

Practical 4

Approaches to georeference locations

Aim of practical

This practical aim to show the attendees how to retrieve geographic coordinates (latitude and longitude) from online sources for locations (or sites) which have not been positioned in the field by using a handheld GPS device or any other platform supporting GPS functionalities (i.e. smartphone, tablet). We also show how to prepare the data to be used in a QGIS framework.

Key learning skills

In this practical, you will:

- Use the web map application called ‘**OpenCage Geocoder**’ to find the location and their retrieve geographical coordinates.
- Manipulate spatial coordinates and use formulae to convert coordinates from Decimals-Minutes-Seconds to Decimal Degrees.
- Show the distribution of the sites in QGIS 2.18.9



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Practical 4

The dataset provided contains 25 sites from Sud (South) Cameroon that participated in the LF programme. For this practical, we will need to populate the dataset by obtaining the geographical coordinates for (latitude and longitude) that are missing for some sites. Other sites have coordinates recorded in Degrees-Minutes-Seconds, you will need to ensure that the coordinate system for all sites have been standardised to a single system in Decimal-Degrees.

- Open the spreadsheet *CMR_SOUTH_LF_sites.csv*. The data file contains the following fields:

Column name	Description
siteID	Unique identification code
site_name	The name of site
region	Region in Cameroon
DD_LAT	Latitude (expressed in decimal degrees)
DD_LONG	Longitude (expresses in decimal degrees)
LAT_DEG	The ‘degree’ component of the latitude (in degrees)
LAT_MIN	The ‘minute’ component of the latitude (in minutes)
LAT_SEC	The ‘second’ component of the latitude (in second)
LAT_DIR	North (N)/South (S)
LONG_DEG	The ‘degree’ component of the longitude (in degrees)
LONG_MIN	The ‘minute’ component of the longitude (in minutes)
LONG_SEC	The ‘second’ component of the longitude (in second)
LONG_DIR	East (E)/West (W)

	A	B	C	D	E	F	G	H	I	J	K	L	M	
1	siteID	site_name	region	DD_LAT	DD_LONG	LAT_DEG	LAT_MIN	LAT_SEC	LAT_DIR	LONG_DEG	LONG_MIN	LONG_SEC	LONG_DIR	
2	100001	Oveng	South						N				E	
3	100002	Evelessi	South						N				E	
4	100003	Mvengue	South						N				E	
5	100004	Ekowong	South						N				E	
6	100005	Campo	South						N				E	
7	100006	Olang	South						N				E	
8	100007	Meyomes	South						N				E	
9	100008	Mevous	South						N				E	
10	100009	Bouandjo	South						N				E	
11	100010	Djourn	South						N				E	
12	100011	Akog II	South						N				E	
13	100012	Nkoumad	South						N				E	
14	100013	Mveng	South			2	45	0	N	12	36.3336182	20.0170898	E	
15	100014	Adjap	South			2	51.8334	50.00381	N	11	19.0002251	0.01350403	E	
16	100015	Kribi	South			2	56.5002	30.0119	N	9	54.4997978	29.9878693	E	
17	100016	Zalengang	South			3	20.6664	39.98394	N	12		15	0	E
18	100017	Yoss II	South			2	13.9998	59.98804	N	11	4.66678619	40.0071716	E	
19	100018	Akomessi	South			2	55.9998	59.9881	N	11	42.4998093	29.9885559	E	
20	100019	Zoetele	South			3	15	0	N	11	52.9998207	59.9892426	E	
21	100020	Atog Boga	South			3	17.8332	49.99191	N	10	28.9997864	59.9871826	E	
22	100021	Ambam	South			2	22.99981	59.98833	N	11	16.0002136	0.01281738	E	
23	100022	Tsangue	South			2	59.3334	20.00381	N	10	56.5002251	30.013504	E	
24	100023	Sangmelir	South			2	55.9998	59.9881	N	11	58.6668205	40.0092316	E	
25	100024	Bengbis	South			3	26.66639	39.9836	N	12	27.4998093	29.9885559	E	
26	100025	Nkolfiti	South			3	5.666399	39.98394	N	12		0	0	E

1. Finding coordinates for single locations

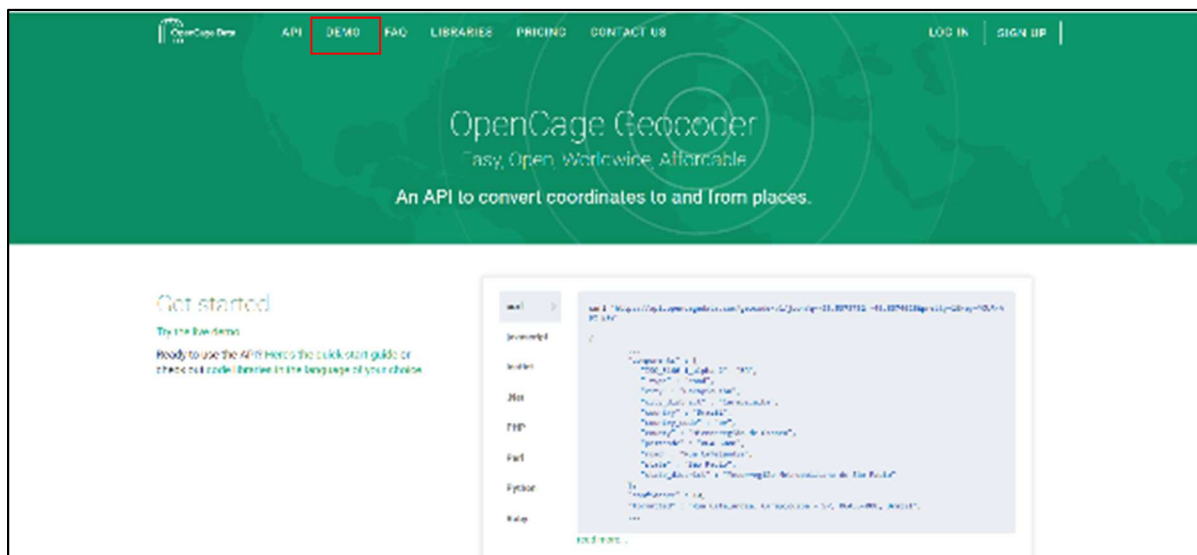
There are a number of web applications that can be used to identify geographic coordinates for locations, namely:

- Bing Maps (<http://www.bing.com/mapspreview?FORM=Z9LH3>)
- Google Map (<https://www.google.co.uk/maps/>)
- OpenStreetMap (<http://www.openstreetmap.org/>)

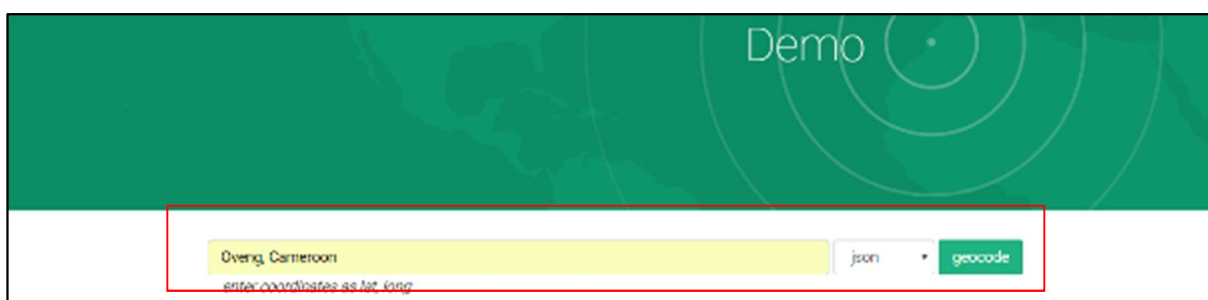
We will be using the OpenCage Geocoder (<https://geocoder.opencagedata.com/>) because it is simple and efficient tool for processing location names and extracting the desired geographical coordinates.

Let us start using OpenCage Geocoder to find the first site ‘Oveng’:

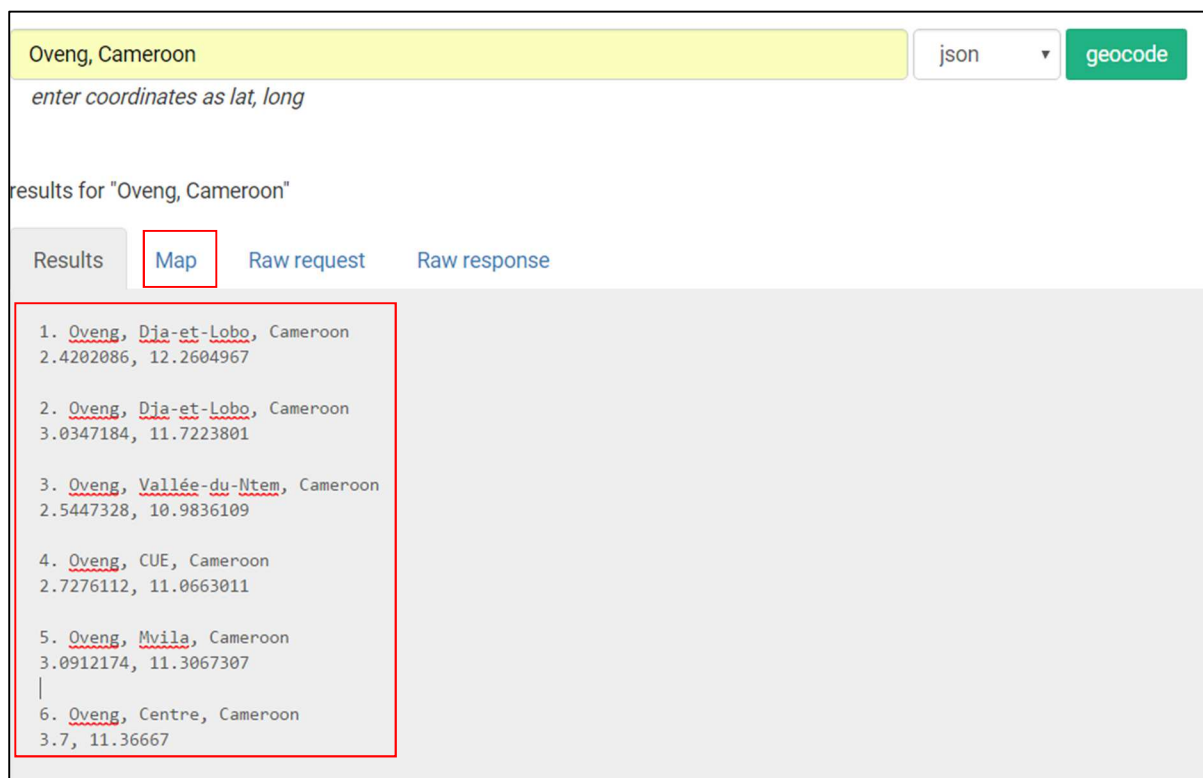
- Open <https://geocoder.opencagedata.com/> Click on the tab “DEMO” on top of the webpage to access the search bar




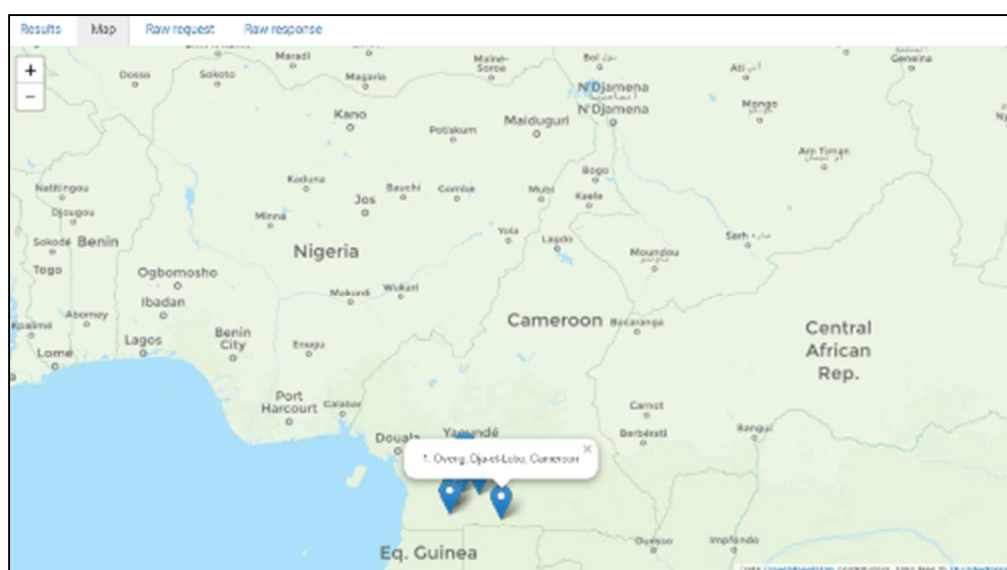
- In the search bar, enter the following search terms for the first site: “Oveng, Cameroon”, and then click on the button



- The search should output six potential locations in the result window



- Bear in mind - our only clue is that ALL study sites fall within the boundaries that’s defined as Sud (South) Cameroon. Therefore, we need to verify on maps (provided by OpenCage) which of these points are located in Sud (South) Cameroon.
- To view these points from OpenCage’s map, simply click on the tab “Map” above the result window.
- You should see six point distributed across Cameroon - click on  to reveal details of the locations.



- The most likely coordinates to choose from this output are those of the first option “**Oveng, Dja-et-Lobo, Cameroon (2.4202086, 12.2604967)**” in southern-most section of Cameroon. The second option, is unlikely, because it is situated in the southwest of Cameroon.
- Next step, extract the coordinates for “Oveng” from OpenCage’s result window, and populate them accordingly in the provided spreadsheet

The screenshot shows a search interface with three tabs: 'Results', 'Map', and 'Raw request'. The 'Results' tab is active, displaying a list of two results. The first result is '1. Oveng, Dja-et-Lobo, Cameroon' with coordinates '2.4202086, 12.2604967'. Two callout boxes point to the numbers: the first says 'This is measured as **LATITUDE** (expressed decimal degrees)' and the second says 'This is measured as **LONGITUDE** (expressed decimal degrees)'.

- The target columns to insert the values are **DD_LAT** (i.e. latitude) and **DD_LONG** (i.e. longitude)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	siteID	site_name	region	DD_LAT	DD_LONG	LAT_DEG	LAT_MIN	LAT_SEC	LAT_DIR	LONG_DEG	LONG_MIN	LONG_SEC	LONG_DIR
2	100001	Oveng	South	2.4202086	12.2604967				N				E
3	100002	Evelessi	South						N				E
4	100003	Mvengue	South						N				E
5	100004	Ekowong	South						N				E
6	100005	Campo	South						N				E
7	100006	Olang	South						N				E
8	100007	Meyomessi	South						N				E
9	100008	Mevous	South						N				E
10	100009	Bouandjo	South						N				E
11	100010	Djoum	South						N				E
12	100011	Akom II	South						N				E
13	100012	Nkoumadjap	South						N				E
14	100013	Mveng	South			2	45	0	N	12	36.3336182	20.0170898	E
15	100014	Adjap	South			2	51.8334	50.00381	N	11	19.0002251	0.01350403	E
16	100015	Kribi	South			2	56.5002	30.0119	N	9	54.4997978	29.9878693	E
17	100016	Zalengang	South			3	20.6664	39.98394	N	12	15	0	E
18	100017	Yoss II	South			2	13.9998	59.98804	N	11	4.66678619	40.0071716	E
19	100018	Akomessing	South			2	55.9998	59.9881	N	11	42.4998093	29.9885559	E
20	100019	Zoetele	South			3	15	0	N	11	52.9998207	59.9892426	E
21	100020	Atog Boga	South			3	17.8332	49.99191	N	10	28.9997864	59.9871826	E
22	100021	Ambam	South			2	22.99981	59.98833	N	11	16.0002136	0.01281738	E
23	100022	Tsangue	South			2	59.3334	20.00381	N	10	56.5002251	30.013504	E
24	100023	Sangmelima	South			2	55.9998	59.9881	N	11	58.6668205	40.0092316	E
25	100024	Bengbis	South			3	26.66639	39.9836	N	12	27.4998093	29.9885559	E
26	100025	Nkolfitti	South			3	5.666399	39.98394	N	12	0	0	E

- We have completed the first entry. Repeat the above steps for the remaining 12 sites that don’t have any geographical coordinates.

Tips: When searching for locations add as much information as possible in the search bar - it is best to have hierarchy for the location search; for instance: **SITE NAME, CITY, DISTRICT, PROVINCE and COUNTRY** etc. This way, the online tool can isolate the most likely location.

2. Converting geographical coordinates

It is useful to have all geographical coordinates standardised to one system. Currently, the assembled dataset has two different systems: 1.) Decimals Degrees and 2.) Degrees-Minutes and Seconds. Most spatial analyses will use the default - Decimal Degrees, therefore we need to convert Degrees-Minutes and Seconds to Decimal Degrees.

The current Degree minutes and seconds coordinates for the site “**Mveng**” are expressed 2° 45.00’ 0.00” (North) and 12° 36.3336182’ 20.0170898” (East), the former represents the latitude, and the latter is the longitude, respectively. To convert these estimates, the formula below can be applied to convert the estimates:

$$\text{Decimal degrees} = \text{Degree} + (\text{minutes}/60) + (\text{seconds}/3600)$$

An example for implementing this formula:

Latitude:

$$\underline{2.75} = 2.00 + (45.00/60.00) + (0.00/3600.00)$$

Longitude:

$$\underline{12.611121} = 12.00 + (36.3336182/60.00) + (20.0170898/3600)$$

The derived latitude and longitude for ‘**Mveng**’ is 2.75 and 12.611121, respectively. Use Excel’s formula tool for carrying out same operation for the other sites in the dataset.

- Under column D (i.e. DD_LAT) - input the formula in cell **D14** by typing: **= F16 + (G16/60) + (H16/3600)**, to convert the values in Column F (degrees), G (minutes) and H (seconds) to latitudinal decimal degrees.
- Drag the corner of the cell through rows **D14** to **D26** to obtain the latitudinal estimates for the remaining sites.
- Repeat the same operations for column E (i.e. DD_LONG) - input the formula in cell **E14** by typing: **= J14 + (K14/60) + (L14/3600)**, to convert the values in Column J (degrees), K (minutes) and L (seconds) to longitudinal decimal degrees.

- Drag the corner of the cell through rows E14 to E26 to obtain the longitudinal estimates for the remaining sites.

The complete dataset should look like:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	siteID	site_name	region	DD_LAT	DD_LONG	LAT_DEG	LAT_MIN	LAT_SEC	LAT_DIR	LONG_DEG	LONG_MIN	LONG_SEC	LONG_DIR
2	100001	Oveng	South	2.420208693	12.26049709				N				E
3	100002	Evelessi	South	2.966670036	11.69999981				N				E
4	100003	Mvengue	South	3.287971973	10.97161102				N				E
5	100004	Ekowong	South	2.516544342	12.19107628				N				E
6	100005	Campo	South	2.377799988	9.82872963				N				E
7	100006	Olang	South	2.208058119	11.16217422				N				E
8	100007	Meyomessi	South	2.816982031	12.20676708				N				E
9	100008	Mevous	South	2.587899208	11.44687653				N				E
10	100009	Bouandjo	South	2.5	9.833330154				N				E
11	100010	Djourn	South	2.671533108	12.67908573				N				E
12	100011	Akom II	South	2.812894106	10.54422092				N				E
13	100012	Nkoumadjap	South	3.186481953	11.94447136				N				E
14	100013	Mveng	South	2.75	12.61112022	2	45	0	N	12	36.33362	20.0170898	E
15	100014	Adjap	South	2.877779961	11.31667423	2	51.8334	50.00381	N	11	19.00023	0.01350403	E
16	100015	Kribi	South	2.950006723	9.916660309	2	56.5002	30.0119	N	9	54.4998	29.9878693	E
17	100016	Zalengang	South	3.355546713	12.25	3	20.6664	39.98394	N	12	15	0	E
18	100017	Yoss II	South	2.249993324	11.08889294	2	13.9998	59.98804	N	11	4.666786	40.0071716	E
19	100018	Akomessing	South	2.949993372	11.7166605	2	55.9998	59.9881	N	11	42.49981	29.9885559	E
20	100019	Zoetele	South	3.25	11.8999939	3	15	0	N	11	52.99982	59.9892426	E
21	100020	Atog Boga	South	3.311106682	10.49999332	3	17.8332	49.99191	N	10	28.99979	59.9871826	E
22	100021	Ambam	South	2.39999342	11.26667404	2	22.99981	59.98833	N	11	16.00021	0.01281738	E
23	100022	Tsangue	South	2.994446516	10.95000744	2	59.3334	20.00381	N	10	56.50023	30.013504	E
24	100023	Sangmelima	South	2.949993372	11.98889446	2	55.9998	59.9881	N	11	58.66682	40.0092316	E
25	100024	Bengbis	South	3.455546379	12.4666605	3	26.66639	39.9836	N	12	27.49981	29.9885559	E
26	100025	Nkolfiti	South	3.105546713	12	3	5.666399	39.98394	N	12	0	0	E

