

Progress Review of Earth Observation and Other Programs based  
on Japanese Efforts Following the Adoption of the *Earth  
Observation Promotion Strategy*

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**Council for Science, Technology and Innovation**  
**Environment Working Group**

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## **1. Summary of the Review of Intervening Matters Following the Adoption of the *Earth Observation Promotion Strategy***

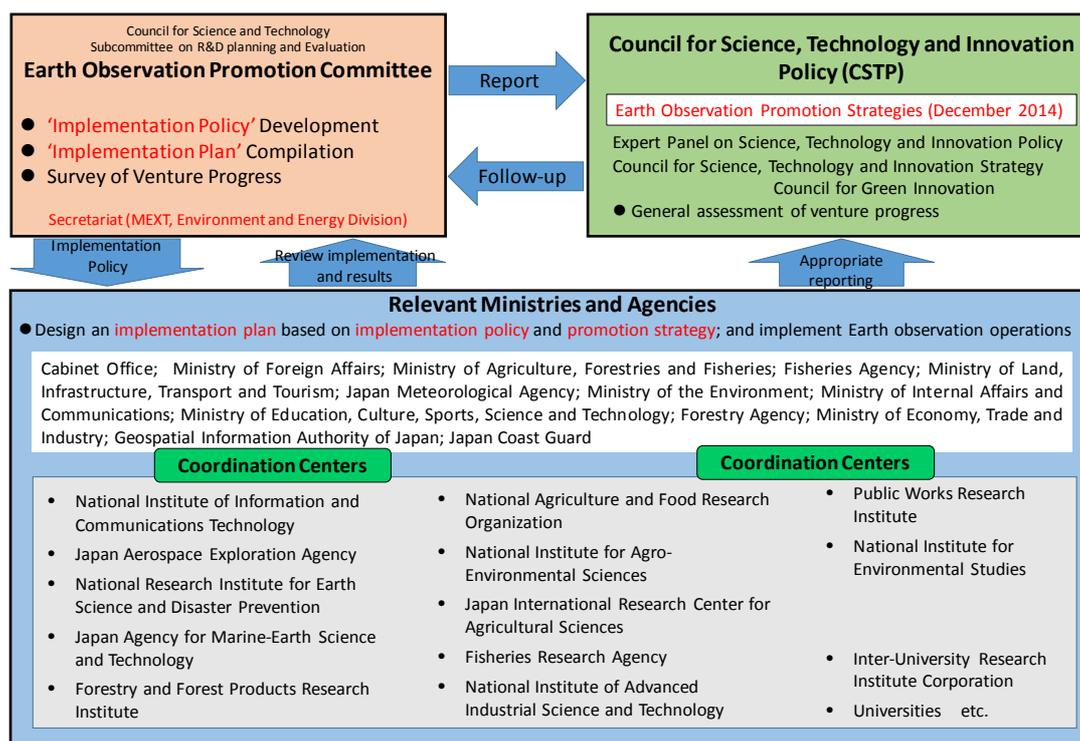
The 4th Science and Technology Basic Plan states that “information obtained from earth observation, forecasts, and integration analysis is significant social / public asset for driving Green Innovation, and the government will markedly enhance technologies related to that and promote the utilization of such information obtained from Earth observation, etc. in various fields.” The Basic Plan further stresses the importance of focusing on the promotion of Earth observation.

The former Council for Science, Technology and Innovation Policy (CSTP) compiled important issues and subjects for, as well as ideas for the strategic approach to, Japan’s focus on Earth observation in the *Earth Observation Promotion Strategy* (December 27, 2004).

*Earth Observation Promotion Strategy:*

- a) The Council for Science and Technology of the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) uses the *Earth Observation Promotion Strategy* as a guide to obtain the cooperation and coordination of related ministries and agencies to create detailed implementation policies for Earth observation promotion, for the improvement of Earth observation systems, and for international policies related to Earth observation.
- b) The former CSTP receives reports from the Council for Science and Technology regarding implementation policies and the progress of Programs based on these policies. The CSTP also receives information from related ministries and agencies as needed to create comprehensive evaluations, as well as to follow up on the state of integrated Earth observation systems. Based on these comprehensive evaluations and trends both foreign and domestic, the CSTP revises the *Earth Observation Promotion Strategy* as deemed necessary.

The nation of Japan determines rules for advancing Earth observation in accordance with the implementation structure as shown in Figure 1.



**Figure 1. Implementation Structure and Organization for Earth Observation and Other Programs (Example from 2012)**

The CSTP has received plans drafted by cooperative ministries and agencies as shown in Figure 1, conducting follow up every year through 2012 on programs designated as registered implementation plans. To date, the Earth Observation Promotion Strategy and the solutions to issues addressed have yielded a steady stream of results across a variety of fields. These results include the advancement of Earth observations contributing to the benefit of society, the improvement of long-term observation systems with the coordination of government entities, the advancement of the multifaceted utilization of Earth observation data through the integration of data, and the development of science diplomacy through stronger international cooperation.

Meanwhile, the CSTP offered the *Earth Observation Promotion Strategy* as an opinion representing a 10-year guide to the relevant government ministers. This 10-year period has nearly expired. As part of this *Earth Observation Promotion Strategy*, it was decided that the CSTP conduct a progress review in December 2012 with an eye toward revising this promotion strategy. Based on this review, in 2013 the MEXT Council for Science and Technology Research Planning and Evaluation Subcommittee Earth Observation Promotion Committee (“Earth Observation Promotion Committee”) compiled a report of all Earth observation initiatives to date in a report titled, “Review of the Status of Efforts Following the Adoption of the *Earth Observation Promotion Strategy* (August 2013).”

At the same time, on the international stage we see deliberations for a new 10-year implementation plan for the Global Earth Observation System of Systems (GEOSS), planned for the fall of 2015. The plan will extend for 10 years beginning 2015. For Japan to take a leading role in this project, our nation must make haste in creating new Earth observation implementation policies that correspond to the direction of GEOSS movement . For that reason, the Cabinet Office Director-General for Policy Planning of the Council for Science, Technology and Innovation (CSTI: administrator in charge of Science, Technology, and Innovation) proposed a GEOSS-oriented approach in Japan's international policy. This proposal places Earth Observation Promotion Committee in a central role, while collaborating with related ministries to produce a long-term implementation policy (26 August 2014; the Expert Lawmakers' Roundtable of the CSTI).

This review provides a background of the changing domestic and international social conditions and technological innovations. It also reflects the report made in Environment Working Group of the CSTI related to the Review of the Status of Efforts Following the Adoption of the *Earth Observation Promotion Strategy* (August 2013), which was the result of the MEXT compilation of all Earth observation efforts in Japan. The Environment Working Group is the lead organization in conducting this review based on the aforementioned report.

## **2. Policies Related to the Review of the Status of Efforts Following the Adoption of the *Earth Observation Promotion Strategy***

The Review of the Status of Efforts Following the Adoption of the *Earth Observation Promotion Strategy* (August 2013) of the MEXT consists of four main sections: (1) Current state of *Earth Observation Promotion Strategy*; (2) Accomplishments of the *Earth Observation Promotion Strategy*; (3) Changes in circumstances subsequent to the adoption of the *Earth Observation Promotion Strategy*; and (4) Prioritization of future initiatives.

The main feature of the Review of the Status of Efforts Following the Adoption of the *Earth Observation Promotion Strategy* is that it summarizes results and issues to date, while at the same time describing changes in circumstances that must be considered from the aspect of Earth observations. The report also states that Japan must strengthen and develop its Earth observation systems if our nation is to take a leading role in

making decisions for the next 10-year implementation plan in response to GEOSS and other international developments.

Accordingly, the purpose of this review is to contribute to the development of Japan's implementation plans in accordance with the new 2016 GEOSS 10-year plan, as well as with the 5<sup>th</sup> Science and Technology Basic Plan.

## **2.1. *Earth Observation Promotion Strategy* Review Policies**

### **(1) Strategic Priorities**

This review discusses the results derived from the strategic priorities noted in the *Earth Observation Promotion Strategy*, particularly from the aspect of these strategic priorities.

### **(2) Integration of Earth Observation Systems**

This review discusses the establishment of coordination centers and initiatives for promoting data sharing and usage as noted in the *Earth Observation Promotion Strategy*.

### **(3) International Earth Observation Frameworks**

This review discusses the Global Earth Observation System of Systems (GEOSS), other Earth observation systems, environmental research, and open data charter initiatives as noted in the *Earth Observation Promotion Strategy*.

### **(4) Implementation Structure and Organization of Integrated Earth Observation Systems**

This review discusses functions required of the implementation structure and organization, as well as the ideal format for implementation structure and organization as noted in the *Earth Observation Promotion Strategy*.

## **2.2 Recent Developments Following the Adoption of the *Earth Observation Promotion Strategy***

### **(1) Changes in Social Conditions**

This section summarizes changes in the social environment surrounding Earth observation in Japan, and the effects of these developments on intimately related items, including the formulation and review of the Basic Plan. Among the societal changes considered are the advance of globalization, the occurrence and increase in disasters and other events that threaten the human sustainability and welfare, and climate change and its emerging effects.

**(2) International Fields to Which Earth Observation Contributes**

Fields in which Japan's Earth observation can make a contribution include ongoing integration with other Earth observation systems employed by nations worldwide, the promotion of shared data systems (including GEOSS), the development of initiatives to couple observation and research more strongly (e.g. Future Earth), and approaches to solving global issues (such as establishing sustainable development goals).

**(3) Scientific Development and Technological Innovation**

Earth observation science is developing in the presence of an enormous body of relevant data that exists beyond the discipline itself. This section considers the state and importance of Big Data with respect to Earth observation, as well as the diverse interrelationships within the data.

**(4) Improvements in Observation Technologies**

Improving Earth observation technologies is significant for technologies to lead to solutions to outstanding issues and to fulfill the needs of society.

**2.3 Conclusions**

**(1) Accomplishments Over the Past 10 Years**

This section reviews accomplishments over the intervening decade following the adoption of the *Earth Observation Promotion Strategy*.

**(2) Challenges to Overcome in the Next 10 Years**

There are a number of challenges that the field of Earth observation must address and overcome in the coming decade:

- a) Formulate responses to pressing social needs
- b) Contribute Earth observation data to resolve policy issues
- c) Promote data utilization and develop capable human resources
- d) Implement long-term, continual Earth observation
- e) Increase collaboration between disciplines, furthering the engagement of a diversity of stakeholders, and develop human resources capable of facilitating these relationships
- f) Develop Earth observation that contributes to science diplomacy and international cooperation
- g) Drive science and technological innovation through Earth observation

**(3) Future Implementation Policies and Implementation Structures for Earth Observation**

This section addresses securing the necessary functions for Earth observation implementation policies and implementation structures.

### **3. Review of the Status of Efforts Following the Adoption of the *Earth Observation Promotion Strategy***

In this section, we reviewed four key elements of the *Earth Observation Promotion Strategy*: (1) Strategic prioritization; (2) Integrating the Earth observation system; (3) Responding to the international Earth observations framework; and (4) Implementation structure and organization of the integrated Earth observation system.

#### **3.1 Strategic Prioritization**

The *Earth Observation Promotion Strategy* states that Japan must clarify and address the pressing needs of our nation: (1) Ensure the public's ease of mind and security; (2) Develop economic society and improve quality of life; and (3) Contribute to international society. This shall be accomplished through an accurate understanding of these needs and through a highly prioritized approach performed in a strategic manner. The original document goes on to assert that Earth observation science, as an element of basic scientific research, serves to further the accumulation of intellectual assets common to all humankind. Therefore, in pursuing Earth observation, it is critical to consider not only short-term benefits, but also our nation and world's long-term interests.

The Review of the Status of Efforts Following the Adoption of the *Earth Observation Promotion Strategy* discusses ten-year results for each area strategic priority. Of the areas and outcomes discussed, the following merit mention here.

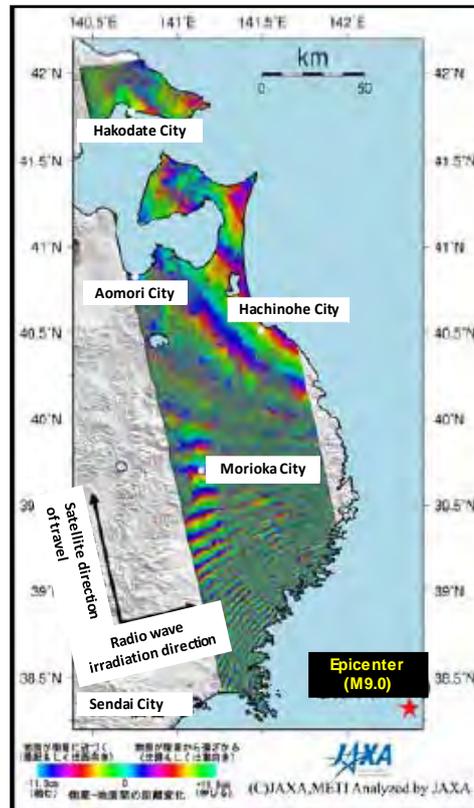
#### **(1) Ensure the public's peace of mind and security**

##### **(a) Disaster Monitoring**

Earth observation technologies have been systematized to provide data to the Cabinet Office and other Japanese and foreign disaster prevention and preparedness organizations. This data includes disaster event and recovery status information for major natural disasters such as the Great East Japan Earthquake. Steady streams of satellite observational data are used to understand conditions on the ground during disasters.



**Image of Widespread Flooding  
by the DAICHI (Advanced Land  
Observing Satellite: ALOS)**

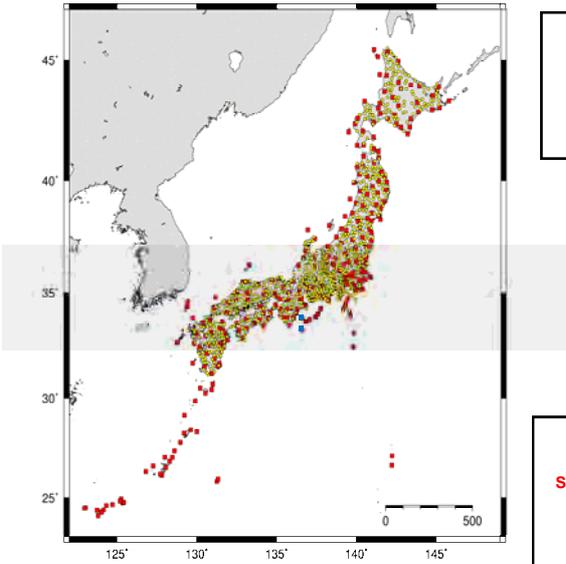


**Image of Crustal Movement by the  
DAICHI (Advanced Land Observing  
Satellite: ALOS)**

### **(b) Earthquake Early Warning System**

Progress in development has led to the practical application of rapid estimation of seismic origin technologies. These technologies are now used by a wide variety of private citizens and organizations as earthquake early warning systems. Today, we collect data from 1,110 seismometers deployed nationwide. Utilization of our Nation's Seafloor Observation Network for Earthquakes and Tsunamis Along the Japan Trench (S-net) and Dense Ocean-Floor Network System for Earthquakes and Tsunamis (DONET) and improvements in technologies to predict earthquake origins and forecasts of ground motion have resulted in advances for initiatives for providing earthquake emergency warnings in a more rapid and accurate manner.

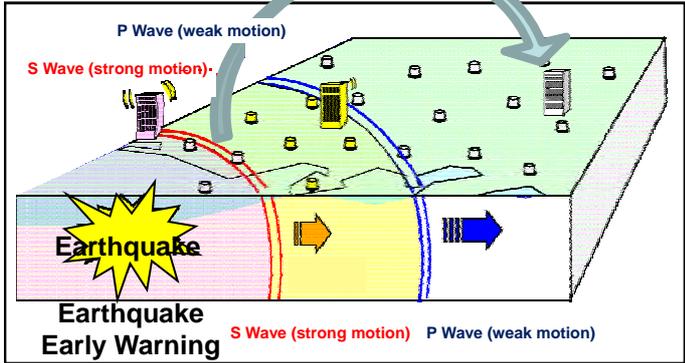
Earthquake Early Warning Observation Point(20150401)



- Japan Meteorological Agency
- NIED
- JAMSTEC

Utilization of earthquake early warning Seismic Station  
(As of March 31, 2015)

Transmission of earthquake information before its arrival

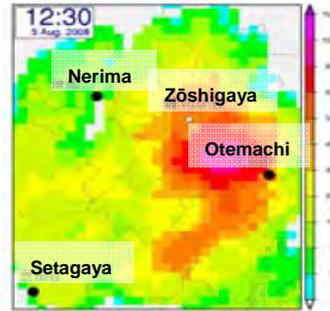


**(c) Torrential Rain Observation Technologies**

Torrential rains and tornadoes are highly localized, suddenly occurring weather events. This is why these types of weather events have been difficult to monitor with previously existing technology. However, advances in high-resolution X Band Multiparameter Radar have resulted in highly accurate rainfall measurement technologies.



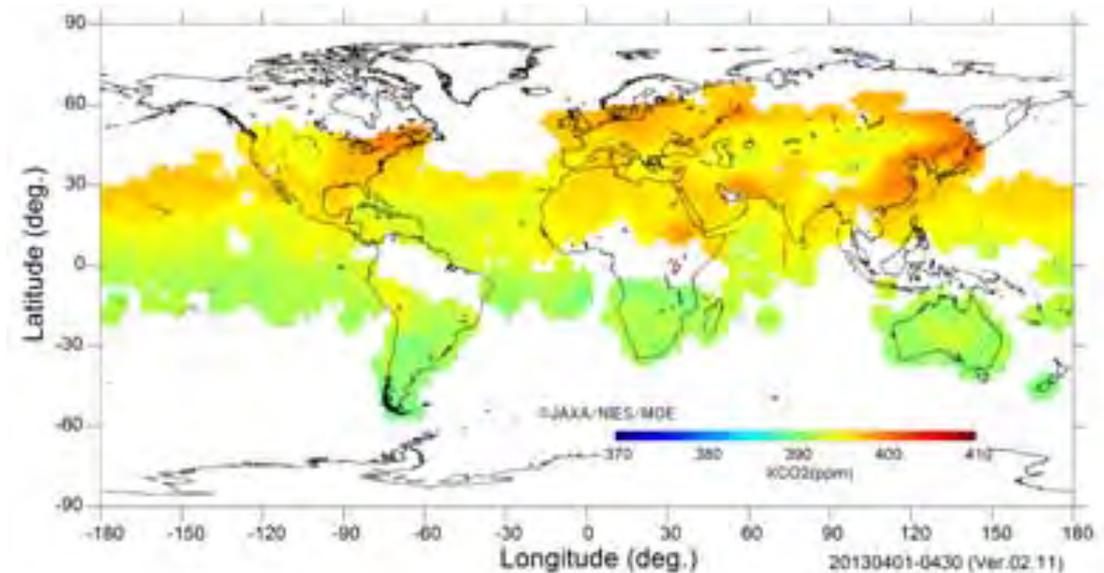
**X Band Multiparameter Radar**



**Observation of torrential rain via X Band Multiparameter Radar**

**(d) Quantitative Measurements of Absorption and Dispersion of CO<sub>2</sub>**

Utilizing a combination of satellite, airplane, and field observations to gather air, ground and sea observation data now allows for the quantitative monitoring of CO<sub>2</sub> absorption and dispersion on a worldwide scale. Use of this data is expected to increase the accuracy of predictions concerning climate change, as well as to aid in formulating more effective policy proposals for dealing with global warming.



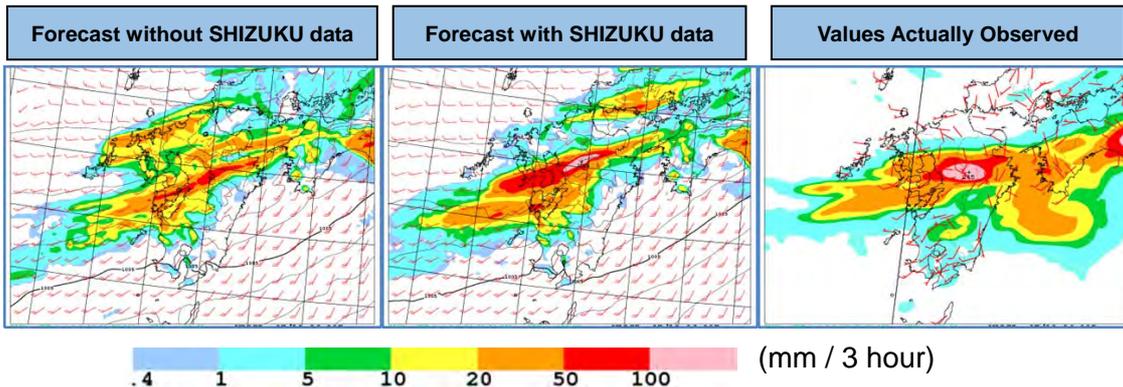
**Carbon Dioxide Concentration as Shown by the IBUKI Greenhouse Gases Observing Satellite (GOSAT)**

**(2) Develop Economic Society and Improve Quality of Life**

**(a) Usage in meteorological and climate services, marine monitoring, etc.**

Satellite observation data continues to find expanding operational applications. The use of this technology is advancing in a wide variety of fields, including numerical weather prediction, typhoon analysis, sea ice monitoring, northern sea route numerical forecasts, and other meteorological, climate forecasting, and ocean monitoring services.

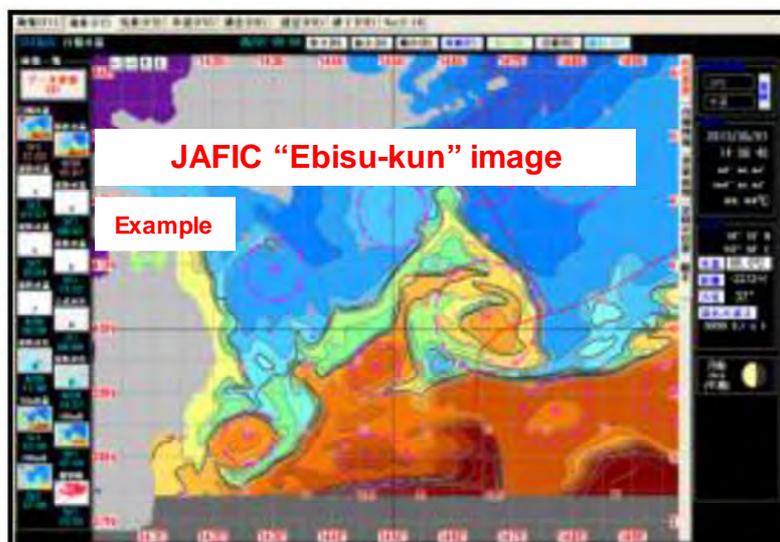
Prediction accuracy improved using data from the SHIZUKU Global Change Observation Mission (GCOM-W)



21-hour forecast beginning 9am July 11, 2012; three-hour precipitation distribution shown.

**(b) Usage in Ocean and Fisheries Monitoring**

Ocean surface temperature and other ocean data collected via satellite observations are used regularly to produce fisheries information, contributing to more efficient fishing vessel operations.



Fishing information from Japan Fisheries Information Center (JAFIC)