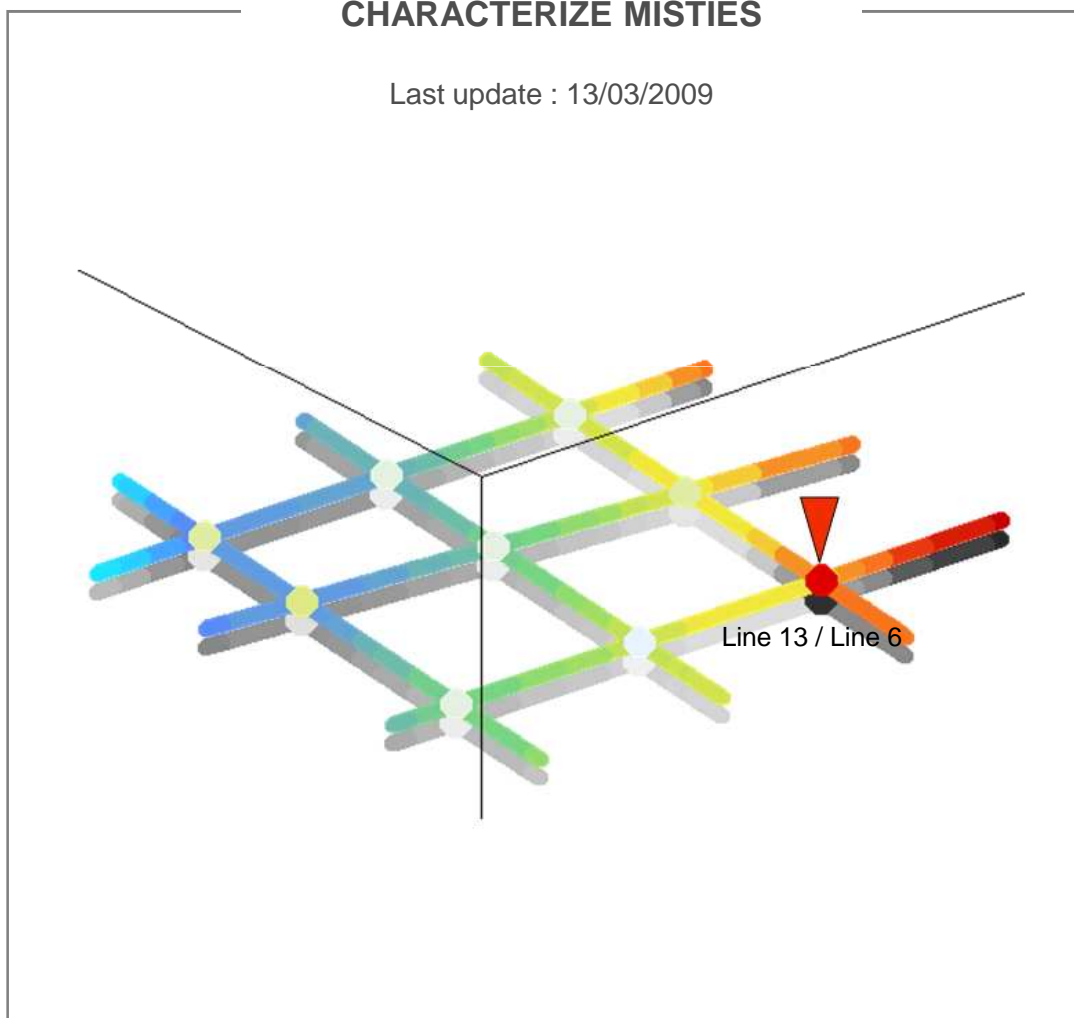


OIL & GAS / HOW TO...

CHARACTERIZE MISTIES

Last update : 13/03/2009

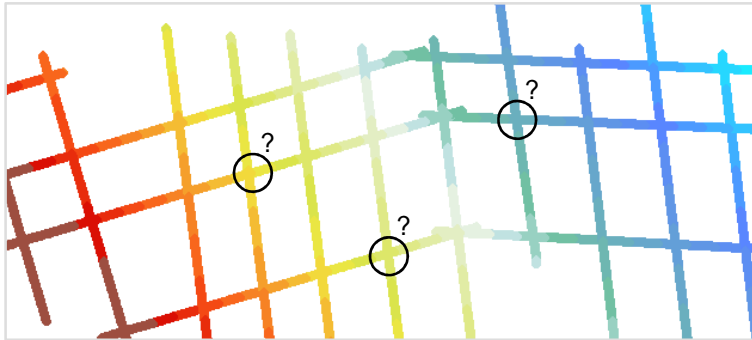


Keywords

Seismic lines, quick interpolation, linear kriging, misties.

Introduction

As acquisition and seismic processing parameters may differ from one seismic line to the other, 2D seismic data sets are often affected by misties, i.e. incoherencies at lines intersections.



Seismic Lines – Coherency at cross-points has to be checked

Here is described an **ISATIS solution for characterizing misties**.

The solution, based on a fast kriging technique, is illustrated for a part of a data set related to a seismic horizon interpretation.

This kind of solution can be applied in 3D, for example when dealing with seismic velocity lines.

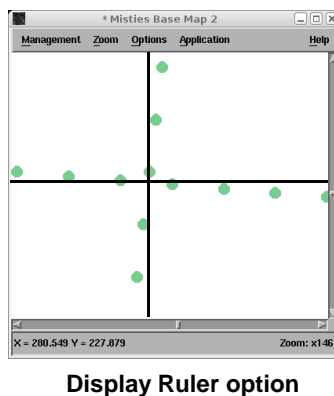
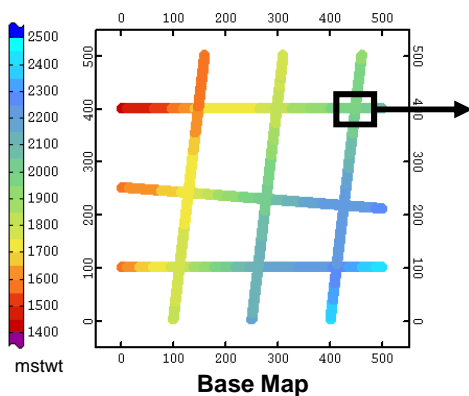
Description

Flowchart

1. Cross-points determination
2. Re-estimation at cross-points
3. Misties computation
4. Misties analysis

1. Cross-points determination

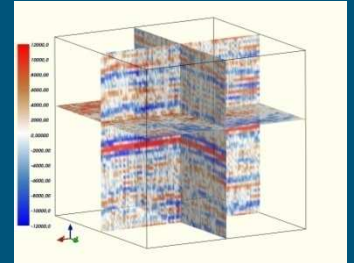
Cross-points (intersection points) can be determined graphically with the Display Ruler option in ISATIS. Their coordinates must be stored into a « text » file and loaded in ISATIS as a 2D point file. For large data sets, automatic determination is required.



ISATIS – CHARACTERIZE MISTIES

2D seismic data

Seismic lines that are acquired individually constitute a 2D seismic data set. In the 90's, 2D seismic has been overridden by more powerful 3D seismic techniques...



3D seismic data (2 sections and one time-slice)

Horizon picking

Seismic (reflexion) data are used to define the geometrical structure of the subsurface. In particular, some seismic horizons are picked, as they correspond to a geological contrast information.

It is sometimes difficult to ensure a good spatial coherency of the horizon picking results, especially when dealing with 2D seismic data sets.



Horizon picking

ISATIS +

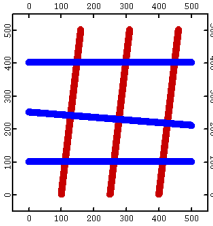
ISATIS is a geostatistical software which is not limited by any data support. ISATIS operates regular grids as well as irregularly sampled ("scatter") data sets.

The **EDA** (Exploratory Data Analysis) window offers powerful interactive tools to analyze scatter data sets. This is illustrated in the video :

http://www.geovariances.com/IMG/avi/Demo_EDA-3.avi

2. Re-estimation at cross-points

2.1. Selections

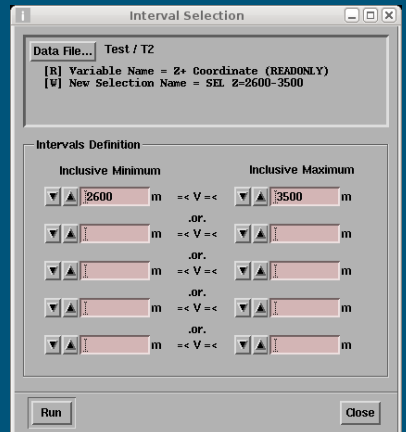


Consistent sets of lines - regarding orientation - must be defined. Generally, two selections are defined. But, it could be necessary to define more than two selections in the case of highly irregular orientation.

Lines selection

- Open Statistics / Exploratory Data Analysis
- Load line# variable*
- Compute the line# histogram
- Histogram calculation parameters: choose a number of classes higher than the total number of lines
- Build the base map
- Select consistent sets of lines by taking advantage of interactivity between base map and histogram
- Save lines selections

* Before loading data lines in ISATIS, check that each line is identified by a line number (variable: line#).



- Logical Operations Selection

using logical operations between selections.

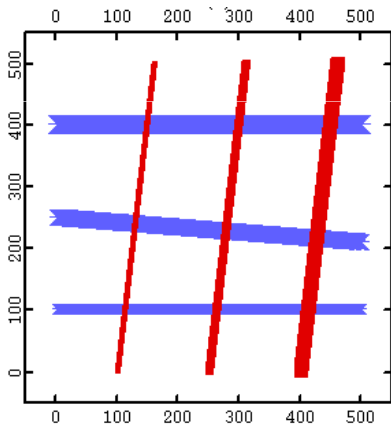
- Sampling Selection

according to samples' position in space.

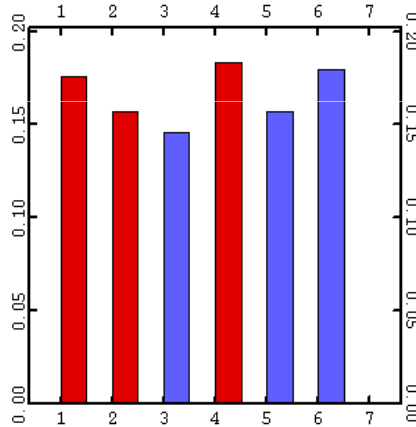
Re-estimation process

To check the consistency of data of different characteristics but sharing the same space, the straight way is to analyze the **difference between the data**. If not directly computable, this difference can be reached by a re-estimation process.

One must pay attention to the fact that the re-estimation process may not introduce a strong bias, leading to a non interpretable difference.



Base Map

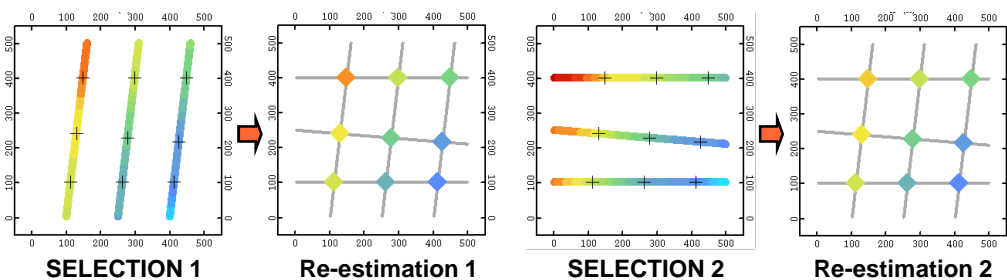


Line# histogram

SELECTION 1
SELECTION 2

2.2. Kriging with selections

The variable under study is re-estimated twice at cross-points locations. One re-estimation is performed using one lines selection as input and the other re-estimation is performed using the complementary lines selection.



SELECTION 1

Re-estimation 1

SELECTION 2

Re-estimation 2

Fast linear kriging is used as the re-estimation method. It is variogram-free and relatively robust method when facing continuous and dense data, as it is generally the case within a seismic data line.

(Fast) kriging with selections

- Open Interpolate / Quick Interpolation
- Input File... Data [SELECTION 1]
- Output File... Cross-Points/Re-estimation 1 (new variable)
- Neighborhood... Optimum number of samples: 10
- Interpolation Method: Linear Model Kriging

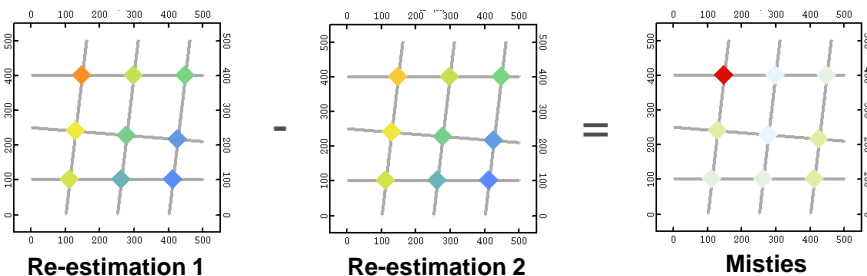
Apply the same procedure using SELECTION 2.

3. Misties computation

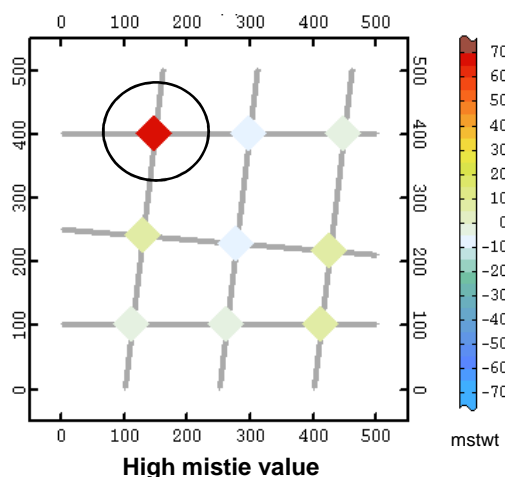
Misties are computed by making the difference between re-estimation results (Re-estimation 1 - Re-estimation 2).

Misties computation

- Open File / Calculator
- Data File...
 - v1 = Re-estimation 1
 - v2 = Re-estimation 2
 - v3 = Mistie (new variable)
- Transformation: $v3 = v1 - v2$



4. Misties analysis

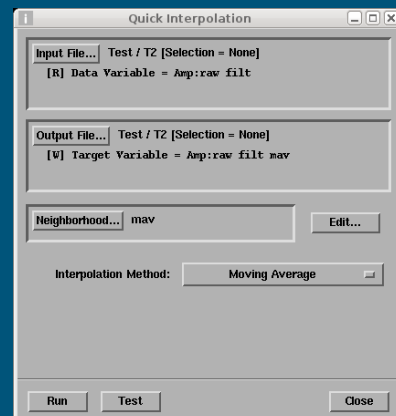


Visual inspection is the first analysis level. Anomalies may be distributed randomly or grouped on one or several isolated lines. In the last case, correction is applied easily.

In presence of large data sets, statistical tools can be used to detect or to characterize high mistie values.

ISATIS +

As a complement to advanced kriging algorithms, ISATIS implements more than ten different interpolation methods. They are grouped into the **Quick Interpolation** panel.

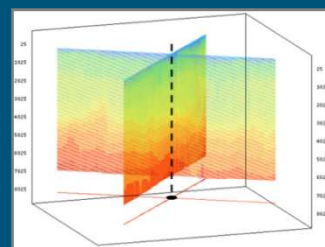


List of quick interpolation methods:

- Linear Model Kriging
- Spline Model Kriging
- Inverse Distances
- Nearest Neighbor
- Least Square Polynomial Fit
- Moving Average
- Moving Median
- Moving Projected Slope
- Discrete Splines
- Bilinear Grid Interpolation
- (Number of Neighborhood Points)

Velocity data sets

The solution described here for a 2D data set can be applied for 3D data sets such as velocity data sets for example. Misties are then analyzed on vertical intersection lines.



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