IMDIS 2021
Online, 12-14 April 2021

Ship Of Opportunity Monitoring of the Western Mediterranean Sea using FerryBox

FerryBox database

Managing and administrating the database in order to get faster and more accurate statistic and scientific results

Analyse

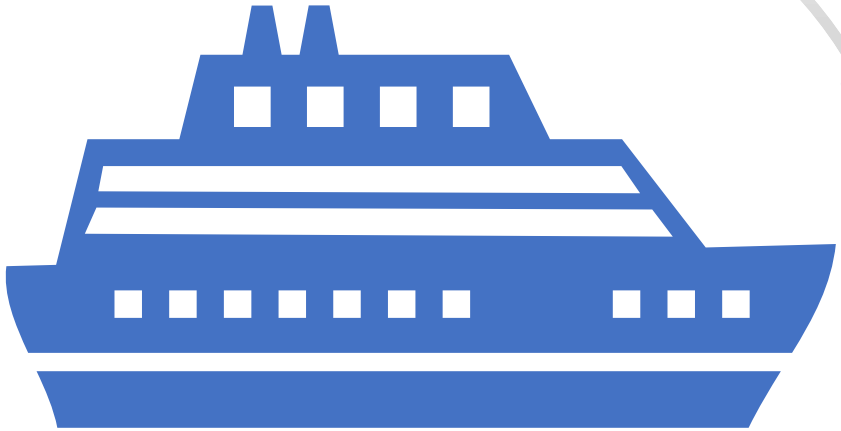
Describe

Visualize

Control

Sana Ben Ismail, Sondos Awachri, Nouha Barraj, Mohamed Anis Ben Ismail, Cherif Sammari

Presentation plan



Introduction
Why it is important to monitor high frequency temperature and salinity data in Western Mediterranean Basin ?

The Tunisian FerryBox project
Why did INSTM team opt for FerryBox technologies ? What has already been done ?

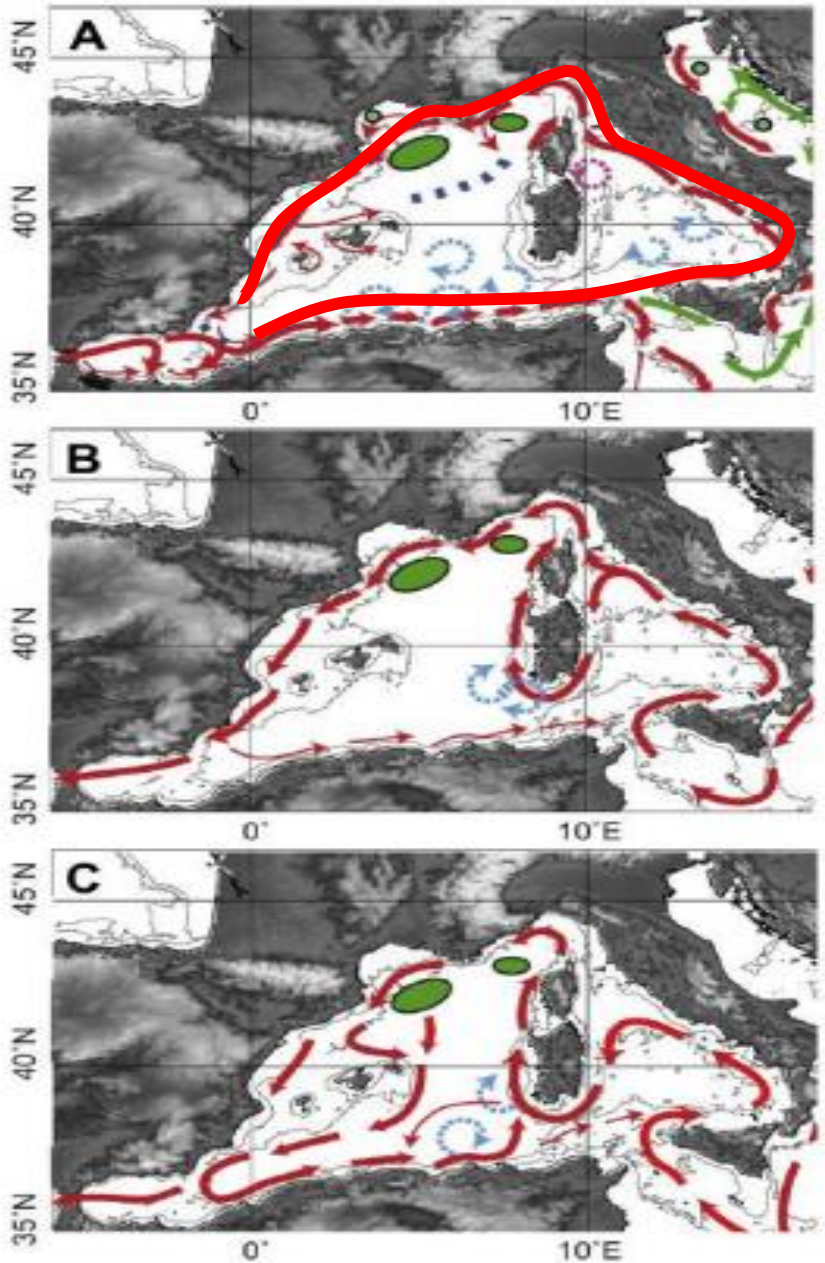
Local management
What data pre-treatments are required to make it scientifically exploitable ? What process to use ?

Web application
What forms of visualization is a user interested in rendering ? How to introduce worldwide FB community to the Tunisian team works ?

Conclusion
What conclusions can we draw at this step ? What should come next ?

Introduction

Western Mediterranean Basin



- ✓ Légère (chaude et peu salée) et s'écoule en surface suivant un parcours cyclonique.
- ✓ Directement soumise à l'action des forçages atmosphériques.

A : Surface Water
B : Intermediate waters
C : Deep Water

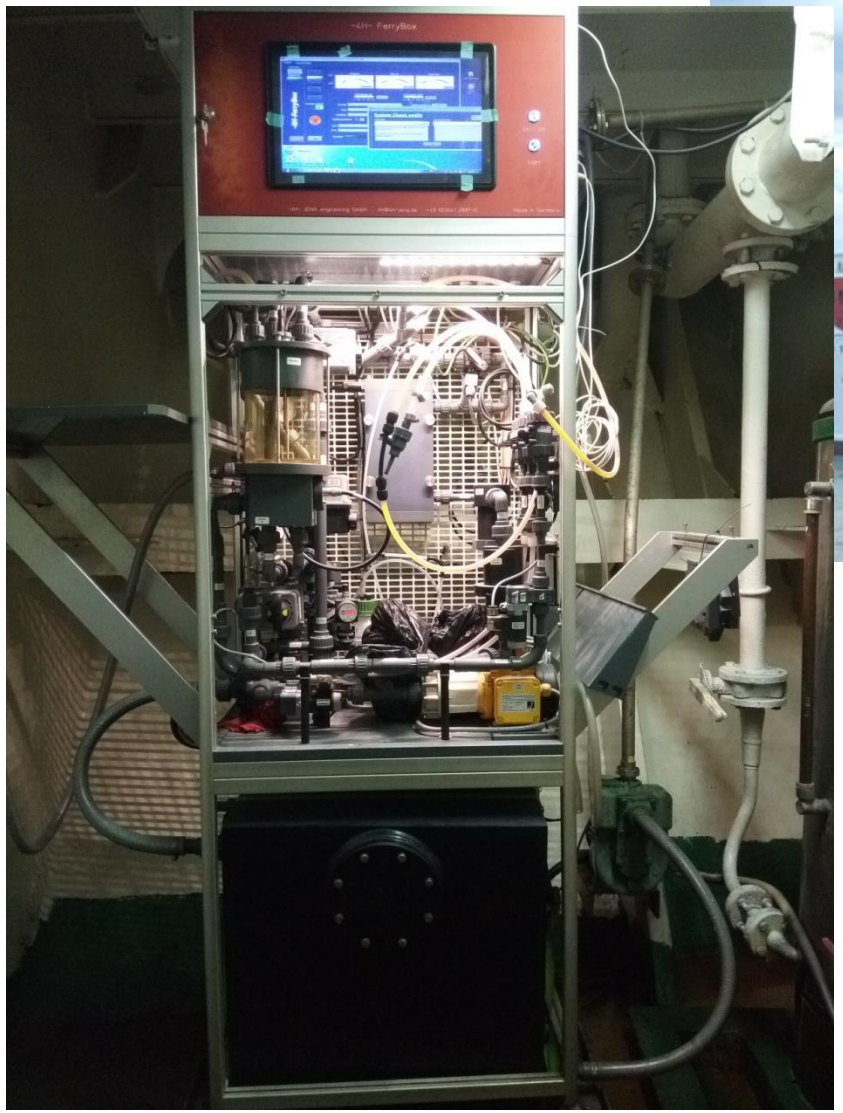
General circulation oft the Western Mediterranean according to Millot[1999] revised by Durrieu de Madron et al.[2011]

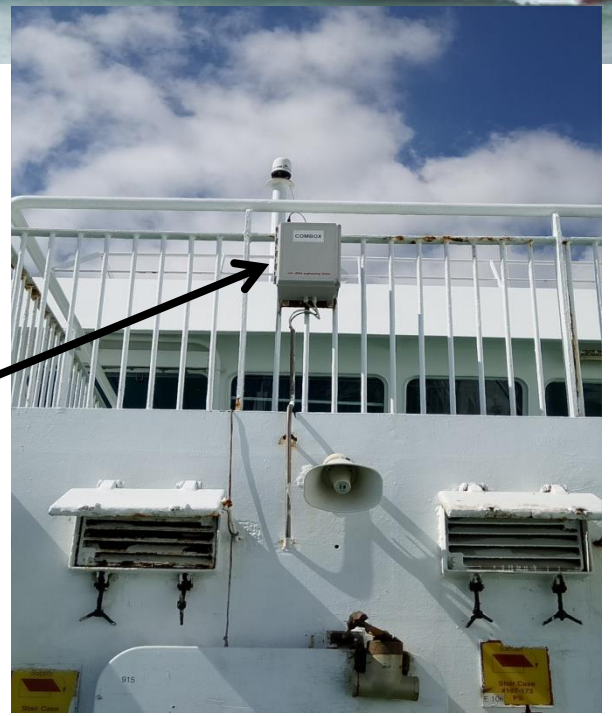
- **AW :** surface water coming from Atlantic Ocean
- **WIW : Between 100 and 200 m** flows under the AW after its formation, and generally follows the circulation of the upper layers
- LIW : Relatively warm (~13.5°C) and salt (~38.75‰) water
- **TDW :** is formed by mixing between the WDMW and the LIW entering through the Strait of Sicily. As it crosses Sardinia, it cyclically flows under the LIW due to its density.
- **WMDW :** deep water formed in winter by convection in th Gulf of Lion

The Tunisian FerryBox project

FerryBx system on c/f Carthage

INSTM





Combox

FerryBox on board c/f Carthage

FerryBox : Water masses properties and dynamics

- ✓ Device at 5 meter depth
- ✓ Sampling frequency of 1 minute
- ✓ Measured parameters :
  - Temperature
  - Salinity
  - Dissolved oxygen
  - Turbidity
  - pH..

- ✓ The Tunisian FerryBox is currently involved in the **CLAIM EU 2020** project

- ✓ The first launch of FerryBox data collecting campaigns was in 2016

- ✓ The growing database offers several interesting scientific possibilities :
  - Statistical studies
  - Comparison with satellite data
  - Insight into the Mediterranean marine dynamics..

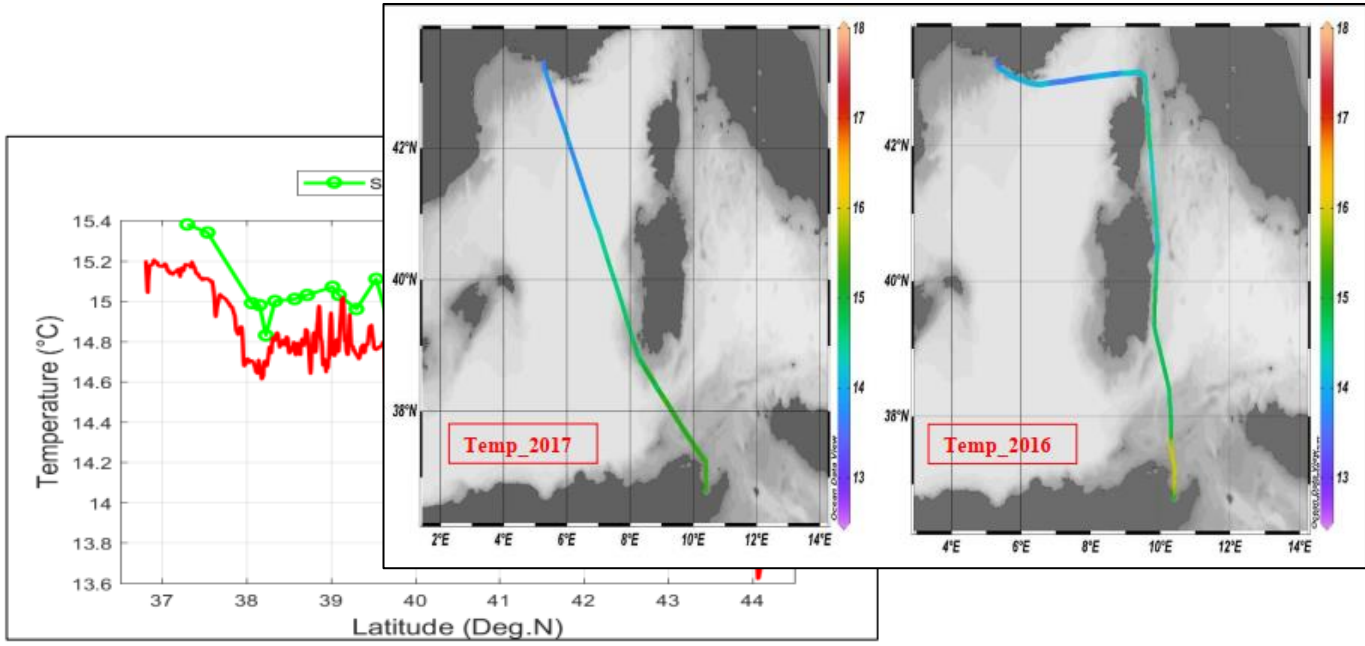
Inventory

Involvement within the Seadatanet 1 and 2 and SeaDataCloud projects has been successfully completed

INSTM oceanographic data plays a central role in Euro-Mediterranean and African projects

The time series of the Ferry Box data as well as the few missing CTD stations along the Tunisian coast are among the future ameliorations

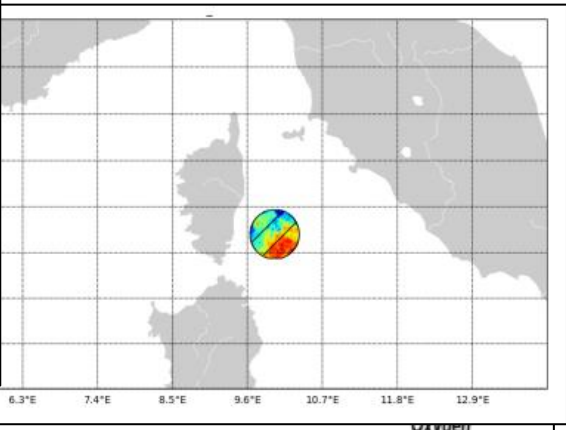
Currently, more than 500 FerryBox transects have been processed. Only 18 examples were used to test the next steps regarding Download Manager (DM) and Request Management System (RMS)

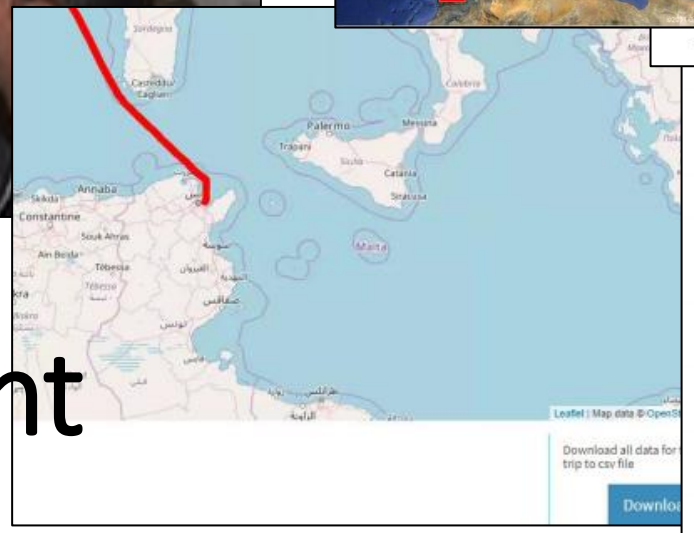


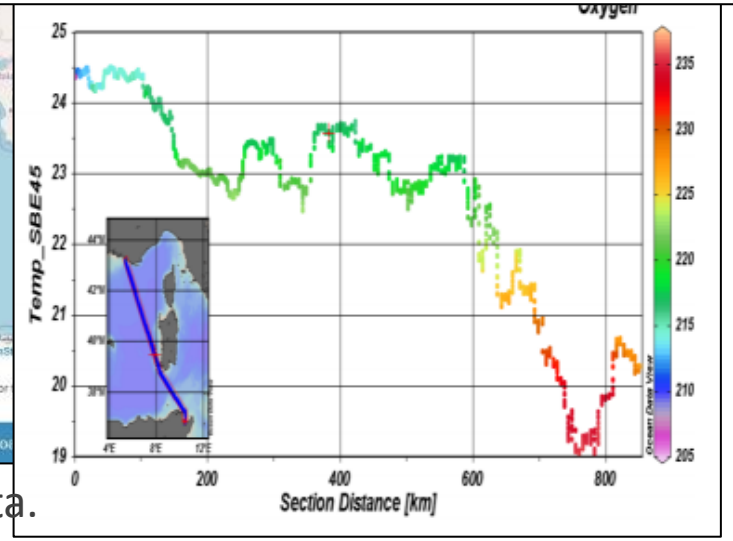
FerryBox system installed on board C/f Carthage of the Tunisian Navigation Company (CTN)

Professional data management is required with agreements on standardization, quality control protocols, archiving and access..

Collect once, Use many times !







4 years of advancement

It has been carried out throughout the last 4 years several attempts to manage FerryBox data.
Each contributor used different technologies to tackle one part or more of the project:

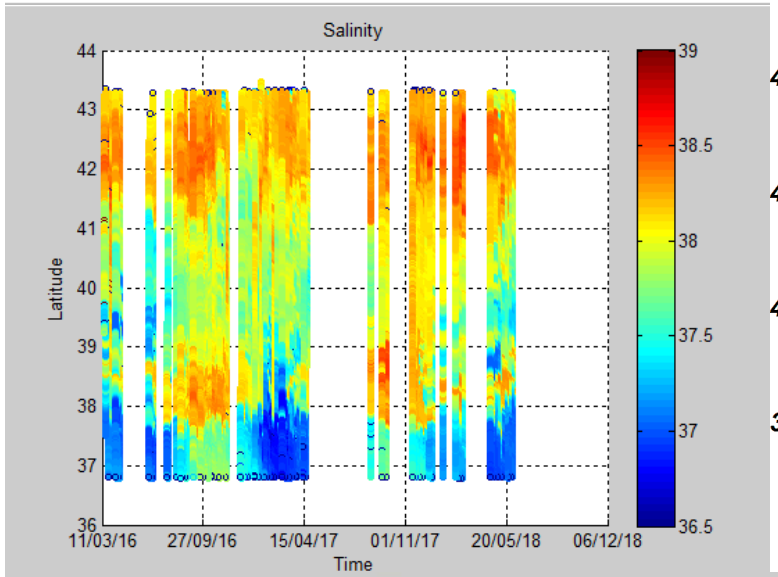
- Eliminating the files heading, data plots, quality control.. **(Matlab)**
- Insertion of data in the web app, transect visualization on a map, relational database creation.. **(Php/ Symphony/PostgreSQL)**
- Plotting data, creation of time series, comparing with satellite data.. **(Excel/Matlab)**
- Data pre processing, classification, quality control.. **(Manual)**

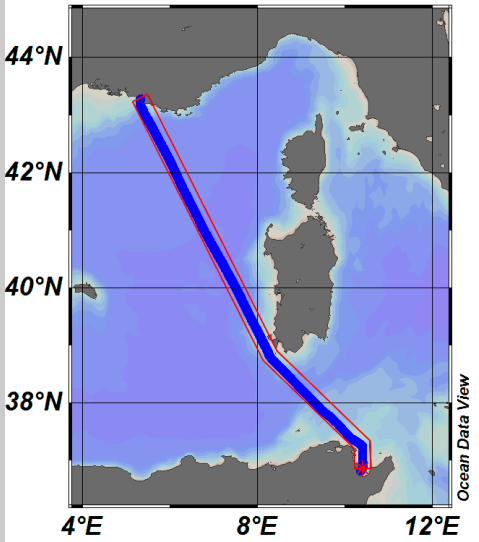
Etc..

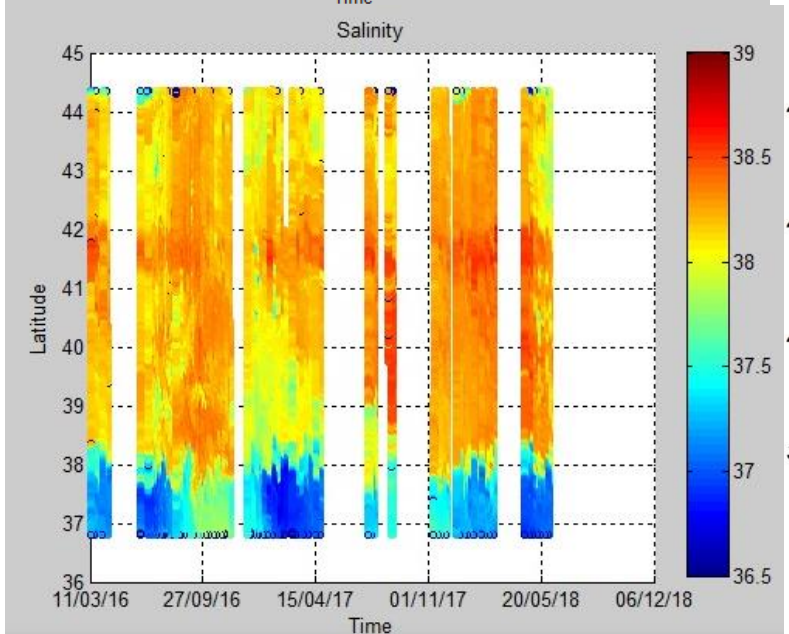
Salinity

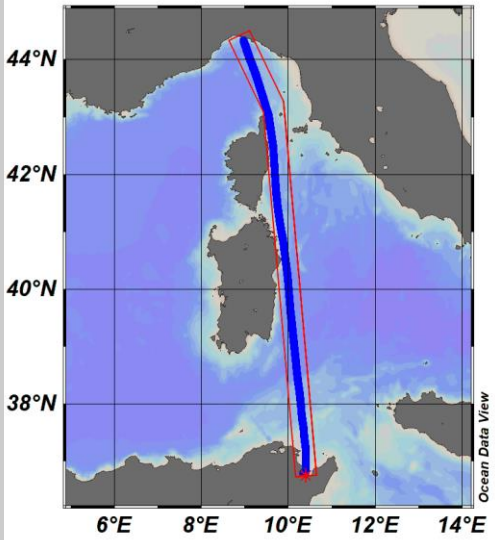
INSTM

2016- 2018

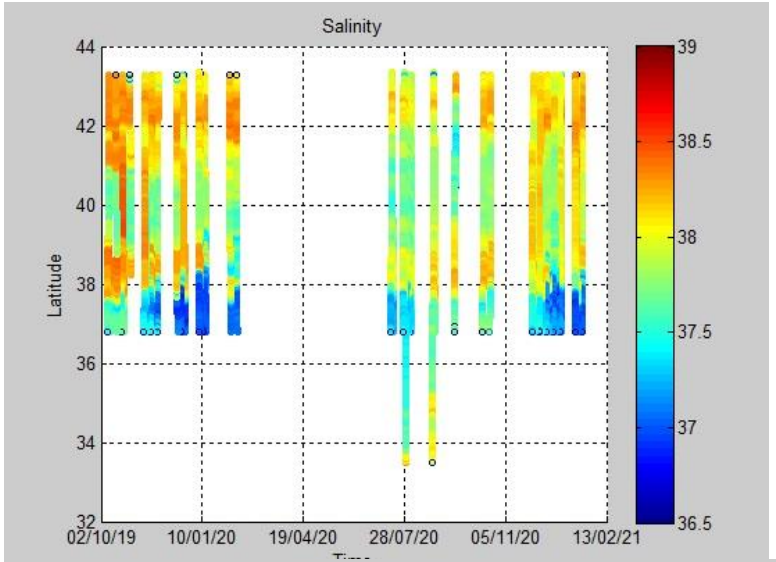


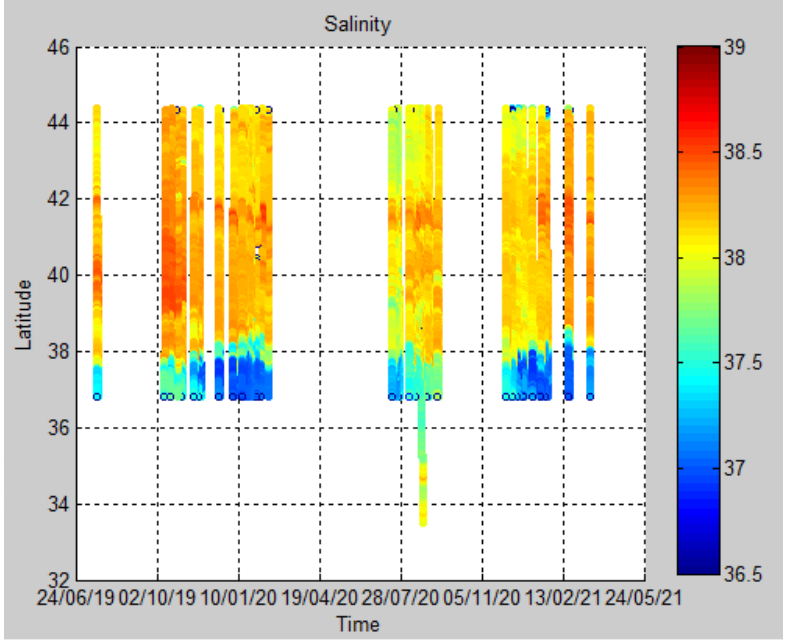






2019-2021

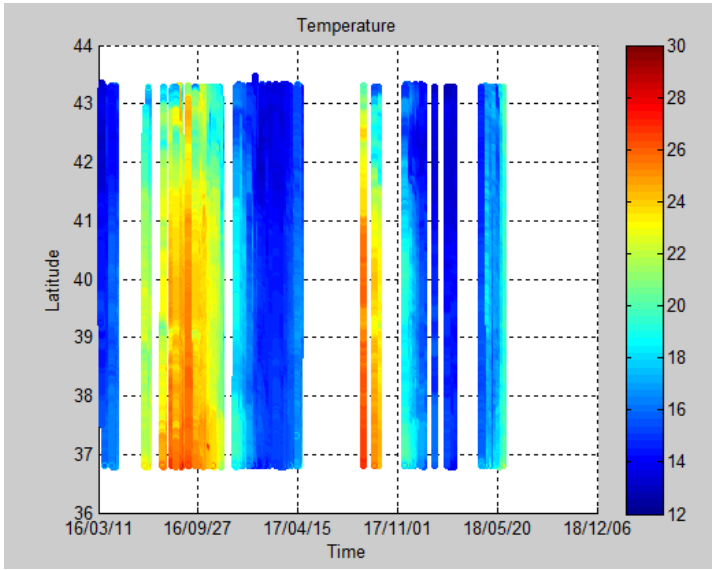


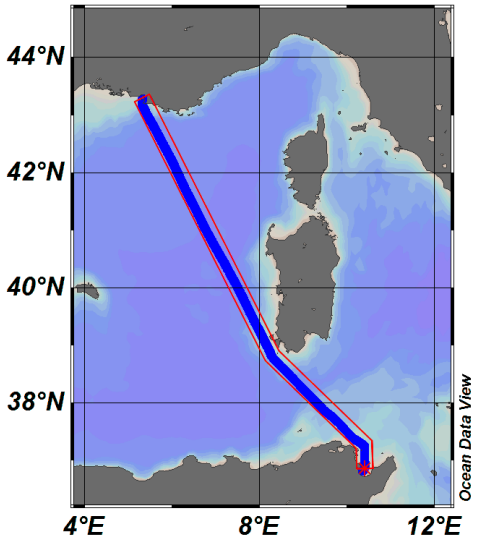


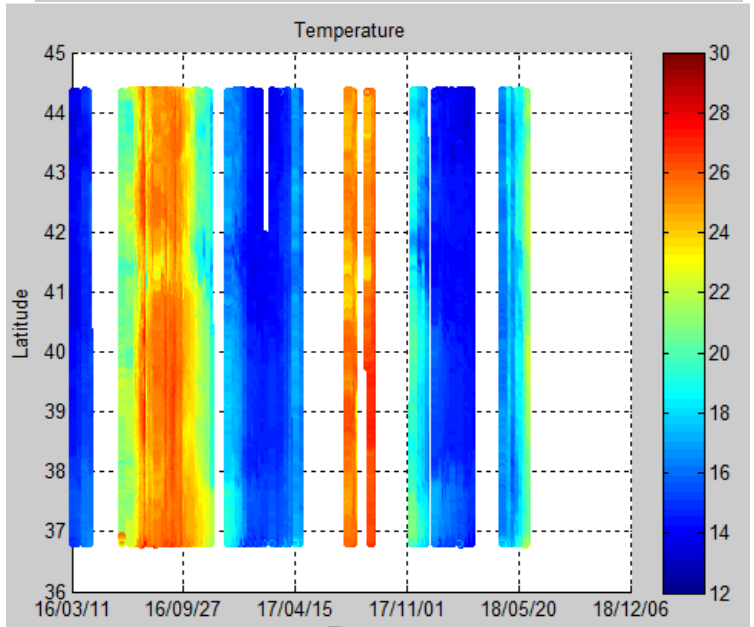
Temperature

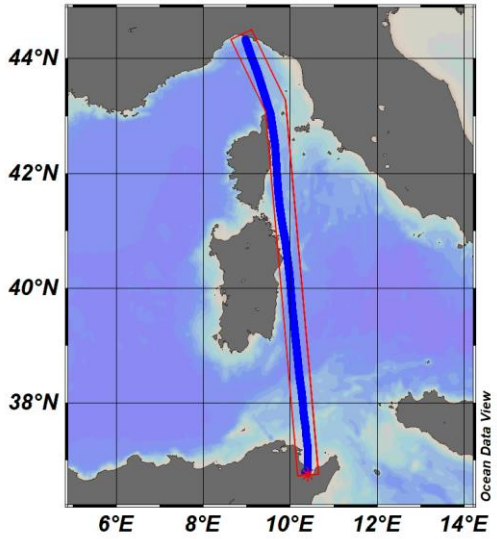
INSTM

2016-2018

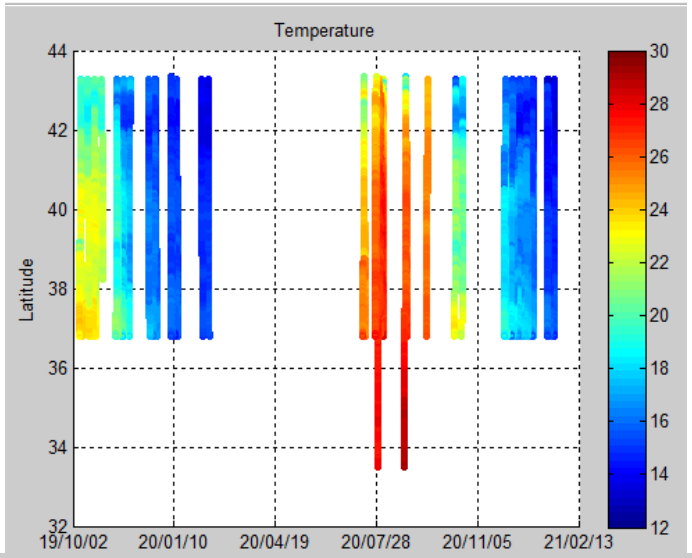


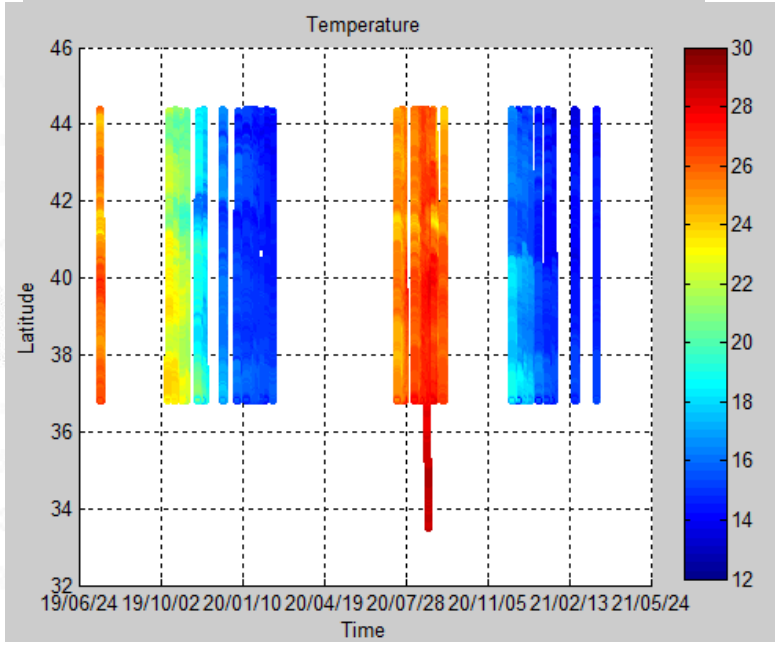






2018-2021





FerryBox database

A very abundant information about the Mediterranean water surface

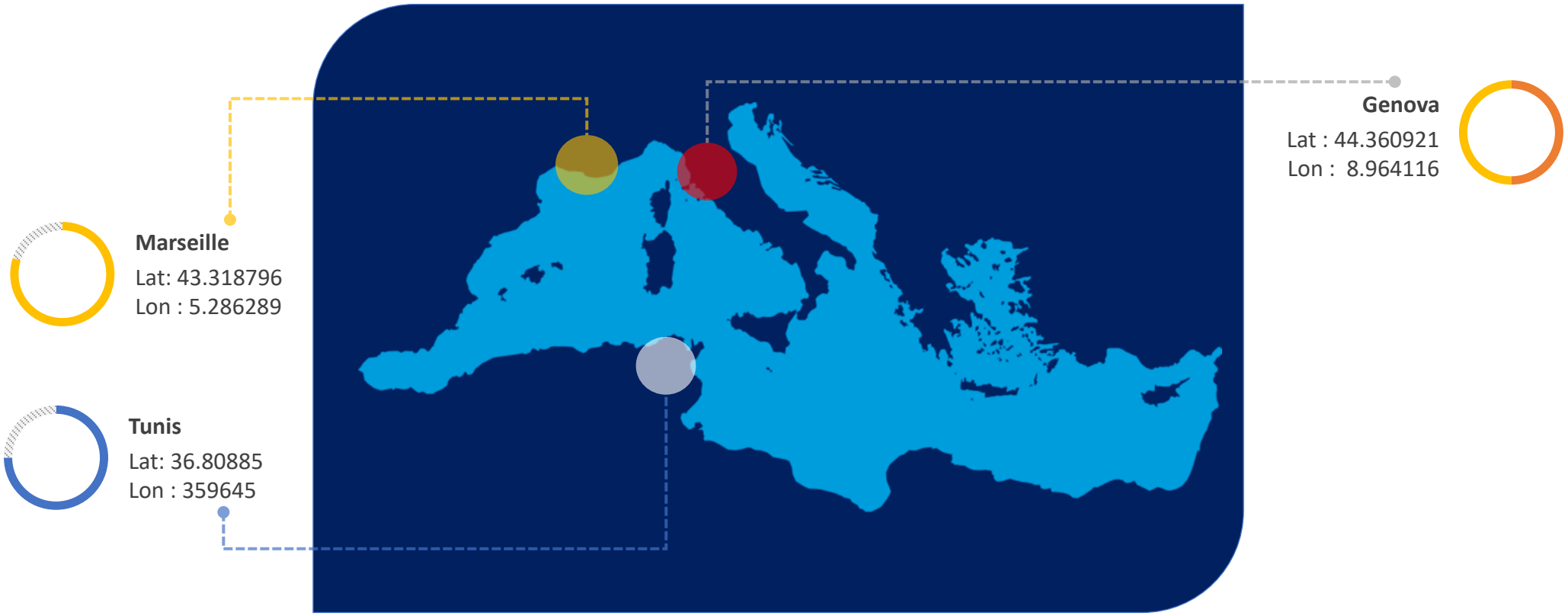
Local management

Managing files and data

Web application

Data interactive visualization

FerryBox transects and data



Marseille
Lat: 43.318796
Lon : 5.286289

Tunis
Lat: 36.80885
Lon : 359645

Genova
Lat : 44.360921
Lon : 8.964116

Metadata

Information about the ferry, measuring device, data..

Physical parameters

Temperature, Salinity..

Geo-referencement

Latitude, Longitude

Nutritional parameters

Chl_a , Turbidity

Different aspects of INSTM FerryBox project focus

A Files management

Gathering, downloading, automating the classification and the protection of the row data

B Data management

Indexing files, transforming data into new forms (plots, general stats, time series), pre treatments and quality control

C Database administration

Creation of relational database on Sqlite3 SGBD, automating data insertion

D Web application

Displaying scientific data in an interactive application, different forms of charts, a blog and user management

Quality system design

ISO 9001 Clauses - PLAN

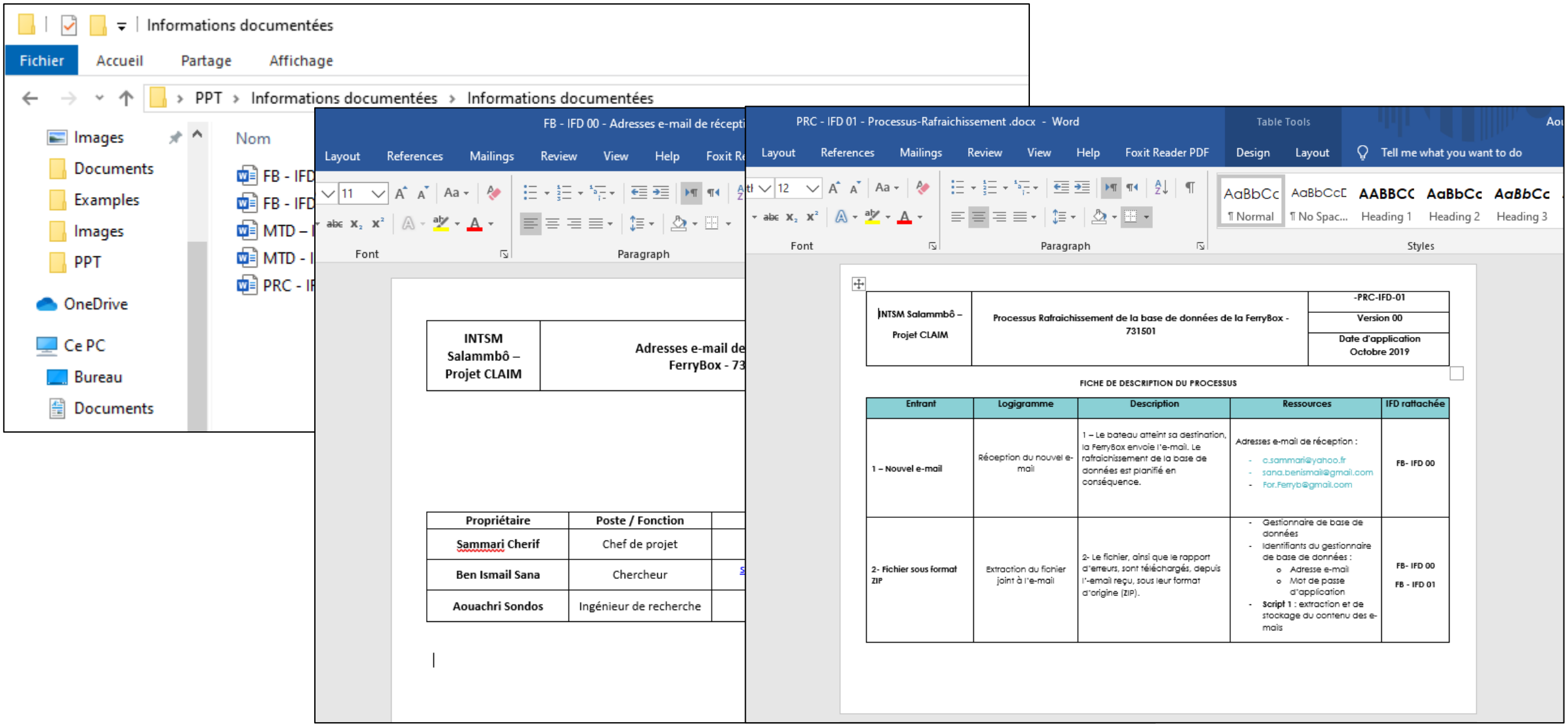
- 1 Scope
- 2 Normative references
- 3 Terms and Definitions
- 4 Context of the organization
  - 4.1 Understanding the organization and its context
  - 4.2 Understanding the needs and expectations of interested parties
  - 4.3 Determining the scope of the quality management system
  - 4.4 Quality management system and its processes
- 5 Leadership
  - 5.1 Leadership and commitment
    - 5.1.1 Leadership And Commitment For The Quality Management System
    - 5.1.2 Customer Focus
  - 5.2 Policy
    - 5.2.1 Establishing the quality policy
    - 5.2.2 Communicating the quality policy
  - 5.3 Organizational roles, responsibilities and authorities
- 6 Planning
  - 6.1 Actions to address risks and opportunities
  - How to address risk in ISO 90001
  - 6.2 Quality objectives and planning to achieve them
  - 6.3 Planning of changes

Key processes are steps that you go through to give the customer what they want, e.g. from order acceptance to design through to delivery.

A good way to do this is to think about how work flows through your organization. Consider how the inputs and outputs to the key processes flow from one process to the next, what sub-processes might exist within it and how the support processes link in.

We have to check that process inputs and outputs are defined and review how each of the processes are sequenced and how they interact.

Management Process creation



Python main libraries

Pandas

Manipulation and analysis of data: structuring of data and operations of manipulation of numerical tables and time series.

Numpy

Manipulation of multidimensional arrays and arrays, as well as mathematical functions operating on these arrays.

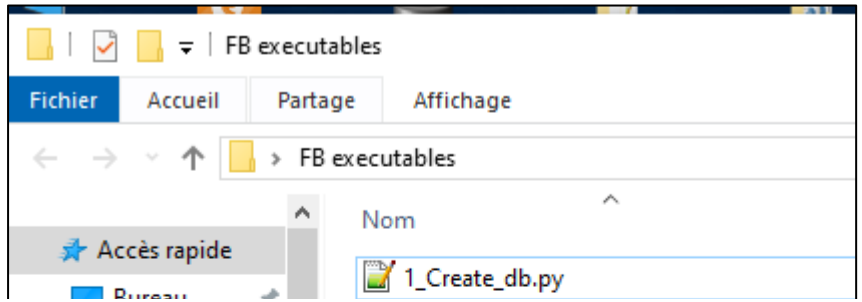
Matplotlib

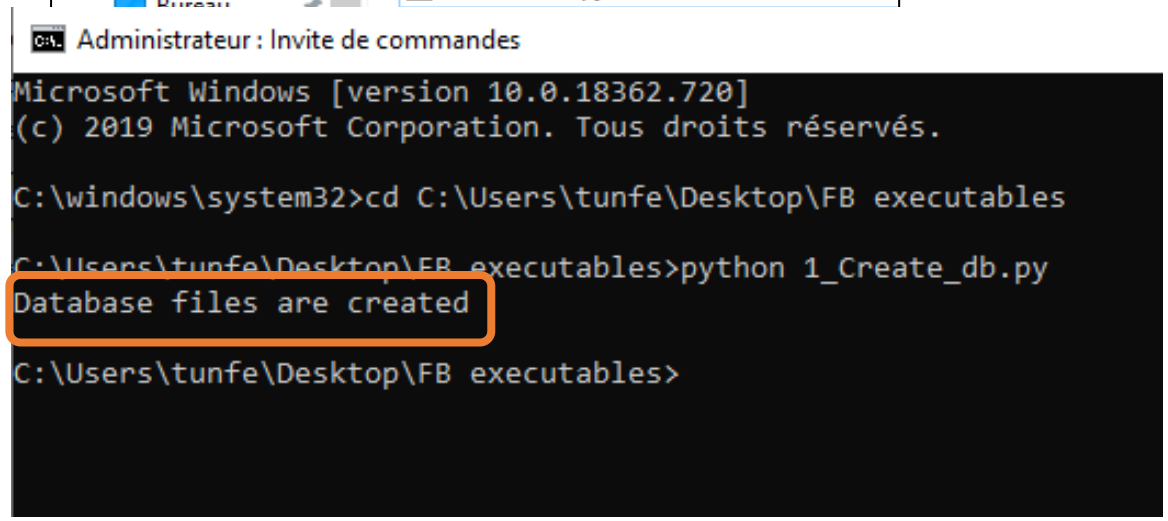
Plotting and visualization of data in the form of graphs

Seaborn

It allows you to create statistical graphs in Python. It is built on matplotlib and is tightly integrated with pandas data structures (hence the choice of this library).

Daily refreshment process





Download

1_Create_db.py
2_E-mail_download.py

Classification

3_Files_classification.py

Indexation

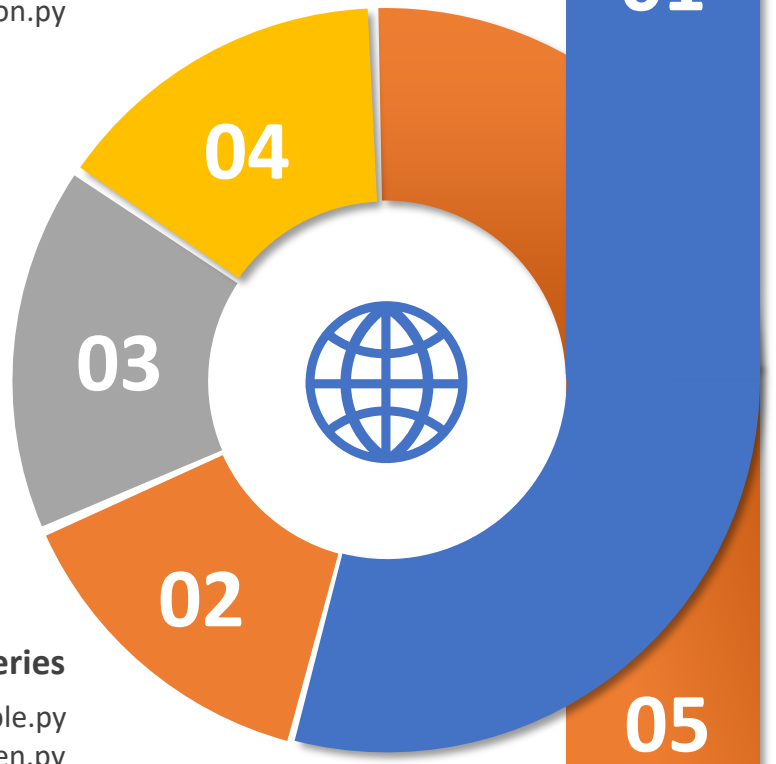
4_Files_pretreatment.py

Visualization

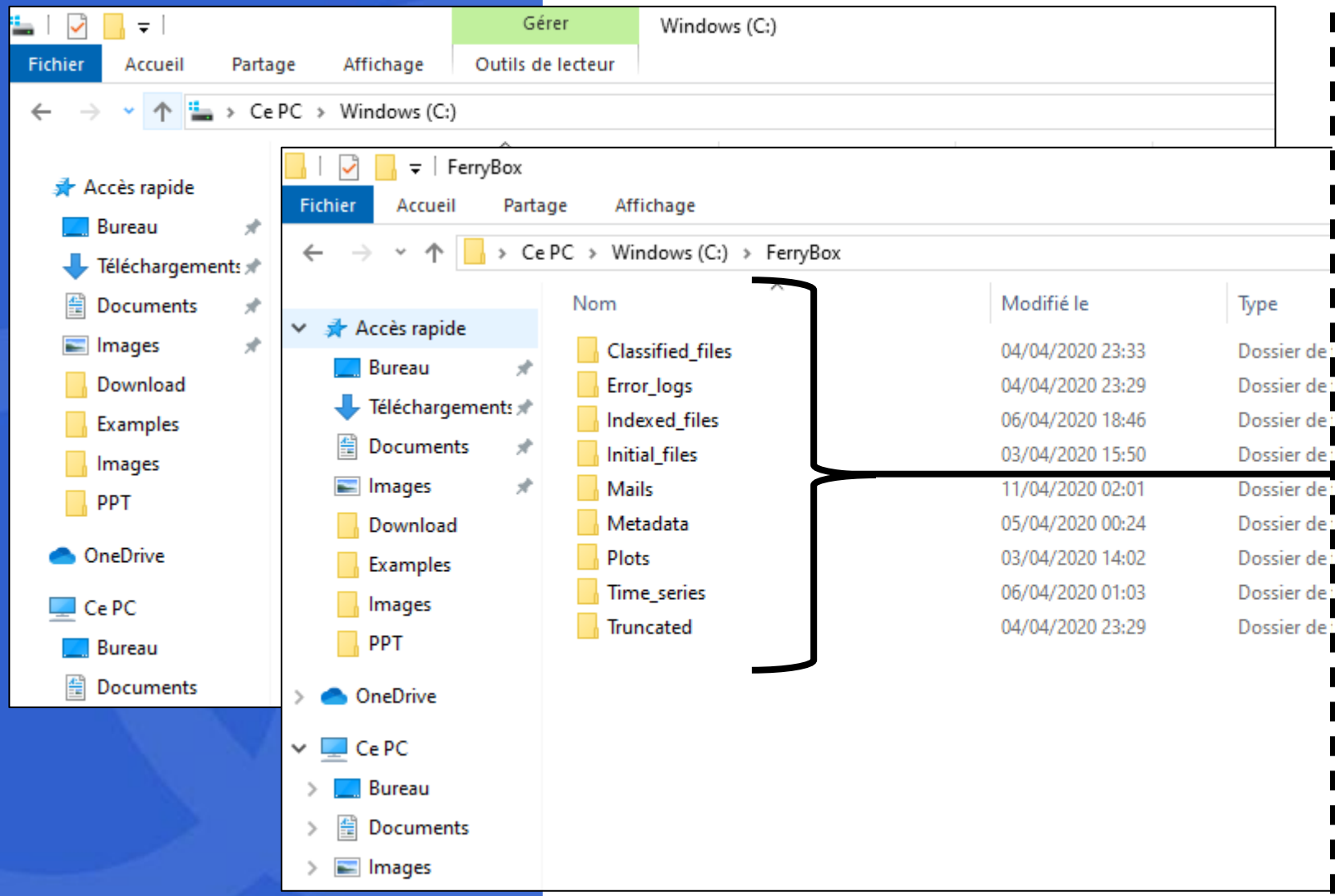
5_plots_generation.py

Metadata / time series

9_Metadata_table.py
7_Time_series_Gen.py
8_Time_series_Mar.py

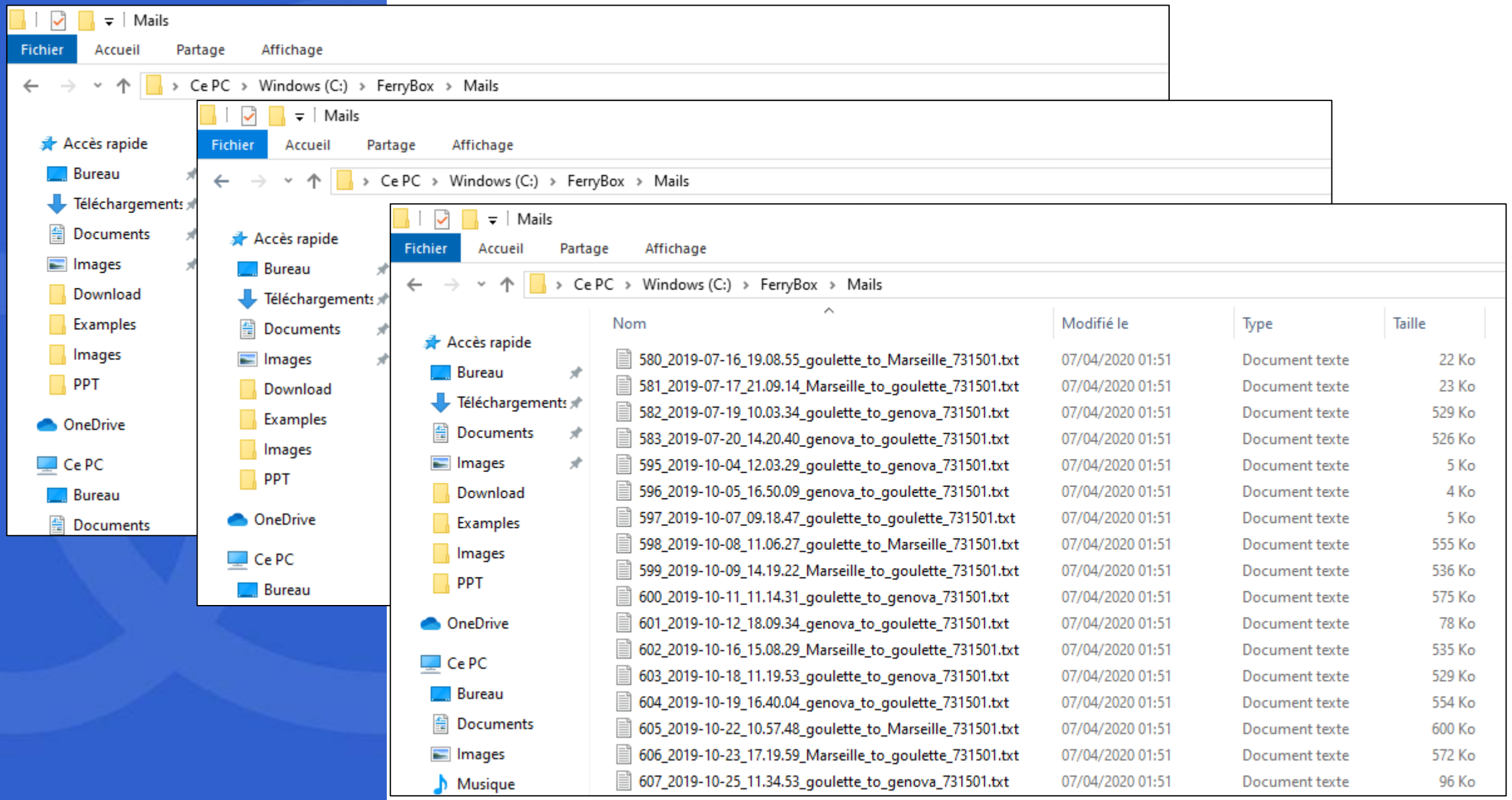


1_Create_db.py



-Windows (C:)
-------FerryBox
----------Classified_files
----------Genova
---------- Temporary
----------Marseille
----------Temporary
---------- Error_logs
---------- Indexed_files
----------Genova
---------- Temporary
----------Marseille
----------Temporary
---------- Initial_files
---------- Mails
---------- Metadata
---------- Plots
----------Genova
----------Chl_a
---------- Oxygen
---------- Salinity_SBE45
---------- Temp_in_SBE38
---------- Turbidity
----------Marseille (..)
---------- Time_series
----------Genova
----------Marseille
---------- Truncated

2_E-mail_download.py



3_Files_classification.py

Initial_files

Fichier Accueil Partage Affichage

Ce PC › Windows (C:) › FerryBox › Initial_files

Error_logs

Fichier Accueil Partage Affichage

Genova

Fichier Accueil Partage Affichage

Truncated

Fichier Accueil Partage Affichage

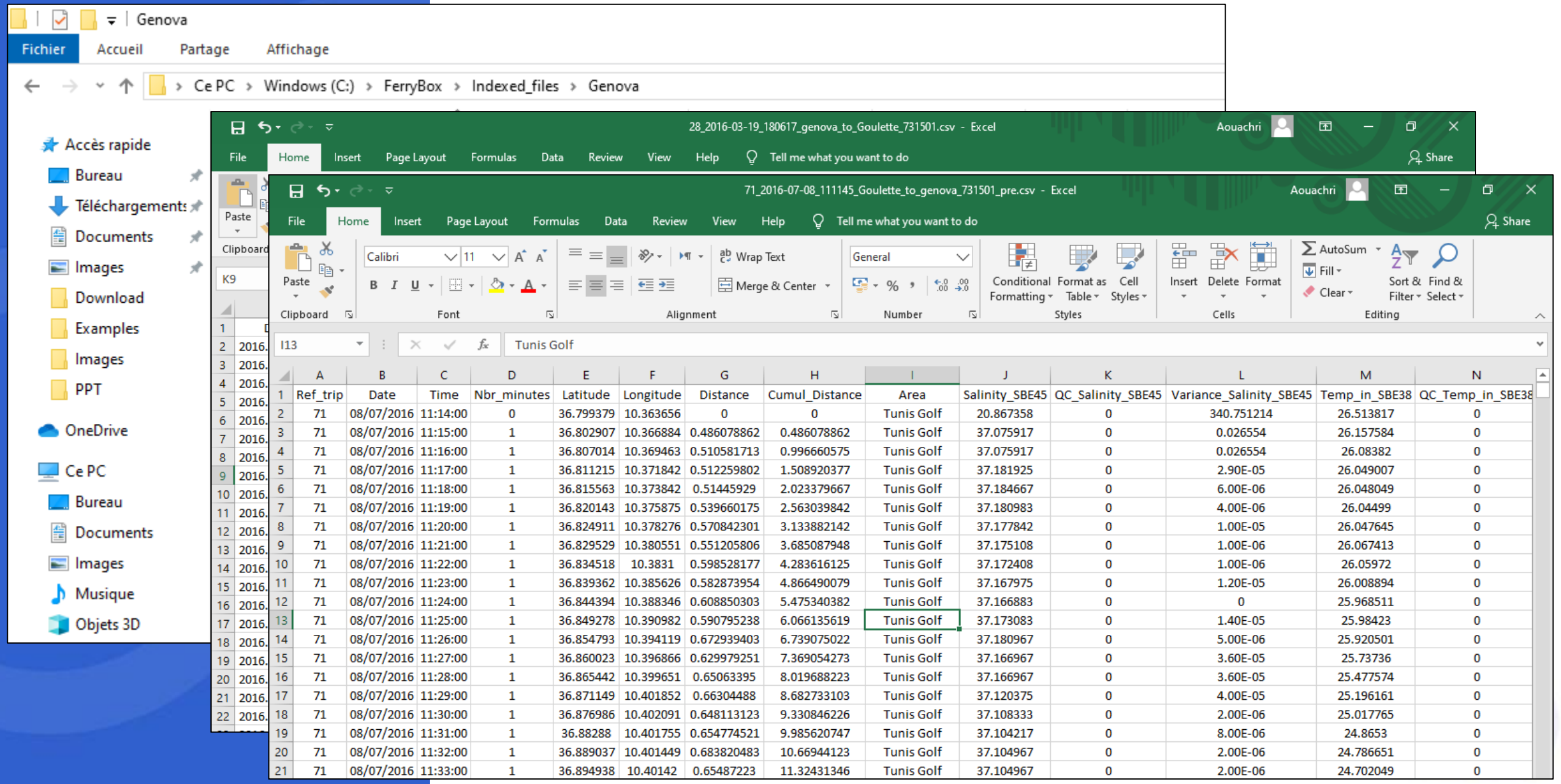
Ce PC › Windows (C:) › FerryBox › Truncated

Accès rapide
Bureau
Téléchargements
Documents
Images
Examples
Genova
Images
PPT
OneDrive
Ce PC
Bureau
Documents
Images

Nom

20_2016-03-04_14.27.47_Goulette_to_genova_731501_B_.csv
26_2016-03-18_07.44.04__to_Goulette_731501.csv
31_2016-03-24_11.44.07_Marseille_to_Goulette_731501.csv
47_2016-06-08_08.01.33_genova_to_genova_731501.csv
51_2016-06-14_11.15.51_Goulette_to_genova_731501.csv
52_2016-06-15_13.57.40_genova_to_Goulette_731501.csv
53_2016-06-17_11.57.22_Goulette_to_Marseille_731501.csv
55_2016-06-19_13.40.14_Goulette_to_genova_731501.csv
67_2016-07-04_08.24.17__to_genova_731501.csv
68_2016-07-04_16.59.10_genova_to_Goulette_731501.csv
145_2016-10-02_20.01.07_Goulette_to_Marseille_731501.csv
154_2016-10-16_12.23.43_genova_to_Goulette_731501.csv
162_2016-10-29_16.52.09_genova_to_Goulette_731501.csv
169_2016-11-11_14.19.35_Goulette_to_genova_731501.csv
173_2016-12-13_11.19.13_Goulette_to_genova_731501.csv
180_2016-12-24_12.03.00_Marseille_to_Marseille_731501.csv

4_Files_pretreatment.py



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Ref_trip	Date	Time	Nbr_minutes	Latitude	Longitude	Distance	Cumul_Distance	Area	Salinity_SBE45	QC_Salinity_SBE45	Variance_Salinity_SBE45	Temp_in_SBE38	QC_Temp_in_SBE38
2	71	08/07/2016	11:14:00	0	36.799379	10.363656	0	0	Tunis Golf	20.867358	0	340.751214	26.513817	0
3	71	08/07/2016	11:15:00	1	36.802907	10.366884	0.486078862	0.486078862	Tunis Golf	37.075917	0	0.026554	26.157584	0
4	71	08/07/2016	11:16:00	1	36.807014	10.369463	0.510581713	0.996660575	Tunis Golf	37.075917	0	0.026554	26.08382	0
5	71	08/07/2016	11:17:00	1	36.811215	10.371842	0.512259802	1.508920377	Tunis Golf	37.181925	0	2.90E-05	26.049007	0
6	71	08/07/2016	11:18:00	1	36.815563	10.373842	0.51445929	2.023379667	Tunis Golf	37.184667	0	6.00E-06	26.048049	0
7	71	08/07/2016	11:19:00	1	36.820143	10.375875	0.539660175	2.563039842	Tunis Golf	37.180983	0	4.00E-06	26.04499	0
8	71	08/07/2016	11:20:00	1	36.824911	10.378276	0.570842301	3.133882142	Tunis Golf	37.177842	0	1.00E-05	26.047645	0
9	71	08/07/2016	11:21:00	1	36.829529	10.380551	0.551205806	3.685087948	Tunis Golf	37.175108	0	1.00E-06	26.067413	0
10	71	08/07/2016	11:22:00	1	36.834518	10.3831	0.598528177	4.283616125	Tunis Golf	37.172408	0	1.00E-06	26.05972	0
11	71	08/07/2016	11:23:00	1	36.839362	10.385626	0.582873954	4.866490079	Tunis Golf	37.167975	0	1.20E-05	26.008894	0
12	71	08/07/2016	11:24:00	1	36.844394	10.388346	0.608850303	5.475340382	Tunis Golf	37.166883	0	0	25.968511	0
13	71	08/07/2016	11:25:00	1	36.849278	10.390982	0.590795238	6.066135619	Tunis Golf	37.173083	0	1.40E-05	25.98423	0
14	71	08/07/2016	11:26:00	1	36.854793	10.394119	0.672939403	6.739075022	Tunis Golf	37.180967	0	5.00E-06	25.920501	0
15	71	08/07/2016	11:27:00	1	36.860023	10.396866	0.629979251	7.369054273	Tunis Golf	37.166967	0	3.60E-05	25.73736	0
16	71	08/07/2016	11:28:00	1	36.865442	10.399651	0.65063395	8.019688223	Tunis Golf	37.166967	0	3.60E-05	25.477574	0
17	71	08/07/2016	11:29:00	1	36.871149	10.401852	0.66304488	8.682733103	Tunis Golf	37.120375	0	4.00E-05	25.196161	0
18	71	08/07/2016	11:30:00	1	36.876986	10.402091	0.648113123	9.330846226	Tunis Golf	37.108333	0	2.00E-06	25.017765	0
19	71	08/07/2016	11:31:00	1	36.88288	10.401755	0.654774521	9.985620747	Tunis Golf	37.104217	0	8.00E-06	24.8653	0
20	71	08/07/2016	11:32:00	1	36.889037	10.401449	0.683820483	10.66944123	Tunis Golf	37.104967	0	2.00E-06	24.786651	0
21	71	08/07/2016	11:33:00	1	36.894938	10.40142	0.65487223	11.32431346	Tunis Golf	37.104967	0	2.00E-06	24.702049	0

Indexed file content

File : 106_2016-08-17_174043_Marseille_to_Goulette_731501_pre.csv

Reference	Date / Time			Latitude / Longitude					Parameters		
Ref_trip	Date	Time	Nbr_min	Latitude	Longitude	Distance	Cumul_ distance	Area	Parameter	QC_parameter	Variance_parameter
106	17/08/2016	17:43:00	0	43.3188	5.286289	0	0	Algeroprovencal basin	21.10924	0	348.341
106	17/08/2016	17:44:00	1	43.31427	5.282313	0.597388	0.597388	Algeroprovencal basin	21.10924	1	348.341
106	17/08/2016	17:45:00	1	43.30955	5.278082	0.626553	1.223941	Algeroprovencal basin	38.31116	1	3.80E-05
106	17/08/2016	17:46:00	1	43.30481	5.273895	0.627324	1.851265	Algeroprovencal basin	38.31554	1	8.00E-06
106	17/08/2016	17:47:00	1	43.29977	5.269607	0.658947	2.510212	Algeroprovencal basin	38.30831	1	1.60E-05
------	------	------	------	------	------	------	------	------	------	------	------

Indexation parameters

01 **Temperature**

Unit : Degree Celsius

02 **Salinity**

Unit : PSU

03 **Oxygen**

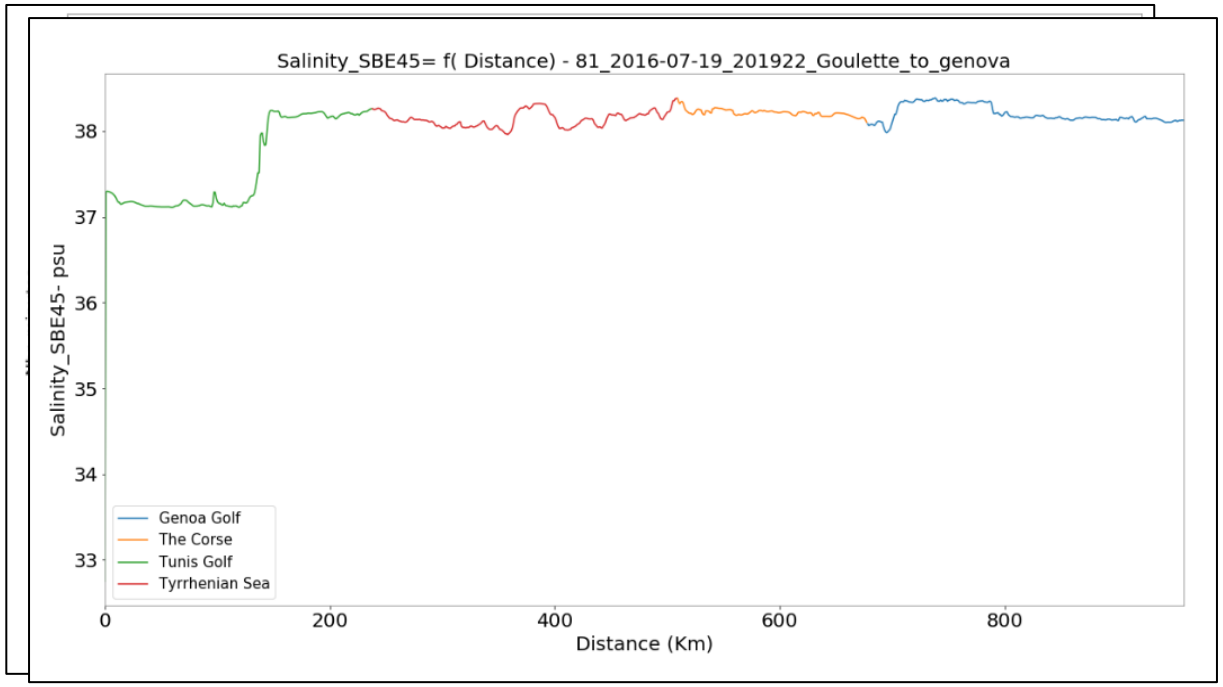
Unit : umol/l

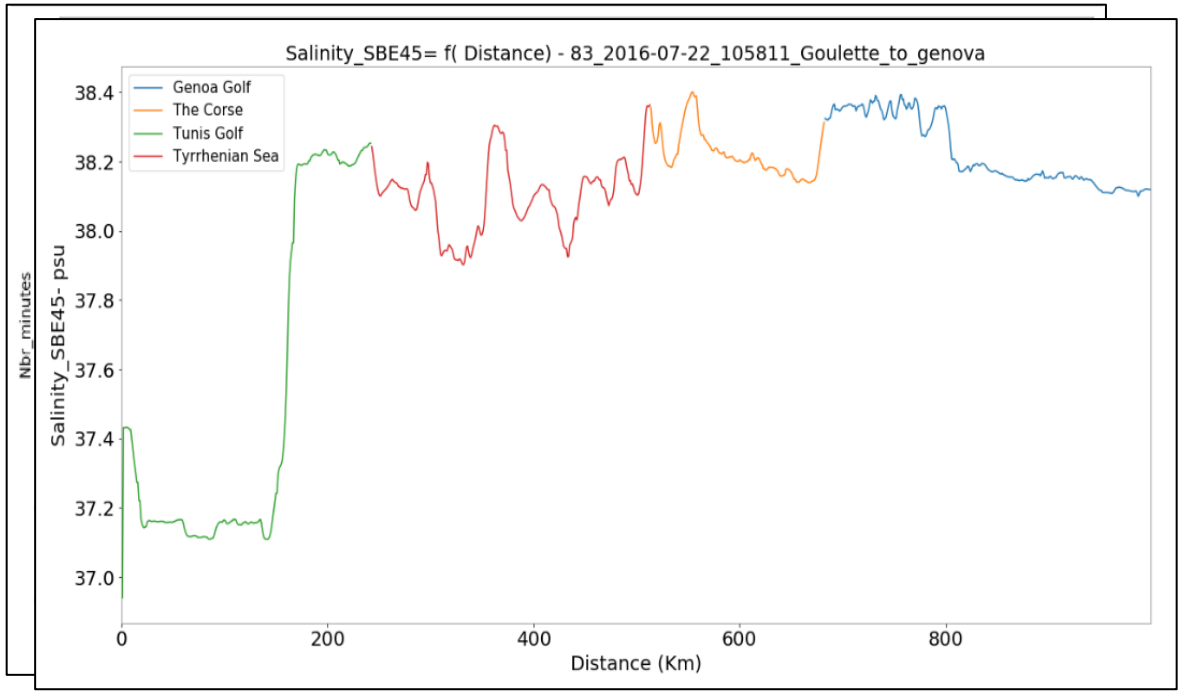
04 **Chl_a**

Unit : µg/l

05 **Turbidity**

Unit : NTU





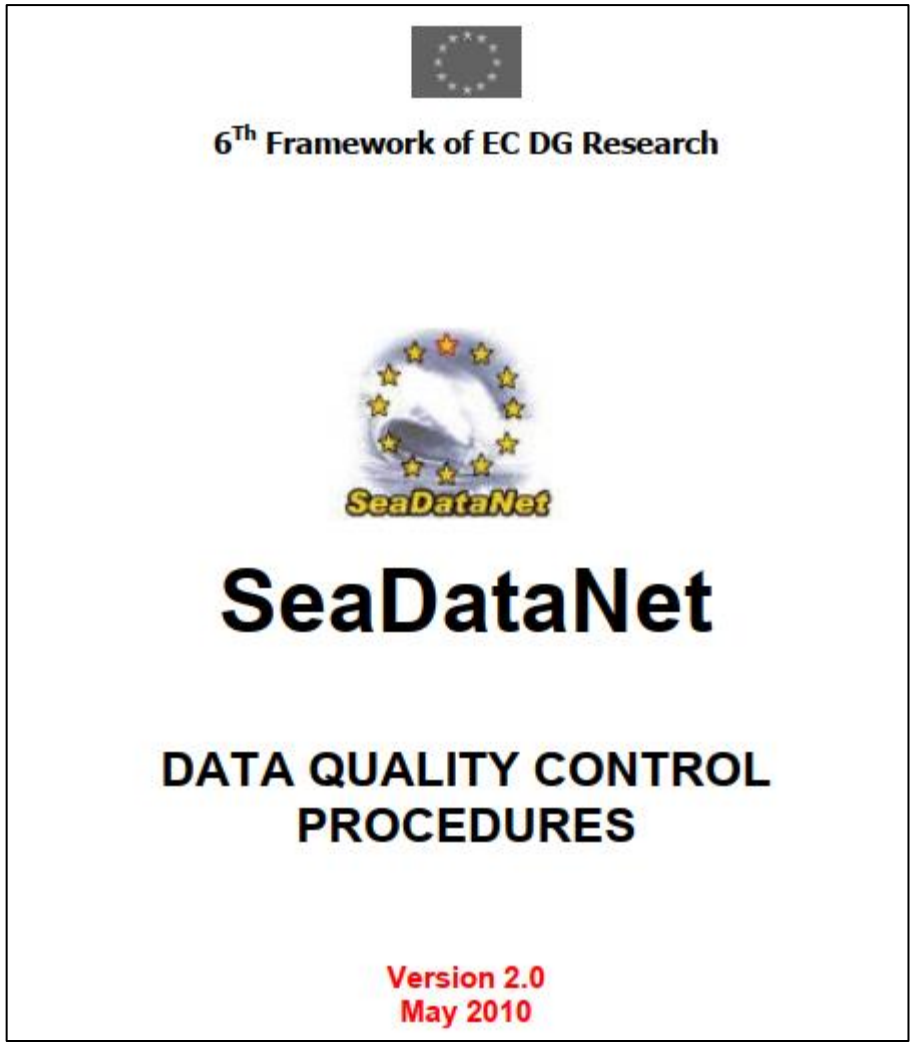
Data quality control

Data quality control has the following objective:

“To ensure the data consistency within a single data set and within a collection of data sets and to ensure that the quality and errors of the data are apparent to the user who has sufficient information to assess its suitability for a task.”

(IOC/CEC Manual, 1993)

SeaDataNet quality references



A - Information to accompany data

- Metadata
- Parameter vocabularies

B - Automatic checks

C - "Scientific" quality control

- CTD (temperature and salinity)
- Currents
- Wave data
- Sea level
- Chemical sample data (nutrients, oxygen)
- Biological data, etc.,

D - Quality control flags

B - Automatic checks

Date and time

• Year 4 digits – this can be tuned according to the data; Month between 1 and 12
• Day in range expected for month; Hour between 0 and 23
• Minute between 0 and 59

Latitude and longitude

• Latitude in range -90 to 90
• Longitude in range -180 to 180

Position must not be on land

• Observation latitude and longitude located in ocean
• The test requires that the observation latitude and longitude from the profile measurement

Global range test

Tests that observed parameter values are within the expected extremes encountered in the oceans

C - “Scientific” quality control

CTD (temperature and salinity)

- Automatic range checking of each parameter
- Plot profiles (individually, in groups, etc)
- Plot temperature vs. salinity
- Check profiles vs. climatology for the region
- Check calibration information available

Chemical sample data (nutrients, oxygen)

Using the GTSPP quality control checks as a starting point, it recommends the following four quantifiable data QC checks for variables as a minimum:

(1) data range checks
(2) excessive gradient
(3) excessive spike
(4) no gradient

C - “Scientific” quality control

Judging the data quality based on Time Series : a plot of the parameters measured over the time of the record

Enables the user to decide whether the data looks reasonable or not judging by:

- **the average values of the parameter measured**
- **the overall ‘noisiness’ of the plot**

✓ The most common are found as ‘spikes’, usually caused by a problem with the instrument as opposed to a sudden rapid change in the water conditions.

✓ **‘Spikes’** are usually singular points which are completely out-of-range when compared to the immediate surrounding values.

D - Quality flags

- A quality flag is assigned to each data value.
- Quality flags are used to describe the data value, no changes are made to the data values.

Spike test

Differences between sequential measurements, where one measurement is quite different than adjacent ones, is a spike in both size and gradient.

$$Test\_value = \left|\frac{V_2 - (V_3 + V_1)}{2}\right| - \left|\frac{(V_3 - V_1)}{2}\right|$$

where V2 is the measurement being tested as a spike, and V1 and V3 are the values previous and next.

- **Temperature**: The V2 value is flagged when the test value exceeds 6.0 degree C.
- **Salinity**: The V2 value is flagged when the test value exceeds 0.9 PSU

Values that fail the spike test should be flagged as wrong and should not be distributed.

Gradient

This test is failed when the difference between adjacent measurements is too steep.

$$Test\_value = \left|\frac{V_2 - (V_3 + V_1)}{2}\right|$$

where V2 is the measurement being tested as a spike, and V1 and V3 are the previous and next values.

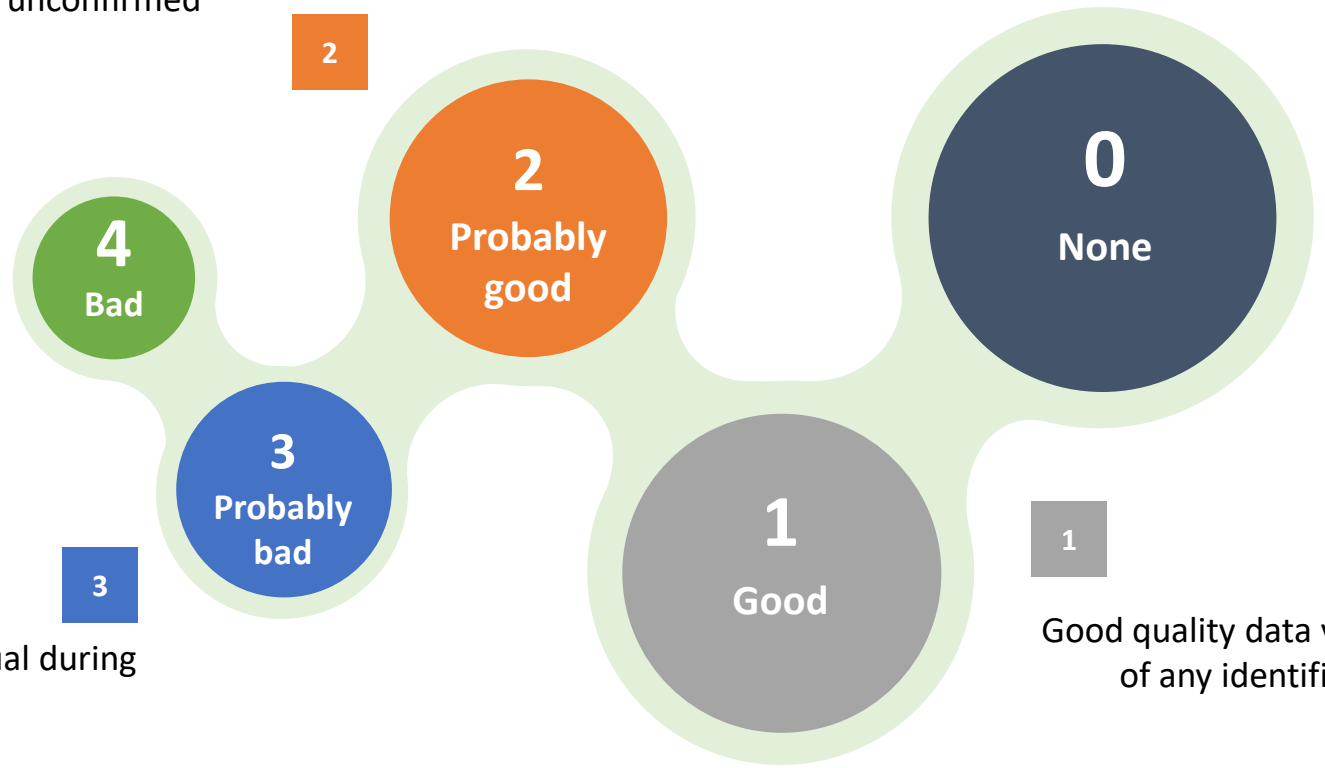
- **Temperature**: The V2 value is flagged when the test value exceeds 9.0 degree C.
- **Salinity**: The V2 value is flagged when the test value exceeds 1.5 PSU

Values that fail the test (i.e. value V2) should be flagged as wrong.

D - Quality control flags

0 No quality control procedures have been applied to the data value

Data value that is probably consistent with real phenomena but this is unconfirmed 2



4 An obviously erroneous data value.

3 Data value recognized as unusual during quality control

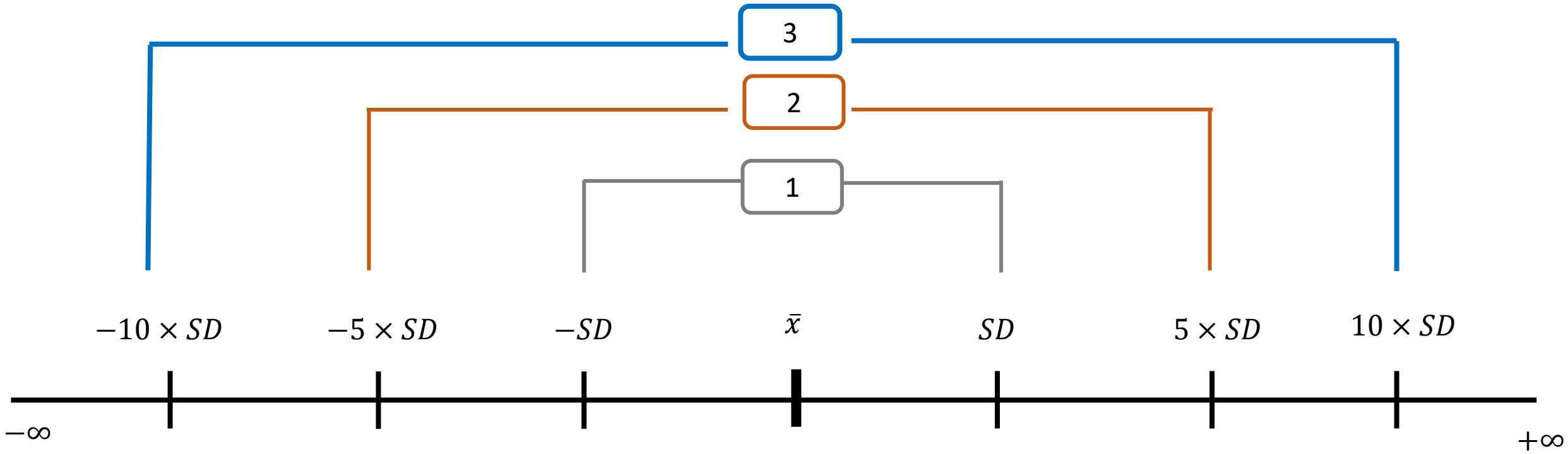
1 Good quality data value that is not part of any identified malfunction

Standard deviation

$$SD = \sqrt{\frac{\sum |x - \bar{x}|^2}{n}}$$

Mean value

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

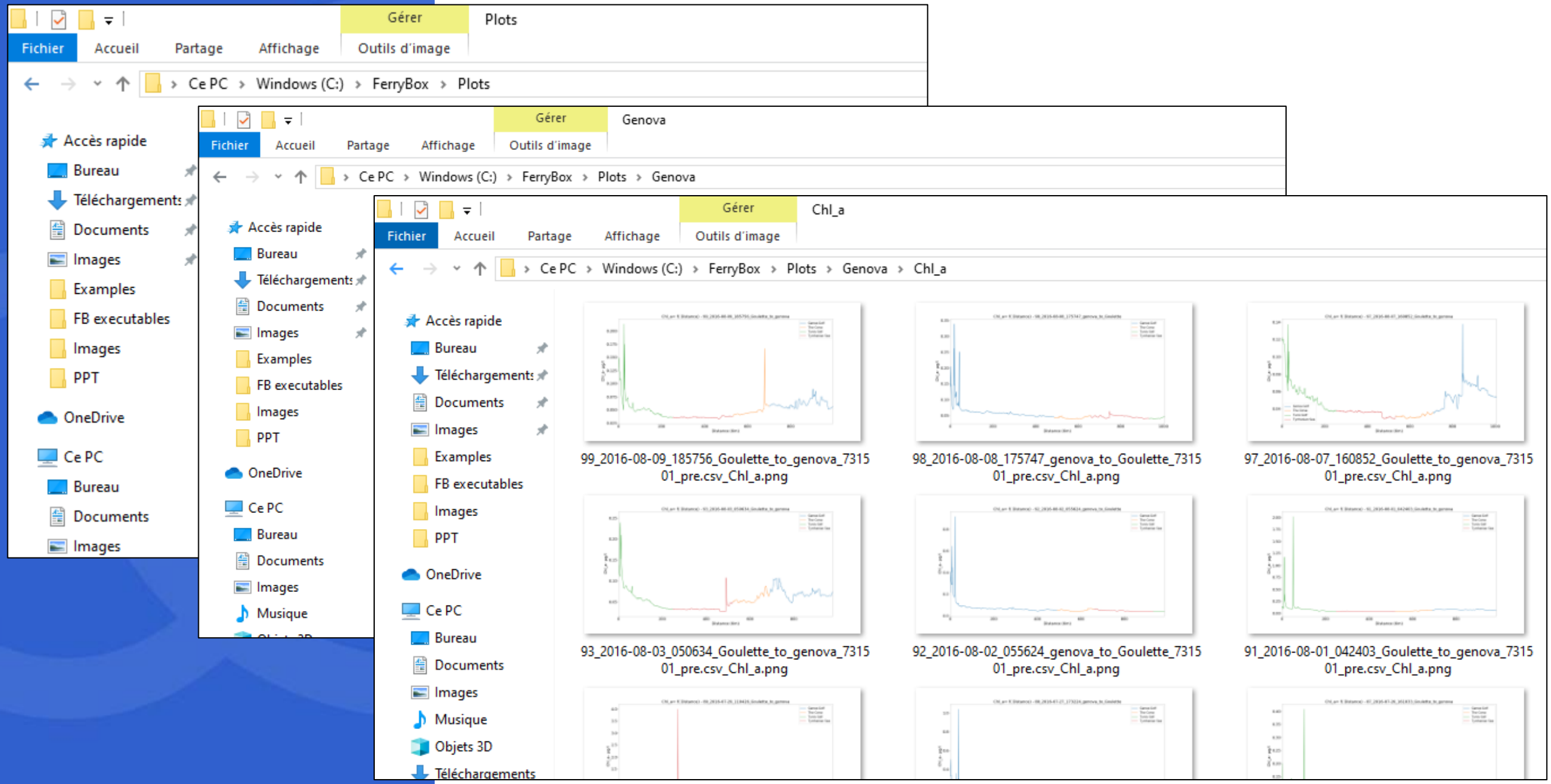


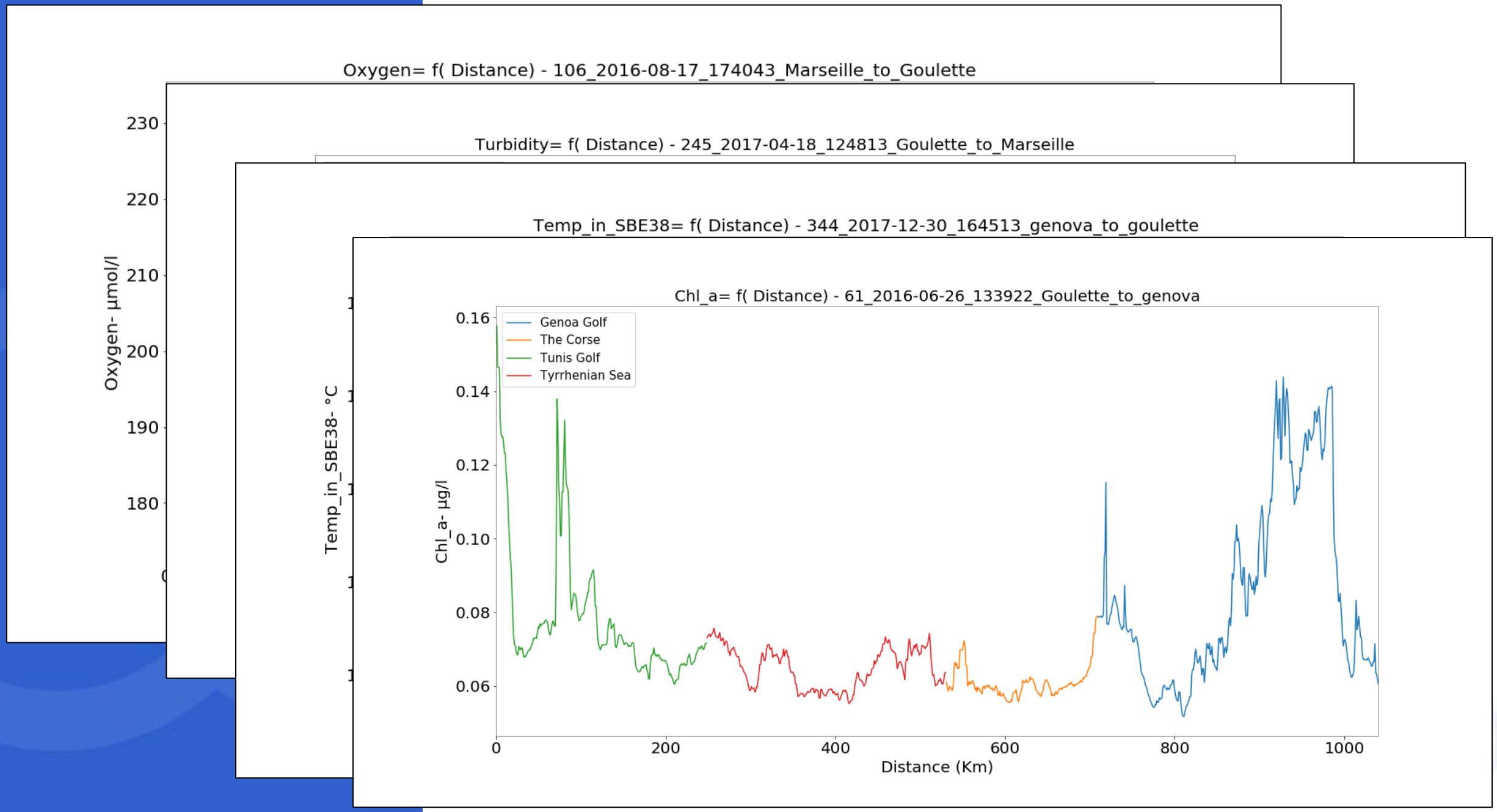
Spike + Gradient test

4

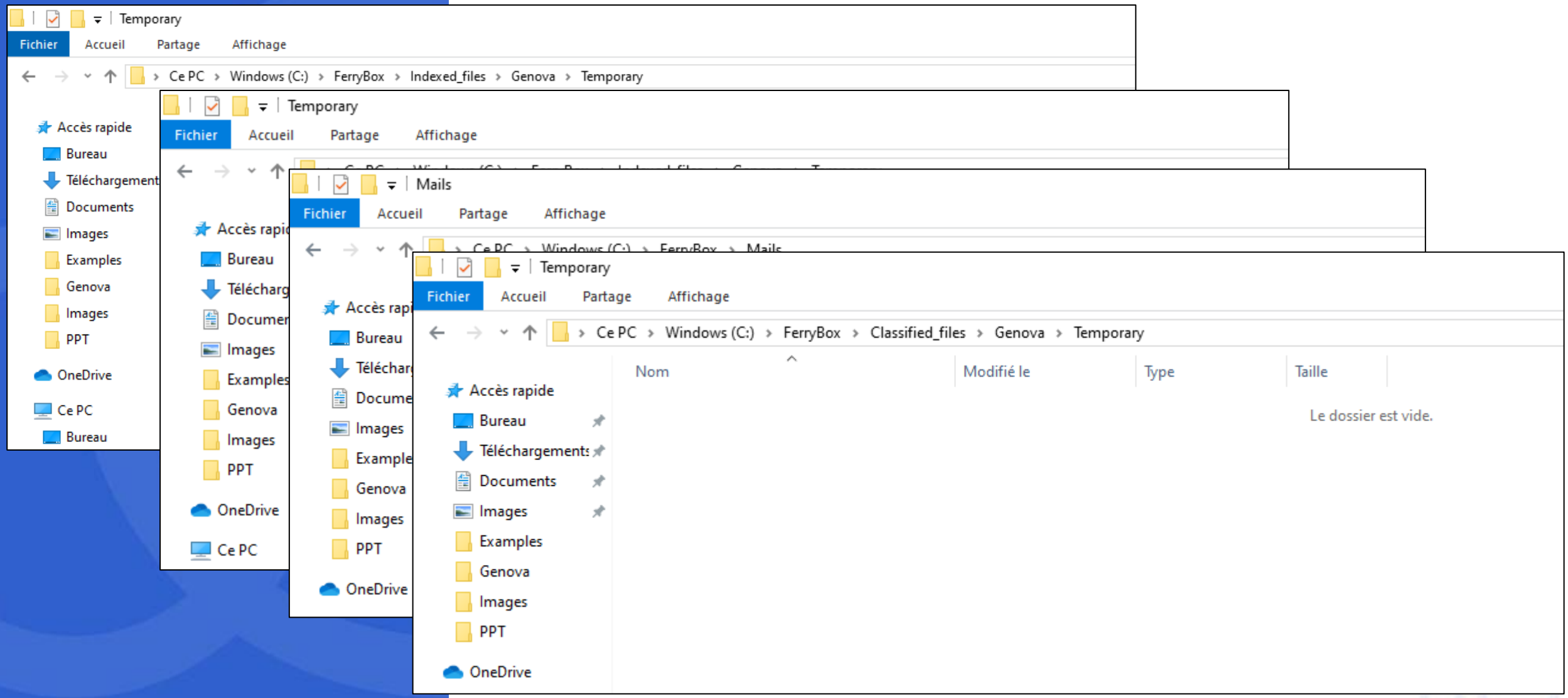
Spike + Gradient test

5_plots_generation.py

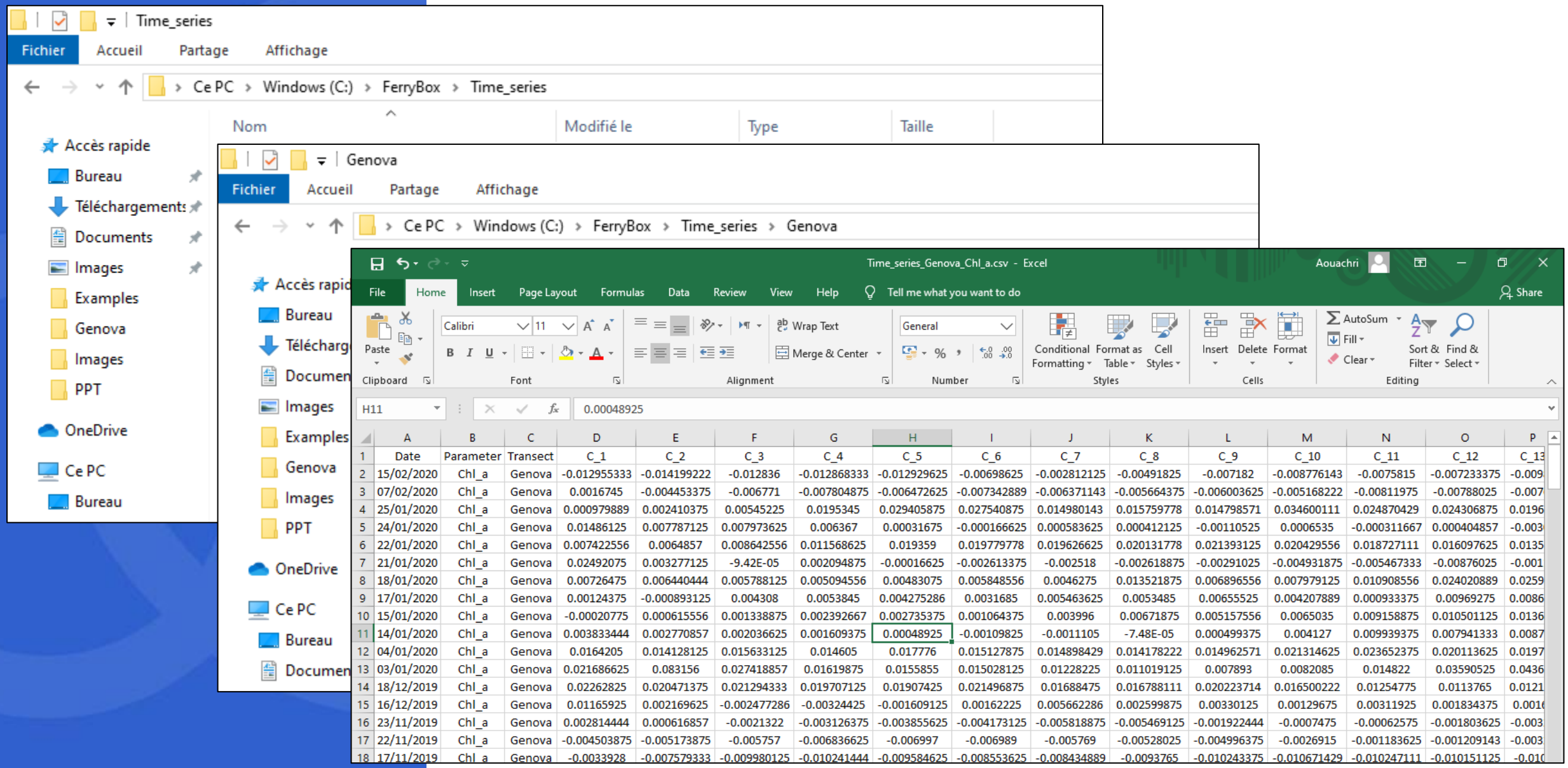



Oxygen= f(Distance) - 106_2016-08-17_174043_Marseille_to_Goulette
Turbidity= f(Distance) - 245_2017-04-18_124813_Goulette_to_Marseille
Temp_in_SBE38= f(Distance) - 344_2017-12-30_164513_genova_to_goulette
Chl_a= f(Distance) - 61_2016-06-26_133922_Goulette_to_genova
Oxygen- µmol/l
Temp_in_SBE38- °C
Chl_a- µg/l
Distance (Km)
Genoa Golf
The Corse
Tunis Golf
Tyrrhenian Sea
230
220
210
200
190
180
0.16
0.14
0.12
0.10
0.08
0.06
0
200
400
600
800
1000

6_Next_refresh_prep.py



7_Time_series_Gen.py



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Date	Parameter	Transect	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_10	C_11	C_12	C_13
2	15/02/2020	Chl_a	Genova	-0.012955333	-0.014199222	-0.012836	-0.012868333	-0.012929625	-0.00698625	-0.002812125	-0.00491825	-0.007182	-0.008776143	-0.0075815	-0.007233375	-0.009
3	07/02/2020	Chl_a	Genova	0.0016745	-0.004453375	-0.006771	-0.007804875	-0.006472625	-0.007342889	-0.006371143	-0.005664375	-0.006003625	-0.005168222	-0.00811975	-0.00788025	-0.007
4	25/01/2020	Chl_a	Genova	0.000979889	0.002410375	0.00545225	0.0195345	0.029405875	0.027540875	0.014980143	0.015759778	0.014798571	0.034600111	0.024870429	0.024306875	0.0196
5	24/01/2020	Chl_a	Genova	0.01486125	0.007787125	0.007973625	0.006367	0.00031675	-0.000166625	0.000583625	0.000412125	-0.00110525	0.0006535	-0.000311667	0.000404857	-0.003
6	22/01/2020	Chl_a	Genova	0.007422556	0.0064857	0.008642556	0.011568625	0.019359	0.019779778	0.019626625	0.020131778	0.021393125	0.020429556	0.018727111	0.016097625	0.0135
7	21/01/2020	Chl_a	Genova	0.02492075	0.003277125	-9.42E-05	0.002094875	-0.00016625	-0.002613375	-0.002518	-0.002618875	-0.00291025	-0.004931875	-0.005467333	-0.00876025	-0.001
8	18/01/2020	Chl_a	Genova	0.00726475	0.006440444	0.005788125	0.005094556	0.00483075	0.005848556	0.0046275	0.013521875	0.006896556	0.007979125	0.010908556	0.024020889	0.0259
9	17/01/2020	Chl_a	Genova	0.00124375	-0.000893125	0.004308	0.0053845	0.004275286	0.0031685	0.005463625	0.0053485	0.00655525	0.004207889	0.000933375	0.00969275	0.0086
10	15/01/2020	Chl_a	Genova	-0.00020775	0.000615556	0.001338875	0.002392667	0.002735375	0.001064375	0.003996	0.00671875	0.005157556	0.0065035	0.009158875	0.010501125	0.0136
11	14/01/2020	Chl_a	Genova	0.003833444	0.002770857	0.002036625	0.001609375	0.00048925	-0.00109825	-0.0011105	-7.48E-05	0.000499375	0.004127	0.009939375	0.007941333	0.0087
12	04/01/2020	Chl_a	Genova	0.0164205	0.014128125	0.015633125	0.014605	0.017776	0.015127875	0.014898429	0.014178222	0.014962571	0.021314625	0.023652375	0.020113625	0.0197
13	03/01/2020	Chl_a	Genova	0.021686625	0.083156	0.027418857	0.01619875	0.0155855	0.015028125	0.01228225	0.011019125	0.007893	0.0082085	0.014822	0.03590525	0.0436
14	18/12/2019	Chl_a	Genova	0.02262825	0.020471375	0.021294333	0.019707125	0.01907425	0.021496875	0.01688475	0.016788111	0.020223714	0.016500222	0.01254775	0.0113765	0.0121
15	16/12/2019	Chl_a	Genova	0.01165925	0.002169625	-0.002477286	-0.00324425	-0.001609125	0.00162225	0.005662286	0.002599875	0.00330125	0.00129675	0.00311925	0.001834375	0.0016
16	23/11/2019	Chl_a	Genova	0.002814444	0.000616857	-0.0021322	-0.003126375	-0.003855625	-0.004173125	-0.005818875	-0.005469125	-0.001922444	-0.0007475	-0.00062575	-0.001803625	-0.003
17	22/11/2019	Chl_a	Genova	-0.004503875	-0.005173875	-0.005757	-0.006836625	-0.006997	-0.006989	-0.005769	-0.00528025	-0.004996375	-0.0026915	-0.001183625	-0.001209143	-0.003
18	17/11/2019	Chl_a	Genova	-0.0033928	-0.007579333	-0.009980125	-0.010241444	-0.009584625	-0.008553625	-0.008434889	-0.0093765	-0.010243375	-0.010671429	-0.010247111	-0.010151125	-0.010

Time series creation process

Fix the position - cell

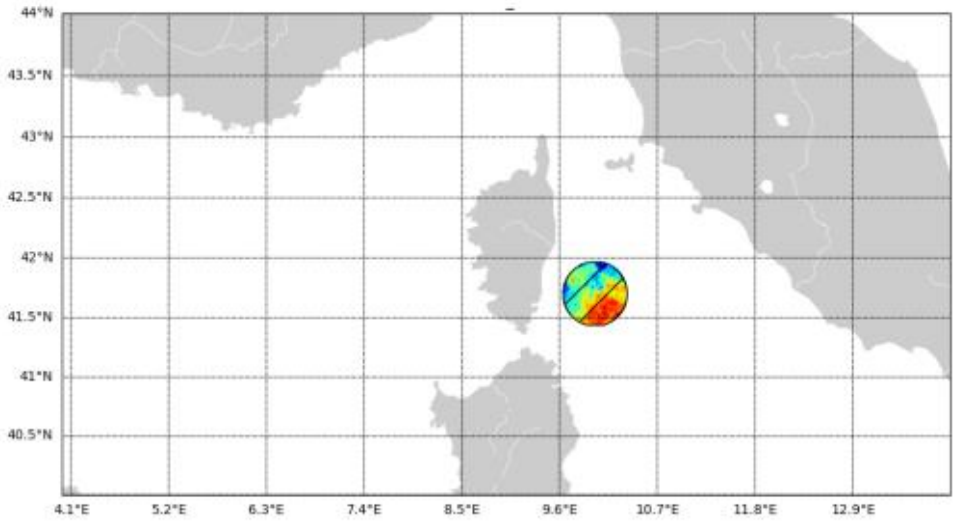
The number of cells is : total distance / size of the cell

Calculate the corresponding average value

The set of values that were captured in the corresponding set are represented by their mean value

Detect the date

The date will be inserted in the x-axis



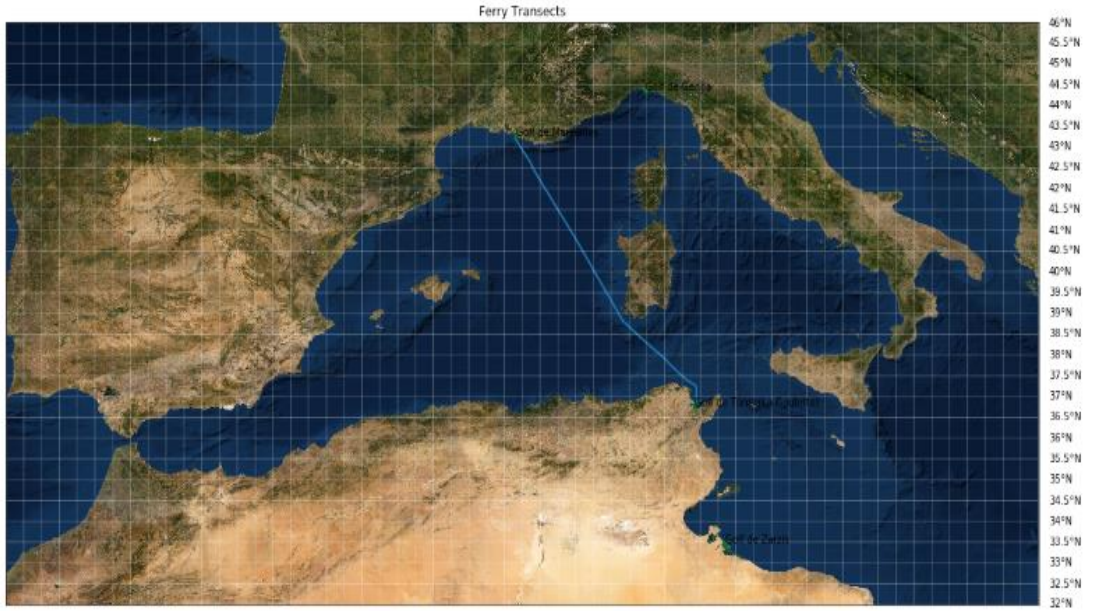
Detect the first path cell (5 km)

Original FerryBox file

Date	Latitude	Longitude	Salinity_SBE45	Distance	Cumul_Distance
09/08/2016	44.325697	8.986357	38.149008	0.601666	850.2433024
09/08/2016	44.330328	8.984447	38.132975	0.536668	850.7799709
09/08/2016	44.334445	8.982676	38.106117	0.478786	851.2587565
09/08/2016	44.338354	8.981048	38.065742	0.453353	851.7121094
09/08/2016	44.342096	8.979485	38.024975	0.434087	852.1461963
09/08/2016	44.345642	8.978024	37.997525	0.41089	852.5570864
09/08/2016	44.349429	8.976265	37.997525	0.443566	853.0006528
09/08/2016	44.353245	8.973875	37.994292	0.464881	853.4655336
09/08/2016	44.356914	8.971277	38.004733	0.457295	853.9228285
09/08/2016	44.360167	8.968976	38.004733	0.405353	854.3281818
09/08/2016	44.363083	8.966903	38.025183	0.363731	854.691913
09/08/2016	44.365833	8.964949	38.0367	0.342986	855.034899

Insert the parameter's mean value

Detect the date

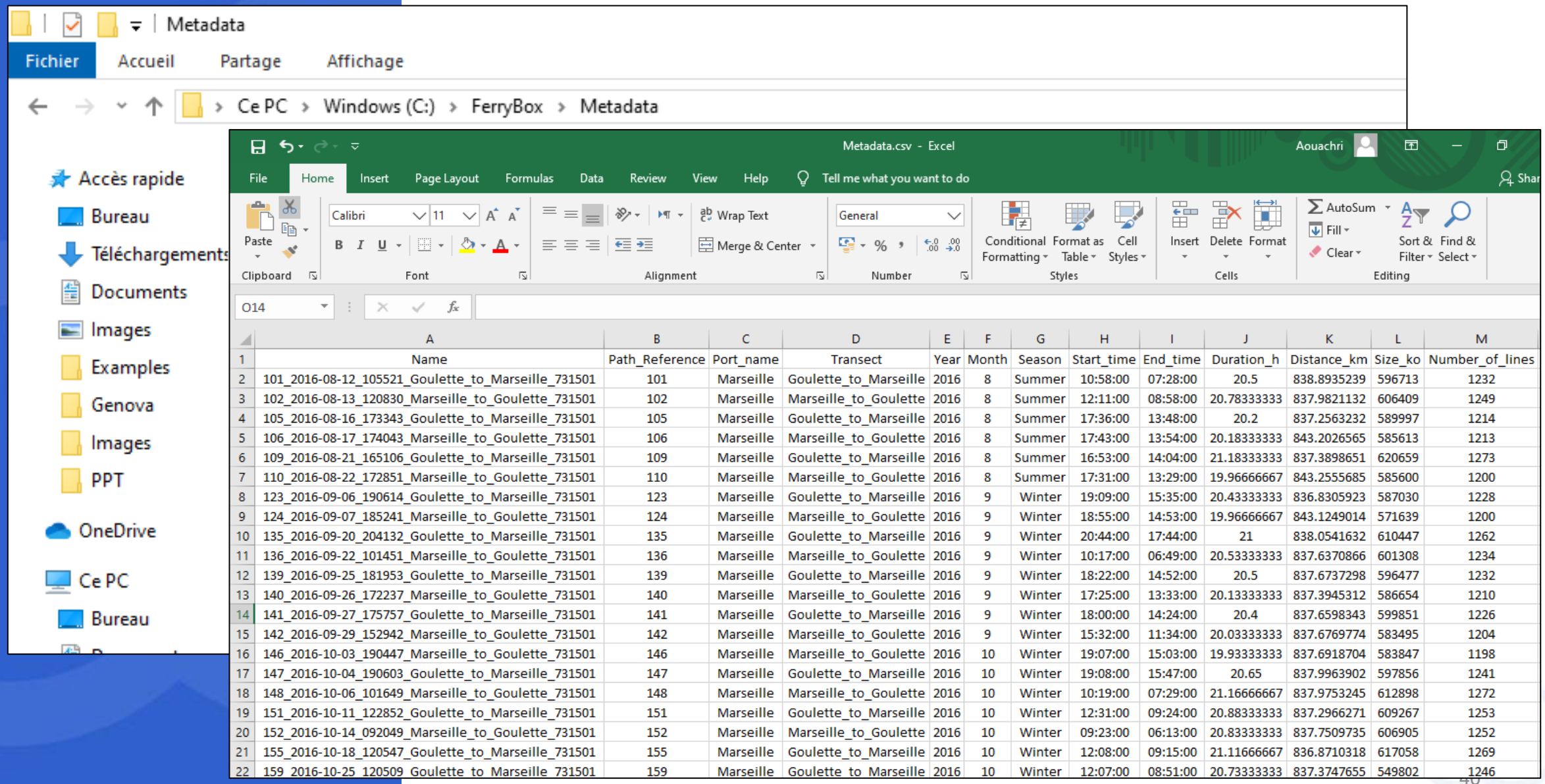


Generated time serie

	A	B	C	D	E	F	G
1	Date	C1	C2	C3	C4	C5	C6
2	09/08/2016	38.0457098	38.201788	38.2851334	38.223326	38.2056789	38.190334
3	08/08/2016	37.3216933	37.2855288	37.2991949	37.2811453	37.2750834	37.250528
4	07/08/2016	38.253919	38.1939946	38.2428334	38.304363	38.1905784	38.22508
5	04/08/2016	37.3654954	37.3230844	37.2925143	37.2979819	37.2904074	37.279241
6	03/08/2016	38.2876265	38.2378459	38.2547643	38.2769547	38.261706	38.218794
7	02/08/2016	37.2999584	37.2895023	37.3070143	37.2898843	37.2484334	37.24317
8	01/08/2016	38.2484234	38.2917585	38.2591799	38.2518169	38.2321976	38.251579
9	29/07/2016	38.2422392	38.2089283	38.228669	38.2632441	38.2394476	38.234801
10	27/07/2016	37.2655537	37.226259	37.219541	37.2319145	37.2163466	37.205981
11	26/07/2016	38.201912	38.1671115	38.1781219	38.2041857	38.206432	38.182373
12	25/07/2016	37.2025665	37.1650584	37.1696249	37.1829989	37.1735787	37.169695
13	24/07/2016	38.1804583	38.1697621	38.1830429	38.2352071	38.2063904	38.180780
14	23/07/2016	37.3310463	37.1769214	37.1608585	37.1464381	37.1464071	37.158096
15	22/07/2016	38.201077	38.1691484	38.1487763	38.1172179	38.1209119	38.13203
16	20/07/2016	37.2608233	37.139301	37.1615947	37.1609644	37.1340291	37.113691
17	19/07/2016	38.1484135	38.1885822	38.1710561	38.1476013	38.1278679	38.129236

File : 99_2016-08-09_185756_Goulette_to_genova_731501_pre.csv

9_Metadata_table.py



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Name	Path_Reference	Port_name	Transect	Year	Month	Season	Start_time	End_time	Duration_h	Distance_km	Size_ko	Number_of_lines
2	101_2016-08-12_105521_Goulette_to_Marseille_731501	101	Marseille	Goulette_to_Marseille	2016	8	Summer	10:58:00	07:28:00	20.5	838.8935239	596713	1232
3	102_2016-08-13_120830_Marseille_to_Goulette_731501	102	Marseille	Marseille_to_Goulette	2016	8	Summer	12:11:00	08:58:00	20.78333333	837.9821132	606409	1249
4	105_2016-08-16_173343_Goulette_to_Marseille_731501	105	Marseille	Goulette_to_Marseille	2016	8	Summer	17:36:00	13:48:00	20.2	837.2563232	589997	1214
5	106_2016-08-17_174043_Marseille_to_Goulette_731501	106	Marseille	Marseille_to_Goulette	2016	8	Summer	17:43:00	13:54:00	20.18333333	843.2026565	585613	1213
6	109_2016-08-21_165106_Goulette_to_Marseille_731501	109	Marseille	Goulette_to_Marseille	2016	8	Summer	16:53:00	14:04:00	21.18333333	837.3898651	620659	1273
7	110_2016-08-22_172851_Marseille_to_Goulette_731501	110	Marseille	Marseille_to_Goulette	2016	8	Summer	17:31:00	13:29:00	19.96666667	843.2555685	585600	1200
8	123_2016-09-06_190614_Goulette_to_Marseille_731501	123	Marseille	Goulette_to_Marseille	2016	9	Winter	19:09:00	15:35:00	20.43333333	836.8305923	587030	1228
9	124_2016-09-07_185241_Marseille_to_Goulette_731501	124	Marseille	Marseille_to_Goulette	2016	9	Winter	18:55:00	14:53:00	19.96666667	843.1249014	571639	1200
10	135_2016-09-20_204132_Goulette_to_Marseille_731501	135	Marseille	Goulette_to_Marseille	2016	9	Winter	20:44:00	17:44:00	21	838.0541632	610447	1262
11	136_2016-09-22_101451_Marseille_to_Goulette_731501	136	Marseille	Marseille_to_Goulette	2016	9	Winter	10:17:00	06:49:00	20.53333333	837.6370866	601308	1234
12	139_2016-09-25_181953_Goulette_to_Marseille_731501	139	Marseille	Goulette_to_Marseille	2016	9	Winter	18:22:00	14:52:00	20.5	837.6737298	596477	1232
13	140_2016-09-26_172237_Marseille_to_Goulette_731501	140	Marseille	Marseille_to_Goulette	2016	9	Winter	17:25:00	13:33:00	20.13333333	837.3945312	586654	1210
14	141_2016-09-27_175757_Goulette_to_Marseille_731501	141	Marseille	Goulette_to_Marseille	2016	9	Winter	18:00:00	14:24:00	20.4	837.6598343	599851	1226
15	142_2016-09-29_152942_Marseille_to_Goulette_731501	142	Marseille	Marseille_to_Goulette	2016	9	Winter	15:32:00	11:34:00	20.03333333	837.6769774	583495	1204
16	146_2016-10-03_190447_Marseille_to_Goulette_731501	146	Marseille	Marseille_to_Goulette	2016	10	Winter	19:07:00	15:03:00	19.93333333	837.6918704	583847	1198
17	147_2016-10-04_190603_Goulette_to_Marseille_731501	147	Marseille	Goulette_to_Marseille	2016	10	Winter	19:08:00	15:47:00	20.65	837.9963902	597856	1241
18	148_2016-10-06_101649_Marseille_to_Goulette_731501	148	Marseille	Marseille_to_Goulette	2016	10	Winter	10:19:00	07:29:00	21.16666667	837.9753245	612898	1272
19	151_2016-10-11_122852_Goulette_to_Marseille_731501	151	Marseille	Goulette_to_Marseille	2016	10	Winter	12:31:00	09:24:00	20.88333333	837.2966271	609267	1253
20	152_2016-10-14_092049_Marseille_to_Goulette_731501	152	Marseille	Marseille_to_Goulette	2016	10	Winter	09:23:00	06:13:00	20.83333333	837.7509735	606905	1252
21	155_2016-10-18_120547_Goulette_to_Marseille_731501	155	Marseille	Goulette_to_Marseille	2016	10	Winter	12:08:00	09:15:00	21.11666667	836.8710318	617058	1269
22	159_2016-10-25_120509_Goulette_to_Marseille_731501	159	Marseille	Goulette_to_Marseille	2016	10	Winter	12:07:00	08:51:00	20.73333333	837.3747655	549802	1246

Metadata table contents

Geo-refrencial

Departure and final port, transect, distance

References

Trip, sensors and FerryBox references

Physical

File size and number of lines

Temporal

Date of start and end of trip, duration

FerryBox database

A very abundant information about the Mediterranean water surface

Local management

Managing files and data

Web application

Data interactive visualization

Linking the local part to the web part

Data insertion

Structuring tables in the relational database

SQLite

Local database

Retained tables :

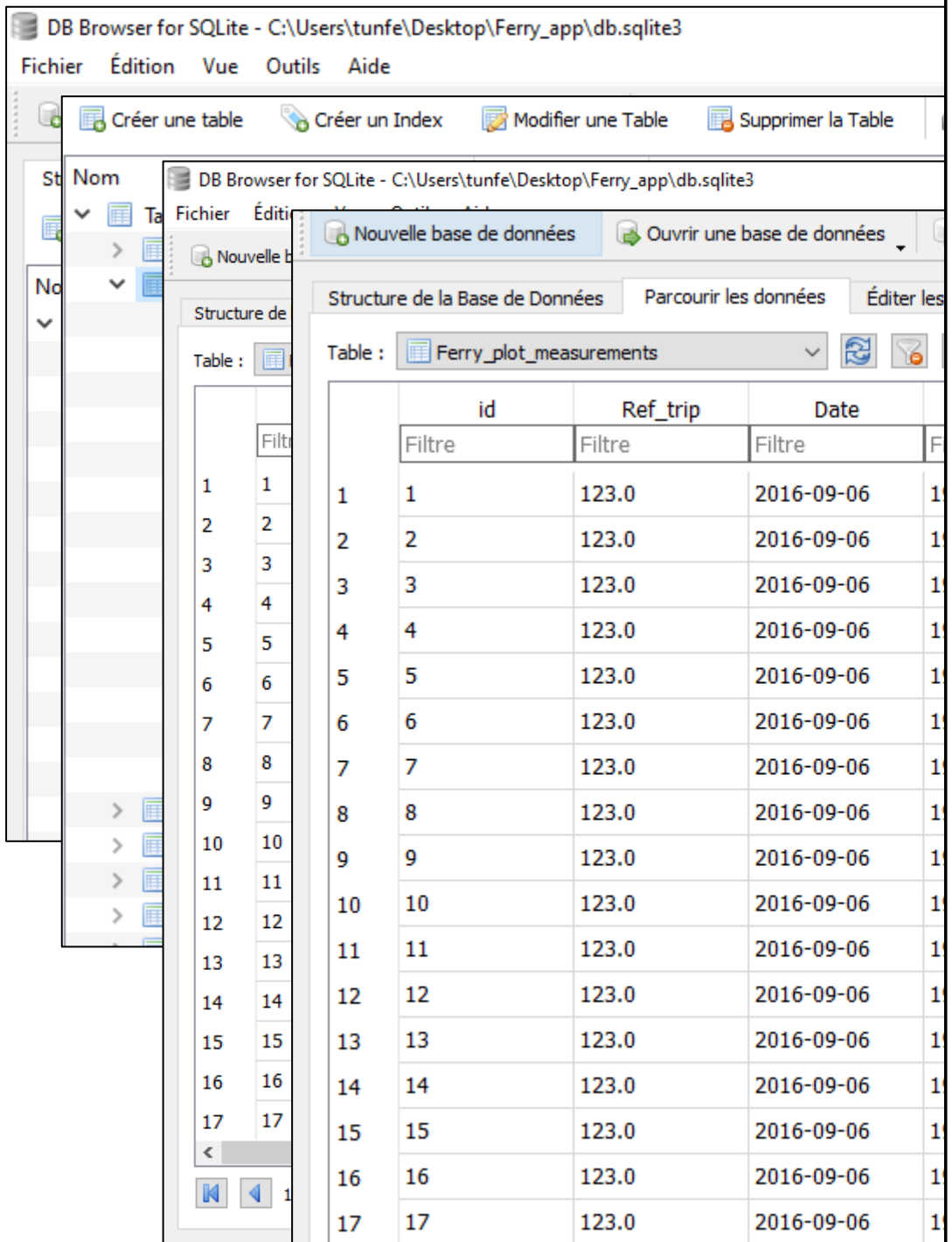
Indexed files

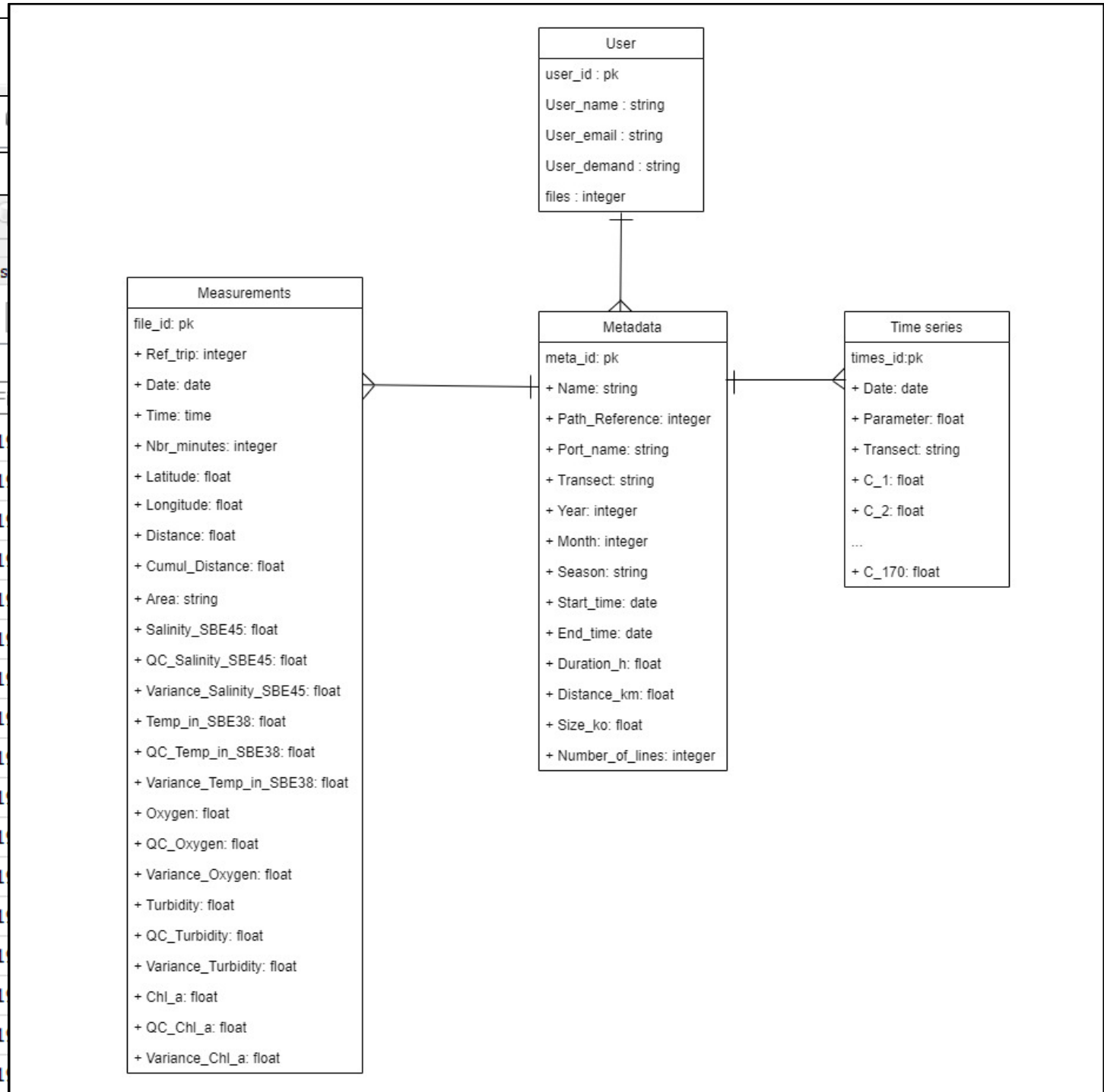
Metadata

Time series

Dynamic web application

Displaying requested data in real-time


DB Browser for SQLite - C:\Users\tunfe\Desktop\Ferry_app\db.sqlite3
Fichier Édition Vue Outils Aide
Créer une table
Créer un Index
Modifier une Table
Supprimer la Table
Nom
DB Browser for SQLite - C:\Users\tunfe\Desktop\Ferry_app\db.sqlite3
Nouvelle base de données
Ouvrir une base de données
Structure de la Base de Données
Parcourir les données
Éditer les
Table : Ferry_plot_measurements
id
Ref_trip
Date
Filtre


User
user_id : pk
User_name : string
User_email : string
User_demand : string
files : integer
Measurements
file_id: pk
+ Ref_trip: integer
+ Date: date
+ Time: time
+ Nbr_minutes: integer
+ Latitude: float
+ Longitude: float
+ Distance: float
+ Cumul_Distance: float
+ Area: string
+ Salinity_SBE45: float
+ QC_Salinity_SBE45: float
+ Variance_Salinity_SBE45: float
+ Temp_in_SBE38: float
+ QC_Temp_in_SBE38: float
+ Variance_Temp_in_SBE38: float
+ Oxygen: float
+ QC_Oxygen: float
+ Variance_Oxygen: float
+ Turbidity: float
+ QC_Turbidity: float
+ Variance_Turbidity: float
+ Chl_a: float
+ QC_Chl_a: float
+ Variance_Chl_a: float
Metadata
meta_id: pk
+ Name: string
+ Path_Reference: integer
+ Port_name: string
+ Transect: string
+ Year: integer
+ Month: integer
+ Season: string
+ Start_time: date
+ End_time: date
+ Duration_h: float
+ Distance_km: float
+ Size_ko: float
+ Number_of_lines: integer
Time series
times_id:pk
+ Date: date
+ Parameter: float
+ Transect: string
+ C_1: float
+ C_2: float
...
+ C_170: float

Web application components

Administrator panel

This part of the dashboard requires administrator login/password access, It enables the import of data in the database.

Community blog

This part of the application is where updates about the project, the advancement and encountered problems are discussed with the international community.

Data description

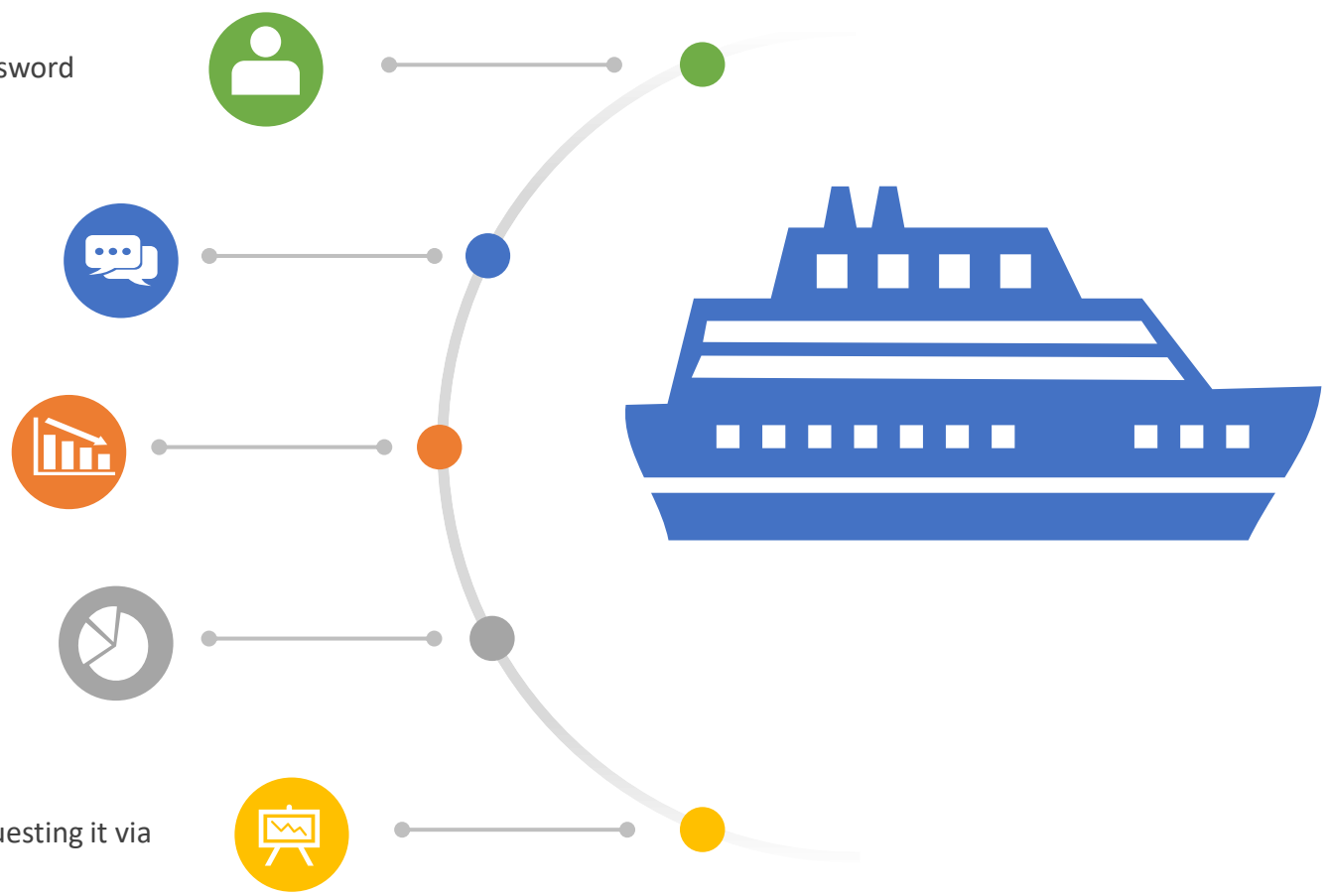
In this part, the projects current advancement, collected measurements and general statistics are displayed,

Data access

The international users of the Tunisian FerryBox Dashboard can, using this part of the application, visualize filtered data dynamically, in real time.

Data download

Users are offered the possibility to download data by requesting it via an online form.

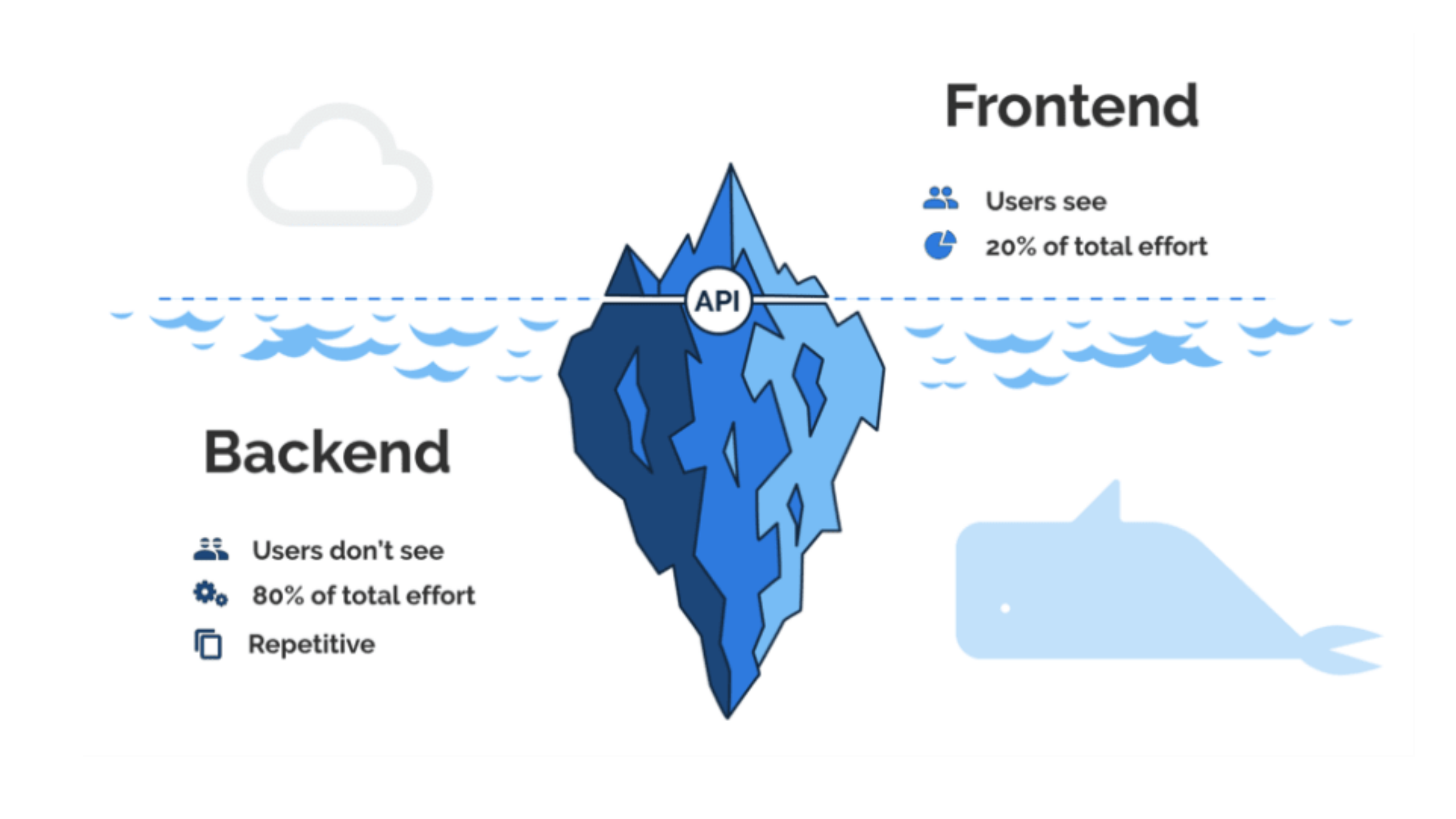


Motivations

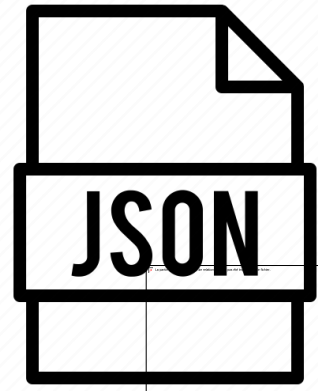
It is important to mention that a web application has already been created , in the previous years. This new web application is inspired from that previous result, while:

- Using a new database structure, based on the new files contents
- Providing a more rich user experience (user interface, data description, blog and articles ..)
- Displaying data in more than one charts type and form
- Filtering data on real-time basis
- Showing the ferry transect while coloring the path based on the measured parameter
- Using a Python-based developing platform, to ensure the continuity and coherence of the used technologies ..

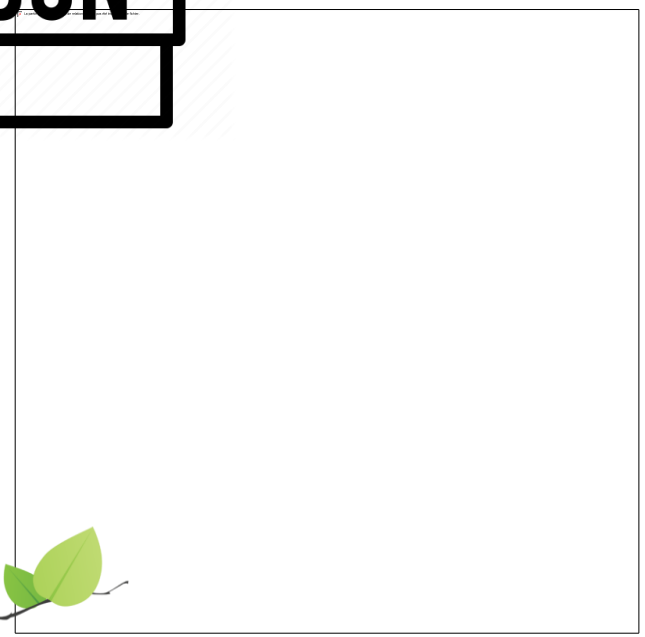
Tunisian FerryBox dashboard


Frontend
Users see
20% of total effort
API
Backend
Users don't see
80% of total effort
Repetitive

Bootstrap



JavaScript



Home page

FERRYBOX DASHBOARD

- Data Overview
- Data Access
- Login

Tunisian FerryBox project presentation

Project timeline, goals, scheme, database and devices description, and more

Visualize FerryBox Marine data

↑ 687 recieved files.

updated 1 day ago

Test data seasonality

Data repartition per month

All data included

Asses data quality

% of truncated vs correct files

Only correct files are accessible

Presentation: PROJECT TRANSECTS DEVICES STATISTICS METADATA PRETREATMENTS QUALITY CONTROL GRAPHICS

FERRYBOX DASHBOARD

The Tunisian FerryBox project is an initiative that's targeting water masse tracking and measuring. It is materialized by a set of sensors that are implemented in Carthage ferry, at 5 meters depth. It is measuring, for each minute of the ferry's trip, several parameters (Temperature, Salinity, Dissolved oxygen, Turbidity, pH...) The first launch of FerryBox data collecting campaigns was on 2016. The growing database offers several interesting scientific possibilities:

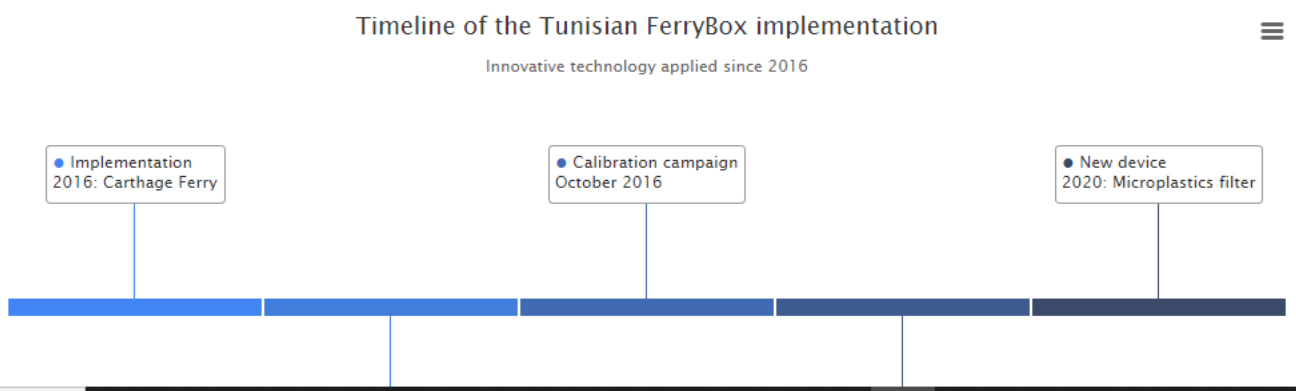
- Statistical studies
- Comparison with satellite data
- Insight into the Mediterranean marine dynamics...

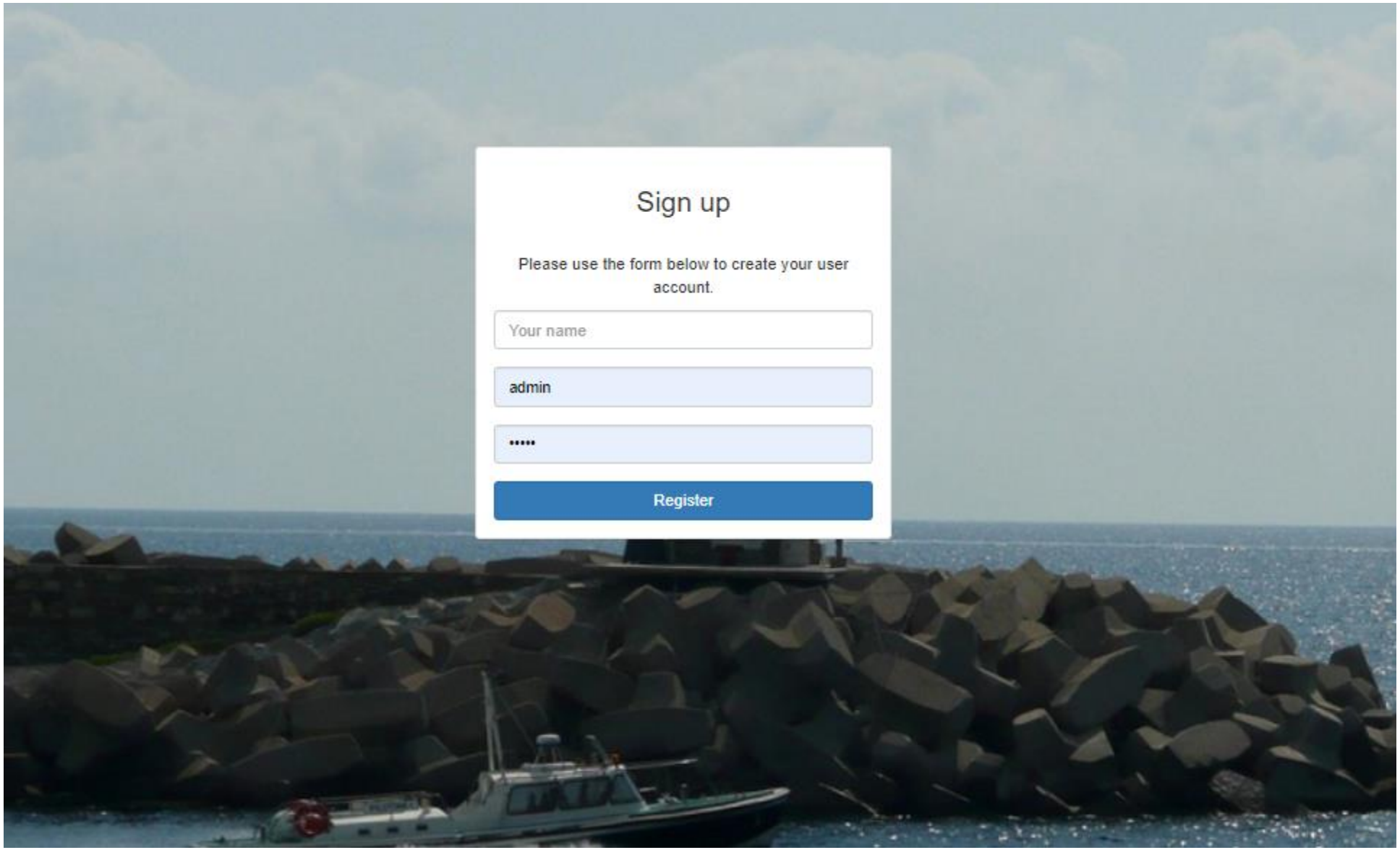
Currently, The Tunisian FerryBox is involved in the CLAIM EU 2020 project.

The Tunisian FerryBox device is a measuring device tracking water masses properties and dynamics. The device is fixed at 5 meter depth, in Carthage ferry. It has a sampling frequency of 1 minute, and measures, for each sample :

- Temperature
- Salinity
- Dissolved oxygen
- Turbidity
- pH..

Below is the timeline of the FerryBox project main events and ameliorations:




Sign up
Please use the form below to create your user account.
Your name
admin
•••••
Register

Displaying data

Tun FerryBox

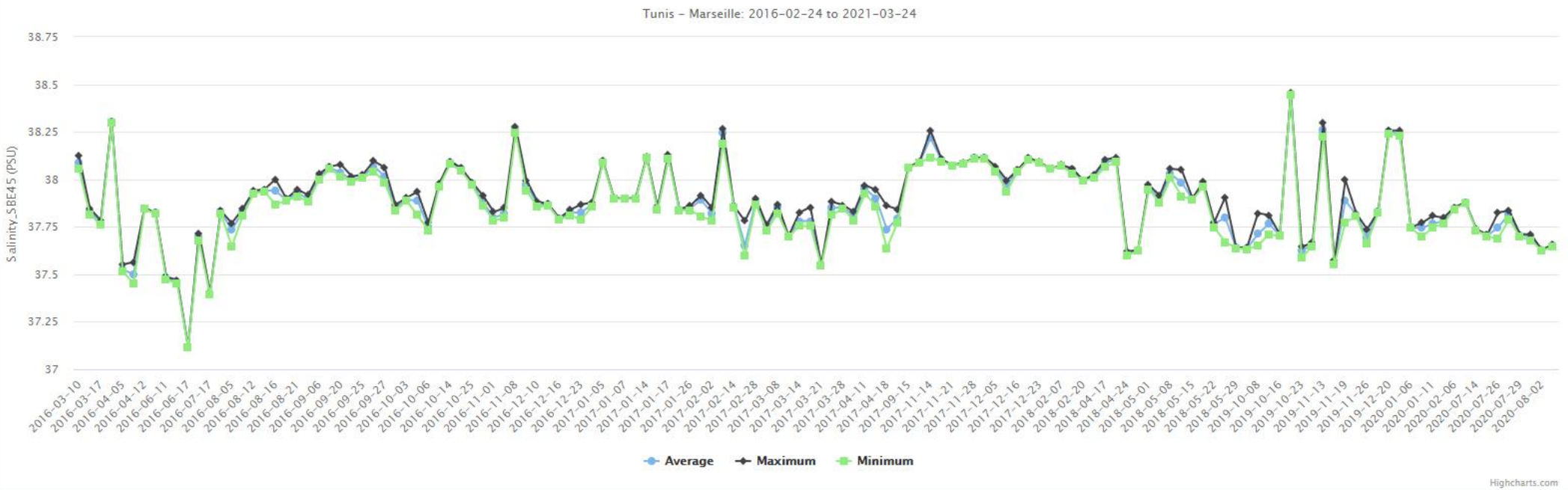
HOME DATA DATA ACCESS DOWNLOAD SIGN IN / SIGN UP

FERRYBOX DASHBOARD

Data Overview

Data Access

Login



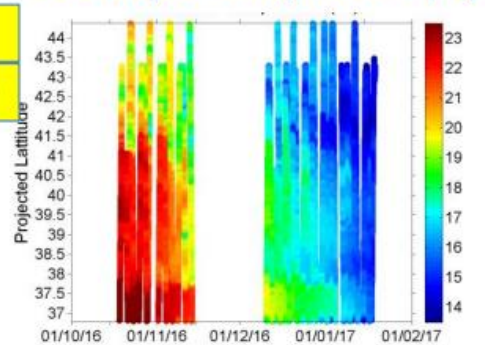
Overview of the FerryBox deployment

Genova

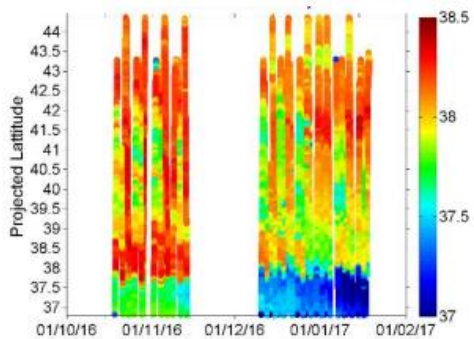
Marseille

Tunis

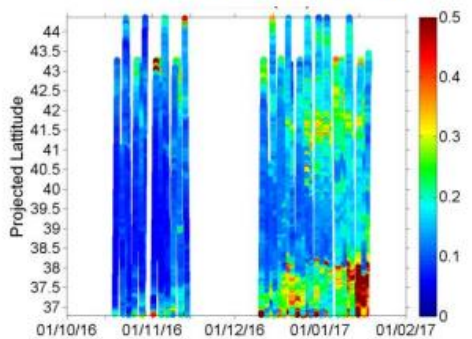
Sea Surface Temperature (°C)



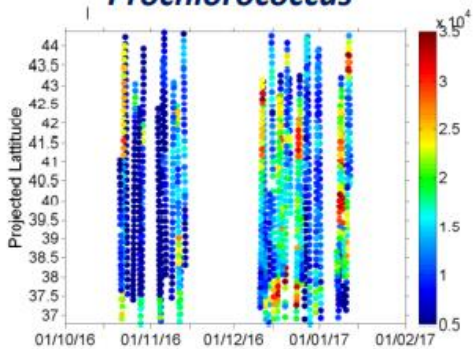
Sea Surface Salinity



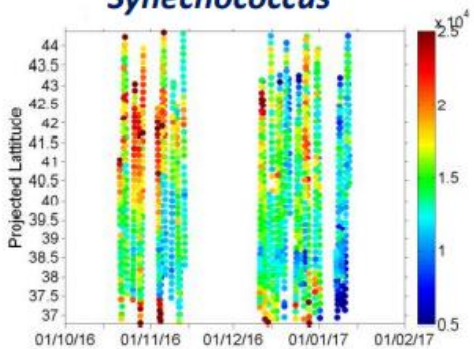
Fluorescence (r.f.u.)



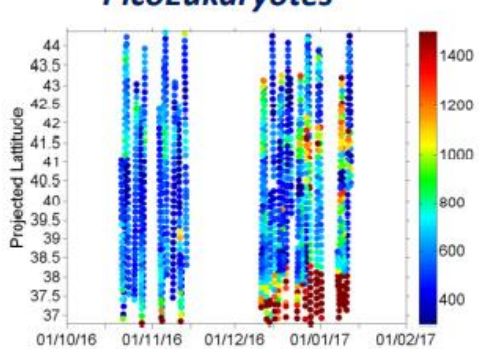
Prochlorococcus



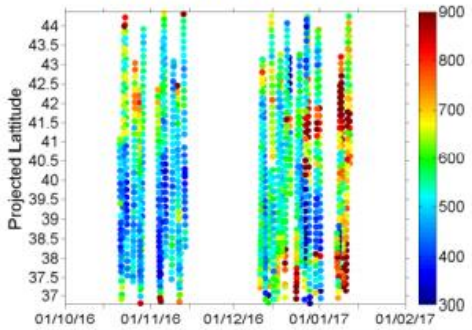
Synechococcus



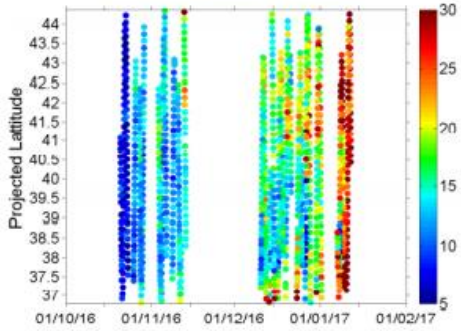
PicoEukaryotes



NanoEukaryotes



MicroEukaryotes



Conclusion

What’s next ?

2021

Scientific paper redaction

The FerryBox data will be analysed and presented in a valuable scientific paper.

2021

Further data exploitation / Satellite data matching
Sensor calibration cruises

The FerryBox INSTM team is planning to carry out further calibration cruise and microplastic sampling this year. We will assign further data quality controls, based on the web application behavior and the local refreshment process efficiency. Preparing data for the matching process could be tackled too.

2022

Finalizing the web application and deployment

The web application, after team meetings and discussions, articles and web redaction, and unit tests validation, can be deployed to international use

- ✓ FerryBox data structuring and preprocessing
- ✓ Data analysis related to the project’s tasks and goals
- ✓ Open and looking for other collaboration opportunities at national and Mediterranean and EU level