

Research Topics of Agricultural Remote Sensing

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Summary

Terra/ASTER has high resolution, large band numbers, stereoscopic ability and about 10 years observations. The regional characteristics of agriculture were investigated using the satellite data. Most of the paddy fields are uniform by repeated cultivation, and upland farming fields show large differences on bare soil and high vegetation for the crop rotation. The Shonai Plains is typical paddy fields area in Japan, and has well-developed irrigation and drainage systems. Sacramento Valley, California, USA is also a very famous commercial rice producing area. At the area, the size of each paddy field is almost ten times larger than Japanese large paddy field. With regard to upland farming fields, Tokachi Plain has smaller size field than Denver area in USA.

Introduction

Remote Sensing Laboratory, Graduate School of Agricultural Science, Tohoku University started in April 2004. At first, for the research and education at the laboratory, we are developing the analysis and storage system of remote sensing and GIS data (Saito *et al.*, 2007, 2008). The hardware of the system consists of ordinary PCs, one digitizer and one color laser printer. The PCs are assembled by us for the optimal performance and low cost and connected to Gigabit LAN. The operating system was Windows 2000 at the starting period and now is Windows XP. The software of the system has ARC/GIS as GIS software and many kinds of Remote Sensing software such as, ERDAS/Imagine, ENVI, eCognition, PG-Steamer and SILCAST. Next, mainly using the system, we research on Agricultural and Grassland Monitoring (Saito *et al.*, 2005; Fukuo *et al.*, 2008), Land Use Analysis (Kunii and Saito, 2009), Digital Field Center (Saito *et al.*, 2009), and Local Characteristics for Agriculture. The last one is important and an interesting subject, and we introduce the subject.

Terra/ASTER has high resolution, large band numbers and stereoscopic ability. Using the advantages, the regional characteristics of agriculture have

been investigated using Terra/ASTER since 4 years ago in our laboratory.

Determination of Agricultural Characteristics in Each Country Using Terra/Aster Data

Paddy Field Analysis

Paddy rice fields analysis is started at first, we analyze five areas in Asia and one area in America, as follows ; 1) The Shonai Plains in Japan, 2) The Yangtze River delta in Middle-East China, 3) North-East Thai Plains, Thailand, 4) Mekong Delta in South Vietnam, 5) Thimphu area, Bhutan 6) Sacramento Valley, California, USA. We perform almost same procedures at the six areas. First, we make DEM and orth-image from ASTER 1A data, and next, we make many color composite images including 3D images. Using the color composite images, agricultural characteristics are extracted, and summarized in Table 1.

Table 1. Characteristics of Each Paddy Field

Location	Regional Topography	Growing Season	Field Size	Field Shape
Shonai, Japan	Mountainous	Summer	Middle	All Rectangle
MW-China, China	Almost Flat	Summer	Middle	Irregular & Rectangle
NE-Thai, Thailand	Very Flat	Rainy	Small	Almost Irregular

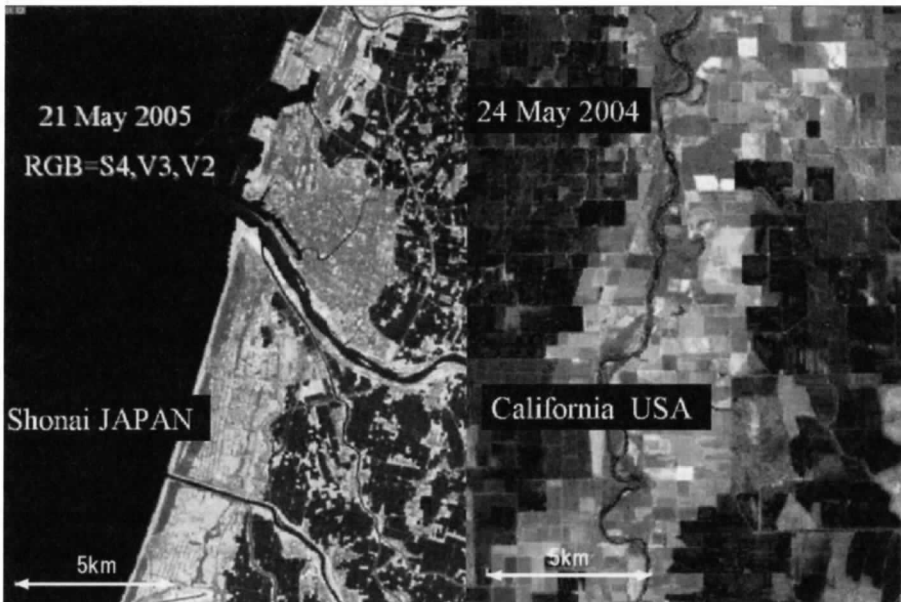


FIG. 1. Paddy fields in Japan and USA (SWIR image, Dark : water)

The image of the Shonai Plains in Japan and that of Sacramento (Central) Valley, California, USA are listed in Fig. 1, and color composite is R.G.B=red, near infrared, short wave infrared. The Shonai Plains (Fig. 1, Left) is typical paddy fields area in Japan, and has well-developed irrigation and drainage systems. The Yangtze River delta in Middle-East China is a famous paddy fields area in the world and recently fishpond area-is increased. North-East Thai Plaines and the area of Mekong Delta in South Vietnam are famous to produce exporting rice. At the area, there is enough temperature, but a limitation factor of rice growth is water. North-East Thai Plains has severe dry season, and at the season, rice cannot grow. Mekong Delta area is adjacent to South China Sea and the mouth of the Mekong River. At the area, rice grows not only in the rainy season but also in the dry season. Bhutan is a small and mountainous country. There are very small paddy fields in Thimphu area in Bhutan. Sacramento Valley (Fig. 1, Right), California, USA is also a very famous commercial rice producing area. At the area, the size of each paddy field is almost ten times larger than Japanese large paddy field. We can easily understand that it is very difficult to make the rice at same cost in Japan and USA.

Upland Farming Field Analysis

Targets areas are 1) Tokachi Plain at Hokkaido in Japan, 2) Riyadh area in

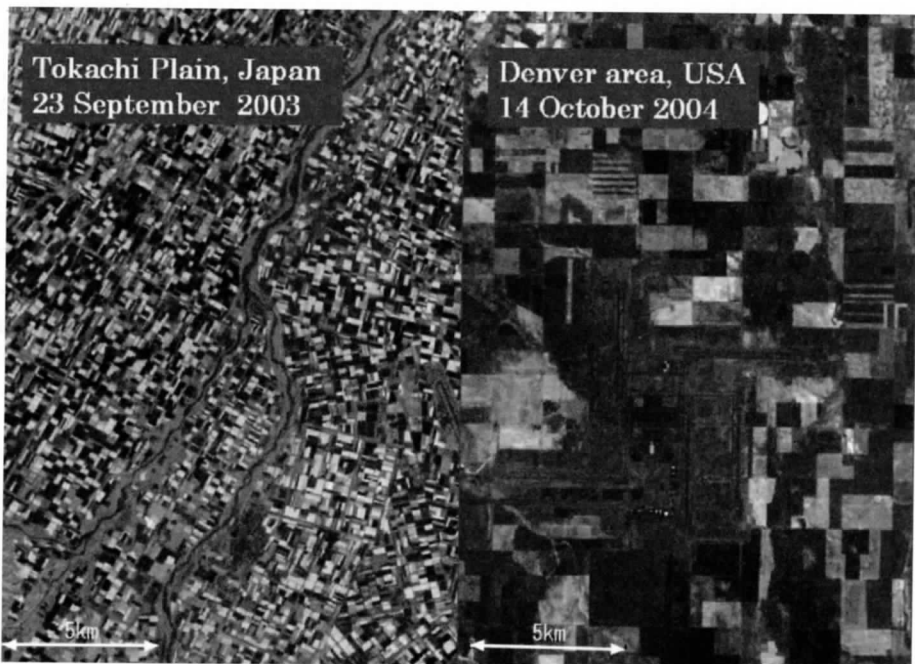


FIG. 2. Agricultural fields in Japan and USA (NIR image, White : Vegetation)

Table 2. Characteristics of Each Agricultural Field

Location	Regional Topography	Field Size	Field Shape
Tokachi, Japan	Mountainous	Small	All Rectangle
Riyadh area, Saudi Arabia	Flat	Large	Almost Circle
Jordan Valley, Jordan	Mountainous	Small	Irregular & Rectangle
Vienna, Austria	Mountainous	Middle	Almost Irregular
Bretagne area, France	Flat	Middle	Irregular
Buenos Aires, Argentina	Very Flat	Large	Almost Rectangle
Denver, USA	Very Flat	Large	Rectangle and Cycle

Saudi Arabia, 3) Jordan basin in Jordan, 4) Bretagne area in France, 5) Vienna area in Austria and 6) Denver area in USA. In many Asian countries, main crop is paddy rice, and at most of Japanese plains, rice paddy is main land use. Hokkaido Island in Japan is on high latitude and it is difficult to make rice because of low temperature. Upland farming is a main subject at Tokachi Plain. Fig. 2 left is the ASTER image of Tokachi Plain, and color composite is R.G.B = red, near infrared, short wave infrared. In Riyadh area, rainfall is 25 mm/year. It is very severe in water supply and irrigation systems are necessary. Most of the area is bare soil, and vegetation area is very small only within irrigated area. Jordan basin has low rainfall of 270 mm/year and has rain from January to March in winter season. Main products are winter wheat and barley, vegetables, and fruits. At Bretagne area in France, field size is almost same to Tokachi area in Japan. Austria is a mountainous country and only eastern part has plain. At the area, cereals, fruits and vegetables are produced. Colorado State in USA is a part of the Great Plains whose elevation is from 1,000 to 2,000 m. Main agricultural products are corn, soybean, wheat, and cotton. Fig. 2 right is the ASTER image of Denver area in Colorado State, USA. The elevation of the image area is from 1,500 to 1,700 m by ASTER DEM. Field sizes are larger than other areas such as Tokachi Plain, Vienna area, Jordan basin and Bretagne area. There are pivot irrigation systems in the images. The information is summarized at Table 2.

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