**Model Support**

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**Introduction** • KNMI participates in the Netherlands Centre for Climate Research (CKO) together with IMAU (Institute for Marine and Atmospheric Research Utrecht) and RIVM (National Institute of Public Health and the Environment). The primary aim of CKO is to improve co-ordination and co-operation among the participants in the field of climate research. Climate models are important tools in this research but, because of their complexity, they are difficult to use and maintain. Therefore, there was a need for support of models within CKO. A support group was established in April 1999.

The group ports the models to and tests them on the computing platforms that are used in CKO and makes them available to the scientists as a baseline version. In addition, the group improves the usability and user-friendliness of the models. This is done in several manners: by defining and maintaining a common software infrastructure for analysing climate and model data, by making improvements and extensions to the models that are relevant for the scientific community, and by guaranteeing continuity in knowledge about the models and their use.

Four models are currently supported: the global atmosphere model ECHAM4, the global ocean model OPA 8.1, the regional ocean model MICOM 2.7 and the coupled atmosphere-ocean model ECBILT.

**Results** • Work in the model support group consisted of the following activities.

- creation and maintenance of the CKO web site (http://www.knmi.nl/onderzoek/CKO). The main purpose of this site is to provide easy access to the supported models and data analysis tools. Next to this, the site contains information about the models and provides links to important web sites with climate data and analysis tools.

- the porting and testing of the four supported models on all computing platforms used in the CKO. The installation of these models has been simplified and installation instructions for each of them are given on the web site.

- creation of a standard software infrastructure for the analysis of climate and model data. To improve the interoperability of models and tools, a standard data format was selected. The models were adapted to accept their input and create their output in this format. A software library was developed to simplify this task. This library is available at the CKO web site for people who want to
adapt models not supported by the model support group. To complete the common software infrastructure for analysing climate and model data, a number of analysis tools accepting the data format were selected. These include HIPHOP, a graphical user interface (GUI) based IDL programme, programme Ferret, a climate data analysis tool with a command-line and GUI, and OpenDX, a high-end scientific data visualisation tool.

The result of these activities is that the use of the supported models has been greatly simplified, enabling scientists to focus on the scientific problems they are studying.

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**ECHAM4**

The global atmospheric climate model ECHAM4 is available at several horizontal resolutions (T21, T30 and T42) with 19 vertical levels (with a model top at 10 hPa, about 30 km height) and at T30 with 39 levels. The latter version is known as MA-ECHAM, the middle-atmosphere ECHAM4 with its top at 0.01 hPa, corresponding to a height of about 80 km. The model runs on single processor computers as well as parallel computers. A database with ECMWF analyses is available to nudge ECHAM4.

**OPA**

OPA (Océan PARallélisé) is an Ocean General Circulation Model (OGCM) which has been developed at the Laboratoire d’Océanographie DYnamic et de Climatologie (LODYC) to study large-scale ocean circulation and its interaction with the atmosphere and sea-ice. The model uses a grid with a resolution of either about four or two degrees in longitude and latitude and 31 layers. A version of the OPA model was made available that can run on single processor, multiprocessor and vector processor computers. A set of scripts to plot and analyse the model output was developed and added to the package.

**MICOM**

The Miami Isopycnic Coordinate Ocean Model (MICOM) is a regional isopycnic ocean model that aims at simulating thermodynamically and mechanically driven flow in realistic basins. Version 2.7 of this model was made available for single processor and vector processor computers with a global climatology data set from which input data for any part of the Earth’s oceans can be created in an automated manner. The input and output facilities of the model were improved. The possibility to nudge to a prescribed state at the northern, southern, and sea surface boundaries was added to the model.
ECBILT

ECBILT is a spectral T21 global three level quasi-geostrophic atmosphere model with simple parameterisations for the diabatic processes. It can be coupled to an ocean model to study ocean-atmosphere dynamics on time scales of the order of thousand years. Two versions of the ECBILT model were made available: one for single processor computers and one for the Fujitsu vector computer at ECMWF.