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Earthquake Disaster Risk Management Usnig Geospatial Technologies: A Case Study of Nigeria.

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ABSTRACT: The process involved in the prediction of areas where earthquake is likely to occur in the future largely depends on the plate boundaries as well as the data containing the location of past and present earthquakes.

The plate boundary was downloaded as a kmz file with legends denoting the color each plate boundary represent from the website usgs.gov. Using the arc map environment of the Arc gis 10.5 software, the kml file was converted to layer in other to add it to the arc map environment. Then the symbol ID (legend) of the plate boundaries was denoted from 0-4 but with the help of the google earth software, the name of each plate boundary with respect to their color was gotten and this was used to decode which plate boundary each digit represents.

After this was done, theearthquake data was downloaded from the earthquake.usgs.gov website. The area to be downloaded was determined on the map shown on the website and since Nigeria is the focus of this study, a rectangle was drawn around the Nigeria map. A magnitude range was also determined ranging from 2.5 – 7. Other parameters were determined such as date and time range for the data, geographic region and output format. The date range was from January 1933 till date. The data gotten for the Nigeria map was only one case of earthquake that occurred on the 7th of March 2000. The area was then expanded to some countries around Nigeria, particularly the ones that shared boundary with Nigeria as we could use this data to predict areas where earthquake is likely occur in the Nigeria in the future. We could go as far as getting earthquake data for the world but that was not necessary as the countries close to Nigeria can help predict and will even predict better since they are closer to Nigeria. The data was downloaded and 55 locations where earthquake occurred ranging from 1979 to 2020 was available in the data along with other attributes such as their magnitude, depths among others. This data was added to the arc map environment using the add x,y data tool.

Keywords: kmz file, geographic region,

I. INTRODUCTION

An earthquake is the result of a sudden release of stored energy in the Earth's crust that creates seismic waves, and it is measured with a seismometer, commonly known as a seismograph. Earthquake can also be said to be a seismic activity. Earthquake occurrence is a global phenomenon. Seismic hazard is a source of major threat to mankind. Seismic hazards have the ability to cause notable and serious destructions and damages to biodiversity and man's immediate environment. The effect of the resulting damage is not only limited to the moment of occurrence but also impacts negatively years after. Damages from impacts of natural hazards leave trail on vital infrastructures, properties, human lives, and at times impact from large seismic occurrence can cause economic downturn for a country.

While some countries have high seismicity, some others are with low seismicity and some are free from seismic events. Among the nations of the earth, Nigeria is one of the countries that have reflected light and dispersed seismic events in her seismic record so far. There are four different types of earthquakes: Tectonic, volcanic, collapse and explosion. A tectonic earthquake is one that occurs when the earth's crust breaks due to geological forces on rocks and adjoining plates that cause physical and chemical changes,while volcanic earthquake is any earthquake that results from tectonic forces which occur in conjunction with volcanic activity.Also collapse earthquake are small earthquakes in underground caverns and mines that are caused by seismic waves produced from the explosion of rock on the surface.An explosion earthquake is an earthquake that is the result of the detonation of a nuclear and/or chemical device.In Nigeria, many earthquake and tremors had occurred

In Nigeria Seismic event was first recorded instrumentally and also historically in 1933 although Nigeria is not located within the major seismic zones of the world. Other events were reported in 1939, 1964, 1984, 1990, 1994,

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1997, 2000 and 2006. The intensities of these events ranged from III to VI based on the Modified Mercalli Intensity Scale.

Geological, geophysical and geodynamic studies indicate the possibility of the existence of large fracture zones trending generally in the SW of the country (D.E.Ajakaiye,1987) The recent earthquakes in southwestern Nigeria could therefore be evidence to support the existence of the Pelusiummegashear system or similar fracture zones that penetrate deep into the continental crust of West Africa. There is therefore a need for more adequate coverage of the area by seismic stations to permit a precise location of future events and detailed data analysis which would help in identifying area where large scale crustal adjustments might be taking place.

II. METHODOLOGY AND DISCUSSION

The process involved in the prediction of areas where earthquake is likely to occur in the future largely depends on the plate boundaries as well as the data containing the location of past and present earthquakes.

The plate boundary was downloaded as a kmz file with legends denoting the color each plate boundary represent from the website usgs.gov. The kmz file was open on the google earth software in order to view it and also convert it to a kml file as the arc gis software will not accept a kmz file when it's added. Using the arc map environment of the Arc gis 10.5 software, the kml file was converted to layer in other to add it to the arc map environment. After this was successfully done, the symbol ID (legend) of the plate boundaries was denoted from 0-4 but with the help of the google earth software, the name of each plate boundary with respect to their color was gotten and this was used to decode which plate boundary each digit represents.

After this was done, theearthquake data was downloaded from the earthquake.usgs.gov website. The area to be downloaded was determined on the map shown on the website and since Nigeria is the focus of this study, a rectangle was drawn around the Nigeria map. A magnitude range was also determined ranging from 2.5 – 7. Other parameters were determined such as date and time range for the data, geographic region and output format. The date range was from January 1933 till date. The data gotten for the Nigeria map was only one case of earthquake that occurred on the 7th of March 2000. The area was then expanded to some countries around Nigeria, particularly the ones that shared boundary with Nigeria as we could use this data to predict areas where earthquake is likely occur in the Nigeria in the future. We could go as far as getting earthquake data for the world but that was not necessary as the countries close to Nigeria can help predict and will even predict better since they are closer to Nigeria. The data was downloaded and 55 locations where earthquake occurred ranging from 1979 to 2020 was available in the data along with other attributes such as their magnitude, depths among others. This data was added to the arc map environment using the add x,y data tool. And the locations where spread on the arc map environment with only one of the 55 locations falling in Edo state within Nigeria.

According to research, earthquakes occur when two blocks of rock or two plates are rubbing against each other, but not moving. After a while, the rocks break because of all the pressure that's built up. When the rocks break, earth occurs. During the earthquake and afterward, the plates or blocks of rock start moving, and they continue until they get stuck again. The plates are moving towards the plate boundary (convergent plate boundary), away from the plate boundary (divergent plate boundary) or moving past each other (transform plate boundary). Generally, earthquakes occur at any of the plate boundaries, but the magnitude of the earthquake that occurs depends on the plate boundary where it is occurring. Since we know now that earthquake occur at the plate boundaries, we can perform a query by determining which locations in Nigeria (in terms of states) are closest to the plate boundaries by setting a particular distance on the arc map.

The method was used by using the select by location in the selection tool and determining which location are 500km within the plate boundaries, no location was selected and that's to show that no place within Nigeria is as close as 500km to the plate boundaries, 1000km was also used and no location was selected. Different values were used until 2000km which now gave 4 locations in Nigeria.

Another query that was performed to predict areas where earthquake is likely to occur in the future involved using the same tool in the previous query such that the query was performed to know which areas in Nigeria are closest to areas where earth quake has previously occurred in or around Nigeria. This method is based on the fact that areas close to where earthquake has occurred are likely to experience earthquake in the future due to the damage that was done in the places where earthquake has occurred. Rupture zones of the earthquakes as determined from aftershock locations tend to cover the plate boundaries and because of this tendency to fill in the plate

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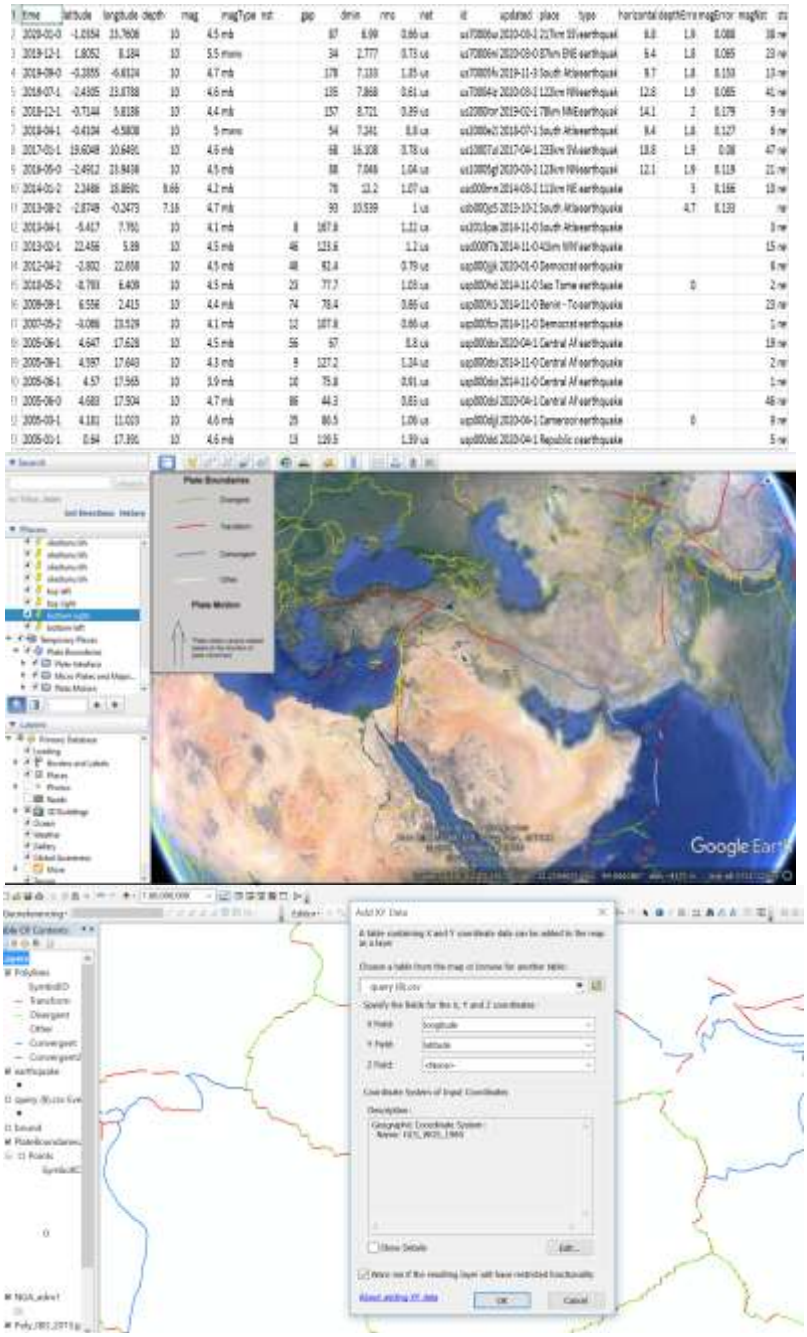
boundaries, segments close to those rupture zones are likely locations for future shock.

The query was performed to know which locations (in terms of the states) in Nigeria are at 50km, 100km and 200km to the previous earthquake locations. At 50km, 5 locations were discovered. At 100km, 7 locations were discovered and at 200km, 19 locations were discovered.

Some of the images showing the operations performed are shown below:



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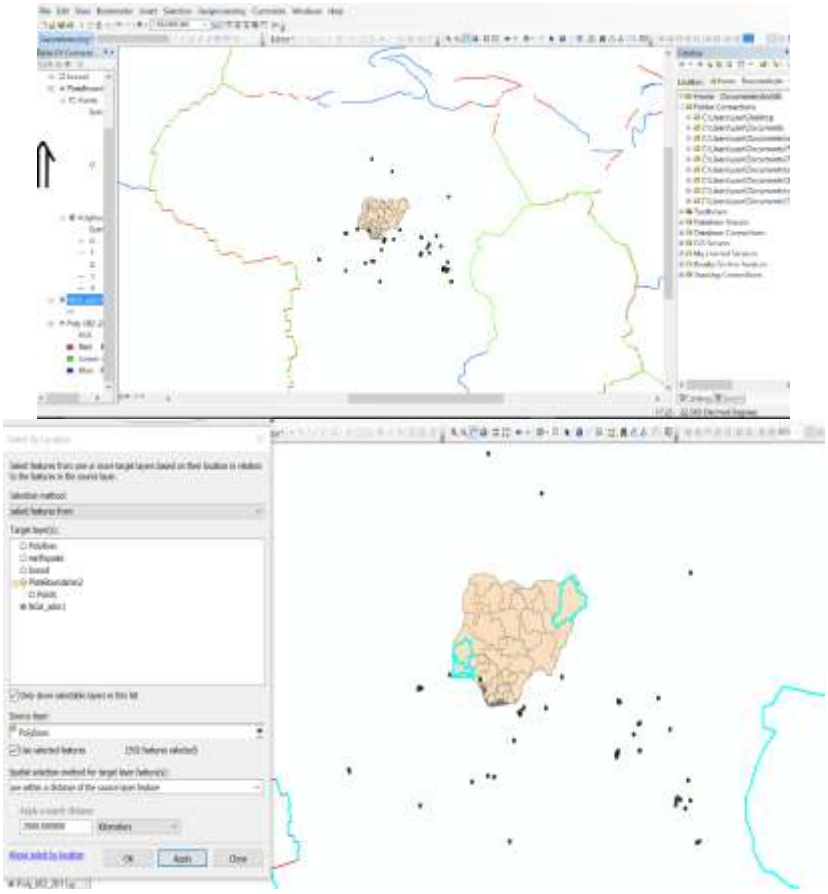

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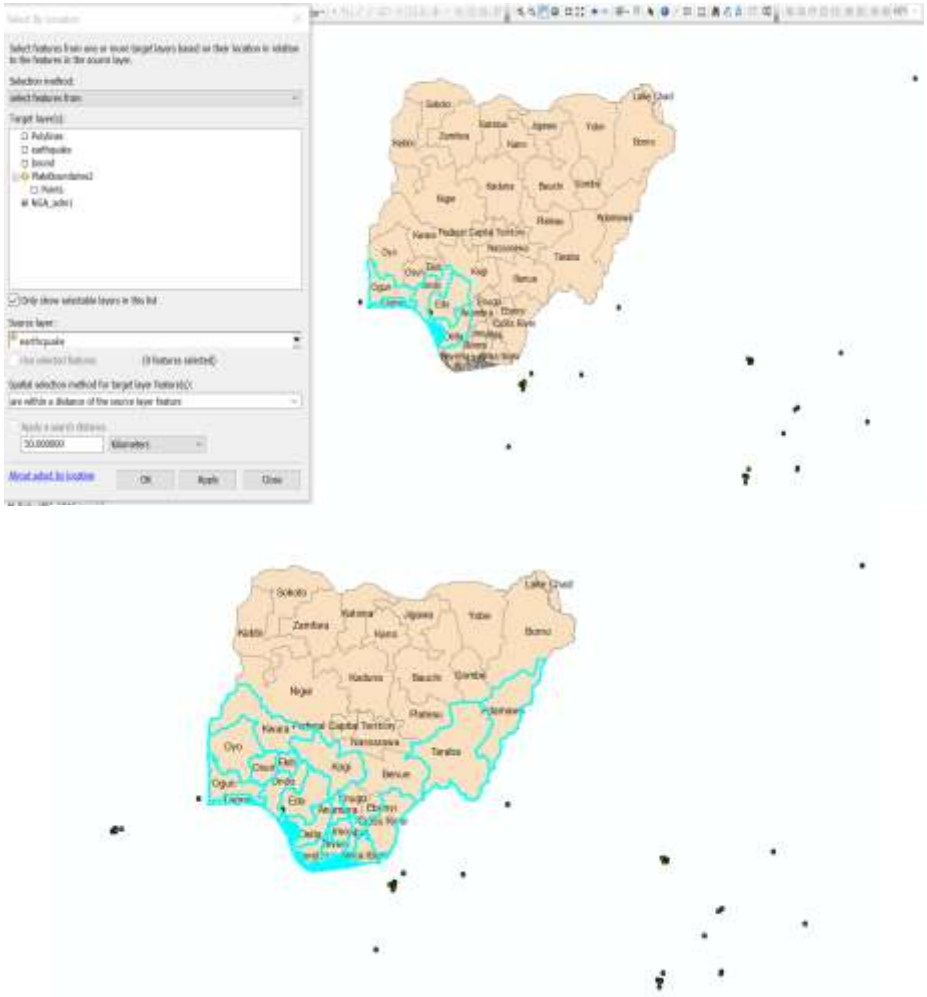

III. RESULTS

The results of all these analysis in terms of maps and tables are provided below. Note that this does not mean earthquake will occur in these locations. It is only a prediction of likely areas where it can occur if it would occur at all.

FID	ISO	NAME_0	ID_1	NAME_1	longitude	latitude
2	NGA	Nigeria	2018	AkwaIbom	7.84	4.91
8	NGA	Nigeria	2024	Cross River	8.58	5.86
9	NGA	Nigeria	2025	Delta	5.97	5.71
11	NGA	Nigeria	2027	Edo	5.90	6.62
24	NGA	Nigeria	2040	Lagos	3.56	6.53
27	NGA	Nigeria	2043	Ogun	3.47	7.00
28	NGA	Nigeria	2044	Ondo	5.16	6.91

AREAS WITHIN 100KM OF THE PREVIOUS EARTHQUAKES WHERE EARTHQUAKES ARE LIKELY TO OCCUR IN THE FUTURE

FID	ISO	NAME_0	ID_1	NAME_1	longitude	latitude
0	NGA	Nigeria	2016	Abia	7.51	5.45
1	NGA	Nigeria	2017	Adamawa	12.44	9.34
2	NGA	Nigeria	2018	AkwaIbom	7.84	4.91
3	NGA	Nigeria	2019	Anambra	6.93	6.21
5	NGA	Nigeria	2021	Bayelsa	6.11	4.77

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8	NGA	Nigeria	2024	Cross River	8.58	5.86
9	NGA	Nigeria	2025	Delta	5.97	5.71
11	NGA	Nigeria	2027	Edo	5.90	6.62
12	NGA	Nigeria	2028	Ekiti	5.31	7.70
16	NGA	Nigeria	2032	Imo	7.05	5.55
22	NGA	Nigeria	2038	Kogi	6.70	7.72
23	NGA	Nigeria	2039	Kwara	4.37	8.98
24	NGA	Nigeria	2040	Lagos	3.56	6.53
27	NGA	Nigeria	2043	Ogun	3.47	7.00
28	NGA	Nigeria	2044	Ondo	5.16	6.91
29	NGA	Nigeria	2045	Osun	4.54	7.53
30	NGA	Nigeria	2046	Oyo	3.62	8.14
32	NGA	Nigeria	2048	Rivers	6.93	4.86
34	NGA	Nigeria	2050	Taraba	10.83	8.04

AREAS WITHIN 200KM OF THE PREVIOUS EARTHQUAKES WHERE EARTHQUAKES ARE LIKELY TO OCCUR IN THE FUTURE

FID	ISO	NAME_0	ID_1	NAME_1	longitude	latitude
9	NGA	Nigeria	2025	Delta	5.97	5.71
11	NGA	Nigeria	2027	Edo	5.90	6.62
24	NGA	Nigeria	2040	Lagos	3.56	6.53
27	NGA	Nigeria	2043	Ogun	3.47	7.00
28	NGA	Nigeria	2044	Ondo	5.16	6.91

AREAS WITHIN 50KM OF THE PREVIOUS EARTHQUAKES WHERE EARTHQUAKES ARE LIKELY

FID	ISO	NAME_0	ID_1	NAME_1	longitude	latitude
7	NGA	Nigeria	2023	Borno	13.13	11.80
24	NGA	Nigeria	2040	Lagos	3.56	6.53
27	NGA	Nigeria	2043	Ogun	3.47	7.00
30	NGA	Nigeria	2046	Oyo	3.62	8.14

TO OCCUR IN THE FUTURE

AREAS WITHIN 2000KM OF THE PLATE BOUNDARIES WHERE EARTHQUAKES ARE LIKELY TO OCCUR IN THE FUTURE

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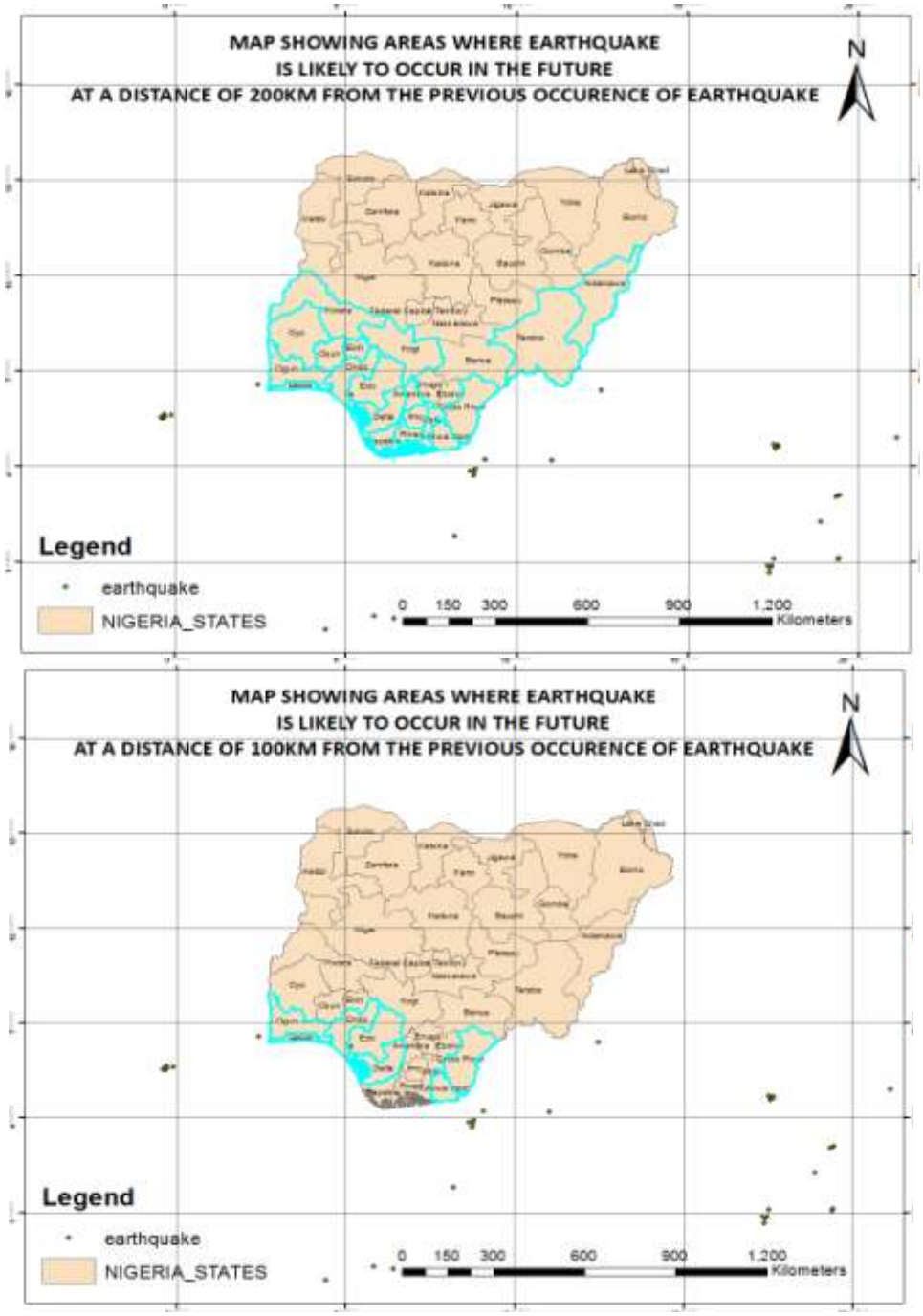

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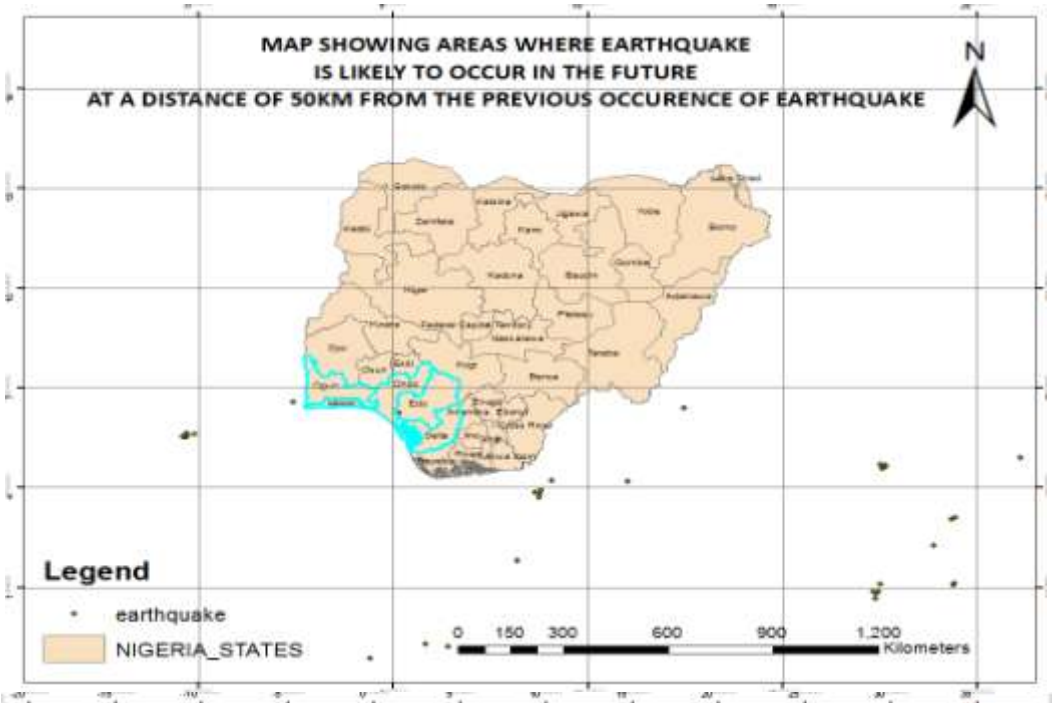

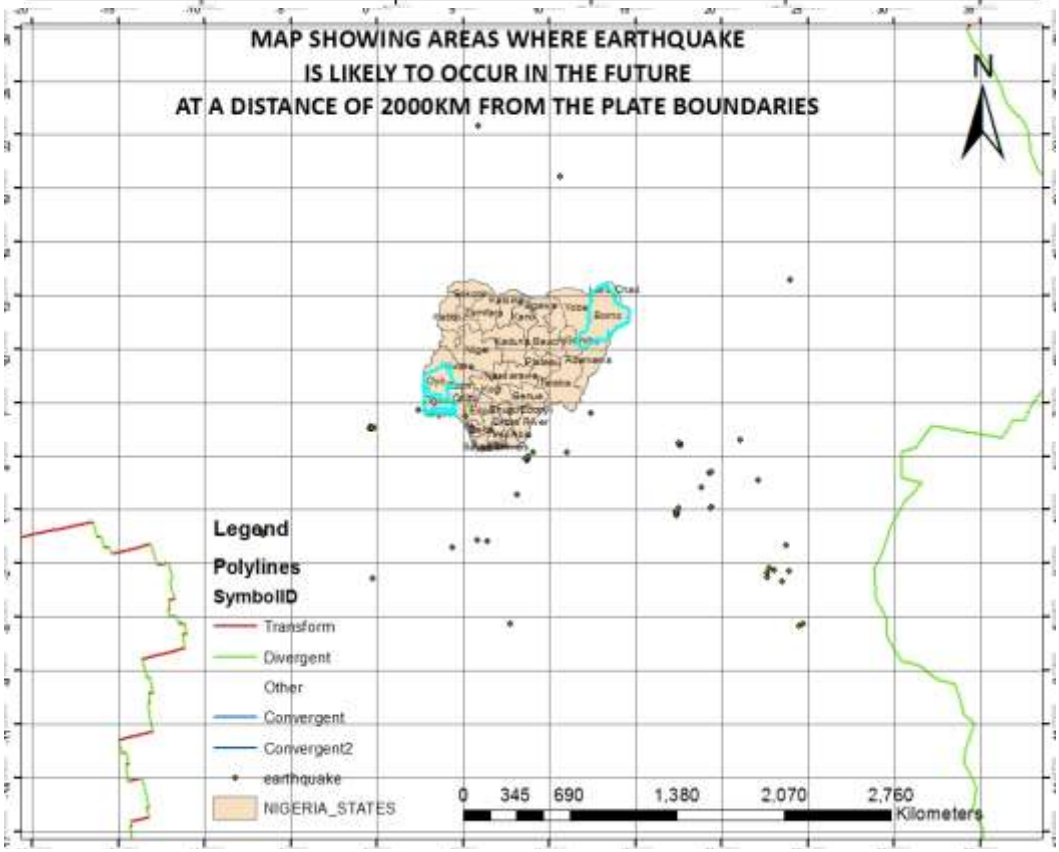

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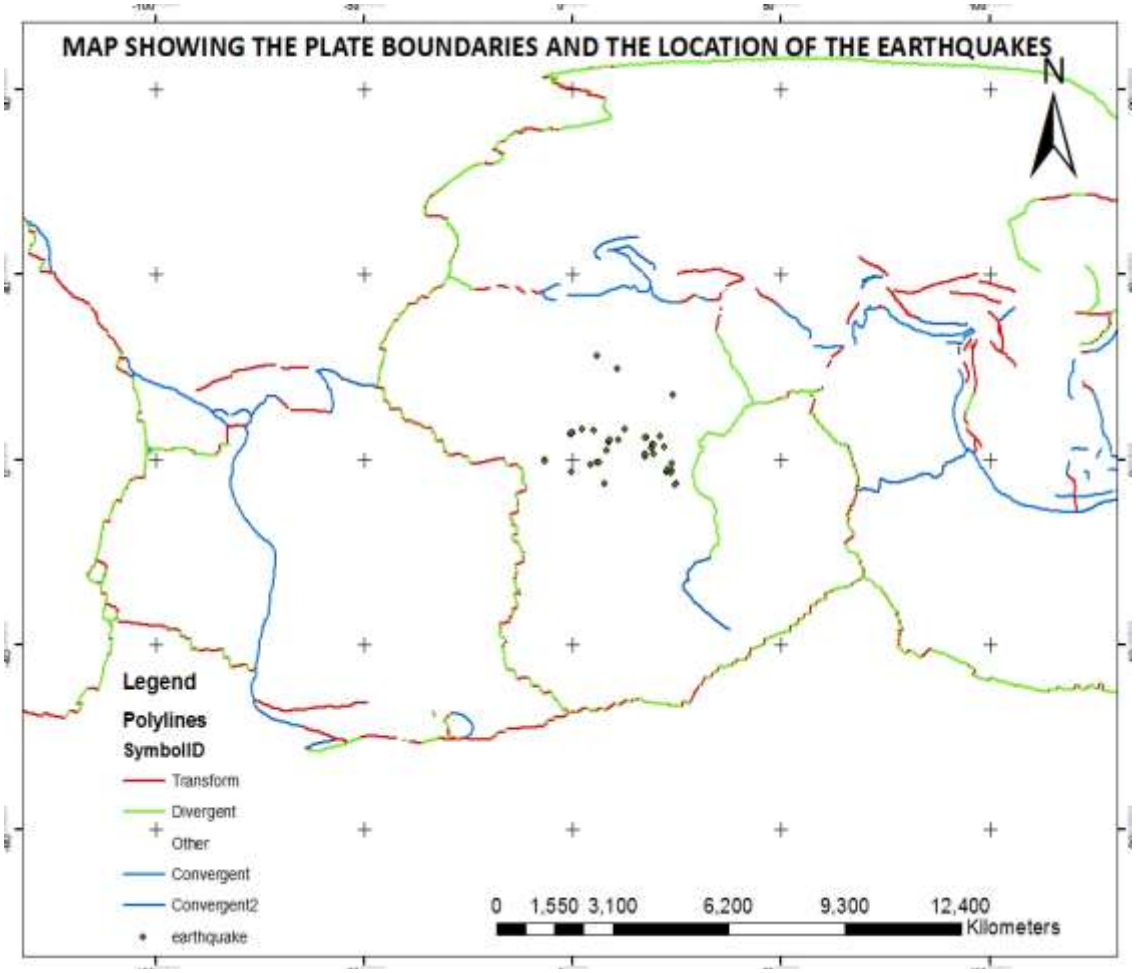

IV. CONCLUSION

Based on the results gotten above, Nigeria is susceptible to large probable future earthquake especially in her south-west region and her seismicity is best classified as low. As against the belief of many that Nigeria is a country that is free from seismic occurrences,

Nigeria is rather a low seismic country based on general conception about seismicity. Nigeria is also at a future risk of experiencing a probable quake that is up to 7.2Ml in her south-west region.

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