

STUDIES FOR REGIONAL CHARACTERISTICS OF UPLAND FARMING USING TERRA/ASTER DATA

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ABSTRACT:

Terra/ASTER has high resolution, large band numbers and stereoscopic ability. Using the advantages, the regional characteristics of paddy fields were investigated using Terra/ASTER from three years ago in our laboratory. Continuing the investigation, "Study for Regional Characteristics of Upland Farming Using Terra/ASTER Data" was started at 2006. Target areas are Tokachi plain at Hokkaido in Japan, Riyadh area in Saudi Arabia, Jordan basin in Jordan, Bretagne area in France, Vienna area in Austria, Denver area in USA. At almost paddy fields are uniform by repeated cultivation, and upland farming fields are very different at bare soil and high vegetation for the crop rotation. In Tokachi Plain, Vienna area, Jordan basin and Bretagne area the field sizes are almost same, and at Denver area, that is very large. Riyadh area is very severe in water supply and irrigation systems are necessary. Jordan basin is also severe and there are many irrigation ponds.

1. INTRODUCTION

Recently, the importance of terrestrial and marine field sciences might be realized in many countries including Japan, and remote sensing and GIS are powerful tools for the study. For this reason, Remote Sensing Laboratory, Field Science Center, Graduate School of Agriculture Science, Tohoku University in Japan started at April 2004, and at the time, there was nothing about Remote Sensing and Geographical Information System (GIS) tools [1]. First, we developed analytical system for the remote sensing and GIS using hand made PCs at the lowest cost.

2. ASTER DATA

We want to more precision understanding of the local characteristics using ASTER data. First we check the advantages of ASTER data, and the results are as follows,

1. High-resolution and the large swath
2. Large wavelength and many bands
3. High-level of geographical location
4. Stereo pair images
5. High performance data searching system

6. High speed data delivery system
7. Cheap price
8. Large volume archive by seven years observation

A kind of project “Determination of Local Characteristics at Global Agriculture Using Archive ASTER Data” was started at middle of November 2005. We establish data processing system and get some results. The procedure is listed in Fig. 3. At first, we survey target and request the data at level 1A data for analyses using ASTER Ground Data System (GDS). Next, The level 1 data are processed to ortho image of Geotiff format with UTM coordination and made to Digital Elevation Model (DEM). At last, we use the data for understanding localities of agriculture using package software such as ENVI, Erdas/Imagine, and PG-Steamer.

3. TARGET AERA

Targets areas are Tokachi plain at Hokkaido in Japan, Riyadh area in Saudi Arabia, Jordan basin in Jordan, Bretagne area in France, Vienna area in Austria, Denver area in USA. The locations are listed Fig. 1.

4. TOKACHI PLAIN AT HOKKAIDO IN JAPAN

At many Asian countries, main crop is paddy rice, and at almost Japanese plain, rice paddy is main land use. Hokkaido Island in Japan is high latitude and it is difficult to make rice because of low temperature. Upland farming is main subject at Tokachi plain. Fig. 2 is the ASTER image of Tokachi plain, and color composite is R.G.B=red, near infrared, short wave infrared. UL means upper left, UR is upper right, and LR is lower right. The elevation of the image area is from 0 to 500 m by ASTER DEM. Each field size in this area is larger than paddy field area in Japan. Therefore, it is very smaller that of USA. In this area, main products are winter wheat, beans, potato, sugar beet, and vegetables.

5. RIYADH AREA IN SAUDI ARABIA

At Riyadh area, rainfall is 25mm/year. It is very severe in water supply and irrigation systems are necessary. Fig. 3 is the ASTER image of Riyadh area and color composite is same Fig.2. Almost area is bare soil, vegetation area is very small and only irrigated area. The elevation of the image area is from 550 to 750m by ASTER DEM. The Circle shape objects at large scale image are the pivot irrigation system using underground water that is pumped up. Main products are winter wheat and vegetables.

6. JORDAN BASIN IN JORDAN

Jordan basin has small rainfall at 270mm/year, almost rainfall is January to March in winter season. Main products are winter wheat and barley, vegetables, and fruits. Fig 4 is ASTER image of Jordan basin, and the elevation of this area is from -400 to 800 m. Jordan basin is severe for rainfall and there are many irrigation ponds.

7. BRETAGNE AREA IN FRANCE

France is agricultural country, and products wheat, barely, corn, potato and sugar beet. Fig 5 is



Fig 1 Target areas for upland farming

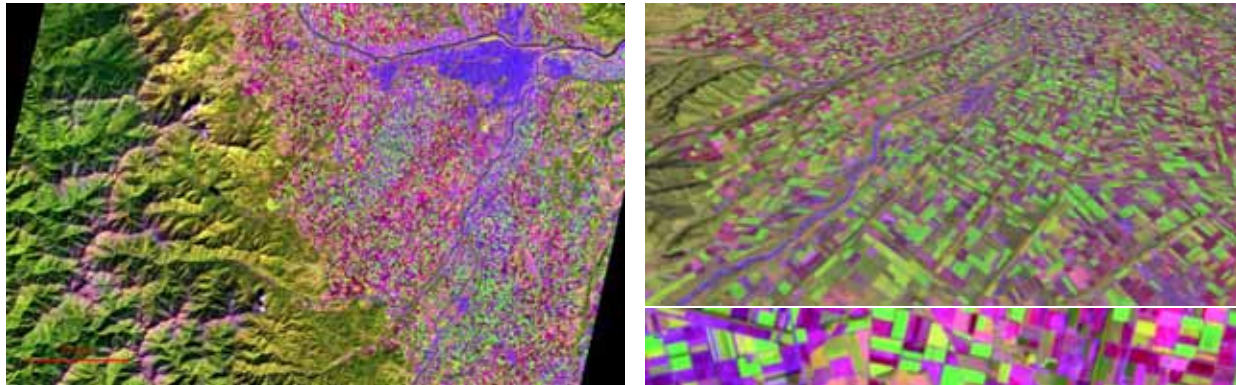


Fig. 2 Tokachi Plain in Japan on 23 Sep. 2003
 UL: Small scale image
 UR: 3D image
 LR: Large scale image

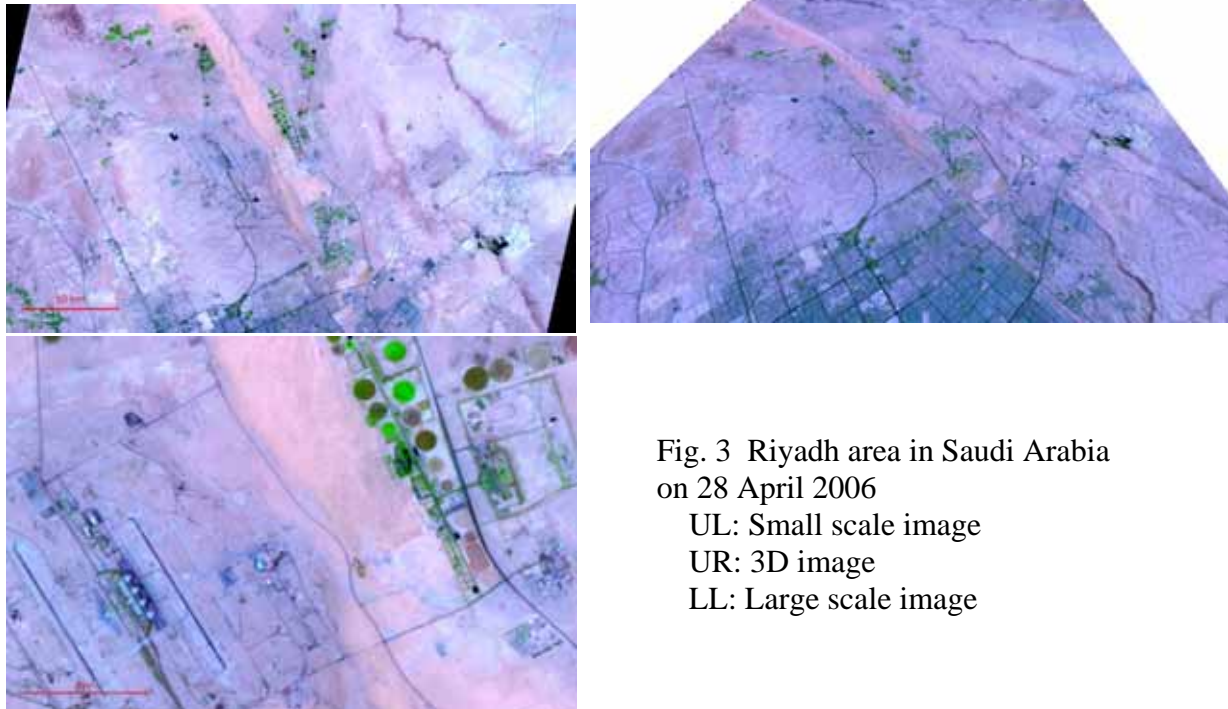


Fig. 3 Riyadh area in Saudi Arabia on 28 April 2006
 UL: Small scale image
 UR: 3D image
 LL: Large scale image

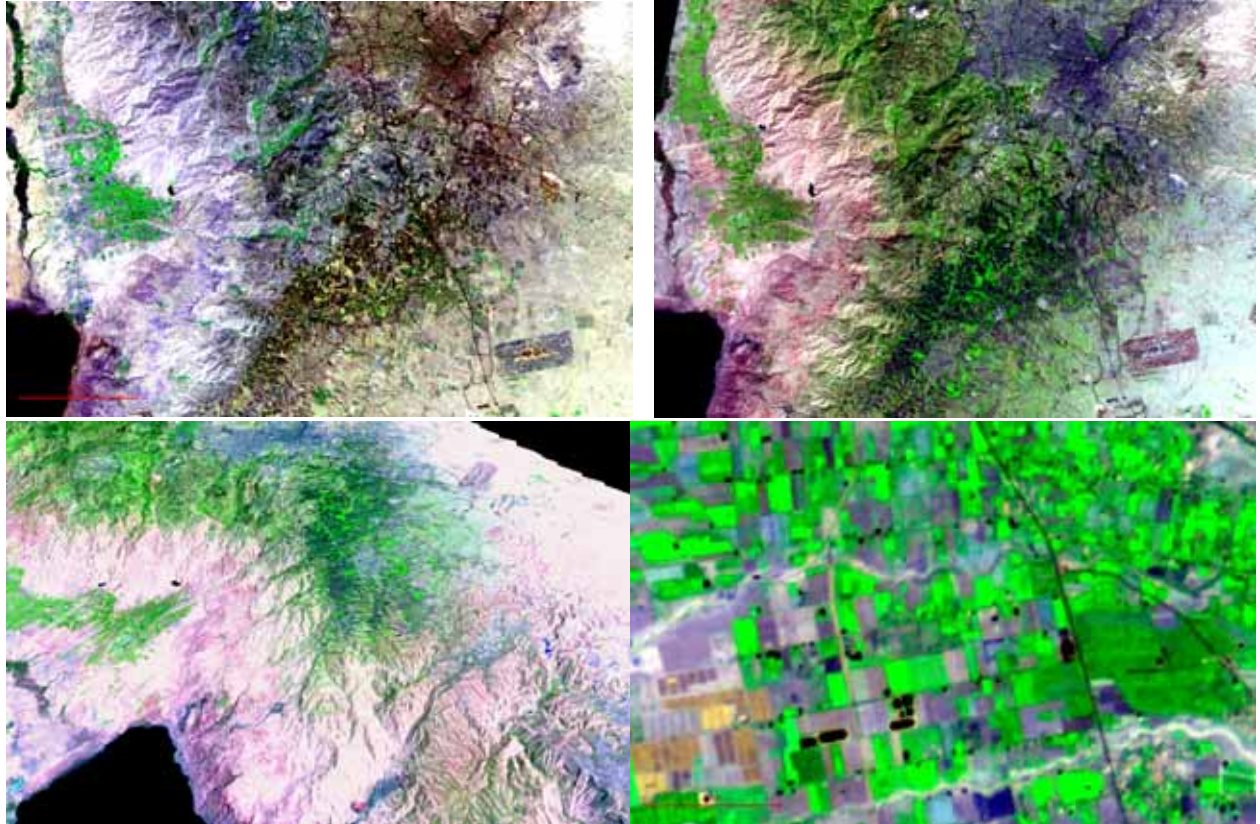


Fig. 4 Jordan basin in Jordan

UL: Small scale image on 16 Aug. 2005

UR: Small scale image on 19 Mar. 2006

LL: 3D image on 19 Mar. 2006

LR: Large scale image on 16 Aug. 2005

listed the ASTER image at Bretagne area in France. The elevation of this area is from 0 to 400 m. Middle right (MR) image is two season NIR image (r: 8 June 2005, G&B: 3 Sep. 2005). Red area has vegetation at early June and no vegetation at middle August, and the area is winter crop that is wheat. Sky blue area has no vegetation at early June and has vegetation at middle August, and the area is summer crop such as corn, potato and sugar beet. Field size is almost same to Tokachi area in Japan.

8. VIENNA AREA IN AUSTRIA

Austria is mountainous country and only eastern part has plain. At this area produces cereals, fruits and vegetables. Fig 6 is listed the ASTER image of Vienna area at eastern part of Austria. The elevation of this area is from 150 to 500 m. The image shows that forest remains at flats area and some fields are long and narrow.

9. DENVER AREA AT COLORADO STATE IN USA

Colorado State in USA is a part of great plain which elevation is 1000 to 2000m. Main agricultural products are corn, soybean, wheat, and cotton. Fig 7 is listed the ASTER image of Denver area at Colorado State in USA. The elevation of the image area is from 1500 to 1700m by ASTER DEM.

Field sizes are larger than other area such as Tokachi Plain, Vienna area, Jordan basin and Bretagne area. There are pivot irrigation systems in the images.

10. FUTURE PLAN

In Asian countries, there is local upland farming, and we hope to determine the farming system collaboration with the researcher of each area. We want to continue the study of “Determination of Local Characteristics at Global Agriculture Using Archive ASTER Data”

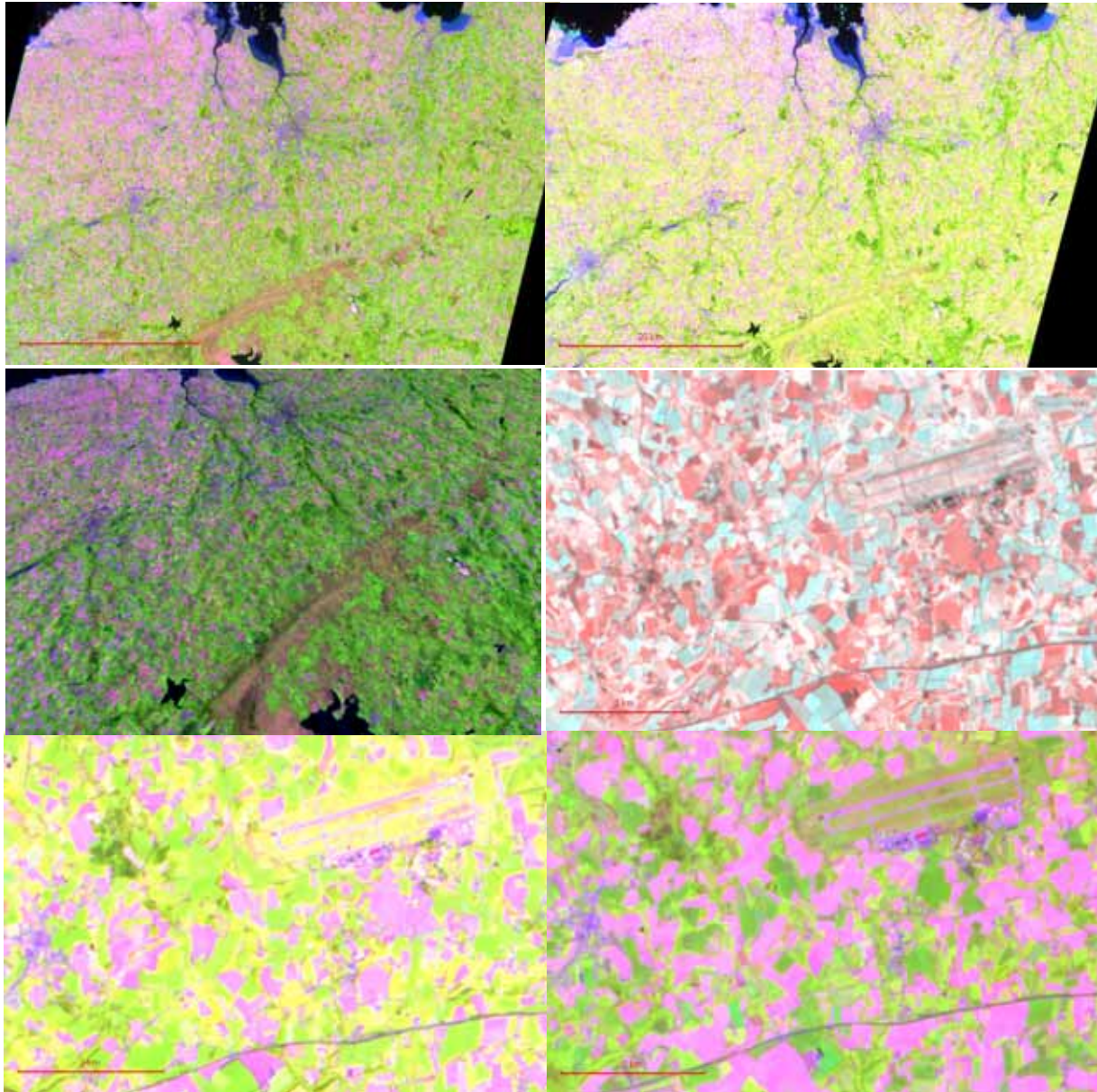


Fig. 5 Bretagne area in France

UL: Small scale image on 8 June 2005 UR: Small scale image on 3 Sep. 2005

ML: 3D image on 8 June 2005 MR: NIR image (r: 8 June 2005, G&B: 3 Sep. 2005)

LL: Large scale image on 8 June 2005 LR: Large scale image on 3 Sep. 2005

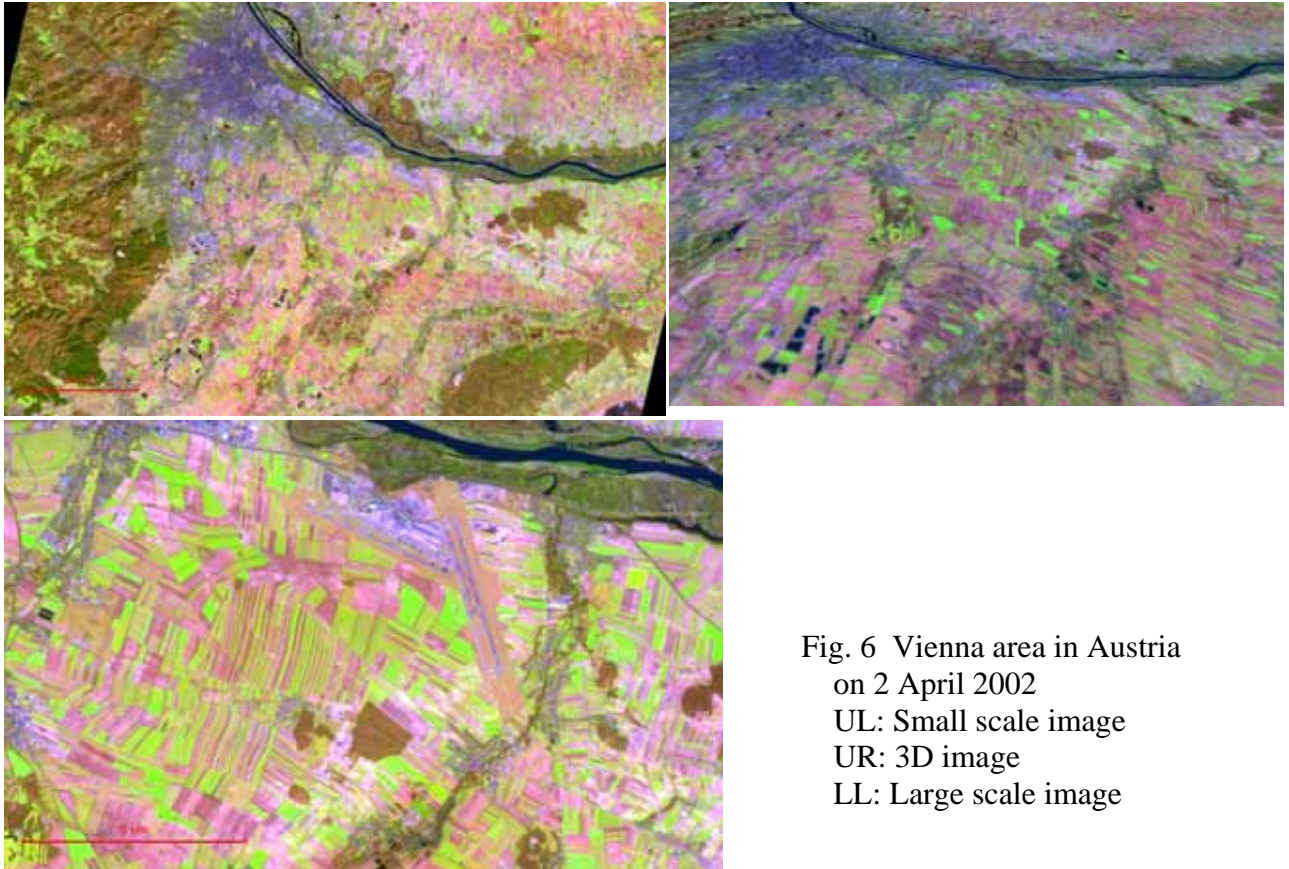


Fig. 6 Vienna area in Austria
 on 2 April 2002
 UL: Small scale image
 UR: 3D image
 LL: Large scale image

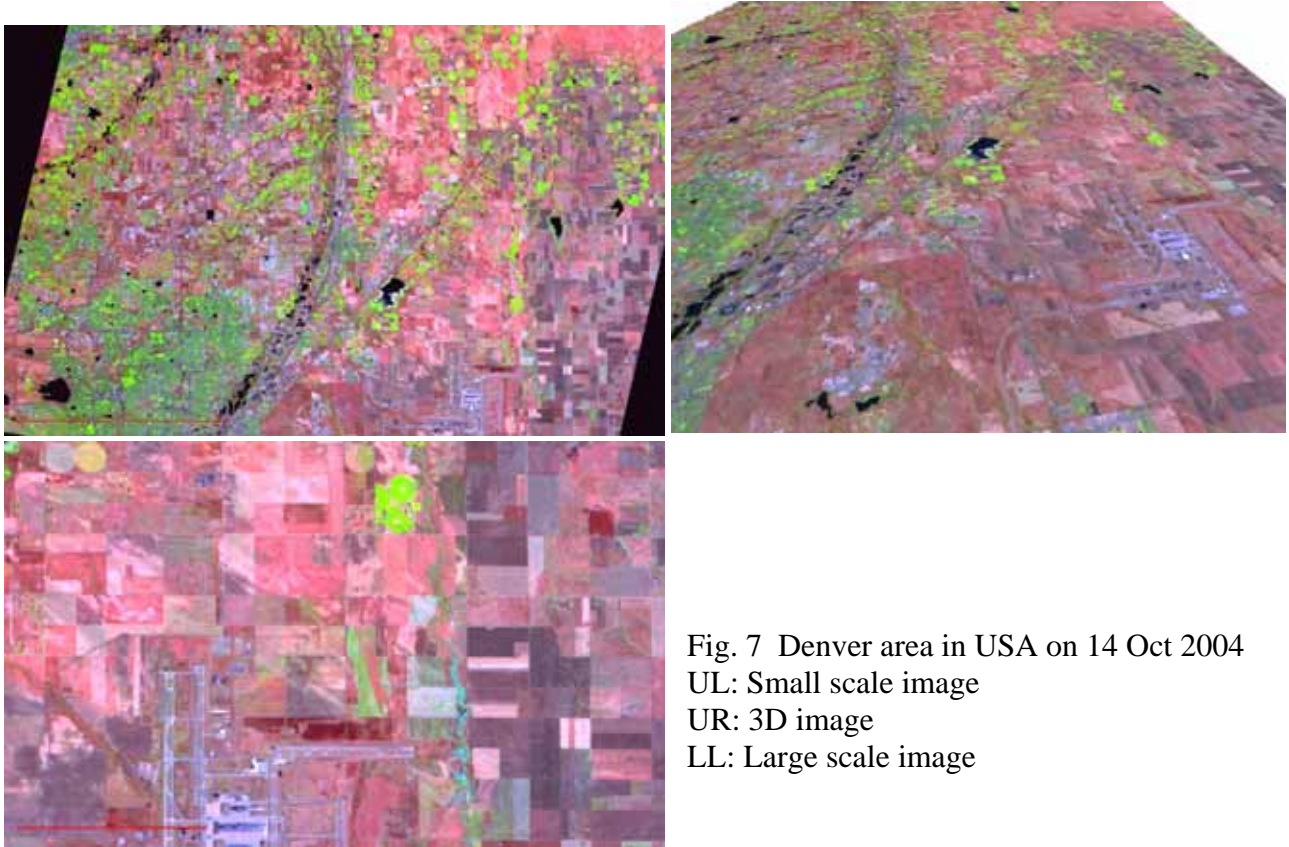


Fig. 7 Denver area in USA on 14 Oct 2004
 UL: Small scale image
 UR: 3D image
 LL: Large scale image