Japan's submission regarding its views on possible topics for consideration at the Twelfth meeting of the Research Dialogue (RD12) to be held at SBSTA 52 (June 2020)

Japan welcomes the opportunity to submit its views on SBSTA Agenda Sub-item "Research and Systematic Observation", in Agenda Item "Matters Relating to Science and Review", regarding possible topics for consideration at the twelfth meeting of the Research Dialogue (RD12) to be held at SBSTA 52 (June 2020).

Japan is pleased to submit at this juncture eight possible topics for consideration regarding the following three themes, with a view that they will be considered for the panel presentation as appropriate:

1. Interconnections of Earth-Human systems
    a. *Future prediction and risk communication of the interconnections of Earth-Human systems based on literature survey and integrated global land model*

2. Climate change attribution using global and regional climate models
    a. *Attribution studies for the recent heavy precipitation and heat wave in Japan related to global warming*

3. Ocean and cryosphere in the climate system: impacts, effects, and integrated observation
    (1) Ocean and cryosphere
    a. *Impact assessment and adaptation of coastal hazards in the Pacific Islands*
    b. *Assessing the impact of climate change on snow water resources – A case study in Japan*
    c. *Effect on the Earth system of realizing a 1.5°C global warming target after overshooting to the 2°C level*
    d. *Integrated ocean observation research*

    (2) Impacts of tropical cyclones
    a. *Use of dynamical downscaling to assess the local impacts of tropical cyclones in the Pacific*
    b. *Tropical cyclone impacts and measures for building resilience*

Further details of each of the eight topics are described below.

Theme 1: Interconnections of Earth-Human systems

1-a: Future prediction and risk communication of the interconnections of Earth-Human systems based on literature survey and integrated global land model *[Suitable for Panel/Poster]*

Future changes in the climate system could have significant impacts on the natural environment and human activities in various sectors, which in turn affect the climate system. In this presentation, the results of two studies will be shared. One is a study that visualizes the chain of climate risks in an easy-to-understand format [1]. An exhaustive literature survey was conducted and a method to illustrate the chain of risks in a network diagram was developed. Japan is pleased to introduce examples of using the created network diagrams for dialogue with the general public. The other study is based on an integrated global land model that describes the interactions of future changes in the climate, ecosystems, water resources, crops, and human land use [2]. We will introduce a future prediction of the feedback processes between these elements based on the analysis of numerical model simulations.

[1] https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018EF000945
[2] https://www.geosci-model-dev-discuss.net/gmd-2019-184/

Theme 2: Climate change attribution using global and regional climate models

2-a: Attribution studies for the recent heavy precipitation and heat wave in Japan related to global warming *[Suitable for Poster]*

Japan experienced extremely heavy precipitation and heat wave in July 2018. The typhoon Hagibis also induced unprecedented heavy precipitation in Eastern Japan in October 2019. Using the large ensemble global and regional climate experiments with and without human-induced climate change, which is called as d4PDF, Japan has evaluated the impacts of global warming on the frequency of heat waves and heavy precipitation in Japan.

Theme 3: Ocean and cryosphere in the climate system: impacts, effects, and integrated observation

(1) **Ocean and cryosphere**

3 (1)-a: Impact assessment and adaptation of coastal hazards in the Pacific Islands *[Suitable for Panel/Poster]*

Vulnerability of coasts from sea-level rise (SLR) is extremely high in the Pacific Islands due to global warming. In addition to SLR, it has become essential since the release by the Intergovernmental Panel on Climate Change (IPCC) of the Special Report on The Ocean and Cryosphere in a Changing Climate (SROCC (2019)) to consider also the total sea-level rise due to changes in storm surges and storm waves for coastal impact assessments. Typhoon Haiyan (2013) and Cyclone Pam (2015), and other recent events have shown the necessity of considering such extreme coastal hazards for the protection of the Pacific Islands. Japan is pleased to present the integrated impact assessments of the total SLR in the Pacific based on the latest projections by Japanese climate change research project, including the Integrated Research Program for Advancing Climate Models (TOUGOU). Furthermore, case studies from the Philippines and other islands will introduce adaptation through mangrove plantations as a nature-based solution/Eco Disaster-Risk-Reduction (Eco-DRR) strategy.

3 (1)-b: Assessing the impact of climate change on snow water resources – A case study in Japan *[Suitable for Panel/Poster]*

Large quantity of water resources is required for rice production and other economic activities in Japan. Climate change caused by global warming may have a significant impact on the use of water resources. In this study, the impacts of climate change on snow water resources in Japan and their uncertainty will be presented mainly based on the latest projections by Japanese climate change research project, including the TOUGOU program. The flow regime will be affected greatly especially in the snowy region, and the flow regime change in winter to spring season is consistent among many ensemble members. This is the consequence of decreasing snowfall. In the present climate, snow accumulated in the mountains during the winter season produces high snowmelt runoff in the spring season. As a result, due to the global warming, significant amount of snowfall will change into rainfall. Thus, on the one hand, the winter season runoff will increase but mostly remain unused. On the other hand, the spring season snowmelt runoff will decrease when the water demand for rice production is higher. Similar changes will be expected in other watersheds in the world where snowmelt water is an important source of water resources.

3 (1)-c: Effect on the Earth system of realizing a 1.5°C global warming target after overshooting to the 2°C level *[Suitable for Panel/Poster]*

Japan is pleased to introduce the results of taking two different scenarios that diverge after reaching the 2 °C level, respectively one that stays at the 2°C level and the other that cools down to the 1.5°C level. Then, the scenario data is fed into an Earth system model to investigate the effect of reaching the target of 1.5°C global warming (relative to preindustrial levels) after overshooting to the 2°C level with respect to selected global environmental indicators.

A considerable difference was found between the two scenarios in terms of the Arctic sea ice, whereas both scenarios indicated few corals would survive past the 21st century. The difference in steric sea level rise, reflecting the total cumulative ocean heat uptake, between the two scenarios was less than 2 cm in 2100 (and around 9 cm in 2300) in the Pacific Island region. A large overshoot (i.e., 0.5°C) may reduce the eventual difference between targets (i.e. 1.5°C in contrast to 2°C), particularly in terms of the indicators related to the total ocean heat uptake, and to sensitive biological thresholds.

Reference: https://iopscience.iop.org/article/10.1088/1748-9326/ab5199

3 (1)-d: Integrated ocean observation research *[Suitable for Panel/Poster]*

Japan Agency for Marine-Earth Science and Technology (JAMSTEC) is now involved in ocean observation to grasp the current global oceanic state, through activities such as high-quality observations by Research Vessels, deployment of autonomous observation platforms equipped with multiple sensors, and monitoring by moored buoy systems.

The available ocean-observation data has been integrated into an ocean state estimation by using data assimilation techniques. The obtained state estimation is used to better understand the temporal development of oceanic state and has started to be applied to construct a systematic observation scheme through, for instance, 3-d drift buoy simulation and observing system evaluation. Japan is promoting a unique ocean-observation research along this line, inclusive of research on recent changes in the deep ocean state, and is pleased to share the latest results.

3 (2): Impacts of tropical cyclones

3 (2)-a: Use of dynamical downscaling to assess the local impacts of tropical cyclones in the Pacific *[Suitable for Panel/Poster]*

A tropical cyclone (TC) is one of the major meteorological hazards in the Pacific, the Atlantic, and the Indian Ocean regions, and sometimes induce significant damages. Especially in regions vulnerable to such meteorological hazards, the damages by TCs are devastating. Quantitative estimation of strong winds at local-scales is necessary in order to understand meteorological risks from TCs. For this purpose, dynamical downscaling approach is quite useful. In this study, the focus is on two TCs in the Pacific regions: one is Typhoon Haiyan (2013) that caused devastating storm surge in the Philippines; the other is Cyclone Pam (2015) that induced extreme winds in the southern Pacific islands. An open software for meteorological simulations is quite useful. The numerical analyses by using such a meteorological simulation model enable us to assess quantitatively extreme winds at local-scales. Furthermore, climate change impacts are successfully estimated with the use of the same meteorological model. The interdisciplinary approach is critically important to conduct the present study; an example of such collaborative works will also be presented.

3 (2)-b: Tropical cyclone impacts and measures for building resilience *[Suitable for Poster]*

Slow-moving tropical cyclones (TCs) can cause heavy rain because of their duration of influence. Combined with expected increase in rain rates associated with TCs in a warmer climate, there is growing interest in TC translation speed in the past and future. Japan will present that a slowdown trend of the translation speed is not simulated for the period 1951 – 2011 based on historical model simulations.

Also, it was found that the annual-mean translation speed could increase under global warming. Although previous studies show large uncertainties in the future projections of TC characteristics, our model simulations show that the average TC translation speed at higher latitudes becomes smaller in a warmer climate, but the relative frequency of TCs at higher latitudes increases. Since the translation speed is much larger in the extratropics, the increase in the relative frequency of TCs at higher latitudes compensates for the reduction of the translation speed there, leading to a global mean increase in TC translation speed.