Shirkat Town Monitoring Using Digital Elevation Model

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Abstract

In this search, a colored image of French satellite SPOT, of Shirkat country in Salahadeen was used with resolution about (5m) for an area with dimensions (4km×8km), and a digital elevation model (DEM) with grids (20m×20m) and levels reach to (1m) resolution from the same satellite for the same country, with an image taken from the IKONOS satellite with (1m) resolution, in addition to master plan and administrative map for the same area.

The IKONOS satellite image processed digitally, and intersected with the DEM, to create a three dimensional model for the area under study, with resolution about (1mm), by the use of AutoCAD and GIS programs, and making a comparison between the field survey and the images information, resulting extensive information about the levels in shirkat country streets and the surrounding buildings, and an attributive results about the agricultural or desert spaces around the country.

Keywords: Dem, Spot, Ikonos.

مراقبة قرية شرقاط باستخدام نموذج المناسيب الرقمية

الخلاصة

استخدم في هذا البحث صورة فضائية ملونة مأخوذة من القمر الاصطناعي الفرنسي SPOT بدقة خمسة أمتار لمساحة (4كم × 8كم) مع نموذج للمناسيب الرقمية (DEM) بتقسيمات (20م×20م) وبمناسيب تصل لدقة متر واحد من نفس القمر بالإضافة إلى صورة مأخوذة من القمر الاصطناعي IKONOS بدقة متر واحد، وقد أخذت هذه الصور لنفس المنطقة لقضاء الشرقاط التابعة لمحافظة صلاح الدين،كذلك استخدمت خارطة إدارية وتصميم أساسي للمنطقة لتحديد استعمالات الأرض وحدود البلدية.

في هذا البحث تم إجراء عمليات تصحيح للصورة المأخوذة من القمر الاصطناعي IKONOS وتعشيقها مع الصورة الأخرى ونموذج المناسيب الرقمية DEM باستخدام برامج AutoCAD وGIS، وتم تكوين شكل ثلاثي الأبعاد للمنطقة بدقة تصل لمليمتر واحد وتوضيح نقاط تقاطع الشوارع، وبإجراء مسوحات حقلية إضافية على المنطقة الآنفة الذكر ودمجها مع النتائج المستحصلة من نموذج المناسيب الرقمية (DEM) ومقارنتها مع بعض حصلنا على استنتاجات واقعية عن المعدلات العامة للمناسيب في شوارع المنطقة وما يشذ عنها في بعض المواضع وهذا للمنطقة المسكونة والمحيطة بالشارع وكذلك معدل عام لمناسيب المناطق الزراعية والصحراوية المحيطة بالقضاء.

Introduction

Urban development is one of the key issues facing land-use planning departments today.

Monitoring the spread of urbanization concerns regions, groups of urban communities.

Or even entire countries, and may sometimes span international borders.

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Regional and local development programs need geographic information to give decision-makers a broad picture that reaches across all sectors. Such programmers have to ensure that land-use provisions are spatially coherent and take environmental issues fully into account.

Collecting uniform and current geographic data for planning purposes is not always an easy task. Tools for tracking built-up areas require map coverage of vast areas that is both accurate and uniform (1).

Digital elevation model (DEM) data are arrays of regularly spaced elevation values referenced horizontally either to a Universal Transverse Mercator projection or to a geographic coordinate system. The grid cells are spaced at regular intervals along south to north profiles that are ordered from west to east (2).

East View Cartographic maintains an extensive inventory of off-the-shelf Digital Elevation Models for immediate delivery. In addition EVC can provide precision DEMs from various in-stock and easily accessible source materials. Such products include DEMs at 90m, 50m, 30m and higher accuracies for much of the world's surface. Source materials include global coverage topographic maps, stereo satellite imagery, and aerial photography (3).

DEM with other satellite images are used to perform the spatial data needed in vast areas monitoring and management.

Sensors of used images

1- SPOT Satellite:

The SPOT-5 Earth observation satellite was successfully placed into orbit by an Ariane4 from the Guiana Space Centre in Kourou during the night of 3 to 4 May 2002.

The VEGETATION2 passenger instrument on SPOT-5 also provides continuity of environmental monitoring around the globe, like its predecessor on SPOT-4.SPOT Image Corporation is composed of four subsidiaries, including an office in Germany and a dense global network of receiving stations, channel partners, and distributors. Satellite Imaging Corporation is an official distributor for SPOT Image Corporation.

Compared to its predecessors, SPOT-5 offers greatly enhanced capabilities, which provide additional cost-effective imaging solutions. Thanks to SPOT-5's improved 5-metre and 2.5-metre resolution and wide imaging swath, which covers 60 x 60 km or 60 km x 120 km in twin-instrument mode, the SPOT-5 satellite provides an ideal balance between high resolution and wide-area coverage. The coverage offered by SPOT-5 is a key asset for applications such as medium-scale mapping, urban and rural planning, oil and gas exploration, and natural disaster management.

SPOT-5's other key feature is the unprecedented acquisition capability of the on-board HRS stereo viewing instrument, which can cover vast areas in a single pass. Stereo pair imagery is vital for applications that call for 3D terrain_modeling and computer environments, such as flight simulator databases, pipeline corridors, and mobile phone network planning (4).

2- IKONOS Satellite:

The IKONOS Satellite is a high-resolution satellite operated by GeoEye. Its applications include both urban and rural mapping of natural resources and of natural disasters, tax mapping, agriculture and forestry

analysis, mining, engineering, construction, and change detection. It can yield relevant data for nearly all aspects of environmental study.

IKONOS images have also been procured for use in the media and motion picture industries, providing aerial views and satellite photos for many areas around the world. Its high resolution data makes an integral contribution to homeland security, coastal monitoring and facilitates 3D Terrain analysis.

IKONOS provides the following services for multiple industries, including oil and gas, agriculture and land management, environmental analysis, and motion pictures:

- Obtaining and providing aerial and satellite images along with professional advice to help in finding the best solution for your project.
- Processing imagery, including ortho-rectification, culture extraction, Digital Terrain Models, and raster-to-vector translation.
- Incorporating third-party service data for Geographic Information System (GIS) projects.
- Consulting on band combinations most appropriate for remote sensing applications, including environmental impact studies (EIS), regional environmental monitoring, and change detection to bring out the geographical and manmade features that are pertinent to project (5).

Experimental work

1- (DEM) from SPOT satellite with grids (20m×20m) and levels reach to (1m) resolution used for getting the levels of study area (Shirkat), as shown in figure (1).
2- Satellite colored image with (5m) resolution from SPOT also for assuring the conformance of the image with the DEM in the (x, y) coordinates, reaching to put the third dimension (z) in the true place, as shown in figure (2&3) .
3- Satellite image from IKONOS with resolution (1m) for getting more details about the country, as shown in figure (4&5).
4- Administrative map of the master plan used for assigning land uses and municipality limits of the study area, as shown in figures (6/a& b).
5- Digital image processing programs have been used for converting the DEM from raster to vector, to facilitate Geographic Information System (GIS) programs work.
6- The country streets have been painted as a network and the intersections of the streets were spotted, by the use of GIS and the AutoCAD programs, as shown in the figures (7/ a, b, c, d& e).
7- For raising the accuracy the grids of DEM interpolated to (10m×10m) covering the area of study in three dimensional form.
8- In AutoCAD program wherever you put the pointer you get three coordinates (x, y& z), as shown in figure (8).
9- Field surveys have been done, and three coordinates were gotten in the country streets and the other places, which confirmed the results of the librarian work.

Conclusions

1- The elevations of this study was very close to the field survey results for the same area, that is mean, DEM can be used in topographic surveys successfully. The accuracy of DEM was (±0.2m).
2- The elevations in open areas were convergent, because of the absence of the buildings.

3- The elevations in the closed areas were convergent in the streets centerlines and, have been changed in terminals, and constructed areas (±0.5-0.7m), because the movement of 1 pixel equals 5m in the station, that is make a cursor moves from the center of road to a nearby building in one pixel movement. So that, if the image resolution is better than the used image, the results may have more accuracy.

4- The DEM can be used in the roads and the water and sewages pipelines designing surveys, because it is giving the designer the differences in elevations and the slopes of the ground.

References

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[3] http://www.cartographic.com/xq/asp/iraq/digital/elevation/models/navmode.r/rid.132/tid.7/sid.0/cid.0/vid.0/oid.0/qx/hub/index.asp

[4]http://www.satimagingcorp.com/satellite-sensors/spot-5.html

[5] http://www.satimagingcorp.com/satellite-sensors/ikonos.html

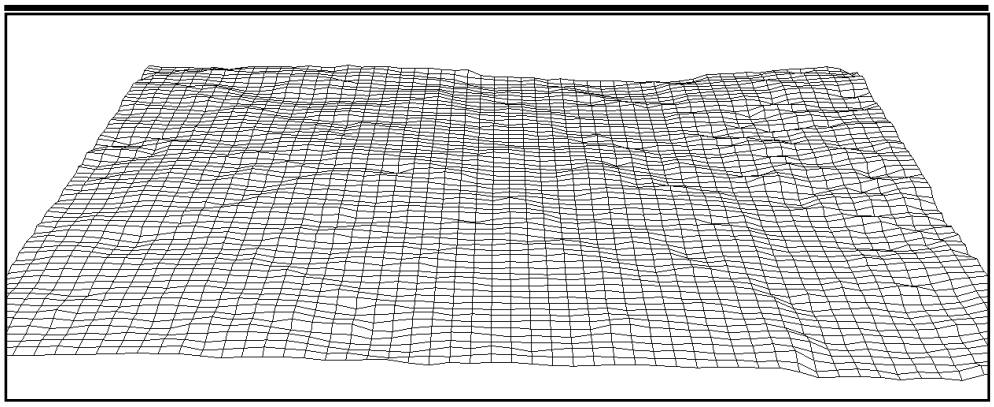


Figure (1) Digital elevation model for shirkat city

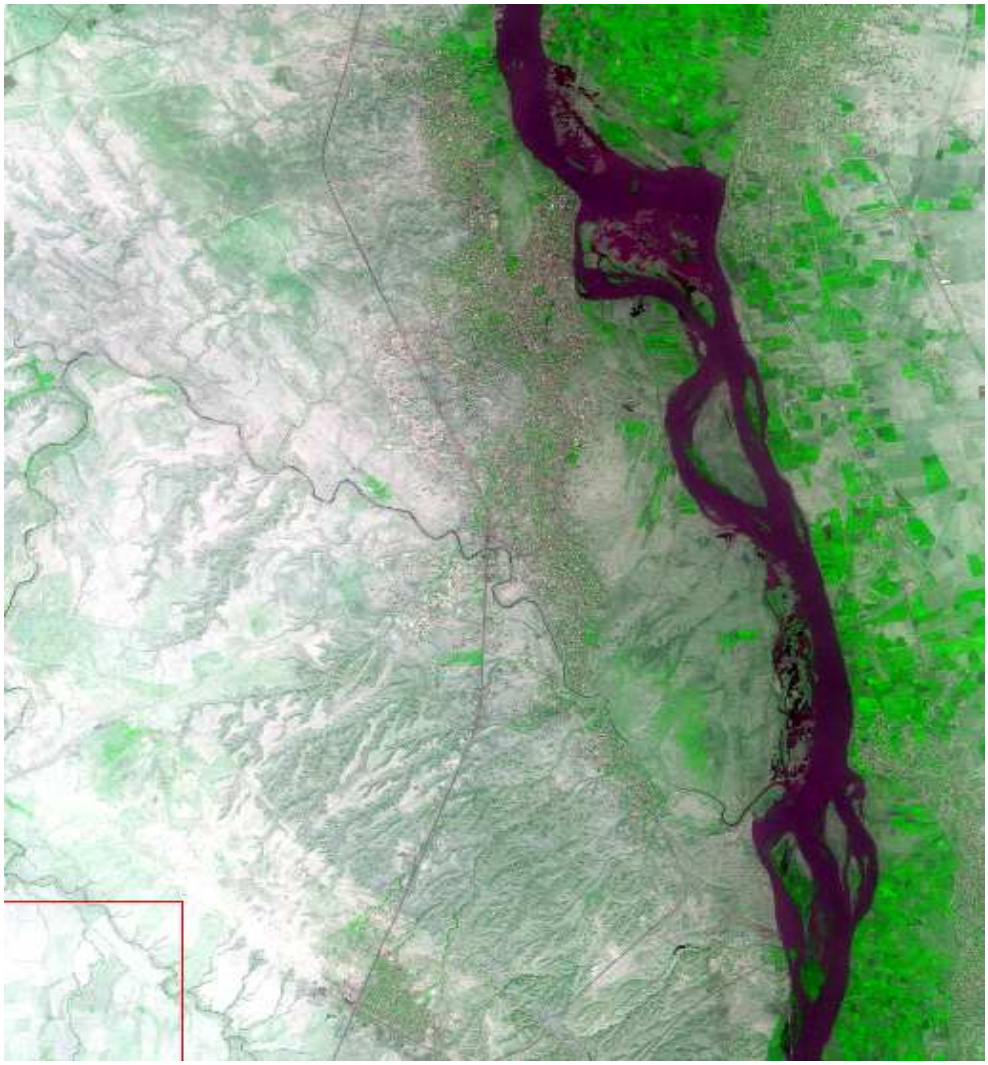


Figure (2) Satellite colored image with (5m) resolution from SPOT

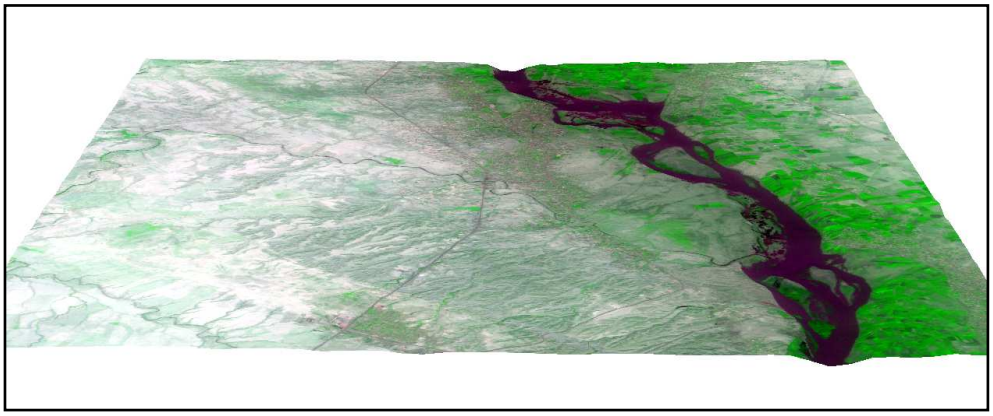


Figure (3) Satellite colored image with (5m) resolution from SPOT with the third dimension from DEM

Figure (4) Satellite image from IKONOS With resolution (1m)

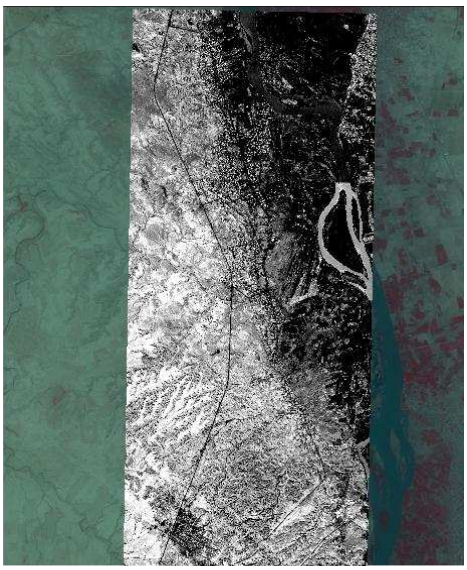
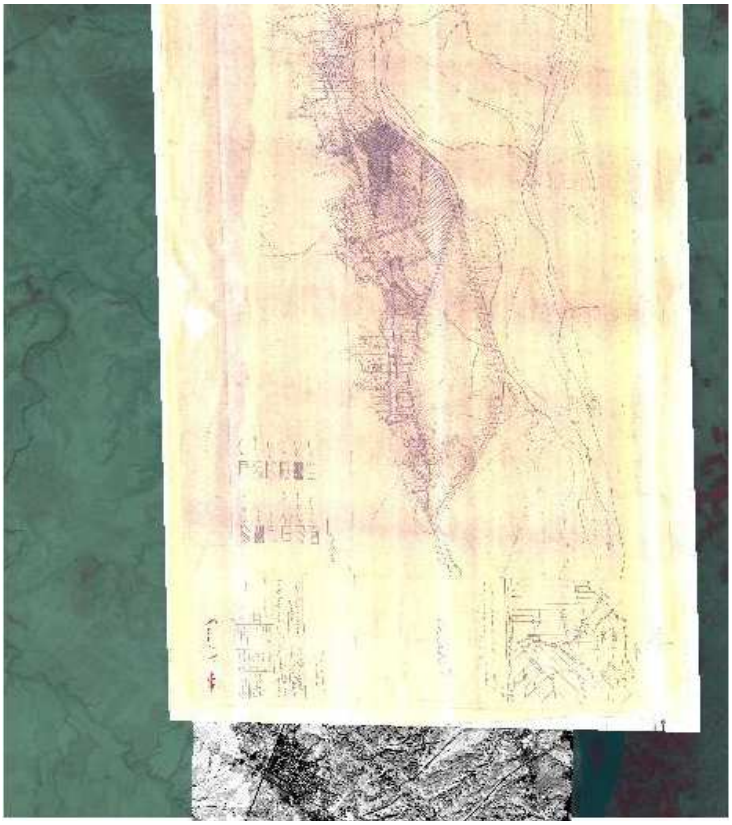


Figure (5) The IKONOS image over SPOT image at the same region

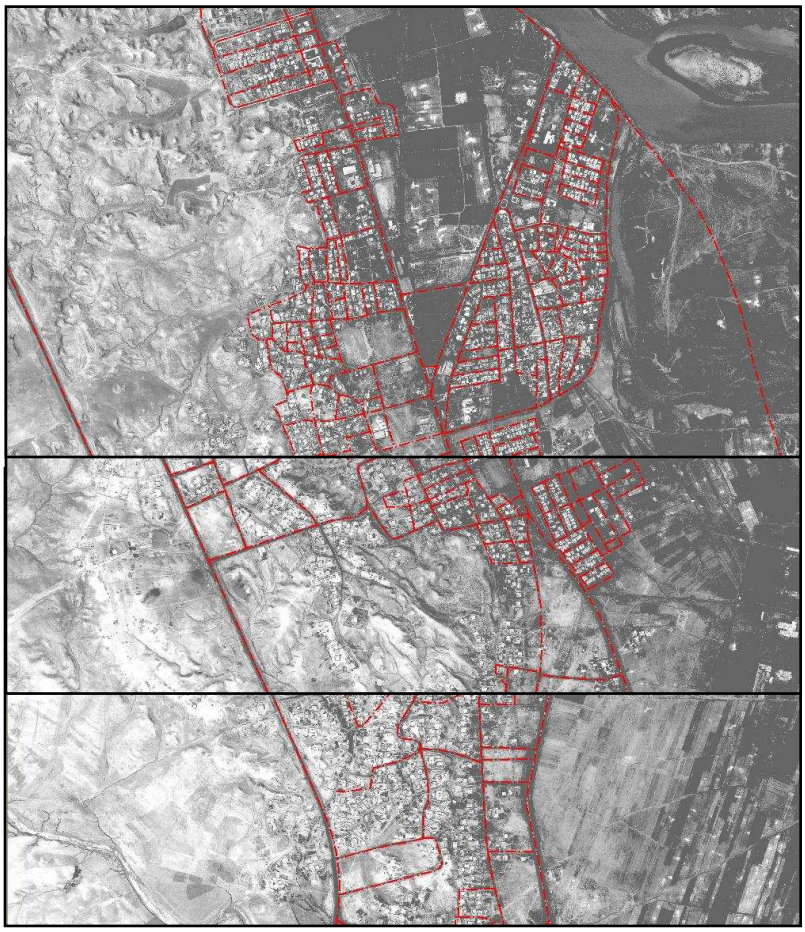


6-a

6-b

Figure (6/a& b) Administrative map of the master plan

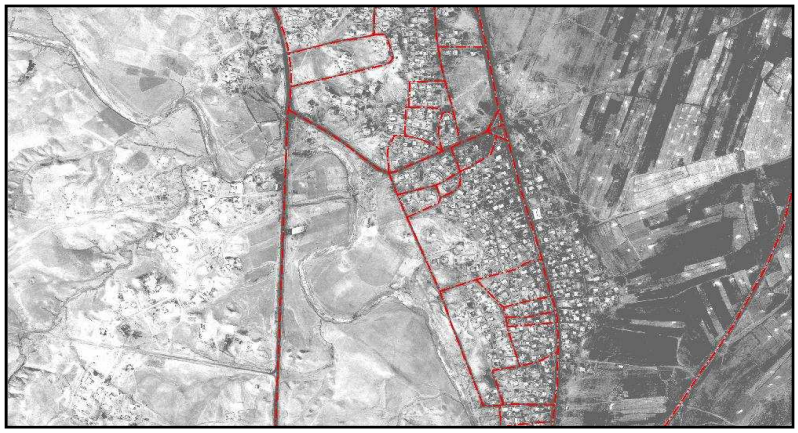
7-a



7-b

7-c

7-d



7-e

Figure (7/a-b-c-d& e) Streets and the intersections of the streets have been painted as a network

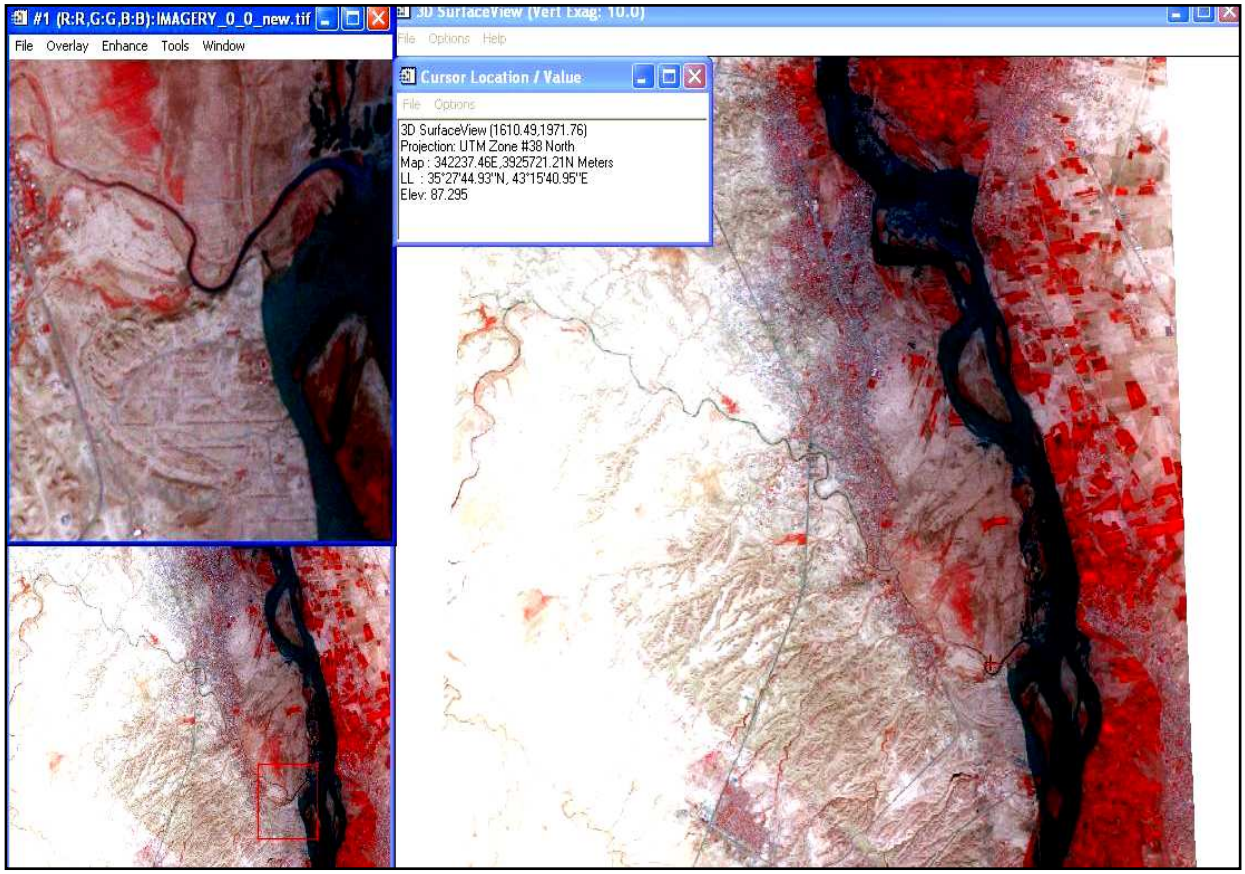


Figure (8) Putting the pointer getting three coordinates (x, y&z)