ECHAM5/MPI-OM model. The atmospheric model component ECHAM5 had a horizontal resolution of approximately 200 km and 31 levels vertically. The ocean model MPI-OM was used with a regionally varying horizontal resolution between approximately 10 km and 150 km.

The simulations were carried out by the MPI-M and the Model and Data Group, and the results were stored in a relational database for further analysis. The data, amounting to 150 Tb, are made available by the World Data Center for Climate (WDCC) and can be accessed on <http://ipcc.wdc-climate.de>.

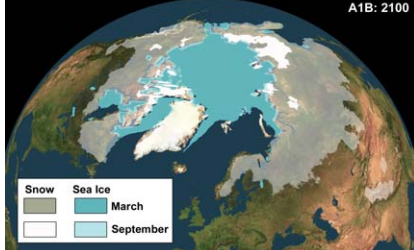
IPCC AR4: Simulations with ECHAM5 / MPI-OM



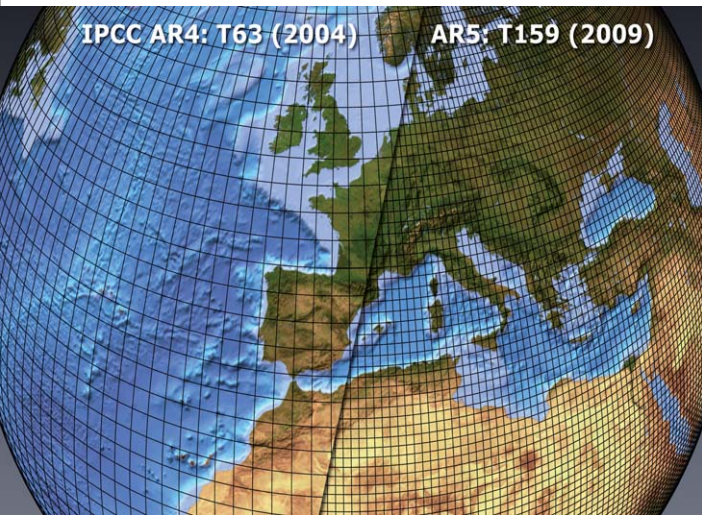
B1: 2100



A1B: 2100



IPCC AR4: T63 (2004) AR5: T159 (2009)



The next IPCC report

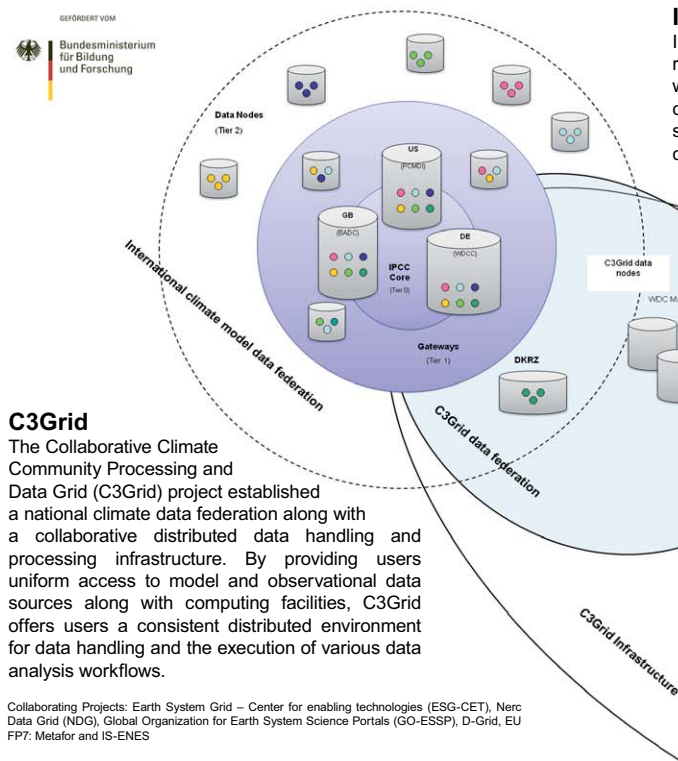
The simulations for the next report, IPCC AR5, are currently prepared. The simulations are planned with much higher resolution (T159, horizontal resolution ~80 km) compared with the IPCC AR4 experiments (T63, ~180 km). The ocean model is planned with a grid interval of 0.4 Degrees (~45 km).

With this increased resolution, physical processes such as strong storms or ocean eddies can be simulated more realistically. Furthermore, MPI-M's new model will include a component for the land biosphere (JSBACH) as well as an ocean biogeochemistry model (HAMOCC) in order to simulate the full carbon cycle.

The computational effort necessary to carry out the IPCC AR5 simulations with this enhanced and extended model will approximately be 60 times the effort needed for the AR4 simulations. DKRZ's new IBM Power6 system was installed just in time to deliver the required computational power.

C3Grid and the IPCC Assessment Report

B. Fritsch / AWI, S. Kindermann / DKRZ, A. Papaspyrou / Uni Dortmund et. al.



IPCC and the international model data federation

In December 2008 an agreement between the Programme for Climate Model Diagnosis and Intercomparison (PCMDI), the British Atmospheric Center (BADC), and the World Data Centre for Climate (WDCC) was signed to join forces to support the World Climate Research Programme (WCRP). The partners decided to build up a distributed data federation to meet the volume and variety of data needs of the climate science community. They form the core of an emerging international climate model data federation (in the context of CMIP5 and IPCC AR5).

C3Grid and IPCC

By translating the metadata descriptions and publishing them, the DKRZ will act as a mediator in the integration process of the international model data federation and C3Grid. As a result, users of the C3Grid portal will be able to uniformly discover IPCC AR5 data. Additionally, data analysis workflows can be triggered, which operate on model data as well as on observational data that is provided e.g. by the DLR or DWD C3Grid partners.

C3Grid

The Collaborative Climate Community Processing and Data Grid (C3Grid) project established a national climate data federation along with a collaborative distributed data handling and processing infrastructure. By providing users uniform access to model and observational data sources along with computing facilities, C3Grid offers users a consistent distributed environment for data handling and the execution of various data analysis workflows.

Collaborating Projects: Earth System Grid – Center for enabling technologies (ESG-CET), Nerc Data Grid (NDG), Global Organization for Earth System Science Portals (GO-ESSP), D-Grid, EU FP7: Metafor and IS-ENES



Deutsches Klimarechenzentrum (DKRZ)

www.dkrz.de