

Chapter Five

Methodology

5.1 Study area:

The study area, Extent:

Eastern: 432867.604200 m - 471285.181100 m

Northern: 1757176.780100 m - 1729510.625500 m

Starting from rallying point two Niles (blue & white) extending for about 30 km from south to north, is chosen as a case study characterized by active river processes. Land use categories are varied along the River Nile including agriculture, settlement, urbanization, recreation, fishing, tourism, and transportation. Agriculture and settlement represent the predominant Land use classes. Settlement activities made a great impact on river stability due to disturbance on river system such as building dams, and partial and unbalanced revetment of river banks.

5.1.1 Climate:

Geographically, Study area, lies in the tropics north of the equator, but its climate feels more like a desert, sunny, hot and dry.

Temperature: Khartoum is hot year-round. The coolest time of the year is December through February when the average temperature is 30 C. The rest of the months are even warmer, and May and June can be absolutely scorching, with temperatures as high as 44 C degrees possible... Below-freezing temperatures are unheard of in Khartoum.

Precipitation: Rain is a rare event in Khartoum. From December through March, there usually is no rain at all. Moisture southwesterly winds begin working their way up the country after that, and by July, Khartoum sees sporadic rain. Even so, it usually rains only a few days in July through September. The wettest month, August, generally sees only about 3 inches of rain on average. May, June and October usually have only a trace of rain.

5.1.2 Vegetation:

Agriculture does take place – along the Nile. Pumps bring water from the river to crops such as sorghum, millet and cereal grains. Fresh vegetables and fruit (e.g. lemons, mangoes, grapefruit, paw paws and oranges) are grown in fields all along the river.

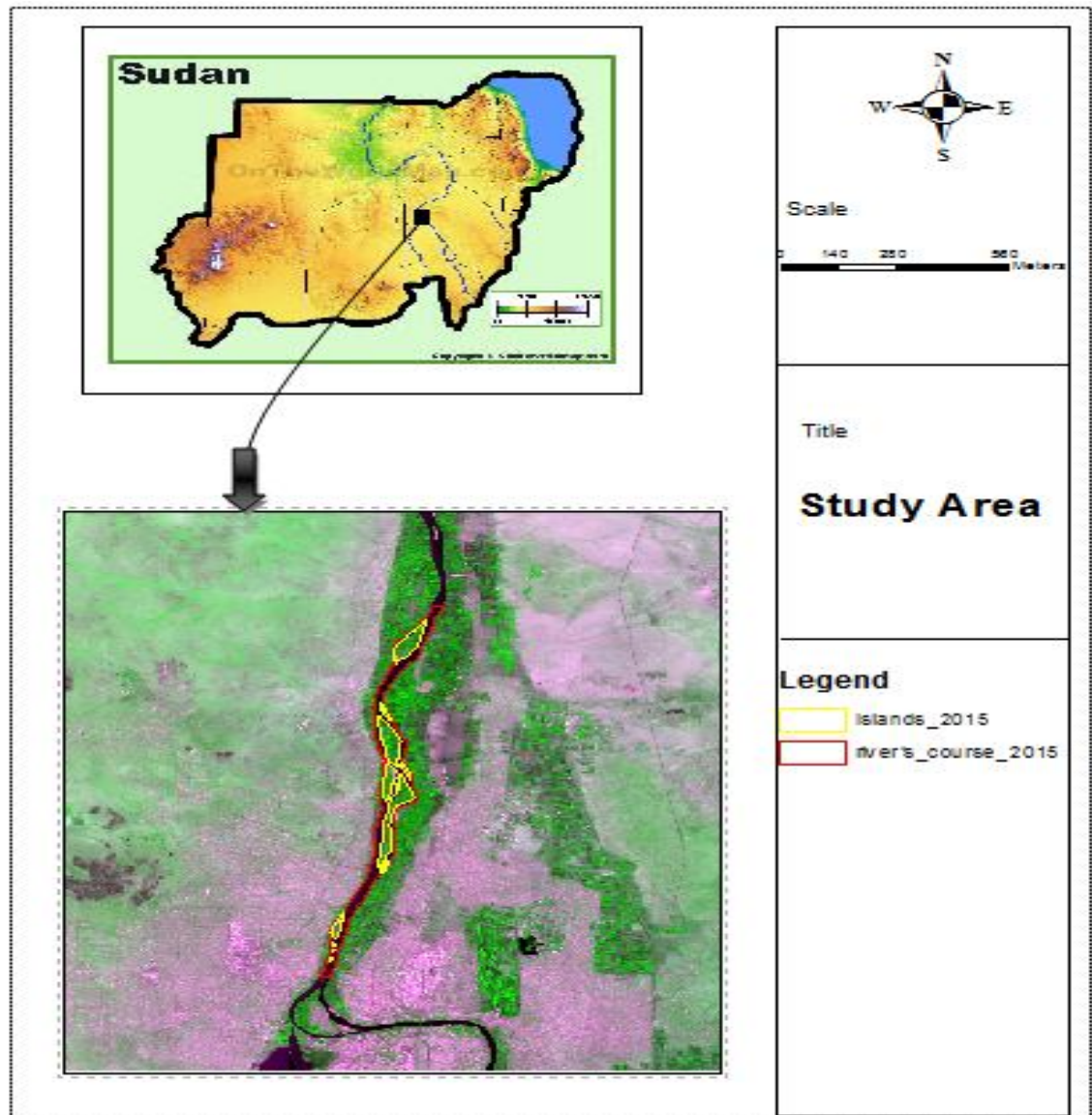


Fig (5.1) Study Area

5.2 Data Collection

Five sets of imagery were used for accomplishing this study:

Landsat Thematic Mapper (TM), Enhanced Thematic Mapper (ETM+) and Operational Land Imager (OLI) images with Path/Row 173/49, acquired on years 1985, 1995, 2003, 2009 and 2015, respectively.

All satellite images were obtained from United States Geological Survey (USGS), downloaded from the archive of satellite site of

USGS > U.S. Geological Survey > <http://earthexplorer.usgs.gov/>.

It kept on mind to download Satellite image of the Nile. When it is in its normal state of the movement before the flooding period that is may happen in the future. February and March represent stable period of river Nile, so that could help to give a good result.

5.2.1 Specifics of satellite images (Metadata):

Table (5.1) Metadata

	<u>Date Acquired</u>	<u>Sensor Identifier</u>	<u>Image Quality</u>	<u>Scene Cloud Cover</u>	<u>Day/ Night</u>	<u>Datum</u>	<u>Map Projection / Zone</u>
IMG 1	1985/03/26	TM	9	0.00	DAY	WGS84	UTM / 36
IMG 2	1995/03/22	TM	9	0.00	DAY	WGS84	UTM / 36
IMG 3	2003/02/16	ETM+ L1T	9	0.00	DAY	WGS84	UTM / 36
IMG 4	2009/03/20	ETM+ L1T	9	0.00	DAY	WGS84	UTM / 36
IMG 5	2015/03/13	OLI_TIRS	9	0.02	DAY	WGS84	UTM / 36

5.3 Methodology:

Field observations, remote sensing and GIS analysis, were used in this study to investigate river meandering and the associated processes of erosion of river banks and islands, deposition of sediments, and formation of new islands. Five sets of images were chosen for the analysis of river meandering where processes of erosion and deposition are observed.

ArcGIS 10.2.2 were used for analysis of data and visualization of results. River basin (30 km) was chosen for the analysis of river meandering where processes of erosion and deposition are observed. The five sets of imagery were used to investigate the change in river's course as well as its islands.

The first step

Composite bands were done to five sets of imagery Excluding panchromatic bands to be used to improve spatial resolution later , also Excluding band 6 in TM images (120*30)m, band 6 in ETM+ images (60*30)m and bands 10 & 11 in OLI image (100*30)m Due to their negative impact on spatial resolution.

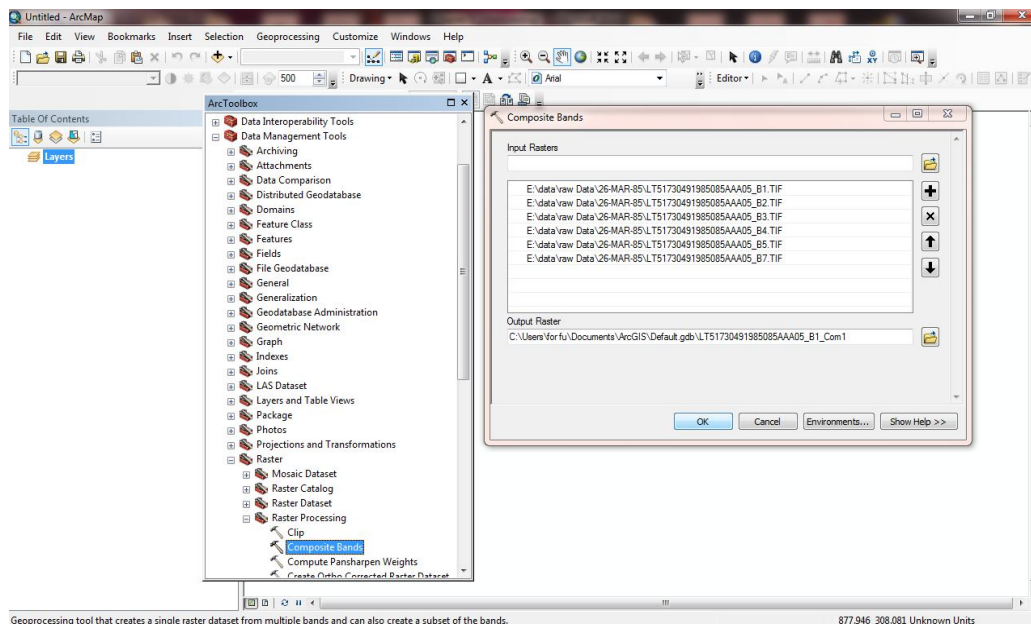


Fig (5.2) Composite Bands

The second step

Pan sharpening was carried out to IMG 3, IMG 4 & IMG 5 which underwent to composite band, (panchromatic band not included in TM sensor). It was performed to enhance the spatial resolution of the image for more detailed information. Defined the three main channels (Red, Green, Blue), Infrared channel (optional) and finally the panchromatic band. Arrangement of bands varies according to the type of sensor.

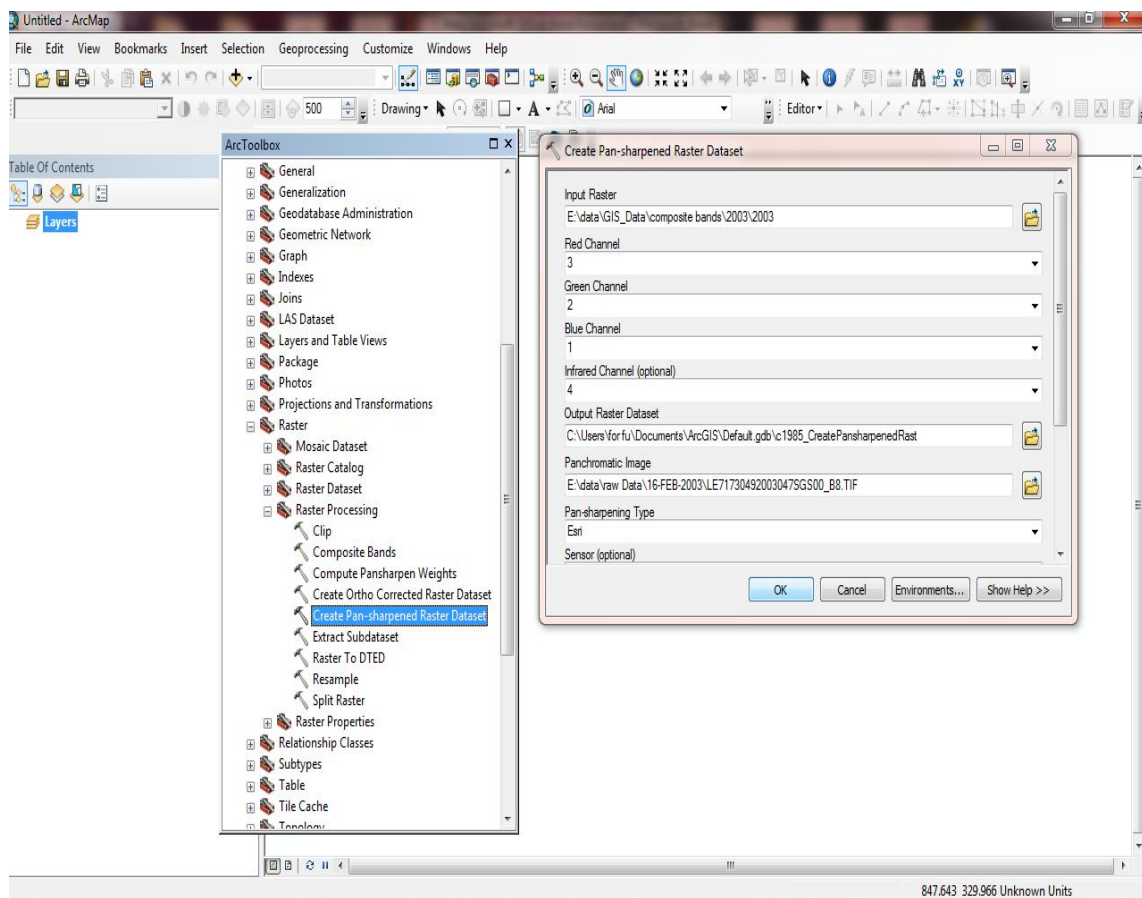


Fig (5.3) Create Pan-Sharpended

The third step

The Landsat images were georeferenced to UTM coordinate system, zone 36 North based on (GCP) in study area.

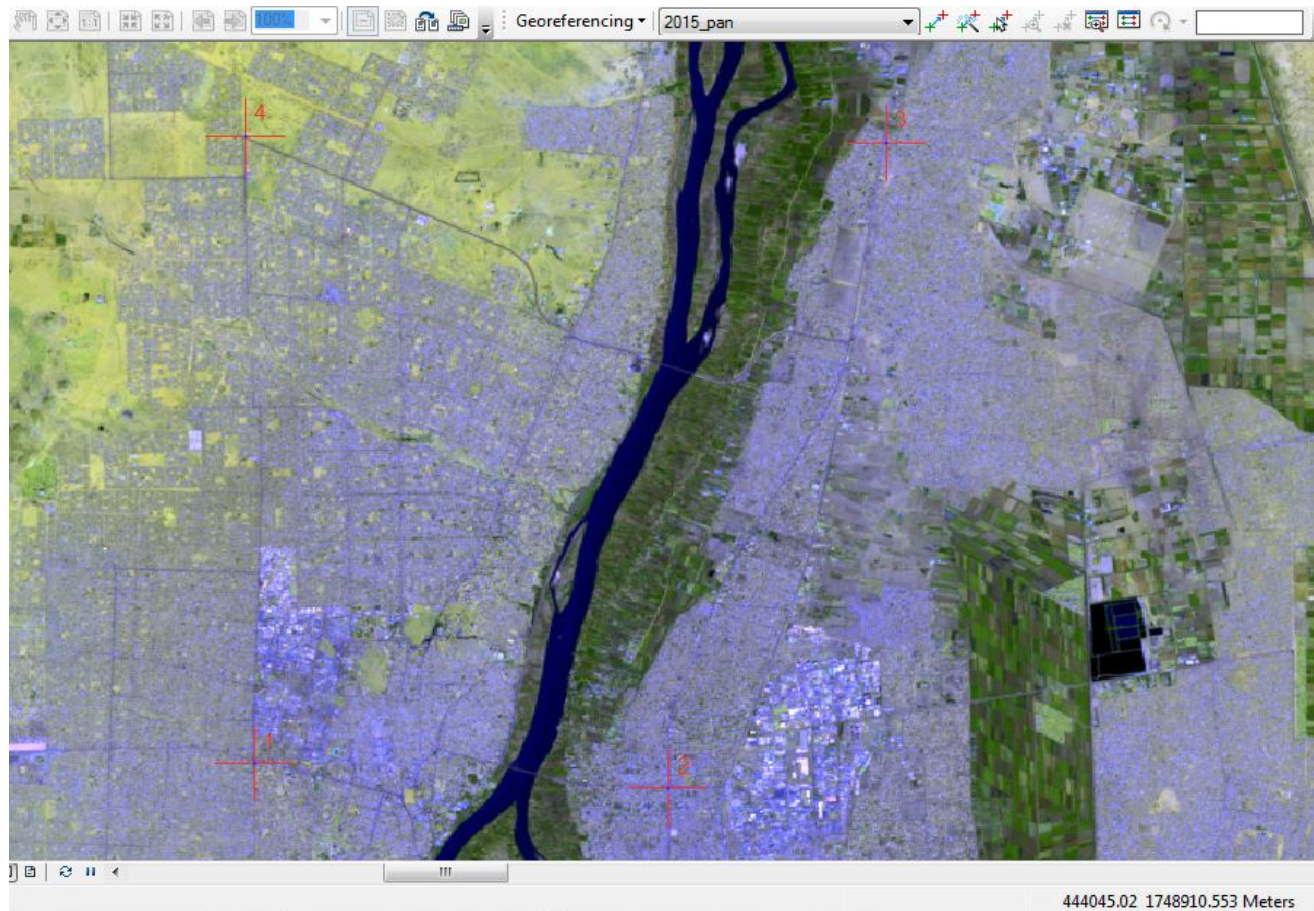


Fig (5.4) Georeferencing

The fourth step

The Landsat images were used to delineate the river course and islands using onscreen digitizing. On screen digitizing were carried out for all images to find out the change in surface area and perimeter of the river's course and its islands through the period 1985 to 2015.

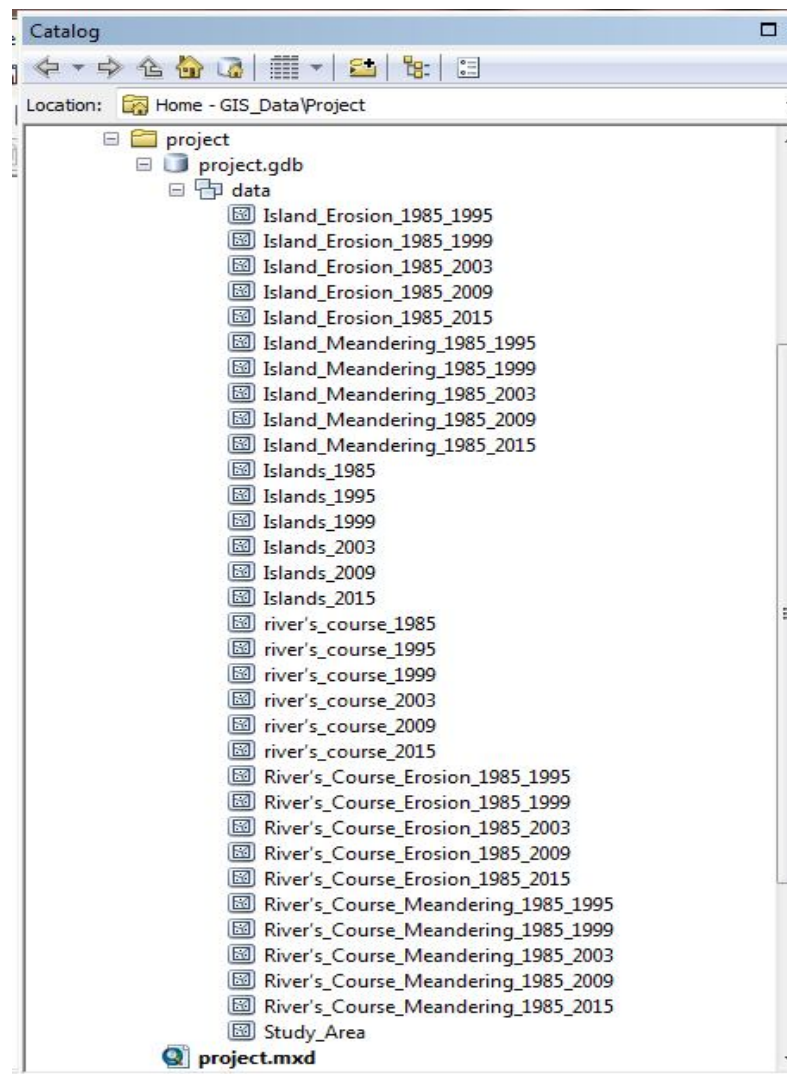


Fig (5.4) Geodatabase