

**SENTINEL ASIA FOR ENVIRONMENT (SAFE)**  
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## ABSTRACT

This paper is a proposal of Sentinel Asia for Environment (SAFE). The essential to this project is to help environmental agencies in Asia to set up an environmental monitoring system with satellite observation data. It is focused on an environmental issues originated from anthropogenic events detected as land cover and land use change in Asians' daily human life including; agriculture, global warming gas, urban environment and forest resources. It is led by Japan Aerospace Exploration Agency (JAXA) along with University of Tokyo and Asian Institute of Technology in Thailand under the umbrella of Sentinel Asia which is dedicated to disaster monitoring issues. It is expected to initiate a information outgoing through WWW for Asian countries to set up their national land information system focusing on environmental changes.

## 1 INTRODUCTION

### 1.1 Needs for better information

SAFE is led by Japan Aerospace Exploration Agency (JAXA) along with University of Tokyo and Asian Institute of Technology in Thailand under the umbrella of Sentinel Asia<sup>1</sup>. This project is officially approved at the 14th Asia Pacific Region Space Agency Forum (APRSF-14) at Bangalore in 2008 November<sup>2</sup>. The essential to this project is to help environmental agencies in Asia to set up an environmental monitoring system with satellite observation data. It is focused on an environmental issues originated from anthropogenic events detected as land cover and land use change in Asians' daily human life including; agriculture, global warming gas, urban environment and forest resources.

which is dedicated to disaster monitoring issues. It is expected to initiate a information outgoing through WWW for Asian countries to set up their national land information system focusing on environmental changes. It is proposed by JAXA to Asian countries in order to contribute to set up their national land information system focusing on environmental changes. It has a satellite data and products distribution function to monitor environmental changes.

### 1.2 Objective of this project

The objective is to study a whole concept of offering optimum environment-related satellite data to Asian countries through development and operation of a WWW based data distribution system, and considering higher products to be offered.

## 2 CONCEPT OF SAFE

### 2.1 Research target

SAFE brings the grounds which assist Asian countries policy decisions of environmental changes, which get on gradually and affect broad area. Especially, it quantitatively evaluates the effect of environmental changes originated from anthropogenic events on ecosystem. Specifically, it establishes a monitoring system focusing on the followings;

- Agriculture (rice paddy map and cropping calendar)
- Global warming (CO<sub>2</sub> and CH<sub>4</sub> emission)
- Urban environment (heat island and air pollution)
- Forest resources management (shifting cultivation and forest fire)

### 2.2 Originality and availability

The originality and availability of SAFE is summarized as follows;

- [Development of original software] Development of a satellite image processing software is a fundamental technology in both practical business and research development, and there is a possibility that we lose international competitiveness if we depend on foreign countries for its development.
- [Data and technology transfer] SAFE verify the availability of the system by internationally transfer data and technology, which is sophisticated to the extent that practical users can operate it.
- [Emphasizing feasibility] SAFE center around the historical archive and current satellite missions which are mainly based on direct broadcasting and data dissemination; ADEOS-II GLI, Aqua/Terra MODIS, NOAA AVHRR, Aqua AMSR-E, MTSAT-1R and Terra ASTER.

<sup>1</sup>Sentinel Asia <http://dmss.tksc.jaxa.jp/sentinel/>

<sup>2</sup>APRSF <http://www.aprsaf.org/>

- [Harmonization with future mission] SAFE is aimed at bridging the present and future missions with specific-purpose-oriented issues; GOSAT, NPP, NPOESS, GCOM.

### 3 ACTIVITY REPORT IN 2007-2008

#### 3.1 Establishment of data user community and implementation plan

SAFE project is initiated by the following three organizations including Institute of Industrial Science, University of Tokyo (IIS/UT), Japan, Earth Observation Research Center, Aerospace Exploration Agency, Japan (EORC/JAXA) and Geoinformatics Center, Asian Institute of Technology, Thailand (GIC/AIT). University of Tokyo has a direct broadcasting system of MTSAT, NOAA AVHRR and Aqua/Terra MODIS data installed at Tokyo and Bangkok. These data are freely available through WWW<sup>3 4 5</sup>.

- [2007 September - December] Carry out caravan to a range of supporting environment-related agencies in Southeast Asian countries
- [2007 November - 2008 March] Start to develop algorithms on element technologies including agriculture, global warming, urban environment and forest resources management.
- [2007 December - 2008 March] Establishment of data user community based on satellite observation network between IIS (Tokyo) and AIT (Bangkok).

#### 3.2 Support for the use of data in southeast Asia and south Asia

We have carried out a preliminary study to find several government offices as a best counter part and their demand or request for satellite remote sensing. When we contacted the government agencies in each country with which we built up the cooperative framework, a network of personal contacts developed in the capacity building program by AIT, which started in 2004 and is supported by JAXA, made an outstanding contribution. The main activities in 2007 are summarized as follows;

- We plan to cooperate with International Rice Research Institute (IRRI), which is a subordinate organization of Food and Agriculture Organization (FAO), in the monitoring system for agriculture after next fiscal year.
- In September 2007, wildfire monitoring system was introduced to Geo-Informatics and Space Technology Development Agency (GISTDA) at request of users in Thailand by IIS and AIT.

- We conducted field surveys for wildfire, flood, and agriculture in Mongolia (Jul. 2007), Philippines (Sep. 2007), Bangladesh (Dec. 2007), Vietnam (Dec. 2007), and Thailand (Jan. 2008), and built up the cooperative frameworks for satellite observation technology and support of data usage.

Figure 1 shows an example of agriculture and global warming application focusing on rice paddy map over Asia as a basement for CH<sub>4</sub> emission estimation study<sup>6</sup>.

Figure 2 shows an example of forest management application based on forest fire monitoring system with satellite remote sensing network<sup>7</sup>.

Figure 3 shows a monthly mean atmospheric optical depth (AOD) images at 0.55 $\mu$ m derived from MODIS over East Asia. This image aims to assess exhaust emissions over Asian mega cities with satellite remote sensing and city traffic modeling (Kishi *et al.* (2008)).

Figure 4 shows a snapshot of capacity building program and field campaigning 2007 in Southeast and South Asian countries. They consist of wildfire, flood, and agriculture in Mongolia (Jul. 2007), Philippines (Sep. 2007), Bangladesh (Dec. 2007), Vietnam (Dec. 2007), and Thailand (Jan. 2008).

### 4 CONCLUDING REMARKS

In 2008, we will determine the counterparts of SAFE seeking cooperation from AIT, and plan to offer a training package including data, software, and start-up tutorials to them. In global warming study, because rice paddy mapping had been finished, it became possible to estimate CH<sub>4</sub> distribution at continental scale by integrated use of irrigation information and generative model of CH<sub>4</sub>. It is expected that this system links up with greenhouse gases observing program such as GOSAT and SCHIAMACY.

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<sup>3</sup>WebGMS <http://webgms.iis.u-tokyo.ac.jp/>

<sup>4</sup>WebPaNDA <http://webpanda.iis.u-tokyo.ac.jp/>

<sup>5</sup>WebMODIS <http://webmodis.iis.u-tokyo.ac.jp/>

<sup>6</sup>Rice paddy map over Asia <http://webmodis.iis.u-tokyo.ac.jp/PADDY/>

<sup>7</sup>Forest fire detection system <http://webmodis.iis.u-tokyo.ac.jp/FIRE/>

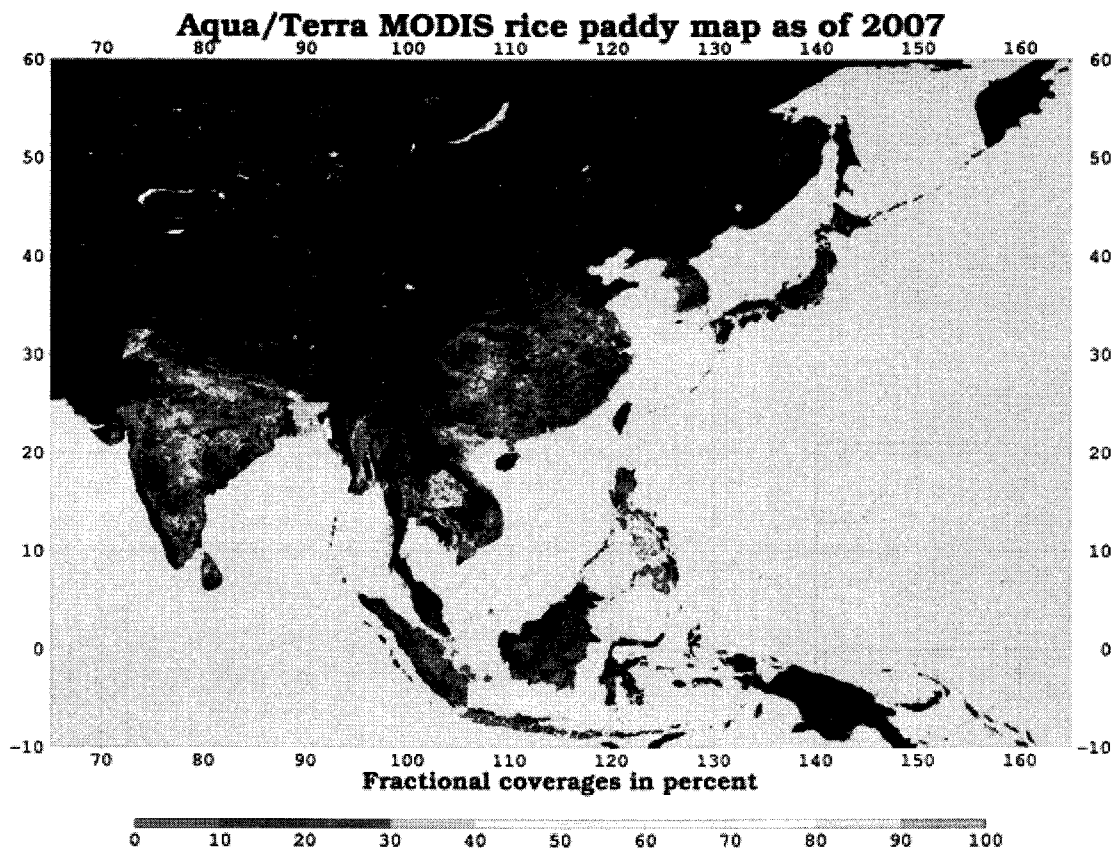
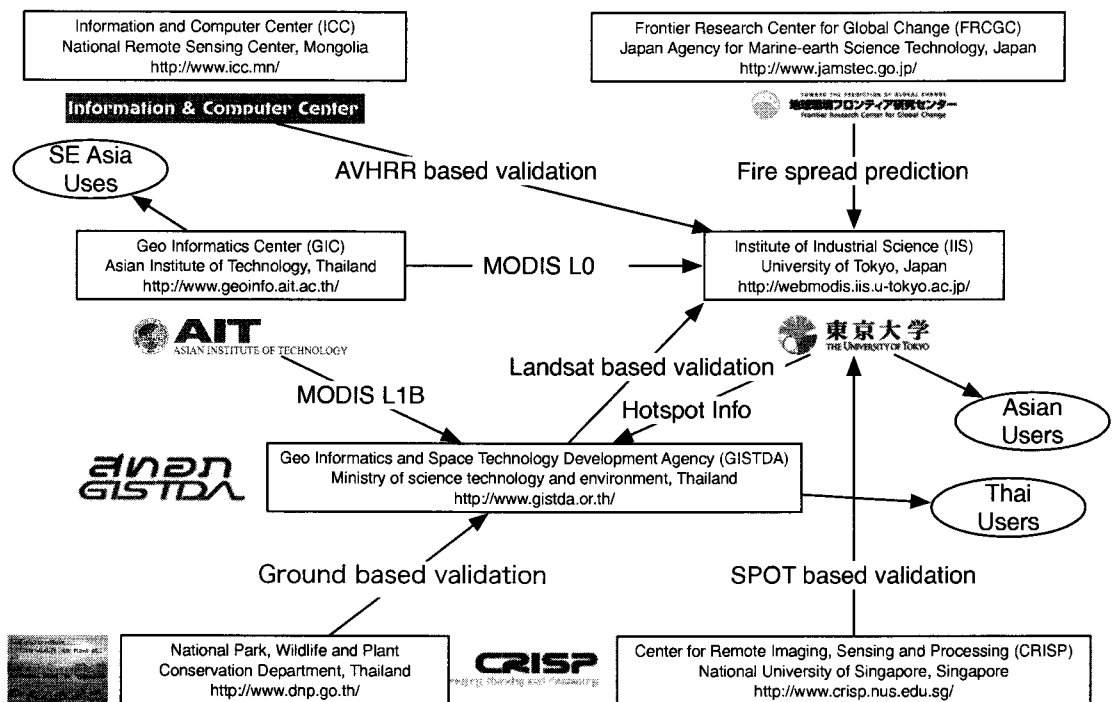


Figure 1: Rice paddy map over Asia as a basement for CH<sub>4</sub> emission estimation study.



Hotspot information distribution, fire spread prediction and validation system

Figure 2: Forest fire monitoring system with satellite remote sensing network.

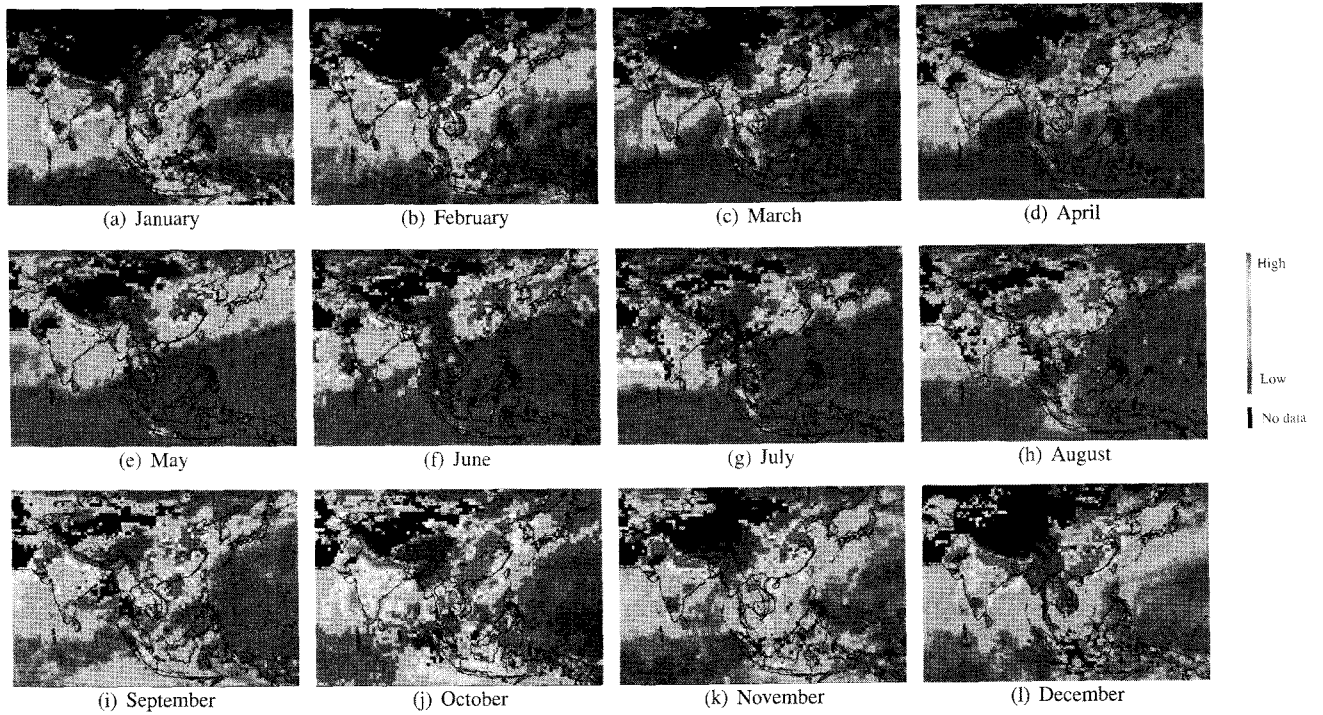


Figure 3: Monthly mean AOD images at  $0.55\mu\text{m}$  derived from MODIS over East Asia.

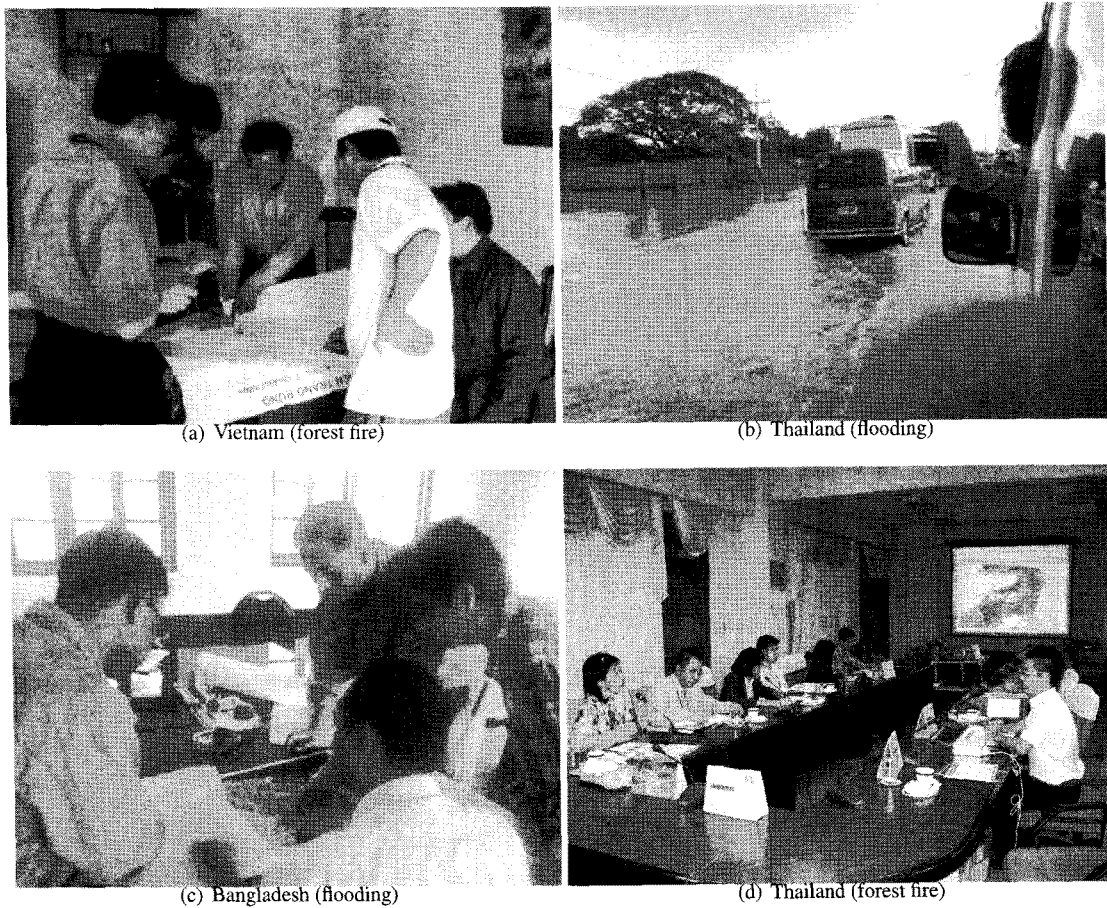


Figure 4: Capacity building program and field campaign 2007 in Southeast and South Asian countries.