ΔΗΜΟΚΡΙΤΟΣ

ΕΘΝΙΚΟ ΚΕΝΤΡΟ ΕΡΕΥΝΑΣ ΦΥΣΙΚΩΝ ΕΠΙΣΤΗΜΩΝ

Applied Data Mining

1st part – Preliminary Data Analysis, SQL queries

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Entity Relation model

The tables that we are going to use in this assignment are listed below. They contain real-world data from the maritime domain [https://zenodo.org/record/1167595#.W9BgcFUzapo] which monitor, analyze and visualize the sea movements. There are tables that contain info of the whole maritime activities and their impact on the environment, tables that contain a set of complementary data having spatial and temporal information and tables with information about ships positions within Celtic sea, the Channel and Bay of Biscay (France).

More specifically, there are four categories of data: Navigation data, vessel-oriented data, geographic data, and environmental data. It covers a time span of six months, from October 1st, 2015 to March 31st, 2016.

Tables are:

- aton
- pg_catalog
- country_codes
- pg_temp_1
- geographic_features
- pg_toast.
- geography_columns
- pg_toast_temp_1
- geometry_columns
- ports.
- information_schema
- public.
- raster_overviews
- receiver
- ship_types_detailled_list
- natura2000
- ship_types_list
- navigational_status
- spatial_ref_sys
- raster_columns
- nari_ais_static
- nari_dynamic
- nari_dynamic_aton
- nari_dynamic_sar

We are going to use most of the tables at the next section at which we will try to understand the data.

Create tables

We have added all the above tables at the database.

Preliminary data analytics

Null values

By observing the data, we discovered many columns that contain multiple null values. We decided it would be a good practice not to remove them in this step, but include them in the dataset and decide in one of the next steps how to handle those cases.

Preliminary data analysis refers to some simple and basic analysis by running some SQL queries. This analysis will helpful in understanding the data.

SQL commands:

1. How many ships there are based on shipname?

```
SELECT Count (DISTINCT shipname)
FROM   nari_ais_static;
```

Count: 4824

Note: Extract this info from static information about ships

2. How many ships have imo number?

```
SELECT Count (DISTINCT imo)
FROM   nari_ais_static;
```

Count: 4033

Note: There are ships with no imo number

3. How many ships there are based on mmsi(dynamic table)?

```
SELECT Count (DISTINCT mmsi)
FROM   nari_dynamic;
```

Count: 5055

Note: Extract this info from dynamic information about ships (ais messages). Here we can see that there are ships which send ais messages but there is no info about them at the static table of ships (nari_static)

4. How many ships there are based on mmsi (static table)?

```
SELECT Count (DISTINCT sourcemmsi)
FROM   nari_ais_static;
```

Count: 4842

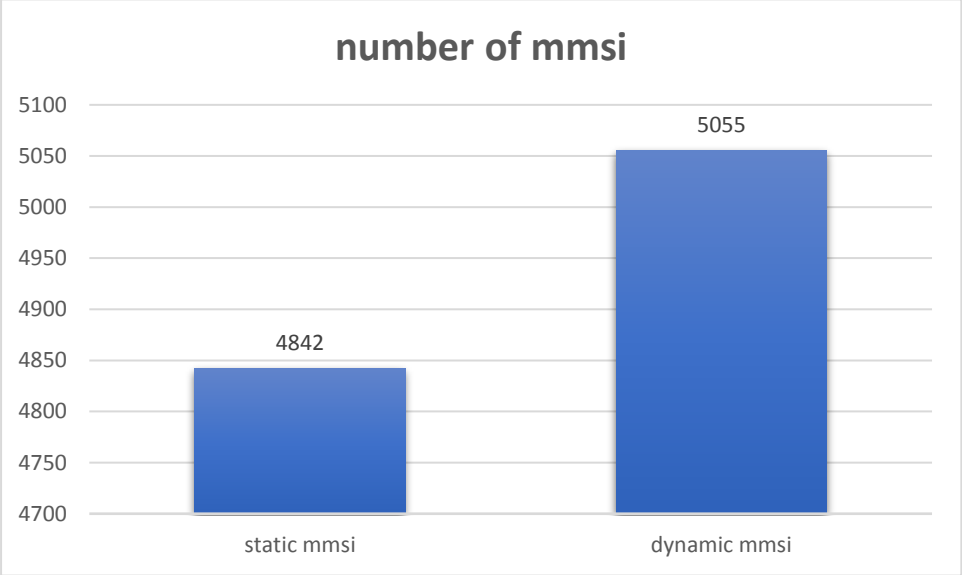

Figure 1:Number of mmsis at 2 tables (static, dynamic)

5. How many ships have mouthermmsi (ships that other ships use them as start point)?

```
SELECT Count (DISTINCT mothershipmmsi)
FROM   nari_ais_static;
```

Count: 228

6. Display 5 ships that have mouthermmsi?

```
SELECT shipname,
       callsign,
       imo,
       sourcemmsi,
       mothershipmmsi,
       detailed_type
FROM   public.nari_ais_static,
       public.ship_types_list,
       public.ship_types_detailled_list
WHERE  nari_ais_static.shiptype = ship_types_detailled_list.id
_detailedtype
       AND ship_types_detailled_list.id_shiptype = ship_types_
list.id_shiptype
       AND nari_ais_static.mothershipmmsi > 0
LIMIT  5;
```

	shipname text	callsign text	imo integer	sourcemmsi integer	mothershipmmsi integer	detailed_type text
1	KINGSTON	MZXE7		235013963	16847107	Suction Dredger
2	IZAR	DGYN		211232180	33558785	Inland Dredger
3	CARRIED AWAY	2HGE4		235103401	23072961	Inland Dredger
4	IZAR	DGYN		211232180	33558785	Inland Dredger
5	KINGSTON	MZXE7		235013963	16847107	Suction Dredger

Figure 2: Ships with mothermmsi

7. Display the most popular mothershipmmsi ship.

```
SELECT mothershipmmsi,
       Count(DISTINCT sourcemmsi) AS num
FROM   nari_ais_static
WHERE  mothershipmmsi > 0
GROUP  BY mothershipmmsi
ORDER  BY num DESC;
```

Mothershipmmsi | count

6320258 | 6

4223106 | 5

8. Display the ships that have as mothershipmmsi the most popular mothershipmmsi ship

```
SELECT DISTINCT sourcemmsi,
                shipname,
                callsign,
                imo,
                mothershipmmsi,
                detailed_type
FROM   PUBLIC.nari_ais_static,
       PUBLIC.ship_types_list,
       PUBLIC.ship_types_detailled_list
WHERE  nari_ais_static.shiptype = ship_types_detailled_list.id
_detailedtype
       AND ship_types_detailled_list.id_shiptype = ship_types_
list.id_shiptype
       AND nari_ais_static.mothershipmmsi = 6320258;
```

	sourcemmsi integer	shipname text	callsign text	imo integer	mothershipmmsi integer	detailed_type text
1	227316100	JEANCANI	FG9660		6320258	Cutter Suction Dredger
2	227591030	SPONTUS	FU5007		6320258	Cutter Suction Dredger
3	227736540	ELORN	FGF6010		6320258	Waste Disposal Vessel
4	227549890	LAITERIE MALO-ESPOIR	FGD2321		6320258	Inland Dredger
5	227635650	ARTEMIS 3	FS5834		6320258	Cutter Suction Dredger
6	227322690	MAM GOZ	FI3738		6320258	Cutter Suction Dredger

Figure 3:Ships with the same mothermmmsi

9. How many ship types there are at the static table?

```
SELECT Count (DISTINCT shiptype)
FROM   nari_ais_static;
```

Count: 45

10. Display the number of ships based on ship type

```
SELECT type_name,
       Count(DISTINCT sourcemmsi) AS num
FROM   PUBLIC.nari_ais_static,
       PUBLIC.ship_types_list
WHERE  ship_types_list.shiptype_min <= nari_ais_static.sh
iptype
       AND ship_types_list.shiptype_max >= nari_ais_stati
c.shiptype
GROUP  BY type_name
ORDER  BY num DESC;
```

	type_name text	num bigint
1	Cargo	2450
2	Tanker	787
3	Fishing	357
4	Cargo - Hazard A (Major)	293
5	Sailing Vessel	222
6	Tanker - Hazard B	123
7	Other	113

Figure 4: Ships per type

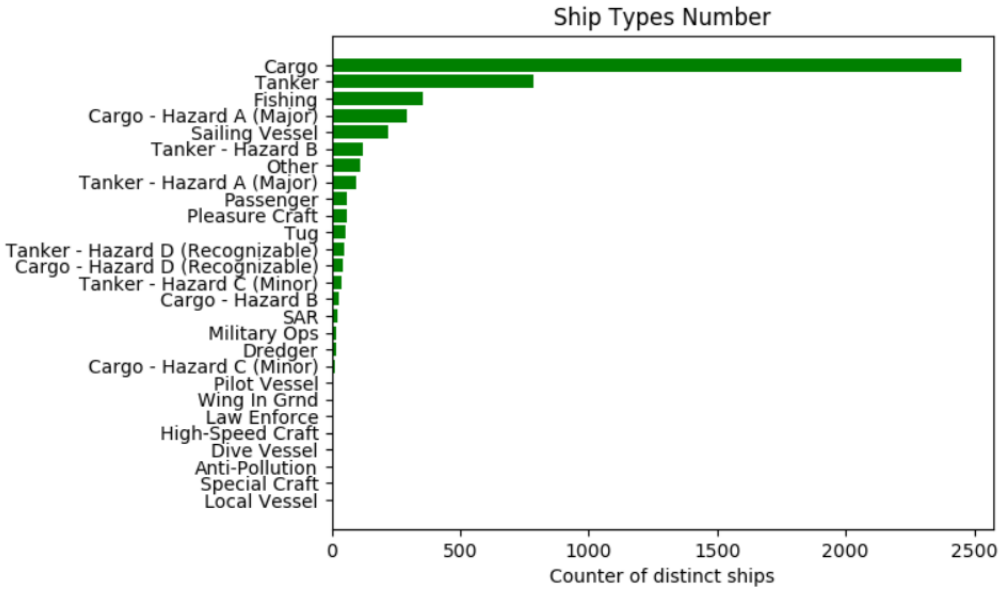

Figure 5 Visualization of number of each vessel type.

11. Find the shipnames that have no ship type defined

```
SELECT DISTINCT shipname
FROM   nari_ais_static
WHERE  nari_ais_static.shiptype IS NULL;
```

	shipname text
1	TORR PENN
2	SEA-EYE
3	RAW ONE
4	NADIA TONY
5	MANEVAI
6	TAMARIND
7	DOLENN

Figure 6:Ships with no type defined

12. Display the number of vessels per country. The first 3 digits of MMSI declare the region country of the ship.

```
SELECT Count(DISTINCT sourcemmsi),
       country
FROM   public.country_codes,
       public.nari_ais_static
WHERE  Left(nari_ais_static.sourcemmsi :: text, 3) :: INTEGER
=
       country_codes.mmsi_country_code
GROUP  BY country;
```

	num bigint	country text
1	715	France
2	368	Netherlands (Kingdom of the)
3	347	Liberia (Republic of)
4	336	Marshall Islands (Republic of the)
5	303	Malta
6	298	Antigua and Barbuda
7	243	Panama (Republic of)

Figure 7:Ships per counrty

13. Display the number of ships and their type per country

```
SELECT Count(DISTINCT( sourcemmsi )),
       country,
       ais_type_summary
FROM   public.country_codes,
       public.nari_ais_static,
       public.ship_types_list
WHERE  Left(nari_ais_static.sourcemmsi :: text, 3) :: INT
EGER =
              country_codes.mmsi_country_code
       AND ship_types_list.shiptype_min <= nari_ais_stati
c.shiptype
       AND ship_types_list.shiptype_max >= nari_ais_stati
c.shiptype
GROUP  BY country,
          ais_type_summary;
```

	num bigint	country text	ais_type_summary text
1	324	France	Fishing
2	307	Netherlands (Kingdom of the)	Cargo
3	284	Antigua and Barbuda	Cargo
4	252	Liberia (Republic of)	Cargo
5	196	Panama (Republic of)	Cargo
6	174	Marshall Islands (Republic of the)	Cargo

Figure 8:Detailed info for ships per counrty

14. Find the ship types for French vessels.

```
SELECT DISTINCT mmsi_country_code
FROM   PUBLIC.country_codes
WHERE  country LIKE 'France';
```

Note: mmsi codes for France are: 226, 227,228

```
SELECT shiptype,
       detailed_type,
       Count(DISTINCT shipname)
FROM   public.nari_ais_static,
       public.ship_types_list,
       public.ship_types_detailled_list
WHERE  nari_ais_static.shiptype = ship_types_detailled_list.id
_detailedtype
       AND ship_types_detailled_list.id_shiptype = ship_types_
list.id_shiptype
       AND ( Left(nari_ais_static.sourcemmsi :: text, 3) :: IN
TEGER = 226
              OR Left(nari_ais_static.sourcemmsi :: text, 3) :
: INTEGER = 227
              OR Left(nari_ais_static.sourcemmsi :: text, 3) :
: INTEGER = 228 )
GROUP  BY shiptype,
          detailed_type;
```

	shiptype integer	detailed_type text	count bigint
1	20	Tractor Tug	1
2	30	Cutter Suction Dredger	331
3	31	Cutter Suction Hopper Dredger	1
4	33	Bucket Dredger	9
5	34	Trailing Suction Hopper Dredge	1
6	35	Trailing Suction Dredger	3

Figure 9:Ships of France

15. Display the most popular destinations

```
SELECT destination,
       Count(DISTINCT sourcemmsi) AS num
FROM   nari_ais_static
WHERE  Length(destination) > 0
GROUP  BY destination
ORDER  BY num DESC;
```

	destination text	num bigint
1	ROTTERDAM	431
2	ANTWERP	231

Figure 10:Most popular destinations

16. Display the type of messages that are sent from ship with shiptype=0.

```
SELECT    Count(*),
          n.status
FROM      (
                 SELECT mmsi,
                        status
                 FROM   PUBLIC.nari_dynamic) a,
          (
                           SELECT DISTINCT(sourcemmsi),
                                           shiptype
                           FROM            nari_ais_static)
 b,
          navigational_status AS n mmsi=sourcemmsi
AND       b.shiptype=0
AND       n.code=a.status
GROUP BY n.status;
```

	count bigint	status text
1	12584	aground
2	8867	at anchor
3	4	constrained by her draught
4	180719	moored
5	1270566	not defined = default (also used by AIS-SART under test)
6	791	not under command
7	210105	restricted manoeuvrability

Figure 11:Messages sent from ships with type=0

17. Display the number of messages that are sent from ships based on their type.

```
SELECT Count(*),
       n.status,
       shl.ais_type_summary
FROM   (SELECT mmsi,
               status
        FROM   PUBLIC.nari_dynamic) a,
       (SELECT DISTINCT( sourcemmsi ),
                        shiptype
        FROM   nari_ais_static) b,
       ship_types_list AS shl,
       navigational_status AS n
WHERE  mmsi = sourcemmsi
       AND shl.shiptype_min <= b.shiptype
       AND shl.shiptype_max >= b.shiptype
       AND b.shiptype != 0
       AND n.code = a.status
GROUP  BY n.status,
          shl.ais_type_summary;
```

	count bigint	status text	ais_type_summary text
1	2055	aground	Fishing
2	12584	aground	Other
3	316	aground	Passenger
4	72556	at anchor	Cargo
5	105	at anchor	Fishing
6	3472	at anchor	Other
7	9	at anchor	Passenger
8	1187	at anchor	Sailing Vessel
9	24004	at anchor	Search and Rescue

Figure 12:Number of messages sent based on ship type

18. Display the number of fishing messages per month

```
SELECT    Count(*) AS num,
          m_month
FROM      (
                    SELECT status,
                           date_part('month',timestamp 'epoch' + t
 * interval '1 second') AS m_month
                    FROM   nari_dynamic) m
WHERE     m.status=7
GROUP BY m_month
ORDER BY num DESC;
```

	num bigint	m_month double precision
1	266961	2
2	190729	3
3	169513	11
4	151189	10
5	119942	12
6	115142	1

Figure 13:Fishing messages per month

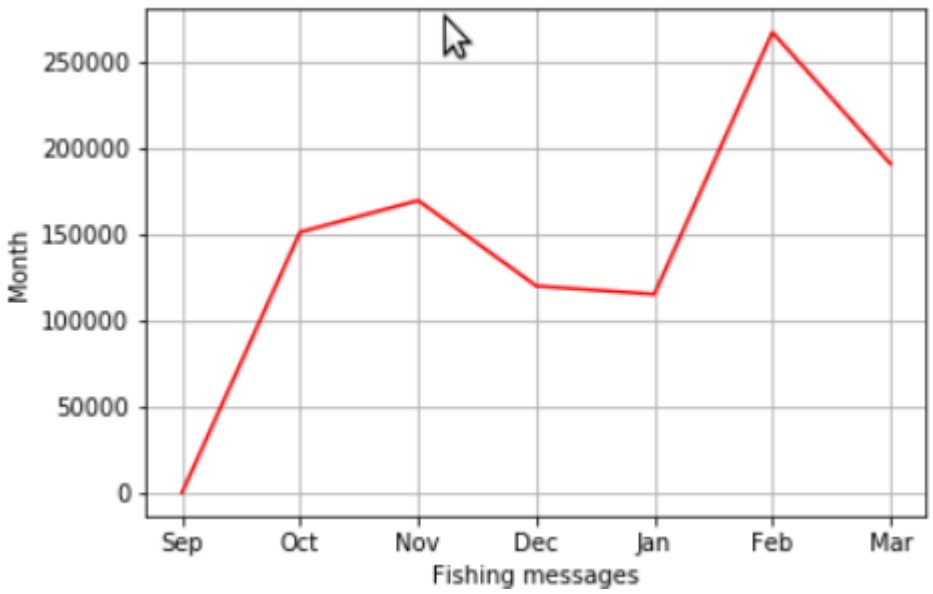

Figure 14:Visualization of fishing messages per month

19. Display the number of messages per month

```
SELECT    Count(*) AS num,
          m_month,
          n.status
FROM      (
                SELECT status,
                       date_part('month',timestamp 'epoch
' + t * interval '1 second') AS m_month
                FROM   nari_dynamic) m,
          navigational_status AS n
WHERE     m.status=n.code
GROUP BY m_month,
          n.status
ORDER BY num DESC;
```

	num bigint	m_month double precision	status text
1	1501657	1	not defined = default (also used by AIS-SART under test)
2	1396348	3	not defined = default (also used by AIS-SART under test)
3	1243249	2	not defined = default (also used by AIS-SART under test)
4	758044	11	not defined = default (also used by AIS-SART under test)
5	735396	10	not defined = default (also used by AIS-SART under test)
6	621065	12	not defined = default (also used by AIS-SART under test)

Figure 15;Number of messages per month

20. Display the types of messages inside a fishing area

```
SELECT Count(*) AS num,
       n.status
FROM   (SELECT DISTINCT maxlong,
                        maxlat,
                        minlong,
                        minlat
         FROM   geographic_features.fishing_areas_eu) g,
        (SELECT lat,
                lon,
                status
         FROM   nari_dynamic) d,
        navigational_status AS n
WHERE  maxlong >= lon
       AND minlong <= lon
       AND maxlat >= lat
       AND minlat <= lat
       AND n.code = d.status
GROUP  BY n.status
ORDER  BY num DESC;
```

	num bigint	status text
1	6260535	not defined = default (also used by AIS-SART under test)
2	1039810	moored
3	1013596	engaged in fishing
4	391680	restricted manoeuvrability
5	179548	at anchor
6	95417	reserved for future amendment of navigational status for ships carrying DG, HS, or MP, or IMO hazard or pollutant category C, high speed craft (HSC)
7	72165	under way sailing

Figure 16:Type of messages inside a fishing area

21. Display the number of fishing messages inside a fishing area

```
FROM    (SELECT DISTINCT maxlong,
                         maxlat,
                         minlong,
                         minlat
         FROM   geographic_features.fishing_areas_eu) g,
        (SELECT lat,
                lon,
                status
         FROM   nari_dynamic) d,
        navigational_status AS n
WHERE   maxlong >= lon
        AND minlong <= lon
        AND maxlat >= lat
        AND minlat <= lat
        AND n.code = d.status
        AND n.code = 7;
```

Count: 1013596

Whereas the total number of messages inside this area is:

```
SELECT Count(*)
FROM    (SELECT DISTINCT maxlong,
                         maxlat,
                         minlong,
                         minlat
         FROM   geographic_features.fishing_areas_eu) g,
        (SELECT lat,
                lon,
                status
         FROM   nari_dynamic) d,
        navigational_status AS n
WHERE   maxlong >= lon
        AND minlong <= lon
        AND maxlat >= lat
        AND minlat <= lat
        AND n.code = d.status;
```

Count: 9092197

Note: fishing messages is 11,147977% of the total messages

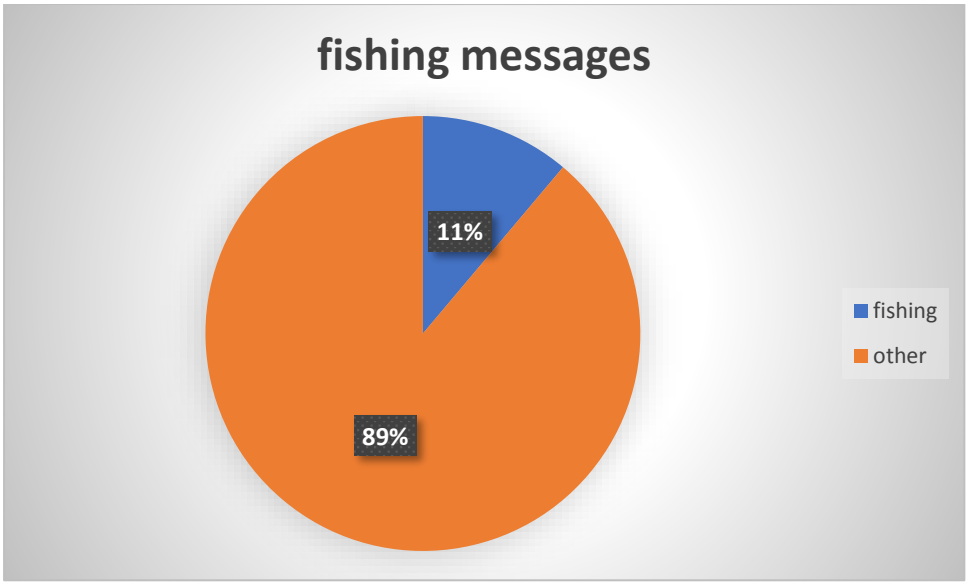

Figure 17:Visualization of total and fishing messages inside a fishing area

22. Display the number of ships that have navigational status "fishing" but out of fishing areas.

```
SELECT Count(*) AS num,
       n.status
FROM   (SELECT DISTINCT maxlong,
                        maxlat,
                        minlong,
                        minlat
        FROM   geographic_features.fishing_areas_eu) g,
       (SELECT lat,
               lon,
               status
        FROM   nari_dynamic) d,
       navigational_status AS n
WHERE  ( maxlong < lon
       OR minlong > lon )
       AND (maxlat < lat

       OR  minlat > lat)
       AND n.code = d.status

       AND n.code = 7
GROUP  BY n.status
ORDER  BY num DESC;
```

Count:0

Note: All ships that have navigational status "fishing" are inside fishing areas.

23. Display the number of ships per type that send fishing messages

```
SELECT type_name,
       Count(DISTINCT sourcemmsi) AS num
FROM   PUBLIC.nari_ais_static,
       PUBLIC.ship_types_list,
       PUBLIC.nari_dynamic
WHERE  ship_types_list.shiptype_min <= nari_ais_static.shiptyp
e
       AND ship_types_list.shiptype_max >= nari_ais_static.shi
ptype
       AND status = 7
GROUP  BY type_name
ORDER  BY num DESC;
```

24. Display the traffic per month

```
SELECT Count(mmsi),
       Extract(month FROM To_timestamp(t)) a
FROM   nari_dynamic
GROUP  BY a
ORDER  BY Count(mmsi) DESC;
```

	count bigint	a double precision
1	3358741	1
2	3353163	3
3	3243176	11
4	3183877	2
5	3130207	10
6	2762531	12
7	3935	4

Figure 18:Traffic per month

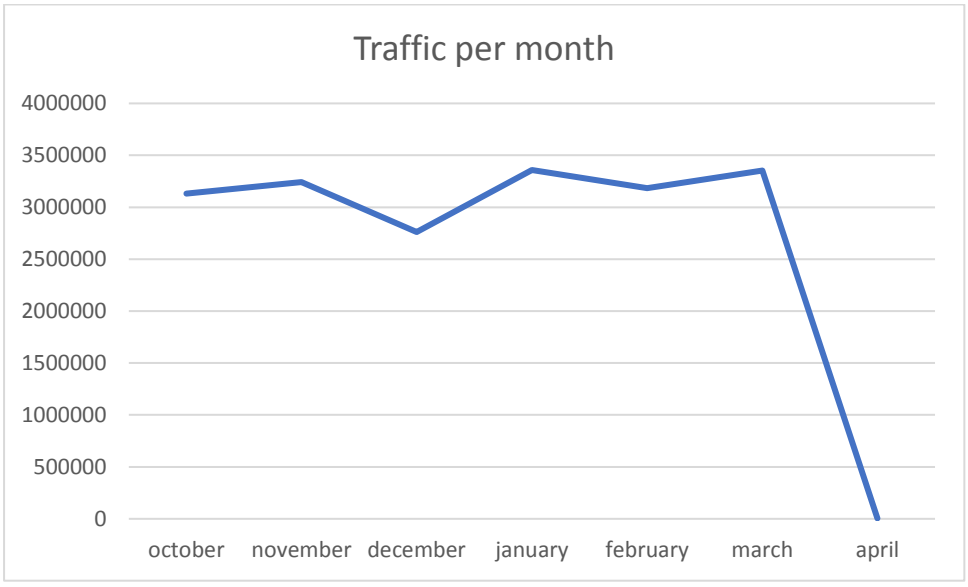

Figure 19:Visualization of traffic per month

25. Display the average speed per Month

```
SELECT Avg(speed),
       Extract(month FROM To_timestamp(t)) a
FROM   nari_dynamic
GROUP  BY a;
```

avg	a
17.0591974493276	1
10.554037420406	2
11.9571499208403	3
13.799288437103	4
4.09282450010901	10
4.28085302802243	11
4.82032302986167	12

Figure 20:Average speed of vessels per month

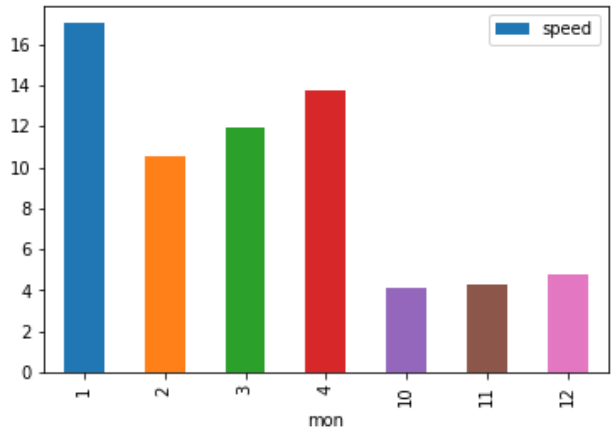

Figure 21: Visualization of Average speed of vessels per month

26. Display average speed, draught, length and width per ship type

```
SELECT b.shiptype,
       type_name,
       Avg(speed),
       Avg(b.draught),
       Avg(b.to_stern),
       Avg(b.to_starboard)
FROM   (SELECT mmsi,
               speed
        FROM   nari_dynamic) a,
       (SELECT DISTINCT( sourcemmsi ),
                        shiptype,
                        draught,
                        to_stern,
                        to_starboard
        FROM   nari_ais_static) b,
       (SELECT type_name,
               shiptype_min
        FROM   ship_types_list
        WHERE  shiptype_min > 0
               AND shiptype_max < 100) c
WHERE  a.mmsi = b.sourcemmsi
       AND c.shiptype_min = b.shiptype
GROUP  BY b.shiptype,
          type_name;
```

shiptype	type_name	avg	avg	avg	avg
20	Wing In Grnd	1.59777777777778	3.69333333333333	3.26666666666666667	2.33333333333333333
30	Fishing	4.93609060771588	1.69934889735548	8.7148782672699574	2.9680948984657168
31	Tug	1.13113637359268	4.10060673763447	19.9533666272396723	5.0599071275244228
32	Tug	0.401223575806678	8.22813871889022	11.4028552649679776	12.0715191904987543
33	Dredger	5.86106486779064	5.2487830952067	28.5842464311174592	7.4229458788190912
34	Dive Vessel	4.06092478311422	7.4	15.9828280118057419	2.9967802522135766
35	Military Ops	2.02956284041059	0.295931659940151	48.6979140566410599	6.3613189084889254
36	Sailing Vessel	3.30649045114843	2.67791987122098	5.1056841225280591	2.4062964239113858
37	Pleasure Craft	1.35407869610842	2.36412262655531	3.8067907187618868	0.900863344181167800076
40	High-Speed Craft	8.27206595538279	2.15322156020505	12.0644312041014272	6.0000000000000000
50	Pilot Vessel	13.1632146855069	0.00544528576859713	2.0970330122924851	1.9973862628310734
51	SAR	56.5769604530518	6.0189955040196	55.6060352110197233	9.5298548616081381

Figure 22:Average speed, draught, length and width per ship type

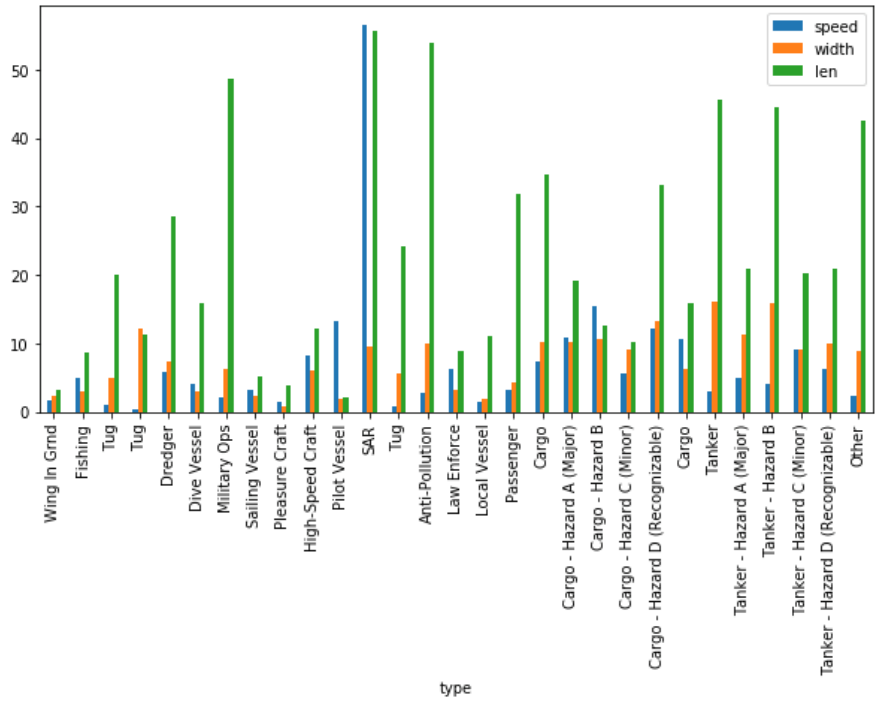

Figure 23:Visualization of average speed, draught, length and width per ship type

27. Display the traffic of Brest port

```
SELECT Count(*)
FROM   nari_ais_static
WHERE  destination LIKE '%BREST%'
        OR destination LIKE '%BES'
        OR destination LIKE ' ';
```

Count of vessels connected with Brest port :640060

Count of all vessels; 1078617

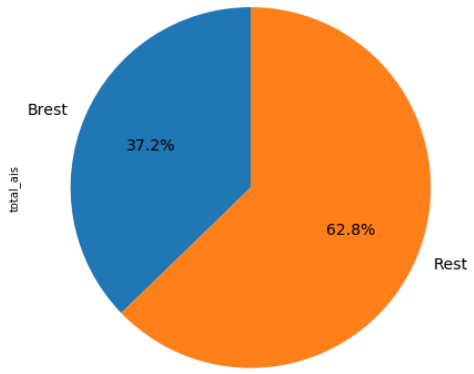

Figure 24:Visualization with the vessels that are connected with Brest Port

28. Display the average of draught, width per month for each ship type

```
SELECT b.shiptype,
       type_name,
       Avg(b.draught)       avg_draught,
       Avg(b.to_starboard) avg_len,
       a.c
FROM   (SELECT mmsi,
               speed,
               Extract(month FROM To_timestamp(t)) c
        FROM   nari_dynamic) a,
       (SELECT DISTINCT( sourcemmsi ),
                        shiptype,
                        draught,
                        to_starboard
        FROM   nari_ais_static) b,
       (SELECT type_name,
               shiptype_min
        FROM   ship_types_list
        WHERE  shiptype_min > 0
               AND shiptype_max <= 100) c
WHERE  a.mmsi = b.sourcemmsi
       AND c.shiptype_min = b.shiptype
GROUP  BY b.shiptype,
          type_name,
          a.c,
          type_name
ORDER  BY a.c;
```

shiptype	type_name	avg_draught	avg_len	c
30	Fishing	1.43644674187529	2.9665094031885342	1
31	Tug	4.10019957015558	5.0379183297513049	1
32	Tug	8.25	12.7500000000000000	1
33	Dredger	5.6850466537058	5.9940454279713314	1
34	Dive Vessel		3.0000000000000000	1
35	Military Ops	0.0013614388398278	6.1129593600895586	1
36	Sailing Vessel	3.48623101036894	3.0082228813877520	1
37	Pleasure Craft	2.29964285714285	1.1814503415659485	1
40	High-Speed Craft	3.7	6.0000000000000000	1
50	Pilot Vessel	0.00258456923846026	2.0021163139476754	1
51	SAR	6.097275797042	9.7340892585258838	1
52	Tug	5.09820913560387	5.5713431697314346	1
54	Anti-Pollution	5.84999999999912	10.0000000000000000	1
55	Law Enforce	1.4	3.5000000000000000	1
57	Local Vessel	2.20000000000024	2.0000000000000000	1
60	Passenger	1.15724124482264	3.9223039814669126	1
70	Cargo	6.65079479312786	10.3411853085653853	1
71	Cargo - Hazard A (Major)	7.34735017483756	10.2153479215794378	1

Figure 25:Average of draught,width per month for each ship type

29. Display the usage of SAR vessels every month

```
SELECT Count(mmsi),
       Extract(month FROM To_timestamp(t)) a,
       Avg(speed)
FROM   nari_dynamic_sar
GROUP  BY a
ORDER  BY Count(mmsi) DESC;
```

count	a	avg
1336	2	178.172155688623
1027	3	211.499513145083
918	10	139.102396514161
792	1	105.010101010101
447	11	71.3243847874720
46	12	26

Figure 26:SAR vessels per month

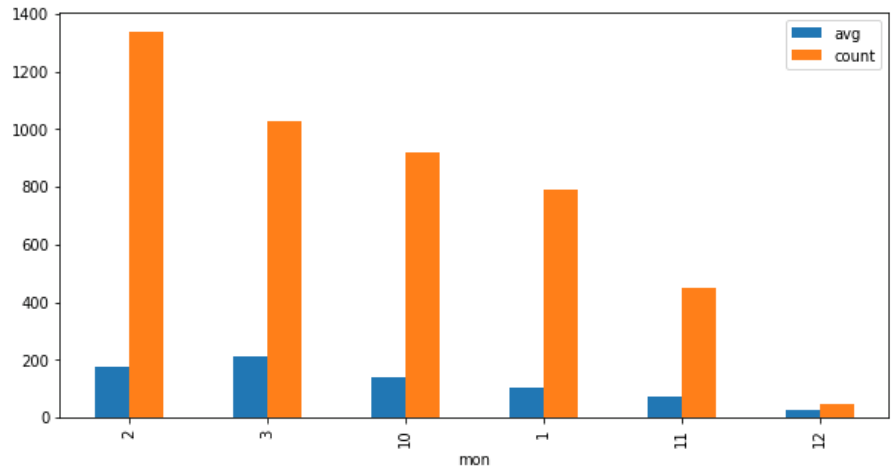

Figure 27:Visualization of SAR vessels per month

30. Display the type of atons

```
SELECT typeofaid,
       Count(typeofaid),
       at.definition,
       virtual
FROM   nari_dynamic_aton a,
       aton at
WHERE  a.typeofaid = at.code
GROUP  BY typeofaid,
          at.definition,
          virtual;
```

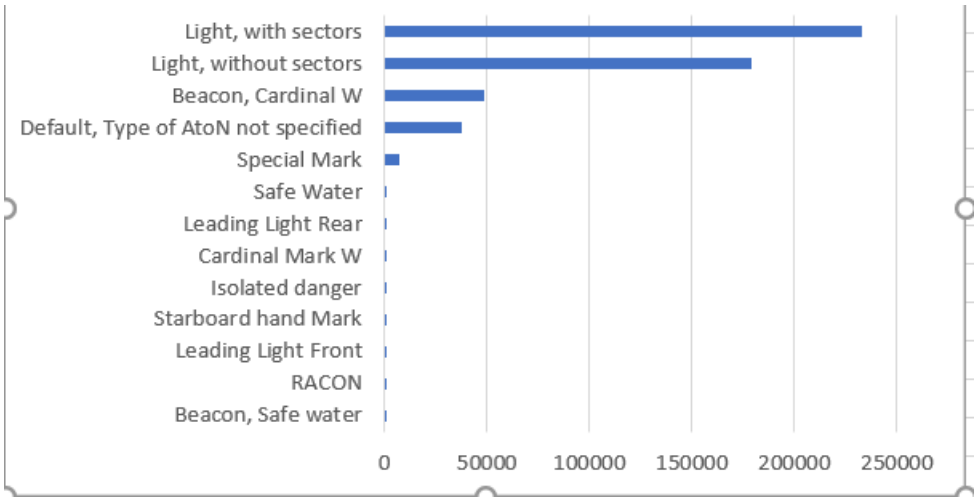

Figure 28: Visualization of type of atons

31. Make a plot for a specific ship according its ais messages (python)

Source code: vessel_route.py

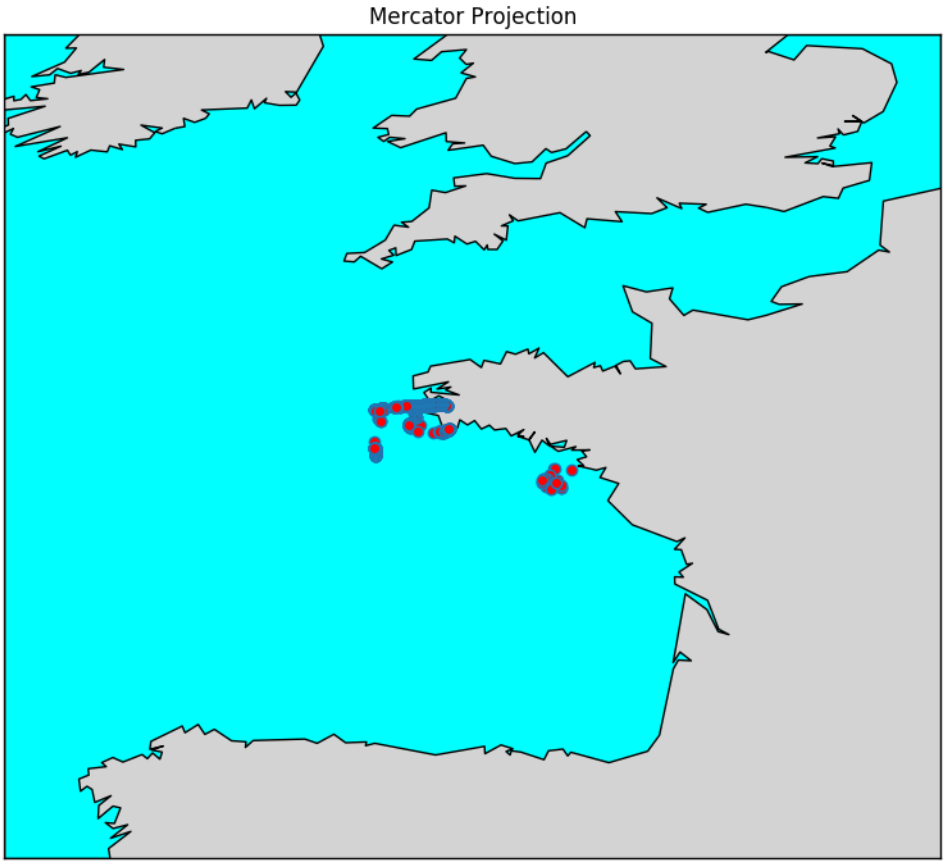

Figure 29:Route of a specific vessel with mmsi= 228931000

32. Make a plot for a specific ship according its fishing ais messages. All these messages are inside a fishing area (QJIS)

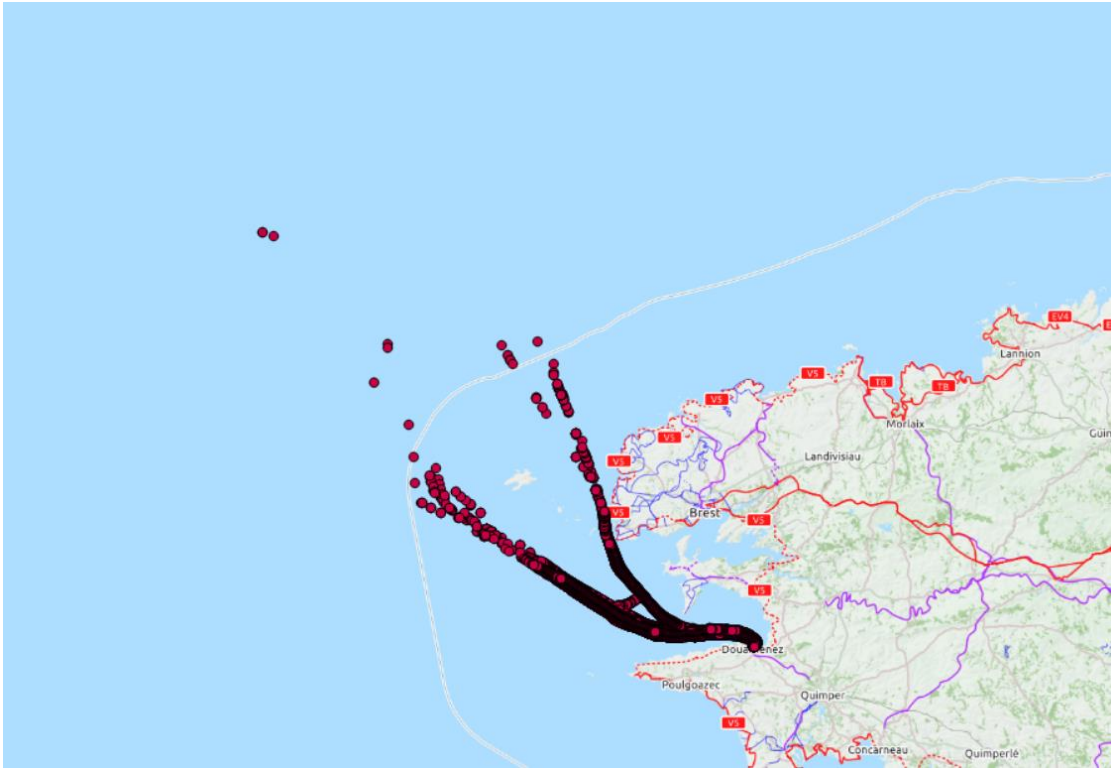

Figure 30: Route of a specific vessel with mmsi= 228931000 with fishing messages

33. Make a plot for a specific ship according its fishing ais messages. All these messages are inside a fishing area. Fishing areas are presented. (QJIS)

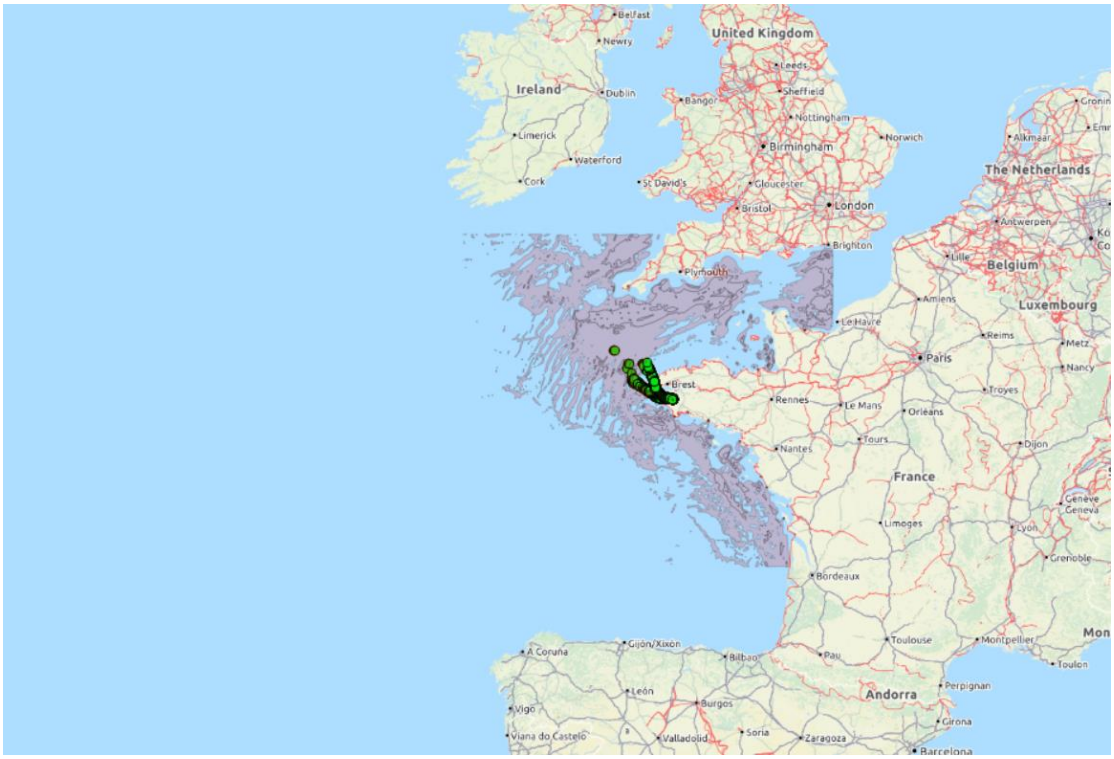

Figure 31: Route of a specific vessel with mmsi= 228931000 with fishing messages, fishing areas are presented

34. Make a plot for a specific ship according its fishing ais messages. All these messages are inside a fishing area. Fishing areas and constraint fishing areas are presented. (QJIS)

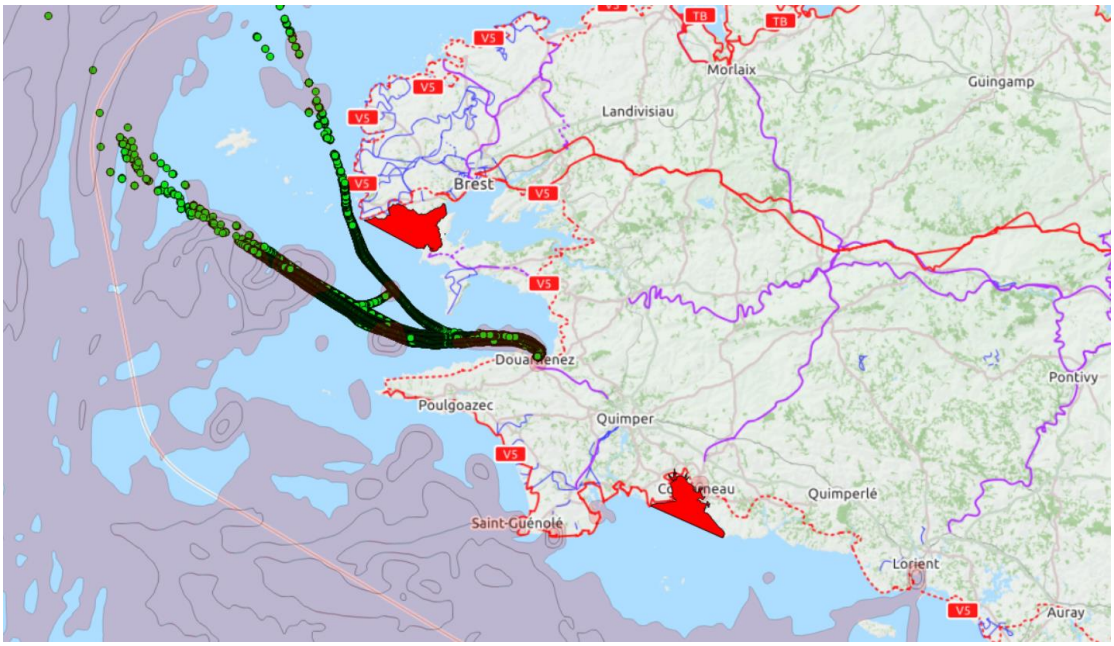

Figure 32:Route of a specific vessel with mmsi= 228931000 with fishing messages, fishing areas and constrained fishing areas are presented (fishing: purple, constraint: red)

35. Plot the route of a specific vessel inside a fishing area (python)

Source code: vessel_at_fishing_area.py

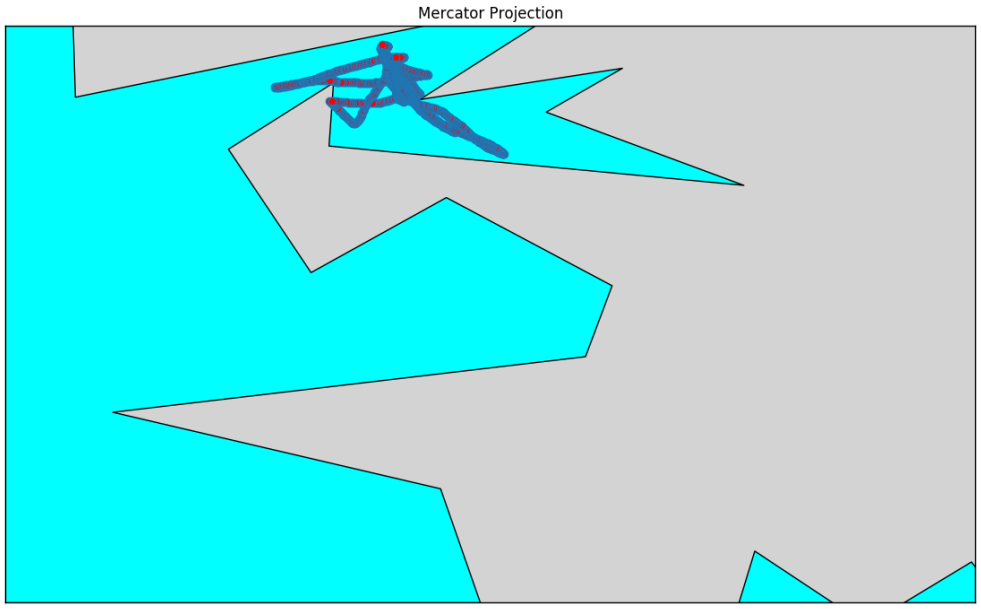

Figure 33:Specific route inside a fishing area for vessel with mmsi= 227741610

36. Plot constrain fishing areas (python)

Source code: constrain_fishing/constrain_fish.py

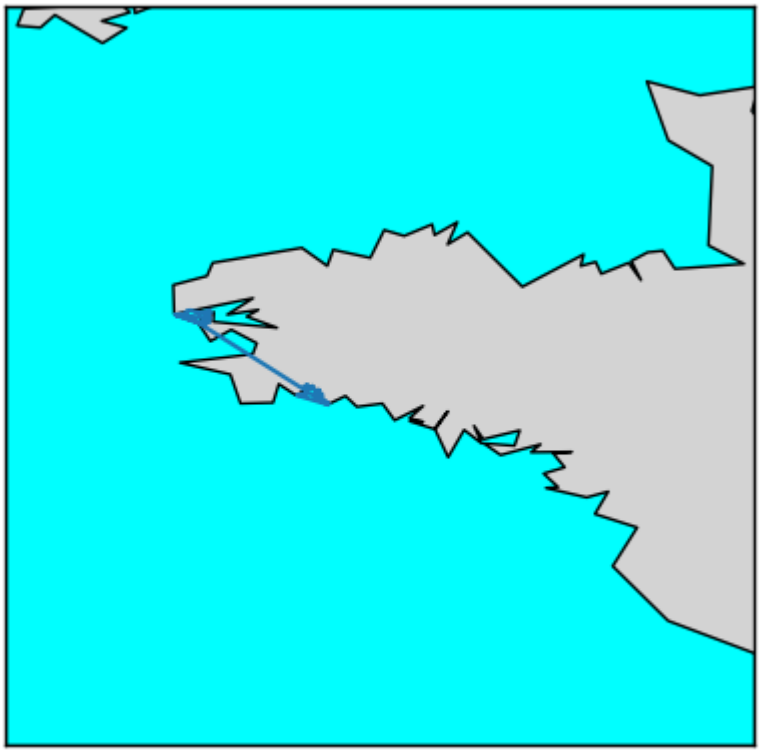

Figure 34: Fishing constraint areas

37. Plot fishing areas(python)

Source code: fishing_area/fishing.py

Figure 35:Fishing areas

38. Plot ports of Brittany(python)

Source code: port_britany/ port_britany.py

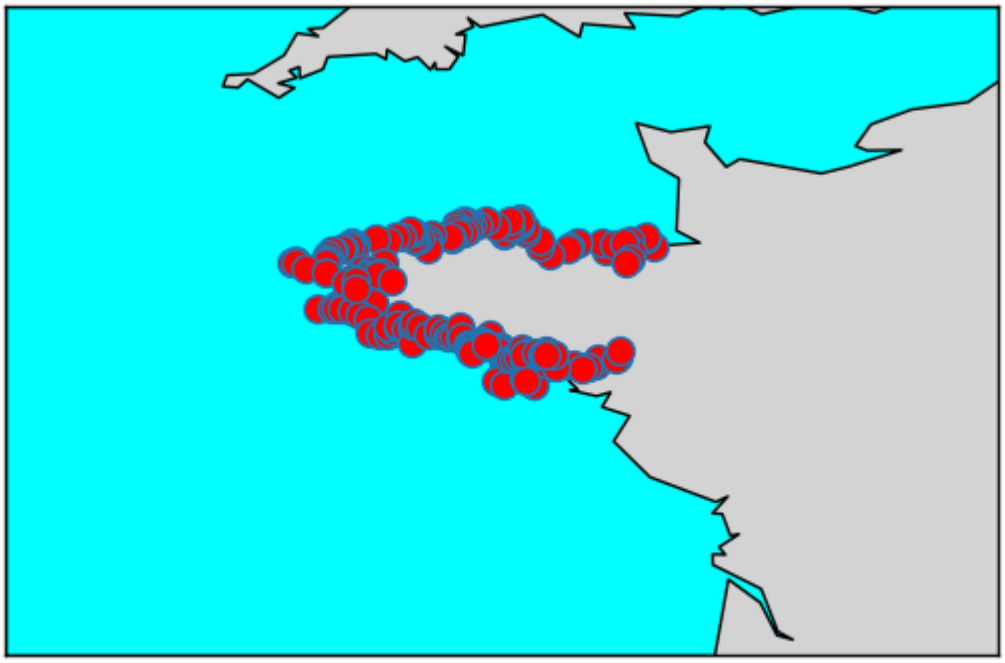

Figure 36:Ports of Brittany

39. Plot the ports of the Europe (python)

Source code: world_port_index/wpi.py

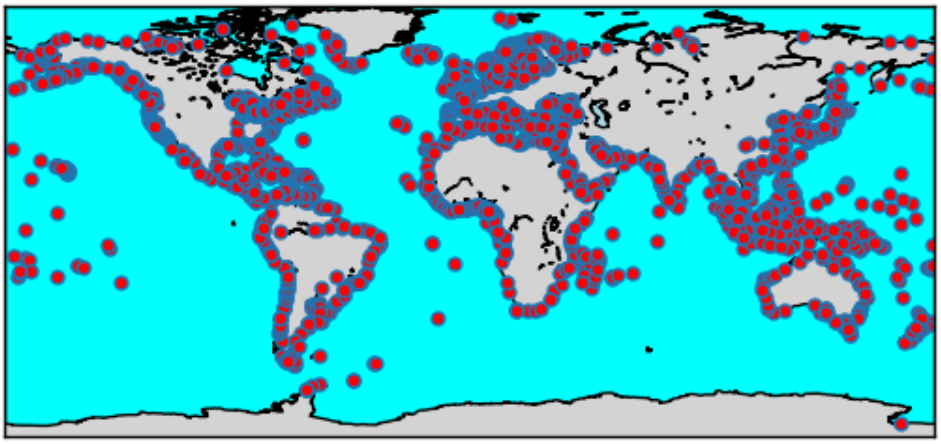

Figure 37:Ports all over the world

Running environment

OS version

- PRETTY_NAME="Ubuntu 18.04.1 LTS"
- VERSION_ID="18.04"
-

Postgres version

- postgres=# SELECT version();

PostgreSQL 10.5 (Ubuntu 10.5-0ubuntu0.18.04) on x86_64-pc-linux-gnu, compiled by gcc (Ubuntu 7.3.0-16ubuntu3) 7.3.0, 64-bit

QGIS version

- version 2.18.0

Python version

- Python 2.7.15