

CGER-W002-90

SUMMARY  
OF  
THE ASIAN AND PACIFIC WORKSHOP  
ON GLOBAL WARMING RESEARCH

18 ~ 20 March, 1991

CGER  
Center for Global Environmental Research

Tsukuba  
Japan

# The Asian and Pacific Workshop on Global Warming Research

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Mr. Kazuhito Yamada  
Ms Mariko Fujimori  
Environmental Dept.  
Pacific Consultants Co., Ltd.

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### Published by :

Secretariat, Executive Committee of  
The Asian and Pacific Workshop on Global Warming Research  
S. Araki, T. Ohashi  
Center for Global Environmental Research (CGER)  
National Institute for Environmental Studies (NIES)  
Japan Environment Agency (JEA)  
Onogawa, Tsukuba, Ibaraki 305, JAPAN  
Tel: (0298) 51-6111 ext. 374  
Fax: (0298) 58-2645

## Preface

The brilliant progress in modern science has given us a type of prosperity never previously enjoyed. At the same time, the serious deterioration and sudden change of the global environment menaces everything from our living conditions to all life on the planet, and the international struggle to respond has begun.

Countries are responding in different ways to take concrete action, some by making cooperative efforts to avoid irreversible damages, and others by steadily promoting the common recognition of global warming. The difficulty of achieving domestic and international consensus to base actual responses to global warming is due to the scientific uncertainties in global warming. Therefore it is necessary to advance monitoring, observation and analysis to reduce uncertainties about global warming in order to devise appropriate responses based on scientific knowledge. Recognizing this, the Center for Global Environmental Research promoted this Workshop.


The goal of the Workshop was to chart the fundamental course for global warming research in the Asian and Pacific Region and discuss the possibility of Japanese cooperation and collaboration. I appreciate the effort all the participants made in attending the Workshop and sharing information.

The Workshop was conducted under the budget for Feasibility Studies of the Global Environment Research Program of the Japan Environment Agency. The Workshop was in response to the Japanese Government's "Action Program to Arrest Global Warming," October, 1990, and the success of the "Asian Pacific Seminar on Climate Change", Nagoya, January, 1991.

I hope this Workshop Summary, which was adopted by the participants, will be included in the Japanese Environment Agency's Global Environment Research Program, and will usefully promote the ongoing and future global environmental research in the Asian and Pacific Region.

This Center was established on October 1, 1990 with the aim of contributing broadly to the study and monitoring of the global environment. Heeding international cooperation to advance interdisciplinary and cross-ministerial research, the Center plans to continuously broaden international cooperation.

Atsunobu Ichikawa  
Executive Director  
Center for Global Environmental Research  
National Institute for Environmental Studies



**SUMMARY  
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ON GLOBAL WARMING RESEARCH**

March 18 to 20, 1991  
Center for Global Environmental Research  
National Institute for Environmental Studies  
Tsukuba, Japan

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## 1. Executive Summary

This Workshop was planned in order to contribute to the international efforts for understanding and responding to the risks of climate change. Research is crucial for reducing uncertainties in the causes and nature of climate change, for estimating the impacts of climate change, and for evaluating response strategies. In the past few years there have been over 100 conferences devoted to the topic of global climate change. What could this Workshop specifically contribute?

The timing of the Workshop followed the achievement of general scientific consensus on the prospects for global warming and consequent human and environmental impacts. (See, for example, the assessments published by the IPCC at the Second World Climate Conference, November, 1990.<sup>1</sup>) As countries in the Asian region are preparing for the Eco-Asia Ministerial Conference (Tokyo, July, 1991), and further for the 1992 world environment conference in Brazil, UNCED,<sup>2</sup> **this Workshop is important in proposing research goals for regional cooperation.**

The causes and impacts of climate change are widely distributed. No one country will uniformly benefit. Some countries such as small island nations are likely to be hurt severely. Other countries may benefit in some localities and be hurt in others. Because of the international nature of climate change, responses to the problem — both by reducing the rate of increase of greenhouse gases, and/or adapting to the impacts of climate change — require regional and international collaboration. The Asian and Pacific Workshop on Global Warming Research has prepared a list of desired research and recommended arrangements for research cooperation, in particular, in the Asian-Pacific Region.

### **Recommended research tasks** include:

urgently,

- (1) the development of emission inventories of greenhouse gases, and
- (2) the preparation of impact and response assessments of climate change, for example, of coastal zone changes; and

importantly,

- (3) the monitoring of climate change, and
- (4) the development of policy and technology assessment tools.

### **Recommended research arrangements** include:

- (1) the preparation of general agreements on sharing research data within countries in the region,
- (2) the establishment of networks of cooperation,
- (3) the promotion of funding, and
- (4) follow-up technical workshops to promote the research tasks outlined herein.

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<sup>1</sup> IPCC: Intergovernmental Panel on Climate Change, coordinated by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). The bibliography lists their reports.

<sup>2</sup> UNCED: United Nations Conference on Environment and Development, June 1992, Brazil.

## **2. Overview of the Workshop**

### **2.1 Objectives**

One objective of this workshop was to prepare a plan for cooperative research action on global warming among Asian and Pacific countries. Researchers from East and Southeast Asia were invited to exchange information and to discuss a framework for international research cooperation and the possibility of Japanese and international aid for supporting research cooperation.

The Workshop also advanced Japan's "Action Program to Arrest Global Warming" launched by the Council of Ministers in 1990. The Workshop specifically recognized the research results of recent years presented at The Asian-Pacific Seminar on Climate Change held at Nagoya in January 1991, and recommended plans for further progress.

Another objective of the workshop was to investigate the feasibility for practical cooperative research projects on Global Warming Studies in the Asian and Pacific Region, to be funded by Japan's budget for Global Environmental Research and other available funds from the fiscal year 1991 and future budgets.

### **2.2 Participants**

The Asian and Pacific Workshop on Global Warming was held from March 18 to 20, 1991 at the Center for Global Environmental Research, National Institute for Environmental Studies in Tsukuba City, Japan. Among the fifty participants of this workshop were guest researchers from six Asian countries (Bangladesh, China, India, Indonesia, Republic of Korea, and Thailand) and one international assistance organization (the Asian Development Bank, ADB). In addition, relevant researchers and observers from Japanese Institutes were invited to attend. A list of participants and addresses is included in the Appendix.

### **2.3 Workshop Sponsor**

This workshop was conducted as part of the budget for Feasibility Studies under the Global Environmental Research Program of the Japanese Environment Agency and was hosted by the Center for Global Environmental Research of the National Institute for Environmental Studies, in Tsukuba.

### **3. Role and Responsibility of the Asian and Pacific Region on Global Environmental Conservation**

The Asian and Pacific countries should take the initiative on research subjects such as: (a) the understanding of climate change mechanisms, and the monitoring of climate, sea level and the greenhouse gas (GHG<sup>3</sup>) concentration; (b) the environmental impact of climate change; and (c) the development of adaptive technical and other policy measures to reduce the adverse impacts of climate change, and to limit the emissions of GHGs; etc. The reasons are as follows:

- Though per capita emissions of GHGs and economic activities differ widely among countries in the region, the Asian and Pacific nations contain more than half the earth's population and currently produce almost one third of global greenhouse gas emissions. With its growing population and rapid economic growth, the Asian and Pacific region is a key agent contributing to the effects of climate change.

- Regional climate phenomena such as monsoons, the El Niño Southern Oscillation (ENSO), and tropical cyclones determine weather and other agricultural conditions in the region, and affect the global climate. Research is needed on how these regional climate phenomena will change with global warming. For example, will storm intensity and frequency increase? Will some regions suffer more severe and more frequent droughts? Will some regions be flooded by increased rainfall?

- Climate change and its associated sea level rise could have severe adverse impacts on many Asian and Pacific countries, especially on small island nations and low lying areas. Effects could include coastal inundation, decrease of agricultural production and harm to human health.

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<sup>3</sup> GHGs: Greenhouse gases, the gases that, as they increase in concentration in the atmosphere, cause the lower atmosphere to warm. The major GHGs are: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), CFCs (chloro-fluoro-carbons, the substances which destroy the stratospheric ozone layer and which have been banned by the Montreal Protocol, 1987), water vapor, and nitrous oxide (N<sub>2</sub>O).

#### **4. Research Tasks**

The research tasks discussed are presented here in the categories used by the IPCC (Intergovernmental Panel on Climate Change). Research for the IPCC was divided into three working groups:

- Working Group I: the scientific assessment of climate change;
- Working Group II: the environmental and socio-economic impacts of climate change (on water cycles, agriculture, forestry, sea level, industry, etc.)
- Working Group III: the responses to the risks of climate change (reducing emissions; adapting to change; etc.)

The IPCC recommended several types of studies. In particular, studies were recommended of certain climate processes that are not well understood, of emissions levels in various countries, of impacts in vulnerable regions, and possible responses at national and regional levels.<sup>4</sup>

The Workshop prepared a sample list of research projects that have already been done or are underway in countries in the Asian region. The subject area of global warming is vast, and accordingly the list includes research projects that are not confined narrowly to global warming. A list was also prepared of research projects that are especially desired in individual countries and among countries in the region.

The discussion of coordinated research led to the need for common methodologies for research. The development and dissemination of common research methodologies is also emphasized under each category below.

As common sense would dictate, some of the research projects may properly be included in more than one category. However, for brevity, they are listed only once. Moreover, this list is merely illustrative.<sup>5</sup> An ongoing well-funded research program would, as a matter of course, extend this list in depth and breadth.

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<sup>4</sup> Please refer to the IPCC Reports published recently and listed in the Appendix.

<sup>5</sup> There is not space in this document to list all of the research projects underway or planned in each of the countries. For ongoing studies, the countries involved are listed after the project. For proposed studies, the countries involved are listed in footnotes, where appropriate. Global warming research projects coordinated by the Japanese Environment Agency are listed in more detail in the Appendix.



#### 4.1 Scientific Assessments of the Greenhouse Effect

##### 4.1.1 National Studies

###### Ongoing studies:

- Studies of climate modeling at a regional level
- Studies of the relationships between regional climate phenomena and climate variability
- Sea level change research and monitoring (Indonesia, Japan)
- Field experiments on the methane emission from paddy fields (China, India, Japan)

###### Proposed studies:

- Emission assessments of GHGs.
- Medium and short-term program for global warming research<sup>6</sup>
- Plans to establish a baseline air pollution monitoring station<sup>7</sup>
- Study on the relationships between forest destruction and global warming by remote sensing techniques and field data<sup>8</sup>

##### 4.1.2 Joint or Regional Studies

###### Ongoing studies:

- Environmental considerations in energy development (ADB<sup>9</sup>. This actually has been completed.
- Study on CO<sub>2</sub> Fixation of Tropical Trees (Thailand)
- Cooperative research program on the change of tropical forests and their influences (Thailand)
- Global environmental monitoring (ground, ocean, and satellite-based monitoring) (Japan)
- Hydrological patterns in an arid region in China (Japan & China)
- Remote sensing of vegetation coverage in Thailand (Japan & Thailand)
- Natural resource accounting in Asian and Pacific countries (Japan)

###### Proposed studies:

- Emission of GHGs and their monitoring; especially the evaluation of CO<sub>2</sub> from fossil fuels, biomass, and land transformation; and CH<sub>4</sub> from livestock and rice paddy fields
- Monitoring of temperature and sea level rise; evaluation of the past data and continuous monitoring towards the future
- Climate modeling for the Asian and Pacific region

##### 4.1.3 Recommended Methodologies for Scientific Assessments of Climate Change

- Development of land, sea, and satellite based monitoring techniques
- Climate modeling

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<sup>6</sup> Proposed by researchers in Korea.

<sup>7</sup> Proposed by researchers in Korea

<sup>8</sup> Proposed by researchers in Thailand

<sup>9</sup> ADB: Asian Development Bank

## 4.2 Impacts of Climate Change

### 4.2.1 National Studies

#### Ongoing studies:

- The study of climate change related to socio-economic impact (three watershed areas, Indonesia)
- Report on the possible impact of climate change on China's environment (China)
- Flooding, impact and implications (Flood Action Plan, Bangladesh)
- Sea level rise and its impact (Bangladesh)
- Long-term assessment of emissions from energy use (Thailand)
- Estimation of coastal areas threatened by sea level rise (India, Thailand)
- Impact on ground water reservoir due to salt water intrusion (India, Thailand)
- Estimation of coastal erosion and degradation and possible consequences on coastal waterways and beaches (India)

#### Proposed studies:

- Research in relation to the impact of climate change and ozone layer depletion on human health<sup>10</sup>
- Effect of global warming on the flowering of economically important plants and on bio-diversity<sup>11</sup>

### 4.2.2 Joint or Regional Studies

#### Proposed studies:

- Impacts of global warming on hydrology
- Impact upon land use, including agriculture, coastal management, industrial siting, human settlement, etc.
- Health impacts of heat stress, vector borne disease, and other hazards in China<sup>12</sup>
- Potential sea level rise and associated impacts<sup>13</sup>
- Socio-economic studies of impacts of climate change
- Ecosystem and biodiversity impacts in tropical regions
- Integrated impact studies, both regional and country specific (ADB)

### 4.2.3 Recommended Methodologies for Impact Assessments

- Use of common scenarios, such as those used by the IPCC studies, to begin with
- The use of the *adjunct question* for assessing vulnerability<sup>14</sup>
- A set of methodologies for common use as recommended by IPCC

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<sup>10</sup> Proposed by researchers in Indonesia.

<sup>11</sup> Proposed by researchers in Thailand.

<sup>12</sup> Proposed initially for cooperation between Japan and China, and open for cooperation with others, by the National Institute of Environmental Studies (NIES) of Japan.

<sup>13</sup> Proposed in Japan by NIES researchers to be conducted jointly with other researchers from other countries.

<sup>14</sup> By the "adjunct question", Prof. M. Parry refers to studies that examine what climate change would be necessary to cause a certain effect. For example, how much would extreme storms or floods have to increase before building codes would be obsolete.

### 4.3 Responses to the risks of climate change

#### 4.3.1 National Level Studies

##### Ongoing studies:

- The preparation of a National Strategy on Global Climate Change (Thailand)
- Assessment of wastes and biomass fuels for energy conversion and cogeneration (Thailand)
- Social aspects of the widespread use of efficient cookstoves (Bangladesh, India, Thailand)
- The Protecting Forest Belt Project in the Coastal Zones (China)

##### Proposed studies:

- Limitation strategies for GHG emissions<sup>15</sup>
- Improved design and technology and use of cookstoves (biomass; lignite bricks)
- Other studies as listed in the IPCC report on response strategies<sup>16</sup>

#### 4.3.2 Joint or Regional Studies

##### Ongoing studies:

- Major study on natural resource use and management and regional cooperation in water resource development (Bangladesh, India, Nepal)

##### Proposed studies:

- Forest management (deforestation and afforestation)
- Evaluation of afforestation schemes (e.g. social forestry; financial incentives, etc.)
- Energy strategies, particularly of efficiency investments and demand-side policies
- Appropriate technology for Asian and Pacific countries (biomass, hydropower, etc.)
- Assessment of policy options by developing integrated modeling (Asian Integrated Model)<sup>17</sup>
- Studies to rationalize coal use and increase combustion efficiency<sup>18</sup>
- Technology assessments for effective technology transfer<sup>19</sup>

#### 4.3.3 Recommended Methodologies for Assessing Response Strategies

- Integrated model for policy assessment (for example, the AIM model)
- Energy-economy-environment models
- Negotiation simulations

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<sup>15</sup> Proposed by researchers in India

<sup>16</sup> See the Appendix for the reference.

<sup>17</sup> For example, in Japan this is proposed by researchers in NIES.

<sup>18</sup> For example, this was proposed by a participant from China

<sup>19</sup> For example, in Japan this is proposed by researchers in NIES.

## 5. Means for Cooperation

Participants in the Workshop presented and discussed various research organizations that would be suitable for engaging in cooperative research. Wishes of researchers include opportunities for the exchange of researchers, improvement of facilities, and funding arrangements.

### 5.1 Institutions and Organizations for Cooperative Research

#### 5.1.1 Institutional background for cooperation in each country:

Each country has its own institutions that shape the means for international cooperation. With some countries, research cooperation must be conducted on a direct government-to-government basis. In other countries, semi-private and private institutions may be able to arrange research cooperation directly. It is important to recognize the institutional variety and respond in sensitive ways.<sup>20</sup>

A partial list of research institutions is included in the papers presented during the Workshop.

For example, comments about institutional arrangements in various countries were mentioned.

- Independent and non-governmental institutions may be better able to engage in cooperative research and maintain high quality research standards in some countries.
- Multilateral development banks appear to be able to obtain information often more easily than non-governmental or governmental research institutes in some countries. What one agency considers public, another agency often will consider confidential.
- In several countries, the research community has only recently become aware of the importance of climate change. Research funding by governmental agencies will accelerate in the next year. Due to limited funds, foreign research funding support is desired.
- Many countries consider much geographic data confidential. This is an important consideration in promoting studies of coastal changes due to sea level rise.
- In Japan, mechanisms at various levels could be used, for example development assistance (ODA) at the government-level or specific programs of government agencies, for funding overseas research facilities. However, there is not yet a specific governmental program for funding overseas research on global climate change.

In general, there appears to be a need for governments and aid organizations to cooperate in establishing general frameworks or protocols for cooperative research under which research organizations could freely communicate with colleagues in other countries.

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<sup>20</sup> A partial list of research institutions is included in the papers presented during the Workshop.

### 5.1.2 Forms of Cooperation

Forms of cooperation that were recommended include:

- information exchange (preparation of research data for climate modeling, impact assessment, and policy evaluation modeling, and research results)
- technical assistance and technology transfer
- exchange of experts
- improvement and provision of common facilities, such as computers, monitoring equipment, and models
- follow-up technical workshops.

At Japan's Center for Global Environmental Research, time on the super-computer that is to be acquired may be provided to interested researchers in Asia. Where ocean research vessels and air monitoring aircraft are used, researchers from other countries would certainly be invited to participate.

Participants mentioned several existing research programs underway internationally and in the region. These research efforts need to be summarized and information should be made easily available in some place that can act as a central clearinghouse, so that research can build cumulatively and duplication of research is avoided where possible.

### 5.2 Financial Mechanisms

The necessity of additional funding was stressed in order to strengthen existing institutions and to introduce new programs without impairing existing programs. New funds should be developed. Suggested sources of funds are as follows:

- Multilateral aid organizations (World Bank, ADB)
- Global Environmental Facility (UNEP, World Bank, UNDP)
- Bilateral aid organizations (e.g. JICA; other)
- Japanese government agencies
- Private organizations/foundations

### 5.3 Ongoing Communication and Future Coordination

For the purpose of promoting cooperative projects and exchanging information, it was suggested that researchers continue personal contact made through this and other conferences and research.

It would be worthwhile if such informal networking could be extended in the future in stages. For the present, the Center for Global Environment Research will help researchers that seek contacts for collaborative research to make contact with relevant institutes and individual researchers in Japan and in other Asian and Pacific countries.

One stage might be to establish an electronic mail network and library for Asian researchers on global environmental change.

Further stages of research networking that should be promoted include new centers for global environmental research in developing countries, as recommended by international scientific programs such as the IGBP.<sup>21</sup> Such centers would, among other tasks, serve as libraries and documentation centers, and research funding centers.

Ongoing research cooperation is encouraged with international research programs such as the IGBP (International Geosphere-Biosphere Programme), the WCRP (World Climate Research Programme) and the WCIP (World Climate Impact Programme).

Japan expressed willingness to secure funds, coordinate and publish, and to collaborate to establish a research structure if there are assurances that other countries will also cooperate. This suggestion was welcomed by the conference.

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<sup>21</sup> IGBP: International Geosphere-Biosphere Programme. This program is the child of the International Geophysical Year, 1957, and subsequent international scientific programs to coordinate global-scale research about planet Earth.

## **6. Summary of Proposed Action**

The Workshop recommends immediate research on a number of tasks. One high priority task would be to establish systems for emissions accounting of GHGs in each country, with data prepared in a manner that could be audited and shared internationally.

In order to share data, policies should be established in each country authorizing a framework for sharing data needed for collaborative studies of this sort. It is understood that some data may be unavailable at first, however, the general principle of sharing data should be established as a general rule, where possible. Specific use of the data will be in the development of common policy assessment tools, such as the Asian Integrated Model (AIM).

Cooperative studies on a bilateral level that have already occurred have laid a good foundation of trust for ongoing research cooperation. The developments planned for the future should build on this foundation in a more systematic manner so as to use personnel and funding in as effective a manner as possible avoiding unnecessary duplication of research.

At a research organization level, international collaboration will require the strengthening of networks of scientists and researchers. National and international conferences will contribute to this. The Workshop noted the important efforts of those countries represented at the Workshop which have hosted regional and international conferences.

As the IGBP recommended, there is a need for regional scientific research centers in developing countries to enhance research capabilities and cooperation. The Japanese CGER may serve as a clearinghouse for research cooperation in the near term. In the long term, other regional research institutions will need to be enhanced or created to supplement the activities of Japan's CGER.

When planning new research programs, it is important to pay attention to methods to ensure quality research results. This is particularly important in international cooperative research where results of similar studies may need to be compared.

At a research support level, the Workshop recognized the importance for industrialized countries to contribute research support to collaborative research efforts. Specifically, participants sought a mechanism for funding international research in an open and liberal manner. In the future next decade or two, contributions may need to be pooled from various countries for supporting joint research projects. Countries should consider establishing the institutional structure to enable this sort of support of international cooperative research.

These recommendations should be pursued by a series of technical workshops, for example to collect and share data for the development of common assessment tools.

## APPENDICES

### WORKSHOP PROGRAM

#### 18 March, 1991 (Monday)

10:00-10:55 Opening Ceremony (Chairman, Dr. Shuzo Nishioka)

10:05- Opening Address  
Dr. Atsunobu Ichikawa,  
Executive Director,  
Center for Global Environment Research

10:15- Introduction to Japan's Action Plan on Global Warming  
Mr. Takashi Iijima, Director,  
Research and Information Office,  
Global Environment Department, Environment Agency

10:35- Statement  
Mr. Neil R. Collier  
Deputy Director, Infrastructure Department,  
Asian Development Bank

10:55-11:50 Introduction and Overview  
Dr. Shuzo Nishioka  
Director,  
Center for Global Environment Research

11:50-13:15 (Lunch)

13:15-17:10 Presentations of Country Reports

Dr. M.Asaduzzaman	Bangladesh
Prof. Ye Ruqiu	China
Ms. Sujata Gupta	India
Dr. Sutarnihardja Tjang Mushadji	Indonesia
Mr. Ir. Sutrisno	"
Mr. Deok-Gil Rhee	Korea
Dr. Darasri Downreang	Thailand
Prof. Prida Wibulswas	"

Discussion

17:30-20:00 Reception  
Restaurant L'ambrosie do Kagetsuroh, Tsukuba

#### 19 March, 1991 (Tuesday)

9:00-12:10 Reports on Japanese Global Warming Research  
Chairman's Introduction (Dr. Shuzo Nishioka)

Dr. Hiroshi Bandow  
Dr. Shigeki Mitsumoto  
Dr. Tsuneyuki Morita  
Dr. Atsushi Tsunekawa  
Dr. Mitsuru Ando  
Dr. Nobuo Mimura  
Dr. Hiroshi Shimizu  
Dr. Gen Inoue  
Dr. Yoshifumi Yasuoka  
Mr. Yuichi Moriguchi  
Dr. Kazuo Watanabe



- 12:10-13:15 (Lunch)
- 13:15-17:00 Discussion (Chairman, Prof. Hidefumi Imura)  
Framework for International Cooperation on Global Warming Research
- 18:00-20:00 Drafting Committee  
Tsukuba Dai-ichi Hotel

**20 March, 1991 (Wednesday)**

- 9:00-10:00 Activity at the National Institute for Environmental Studies
- 10:00-11:40 Workshop Summary  
Discussion on Workshop Summary Draft  
Adoption of Workshop Summary
- 11:40-11:45 Closing Address  
Dr. Akira Koizumi  
Director General  
National Institute for Environmental Studies
- 11:50-13:00 (Lunch)
- 13:30- (Microbus start for the JICA International Center)

## **B. Useful and Recent Bibliography and Sources of Information**

1. Intergovernmental Panel on Climate Change (IPCC), 1990, *Climate change: The IPCC scientific assessment*, Cambridge, Cambridge University Press (for the World Meteorological Organization and the United Nations Environment Programme IPCC) 362 p.
2. Intergovernmental Panel on Climate Change (IPCC), 1990, *Climate change: The IPCC assessments*, Canberra, Australian Government Publishing Service (for the World Meteorological Organization and the United Nations Environment Programme IPCC).
3. Intergovernmental Panel on Climate Change (IPCC), 1990, *Climate change: The IPCC, Response Strategies*, The World Meteorological Organization and the United Nations Environment Programme . 270p.
4. Boden, Thomas A., Paul Kanciruk and Michael P. Farrell, ed., 1990, *Trends '90: A compendium of data on global change*, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6335, USA. 257p. ORNL/CDIAC-36. (This is a very useful collection of data from major research groups worldwide, presented in a way that is easy to use, with good references. The data is also available on magnetic tape.)
5. *Glossary: Carbon Dioxide and Climate, (Third Edition)* 1990, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6335, USA. 59p. ORNL/CDIAC-39. (An extensive collection of scientific and non-technical terms, references, tables and conversion factors especially helpful for international collaborative work.)
6. Handel, Mark David and James S. Risbey, 1990. "An annotated bibliography on greenhouse effect change." Center for Global Change Science, Massachusetts Institute of Technology. (This seems to be the best annotated bibliography available on the greenhouse effect. It is available for free by writing the above center at MIT, Cambridge, Massachusetts 02139, USA.)

## Appendix C

## LIST OF PARTICIPANTS

### BANGLADESH

Dr. M. Asaduzzaman  
Senior Research Fellow  
Bangladesh Institute of Development Studies  
E-17 Agargaon Shere Bangla Nagar G.P.O  
Box 3854 Dhaka, BANGLADESH  
Tel: 880-2-318617 (office)  
880-2-319883 (residence)  
Fax: 880-2-813023  
Cable : BIDECON

### CHINA

Prof. Ye Ruqiu  
Deputy Director  
National Environmental Protection Agency  
Foreign Affairs Office  
115 Xizhimennei Nanxiaoje  
Beijing 100035, CHINA  
Tel: 86-1-601-1194 (office)  
86-1-602-4553 (office)  
86-1-422-6206 (home)  
Fax: 86-1-601-1194  
Telex : 222359 NEPA CN

Mr. Wu Baozhong  
Director  
Division of Air Pollution Control, China  
National Environmental Protection Agency  
115 Xizhimennei Nanxiaoje  
Beijing 100035, CHINA  
Tel: 86-1-601-2120  
Fax: 86-1-601-1194  
Telex : 222359 NEPA CN

### INDIA

Ms Sujata Gupta  
Research Associate  
TATA Energy Research Institute  
7, Jor Bagh, New Delhi-110003, INDIA  
Tel: 615032,690503 (office)  
Telex : 31-61593 TERI IN  
Fax: 91-114-621770  
Cable : TERINST 110003

### INDONESIA

Dr. Sutamihaudja Tjang Mushadji  
Deputy Assistant Minister II  
Division of Natural Resources (M.G.T)  
Ministry of Population and Environment  
Jalan Merdeka Barat  
No.15B Jakarta Pusat, INDONESIA  
Tel: 62-21-374307  
Fax: 62-21-3802183

Mr. Ir. Sutrisno  
Chief of Sub-Department for Climate Analysis  
Indonesia Meteorological and Geophysical  
Agency (BMG)  
Jalan Pemancar No.7 Rt. 03/Rw. 06  
Pondok Betung-Tangerang 15225, INDONESIA  
Tel: 62-21-375508, ext.378  
Fax: 62-21-3107788  
Telex : 45331 METEO JKT

### KOREA

Mr. Deok-Gil Rhee  
Director, Atmospheric Physics  
National Institute of Environmental Research  
Seoul, KOREA  
Tel: 82-2-385-5711-20 ext.610  
Fax: 82-2-357-6188

### THAILAND

Dr. Darasri Downreang  
Chief, Data Analysis Section  
Remote Sensing Division  
National Research Council of Thailand  
196 Phahonyo-thin Road, Bangkok  
Bangkok 10900, THAILAND  
Tel: 66-2-579-0733  
66-2-579-0345  
Fax: 66-2-326-9150  
Telex : 82213 WARECOU

Prof. Prida Wibulswas  
School of Energy and Materials  
King Mongkut's Institute of Technology  
Thonburi Bangmod, Bangkok 10140  
THAILAND  
Tel: 66-2-427-8094  
Fax: 66-2-427-8077

### ASIAN DEVELOPMENT BANK (ADB)

Mr. Neil R. Collier  
Deputy Director, Infrastructure Department  
Asian Development Bank  
6 ADB Avenue, Mandaluyong  
Metro Manila, PHILIPPINES  
Tel: 63-2-6781 (office)  
Fax: 63-2-631-6816  
Telex : 29066 ADB PH  
40571 ADB PM  
Cable : ASIANBANK MANILA

## JAPAN

Prof. Yoshikazu Ikura  
Department of Mathematics/Physics  
Faculty of Engineering  
Iwate University  
4-3-5 Ueda, Morioka, Iwate, 020, JAPAN  
Tel: 0196-23-5171  
Fax: 0196-25-7222

Prof. Hidefumi Imura  
Institute for Environmental Systems  
Kyushu University  
6-10-1 Hakozaki, Higashi-ku,  
Fukuoka, 812, JAPAN  
Tel: 092-641-1101

Dr. Yuzo Suga  
Associate Professor  
Hiroshima Institute of Technology  
Department of Civil Engineering  
2-1-1, Miyake, Saeki-ku,  
Hiroshima, 731-51, JAPAN  
Tel: 0829-21-3121, ext.425  
Fax: 0829-23-6694

Prof. Toshiharu Suzuki  
Faculty of Economics  
Nagoya Economics University  
61-1, Uchikubo, Inuyama-shi,  
Aichi-ken, 484, JAPAN  
Tel: 0568-67-0511  
Fax: 0568-67-4299

Dr. Kaoru Takara  
Associate Professor  
Department of Civil Engineering  
Gifu University  
1-1, Yanagido,  
Gifu, 501-11, JAPAN  
Tel: 0582-30-1111, ext.4194  
Fax: 0582-30-1891

Dr. Nobuo Mimura  
Associate Professor  
Department of Urban and Civil Engineering  
Faculty of Engineering  
Ibaraki University  
Nakanarusawa 4-12-1  
Hitachi Ibaraki 316, JAPAN  
Tel: 0294-35-6101, ext.443  
Fax: 0294-35-8146

Prof. Masatoshi Yoshino  
Institute of Geoscience  
University of Tsukuba  
Ibaraki, JAPAN 305  
Tel: 0298-53-4308  
Fax: 0298-51-9764  
Telex : 3652580 UNTUKU'3  
Cable : UNTUKU TSUCHIURA

Dr. Seijiro Ihara  
Head  
Energy and Information Science Section  
Electrotechnical Laboratory  
Umezono 1-1-4, Tsukuba  
Ibaraki 305, JAPAN  
Tel: 0298-54-5411  
Fax: 0298-38-8199

Dr. Tatsuji Tokioka  
Meteorological Research Institute  
1-1 Nagamine, Tsukuba  
Ibaraki, 305, JAPAN  
Tel: 0298-51-7111  
Fax: 0298-51-1449

Dr. Haruo Tsuruta  
National Institute of Agro-Environmental  
Sciences  
Ministry of Agriculture, Forestry & Fisheries  
3-1-1 Kannondai Tsukuba,  
Ibaraki, 305, JAPAN  
Tel: 0298-38-8276  
Fax: 0298-38-8199

Mr. Junichi Yoshitani  
Hydrology Division  
Public Works Research Institute  
Ministry of Construction  
1 Asahi, Tsukuba  
Ibaraki, 305 JAPAN  
Tel: 0298-64-2211  
Fax: 0298-64-2840  
Telex : 3652-574 PWRIMC J

Dr. Shuji Yamakawa  
Division of Changing Earth and Agro-  
Environment  
National Institute of Agro-Environmental  
Sciences  
Ministry of Agriculture, Forestry, & Fisheries  
3-1-1 Kannondai, Tsukuba  
Ibaraki, 305, JAPAN  
Tel: 0298-38-8356

Japan Environment Agency (JEA)  
2-1-1, Kasumigaseki, Chiyoda-ku  
Tokyo, 100, Japan  
Tel: 81-3-3581-3351

Mr. Takashi Iijima  
Director, Research and Information Office  
Global Environment Department

Mr. Kazuya Asada  
Global Environment Department

Mr. Yasuo Takahashi  
Global Environment Department

National Institute for Environmental Studies  
(NIES)  
Japan Environment Agency  
16-2, Onogawa, Tsukuba-shi,  
Ibaraki, 305, JAPAN  
Tel: 81-298-51-6111  
Fax: 81-298-51-4732

Dr. Akira Koizumi  
Director General, NIES

Center for Global Environmental Research  
(CGER)  
Tel: 81-298-51-6111 ext.374, 383  
Fax: 81-298-58-2645

Dr. Atsunobu Ichikawa  
Executive Director, NIES  
Deputy Director General, NIES

Dr. Shuzo Nishioka  
Director, CGER

Dr. Gen Inoue, CGER

Dr. Kazuo Watanabe  
Research Coordinator, NIES

Dr. Hiroshi Bandow  
Global Environment Division, NIES

Dr. Tsuneyuki Morita  
Global Environment Division, NIES

Dr. Mikiko Kainuma  
Global Environment Division, NIES

Mrs. Keiko Masuda  
Global Environment Division, NIES

Dr. Mitsuru Ando  
Regional Environment Division, NIES

Dr. Hiroshi Shimizu  
Regional Environment Division, NIES

Mr. Yuichi Moriguchi  
Regional Environment Division, NIES

Dr. Yoshifumi Yasuoka  
Social & Environmental Systems  
Division, NIES

Dr. Shigeki Mitsumoto  
Atmospheric Environment Division,  
NIES

Dr. Atsushi Tsunekawa  
Water & Soil Environment Division,  
NIES

Secretariat  
Mr. Shinichi Araki  
CGER

Mr. Takao Ohashi  
CGER

Mr. Peter J. Poole  
Center for International Studies  
Massachusetts Institute of  
Technology, Cambridge, MA, USA

Cooperation  
Pacific Consultants Co., Ltd.  
Environment Division  
7-5, Sekido 1 Chome,  
Tama-shi, Tokyo-206, JAPAN  
Tel: 0423-72-6310  
Fax: 0423-72-6349  
Telex : J26832  
Cable : CONSPAC TOKYO

Mr. Hidemi Fujimori

Mr. Masashi Hattori

Mr. Osamu Isoda

Mr. Kazuhito Yamada

Ms Mariko Fujimori

## **Appendix D.**

### **List of Research Projects on Climate Change Underway or Proposed that are Coordinated by the Japan Environment Agency**

This list is divided into the three categories of projects used by the IPCC, namely, Scientific Assessments (1.1-1.8), Environmental and Socio-Economic Impact Assessments (2.1-2.5), and Assessment of Response Strategies (3.1).

#### **1 Scientific Assessments of Climate Change**

##### **1.1 Evaluation of temporal and spatial variability of greenhouse gases**

###### **Acting Organizations**

National Institute for Environmental Studies (Environment Agency [JEA])  
National Institute for Pollution and Resources (Ministry of International Trade and Industry [MITI])

###### **Research Needs**

In order to develop highly reliable models for prediction of global warming, there is a need to grasp and clarify the dynamics of temporal and spatial changes in GHGs.

###### **Project Outline**

Fact-finding surveys on the generation of carbon dioxides and CFCs which originate from industrial activities, and surveys on the concentration and flux distribution using aircraft and ground monitoring, and systematic and elaborate field surveys will be performed on reactive GHGs such as CH<sub>4</sub>, non-methane hydrocarbons (NMHC), etc., will be performed.

##### **1.2 Clarification of the sources and emissions of CH<sub>4</sub> and N<sub>2</sub>O**

###### **Acting Organizations**

Institute of Public Health (Ministry of Health and Welfare [MHW])  
National Institute for Environmental Studies (JEA)  
National Institute of Agro-Environmental Sciences (Ministry of Agriculture, Forestry and Fisheries [MAFF])  
National Institute of Animal Industry (MAFF)  
National Grassland Research Institute (MAFF)  
National Research Institute for Pollution and Resources (MITI)  
Public Works Research Institute (Ministry of Construction [MoC])

###### **Research Needs**

The concentration of methane and nitrous oxide, which are GHGs, have sharply increased. Therefore, it is necessary to clarify the sources and emissions of CH<sub>4</sub> and N<sub>2</sub>O from human activities to predict global warming.

###### **Project Outline**

Field survey or modeling will be done in order to clarify the CH<sub>4</sub> and N<sub>2</sub>O emissions from waste disposal, biomass burning, agriculture, livestock, industrial activities, semi-closed water areas, and sewage treatment plants.

##### **1.3 Precise evaluation of greenhouse effect of CH<sub>4</sub> and N<sub>2</sub>O**

###### **Acting Organization**

Meteorological Research Institute (Ministry of Transport [MoT])

###### **Research Needs**

CH<sub>4</sub>, N<sub>2</sub>O and CFCs have greater greenhouse effects than CO<sub>2</sub>, but the precision of their assessment is not necessarily high. To make better predictions of global warming, there is a need to estimate the greenhouse effect of those molecules.

**Project Outline**

Attempts will be made to work for the development and acceleration of models with which to strictly compute the greenhouse effects of CH<sub>4</sub>, N<sub>2</sub>O and CFCs, and the radiation scheme of GCM model will be improved.

**1.4 Clarification of atmospheric chemistry of GHGs and related compounds**

**Acting Organizations**

National Institute for Environmental Studies (Environment Agency)  
Electrotechnical Laboratory (Ministry of International Trade and Industry)

**Research Needs**

For the estimation of global warming potentials (GWP) which are important parameters for assessing greenhouse effects, one needs to know the lifetime of GHGs in the atmosphere. Therefore, it is necessary to clarify the speed and mechanism of reactions by those gases in the atmosphere.

**Project Outline**

In regard to GHGs and related trace gases in the atmosphere, the mechanism of photochemical reactions in the atmosphere will be clarified, the speed of reactions measured and studies made on the speed of photo dissociation.

**1.5 Evaluation of exchanges of carbon dioxide between the atmosphere and the ocean**

**Acting Organization**

Meteorological Research Institute (Ministry of Transport)

**Research Needs**

Though it is considered that 40% of the total CO<sub>2</sub> released into the atmosphere by the consumption of fossil fuels and other means is absorbed by oceans and plants, no adequate quantitative clarification has been made. Therefore, it is important to quantify the volume absorbed by oceans for the prediction of future climatic changes.

**Project Outline**

The partial-pressure of CO<sub>2</sub> in the air and surface sea water will be measured in the middle/low latitude area of Pacific Ocean, and flux will be quantified along with the findings of indoor experiments

**1.6 Evaluation of the circulation and fixation of carbon in the oceans**

**Acting Organizations**

National Institute for Environmental Studies (JEA)  
Geological Survey Institute (MITI)

**Research Needs**

In order to improve the precision of prediction on global warming, it is necessary to clarify the carbon circulation and the carbon fixation capacity in the ocean which is an important source for the absorption of CO<sub>2</sub> in the atmosphere.

**Project Outline**

The mechanism of CO<sub>2</sub> absorption into the oceans in conjunction with increases in the concentration of CO<sub>2</sub> in the atmosphere will be clarified, and the carbon removed by sinking and sedimentation will be assessed.

## **1.7 Clarification of carbon cycling processes in the terrestrial ecosystem**

### **Acting Organizations**

National Institute of Agro-Environmental Sciences (MAFF)  
National Institute for Environmental Studies (JEA)

### **Research Objective**

As the carbon cycling processes in the terrestrial ecosystem has been significantly affected by brisk human activities in recent years, the balance of carbon is disrupted, and CO<sub>2</sub> is increasing. Therefore, it is necessary to understand quantitatively how the carbon cycle is affected by the change of vegetation and land use which are brought about by human activities, and how the warming in turn affects the carbon cycle.

### **Project Outline**

The carbon cycle in the agricultural ecosystem will be quantitatively analyzed, and impacts of global warming on the carbon cycling processes will be estimated. The balance of carbon in the terrestrial ecosystem will be analyzed and the capacity of vegetation to absorb CO<sub>2</sub> with an increase in the concentration of CO<sub>2</sub> will be estimated.

## **1.8 Clarification of the atmospheric physics of clouds in climate change**

### **Acting Organization**

National Institute for Environmental Studies (JEA)

### **Research Needs**

Global warming will have effects on the generation and distribution of clouds, which will have feed-back effects on global warming itself and human activities through changes of the amount and pattern of precipitation. As there is a significant lack of quantitative knowledge about clouds, it is necessary to comprehensively clarify the optical and dynamic properties of clouds and grasp their global distribution in order to predict climate change more precisely.

### **Project Outline**

Data on the distribution of clouds will be gathered and sorted out and their dynamic correlations analyzed. At the same time, simulation will be done to grasp interactions between cumulus convection and atmospheric circulation.

## **2 Environmental and Socio-Economic Impacts**

### **2.1 Evaluation of the global warming effects on plants**

#### **Acting Organizations**

National Institute for Environmental Studies (JEA)  
Forestry and Forest Products Research Institute (MAFF)

#### **Research Needs**

There is concern about changes in the distribution of vegetation and possible extinction of plant species caused by global warming. Therefore, it is necessary to carry out studies on the prediction of changes in vegetation and survival of plants in conjunction with global warming.

#### **Project Outline**

In regard to plants with the southern limit of distribution, and those in the alpine and alpestrine zones, which are presumably apt to be affected by global warming, attempts will be made to clarify the effects of climate change on plants and the distribution of vegetation and study prediction methods with field surveys, experiments, an analysis of existing information and other measures.



## **2.2 Clarification of effects of sea level rise caused by global warming**

### **Acting Organizations**

Geological Survey of Japan (MITI)  
Port and Harbor Research Institute (MoT)  
Communications Research Laboratory (Ministry of Posts and Telecommunications)  
Geographical Survey Institute (MoC)

### **Research Needs**

There is concern that global warming will result in sea level rise, bringing about significant impacts on the coastal areas. In order to carry out appropriate measures in response to those phenomena, there is a need to precisely monitor the sea level rise and the change in environmental conditions of coastal areas. On the basis of those findings, it is necessary to make a quantitative assessment of the natural, social and economic impacts on the coastal areas.

### **Project Outline**

This subject will focus on following items: development of methodologies to measure sea level rise precisely with geodetic satellites; development of methods to grasp and assess the changes in the environmental conditions of coastal areas with an analysis of the old environment; methods to quantitatively assess the impacts which are produced by changes in external force, such as sea level rise, using topographical and hydrologic surveys and remote sensing technology.

## **2.3 Assessment of the global warming effects on the water balance**

### **Acting Organizations**

Public Works Research Institute (Ministry of Construction)  
Civil Engineering Research Institute, Hokkaido (Hokkaido Development Agency)

### **Research Needs**

It is assumed that global warming will significantly change the pattern of water circulation on the earth. Therefore it is necessary to develop methods to predict the changes in the hydrologic environment of river basins caused by global warming.

### **Project Outline**

Methods for the projection of the volume of evaporation and exhalation in river basins, which incorporate the effects of soil water content and vegetation cover will be developed. Based upon those methods, meteorological and hydrologic models for the basins will be developed. Further, the trends caused in the hydrologic environment of snowy and cold areas by global warming will be projected with runoff models.

## **2.4 Assessment of the effect of global warming on urban environment and its countermeasures**

### **Acting Organization**

National Institute for Environmental Studies (Environment Agency)

### **Research Needs**

In cities where population and various functions are highly concentrated, there is a possibility that a wide variety of impacts will appear with global warming. For this reason, it is necessary to systematically and comprehensively assess how cities are affected by global warming and study effective countermeasures.

### **Project Outline**

The impacts of global warming on the urban energy, water utilization, circulation, air pollution, disaster prevention and infrastructure systems will be comprehensively assessed with a wide variety of models. At the same time, various impacts and the relation between these impacts and the characteristics of urban structure and activity will be clarified. Measures against global warming will be studied.

## **2.5 Evaluation of the effects and the risks of global warming on human health**

### **Acting Organizations**

National Institute for Environmental Studies (Environment Agency)  
Institute of Public Health (Ministry of Health and Welfare)

### **Research Needs**

Global warming is considered to cause direct and indirect impacts on human health. Therefore, it is necessary to clarify and assess health risks of global warming.

### **Project Outline**

In regard to the physiological impacts produced on individuals by global warming and those brought about on the life style and behaviour of social groups, the risks which are currently in existence will be assessed.

## **3 Assessment of Response Strategies**

### **3.1 Evaluation of measures to cope with global warming**

#### **Acting Organizations**

Electrotechnical Laboratory (MITI)  
Construction Research Institute (Ministry of Construction)  
National Institute for Environmental Studies (Environment Agency)  
Institute of Public Health (Ministry of Health and Welfare)  
National Institute of Agro-Environmental Sciences (MAFF)  
Forestry and Forest Products Research Institute (MAFF)

#### **Research Needs**

As for measures to cope with global warming, it is important to develop and disseminate effective technologies. In order to implement them in an appropriate manner, it is necessary to make a full prior assessment of a wide variety of measures and techniques to cope with global warming. Further, the policy options to prevent global warming are broad in range, including energy, forestry, agriculture and waste, and it is necessary to comprehensively predict and evaluate the effects of the introduction and combination of those measures.

#### **Project Outline**

While attempts are made to search for possible technological measures to cope with global warming, systems will be developed to evaluate those technologies from various viewpoints such as effects, technical difficulty, cost, safety, social adaptability, and assessments will be made based on those systems. Further, the development of models will begin to evaluate the change of GHGs emission, global warming phenomena and its environmental, social and economic impacts which will be brought about by introduction and combination of policy options for various areas including energy, forestry, agriculture technology and waste reduction.

## **Appendix E            List of Workshop Papers**

### **I.        Background Papers**

1.     The Asian and Pacific Workshop on Global Warming Research:  
        Overview and introductory materials
2.     The Asian and Pacific Workshop on Global Warming Research:  
        Organizations and institutes concerning global climate change in the Asian and  
        Pacific Region
3.     Summary of the Potential Impacts of Climate Change on Nations in the Asian Pacific  
        Region, (I)
4.     Summary of the Potential Impacts of Climate Change on Nations in the Asian Pacific  
        Region, (II)
5.     Summary of the national committee, governmental organization and institutes  
        concerning global warming in the Asian Pacific Region

### **II.      Country Studies**

1.     Country Reports (I)
  - Bangladesh
  - Peoples' Republic of China
  - India
  - Indonesia
  - Republic of Korea
  - Thailand
2.     Country Reports (2)

Japanese research plans concerning global warming.