Geostatistics in the SPRING
Exercise 2

Course: Master of Science on Geospatial Technologies
Professor: Carlos A. Felgueiras

Contents

3 Modeling spatial variable considering isotropic behavior

3.1 Performing exploratory analysis in the original samples

- Select, in the **Control Pan**el, the InfoLayer (IL) *pts_originais* of the category *Altimetria*.
- In the **Análysis menu** of the SPRING choose the **Geoestatístics** option and, following, choose the **Exploratory Analysis** option.

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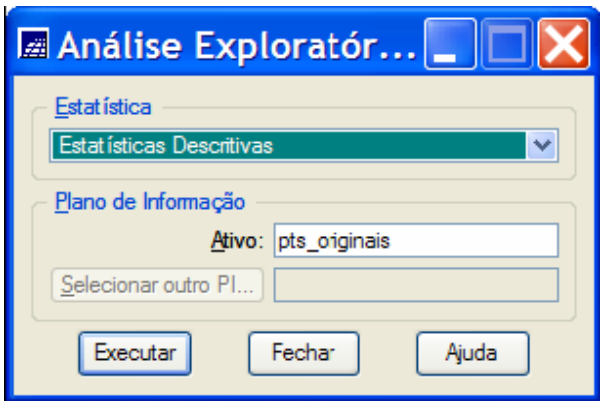
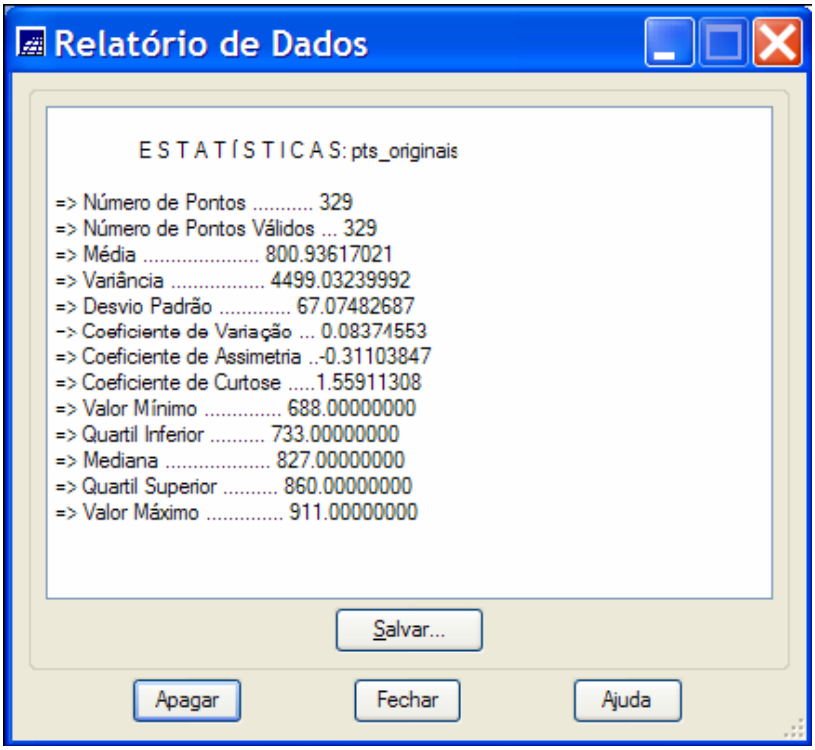
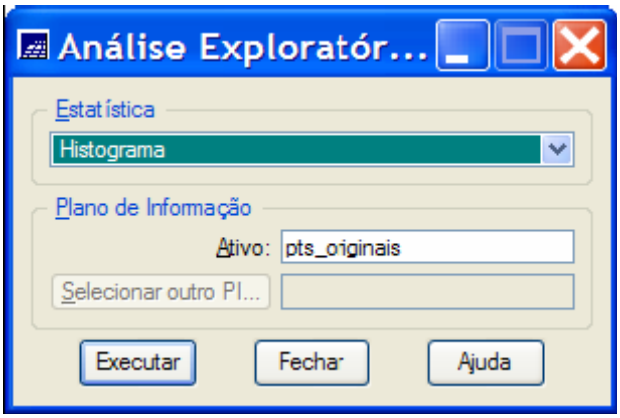


- Generating the report of statistic summaries for the pts_originais data
  - Select the **option**: *Descriptive Statistics*.
  - Click on the *Apply* **button**.
  - The figure below shows the *report of the statistic summaries* calculated for the InfoLayer pts_originais.

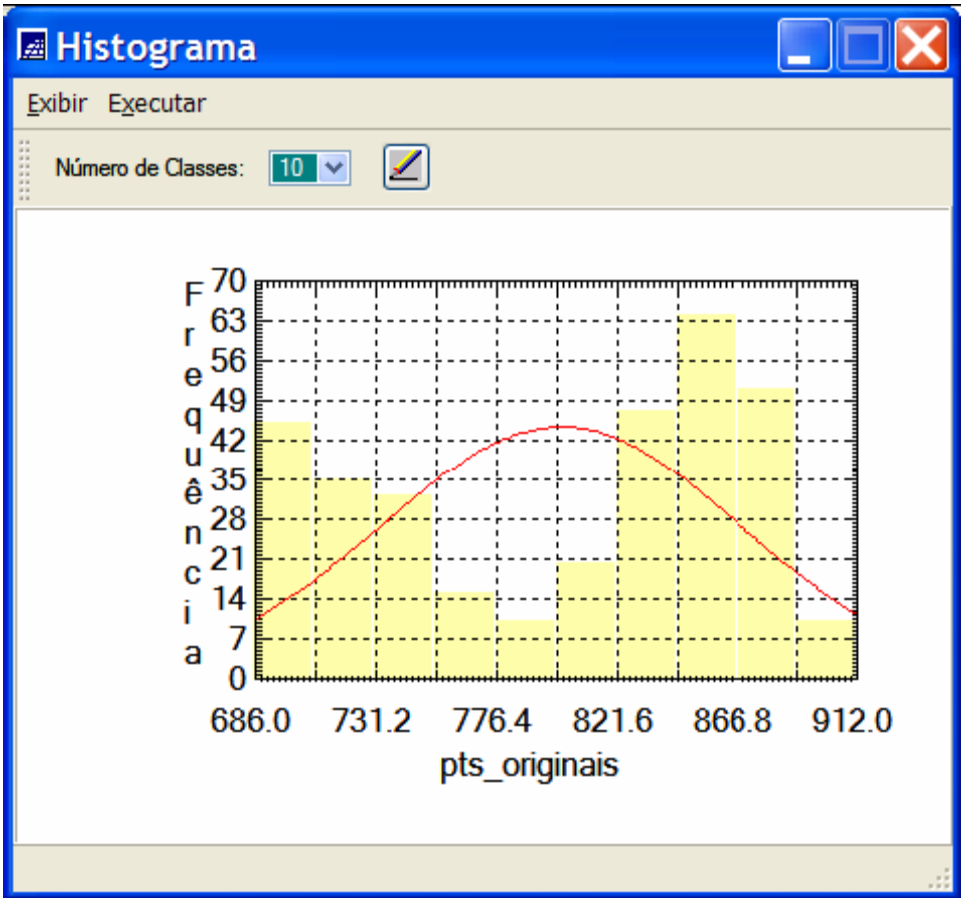


o Visulising the data Histogram

- In the same Exploratory Analysis window select the **option** *Histogram*
- Click on the Apply **button**

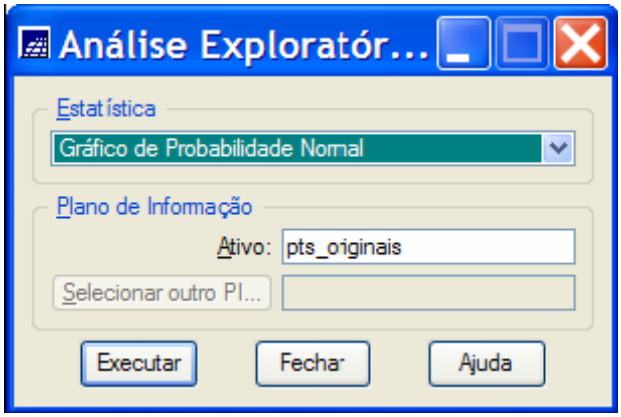


- The figure below shows the *histogram graph* for the data of the pts_originais InfoLayer

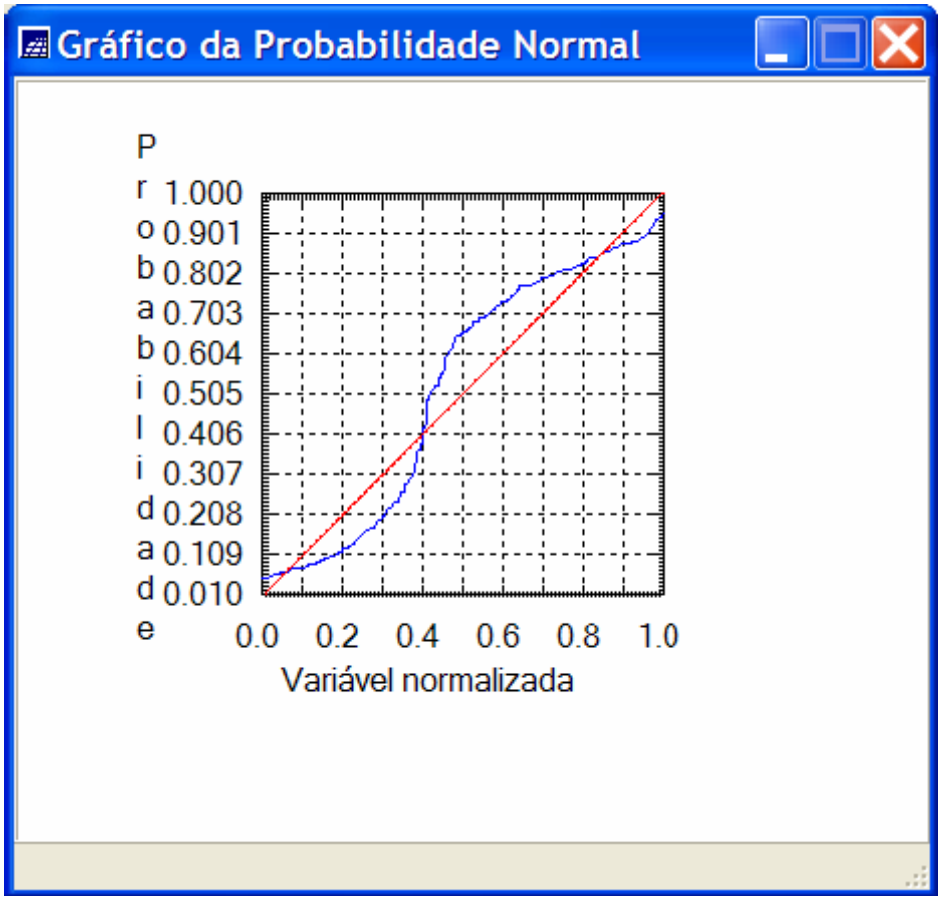


o Visualizing the Normal Probability Graph

- In the same Exploratory Analysis window select the **option** *Normal Probability Plot*.
- Click on the *Apply* **button**.



• The figure below shows the *Normal Probability graph* for the data of the pts_originais InfoLayer



3.2 Performing exploratory analysis in the without tendency point samples

0 Select, in the Control Panel, the InfoLayer (IL) *pts_semtendencias* of the category *Altimetria*.

0 In the *Analysis* **menu** of the SPRING choose the *Geoestatísticos* **option** and, following, choose the *Exploratory Analysis* **option**.

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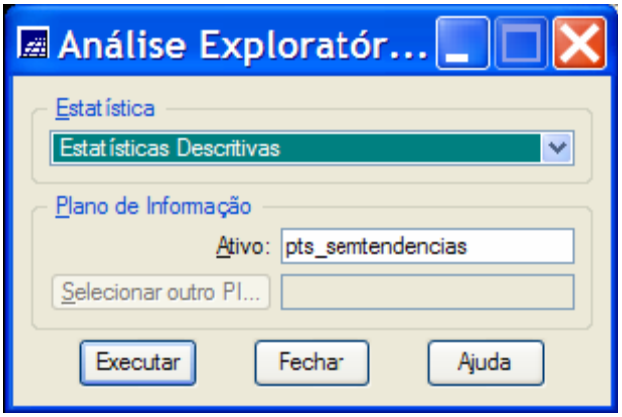
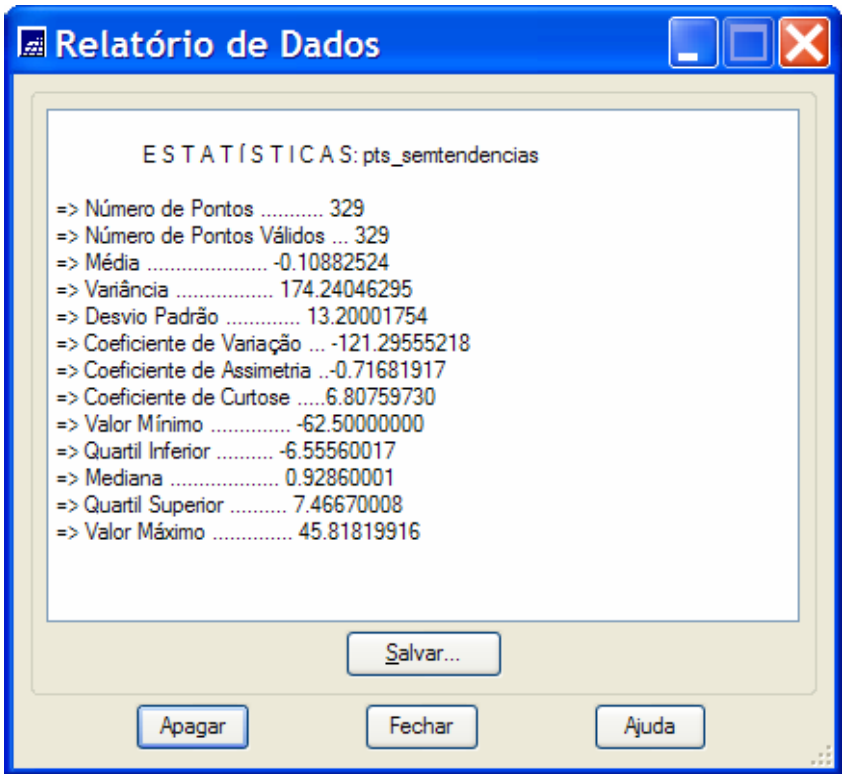


o Generating the report of statistic summaries for the pts_semtendencias data

• Select the option: *Descriptive Statistics*.

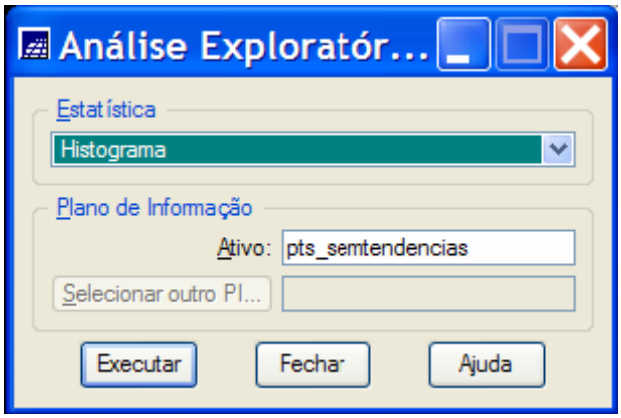
• Click on the *Apply* **button**.

• The figure below shows the *report of the statistic summaries* calculated for the InfoLayer pts_semtendencias

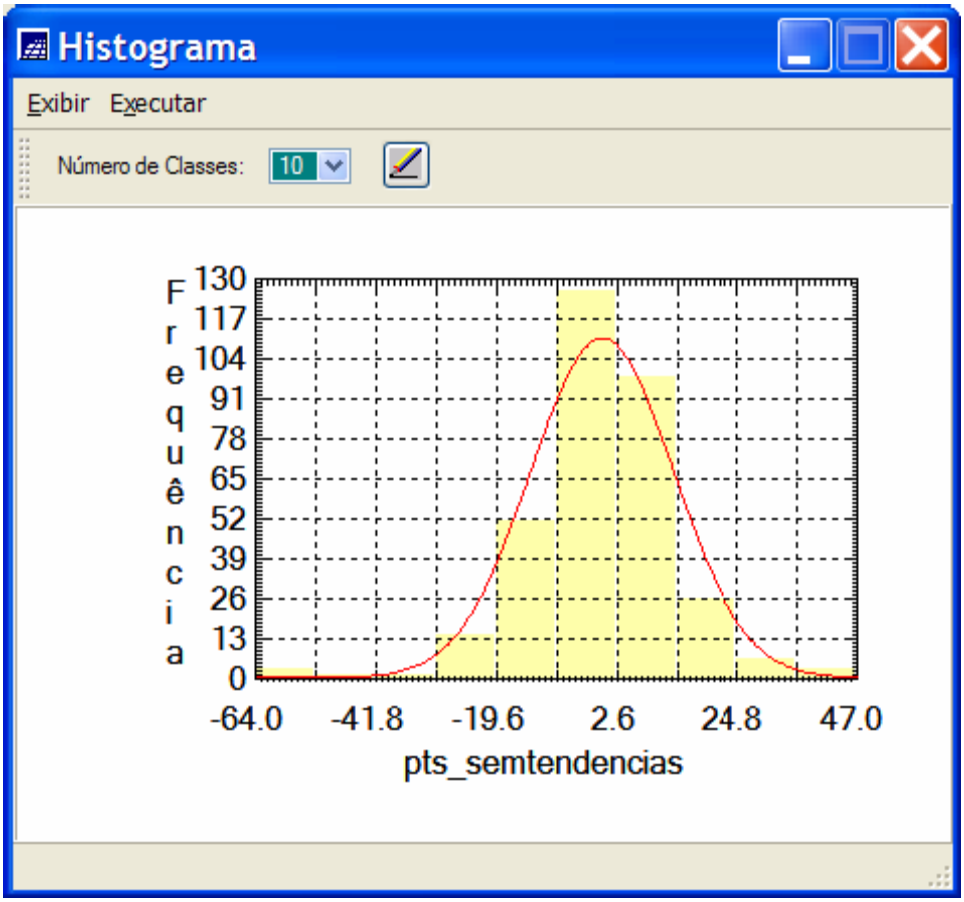


o Visualizing the Histogram of the data

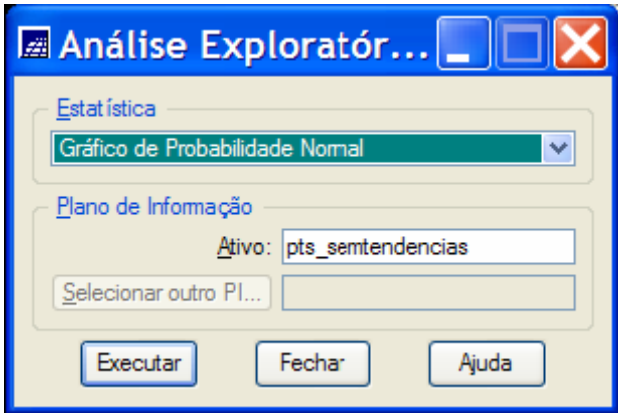
- In the same Exploratory Analysis window select the **option**: *Histogram*.
- Click on the *Apply* **button**.



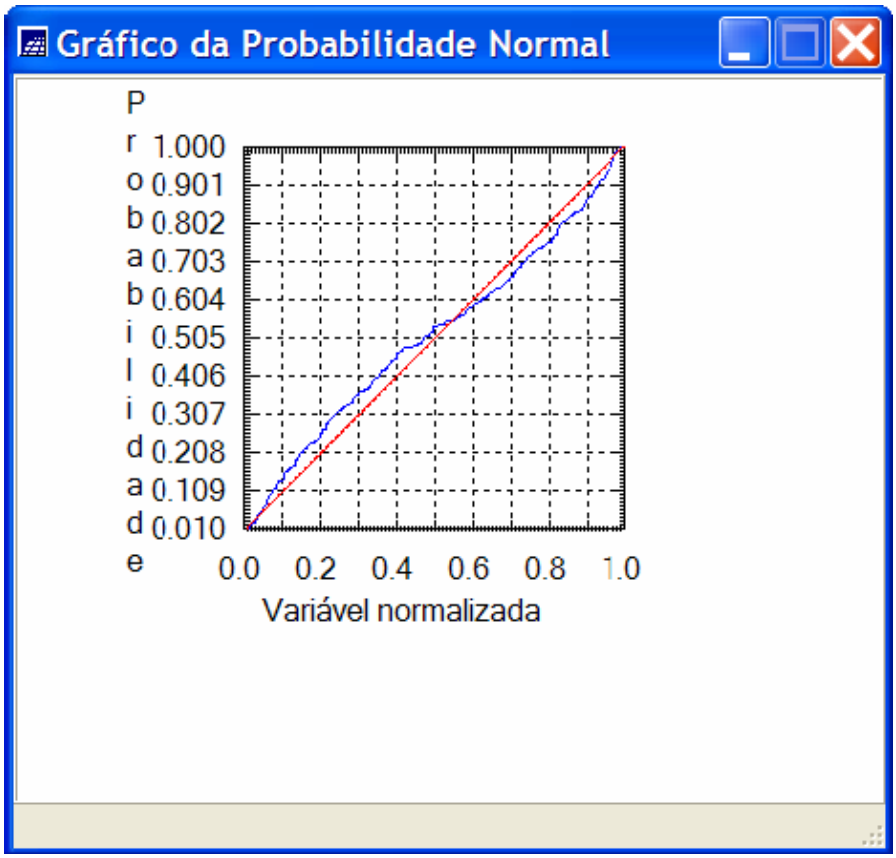
- The figure below shows the *histogram graph* of the data in the InfoLayer pts_semtendencias.



- Visualizing the Normal Probability Graph
    - In the same Exploratory Analysis window select the **option** *Normal Probability Plot*.
    - Click on the *Apply* **button**.



• The figure below shows the *Normal Probability graph* for the data of the pts_semtendencias InfoLayer



IMPORTANT: PERFORM A COMPARATIVE ANALYSIS FOR THE TWO EXPLORATORY ANALYSIS WITH INFOLAYERS: pts_originais e pts_semtendencias

3.3 Generating omnidirectional experimental semivariograms for the original points

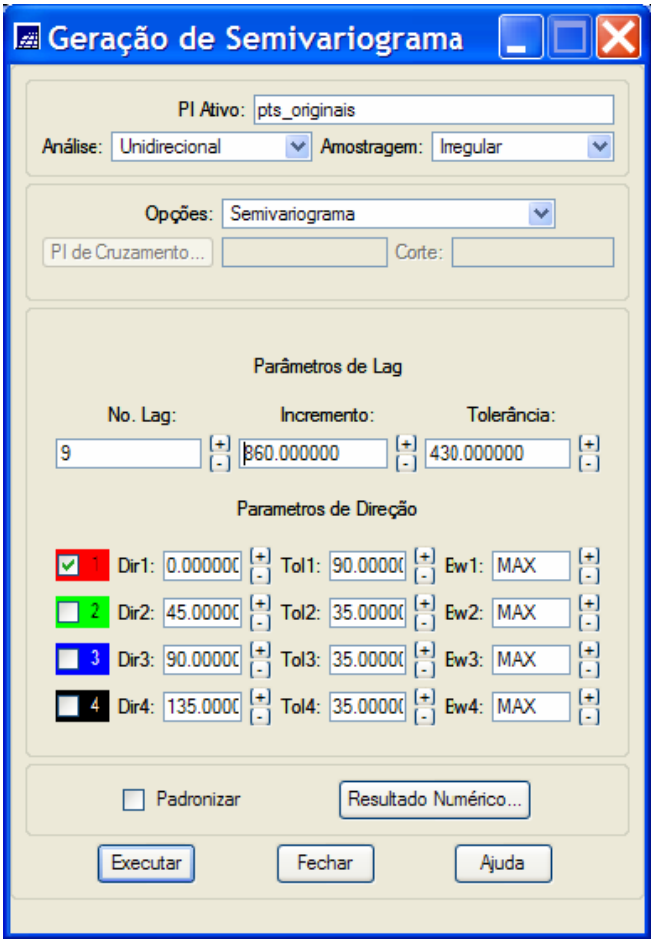
o Select, in the Control Panel, the InfoLayer *pts_originais* of the category *Altimetria*.
o In the *Analysis* **menu** of the SPRING select the **option** *Geoestatistics* and, following, select the **option** *Semivariograma Generation...*
o Visualizing the experimental semivariogram taken from the original data.

• In the window Semivariogram Generation select the **option** *Unidirectional* as the **Analysis**:

• Select the option *Irregular* for the **Sample field**

• Select the option *Semivariogram* for the **Options field**

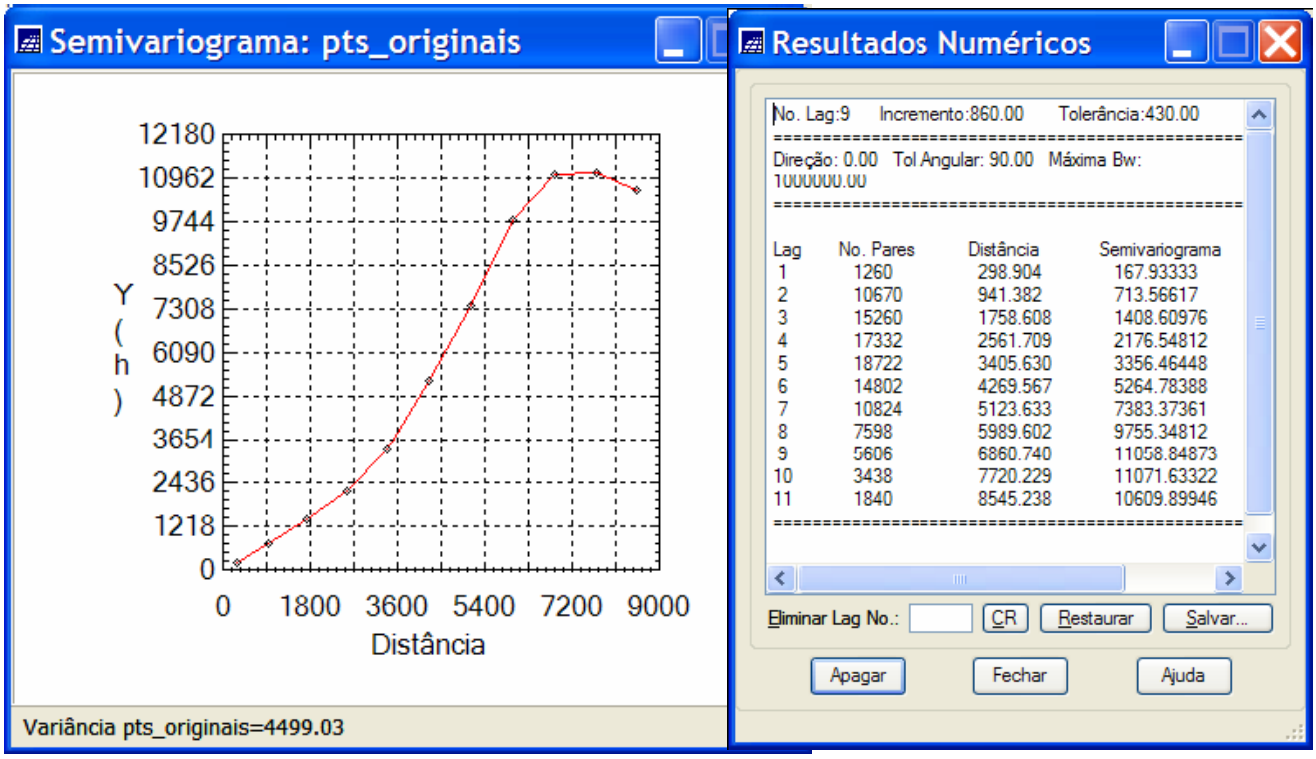
• Create the unidirectional semivariogram setting, in this window, the following distance and direction parameters: Number of lags (**No lags**) equal *9*, Spatial **Increment** equal *860*, Spatial **Tolerance** equal *430*, Angular Direction **(Dir1:**) equal *0* degrees, Angular Tolerance (**Tol1:**) equal *90* degrees and Bandwidth (**Bw1:**) equal *Max*.



• Click on the *Apply* **button** to show the semivariogram graph generated from the given parameters. Change the current distance and directions parameters in order to create new semivariograms better the already created. Use qualitative visual criteria to compare the variograms.

• Observation: Click on the **button** *Numeric Result…* to display a numeric report related to the experimental semivariogram values (*lag, No. pairs, distance and* $\gamma(h)$). In this window pay attention mainly to the $\gamma(h)$ values obtained with few pair of points.

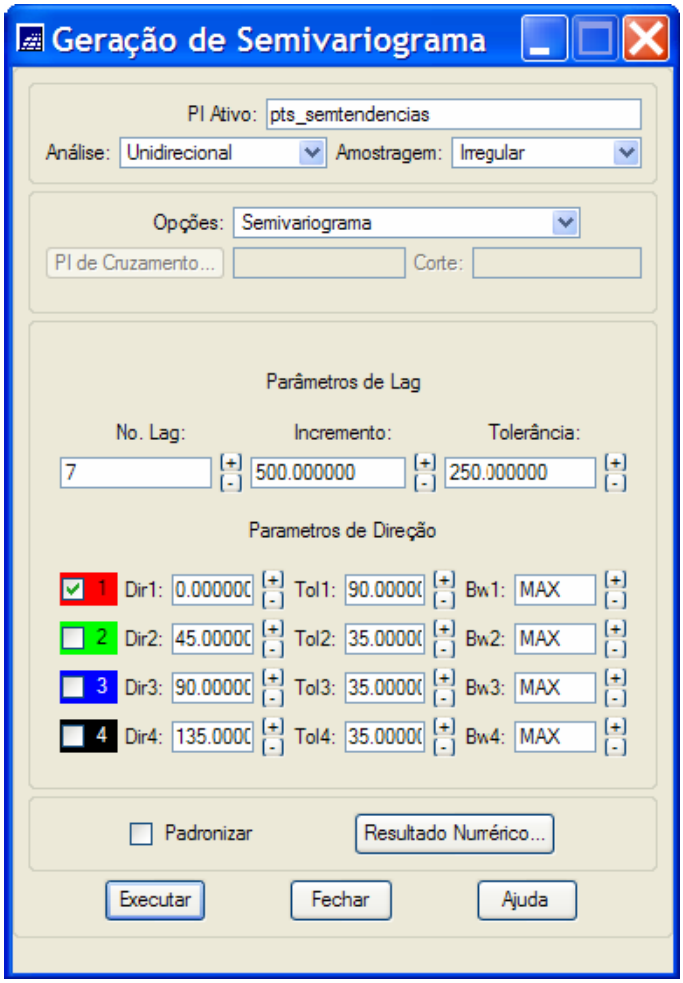
• The figures below shows the semivariogram graph and numerical results created from the user defined parameters.



• **Important: Perform visual and quantitative analysis in the above semivariogram. What is approximately its sill value? Compare this sill value with the global variance value of the data. Observe the nugget and range values. Compare the value of the range with the length of the region we are studing (7km x 10km). What is your opinion about the range value of the above semivariogram?**

3.4 Generating omnidirectional experimental semivariograms for the points with no tendencies

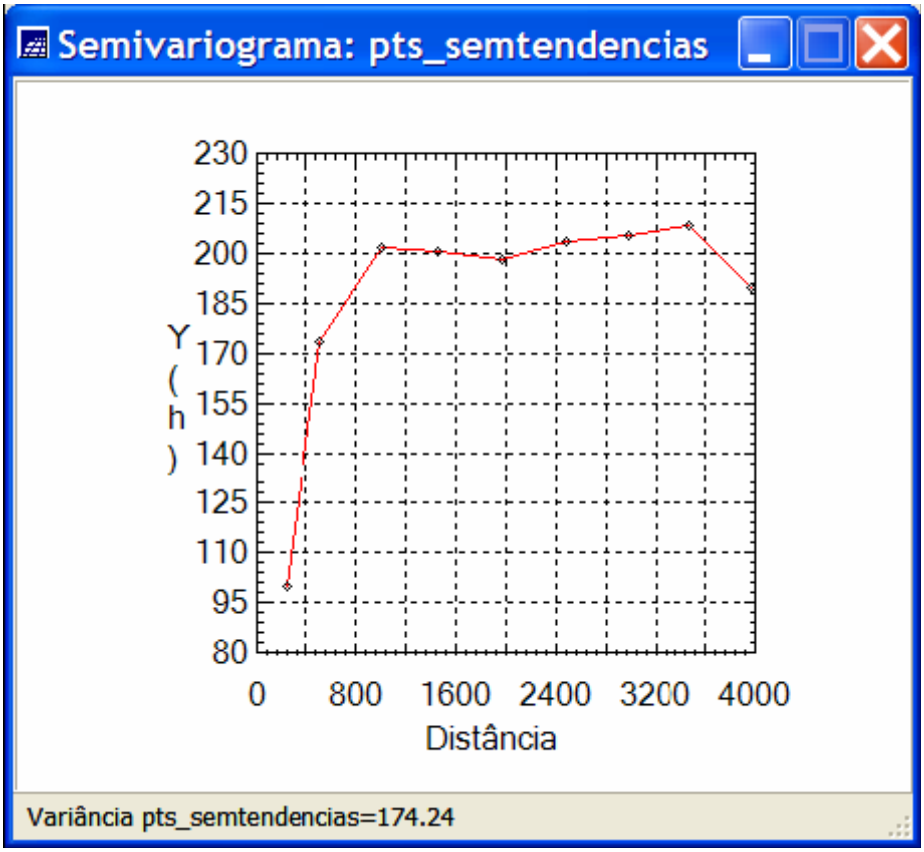
- o Select, in the Control Panel, the InfoLayer *pts_semtendencias* of the category *Altimetria*.
- o In the *Analysis* **menu** of the SPRING select the **option** *Geoestatistics* and, following, select the **option** *Semivariograma Generation...*
- o Visualizing the experimental semivariogram taken from the original data.
  - • In the window Semivariogram Generation select the **option** *Unidirectional* as the **Analysis**:
  - • Select the option *Irregular* for the **Sample field**
  - • Select the option *Semivariogram* for the **Options field**
  - • Create the unidirectional semivariogram setting, in this window, the following distance and direction parameters: Number of lags (**No lags**) equal *7*, Spatial **Increment** equal *500*, Spatial **Tolerance** equal *250*, Angular Direction **(Dir1:**) equal *0* degrees, Angular Tolerance (**Tol1:**) equal *90* degrees and Bandwidth (**Bw1:**) equal *Max*.



• Click on the *Apply* **button** to show the semivariogram graph generated from the given parameters. Change the current distance and directions parameters in order to create new semivariograms better the already created. Use qualitative visual criteria to compare the variograms.

• Observation: Click on the **button** *Numeric Result…* to display a numeric report related to the experimental semivariogram values (*lag, No. pairs, distance and* $\gamma(h)$). In this window pay attention mainly to the $\gamma(h)$ values obtained with few pair of points.

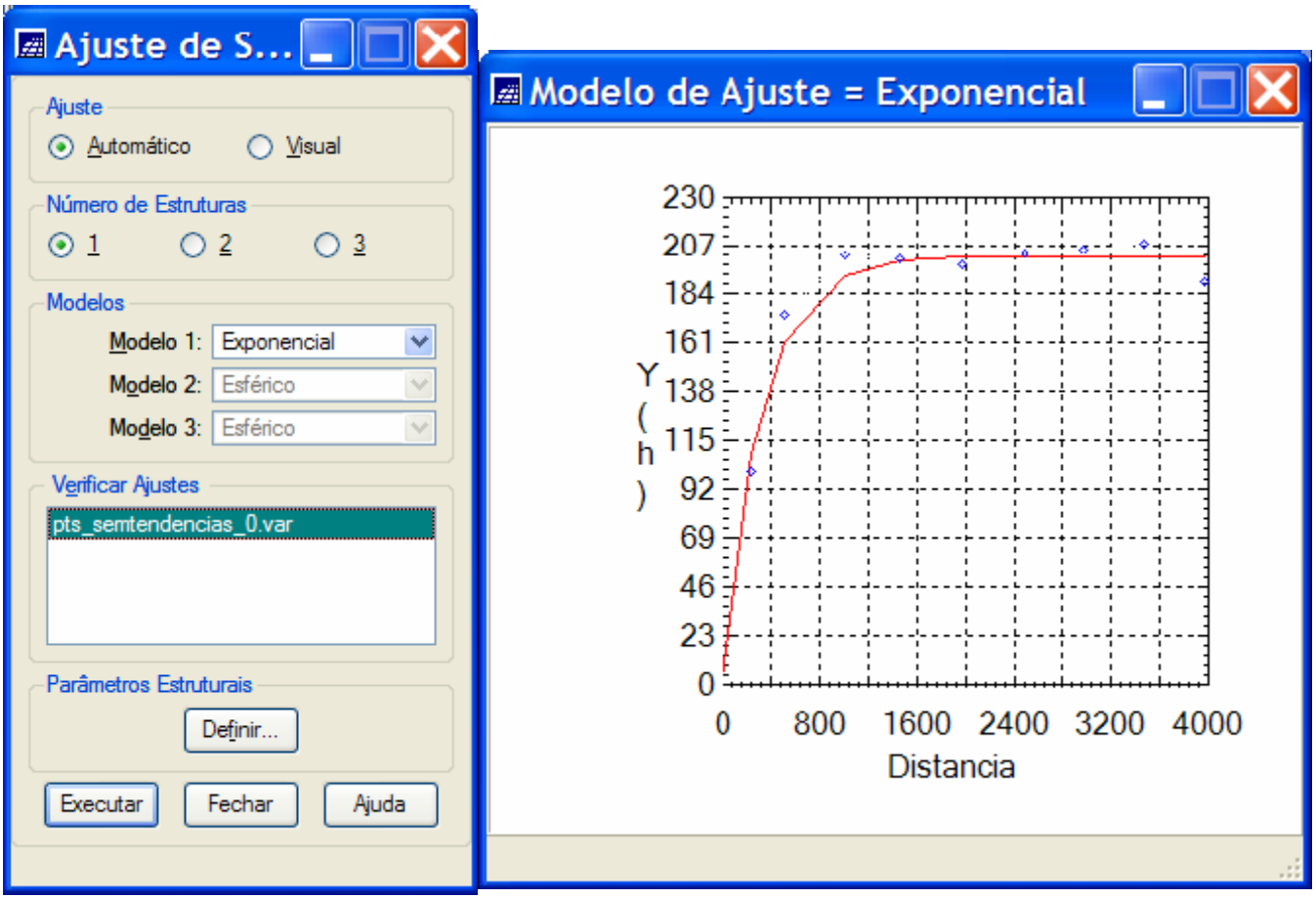
• The figures below shows the semivariogram graph and numerical results created from the user defined parameters.



• **Important: Perform visual and quantitative analysis in the above semivariogram. What is approximately its sill value? Compare this sill value with the global variance value of the data. Observe the nugget and range values. Compare the value of the range with the length of the region we are studing (7km x 10km). What is your opinion about the range value of the above semivariogram?**

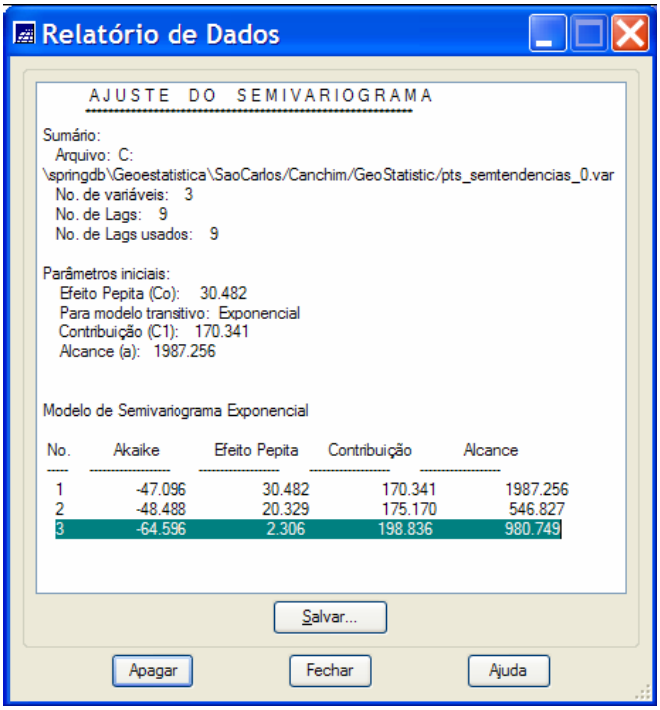
3.5 Fitting theoretical semivariograms into the experimental ones

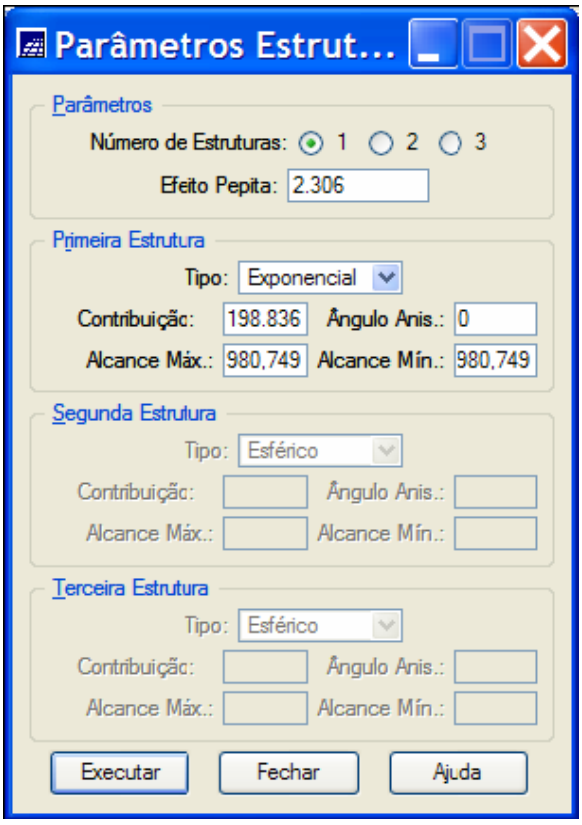
- Select, in the Control Panel, the IL *pts_semtendencias* of the category *Altimetria*.
- In the *Analysis* **menu** of the SPRING select the **option** *Geoestatistics* and, following, select the **option** *Semivariogram Modeling*
- Visualizing Fitted Semivariogramas for the data of the pts_semtendencias Info Layer.
  - Select *Automatic* as the **Adjust option** in the Semivariogram Modeling window
  - In this same window select **Number of Structures** equal *1* and *Exponential* for the **Model option**.
  - Click on the **button** *Apply* .
  - Click on the semivariogram name that appears in the Adjust Verification list to show the graph of the fitted semivariogram got with the defined model parameters.
  - Change the parameter values to obtain different theoretical semivariograms until you find a satisfactory result. Perform qualitative analysis (visual) and quantitative analysis using the data report presented along with the fitted semivariograma graph.



• Click on the *Define...* **button** in the Semivariogram Modeling window to open a new window where the user will store the final parameters of the semivariograma model.

• The Nugget Efect, Contribution and Range parameters are reported in the last line (see highlighted line below) of the values presented in the Data Report window.





• The Structural Parameters window must be filled out with:

Number of Structures equal *1*

- **Nugget Effect** igual to *2.306*

- For the first structure fields, because we have only one structure,:

Choose *Exponential* as the Structure **Type**.

Fill out **the Contribution** field with the value *198.836*

Fill out the **Anis. Angle** (anisotropy angle) field with the value *0*.

Fill out the **Max Range** (maximum range) field with the value *980.749*.

Fill out the **Min Range** (minimum range) field with the value *980.749*.

• Click on the Apply button of the window Structural Parameters in order to store the above information related to the theorectical (modeled) semivariogram.

IMPORTANT: To define a semivariograma to the IL pts_originais repeat the sections 3.4 and 3.5 selecting the pts_originais in the Control Panel.or you can use the same variogram model you got for the pts_semtendencia. What do you think about this?