Preface

The Kyoto Protocol was finally put into practice on 16 February 2005. Developed countries, including Japan, are now anticipated to reinforce and promote their domestic CO_2 reduction measures by complementarily utilizing Kyoto mechanisms such as emissions trading and the clean development mechanism in order to achieve their reduction goals during the first commitment period (from 2008 to 2012). On the other hand, the impacts of global warming are becoming increasingly apparent all around the world and there is growing concern about these impacts, as exemplified by both the recent frequent occurrences of extreme weather phenomena and the measures taken to adapt to these phenomena. For example, the heat wave that hit Europe in 2003 killed 15,000 people in France; Japan experienced record heat, disastrous rain and 10 typhoon hits in 2004; and gigantic-scale hurricanes occurred one after another in the Caribbean Sea in 2004 and 2005, causing enormous and extensive damage to the United States and neighboring countries. Although the relationship between individual extreme climate phenomena and global warming has yet to be clarified, past studies using climate models suggest that extreme phenomena such as heat waves, devastating rain, typhoons and hurricanes will occur more frequently and their magnitude will become larger as global warming progresses.

Identification of the present situation and prediction of the future effects of global warming, together with scientific knowledge of possible adaptation measures that can be taken to alleviate these effects, are indispensable to the implementation of global warming prevention measures. Because of this, studies of the effects of, and measures for adaptation to, global warming have definitely advanced over the last ten years. However, the scientific symposium "Avoiding Dangerous Climate Change" held in Exeter, UK in February 2005 revealed that global warming is worsening more rapidly than researchers thought and is having some extremely serious effects. This is something that may have been overlooked by researchers and their studies, and therefore further cooperation between climate system and model studies, and effect and adaptation studies is definitely necessary.

As provided in Article 2 of the United Nations Framework Convention on Climate Change, the basic policy for prevention of global warming aims to stabilize both temperatures and greenhouse gas concentrations in the atmosphere. Consequently, we need to judge what constitutes a dangerous rise in temperature and the level of effect that this may have, and we need to judge "What constitutes danger?" in order to decide on a dangerous effect level. Science must always separate itself from politics, and policymakers have been assumed to be responsible for deciding "what constitutes danger." However, in regard to the global warming issue, policymakers should not only be responsible for providing research data on its effects and our possible adaptation strategies, but they should also show us what level of effects is dangerous. To this end, we have an urgent task ahead of us to identify the dangerous effect level by promoting studies of effects and adaptations and integrating the knowledge obtained from individual fields and regions, and furthermore to promote research in cooperation with stakeholders, including policymakers.

For this special issue of *Global Environmental Research*, the latest achievements in research on global warming effects and adaptations have been summarized by front-line researchers. Part I will introduce the latest research developments on future climate forecasting, which are the basis for predictions and assessments of the effects of global warming. Although there is a time lag (1–2 years) when the results of climate model-based prediction are used for studies on effect and adaptation, thanks to the global warming research initiative by the Council for Science and Technology Policy, cooperation between climate model-based studies and effect-related studies has grown increasingly close, and impact studies are now able to use the latest climate-prediction as climate scenarios. In parts II, III and IV, the latest research achievements in effects and adaptations in different fields will be summarized. These fields include ecosystems, agriculture and fisheries, water resources and drought risk. Part V is a summary of the latest studies on the effects on civil life, including human life and an evaluation from an economic point of view, none of which have been studied much so far. Part VI and Part VII summarize adaptation to global warming and studies on the dangerous impacts level and stability concentration, respectively. More advanced studies that will be useful for the prevention of global warming, including ones on dangerous effect levels, are expected to be conducted into effects and adaptations on the basis of accumulated past results.

Hideo Harasawa
National Institute for Environmental Studies