

B-11 Research on evaluation and detection of socio-economic impacts of climate change

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Abstract

Considering the increasing importance of scientific knowledge on impacts of global warming on various fields in Japan for better understanding response strategy, this research aims at 1) reviewing the latest research papers or reports published in terms of global warming impacts in Japan, 2) summarizing the impacts of hot summers in 1994 and 1995, and 3) developing appropriate indices to detect potential impact on socio-economic conditions in the country. The research results are (1) intensive review of the global warming related research in Japan, and the results were published as a report and a book, (2) publication of English report on the potential impacts of global warming in Japan to disseminate Japanese experience to the impact research communities and IPCC third assessment report activities, (3) collection of global warming impacts in Japan and the world and development of indices for detection of global warming impacts, and (4) quantitative assessment of impact's detection using bio-phenological indices and lake water quality data.

Key Words Climate Change, Socio-economic impacts, impacts detection

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) has investigated and reviewed impacts, adaptation, and responses to the climate change, and published the second assessment report in 1995. This report mainly deals with the impacts of global warming in world scale, so there is very limited information on what impacts would occur in Japan. Detailed information about global warming impacts in Japan is necessary for the administrators and the general public to understand cause and impacts of global warming, to realize the importance of the prompt policy response to global warming, and to promote countermeasures to the warming. In addition, IPCC 1995 report stated that global warming induced by human activities has already started based on various facts and observations. From this recognized impacts of global warming detection of such impacts in Japan as well as the world becomes more and more important for adapting warmed climate.

2. Research Objective

Considering the increasing importance of scientific knowledge on impacts of global warming on various fields in Japan for better understanding cause and impacts, response strategy, this research aims at

1) reviewing the latest research publications such as scientific papers or reports published in

terms of global warming impacts in Japan for the past decade,

2) summarizing the impacts on natural ecosystems and socio-economic conditions of hot summers in 1994 and 1995, and

3) developing appropriate indices to detect potential impacts on socio-economic conditions in the country.

In addition, authors intend to contribute to the IPCC work such as Special Report on Regional Impacts and the third Assessment Report by dissemination of reviewed scientific knowledge and participation to these IPCC work as lead authors.

3. Results and discussion

The following are the major research results obtained in the three year research.

(1) Potential impacts of global warming in Japan

Reviewing the past 5 to 10 years' research papers and reports, potential impacts of global warming on various fields in Japan were identified and summarized as a country study report and then it was published as a book for its distribution. Its summary was cited in the second National Communication of Japan which was submitted to the UN Framework Convention of Climate Change just before the COP3. This reviews cover potential impacts on various fields in Japan in the next century. For example, in agricultural crop production, rice production will increase in the Northern Japan, but some decrease in the Western Japan. In total, considering some adaptation technology, total production of rice would not change significantly. But in the case of wheat, great decline of production will be predicted. At present self-sufficiency ratio of food is very low, about 42% by calorie base, so that if global warming affect agricultural regions from which Japan imports vast amounts of food and grain, negative impacts on crop production in such regions has possibility to propagate to Japan. The sectors covered are natural ecosystems, hydrology and water resources, agriculture, forestry, fishery, human settlement, human health and extreme events.

(2) Lessons from the past hot summers: Collection and analysis of the information on hot summers in 1994 and 1995.

The summer in 1994 was the hottest summer that we have ever experienced in Japan, and the following 1995 was also hot summer. The mean temperatures in July, August, and September were about 2.1 degree Centigrade above the normal temperature mean for these months. According to the IPCC scenario, this fact corresponds with conditions of global warming in the end the 21st century. Severe water shortage occurred in various parts the country, and the daily life of citizens was affected in various ways. For such experiences as well as a cold summer/long rain record in 1993 Japan got a chance to concretely consider the effects of climate change on human life. This work clarifies the effects of Japanese hot summers in 1994 and 1995 on human life and we try to quantitatively understand as many as possible. Therefore, we are able to understand some of the concrete warming effects and the research provides us with an indicator for the detection of global warming effects.

(3) Development of indices for detection of global warming impacts

Based on the impact studies and information on hot summers in 1994 and 1995, indices for detection of global warming impacts in various sectors were identified. The detection and monitoring of global warming is becoming important along with detection of climate change. Since natural ecosystems are sensitive and vulnerable to climate change,

some research indicated global warming had already started and have affected natural ecosystems such as flowering of trees. But in case of socio-economic impacts are in general difficult to detect directly, so that emerging of impacts are delayed with comparison to natural ecosystems.

(4) Quantitative assessment of impact's detection using bio-phenological indices

Using the observed bio-phenological data which has been observed by the Meteorological Agency since 1953 to 1996, 44 years, we investigated the possibility of detecting the impacts of global warming. There are 16 plant related items and 11 animal-related items observed in 102 sites. It was shown from a statistical analysis of these bio-phenological data and plotting the results on the map using GIS that bio-phenological items are good indices to detect warming impacts. But there are some differences of sensitivity among plant items and animal items to the warming. In addition, there is a practical problem since there is relatively large numbers of missing data in these data.

(5) Quantitative analysis of lake water and meteorological data

Based on the long-term lake water quality of Lake Kasumigaura which is the second largest lake in Japan and highly eutrophicated and meteorological data (17 years), the relationship between lake water quality and meteorological data was analyzed. A new method of using consecutive 2 years data to eliminating change in rainfall and human activities in the watershed. As a result, 1 degree centigrade increase in atmospheric temperature has proved to affects the lake water quality significantly. In case of COD, 1 ppm increase in its concentration is induced by a 1 degree air temperature increase. From this analysis, the water quality of Lake Kasumigaura will be influenced by future possible global warming as well as pollution inputs from its watershed.

4. Future research needs

The following research are identified for further understanding of the potential impacts and its detection in Japan.

- 1) Collection and reviews of Impacts and its detection research in Japan and the world
- 2) Quantification of sensitivity and vulnerability of various sectors especially socio-economic sectors
- 3) Summarize and accumulate adaptation strategy, technology and institutions for warming climate
- 4) Cost evaluation of such adaptation strategy in comparison with mitigation strategy

Publications in English

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