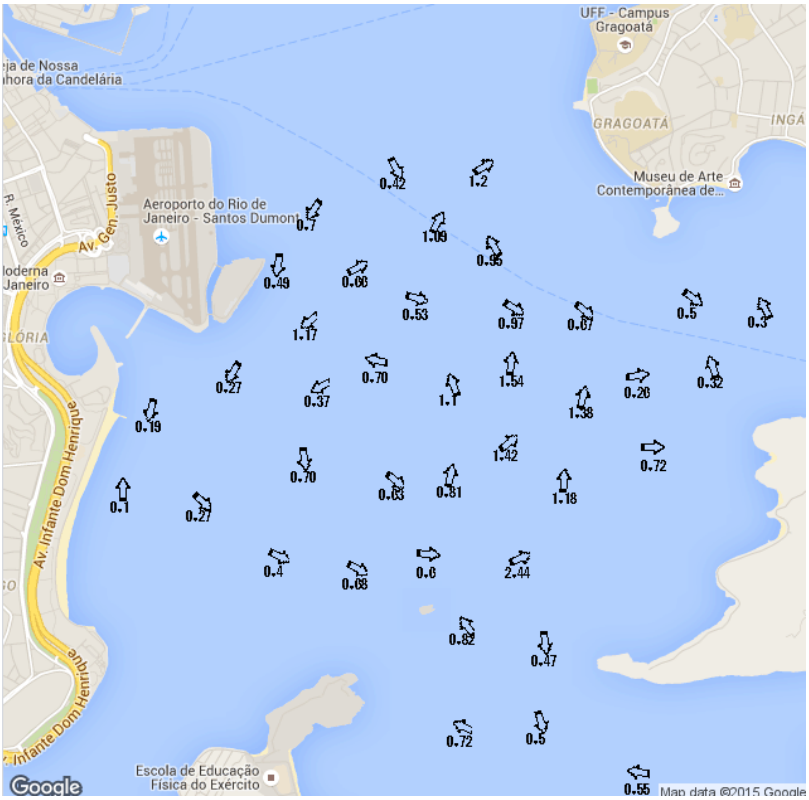
HydroMeteo Analysis

User's Guide

Contents

Interacting with the map

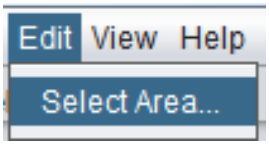
The Map is a single image that represents visually the last query, the size varies with the monitor's dimensions and it can reach 640x640 pixels maximum.



The program doesn't control neither the amount nor the density of the data to be displayed. Therefore, **it can take some time to paint the image** after the query, the painting operation it's quite slow in terms of computing.

Select Area

The area selection is activated by clicking `Select Area…` in the bar menu item `Edit`.



When activated, the user has a maximum of four clicks in the map to determine the area. These clicks have to follow the order: minimum latitude, maximum latitude, minimum longitude and maximum longitude. This way a square is determined.

If the user chooses to make a query before the fourth click, area selection will be deactivated.

The last selected area can be cleaned from the "Select by" Panel by clicking `Clear Area…` in the bar menu item `Edit`.

Drag

When the user makes a query, the program centers the image calculating the centroid of the set of coordinates to be displayed. That center can be moved by dragging intuitively with the mouse left click.

In order to improve the experience the data displayed disappears temporally while the user is dragging the scene. Again patience when the mouse is released, it can take a while depending on the data.

Zoom

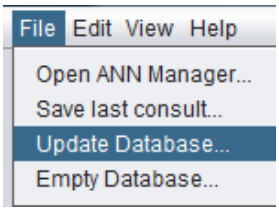
The zoom level can be controlled intuitively using the mouse wheel. While the drag just lasts until the next query, the zoom level is maintained.

Managing the database

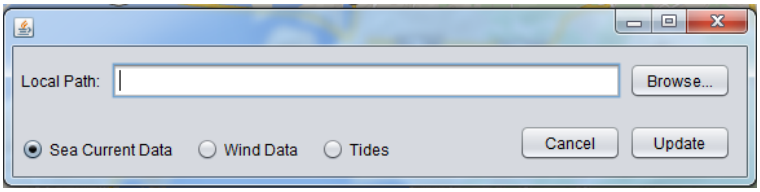
This program uses an embedded SQL database. Hence, no additional software has to be installed previously.

Update

In the first place we have to open the update form. To do it we must click `Update Database…` in the bar menu item `File`.



Now we can type the location or browse the file or directory to upload. Only .txt or .csv file extensions are allowed, if the directory is selected all the files contained will be uploaded (no subfolders).



As can be seen, the data type has to be fixed.

Finally, to update successfully the data it is very important to respect the next format:

- Sea current Header:
  - Date, Time, Latitude, Longitude, from True, heading True, from Magnetic, heading Magnetic, Magnetic Deviation, Speed, Time Zone.
  - There are three additional fields that are calculated automatically: time to the closest high tide (distH), time delta (DT) and tide delta (DH). To do this calculation **it must exist data from the date's tides**. **If it doesn't exist, the line won't be inserted to the database**.
- Wind Header:
  - Date, Time, Latitude, Longitude, heading Magnetic, Intensity, heading True, Ship speed, Ship heading, Atmospheric Pressure, Temperature, Humidity, IS Thresholded.
  - There is a last field named Coach that is extracted from the file's name. Specifically is the third word separated by "_", if exists.
  - The last element per each line (theoretically IS Thresholded), will not be inserted to the database.

- Tides Header:
    - Date, first low tide time, first low tide level, first high tide time, first high tide level, second low tide time, second low tide level, second high tide level, second high tide time.
    - **The first line in the file is ignored** because it's supposed to be the header.

Having said that, let's look at the formats of the different magnitudes:

- Date: ddmmyyyy or dd/mm/yyyy.
    - E.g. 02082015 or 02/08/2015
- Time:
    - Sea Current and Wind: hhMMss or hh:MM:ss
    - Tides: hhMM or hh:MM
- Latitude or Longitude: Expressed in decimal degrees (DD).
    - E.g. 38.888565 or -77.00089675
- Numbers: With or without decimals**. A single dot instead of coma for decimals**. **Do not use multiple dots or comas between thousands.**
  E.g. 8 or 4.07 or -99.3223325

For **sea current and wind data, all the magnitudes in the same line must be separated by semicolons ";"**. There must be no semicolons at the ends of the line.

Date, time, latitude and longitude can't be null. This applies for all data types. Also, it's recommended that the direction (heading True) and intensity/speed aren't null either. The rest of the values can be nulled by writing "NaN" preferably or also "-".

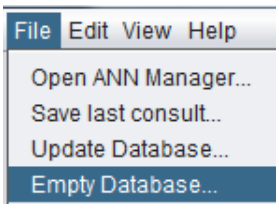
Regarding the tides data, all the magnitudes must be separated by a single tab "\t" even if the value is null. Again, there must be no tabs at the ends of the line.

Finally, **all the readings have to be in separated lines** (i.e. separated by a single newline).

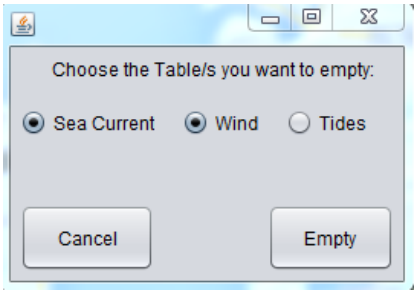
Please try to avoid blanks, additional newlines, tabs, headers… or any other element that has not been explicitly specified.

Empty

Empty the database is a simple process, one just has to press `Empty Database…` in the bar menu item `File`.



Right after, appears a new form where the data to be eliminated can be chosen according to the type. Multi-choice is allowed.

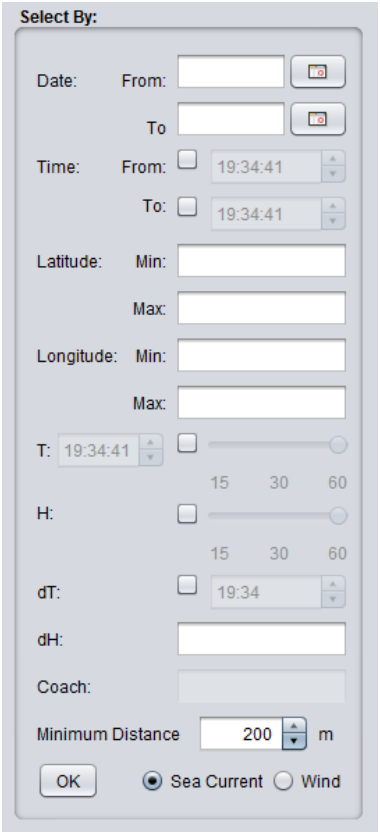


Careful, **all the data of the selected types is eliminated from the database permanently**.

Queries

In general it is recommended to use the "select by" Panel for comfort and to avoid errors.

"Select by" Panel



We find in the Panel four types of fields:

1. Date fields (Date): It's preferable to use the right button because it provides an interface. Even though, it can be set manually respecting the format dd-mmm-yyyy. E.g. 17-Jul-2015

2. Time fields (Time, T, dT): This field needs that the correspondent checkbox has been clicked. Then one can interact with the time picker without caring about the format.

3. Interval fields (T, H): Here we can tag and group any query in relation with the high tide time (H) or a certain hour in the day (T). Additionally, we can set the interval to be used being able to choose between three options: 60, 30 and 15 minutes. Also, the checkbox has to be checked.

4. Text fields (Latitude, Longitude, dH, Coach): In this case there is no format restriction. The user is responsible for the data that is typing, whether numbers or characters. SQL exceptions will be thrown if there are problems in this fields.

Fields date, time, latitude, longitude, time reference (T) and minimum distance work for both sea current and wind data.

Fields high tide reference (H), time delta (dT) and tide delta (dH) are exclusive for the sea current data type. On the other hand, the field coach belongs to the wind data type.

All the ranges (From-To and Min-Max) are closed intervals.

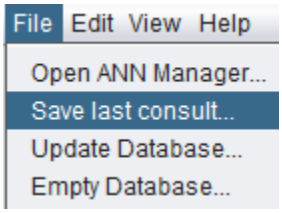
Minimum distance it's set to 200 meters by default. Of course it can be modified manually.

"Type SQL" Text area

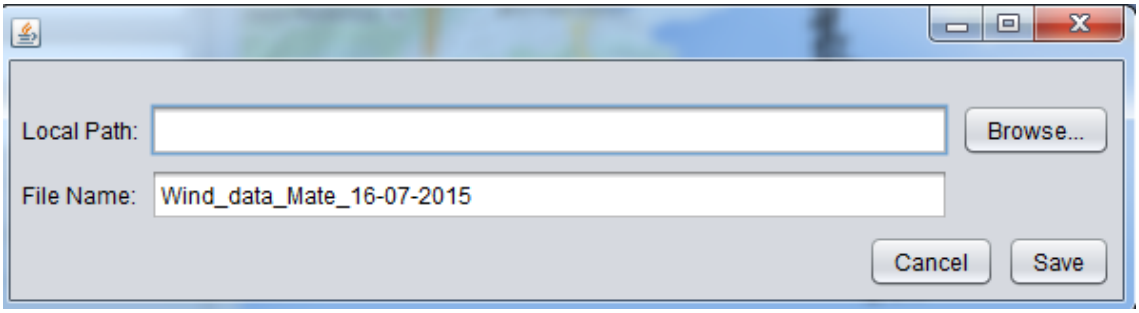
Located at the GUI's bottom, this text area allows to introduce all kind of SQL queries directly to the database. In order to prevent gaps in the system, **"SELECT *" it's the only instruction allowed**. Within this option, one can use the "WHERE" clause full will. Beware with errors.

Save

If we want to save the last query we just have to click `Save last consult…` in the bar menu item `File`.



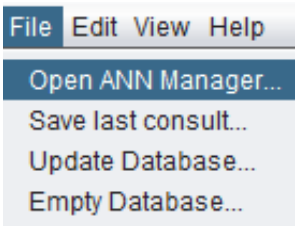
Once the save form is opened, the user just has to type or browse the local directory that wants to use. As can be seen, a file name is automatically proposed. Even though, the user can change it manually. Except if the last consult used some reference system (i.e. H or T reference).



The save algorithm uses tabs to separate the magnitudes.

Using Artificial Neural Networks

The application allows you to create and test artificial neural networks (ANN) with an additional panel that we can find in `Open ANN Manager…` in the bar menu item `File`.



This panel just allows forecast for the sea current data type. The neural network uses distance to the closest high tide (distH,), the time delta (dT) and the tide delta (dH) in this order as an input. The network uses regression over the training set to minimize the error rate (MSE) and outputs magnetic direction (heading) and speed.

The algorithm adds the magnetic deviation the real direction. Therefore the magnetic deviation field has to be updated in order to obtain the right magnetic direction.

Once in the ANN Manager, we find the following functionalities:

1. Load existing ANN

   Displaying the combo box we can choose any of our saved ANNs.

2. Create and train new ANN with the last database query

   We just have to come up with a new name and press `create`. The training should take some time because the algorithm will train the network exhaustively, probably in a reasonable time.

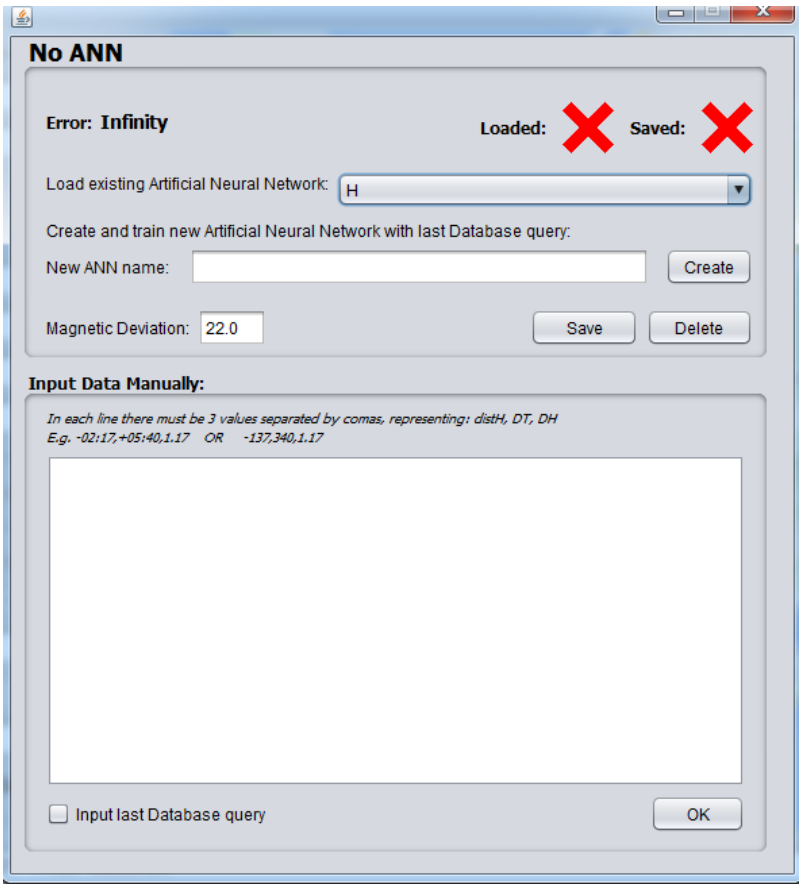
   The created ANN will be loaded after the training (but not saved).

3. Manage loaded ANN

   In this section several options are included. In one hand, we can save or delete the loaded ANN. It must be said that the user has to close the panel to make the changes effective. If the program is shut down without closing the panel, the changes won't be saved.

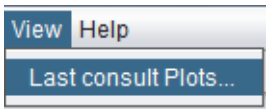
   On the other hand, we can test de ANN by inputting the data in the text area. Three values per line, separated by comas and with two possible formats: (+-)hh:mm, +hh:mm, number or number (interpreted as minutes), number (interpreted as minutes), number. Also, we can input the last database query by clicking the correspondent checkbox. As in this case we know the ideal output, the program calculates the set's error rate with the RMSE/RMSD formula and independently for speed and direction.

   Both methods can be used simultaneously.



View

Although this tool has a wide range of possibilities, it works automatically so the user just has to press `Last consult Plots…` in the bar menu item `View`.



Basically, the program will customize the plots according to the last query.

If the last query isn't empty, **there will always be two plots**. One for the direction and the other for the speed/intensity. In most of the queries the reference will be time sorted by day hours (0-24). If we filter the query by the high tide time reference, that will be the reference in the plot (exclusive for sea current data).

The plots are interactive so one can enlarge, copy, save… the information contained.