GEOGLAM ASIA RICE TEAM AS WELL AS JAPAN'S ACTIVITY USING ALOS-2

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ABSTRACT The Asia-RiCE initiative (http://www.asia-rice.org) has been organized to enhance rice production estimates through the use of EO, and seeks to ensure that Asian rice crops are appropriately represented within GEOGLAM (Group on Earth Observation Global Agriculture Monitoring). Asia-RiCE is composed of national teams that are actively contributing to the Crop Monitor for AMIS and developing technical demonstrations of rice crop monitoring activities using both Synthetic Aperture Radar (SAR) data (Radarsat-2 from 2013; Sentinel-1 and ALOS-2 from 2015; TerraSAR-X, Cosmo-SkyMed, RISAT, and others) and optical imagery (such as from MODIS, SPOT-5, Landsat, and Sentinel-2) for 100x100km Technical Demonstration Sites (TDS) as a phase 1 (2013-2016) and main rice produce region (wall-to-wall) in Indonesia and Vietnam as a phse 2 (2016-2017)in Asia. with satellite –based cultivated area and growing stage map. The Asia-RiCE teams are also developing satellite-based agro-met information for rice crop outlook, crop calendars and damage assessment in cooperation with ASEAN food security information system (AFSIS) for selected countries (currently Indonesia, Thailand, Vietnam and Japan; http://www.afsisnc.org/blog), using JAXA's Satellite-based MonItoring Network system as a contribution to the FAO AMIS outlook (JASMIN) with University of Tokyo (http://suzaku.eorc.jaxa.jp/cgi-bin/gcomw/jasm/jasm_top.cgi).

1. INTRODUCTION

The Asia-RiCE initiative (http://www.asia-rice.org) has been organized to enhance rice production estimates through the use of Earth observation satellites data, and seeks to ensure that Asian rice crops are appropriately represented within GEO Global Agriculture Monitoring (GEO-GLAM) to support FAO Agriculture Market Information System (FAO-AMIS). Asia-RiCE is composed of national teams that are actively contributing to the Crop Monitor for AMIS and developing technical demonstrations of rice crop monitoring activities using both Synthetic Aperture Radar (SAR) data (Radarsat-2 from 2013; Sentinel-1 and ALOS-2 from 2015; TerraSAR-X, Cosmo-SkyMed, RISAT, and others) and optical imagery (such as from MODIS, SPOT-5, Landsat, and Sentinel-2) for 100x100km Technical Demonstration Sites (TDS) as a phase 1 (2013-2016) and main rice produce region (wall-to-wall) in Indonesia and Vietnam as a phse 2 (2016-2017)in Asia. with satellite –based cultivated area and growing stage map.

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Because of continous El Nino in South East Asia, there are less precipitation and rain fall pattern change in South East Asia, crop pattern has been changed and production may be decreased, especially for dry season crop. JAXA provides drought index (KBDI) and accumulated precipitation of Tak province, Thailand where main reservior is located, to AFSIS and national experts to assess rice crop outlook and NDVI time seriese to Ang Tong province where is main rice production area in downstream area of that reservior.

2. ASIA RICE

2.1 GEOGLAM

The Group on Earth Observations (GEO) is an Intergovernmental body with 90 members and 64 participating organizations seeking to deploy a Global Earth Observation System of Systems (GEOSS) for 9 social beneficial areas such as water, climate change, disaster, weather, agriculture, energy, health, bio-diversity. The vision for GEOSS is a world where decisions and actions are informed by coordinated, comprehensive and sustained Earth observations. In November 2011, the G20 Agriculture Ministers addressed the issue of food price volatility with the ultimate objective to improve food security and agreed on an "Action Plan on food price volatility and agriculture".

To increase information availability, quality and transparency, 2 initiatives are suggested. One is FAO's

Agricultural Market Information System (AMIS) and another is GEOGLAM. The G20 final declaration in France mentioned that the GEOGLAM initiative would coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections and weather forecasting data. The objective of GEOGLAM is to reinforce the international community's capacity to produce and disseminate relevant, timely and accurate forecasts of agricultural production at national, regional and global scales.

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2.2 Asia Rice Overview

It has been estimated that half the world's population subsists wholly or partially on rice – with 90% of the world crop grown and consumed in Asia. Given the importance of rice, Asia-RiCE (Asia Rice Crop Estimation & Monitoring) program as support to GEOGLAM led by JAXA with more than 20 Asian Space agencies and Ministries of Agriculture with International organization such as ASEAN, UN/FAO, IRRI from 2013. The relevant GEOGLAM component focuses on the major grain crops (wheat, maize, rice and soybean, total grain) for the G20 + 7 countries covered by AMIS, and aims to provide enhanced, improved 1) enhancing global agricultural production monitoring systems; 2) building capacity at the national level to utilize Earth observations; 3) supporting the monitoring of countries at risk to improve food security; 4) improving the coordination of Earth observations for agricultural monitoring; 5) coordinating research and development (R&D) in support of improved operational agricultural monitoring; 6) disseminating data, products and information. and timely production forecasts to AMIS based on existing global monitoring systems, and in due course regional monitoring systems. Table 1 shows target products of Asia Rice using remote sensing data.

Table. 1 Target products of Asia Rice

ID	Target Agricultural Products
P1	**Rice Crop Area Estimates/Maps**
P2	**Crop Calendars/Crop Growth Status**
P3	**Crop Damage Assessment**
P4	**Agro-meteorological Information Products**
P5	**Production Estimation and Forecasting**

3. ASIA RICE ACCMOPLISHMENTS

3.1 Rice Crop Area Estimation

It is difficult to differentiate paddy rice areas from other crop areas because they have similar spectral and

scattering signatures during the flowering stage. Xiao detected paddy fields by using optical images such as MODIS data to identify distinctive phenological stages when the surface is flooded just before paddy rice is planted and when the surface is matured after planting. The seasonal characteristics of paddy fields were retrieved from multiple space based active radar - SAR data. During the flooding season, backscatter is quite low because the flooding surface is so smooth that it causes specular reflection. In the maturing season, backscatter is at its highest because the surface of a vegetated paddy field is so rough that it causes strong backscatter. Figure 1 is a schematic illustration of the seasonal change.

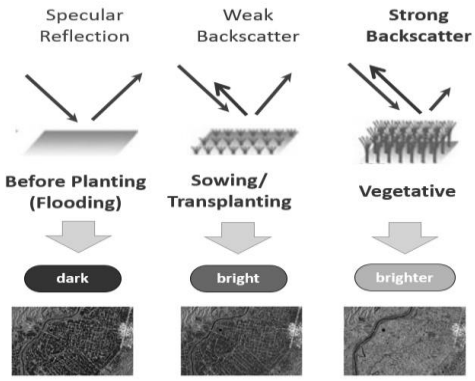

Fig 1. Backscattering chnage

Asia Rice crop team members studyed in TDS to to estimate rice planted area, growing status, damage area using time series SAR data from multiple providers in Indonesia, Vietnam, Thailand, Japan and others. JAXA/RESTEC teams developed the INAHOR (rice crop planted area estimation) software and NASA/CEOS SEO developed & tested a crowd computing SAR processing (INAHOR) platform for Indonesia. CESBIO team also worked to define standard ground observation data collection method for this team under GEORIICE project funded by ESA in cooperation with VAST, Vietnam. In Indonesia and Vietnam, from 2016, we did regional rice crop area estimation to multiple provinces (regional) to provide national statistical information and farming advice in those countries.

Fig. 2 shows rice crop area estimation using multile scence of ALOS-2 ScanSAR data for Indonesia in cooperation with JAXA and Ministry of Agriculture, Indonesia to provice rice crop area and growing status information.

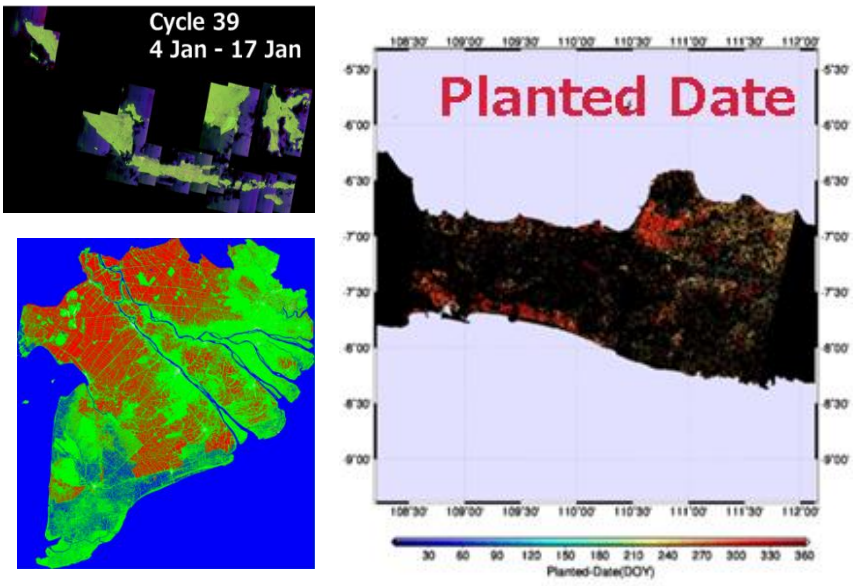

Fig 2. Rice crop area estimation using ALOS-2 in Indonesia and using Sentinel-1 in Vietnam

3.2 Rice Crop Outlook

In addition to SAR observations to detect cultivated rice crop area in rainy season (cloudy condition), there are several observation requirements for rice crop monitoring. As an early warning of rice crop damage caused by weather conditions, it is important to have agro-weather information observed by satellites with ground data including soil moisture, temperature, rainfall, PAR, etc. These agro-weather information are also useful to implement crop yield estimation with crop growth models. Because some regions are cultivated two/three times in a year and Rice is the dominant crop in Asian countries with a large diversity of crop varieties (short, medium and long duration crops), detailed crop calendars (mean crop calendar and abnormal year crop calendar) are necessary.

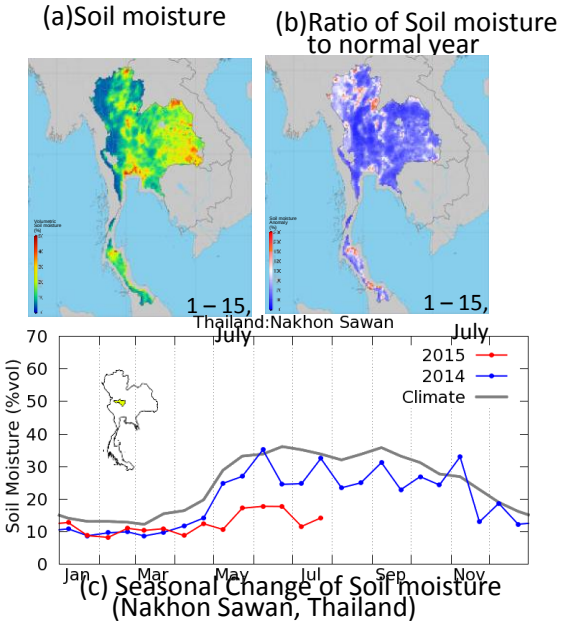

Fig. 4 Example of soil moisture information in Thailand

Thailand is experiencing the worst drought in decades. The left article is a citation from AFSIS Blogs in 2015. In Thailand, a wet season rice is in the time of field preparation and sowing stage, however, some farmers started seeding later due to late coming of rain and less of an irrigation water than normal year. The government has set a policy for the farmers in the Chao Phraya river basin (central region) to shift their period of cultivation. By implementing this policy, some farmers cannot grow the wet season rice two times. In addition, some farmers have shifted to grow other crops such as maize, soybean, cassava, and sugarcane. Consequently, the planted areas are forecasted to decrease about 0.8 million hectares. Moreover, the rice growing condition is poor due to the insufficient water for the field and some rice plants were died by drought which was report by Ms. Chidchanok Lekkao in AFSIS Rice Growing Outlook for the month of July 2015 (http://www.afsisnc.org/blog). Fig. 4. shows an exmaple of drought condition derived from soil moisture information by GCOM-W AMSR2. Figure (a) and (b) show distribution maps of soil moisture and its ratio to normal year. Figure (c) shows a time series graph of soil moisture in Nakhon Swan, Thailand. The red and gray lines mean lines of 2015 and normal year, respectively. A very dry condition is continued from the beginning of this year.

4. CONCLUSION

This paper explains the overview of GEOGLAM's Asia rice crop component. After authorization of this Asia rice crop component in the GEOGLAM, we will move to the development phase of the GEOGLAM system of systems to tackle global and regional food security issues using space-based technology to contribute UN SDGs and national / regional food security topic in cooperation with international donor and national / regional / international related organizations. .