

Real-time Agricultural Field Information Monitoring in Thailand

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1. Introduction

Spatial and temporal soil monitoring is required for assessing impacts of land use and management on soil quality over large area. Although remote-sensing techniques by satellite are often used for such soil monitoring, it gives us information on only the surface but not the inside of soil. On the other hand, soil scientists survey soil profiles and measure soil physical properties, i.e. soil water moisture, temperature, electrical conductivity (EC), with some sensors connected to a data logger in a pit selected from large area. However, they need to set a lot of data loggers to get more reliable soil information in a large area because the selected point is not guaranteed to be representative. In order to validate satellite remote-sensing data, we are testing real-time monitoring of soil information including vegetation and soil moisture in a rain-fed field Khon Kaen in Northeast Thailand using Fieldserver with soil moisture sensors. In this study, we outline this new monitoring system and demonstrate the results obtained, then discuss the possibilities of the system for MAHASRI.

2. Experimental Methods

2.1 Fieldserver

Fieldserver (FS) is an automatic monitoring system, which consists of CPU (Web server), AD converter, Ethernet controller and sensors such as air temperature, relative humidity, solar radiation (PPFD), soil moisture, soil temperature, electrical conductivity, CCD camera. The FSs are interconnected by Wireless LAN (Wi-Fi, IEEE802.11b). Digital cameras and Web cameras can be connected, and high-resolution pictures of fields are transferred through Wi-Fi broadband networks, and stored on Web servers. The cameras can be remotely controlled by a web browser.

2.2 Soil information monitoring system

The system we used composed of a FS, a solar panel, a router, an agent box (in-site data logger).

2.3 Experimental site

We installed three FSs in a rain-fed field in Khon Kaen, Northeast Thailand in December 25, 2006. Each FS is about 300 m apart, but signals are less interfered because the FS is stood higher the rice canopy. We got meteorological data (air temperature, humidity, radiation, wind velocity, precipitation) and soil information (soil moisture content, ground temperature, electrical conductivity) with image data of the site. We inserted soil sensors (EC-TE, Decagon Device, 2007) at the depth of 4, 8, 16, 32 cm for monitoring soil information. These data are automatically stored through internet into a data-server at NARO (National Agriculture and Food Research Organization) in Japan.

3. Results and Discussion

Once data are stored in a data server at NARO, we can download the meteorological data and images data using a software which was developed at NARO. The stability of the system is mainly dominant to internet connection in the site. We are now developing a system with a mobile phone to get data even in the field where it is hard to access internet.

Soil moisture increased abruptly just after rains and decreased gradually after rain stop in March and April. On the other hand, the soil moisture kept high after a heavy rain at the end of April. The variation of soil temperature became small after May, indicating that the heat capacity of soil increased because the soil contained much water. In fact, the image on May 21 tells us the water logging in the rain-fed field. In this way, the real-time monitoring of soil information including meteorological data and image is helpful to understand events at remote agricultural fields.

4. Conclusions

The FS is a quite promising tool for field science and technology only if we can find or develop suitable soil sensors because it detects both real-time images and meteorological data including soil information.

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