Drawing Storylines of Extraordinal Weather Phenomena around Japan for an Impact Assessment of the Climate Change

Principal Investigator: Yukari N. TAKAYABU
Institution: The University of Tokyo, 7-3-1 Bunkyo-ku, Tokyo, JAPAN
Tel: 04-7136-4402 / Fax:04-7136-4375
E-mail: yukari@aori.u-tokyo.ac.jp
Cooperated by: Hokkaido University, Meteorological Research Institute, National Institute for Environmental Studies, Kyushu University, University of Toyama, Japan Agency for Marine-Earth Science and Technology, Tokyo Gakugei University, Tokyo Metropolitan University

[Abstract]

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Frequent occurrences of extraordinary weather events in recent years have disclosed the vulnerability of our society to unexperienced kinds of extreme events. Increase of such extreme weather events are attributed to the global warming. Since we expect to face even further increases of extreme events in future, it is necessary to support policy makers for making adequate adaptation plans. To this end, we aim to estimate the range of uncertainty for future changes of phenomena, and to adequately convey such information to the policy makers.

In this project, supported by the Environment Research and Technology Development Fund (JPMEERF20192004), we employed the Storyline Approach, a method to narrate representative possibilities for future changes of extraordinary weather phenomena, based on physical understanding of how they are affected by the global climate change.

Utilizing various observational data and CMIP6 multi-model ensemble data, we drew storylines focusing on future changes of local extreme phenomena around Japan, such as torrential rainfalls, droughts, heat waves, typhoons, heavy snowfalls, etc. Future changes are attributed not only to thermodynamic impacts but also to dynamic teleconnections associated with the climate change. For example, utilizing space-borne precipitation radar observations, global reanalysis data, and CMIP6 future projections, we pointed out that as the global warming progresses, the risk of torrential rainfall increases in Eastern Japan. While in Western Japan, their future projections vary among models, depending on the future change of the subtropical jet streams.

On the other hand, we developed a method to select a small number of representative Global Climate Models (GCMs) that appropriately cover the uncertainty range of the CMIP6 projections in terms of climate variables utilized in the impact assessment model. We selected five representative CMIP6 GCMs and produced a climate scenario data, which has been released from the A-PLAT-Program of the National Institute for Environmental Studies (NIES). It has been utilized as a common climate scenario in S-18 project, in NIES impact assessment and adaptation studies, and in other studies for the next Climate Change Impact Assessment Report.

Finally, we examined how these five representative models cover the uncertainty range of the CMIP6 ensemble in terms of future changes of the extreme weather around Japan. Storylines of various extraordinary weather phenomena were drawn for the five representative models and provided to the impact assessment and adaptation researchers.

The results are summarized as a pamphlet for the public. URL https://ccsr.aori.u-tokyo.ac.jp/~takayabu/pamphlet.html

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