

Japan's submission regarding its views on possible topics for consideration  
at the Eleventh meeting of the Research Dialogue (RD11)  
to be held at SBSTA 50 (June 2019)

Japan welcomes the opportunity to submit its views on SBSTA Agenda Sub-item (a) "Research and Systematic Observation", in Agenda Item 6, "Matters Relating to Science and Review", regarding possible topics for consideration at the eleventh meeting of the Research Dialogue (RD11) to be held at SBSTA 50 (June 2019).

Japan is pleased to submit at this juncture eight possible topics for consideration regarding the following six themes:

1. Attribution of extreme climate events
  - a. *Attribution of extreme climate events in Japan in 2018 summer*
  
2. Adaptation measures using huge ensemble of high-resolution climate model simulation
  - a. *A case study: Adaptation measures for extreme floods using huge ensemble of high-resolution climate model simulation*
  
3. Role of the ocean and cryosphere in the climate system, including warming, acidification and sea level rise
  - a. *Acceleration of ocean acidification in the western North Pacific*
  - b. *Abrupt changes in the climate system*
  - c. *Impact of storm surge on top of the ongoing sea level rise*
  
4. Climate information service under the ongoing climate change using global environmental information platform
  - a. *A case study: Early warning system for Malaria outbreaks in South Africa and the enabling information platform*
  
5. Future power electronics to reduce energy consumption
  - a. *R&D of next-generation semiconductors: from the basics of gallium nitride (GaN) to the energy-saving device fabrication*
  
6. Working towards a CO<sub>2</sub>-free "Hydrogen Society"
  - a. *Fundamental R&D to establish global hydrogen supply chain*

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

## **Theme 1: Attribution of extreme climate events**

### ***1-a: Attribution of extreme climate events in Japan in 2018 summer***

When extreme climate events occur, a question is frequently asked, “whether the ongoing anthropogenic global warming caused them or not?” Event attribution (EA) is one of the keys to provide answers to such a question, because it can quantify the contributions of global warming to specific climate events using huge ensemble simulations. Scientific knowledge by EA researches tends to widely attract the public interest and has great implication for decision making in, for instance, adaptation measure planning.

In 2018 summer, Japan was hit by unprecedented heavy rain event and subsequent severe heat wave, which caused widespread havoc nationwide. The relationship between those extreme events and global warming highly attracted societal interest and EA analysis was immediately started for those events. Japan is pleased to share those recent results.

## **Theme 2: Adaptation measures using huge ensemble of high-resolution climate model simulation**

### ***2-a: A case study: Adaptation measures for extreme floods using huge ensemble of high-resolution climate model simulation***

Japan has been implementing the downscaling project ‘SI-CAT (Social Implementation Program on Climate Change Adaptation Technology)’. In this project huge ensemble of high-resolution climate model simulation for Japan has been created, which could be utilized to analyze climate change impacts in local areas and support local governments in formulating and carrying out their adaptation plans.

As one of the best practices of utilizing such a state-of-the-art huge ensemble data and the good collaboration between researchers and local governments, Japan is pleased to share the recent achievement that assessed the future changes of extreme rainfall and floods in the Hokkaido prefecture of Japan and its implication for the future adaptation measure planning. Our practice would also be relevant for other countries that need regional information.

## **Theme 3: Role of the ocean and cryosphere in the climate system, including warming, acidification and sea level rise**

### ***3-a: Acceleration of ocean acidification in the western North Pacific***

Over the past 35 years since the early 1980s, Japan Meteorological Agency (JMA) has been conducting shipboard measurements of CO<sub>2</sub> in the ocean and in the atmosphere at 3°N through 34°N along 137°E in the western North Pacific. The result of these measurements demonstrates that the total dissolved inorganic carbon (DIC) has been increasing and ocean acidification has been occurring in the upper layer of the ocean owing to the uptake of anthropogenic CO<sub>2</sub>. In addition, the rates of DIC increase and ocean acidification have been accelerating in the surface layer of the subtropical zone at 25°N – 30°N. The rate of pH decreases for the recent 10 years (2007 – 2017) was approximately 1.4 times as large as that for the entire period of measurements (1983 – 2017). Japan is pleased to share these results.

### ***3-b: Abrupt changes in the climate system***

The societal interest in sea level rise has been growing for years. Moreover, the *Special Report on the Ocean and Cryosphere in a Changing Climate* (SROCC) is being developed by IPCC (Intergovernmental Panel on Climate Change) and scheduled to be published in 2019. In this context, Japan is pleased to share the latest cutting-edge research using the Earth System Model (ESM) developed in our research program, Integrated Research Program for Advancing Climate Models (TOUGOU). Specifically, under the TOUGOU program abrupt changes in the climate system is being studied intensely, for example the collapse of the Antarctic ice sheets, with which the probability may be low but the damage is gigantic (low-probability high-risk event).

### ***3-c: Impact of storm surge on top of the ongoing sea level rise***

Sea level rise has great impact on human activity along the coastal zone. It causes not only sea water inundation to low-lying land areas, but also can increase the risk of extreme storm surge impacts associated with strong tropical cyclones.

Under the aforementioned TOUGOU program, we have been studying the future change of extreme storm surges and storm waves in Southeast Asia and the Pacific island countries. Japan is pleased to share the recent achievements of this research which is applicable in regional areas outside Japan.

## **Theme 4: Climate information service under the ongoing climate change using global environmental information platform**

### ***4-a: A case study: Early warning system for Malaria outbreaks in South Africa and the enabling information platform***

Japan has been developing the Data Integration and Analysis System (DIAS), as the Global Environmental Information Platform, with the following aims; to collect and archive the big data of earth observation data; to analyze such data in combination with socio-economic data, and convert those data into information useful for crisis management with respect to global-scale environmental disasters, and other threats; and to make this information available within Japan and overseas.

Various kinds of applications are currently run on the DIAS for supporting decision making under the ongoing climate change. As one of the case studies of the climate information services of DIAS, Japan is pleased to share an early warning system for Malaria outbreaks in South Africa, which is based on the combination of climate prediction model simulation and the local data related to malaria, such as the number of patients and malaria vectors. While the summary for policymakers of the Working Group II contribution to the IPCC Fifth Assessment Report mentioned “changes in the incidence and geographic range of vector- and water-borne diseases due to changes in the mean and variability of temperature and precipitation, particularly along the edges of their distribution” as one of key risks in Africa, our practice would also be relevant for other countries that would become affected by vector-borne diseases.

## **Theme 5: Future power electronics to reduce energy consumption**

### ***5-a: R&D of next-generation semiconductors: from the basics of gallium nitride (GaN) to the energy-saving device fabrication***

In order to achieve sustainable development based on clean energy that does not rely on fossil fuels, energy-saving technology, such as power electronics, is one of the crucial key factors. Since power electronics is the key technology in controlling and using electricity in all facets, for example, when using personal computers, driving electric vehicles, and riding trains, the future of this power electronics technology requires the use of the next-generation semiconductors to improve the power conversion efficiency. Because this power conversion efficiency strongly depends on the physical properties and defect density of the semiconductors, as a promising candidate for the next-generation semiconductors, Japan would like to introduce gallium nitride (GaN), which has been developed first in Japan for the blue light emitting diode (LED), and share the R&D progress to accelerate the practical realization of the future power electronics that can contribute to climate change mitigation through energy-saving measures.

## **Theme 6: Working towards a CO2-free “Hydrogen Society”**

### ***6-a: Fundamental R&D to establish global hydrogen supply chain***

With a view to achieve sustainable development based on renewable energy, Japan has been pursuing various possibilities. As one of the options, Japan is contributing to create a CO2-free “Hydrogen Society”, where hydrogen is generated from water with low-cost renewable electricity, compressed for transportation and converted to electricity with high efficiency. Japan is pleased to share the recent achievements of this fundamental research that can contribute towards future climate change mitigation.