THE OVERVIEW OF SPACE APPLICATIONS FOR ENVIRONMENT INITIATIVES

Shin-ichi Sobue*1, Toru Fukuda*1 and Tomoyuki Nukui*1
*1 JAXA, Earth observation research center, 2-1-1 Sengen, Tsukuba, Ibaraki 305-8505, Japan,
E-mail: nukui.tomoyuki@jaxa.jp

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ABSTRACT

Recently, climate change and human activities have accelerated the frequency of hazards such as deforestation, landslides, draughts, and floods in Asian-Pacific countries. To mitigate hazards due to climate change and human activities, environmental monitoring has become important, including monitoring the condition of land, air, ocean, and water resources by using space-based technology. Being able to determine the threshold between normal and abnormal is important and the threshold itself could change because of climate change and human activities. The Asian Pacific Regional Space Agency Forum (APRSAF) agreed to host "Space Applications for Environment" (SAFE) initiatives. Under APRSAF, there are several on-going SAFE prototyping activities for water management and forest monitoring. This paper gives an overview of SAFE and describes the current situation of SAFE prototyping.

1. INTRODUCTION

The Space Applications for Environment (SAFE) program is a volunteer-based initiative. It aims to encourage long-term environmental monitoring to grasp environmental changes that may be useful for risk reduction and adaptation programs for disaster and risk related activities as well as other climate change associated problems, using space applications, particularly satellite remote sensing technology. Key information on some changing environmental parameters such as water resources, river water levels, land cover, deforestation, agricultural production, and ecosystems, could be provided through satellite remote sensing.

Figure 1. SAFE structure

SAFE considers continuous data that could provide environmentally sensitive information with varying spectral and spatial resolution for better understanding of the status of the environment and its changes. SAFE has a robust approach for long-term monitoring of our natural environment with satellite remote sensing to evaluate its current status, understand the changes, monitor the nature of those changes, and where possible, use as base information for risk management and adaptation. Furthermore, the end users of SAFE are the agencies and experts that are responsible for management of the environment, each with their own mandate, functionalities, and responsibilities.

2. SAFE OVERVIEW

2.1 Implementation scheme

SAFE adopted a prototype approach to demonstrate the value of space-based technology to tackle climate change issues. The SAFE prototype has been implemented by a project team that consists of the prototyping executor, the technical supporter, and the data & application creator. The team can ask other SAFE members to support their activities, and the members then react to the team's request. To ease barriers to start-up, the first stage of prototype activity is limited to two years. New SAFE prototyping are reviewed by the SAFE review board meeting during the SAFE workshop every year. SAFE review board members are selected from the Asian Pacific Regional Space Agency Forum (APRSAF) members and the SAFE secretariat by the Japan Aerospace Exploration Agency (JAXA). The call for proposal is issued about two months before the SAFE workshop to propose new SAFE prototyping by entities of APRSAF member countries. Since it is voluntary based activities, each proposed member must provide the necessary resources to analyze earth observation data provided by APRSAF member agencies to tackle climate change issues in cooperation with operational governmental bodies (end users). The activities are implemented by a prototyping project team that consists of the end user, the technical supporter, and the data and application creator. The project team members work together under APRSAF.
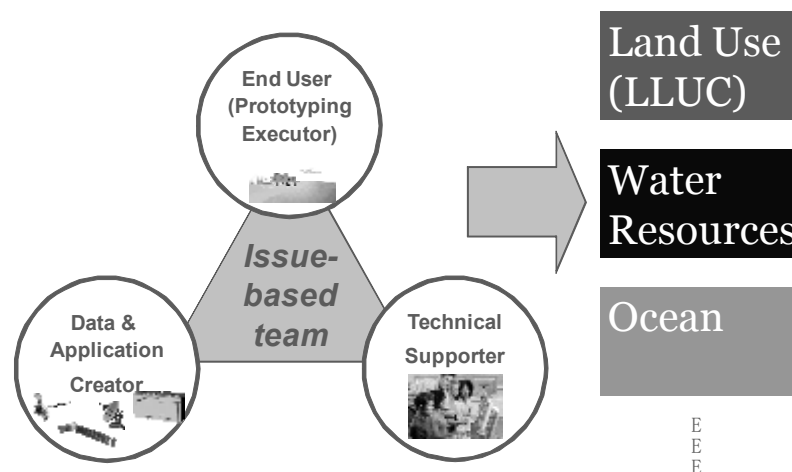

Figure 2. Formation for implementing SAFE prototype

2.2 Review process

To approve a SAFE new proposal, an international review board is organized from APRSAF participant countries and scientific research communities. The board is chaired by the APRSAF earth observation working group co-chairs, and is held just prior to the SAFE workshop. After the presentation of new proposals in the SAFE workshop, the board decides the approval of the proposed prototyping. This process is defined in terms of reference to SAFE initiatives, and is shown in Figures 3 and 4.
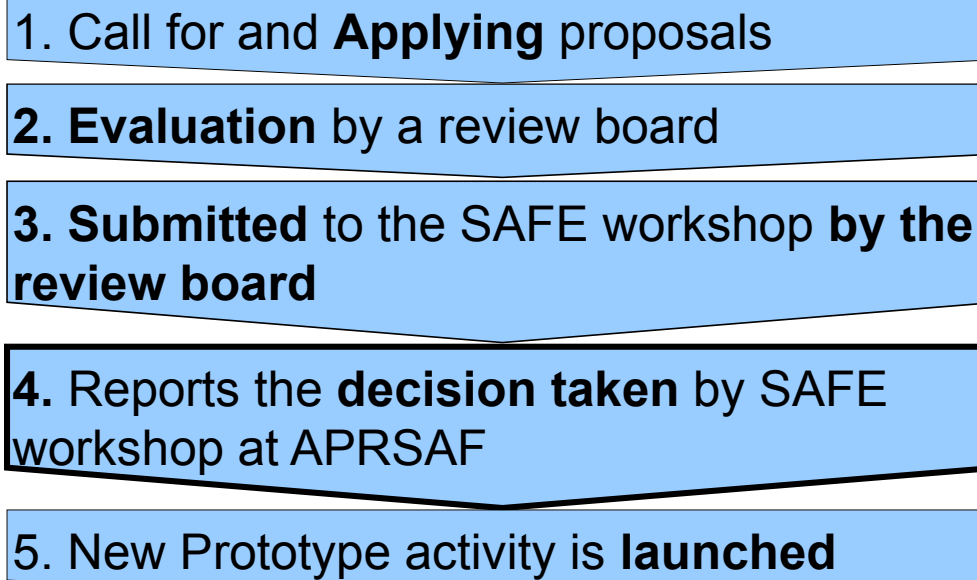
1. Call for and **Applying** proposals

2. **Evaluation** by a review board

3. **Submitted** to the SAFE workshop **by the review board**

4. Reports the **decision taken** by SAFE workshop at APRSAF

5. New Prototype activity is **launched**

Figure 3. Flow of proposal review

1st year		2nd year	
6 months	6 months	6 months	6 months

Approved

Progress Report at workshop   1st   2nd   3rd   Final

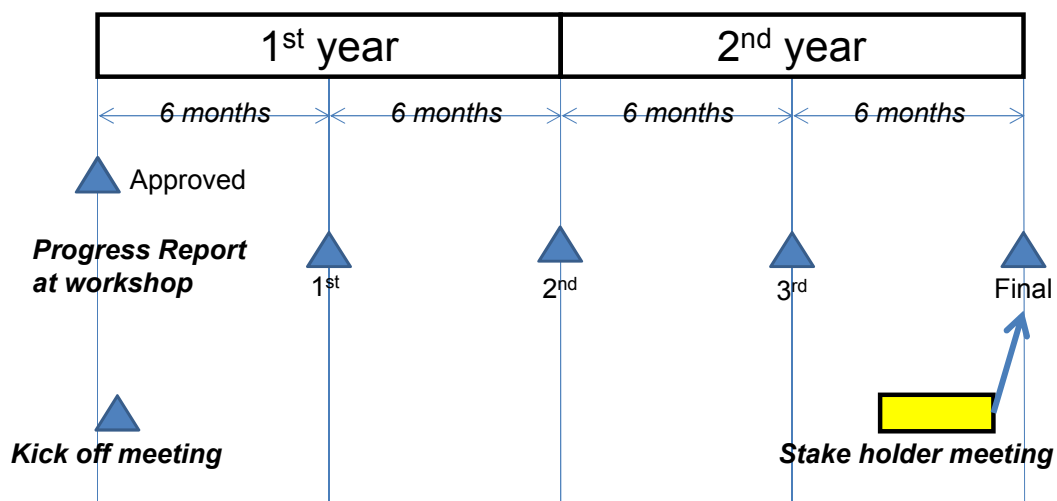*Kick off meeting*   *Stake holder meeting*

Figure 3. General milestones of two-year SAFE prototyping

2.3 SAFE prototyping

Through on-going SAFE prototyping, information on climate change and other important information derived from space-based technologies are provided to national/regional end users. SAFE was officially established at APRSAF-15 in Hanoi, 2008, and the first SAFE workshop (WS) was held in Pattaya, Thailand (May 2009). In that WS, 7 proposals from 4 countries were submitted as new SAFE activities and two proposals were approved. A mini-WS was held in Jakarta, Indonesia (August 2009) and 5 revised proposals were reviewed, of which 2 were endorsed. Those two proposals were approved at APRSAF-16 in Bangkok, 2010. The second SAFE workshop was held in Sri Lanka (June 2010), the third SAFE workshop was held in Vientiane (June 2011) and the fourth SAFE workshop was held in Perth (May 2012). There are now a total of eight ongoing prototyping activities (as of May 2012). Table 1 lists the current SAFE prototype activities.

Completing	SRI LANKA	Risk of Sea Level Rise on Coastal Zone
	INDONESIA	Potential Drought Monitoring
Ongoing	PAKISTAN	Monitoring Water Cycle Variations & Assessing Climate Change Impacts
	SRI LANKA	Modeling ocean frontal zones using high resolution satellite and float data to locate tuna fish aggregations
	THAILAND	Economic Fish Larvae Mapping and Monitoring
	VIETNAM	Mangrove Forest Mapping and Carbon Stock Estimation
	SRI LANKA	Mapping and Detecting Wetlands in River Basin
	Indonesia	Assessment of drought impact on rice production in Indonesia by satellite remote sensing and dissemination with web-GIS
	Cambodia	Water and Flood Security under the Climate Change
	Bangladesh	Assessment of Morphological Changes in the Meghna Estuary

Table 1. SAFE prototyping status

3. ACCOMPLISHMENT OF SAFE PROTOTYPING

3.1 Success story

There have been six success stories in SAFE prototyping for forest monitoring, coastal monitoring, and water resource management from 2008 to 2011.

3.2 Forest management

The Vietnamese Forest Protection Department, Ministry of Agriculture and Rural Development (FPD/MARD) is the agency responsible for forest management in Vietnam. FPD has a MODIS receiving station and provides wild fire hotspot information to the rural branch. As the next step, FPD is trying to strengthen forest management with the use of MODIS. Ministry of Agriculture and Rural Development (MARD), Ministry of Natural Resources and Environment (MONRE), Vietnamese Academy of Science and Technology (VAST), Japan Aerospace Exploration Agency (JAXA), University of Tokyo (UT), and Asian Institute of Technology (AIT) are jointly implemented in this prototyping. In this prototyping, an automated forest classification tool was developed to develop forest maps using MODIS and other sensors, which has been helpful to improve forest inventory counting in FIPI. An overview of this tool is shown in Figures 4 and 5.
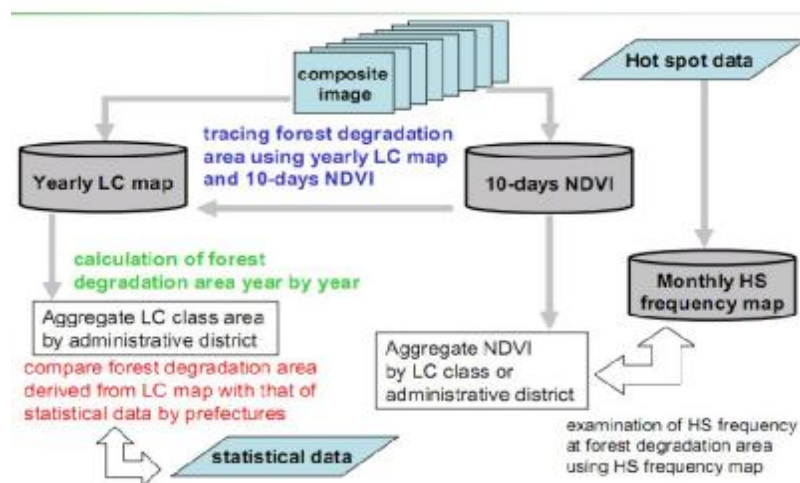

Figure 4. Forest map classification tool

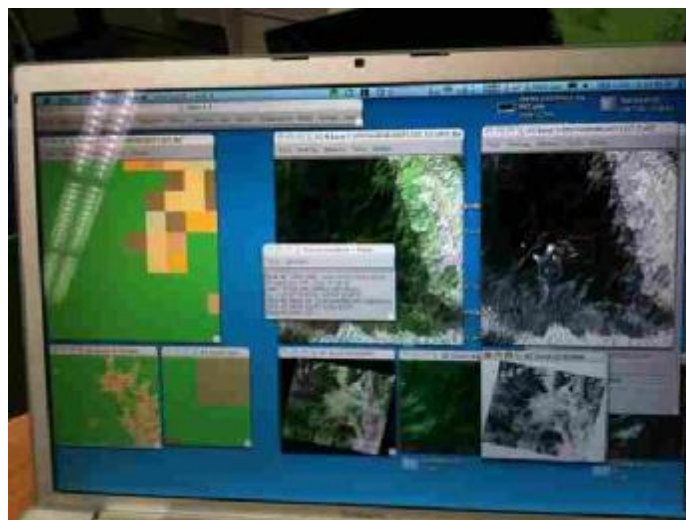**Figure 5. Snapshot of forest auto classification tool**

Updated 1 Oct 2012

3.3 Integrated water management

Vietnamese National HYDRO-METEOROLOGICAL Service, Ministry of Natural Resources and Environment (NHMS/MONRE) is the agency responsible for flood management and the Metrological Service in Vietnam. NHMS is trying to strengthen precipitation monitoring by using GSMAP (Global Satellite Mapping of Precipitation), ground observation data, and reservoir management under the Asian Water Cycle Initiative in cooperation with University of Tokyo and JAXA. Figure 6 shows the overview of this prototyping.
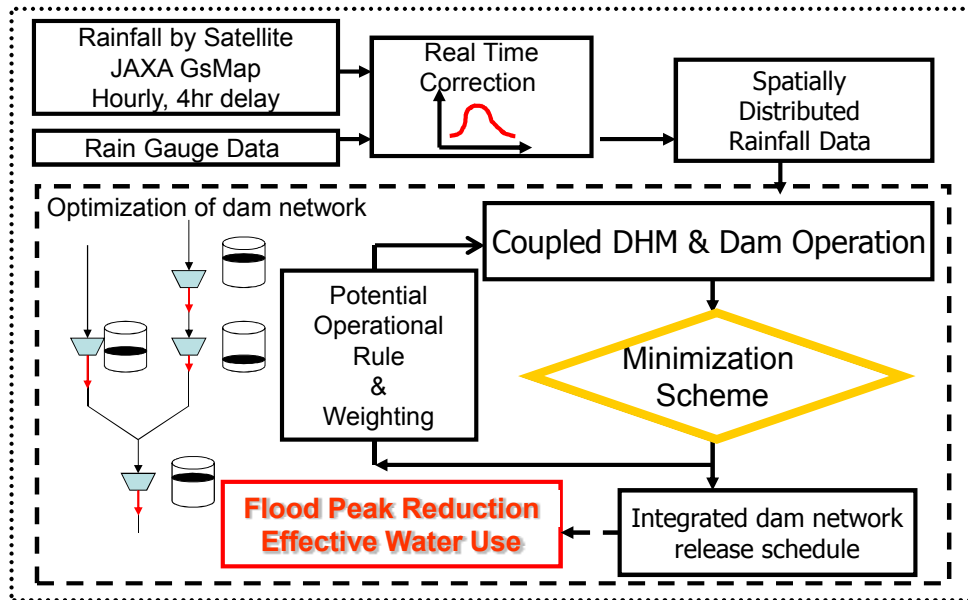

Figure 6. Concept of integrated water resource management with space technology

By using this prototyping, integrated water resources management in the Hong River Basin in Vietnam is promoted. In addition, by using this prototyping result, an ADB funded project will be implemented to improve the flood early warning system by extending the warning lead time (shown in Figure 7).
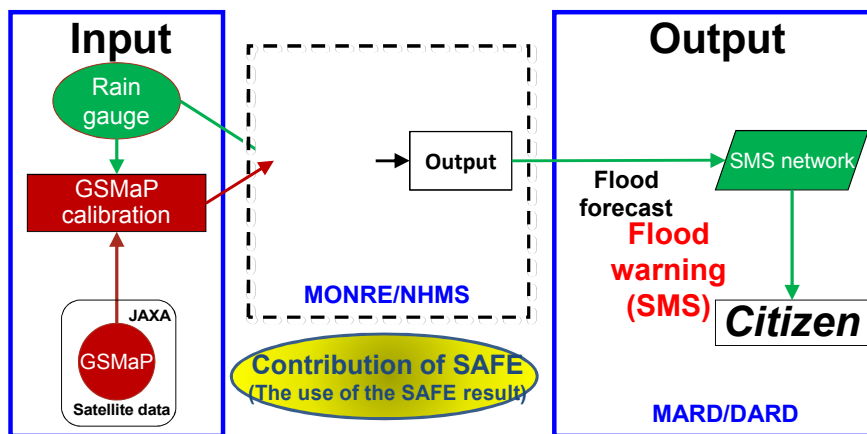

Figure 7. ADB funded flood early warning system

3.4 Coastal monitoring

Since capturing/monitoring long-term change of the near-shore environment is essential for better coastal planning and development, the coastal conservation department (CCD) proposed a SAFE prototyping to develop a monitoring system for near-shore environments based on satellite data. Wide-range monitoring is essential, and satellite data provide widely covered spatial information. CCD applied the developed model to the northeast coast of Sri Lanka in cooperation with University of Tokyo.
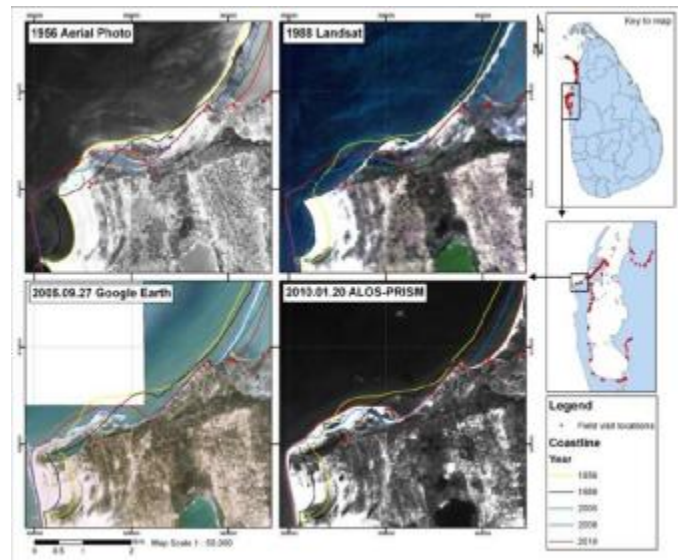

Figure 8. Coastal line change detection.

With prototyping results such as those shown in Figure 8, several meetings were conducted with coastal experts in the country and high level government officials involved in the Kalpitiya Tourism Development Project to launch discussions for the establishment of governmental or administrative laws and ordinances for coastal area management.

4. CONCLUSION

SAFE prototyping is an ongoing activity to provide a bridge between earth observation satellite data providers and end users in cooperation with technical supporters. Demonstrated by some of its success stories, SAFE prototyping will provide a cornerstone to contribute to climate change adaptation and mitigation strategy development and research in the Asia Pacific region by using space-based technology.