GIS AND REMOTE SENSING BASED ASSESSMENT OF HYDRO-GEOMORPHOLOGICAL PARAMETERS OF LOWER NIGER BASIN IN NIGERIA

PRESENTED

BY

AHUCHAOGU.U.E, OJINNAKA O.C, CHUKWUOCHA .A.C

DEPARTMENT OF SURVEYING AND GEOINFORMATICS
F.U.T.O
DEPARTMENT OF GEO-INFORMATICS AND SURVEYING
U.N.N

INTRODUCTION

Conservation of natural resources is of prime importance for environmental protection and sustainable development therefore it requires the use of state-of-the-art technologies for effective management.

Watershed management (river basin) is an area of study targeted towards environmental protection and sustainability. Therefore Good understanding of hydro-geomorphological characters of all the basins is paramount to actualize this objective

watershed management implies the proper use of all land and water resources of a watershed for optimum production with minimum hazard to natural resources and environment (Amulya e tal 2018)

INTRODUCTION CONT.

Hydrology deals with surface and underground water flow and geomophorlogy is the science of landform (kuldeep 2012).

Despite that Lower Niger Basin is one of the most important Catchments in Nigeria its morphometry is not well known.

In this study, topographical, hydrological and geological processes of the basin have been investigated and understood by drawing inferences from morphometric analysis

INTRODUCTION CONT.

Morphometric parameters define the topographical, geological and hydrological condition of a basin (Angillieri 2012; Kabite and Gessesse 2018; Madavi 2019)

Therefore they are invaluable for assessment of surface and ground water potentials, infiltration rate, assessment of flood and erosion prone areas, etc.

Remote sensing and GIS have emerged as most powerful tools for development of regional hydrological and topographical models for solving various environmental problems (Sayeed et al 2017).

AIM

The aim of the study is to extract the morphometric attributes of Lower Niger Basin using Remote Sensing and GIS

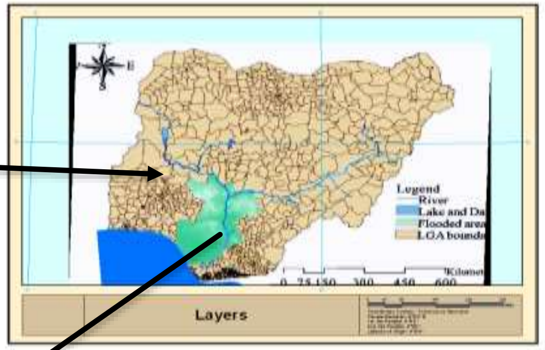
OBJECTIVES OF THE STUDY INCLUDE

To Investigate the Topographical and Hydrological Characteristics of the River basin

To investigate the relationship between the drainage pattern and land form of the study area

To determine the linear morphometry of river basin

To determine the areal morphometry of river basin



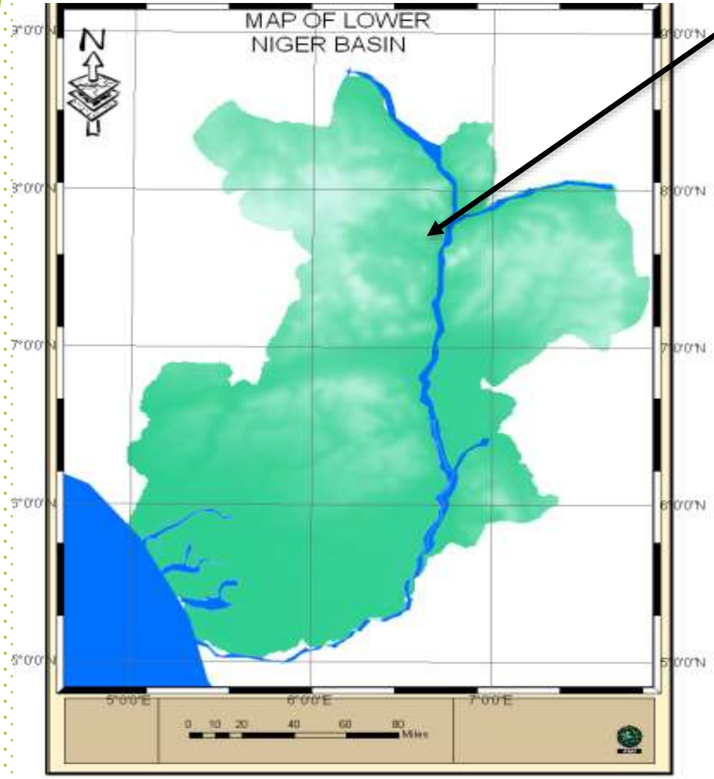


Fig1 Location Map

STUDY AREA

The basin measured approximately 70959.175 sqkms.

It is geographically located between latitude 5⁰ 00'N and 8⁰ 45'N and between longitude 5⁰ 00E' and 7⁰ 45'

Total annual rainfall: 1000mm-1500mm
Relative humidity: 70% in wet season

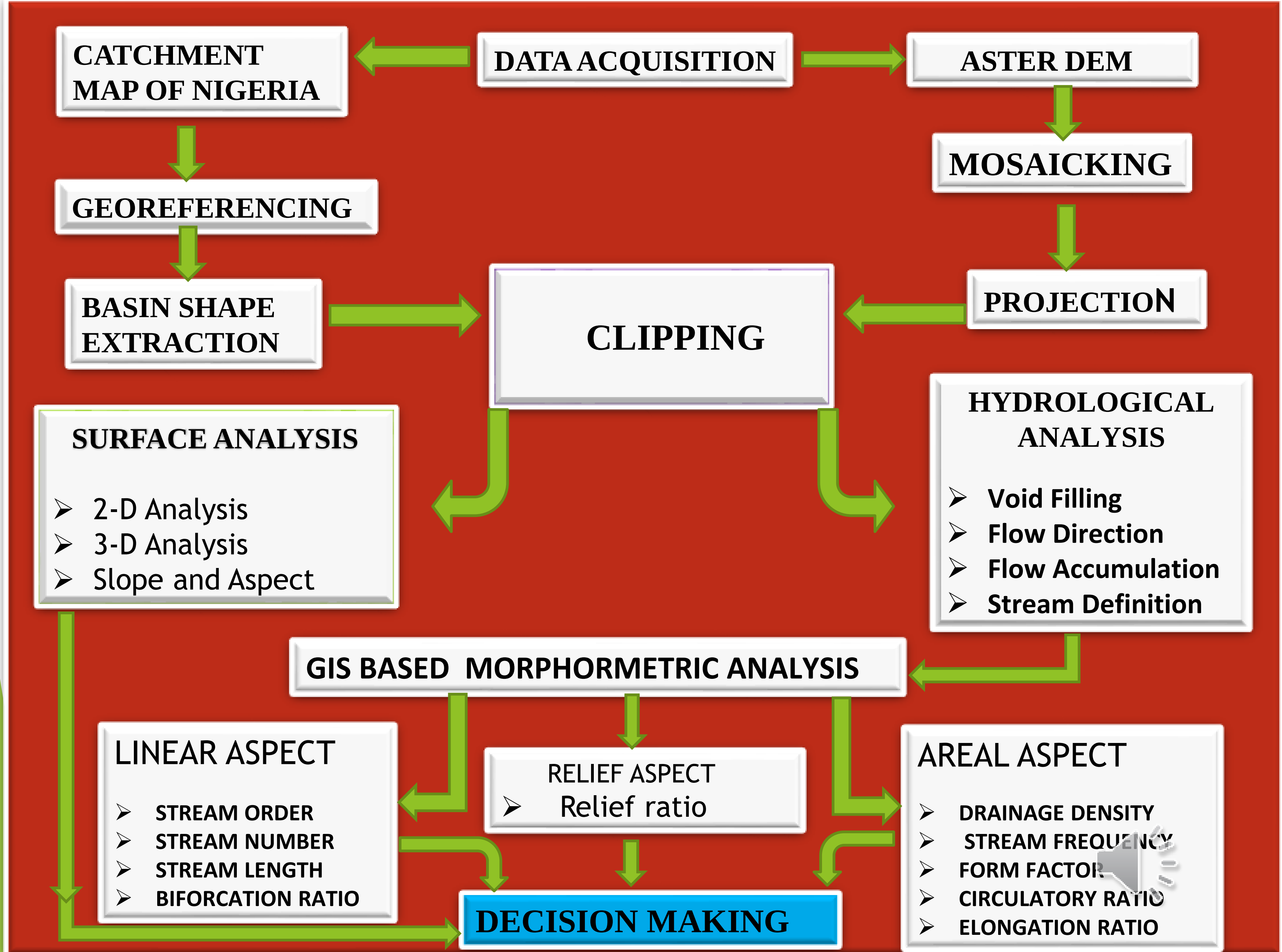


Fig2 Methodological flow chart

RESULTS

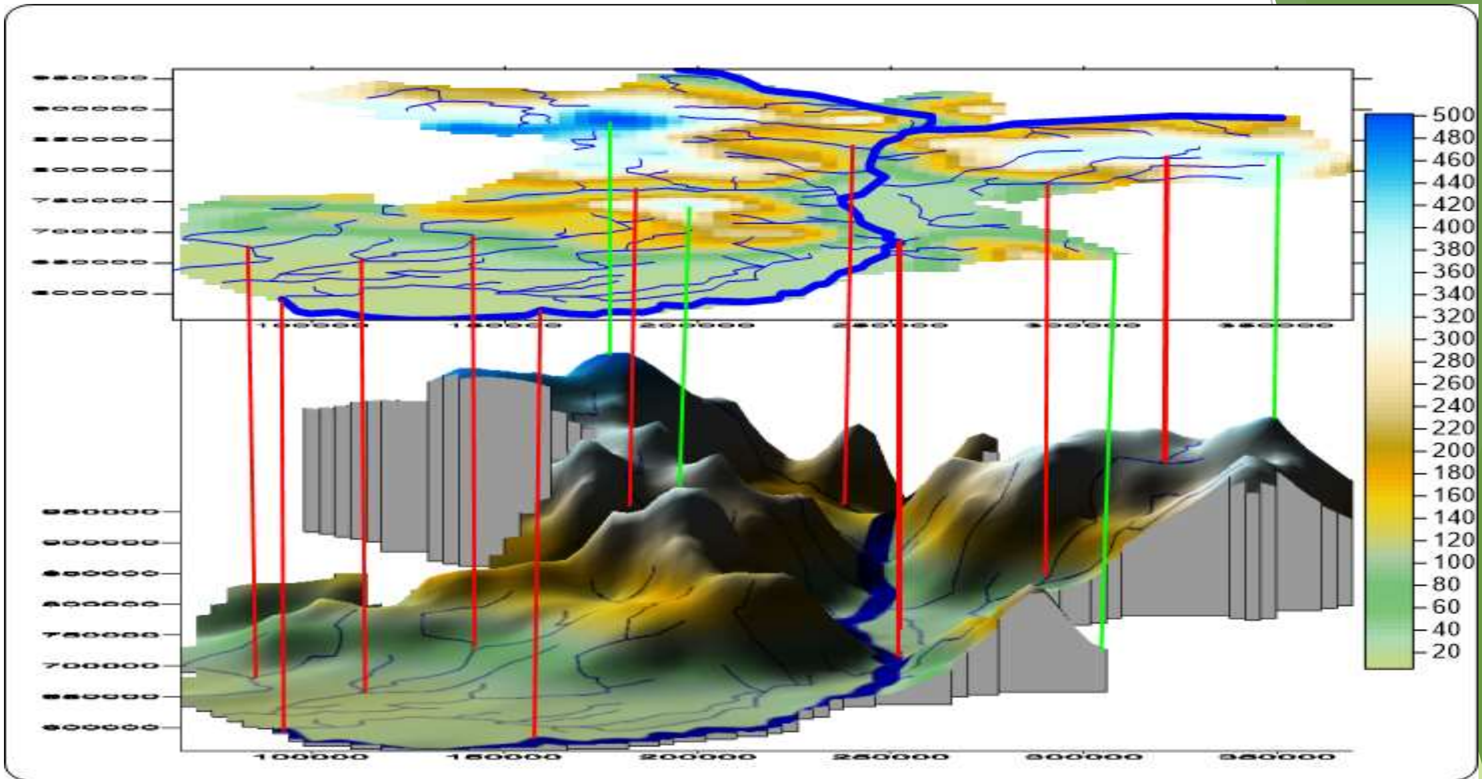


Fig3 A stack of the hydro-terrain and 3-D landscape of the of the catchment

- **The topography of the catchment is undulating and lies within elevation range of 20m to 500m above mean sea level.**
- **Each flow route is naturally located in the valley.**
- **The interaction between the natural drainages and geology is among the major forces that determine the land form of an area**

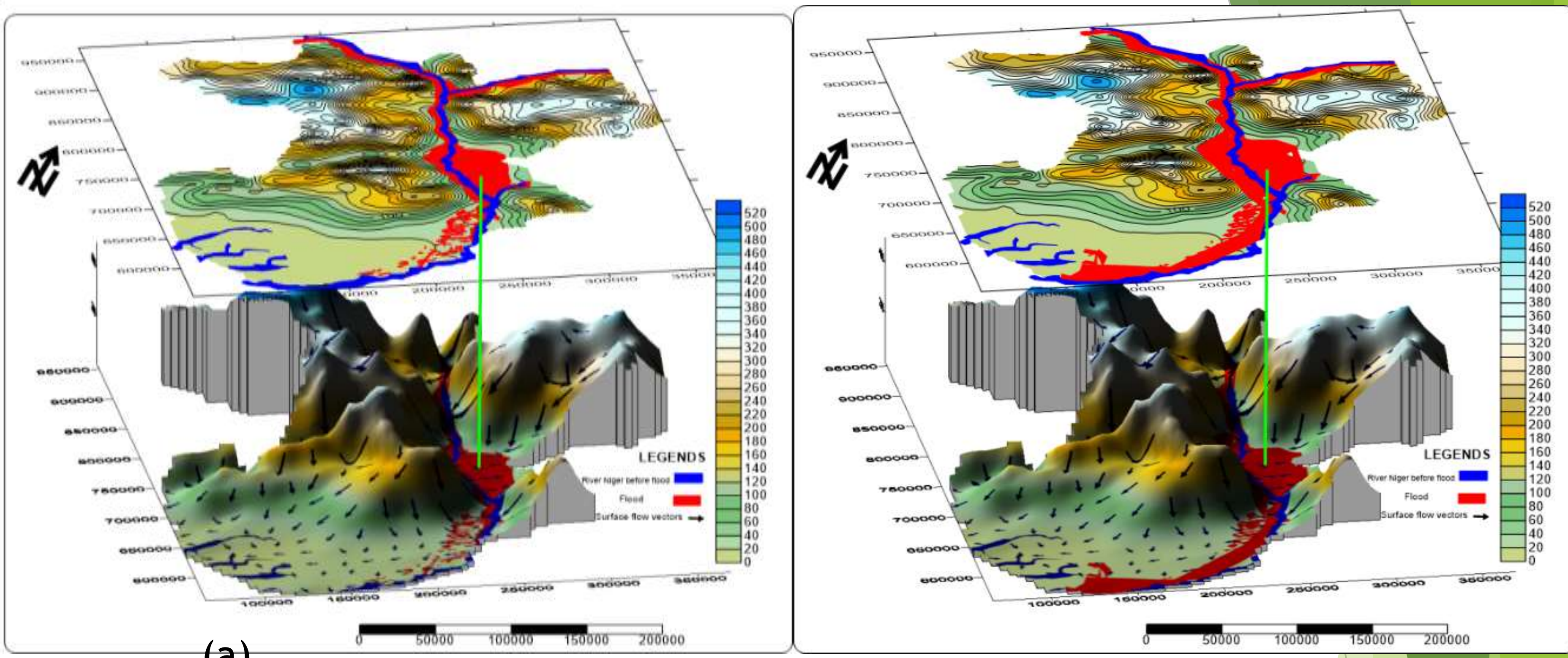


Fig4 Stereoscopic view of (a) 2012 and (b) 2022 flood along the basin

Making the landforms available to public on time enables communities to have pre- knowledge of their level of exposure. Precautionary measures may be put in place ahead of time.

It also guides the emergency response unit to prioritize their response to areas that needs urgent attention.

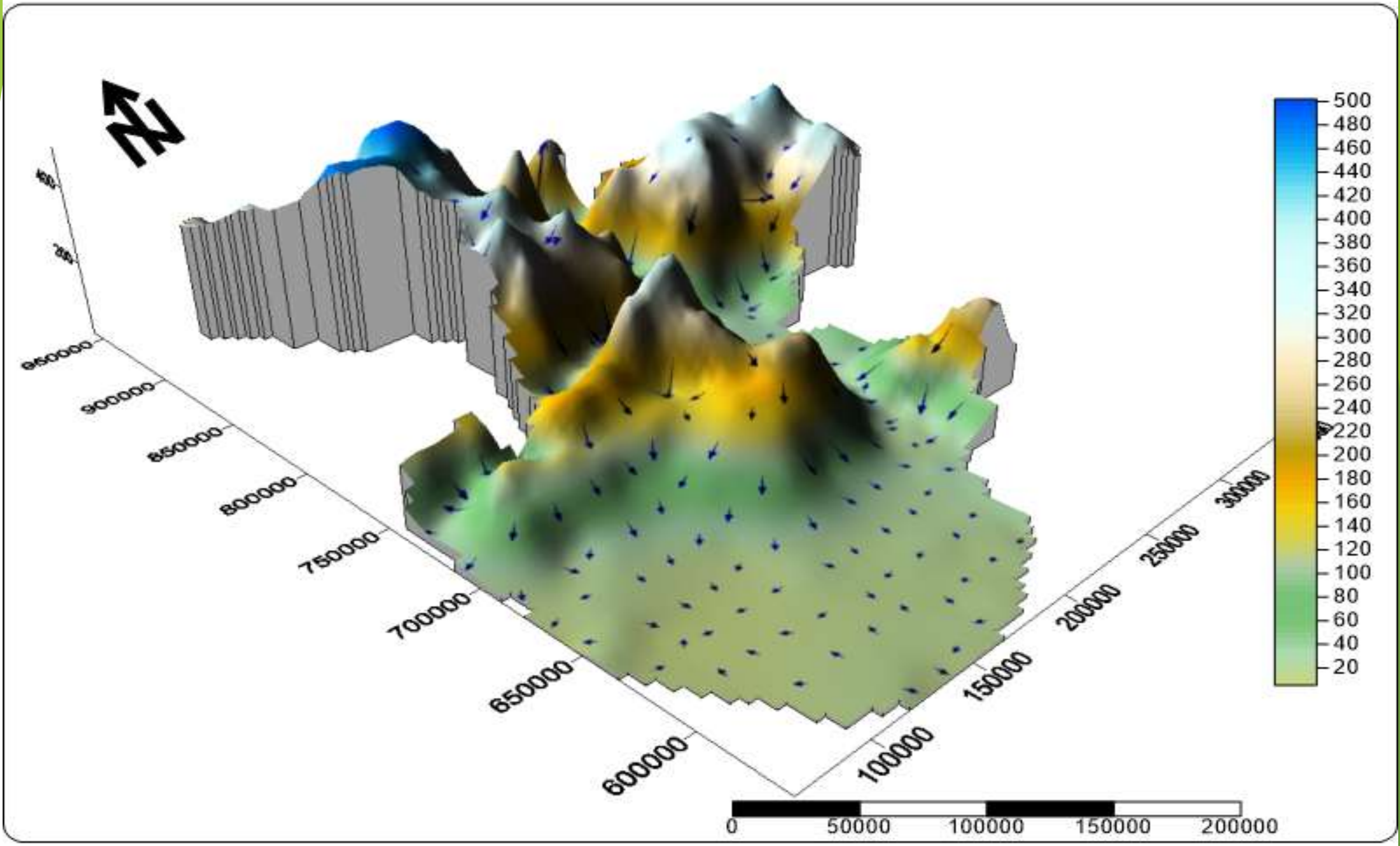


Fig5 Overlay analysis of the surface flow vectors on the 3-D Landscape of the Basin

- Surface flow vectors are invaluable for locating natural flow route during drainage design
- Flow routes are linear connections of cells that accumulate the most runoff in an area

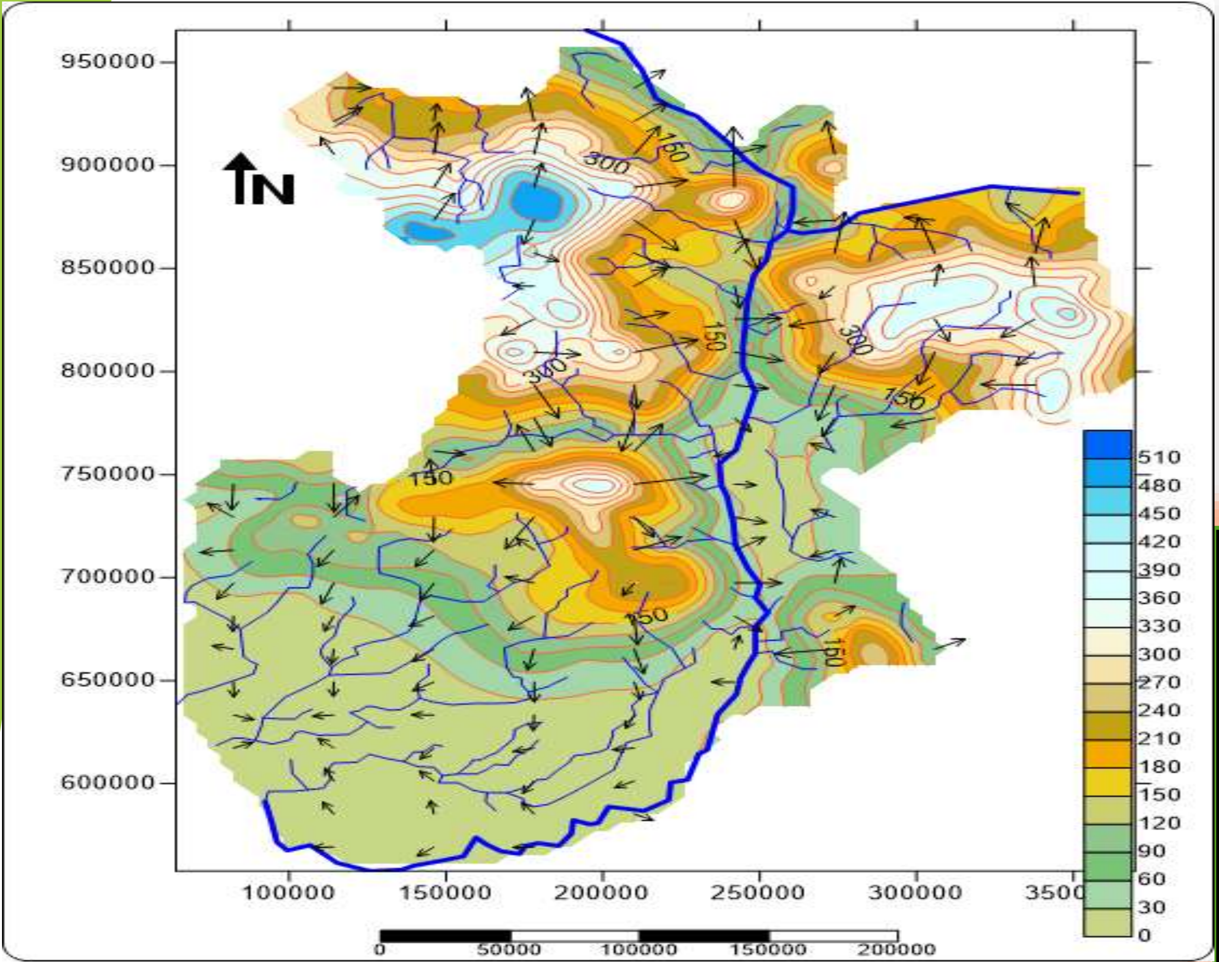
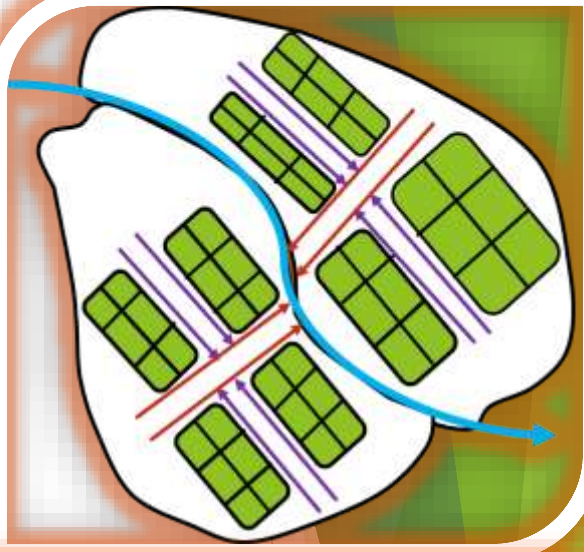


Fig6 Overlay analysis of the surface flow direction on the natural drainage network



- Surface flow vectors are directed to the natural flow routes.
- These flow routes are the result of the natural morphology of the landscape.

- Flow efficiency, demands that drainage networks be designed considering the natural flow routes and their sub-catchments.
- The natural flow routes represent the primary drainage networks in the design.
- They drain flows collected from the secondary and tertiary drainage networks off the catchment

Fig7a Photographs of urban flooding

Fig7b Photographs of erosion in urban areas

- **These situations are sometimes caused by failure on the part of decision makers to recognize surveyors and surveying as pioneers of landed information and bedrock of any sustainable development.**

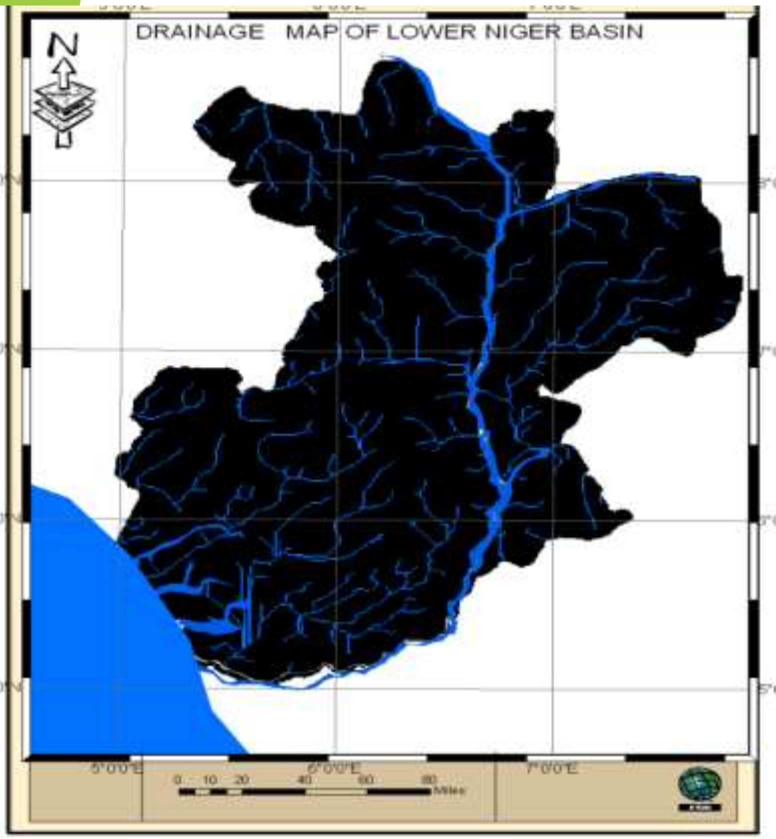


Fig8a Flow direction grid of the basin

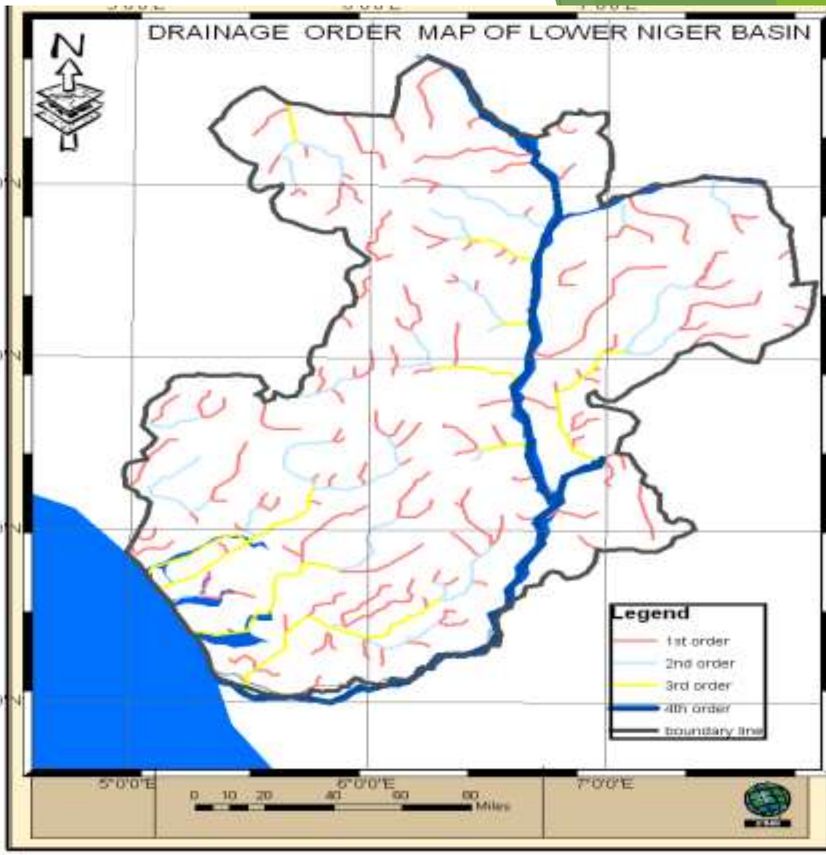


Fig8b Drainage order map of the basin

Drainage order defines the position of a stream, within a drainage network

A finger stream without a tributary within the network occupies the 1st order position

The second order begins where the two or more first order stream joined and so on

Table1 Mophormetric attributes of Lower Niger basin

PARAMETER	FORMULAR	REFERENCE	DIMENSION
Basin Area	GIS Analysis/DEM		70959.175sq km
Basin Length	GIS Analysis/DEM		745.976km
Drainage Density	$D= \Sigma Lu/Au$	Horton (1945)	0.0665 km^{-1}
Stream Frequency	$F=\Sigma Nu/Au$	Horton (1945)	2.452×10^{-3}
Circulatory Ratio	$Rc=4\Pi A/P$	Straler (1964)	0.319
Form Factor	$Ff=A/LP^2$	Horton (1945)	0.128
Perimeter of Basin	GIS Analysis/DEM		1671947km
Elongation Ratio (Re)	$Re = D/L = 1.128HA/L$	Schumm(1956)	0.040
Relief ratio	$Rh=H/Lb$	Schumm(1956)	

STREAM ORDER	STREAM NUMBER	STREAM LENGHT	MEAN STREAM LENGTH (Lsm)	BIFURCATION RATIO	STREAM LENGTH RATIO
1	132	2508576	19004.36	5.076923	
2	26	911625	35062.5	2	0.363403
3	13	648186	49860.46	4.333333	0.711023
4	5	650737	216912.3		1.003936

- The basin is a 4th order basin
- The geometric attributes attest that the basin is drainage coarse textured, moderately elongated in shape, permeable and of low discharge and erosion potential

REMAIN BLESSED