

B-1 Study on the Evaluation of Climate Change by a Climate and Mass Transport Model (Final Report)

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Key Words Global and Regional Climate Model, Greenhouse Gases, Sulfate Aerosol, Land-surface Process, Forest Ecosystem

The main purposes of this research project are to reduce uncertainties in the future projection (or prediction) of the global scale climate change, to evaluate regional climate change, and to establish the basis of a new-generation climate and material circulation model incorporating interaction of ecosystems with climate.

The main body of the project is to develop and apply the CCSR/NIES climate model which is developed through joint research of NIES (National Institute for Environmental Studies) with CCSR (Center for Climate System Research, University of Tokyo). Part of the project consequently aimed at contributing to IPCC (Intergovernmental Panel on Climate Change), especially IPCC TAR (Third Assessment Report).

The project consists of the following seven sub-themes.

B-1.1 Study on the evaluation of the effects of atmospheric aerosols and water substances for the global scale climate change.

B-1.2 A preliminary study on derivation of aerosol distribution using a climate model on the basis of anthropogenic emission data of aerosol sources

B-1.3 Studies on formation and loss processes of SO₃ for a model including aerosol production

B-1.4 Study on atmospheric circulation and mass transport model for the tropospheric atmospheric system

B-1.5 Study on the evaluation of regional scale climate change

B-1.6 Modeling of energy exchange between a forest ecosystem and the atmosphere

B-1.7 Impact assessment of global warming on the change of local climate with a local climate model including a forest ecosystem model

The characteristics of this project include development of modeling some material circulation processes important to climate such as aerosol, water substances, and greenhouse gases. The project consists of the following two categories: (i) To run the CCSR/NIES climate model incorporating important processes as much as possible for future projection of climate; (ii) To develop process models for a new-generation climate and material circulation model. With regard to the category (i), on the basis of the achievements of the project, we performed climate change experiments with a new set of aerosol emission scenario of IPCC SRES (Special Report on Emissions Scenarios) utilizing the CCSR/NIES climate model and discussed the differences in the future projections of climate change among the different scenario runs: the results will be included in IPCC TAR which is now in the final editing stage. With regard to the category (ii), we developed modeling of energy and water substances exchange between a forest ecosystem and the atmosphere which is among important processes in climate and tried to couple the exchange process in the CCSR/NIES climate model.

The project required computer resources, and utilized the computer system of NIES including the supercomputer (NEC SX-4).

The future research project along the lines on this project will include the development of advanced process modeling such as tropospheric aerosol, tropospheric ozone, and land-surface including vegetation, and the development of coupling the process models with the climate model.