GG5065, GG5066, GL5063

Assessment-2

Exploratory Data Analysis (EDA) and Visualisation of the UK oil production during the period 1980 to 2010

Background

As a GIS analyst of an energy company, you have been tasked to perform an analysis of the UK offshore oil production during the last decades.

You work in a multidisciplinary group: other colleagues are working on different sections of the main report, and you should focus on the spatial component.

You will be working with some real spatial data that has already been downloaded from the website mentioned above. This is contained in the **DATA** folder on **MyAberdeen** for this Assessment. All files are Zipped (.ZIP).

Well-production data is currently only available for certain areas and dates; therefore, some data was simulated.

Learning objectives

When you have finished the proposed tasks, you should ***feel confident*** in:

- Exploring spatial data:
    - Visualization
    - Identification of spatial reference (coordinate system)
    - Type of data (raster/vector; point/line/polygon)
    - Table of attributes
    - Useful / anecdotal data
- Linking a non-spatial database with a spatial vector dataset
- Selecting and cleaning data for analysis
- Producing a continuous map of a given attribute measured at sample plots (e.g., using Kriging interpolation)
- Analysing spatial patterns of continuous properties
- Identifying spatial relations, visually and with automatic tools
- Analysing temporal change of spatially distributed properties

Tasks

Explore all the spatial layers:

This is in effect Exploratory Data Analysis (EDA) using a Geographic Information System (GIS). Visualising the data (as information) is one way to understand the content of the data. To do this in a GIS e.g., ArcGIS you have tools to map the data (each layer) in the Data View and to explore the raw data in the Attribute table. Eyeballing the map patterns is one way to proceed. Plot all data using Add+ and switch layers ON and OFF to view them in the Data View.

Link the .xlsx or .csv database (table) with the offshore-wells spatial database (shapefile).

This step requires you to JOIN the two attribute tables. In this case you need to Use File Add+ Data to add the spreadsheet file and use Add+ data to open the shapefile. You will need to save the spreadsheet file to a shapefile (see e.g.) and then JOIN (see e.g.). Find the field common to both attribute files to be able to link the datasets.

Describe the distribution of wells by geological basin, by cartographic quadrant, and by water depth. Consider using tables or graphs for presentation of results (4 marks)

This is a reasonably simple thing to do. You can overlay the layers and use the i (information) tool and simply describe whether (a) there is any evidence of scatter, clusters etc.) and (b) try to establish any relationships that might exist between wells and e.g., water depths. Use the tools (zoom, pan etc.) as well and look at both the map and attribute tables.

Derive two maps of oil production from your data: one map representing oil production during period 1980-1995, the other during period 1995-2010 (4 marks)

Map the Oil Production datasets – two of them in total.

Examine and describe visual patterns of oil production (2 marks)

Simply eyeball the maps and describe the 'patterns' you see.

Compare quantitatively the global production at the two periods of analysis (3 marks)

Here you need to use the attribute table to look at the oil production numbers for both database fields (Production period 1 and Production period 2) and perhaps plot the data using a histogram for a simple comparison of the values.

Examine and describe patterns of change (2 marks)

Simply eyeball the maps and describe the 'patterns' you see.

Calculate the change in production of each well and then derive a new map.

This can be achieved by (a) creating a New Field (e.g., difference / numeric) – to do this you will need to turn on the table editor, add the new field, and then subtract one production period from the other to establish +ve/-ve change for each location). Then map the difference field.

Compare your two maps of production change. Describe any differences (3 marks)

Look at the +ves and -ves – and maybe compare to other layers of data.

Additional / original analysis and results will make a difference (4 marks)

Any other **novel** things you can provide in your **Exploratory Data Analysis (EDA)**

Report

1. Write a focused report describing your findings resulting from the spatial analysis of the oil production datasets.
2. The methodology you have used should be detailed for inclusion in an Appendix of the main company document.
3. The purpose is to provide a methodology to be applied in other offshore oil production areas.

When your report is finished, please submit to Turnitin as single PDF file on MyAberdeen.

Marking will be based on your report as it compiles the results of the tasks proposed

Notes

This part enlists some resources that can be helpful while working on the assessment.

The Spreadsheet data and Attribute Tables are your databases for the exercises.

There are many sources of information online (via Google) to assist you in completing the tasks and answering the questions.

YouTube Videos (For example)

Joining Tables:

https://www.youtube.com/watch?v=vedylf2pMjQ

Kriging:

https://www.youtube.com/watch?v=hahHRhQetyg

Websites

Kriging:

http://desktop.arcgis.com/en/arcmap/10.3/tools/3d-analyst-toolbox/how-kriging-works.htm

Kriging:

https://desktop.arcgis.com/en/arcmap/latest/extensions/geostatistical-analyst/kriging-in-geostatistical-analyst.htm

Joining Tables:

http://desktop.arcgis.com/en/arcmap/10.3/manage-data/tables/essentials-of-joining-tables.htm

Joining Spreadsheet to Feature Class:

https://support.esri.com/en/technical-article/000008903

Field Calculator:

http://desktop.arcgis.com/en/arcmap/10.3/manage-data/tables/making-field-calculations-making-simple-field-calc.htm

Import XY (spreadsheet) and convert to Shapefile:

https://support.esri.com/en/technical-article/000012745

Deadline for submission is December 6, 2021.