

CGER'S SUPERCOMPUTER MONOGRAPH REPORT Vol. 3

Study on the Climate System and Mass Transport by a Climate Model

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NIES: National Institute for Environmental Studies
CGER: Center for Environmental Research
EIC: Environmental Information Center

Foreword


The Center for Global Environmental Research (CGER), an organ of the National Institute for Environmental Studies of the Environment Agency of Japan, was established in October 1990 to contribute broadly to the scientific understanding of global change, and to the elucidation of and solution for our pressing environmental problems. CGER conducts environmental research from interdisciplinary, multi-agency, and international perspective, provides research support facilities such as a supercomputer and databases, and offers its own data from long-term monitoring of the global environment.

In March 1992, CGER installed a supercomputer system (NEC SX-3, Model 14) to facilitate research on global change. The system is open to environmental researchers worldwide. Proposed research programs are evaluated by the Supercomputer Steering Committee which consists of leading scientists in climate modeling, atmospheric chemistry, oceanic circulation, and computer science. After project approval, authorization for system usage is provided. In 1995 and 1996, several research proposals were designated as priority research and allocated larger shares of computer resources.

The CGER supercomputer monograph report Vol. 3 is a report of priority research of CGER's supercomputer. The report covers the description of CCSR/NIES atmospheric general circulation model, lagrangian general circulation based on the time-scale of particle motion, and ability of the CCSR/NIES atmospheric general circulation model in the stratosphere. The results obtained from these three studies are described in three chapters.

We hope this report provides you with useful information on the global environmental research conducted on our supercomputer. In order to promote the exchange of ideas and opinions amongst all the science fraternity utilizing this supercomputer, and fully represent existing opinions, the Research Integration Section of CGER will greatly appreciate any comments or suggestions you feel could enhance future.

May 1997



Gen Ohi
Executive Director
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Preface

The Center for Global Environmental Research (CGER) of the National Institute for Environmental Studies (NIES) of the Environment Agency of Japan provides research support facilities such as a supercomputer and databases for global environmental research activities.

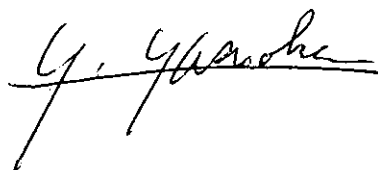
CGER's supercomputer is open to researchers internationally for any global environmental research applications. Users need to be authorized for such usage every fiscal year. CGER is responsible for efficient allocation of supercomputer resources for each research subject, such as CPU time and memory, sufficient for the research plans recommended by the Supercomputer Steering Committee, consisting of scientists.

NIES's Environmental Information Center (EIC) manages routine operations of the supercomputer system. This system is operated with close and cordial communications between users and the managing staff, including daily consultation by the engineers.

This CGER supercomputer monograph is the third publication to disseminate research progress achieved by the users of the supercomputer facilities set up by CGER. The system's CPU time and memory were fully occupied in fiscal years 1995 and 1996 (from April 1995 to March 1997), demonstrating that the needs of researchers for this facility have been very high and that users from national research institutes and universities have fully utilized the system. We provided high-priority resource allocation to the group which studies on the climate system and mass transport by a climate model at the NIES, in consideration of their prospective contribution to international frontier research activities.

We hope this publication contributes to further progress in global change research and efforts for global environmental conservation.

May 1997



Yoshifumi Yasuoka
Director

Center for Global Environmental Research
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Chapter I

Description of CCSR/NIES Atmospheric General Circulation Model

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Abstract

An atmospheric general circulation model for climate studies (CCSR/NIES AGCM) has been developed. The model is based on the three-dimensional primitive equations in sigma coordinate and uses spectral transformation method in horizontal discretization. The physical parameterization includes a two-stream k-distribution scheme for radiative transfer, simplified Arakawa-Schubert cumulus scheme, prognostic cloud water scheme, turbulence closure scheme with cloud effect, orographic gravity wave drag, and a simple land-surface submodel. The model also includes plug-in-compatible alternative physical parameterization schemes and a slab mixed-layer ocean as optional modules. The climatology of a standard integration are presented.