Emmanuel Poizot
Cnam/Intechmer
B.P. 324
50103 Cherbourg Cedex
Mail : emmanuel.poizot@cnam.fr

GiSedTrend
A QGIS plugin for Grain Size Trend Analysis

1 Introduction

GiSedTrend is a plugin of QGIS ready for Grain Size Trend Analysis (GSTA).
GSTA is a method which aim to determine transport pathways of sediment particles on water. For more informations about GSTA you can have a look to [Gao & Collins 1992] or [Poizot et al. 2008].

2 Getting starting with GiSedTrend

When you start GiSedTrend application, a dialog appears (see front page of this help). It contains four tabs: “GiSedTrend”, “Data”, “Settings” and “Outputs”. At start, only the two first tabs are enabled.

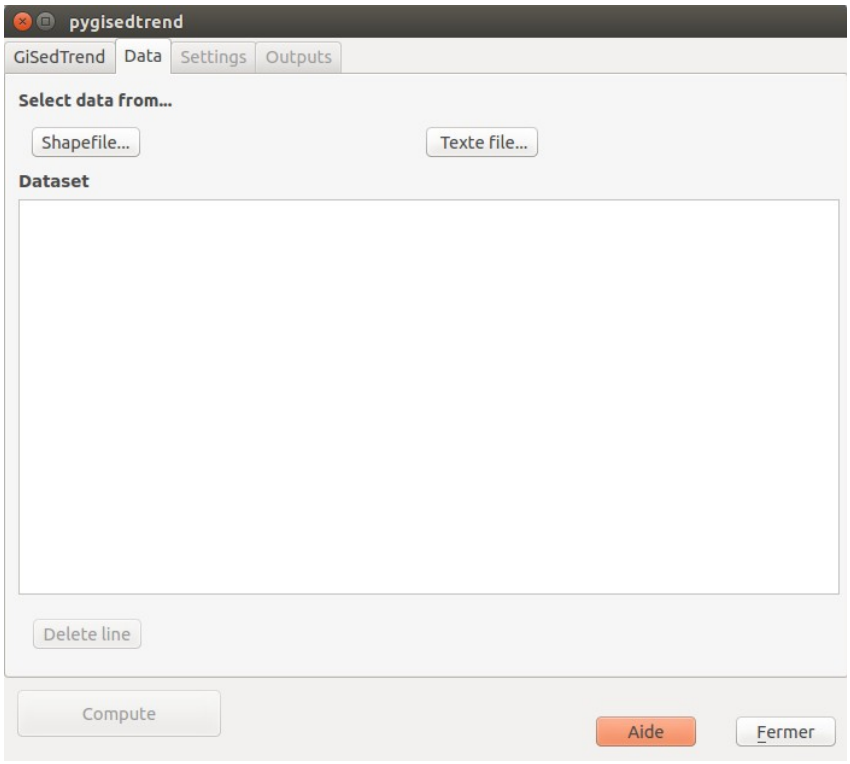


Figure 1: The "Data" tabs allows the user to enter a data set from both text file or shape file format.

The first thing to do, is to import a dataset which must contains location information, i.e. x,y or Longitude, Latitude, of sediment sample points and the corresponding sedimentological statistical parameters, i.e. mean, sorting and skewness. To do so, select the “Data” tab (Fig. 1). Two way are for instance available to import data :

- import of a text file containing the information (“Text file..,” button),
- selection of a shape file layer currently available in the QGIS working session (“Shapefile...” button).

Import from a text file

With an action on the “Text file...” button, a first dialog box appears asking to select a file. User is able to navigate along directories to select a file (.csv or .txt).
Once done, a new dialog box appears (Fig. 2).

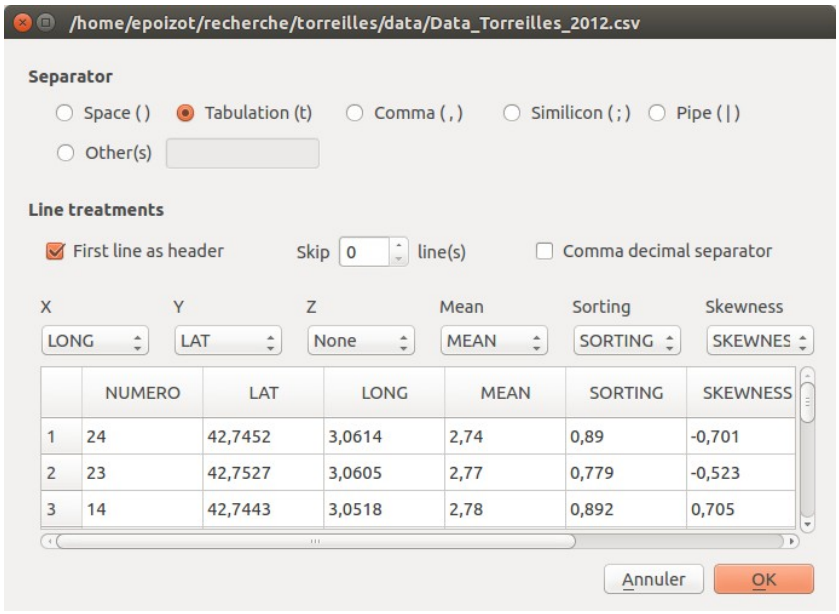


Figure 2: this dialog box analyze a text or csv file organization to load a GSTA data set. In the present example, settings have been set which allow a correct understanding of the content of the current file.

Text or csv files must follow the following rules:
- each imported line must contains the same number of fields,
- each fields must be separated by the same character all along the file.

In addition to this rules:
- the files can have the first line to read containing the headers of each fields (“First line as header” check box),
- a number of lines can be skipped at the beginning of the file (“Skip x lines”), zero is the default,
- decimal character can be either a point or a comma. Point is the default, if that's not the case, then check “Comma decimal separator”.

Each time one of the previous settings is defined, effects of the choice can be check in the tabular like area at the bottom of the dialog box. As an example, on the figure 2 shows an analysis of a csv file (Data_Torreilles_2012.csv). This file has it's fields separated by tabs and contains headers of the fields on it's first line. However, looking to the tabular like area at the bottom of the dialog box, it can be noticed that the decimal separator of the numbers is a comma, which can not be understand by GiSedTrend. By checking “Comma decimal separator” check box, the bottom dialog box is updated as shows in figure 3.

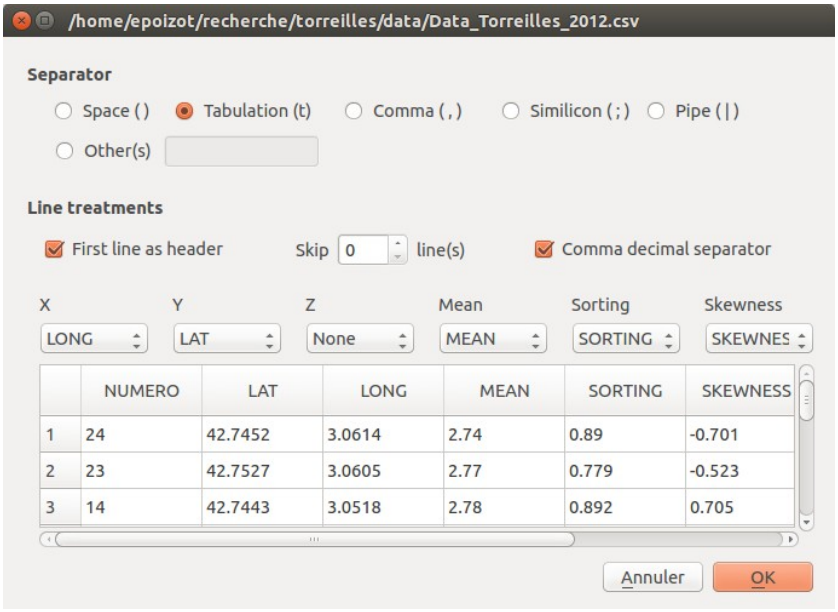


Figure 3: Updates of the dialog box after checking "Comma decimal separator". Notice commas replaced by points.

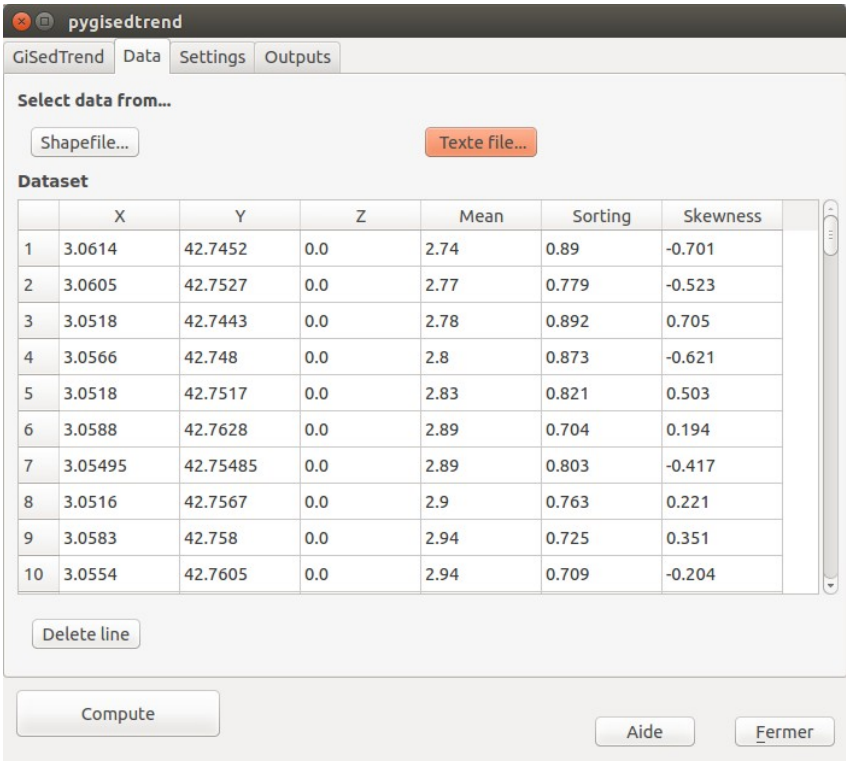
When the user settings allows a correct understanding of the file content, the “Ok” button can be pressed.
In the case of a text or csv file, the user is asking to choose the geodetic datum of the data set. The QGIS classical datum dialog box appears for this purpose.

Import from a existing shape file layer
With an action on the “Shapefile...” button, a first dialog box appears asking to select an ESRI file of shape file format (.shp). User is asked to navigate along directories to select the desire file.

Figure 4: Dialog box of shape file analysis. User is able to link attributes of the shape file with needed sttaistical parameters for GSTA.

When the user select a layer, a dialog box appear, showing a list of the attributes of the corresponding layer (“Shapefile attributes”) and a list of the three needed statistical parameters (“GSTA attributes”) (Fig. 4). The user needs to choose the name of a field in the

“Shapefile attributes” list and the name of a statistical parameter in the “GSTA attributes” list. To validate each choice, the user must press the down arrow. A confirmation of the choice is asked. Associations of the shape file fields and the corresponding statistical parameter are showed in the main area of the dialog box.
User is allowed to erase one links by selecting it and press the up arrow. The entire link list can be erase in one time by pressing the “Clear list” button.
Once the link list is built, an action on the “Ok” button, the QGIS classical datum dialog box appears to define datums of the current data set.
Notice that in the case of a shape file, coordinates are directly read from the file.



	X	Y	Z	Mean	Sorting	Skewness
1	3.0614	42.7452	0.0	2.74	0.89	-0.701
2	3.0605	42.7527	0.0	2.77	0.779	-0.523
3	3.0518	42.7443	0.0	2.78	0.892	0.705
4	3.0566	42.748	0.0	2.8	0.873	-0.621
5	3.0518	42.7517	0.0	2.83	0.821	0.503
6	3.0588	42.7628	0.0	2.89	0.704	0.194
7	3.05495	42.75485	0.0	2.89	0.803	-0.417
8	3.0516	42.7567	0.0	2.9	0.763	0.221
9	3.0583	42.758	0.0	2.94	0.725	0.351
10	3.0554	42.7605	0.0	2.94	0.709	-0.204

Figure 5: Example of the "Data" tab when a data set is loaded from both a text/csv file or an ESRI shape file .

At then end of the import process the “Data” tab is filled by the selected data set (Fig. 5). The user is able to check if everything is correctly imported and can eventually delete a line, if needed, by selected the desire line and press the button “Delete line” at the bottom of the dialog box.

3 Grain Size Trend Analysis with GiSedTrend

When data are imported, the GSTA computation can take place. When the “Settings” tab is selected, an information box indicate to the user the number of points taken into account for next computations.

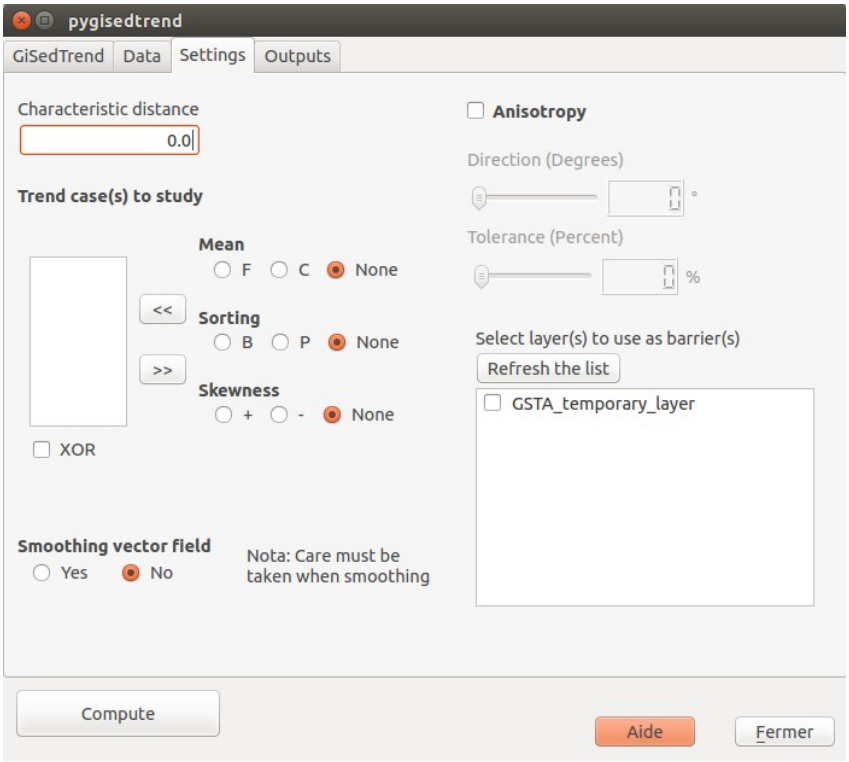


Figure 6: The "Settings" tab of GiSedTrend allows to define the characteristics to perform a GSTA analysis.

Characteristic distance

The first parameter to define is the characteristic distance (Fig. 6). If you are not aware with the meaning of that distance, you can find information in the following paper :

- *Poizot, E.; Méar, Y.; Thomas, M. & Garnaud, S. The application of geostatistics in defining the characteristic distance for grain size trend analysis. Computers & Geosciences, 2006, 32 (3), 360-370*

Trend case to study

Next choice is the trend case(s) to study (Fig. 6). Every kind of trend evolution mixing one, two or three parameters, can be perform using GiSedTrend.
For example, if you want to construct a trend vector field based on FB- trend case:
1- check “F” boxe, “B” boxe, and “-” boxe,
2- an action on “<<” button make the sentence “FB-” appear in the list on the left.
Repeat step 1 and 2 for each trend case you want to study at the same time.

Notice that if more than two trend cases are defined, the “XOR” (Exclusive OR) check box is enabled, allowing an “XOR” study. If you are not aware with the meaning of that parameter, you can find information in the following paper :

- *Poizot, E. & Méar, Y. Using a GIS to enhance grain size trend analysis Environmental Modelling & Software, 2010, 25, 513-525*

Smoothing the vector field

Gao and Collins (1991) suggested a procedure to remove the “noise” in the data. Noise is defined as vectors that are not in agreement with the general pattern (Gao et al.,1994).

This operation is provided here for convenience, but is not recommended in case of a characteristic distance defined through a geostatistical approach (see cited paper at page 2).

Define an "Anisotropy"

By default, vector computation use the characteristic distance as a half the diameter of a circle to select surrounding points parameters. When "Anisotropy" is checked, user is allowed to define both a main direction and a tolerance which will define characteristics of an ellipse to select surrounding points parameters. This features is explained in more details in the paper cited in previous page.

Define "barrier layers"

The main enhancement in GSTA approach provided by GiSedTrend, is it's capability to take into account environmental information, in particular, the existence of obstacles which stop or forbid sediment transports.

In the "Settings" tab (Fig. 6) a selection of one or more layers which are considered as "barriers" can be made. A list of available layers (layers that are currently loaded in the current QGIS project) is constructed. A check box in front each layer is present, and if checked, the layer will be taken into account during computations.

Compute vector field

When all the settings are defined, an action on the "Compute" button start the computation of the vector field. During the computation, a dialog box appears showing progression. At the end of the computation, the progress dialog box disappear and the results are stored in a temporary shape file named "GSTA_Temporary_Layer".

Visualization of the results

Once the computation is perform, you can close GiSedTrend dialog box. User can then select the "GSTA_Temporary_Layer" to perform the needed customizations.

"GSTA_Temporary_Layer" contains the following attributes : z, mean, sorting, skewness, angle, module and bestcase.

The "z" attribute is not use actually. It will be the object of a fiture enhancement of the GSTA method.

"mean", "sorting" and "skewness" are the repeated statistical parameters used.

"angle", "module" and "bestcase" are the results of the GSTA computation. The two first one are the characteristics of the vector computed at the point. The last one is the meaning of the computed vector. Classically "angle" and "module" are the two attributes used to draw an arrow at each sample location (Fig. 7).

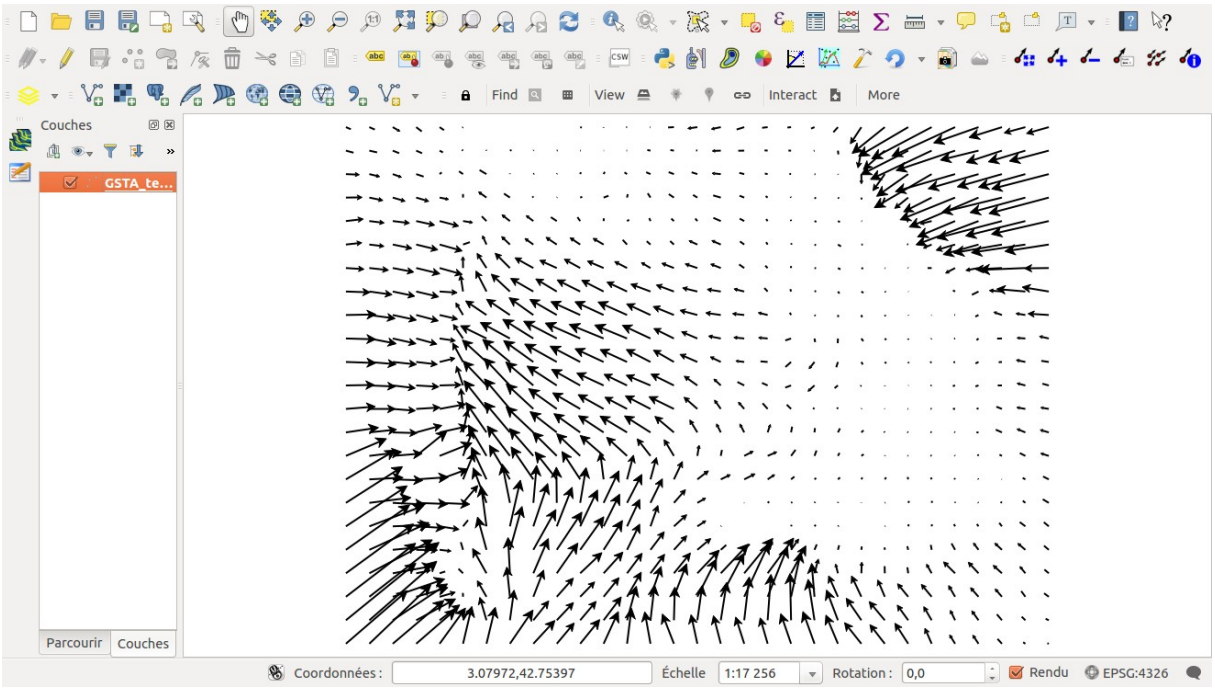


Figure 7: Example of an output after a GSTA computation.

4 Outputs with GiSedTrend

GiSedTrend plugin provide an “Outputs” tab into which the user can choose two ways for results outputs : an ESRI shape file format or a text file format (Fig. 8).

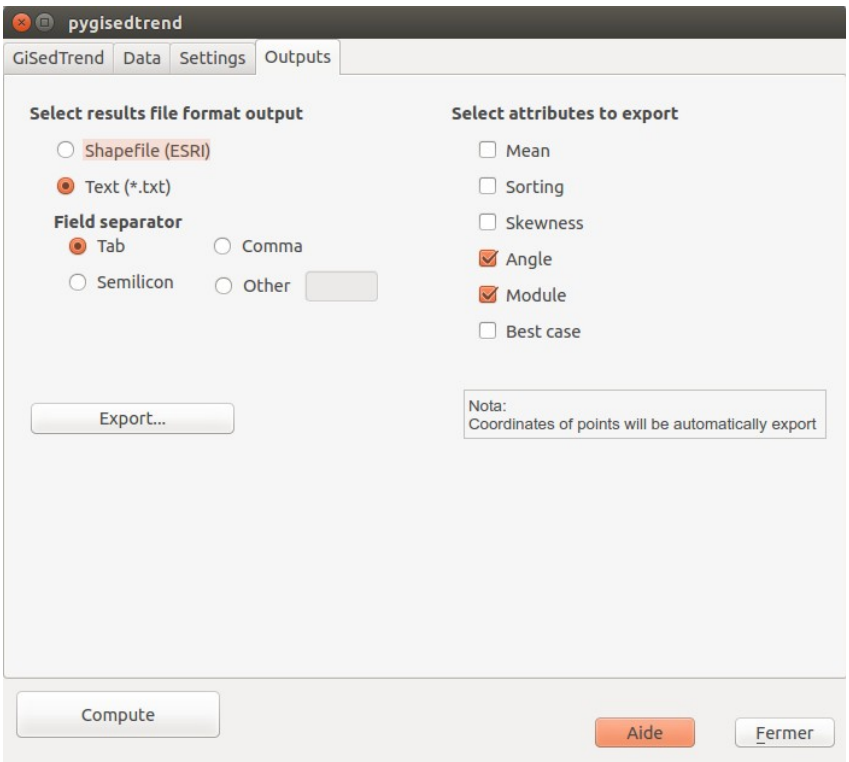


Figure 8: Outputs tab of the GiSedTrend plugin

In both cases alist of attributes can be exported (right of the dialog box). These settings are available for both text and shape file format.

In the particular case of the text format, a particular separator can be chosen for each field of the file.

When the “Export...” button is pressed, a classical dialog box appears asking to choose the name and the location of the result file.