

# MDTop User's Manual



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## Contents:

<b>1.</b>	<b>Introduction</b>	<b>5</b>
1.1.	What is MDTop?	5
1.2.	User's Interface	6
1.3.	Application Menus	9
1.4.	Toolbar MainTool	16
1.5.	Toolbar MdtopTool	17
1.6.	Toolbar Palette	18
1.7.	Toolbar Visualization	20
1.8.	Toolbar Triangulation Edition	21
1.9.	Toolbar Triangulation Plus Edition	22
1.10.	Status Bar	23
1.11.	Fast Keys with Associated Operations	24
<b>2.</b>	<b>Tools</b>	<b>27</b>
2.1.	Triangulation	27
2.2.	Contours map	30
2.3.	Profiles	35
2.4.	Volume	46
2.5.	Check DTM	50
2.6.	Project over DTM	52
2.7.	Grid	55
2.8.	Hypsometrical Colour Map	57
2.9.	Shading Map	62
<b>3.</b>	<b>Tools from the Command Line</b>	<b>65</b>
3.1.	Introduction	65
3.2.	Triangulation from the Command Line	66
3.3.	Contours from the Command Line	67
3.4.	Profiles from the Command Line	70
3.5.	Volume from the Command Line	78
3.6.	Project over DTM from the Command Line	83

3.7.	Check DTM from the Command Line	84
3.8.	Grid from the Command Line	85
3.9.	Hypsometrical Tints Map from the Command Line	87
3.10.	Shading map from the Command Line	89
<b>4.</b>	<b>Triangulation Edition Tools</b>	<b>91</b>
4.1.	Erase inside or outside Limits	91
4.2.	Calculate Limit of Triangulation	92
4.3.	Erase Triangles by Side Length	92
4.4.	Clean Triangulation	93
<b>5.</b>	<b>File Operations</b>	<b>95</b>
5.1.	Import GTOPO30 Files	95
5.2.	Export GTOPO30 Files	97
5.3.	Export BIN or DXF Files	98
5.4.	Export DEM or ASCII Files	99
5.5.	Open Reference Files	100
<b>6.</b>	<b>Other Tools</b>	<b>103</b>
6.1.	Dialog Box List of Codes	103
6.2.	Dialog Box Drawing Document Information	105
6.3.	Dialog Box Triangulation Document Information	105
6.4.	Dialog Box Entity Information	105
6.5.	Dialog Box Triangle Information	106
6.6.	Dialog Box 3D View	106
6.7.	Dialog Box Toolbar	107

## 1. Introduction

### 1.1. What is MDTop?

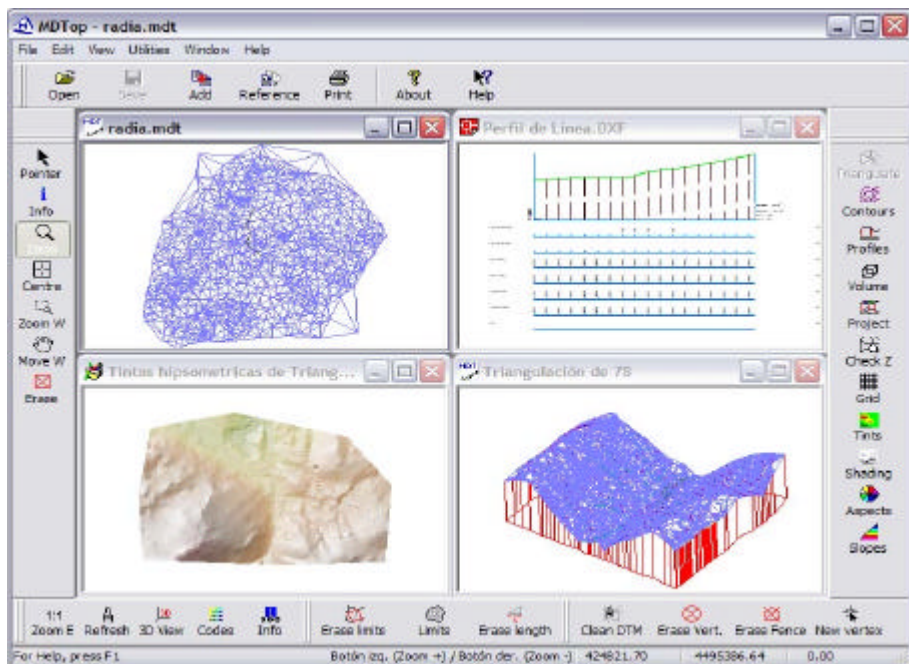
The program MDTop is designed to generate digital terrain models, to be later used within the realm of mapping and engineering.

The program calculates a digital model out of points coming from cartographic or topographic files, storing it in a special format where the neighbouring relationships between the different points are saved. Moreover, it is possible in this format to store and retain the possible breaklines defining the ground.

The input / output files valid for the program are: DIGI files, DXF files, DGN files, ASCII files and TopCal and TopCal 21 files.

The program allows generation of TIFF files with the hypsometrical colour maps or shading of the zone's relief. In like manner, it allows generation of digital models based on a regular grid, as well as exportation to different digital model formats, such as the MTN 25 of the Instituto Geográfico Nacional or the GTOPO30 of the USGS.

## 1.2. User's Interface



The appearance of the program is that of a drawing multi-document application with palettes of floating tools, command bars, status bar and menus on the upper portion of the window.

The most commonly used commands for fast execution are to be found in the command bars. The ones that are included in these bars show a representative icon with the corresponding function. By placing the mouse pointer lightly over each icon, the program will show the name of the associated command. By pressing with the mouse pointer over the icon, the command will be executed. The included toolbars are:

- Toolbar Maintool

- Toolbar MdtopTool
- Toolbar Palette
- Toolbar Visualization
- Toolbar Triangulation Plus Edition

In the status bar, information will be available about the selected tool, as well as request messages from the program to the user.

Also the cursor's coordinates are offered. If the current document is a digital terrain model, the coordinates will be offered in real time. If the document is a TIFF file, it will offer the pixel colour.



## 1.3. Application Menus

The menus showing up on the upper portion of the window, below its name, are as follows:

- **File:**
  - **Open:** It opens an existing document. The types of documents MDTop accepts are:
    - DTM: MDTop's own files containing a digital terrain model.
    - BIN: DIGI's drawing files.
    - DXF: AutoCad exchange drawing files.
    - DGN: MicroStation drawing files.
    - PTS: TopCal control point files.
    - TIF: Files with raster images of TIFF format.
    - ASC: Files of ASCII format with a listing of X, Y, Z coordinates.
  - **Close:** It closes the current document.
  - **Save:** It saves the current document. If the document had not been saved earlier, the program will open the Windows' explorer to indicate a name and a destination folder. This option will only be active if the document was modified.

- **Save as:** It saves the current document with a different name or destination folder than the current ones. The program opens the Windows' explorer to indicate the name and the destination folder.
- **Add file:** It combines existing files with the current one. In the case of an active digital model, it is only possible to add this same type of file to it. In the case of an active drawing file, BIN, DXF or DGN drawing files can be added to it. The program will open the Windows' explorer for selection of the files to be added. In this dialog box, a single file or several of them can be selected by using the uppercase keys and Control.
- **Load reference file:** It allows loading as reference an existing drawing file on the current document. This is a useful option, for instance to analyze how the triangles of a digital model have been curved. The drawing file with the contour lines are loaded over the digital model. The program displays a dialog box that is explained in detail in the paragraph Open Reference Files.
- **Import:** It imports data coming from other types of digital models. The likely data to be imported are:
  - Files with GTOPO30 format of the USGS. If this format is selected, the program displays a dialog box that is explained in detail in the paragraph Importation of GTOPO30 Files.
  - Files with digital model format of the MTN 25.
  - DEM files of VirtuaLand.

- **Export:** It exports the data making up the digital model to another digital model type of structure. The likely data to be exported are:
  - DIGI files: The program displays a dialog box that is explained in detail in the paragraph Export BIN or DXF Files.
  - DEM files for the application VirtuaLand: The program displays a dialog box that is explained in detail in the paragraph Export DEM or ASCII Files.
  - ASCII files: The program displays a dialog box that is explained in detail in the paragraph Export DEM or ASCII Files.
  - Files with GTOPO30 format of the USGS: The program displays a dialog box that is explained in detail in the paragraph Export GTOPO30 Files.
- **Print:** It prints the current document.
- **Print preview:** It shows on screen how the current document would be printed.
- **Printer set up:** It sets up the printing output device.
- **List of recent files:** It shows the listing of up to ten files with the latest documents used. It is a quick way of opening already generated documents.
- **Exit:** It exits the application. If any opened document has not been saved, the program will inquire about it.

– **Edit:**

- **Erase triangles inside or outside limits:** This tool allows erasing of triangles inside or outside limits that may be defined by breaklines or by drawing files. The program displays a dialog box that is explained in detail in the paragraph Erase inside or outside Limits.
- **Calculate limit of triangulation:** This tool allows recalculating the outer or inner limit(s) of the triangulation, defined by the generated triangles. For further information, see Calculate Limit of Triangulation.
- **Erase triangles by side length:** This tool is used to automatically erase triangles in terms of the side length. It is of use to erase triangles that are too big for their points to be regarded as neighbours. This tool is explained in detail in the paragraph Erase Triangles by Side Length.
- **Clean triangulation:** This tool allows erasing triangulation points in terms of the slope of the triangles to which they belong. Those points having too much or too little of a slope can be erased. For further information, see Clean Triangulation.

– **View:**

- **Toolbar:** This option allows selection of the tools to be visualized in the user's interface of the program. For that purpose, the application displays a dialog box that is explained in detail in the paragraph Dialog Box Toolbars.
- **Status bar:** This option allows viewing or hiding the status bar.

- **Regenerate view:** This option regenerates the window, including visualization of the current document.
- **Extension zoom:** It adjusts the view for visualization of the current document in its entirety.
- **3D Viewpoint:** This option allows visualization of a dialog box for the change of the current document's viewpoint. This dialog box is explained in detail in Dialog Box 3D View.
- **Information:** This option allows getting information about the current document. The program displays a different dialog box depending on the type of document. They are all explained in detail in Dialog Box Drawing Document Information and in Dialog Box Triangulation Document Information.
- **List of codes:** This option is of use to handle the drawing codes the application has in store. These codes will allow visualization of different entities with different weights, colours and types of lines. To handle these codes, the program displays a dialog box that is explained in detail in Dialog Box List of Codes.
- **Triangles:** This option allows viewing or hiding the triangles shaping the digital model.
- **Breaklines:** This option allows viewing or hiding the breaklines kept in the digital model.
- **Colour cut / fill:** This option allows viewing or hiding the filling colour of the triangles if the digital model is the result of volume measurement. These colours will depend on whether the triangles are above or below the cut line: red for the fill, green for the cut and blue if the volume is zero.

– **Utilities:**

- **Triangulation:** Tool used to generate the digital model from a cartographic file. This tool is explained in detail in Triangulation.
- **Contours:** Tool used to generate a map of contour lines of the same height from a digital model. This tool is explained in detail in Curving.
- **Profiles:** Tool used to calculate profiles projected over a digital model. This tool is explained in detail in Profiles.
- **Volume:** Tool used to calculate the volume between two digital terrain models of the same zone. This tool is explained in detail in Volume.
- **Check altimetry:** Tool used to check the altimetry of a digital model. Possible errors may be revealed in the hypsographic entities of such a model. This tool is explained in detail in Check DTM.
- **Projection:** Tool used to project a file with cartography over a digital terrain model of the same zone. This tool is explained in detail in Projection over DTM.
- **Grid:** Tool used to generate a drawing projected over the digital model, made up of points or lines arranged in a grid-like fashion. This tool is explained in detail in Grid.
- **Hypsometrical colour map:** Tool used to generate a hypsometrical colour map from a digital model. This tool is explained in detail in Hypsometrical Colour Map.
- **Shading:** Tool used to generate a map of shadows from a digital model. This tool is explained in detail in Shading.

## – **Window:**

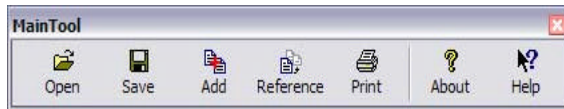
- **New window:** It generates a new window with the data of the current document. It is not a new document but a new window with the same data. For that reason, modifications on one of the windows will affect the visualization of the other one.
- **Cascade:** It lays out the windows, making a cascade with them.
- **Tile:** It lays out the windows of the different documents so that all of them will be displayed at the same time in the application.
- **Arrange icons:** It places the icons corresponding to the documents in order when minimized.

## – **Help:**

- **Help topics:** It shows the program's help. If an element is pressed, information about it will be displayed. Pressing anywhere on the screen, general information about the program will be displayed.
- **About MDTop:** It shows information about MDTop version.

## 1.4. Toolbar MainTool

In this toolbar are grouped together the main program's operations of a general nature. This is its appearance:

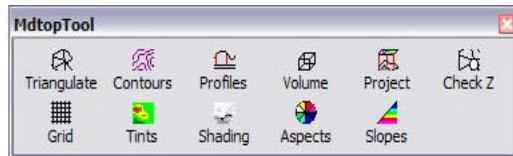


This toolbar consists of the following commands:

- **Open:** Command *Open* of the menu *File*. It opens an existing document.
- **Save:** Command *Save* of the menu *File*. It saves the current document.
- **Add:** Command *Add file* of the menu *File*. It adds one or several existing documents to the current document.
- **Print:** Command *Print* of the menu *File*. It prints the current document.
- **About:** Command *About* of the menu *Help*. It gives information about the version of MDTop.
- **Help:** Command *Help topics* of the menu *Help*. It shows the program's help.

## 1.5. Toolbar MdtopTool

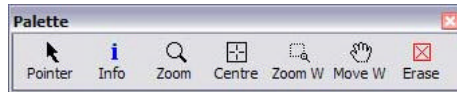
In this toolbar are grouped together the operations included in the menu *Utilities*. This is its appearance:



This toolbar consists of the following commands:

- **Triangulate:** Tool used to generate a digital terrain model. Command *Triangulation* of the menu *Utilities*.
- **Contours:** Tool used to generate a curving. Command *Curving* of the menu *Utilities*.
- **Profiles:** Tool used to generate longitudinal and transversal profiles. Command *Profiles* of the menu *Utilities*.
- **Volume:** Tool used to calculate the volume between two digital models. Command *Volume* of the menu *Utilities*.
- **Project:** Tool used to project mapping over the digital model. Command *Projection* of the menu *Utilities*.
- **Check:** Tool used to check the altimetry of a digital model. Command *Check altimetry* of the menu *Utilities*.
- **Grid:** Tool used to generate a grid projected over the digital model. Command *Grid* of the menu *Utilities*.
- **Hypsometrical colours:** Tool used to generate a hypsometrical colour map. Command *Hypsometrical colour map* of the menu *Utilities*.
- **Shading:** Tool used to generate a map of shadows. Command *Shading* of the menu *Utilities*.

## 1.6. Toolbar Palette

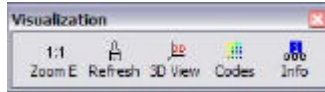


This toolbar consists of the following commands:

- **Pointer:** This option should be selected whenever one is just interested in getting the height in real time on the digital model.
- **Info:** Tool used to offer information about the selected element, either belonging to a drawing or to a triangle. With the left button, the desired element is selected and accepted. With the right button, either the previous selection is cancelled or the search for another element in the same location is tried.
- **Zoom:** This option is selected to increase or reduce the view. With the left button, the image is brought nearer and with the right button, it is moved away.
- **Centre:** This option centres the image on a point.
- **Zoom W:** With this option, the visualization is adjusted to a desired window, which is selected with the left mouse button.
- **Move W:** With this option, the view can be moved in real time by pressing the left button without releasing it, and moving the mouse.

- **Erase:** With this option, elements of a drawing or triangles can be erased. In the event the active document is a digital model, several triangles can be erased at the same time by pressing the left button of the mouse and dragging it, without releasing, along a right line; all triangles run across by that right line will be erased.

## 1.7. Toolbar Visualization



This toolbar consists of the following commands:

- **Zoom E:** It is of use to view the current drawing in its entirety. Command *Zoom Extension* of the menu *See*.
- **Regenerate:** It is of use to repaint the current view. Command *Regenerate view* of the menu *See*.
- **3D View:** It allows changing the viewing angle of the current document. For that purpose, the program displays a dialog box that is explained in detail in the paragraph *Dialog Box 3D View*. Command *Viewpoint 3D* of the menu *See*.
- **Codes:** It shows the registered drawing codes. They can be added, removed or edited by means of a dialog box that is explained in the paragraph *Dialog Box List of Codes*. Command *List of codes* of the menu *See*.
- **Info:** It shows the information about the current document, either a drawing or a digital model. This tool is explained in detail in *Dialog Box Drawing Document Information*. Command *Information* of the menu *See*.

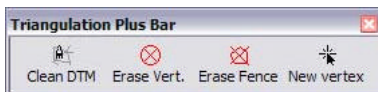
## 1.8. Toolbar Triangulation Edition



In this toolbar are commands associated with the edition of the digital model. They are as follows:

- **Erase limits:** It erases triangles inside or outside limits. They may be defined by breaklines or they may be stored in a drawing file. Command *Erase inside or outside Limits* of the menu *Edition*.
- **Limit:** It recalculates the inner and outer limits of the digital model defined by the whole of generated triangles. Command *Calculate Limit of Triangulation* of the menu *Edition*.
- **Erase sides:** It erases triangles in terms of the side length defining them. Command *Erase Triangles by Side Length* of the menu *Edition*.

## 1.9. Toolbar Triangulation Plus Edition



In this toolbar are extra commands for the edition of the digital model. They are:

- **Clean DTM**: This command is of use to erase vertices belonging to the digital model in terms of the slopes of the triangles to which they belong. Command *Clean Triangulation* of the menu *Edition*.
- **Erase vertices**: This command is of use to erase vertices of the triangulation, selecting them with the mouse. The application recalculates in real time the new triangulation without the selected point.
- **Erase with enclosure**: This command is of use to erase vertices of the triangulation, selecting them by means of an enclosure. In order to build this enclosure, its vertices are defined with the left mouse button, the process being finished with the right mouse button. All points remaining inside the enclosure will be selected and erased. This operation is accepted by pressing the left mouse button. It is cancelled by pressing the right mouse button. The application recalculates in real time the new triangulation without the selected point.

## 1.10. Status Bar

For Help, press F1 | Botón izq. (Zoom +) / Botón der. (Zoom -) | 424689.29 | 4495262.61 | 920.82

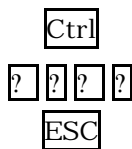
The status bar appears on the bottom of the screen. It is divided in several parts with different information, which, from left to right, is as follows:

- Additional information about the application. Information about the tool to be selected shows up at the spot where the mouse has been positioned.
- Additional information about the tool. Messages indicating what to do and what the application expects the user to accomplish.
- X ground coordinate of the current mouse's position. If there is an active document with an image, the pixel measured in the axis of abscissas, starting from the left lower corner of the image, will be shown.
- Y ground coordinate of the current mouse's position. If there is an active document with an image, the pixel measured in the axis of ordinates, starting from the left lower corner of the image, will be shown.
- Z ground coordinate of the current mouse's position, if there is a document with a digital terrain model. If there is an active document with an image, the RGB value of the pixel where the mouse is positioned will be shown.

If the size of the window is not big enough, some fields may not be displayed. The ones located on the right will disappear first.

## 1.11. Fast Keys with Associated Operations

Key	Associated operation
Ctrl + O	Open file
Ctrl + V	Volume
Ctrl + C	Contours map
Ctrl + S	Save document
Ctrl + H	Hypsometrical colour map
Ctrl + P	Print document
Ctrl + O	Check altimetry
Ctrl + P	Profiles
Ctrl + G	Grid
Ctrl + S	Shading
Ctrl + T	Triangulation
F1	Help
Ctrl + F4	Close document
Alt + F4	Exit application
F5	Regenerate view
F6	Next document
Caps + F6	Previous document
Ctrl + Y	Projection
Space bar	Move view



Zoom

Move view to the sides

Cancel regeneration of view



## 2. Tools

### 2.1. Triangulation

Triangulation is a relationship between digitally registered geographic entities. This relationship is based on the mathematical principle of Delaunay triangulation or Thiessen polygons, stating that the triangles generated from the available points will be, by means of this algorithm, as close as being equilateral as possible, and they will be generated regardless of the point of origin of the calculation.

Starting from this algorithm, a neighbourhood reciprocal relationship is established between the points, making the generation of multiple triangles possible.

In order to strengthen the authenticity of this triangulation in relation to the original ground, the algorithm takes into account the existence of breaklines, defining a change of slope in the ground. No triangle will go across these lines, which will be constrained to become the sides of the triangles of the final digital model.

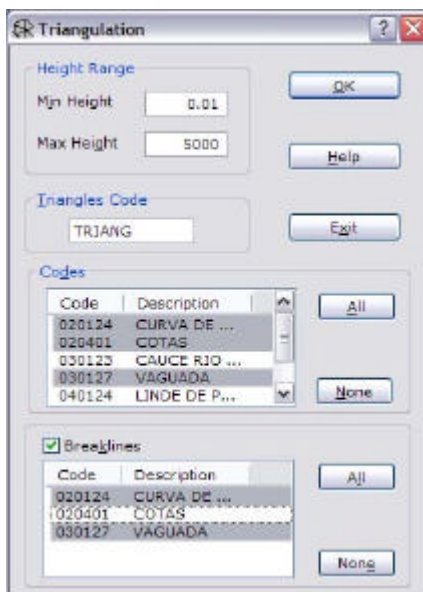
Therefore, in order for the generated digital model to be as adjusted to the original ground as possible, not only a good distribution of the ground's altimetric information is necessary, but also a good definition of the breaklines defining the ground. These breaklines may be dividing lines: valleys, paths, roads, side slopes, etc.

The tool Triangulation is based on this algorithm for the calculation. It may be executed in three different ways:

- Press the button .
- Unfold the menu **Utilities** and select the option **Triangulation**.

- Press the combination of keys **CTRL** + **T**.

On execution of this tool, a dialog box will be displayed:



If the button **OK** is pressed, the program will calculate the triangulation, generating the digital terrain model in a new document and displaying it on screen.

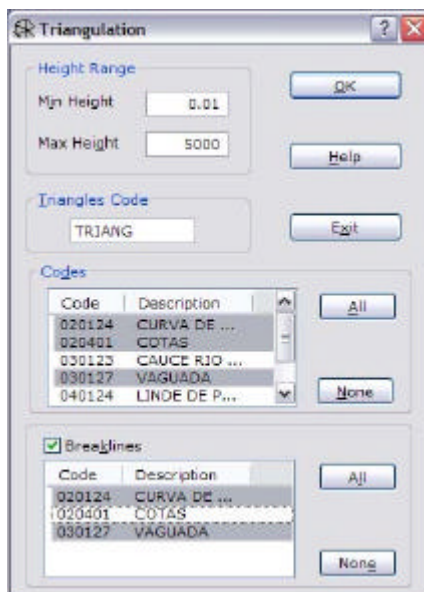
### 2.1.1. Dialog Box Triangulation

This dialog box contains the following fields to be filled in:

- **Height range:** A minimal and a maximal height will both be indicated, so that the entities not belonging to the final digital model will be identified.

- **Triangle code:** Code for triangle storage.
- **Codes:** Entities to be selected when proceeding with the triangulation. In order for them to be selected, they must be within height range. In the list, the name of the code appears as well as the mnemonics as the case may be. For further information about the codes, look up Dialog Box List of Codes.
- **Breaklines:** It can be activated/deactivated according to whether the breaklines are to be kept or not. If activated, the codes that will become breaklines can be selected. Only those codes having been previously selected in the list of codes, that will be utilized to generate the digital model, will be visualized in this list, together with the name of the code as well as the mnemonics as the case may be.

Example:




In this example, only those entities having a height between 0.1 meters and 5,000 meters will be selected. Besides, the codes RASANT and TERREN will be selected to carry out the triangulation, though only the code RASANT will be a breakline. Finally, the generated triangles will be stored with the code TRIANG.

## 2.2. Contours map

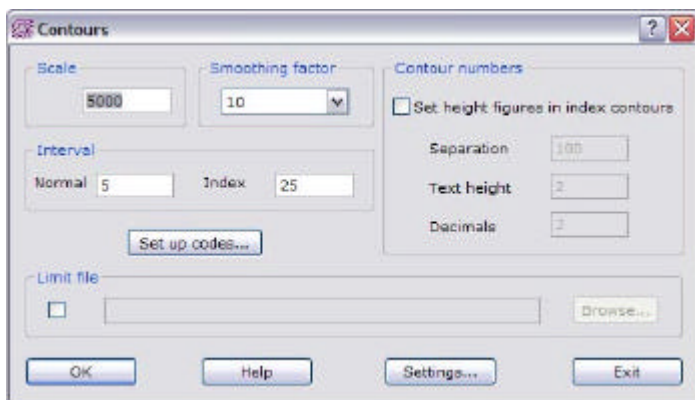
It is a map of contour lines representing the ground. The contour lines are classified, according to their height, in principal and intermediate.

The contours can only be generated from a digital terrain model, therefore in order to be able to call this tool, an active document with a digital model is necessary.

This tool may be called in three different ways:

- Press the button 
- Unfold the menu **Utilities** and select the command **Contours**.
- Press the combination of keys **CTRL** + **C**.

On calling the tool, the following dialog box will be displayed:



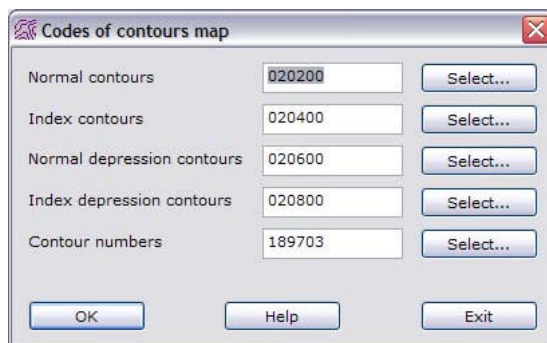
If the button **OK** is pressed, the program will calculate the curving, generating a new document that will be displayed on screen. This document can later be saved in DIGI or DXF format.

### 2.2.1. Dialog Box Contours

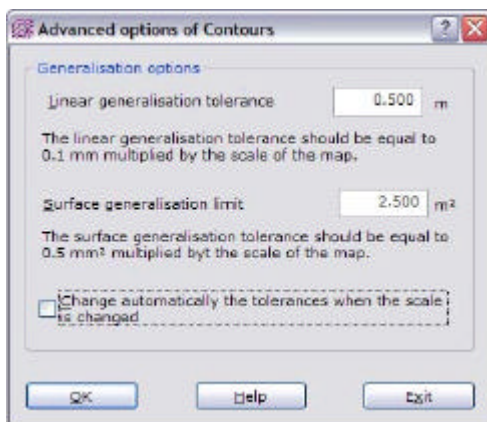
This dialog box contains the following fields to be filled in:

- **Scale:** It indicates the final scale of the document. It is needed to know what precision magnitudes must be taken into account at the time of the smoothing and generalization of the contour lines.
- **Smoothing type:** It may be *Not smoothed*, *Slightly smoothed* or *Greatly smoothed*. A very smoothed curving can distort the result, cuts might occur between close neighbouring contour lines.
- **Contour line interval:** It indicates the altimetric distance in meters at which the different contour lines will be traced.

- **Set up codes:** It displays the next dialog box where you can change the codes in which the different contour lines will be registered:

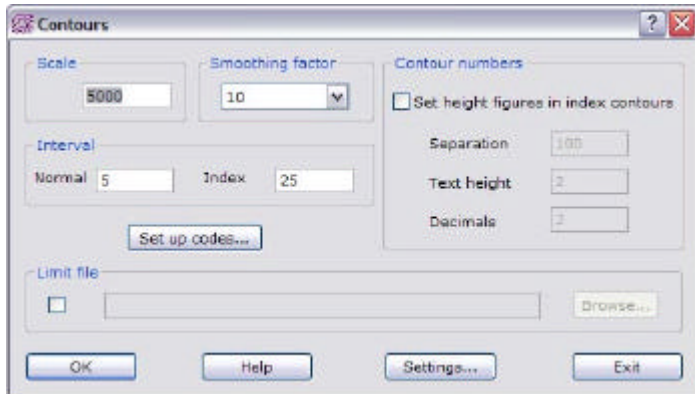


- **File with limit:** Drawing file with the limit of the area to be curved. This file's format may be BIN or DIGI, DXF of AutoCad, DGN of MicroStation or an ASCII file with the limit's coordinates. The limit may be made up of one or several closed lines. In the case of the ASCII file, only one line can be read.
- **Lettering of principal contour lines:** It indicates whether texts will be registered with the lettering of the principal contour lines.
- **Distance between texts:** Distance in meters between texts in the same contour line.
- **Text height:** Height in meters of the lettering texts.
- **Number of decimals:** Number of decimal digits the text with the height of the contour line will have.
- **Text code:** Code in which the lettering texts will be registered.
- **Advanced:** It displays the following dialog box with the advanced contours options:



This dialog box is explained in detail in Dialog Box Advanced Curving Options.

Example:



In this example, a curving will be carried out at scale 100,000, with non-smoothed contour lines and a contour interval of 500 meters. The principal lines will be registered every 2,000 meters. The intermediate lines will be registered in the code 020123 and the principal lines in the code 020124. No limit and no lettering of the principal lines will be used.

### 2.2.2. Dialog Box Advanced Contours Options

In this dialog box, different generalization values than the ones recommended for the curving scale can be indicated. The following fields should be filled in:


- **Linear generalization tolerance:** In this field, the linear generalization tolerance in meters should be given. This value indicates that any point not exceeding this distance in relation to the line joining the ends of another given line will be eliminated.
- **Surface generalization tolerance:** In this field, the surface generalization tolerance in square meters will be indicated. If a closed contour line does not exceed this value in surface, it will not be registered.
- **Automatic change in tolerances when modifying the scale factor:** This box will activate or deactivate the program's option of automatic calculation of the tolerances mentioned above according to the curving scale. If not activated, the program will use the tolerance values indicated to generalize the contour lines.

## 2.3. Profiles

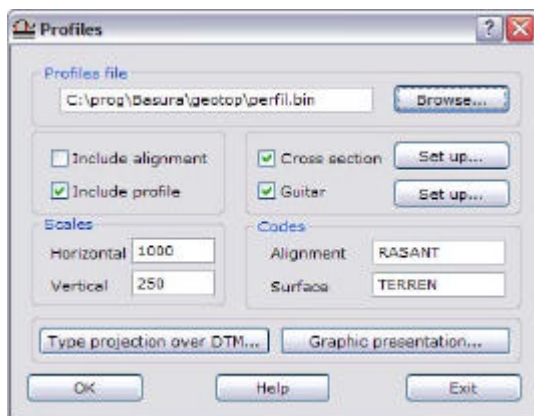
The program can calculate the projection of a profile previously defined in a drawing file. Longitudinal and transversal profiles can be annotated and the volume of a horizontal alignment over the ground calculated.

In order to be able to calculate the projection of a profile, it is necessary to have a digital model as active document.

This tool can be called in three different ways:

- Press the button .
- Unfold the menu **Utilities** and select the option **Profiles**.
- Press the combination of keys **CTRL** + **P**.

The following dialog box will be displayed:



If the button **OK** is pressed, the program will calculate the profiles and generate the following files:

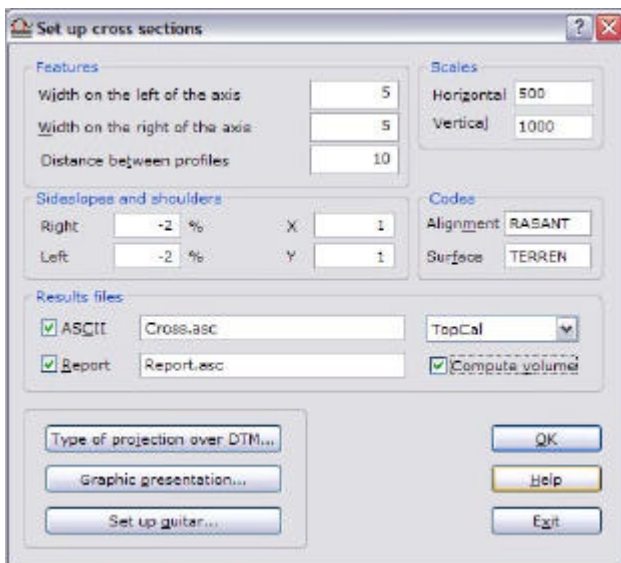
- If the option of longitudinal profiles is activated, a document will be generated of drawing format with the longitudinal profiles.
- If the option of transversal profiles is activated, two documents will be generated: one, of drawing format, with the transversal profiles and another one with the longitudinal and transversal profiles projected over the horizontal plane. Moreover, if in the dialog box of the transversal profiles, the option of measuring the volume of the horizontal alignment is activated, another document will be generated with the volume of the horizontal alignment.

### 2.3.1. Dialog Box Profiles

This dialog box contains the following fields to be filled in:

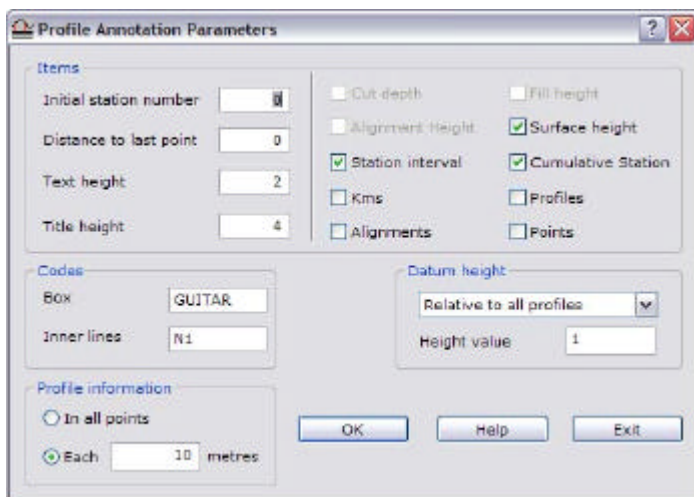
- **File with profiles:** Drawing file holding the profiles to be projected. The format of this file may be BIN of DIGI, DXF of AutoCad, DGN of MicroStation or an ASCII file with the profiles' coordinates. Several profiles can be stored, except in the case of the file of ASCII format, in which only one will be read.
- **Get vertical alignment:** This box will be activated if one wants to annotate the entity originating the profile, namely the vertical alignment. It should not be activated if one wants to get the ground profile only.
- **Get longitudinal profiles:** This box will be activated if one wants to get the corresponding longitudinal profiles. It should not be activated if one does not want to get them and is interested in getting only the transversal profiles.

- **Transversal profiles:** This box will be activated if one wants to get the transversal profiles from the longitudinal profiles. They can be configured by pressing the button **Configure**. The following dialog box will be displayed:



This dialog box is explained in detail in the paragraph Dialog Box Transversal Profiles.

- **Profile annotation:** This box will be activated if one wants to annotate the longitudinal profiles. To configure such an annotation, the button **Configure** should be pressed. The following dialog box will be displayed:



This dialog box is explained in detail in Dialog Box Profile Annotation.

- **Scales:** The denominators of horizontal and vertical scales should be indicated. This will be of use to know the degree of generalization of the profiles and the relationship between one axis and another one of the presentation.
- **Codes:** The codes for the line representing the vertical alignment and the one representing the ground should be indicated.
- **Type of projection over DTM:** It indicates how the profiles should be projected over the digital model. If this button is pressed, the following dialog box will be displayed:



This dialog box is explained in detail in Dialog Box Type of Projection.

- **Graphic presentation:** It indicates how the profiles should be presented in the final drawing file. If this button is pressed, the following dialog box will be displayed:



This dialog box is explained in detail in Dialog Box Graphic Presentation.

### 2.3.2. Dialog Box Profile Annotation

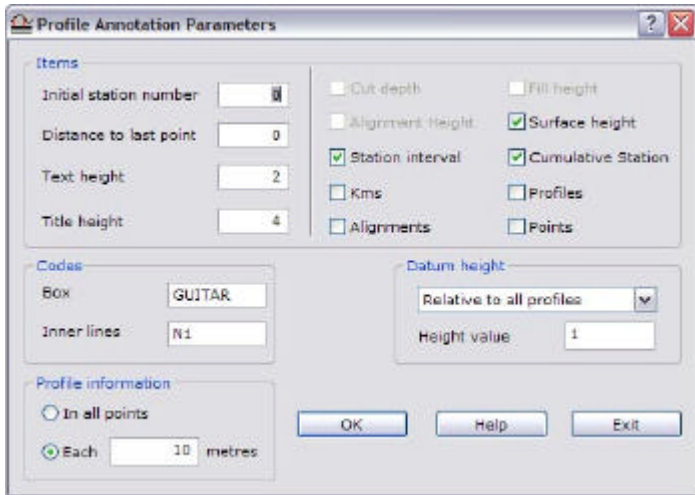
This dialog box contains the following fields to be filled in:

- **Distance to the origin:** Distance in meters to the origin of the longitudinal profile's first point.
- **Text height:** Height in meters of the texts making up the information contained in the annotation.

- **Name height:** Height in meters of the names in the annotation.
- **Comparison plane:** The purpose of this field is to choose the way the program is going to calculate the height of the profiles' comparison plane. If the option *Absolute* is selected, the program will set the plane at the height indicated in the field *Height value*. If the option *Relative to each profile* is selected, the program will calculate the height of the plane, subtracting to the lowest height of each profile the amount expressed in the field *Height value*. If the option *Relative to all profiles* is selected, the program will calculate the height of the plane, subtracting to the lowest height of all profiles the amount expressed in the field *Height value*.
- **Height value:** It indicates the value in meters of the absolute or relative height of the comparison plane.
- **Codes:** Codes in which the elements of the profile annotation and the lines defining the profile's points are registered.
- **Profile information:** Information can be included in all the profile's cross-sections with the digital model or every x meters along the profile. If *At all points* is checked, only those texts not overlapping others will be included.
- **Elements of the annotation:**
  - Red height cut / fill
  - Height vertical alignment / ground
  - Partial distance and distance at the origin
  - Kms
  - Profiles
  - Alignments

– Points

Example



In this example, an annotation will be generated with elements every 10 meters. The partial distance, the distance at the origin and the ground height will be indicated. There is no distance at the origin and the text height of the annotation will be 2 meters. The names will be presented at 4 meters. The comparison plane will have a height of 1 meter less than the lowest point of all profiles.

### 2.3.3. *Dialog Box Type of Projection*

This dialog box contains the following fields to be filled in:

- **Point interpolation:** There may be interpolation with the cuts or individual projection. If the interpolation is made with the cuts, the entity points are not directly projected over the digital model, whereas if they are individually projected, no interpolation with the cuts will be taken into account. It is useful to smooth out projections of lines over digital models formed by contour lines.
- **Cuts when projecting lines:** There may be with the breaklines, with all the triangles or without using cuts, i.e. only projection of points.

### 2.3.4. *Dialog Box Graphic Presentation*

This dialog box contains the following fields to be filled in:

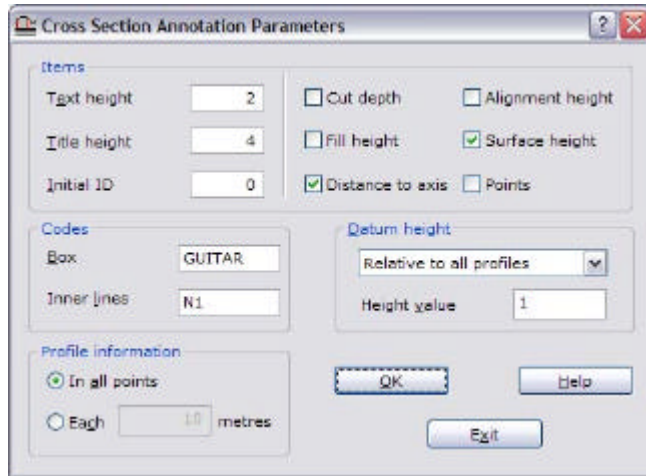
- **Profile arrangement:** Whether aligned by columns or lines.
- **Number by line or column:** Number of profiles in each line or column.
- **Separation in X / Y:** Separation in meters between profiles in each axis.

### 2.3.5. *Dialog Box Cross Sections*

This dialog box contains the following fields to be filled in:

- **Codes:** Codes in which the lines representing the vertical alignment and the lines representing the ground will be registered.

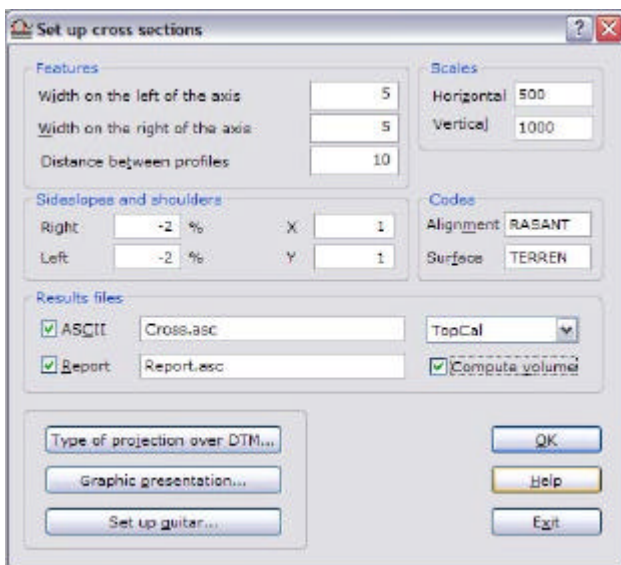
- **Scales:** Vertical and horizontal scales in which the profiles will be registered within the drawing file.
- **Superelevations:** Superelevations that the vertical alignment will have in percentages, both on the left and on the right.
- **Width:** Width of the vertical alignment in meters, on the left and on the right of the axis.
- **Distance:** Distance in meters between two consecutive transversal profiles.
- **Side slopes:** Relationship between the displacement in X and Y in a side slope.
- **Type of projection over DTM:** Dialog box where the user can configure the type of projection of the profiles over the digital model. This dialog box is explained in the paragraph Dialog Box Type of Projection.
- **Graphic presentation:** Dialog box where the user can configure the presentation of the profiles in the drawing output file. This dialog box is explained in the paragraph Dialog Box Graphic Presentation.
- **Configure profile annotation:** Dialog box where the user can configure the annotation of cross sections:



This dialog box is explained in detail in Dialog Box Profile Annotation of Transversal Profiles.

- **ASCII output file:** Containing the transversal profiles. It presents its points, with distances to origin, and heights.
- **Type of ASCII file:** Format of the output ASCII file with the transversal profiles. This format may be TopCal, Clip or Genius.
- **Output file with report**
- **Determine volume of horizontal alignment:** In case one wants to determine the volume of the proposed horizontal alignment in relation to the original ground.

Example:



In this example, transversal profiles will be generated every 10 meters, with a width of 15 meters to the left of the axis and 5 meters to the right. The superelevations will be both  $-2\%$  and the side slopes will be 1:1. An ASCII file of the profiles with TopCal format and a report with the volumes will also be generated. Besides, the volume of the projected horizontal alignment will be determined in its entirety in relation to the original ground.

### 2.3.6. Dialog Box Annotation of Cross Sections

This dialog box contains the following fields to be filled in:

- **Codes:** Codes in which the lines of the annotation and their texts will be registered.
- **Text height:** Height in meters of the texts making up the information contained in the annotation.

- **Name height:** Height in meters of the names in the annotation.
- **First profile:** Numbering of the first profile. Starting from this number, the program will successively number the remainder of the profiles.
- **Comparison plane:** The purpose of this field is to choose the way the program is going to calculate the height of the profiles' comparison plane. If the option *Absolute* is selected, the program will set the plane at the height indicated in the field *Height value*. If the option *Relative to each profile* is selected, the program will calculate the height of the plane, subtracting to the lowest height of each profile the amount expressed in the field *Height value*. If the option *Relative to all profiles* is selected, the program will calculate the height of the plane, subtracting to the lowest height of all profiles the amount expressed in the field *Height value*.
- **Height value:** It indicates the value in meters of the absolute or relative height of the comparison plane.


## 2.4. Volume

The volume is calculated between two digital models corresponding to the same zone in characteristics or at different times. In other words, one can calculate the volume between an original ground and the same ground after an excavation has taken place. The digital models must be calculated beforehand, and a file must be available with a closed line as a limit for the zone where the volume is going to be calculated.

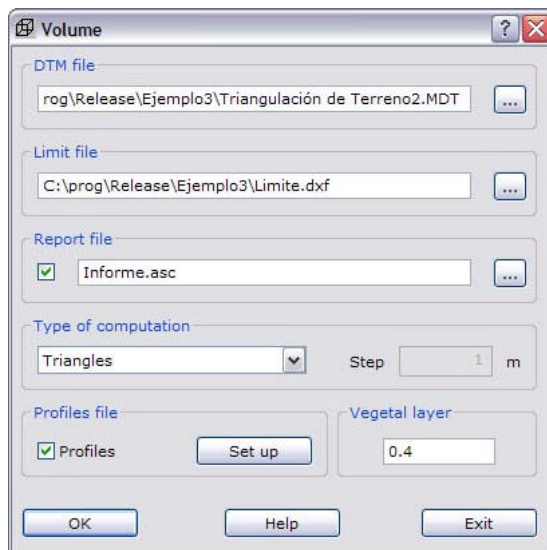
The active document will be taken as the digital terrain model, and for that reason that document will necessarily have a DTM format. The digital model corresponding to the subsequent situation of the ground should be stored as a file.

It is possible to project profiles over the volume. To do that, the corresponding box should be activated. A previous file must be at hand with the lines that will be of use to trace the profiles.

This tool can be called in three different ways:

- Press the button 
- Unfold the menu **Utilities** and select the option **Volume**.
- Press the combination of keys **CTRL** + **B**.

The following dialog box will be displayed:



If the button **OK** is pressed, the program will calculate the volume. In so doing, it generates the following files:

- If the chosen mode of calculation is the *Triangle intersection*, a file will be generated with the volume and the coloured areas, either cut or fill. This document will have a digital model format and it will be made up of triangles, the height being the difference between both digital models.
- If the chosen mode of calculation is the *Grid*, a drawing file will be generated with the grid points where the points have been projected. These points will have the code TERRAPLEN or DESMONTE, as the case may be and NADA if the height in both digital models is the same.
- If one decides to trace profiles, another document will be generated with a drawing file format and with the projected profiles over both digital models.
- If one wants to have a file with the report, an ASCII file will be generated with the result of the volume determination of all the generated prisms, as well as the complete results.

#### 2.4.1. Dialog Box Volume

This dialog box contains the following fields to be filled in:


- **DTM file**: File with the digital model over which the prisms will be projected and their volume determined.
- **Calculation type**: By triangle intersection or by means of a passage grid, indicated in the field **Passage** in meters. The calculation by triangle intersection takes a longer time but it is more accurate. The calculation by grid is the more accurate the smaller the passage, however the bigger the passage the faster the calculation.

- **File with limit:** File with the volume limit. The format of this file may be BIN of DIGI, DXF of AutoCad, DGN of MicroStation or an ASCII file with the limit's coordinates. The limit may be made up by one or several closed lines. In the case of the ASCII file, only one line may be read.
- **Trace profiles:** This field is of use to project the volume's profiles.
- **Configure profiles:** This field is of use to measure the volume of the profiles to be projected. It displays a dialog box that is described in the paragraph Profiles.
- **File with report:** File with a listing of the calculated volume.
- **Clearing of vegetal layer:** Distance in meters of the ground's vegetal layer that will not count in case of a cut.

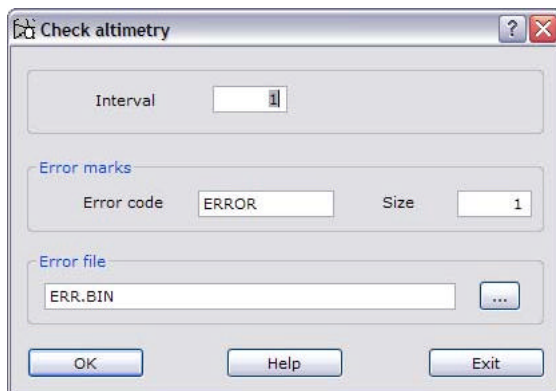
## 2.5. Check DTM

This tool is designed to check absence of contour lines, errors in altimetry within a contour line or errors in a registered point of an altimetry. For that purpose, it is necessary to carry out the triangulation of a file containing only altimetric cartographic elements, considering as breaklines all entities having a constant height, for example, the contour lines.

The call to this tool can be made in three different forms:

- Press the button 
- Unfold the menu **Utilities** and select the option **Check altimetry**.
- Press the combination of keys **CTRL** + **O**.

On calling it, the following dialog box will be displayed:



This tool does not generate any document but it does generate a drawing file with the errors being found.

### 2.5.1. Dialog Box Check DTM

This dialog box contains the following fields to be filled in:


- **Interval:** Altimetric distance between intermediate contour lines, to be expressed in meters.
- **Error code:** Code in which the errors are stored.
- **Size:** Size, in meters, in which the error marks are stored.
- **Error file:** Filename in which the errors are to be stored. It may be in DIGI format (with BIN extension) or in AutoCad format (DXF extension).

## 2.6. Project over DTM

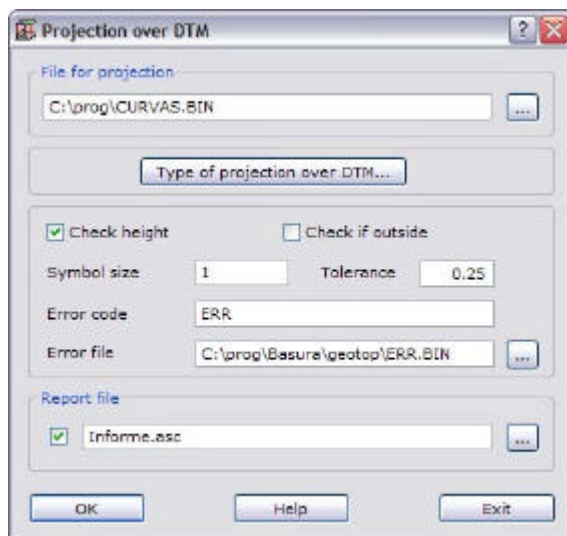
This tool is useful to give a height to a file with entities that did not have it or to compare the height of the entities with the one they will have after having being projected, there being the possibility of finding errors.

A generated digital model is necessary. It will be the active document at the time of calling the tool. A drawing file is also needed, containing the entities one wants to project.

The call to this tool can be made in three different forms:

- Press the button 
- Unfold the menu **Utilities** and select the option **Projection**
- Press the combination of keys **CTRL** + **Y**.

On calling it, the following dialog box will be displayed:



### 2.6.1. Dialog Box Projection over DTM

This dialog box contains the following fields to be filled in:


- **File for projection:** The filename should be indicated with the entities one wants to project. The button *Search* can be used to execute the Windows' explorer in order to look for the file. The format of this file may be BIN of DIGI, DXF of AutoCad, DGN of MicroStation or an ASCII file. Several entities may be stored except in the case of the ASCII file, where only one can be read in the form of a line.
- **Type of projection over DTM:** Dialog box where the type of projection of the profiles over the digital model may be configured.

- **Check height:** This box is activated if one wants to compare the height of the entities with the heights they will have after being projected over the digital model.
- **Check if outside:** This box is activated if one wants to check the entities that are outside the outer limit of the digital model.
- **Symbol size:** Size in meters of the marks generated by the errors.
- **Tolerance:** The tolerance is indicated in meters. It should not exceed the difference of heights in an entity.
- **Error code:** Code in which the errors are to be registered.
- **Error file:** Name of the file of errors with extension, where they will be stored. The extension should indicate the file format, therefore it will be BIN for DIGI files and DXF for AutoCad files.

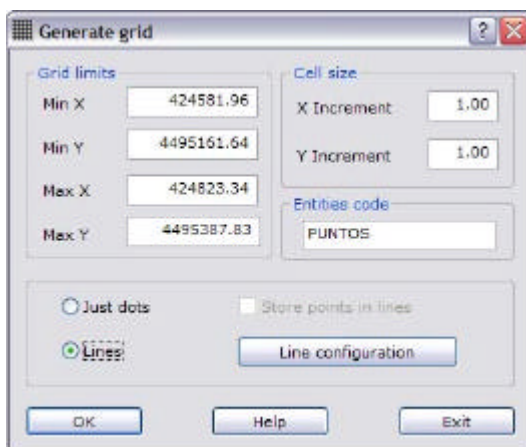
## 2.7. Grid

This tool is of use to generate regular grids of points projected over the digital model.

The call to this tool can be made in three different forms:

- Press the button 
- Unfold the menu **Utilities** and select the option **Grid**.
- Press the combination of keys **CTRL** + **R**.

On calling it, the following dialog box will be displayed:

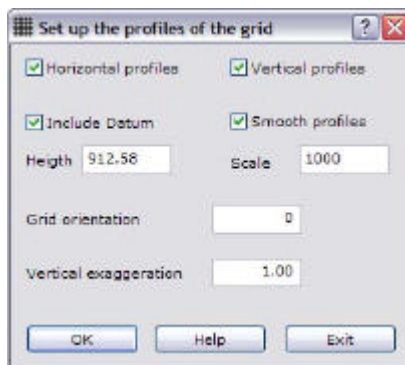


If the button **OK** is pressed, the program will calculate the grid, generating a new document that will be displayed on screen. This document can later be saved in DIGI or DXF format.

### 2.7.1. Dialog Box Grid

This dialog box contains the following fields to be filled in:

- **Grid limits:** Maximal and minimal coordinates in meters of the rectangular limit of the grid.
- **Grid frequency:** Increment in meters of the points in X and Y.
- **Entity code:** Code in which the entities will be registered.
- **Entity type:** The entities generated in the grid may be *Points* or *Lines*.
- **Configuration of lines:** In case the option *Lines* is selected in *Type of entities*, these may be configured from this dialog box:



### 2.7.2. Dialog Box Configuration of the Grid Lines

This dialog box contains the following fields to be filled in:

- **Horizontal profiles:** It activates or deactivates the generation of horizontal lines in the grid.
- **Vertical profiles:** It activates or deactivates the generation of vertical lines in the grid.


- **Include DATUM:** It activates or deactivates the generation of a line around the grid at the height specified in the field *Height*.
- **Smooth profiles:** It activates or deactivates the smoothing of the resulting grid lines.
- **Height:** Height in meters of the Datum.
- **Scale:** Scale denominator of the resulting grid, needed for the calculation of the lines' smoothing.
- **Grid orientation:** Orientation in degrees of the grid's horizontal lines. The orientation of the vertical lines will be perpendicular to it.
- **Vertical exaggeration:** Degree of exaggeration of the height of the generated lines, useful to highlight the zone's relief.

## 2.8. Hypsometrical Colour Map

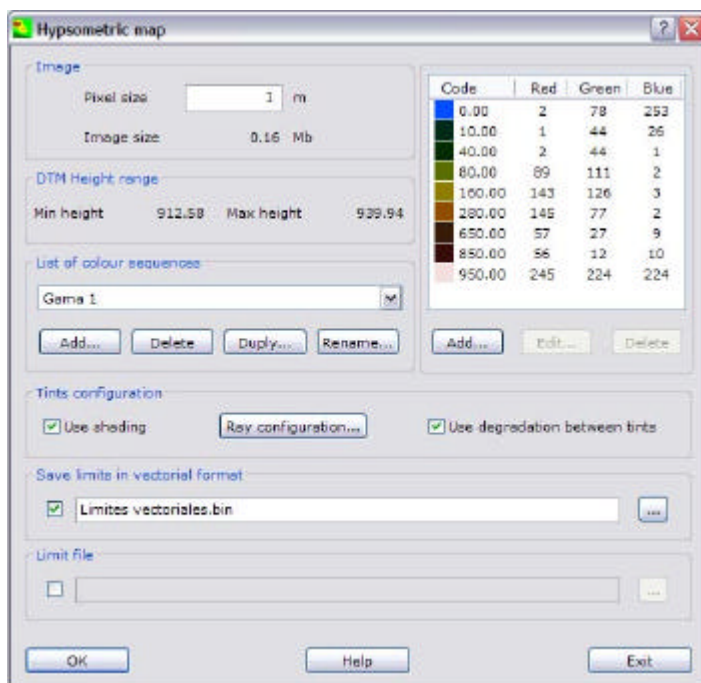
This is a map representing the ground's relief by means of coloured surfaces according to their height. The relationship between the used colours and the height ranges are indicated in a table which is to be configured by the user.

The hypsometrical colour map can only be generated from a digital terrain model, so that in order to be able to call this tool, it is necessary to have an active document with a digital model.

The call to this tool can be made in three different forms:

- Press the button 
- Unfold the menu **Utilities** and select the option **Hypsometrical colour map**.
- Press the combination of keys **CTRL** + **H**.

On calling it, the following dialog box will be displayed:

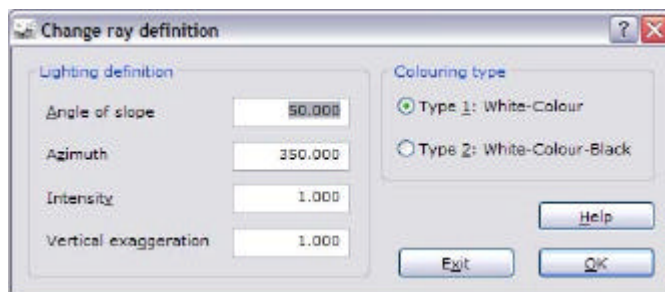


If the button **OK** is pressed, the program will calculate the colour map. This document can later be saved in TIF format. When saved, an ASCII file with the same name and ORT extension will be simultaneously generated, with the geo-referencing of the map. This file contains the coordinates of the left lower corner and the pixel size in meters.

### 2.8.1. Dialog Box Hypsometrical Tints Map

This dialog box contains the following fields to be filled in:

- **Pixel size:** Size in meters of the pixels that will constitute the raster hypsometrical colour map. The bigger the pixel size the worse the quality of the image obtained. Nevertheless it is not recommended to make it too small due to the necessary space increase in memory and disk for the file.
- **Maximal and minimal height:** Maximal and minimal height of the digital model, with the purpose of giving information to the user to work out a table of height intervals.
- **Name of gamut:** Name of the colour gamut to use. The tables can be added, eliminated or duplicated to be used in different files.
- **Use shading:** If this option is selected, a hypsometrical colour map will be generated combined with an oblique shading of the digital model, so as to represent the relief more realistically. The oblique shading will be calculated in black. For further information, see the utility Shading.
- **Configure ray:** If *Use shading* is selected, the configuration can be made from this dialog box:



This dialog box is explained in detail in the paragraph Dialog Box Configure Characteristics of the Ray.

- **Table of height intervals:** In this table the relationship between the colours and the different heights can be established. The intervals can be Added, Eliminated or Edited to adjust to the height range of the document. Surfaces above the maximal height or below the minimal height of this table will not be coloured.
- **Limit File:** A file can be used with the limit of the zone whereof the colour map is wanted. The format of this file may be BIN of DIGI, DXF of AutoCad, DGN of MicroStation or an ASCII file with the limit's coordinates. The limit may be made up of one or several closed lines. In the case of the ASCII file, only one line can be read.

Note: A good gamut for a file between 0 and 950 meters combined with shading could be:

Height	Red	Green	Blue
0	2	78	253
10	1	44	26
40	2	44	1
80	89	111	2
160	143	126	3
280	145	77	2
650	57	27	9
850	56	12	10
950	245	224	224

This means that the colour 2-78-253 (expressed in amount of red, green and blue) is assigned to height 0, and the colour 1-44-26 is assigned to height 10. A progressive colour between those limits will be assigned to the intermediate heights. If there were heights lesser than 0 or greater than 950 meters, no value would be assigned to them.

### 2.8.2. Dialog Box Configure Characteristics of the Ray

This dialog box is of use to configure the characteristics of the lighting rays that will generate the model's shadows. The orientation, the inclination angle, the intensity of lighting or the vertical exaggeration are all susceptible of change for the purpose of achieving a different image. It contains the following fields to be filled in:

- **Inclination angle:** The angle of ray's inclination should be expressed in centesimal degrees. A normal inclination angle will be 50 degrees.
- **Orientation azimuth:** The azimuth of the rays' direction should be expressed in centesimal degrees. By choosing an azimuth originating from the NW, i.e. 350 degrees, a good impression of relief will be provided.
- **Lighting intensity:** A number of intensity rate will be indicated, 1 if normal rays are chosen.
- **Vertical exaggeration:** A number of relief rate will be indicated so that elements with exiguous height can be visualized and given a shadow.
- **Colouring mode:** This is the way the application puts shading into practice. There are two options:
  - **White - colour:** The program will apply the white colour to those zones facing the light and the colour corresponding to their height to the zones opposite the light. It generates a pale image, ideal for superposition of vectorial cartography.
  - **White - colour - black:** The program will apply the white colour to those zones facing the light and the black colour to the zones opposite the light. It will go through the colours corresponding to their height in zones lying in an intermediate position. It generates a dark image, ideal for printing without cartography.

## 2.9. Shading Map

The shading of a DTM generates a map with different tonalities depending on the lighting received by each zone. This is of great help to conceive of the relief.


The lighting may be zenithal, so that the flattest zones will receive more light (they will be brighter), and the zones that are most slanted will receive less light. This kind of lighting does not offer a good representation of the relief, however the different slopes of the zone can be quantitatively assessed.

The lighting may also be oblique, projecting light rays from the NW corner of the document at an inclination of 45 degrees. With this kind of lighting, the zones facing in that direction will receive more light and the zones opposite that direction will receive less light. This kind of lighting offers a good representation of the relief but cannot quantitatively assess the inclination of the ground.

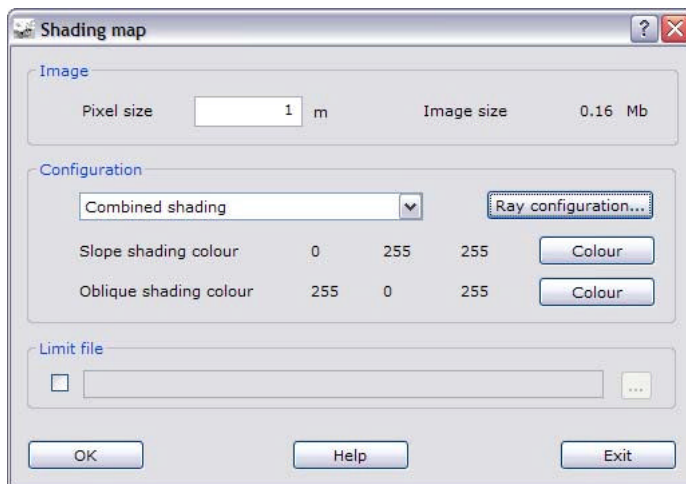
The lighting may also be combined: oblique plus zenithal. Two lightings may then be applied with different colour gamuts (generally warm colours for the zenithal lighting and cold colours for the oblique lighting). One can get the benefits of both types.

The shading can only be generated from a digital terrain model, so that in order to call this tool, an active document with a digital model is necessary,

The call to this tool can be made in three different ways:

- Press the button 
- Unfold the menu **Utilities** and select the option **Shading**.
- Press the combination of keys **CTRL** + **S**.

On calling it, the following dialog box will be displayed:



If the button **OK** is pressed, the program will calculate the shading of the DTM. This document can later be saved in TIF format. An ASCII file with the same name and ORT extension will then be generated, with the geo-referencing of the shading. This file contains the coordinates of the left lower corner and the pixel size in meters.

### 2.9.1. Dialog Box Shading

This dialog box contains the following fields to be filled in:

- **Shading type:** It may be *Zenithal*, *Oblique* or *Combined*.
- **Pixel size:** Size, in meters, of the pixels that will make up the raster map with the shading. The bigger the pixel size, the worse the quality of the image obtained. Nevertheless it is not recommended to make it too small, due to the necessary increase in space in memory and disk for the file.

- **Colour of zenithal shading:** Colour to be used in the zenithal lighting.
- **Colour of oblique shading:** Colour to be used in the oblique lighting.
- **Configure ray:** The ray can be configured using the dialog box that has been described in Dialog Box Configure Characteristics of the Ray.
- **File with limit:** A file with the limit of the zone whereof the shading is planned may be used. The format of this file may be BIN of DIGI, DXF of AutoCad, DGN of MicroStation or an ASCII file with the limit's coordinates. The limit may be made up of one or several closed lines. In the case of the ASCII file, only one line may be read.

Note: If a *Combined* type of shading is used, it is recommended to utilize warm colours for the zenithal shading (pink, yellow...) and cold colours for the oblique shading (blue, purple...).

## 3. Tools from the Command Line

### 3.1. Introduction

MDTop may be executed from the command line, assigning parameters to configure the calculation. For that purpose, the program needs an ASCII file called MDTop.INI in the same directory wherefrom the call is being executed. The setting options are in this file.

This mode of execution offers an advantage: the files are not displayed on screen, so that the calculation time of big files is reduced to a considerable extent.

The tools available from the command line are:

- Triangulation
- Contours Map
- Profiles
- Volume
- Check DTM
- Project over DTM
- Grid
- Hypsometrical tints Map
- Shading Map

### 3.2. Triangulation from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /TRI [output file]
```

The input file should be a file with topographic or cartographic information, from which the digital model will be calculated. This file may be a control point file of TopCal, a drawing file of DIGI, a drawing file DXF of AutoCad, a drawing file of MicroStation or an ASCII file with X, Y, Z coordinates.

The output file must have the name with which the triangulation is saved, so that it must carry the MDT extension.

In addition to this sequence, and in order to configure the mode of triangulation, a compulsory line should exist in the file MDTop.INI with the text *[Triangulation]*, and the following fields thereafter:

- **TriCod**: Code in which the triangles are stored.
- **MaximalHeight**: Maximal height in meters the entities may have to be a part of the digital model.
- **MinimalHeight**: Minimal height in meters the entities may have to be a part of the digital model.
- **ThereAreBreaks**: It indicates whether there will be breaks (value 1) or not (value 0).
- **Code[n]**: Sequence of codes being a part of the digital model, *n* being a correlative number beginning with 1.
- **Break[m]**: Sequence of codes that will be breaklines, *m* being a correlative number beginning with 1.

Example:

```
[Triangulation]
TriCod = TRIANGUL
MaximalHeight = 950.5
MinimalHeight = 0.01
ThereAreBreaks = 1
Code1 = 020123
Code2 = 020124
Code3 = 060140
Break1 = 020124
Break2 = 060140
```

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.3. Contours from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /CUR [output file]
```

The input file should be a digital model file, wherefrom the curving will be calculated.

The output file will be the name with which the curving is saved. The program will save it in the format indicated by the extension BIN (DIGI) or DXF (AutoCad).

In addition to this sequence, and in order to configure the mode of curving, a compulsory line should exist in the file MDTop.INI, with the text *[Contours]* and the following fields thereafter:

- **TextHeight**: To be indicated in meters.
- **Smooth**: 0 (not smoothed), 1 (slightly smoothed) or 2 (greatly smoothed).
- **ContourLineText**: 0 (without lettering) or 1 (with lettering).
- **IntermediateLineCod**: Code in which the intermediate contour lines are registered.
- **PrincipalLineCod**: Code in which the principal contour lines are registered.
- **TextCode**: Code in which the lettering texts will be stored.
- **Scale**: Denominator of the curving scale.
- **IntermediateLines**: Interval of the intermediate contour lines.
- **PrincipalLines**: Interval of the principal contour lines.
- **TextSeparation**: Separation in meters of the lettering texts along the contour line.
- **ThereIsLimit**: 0 (without limit) or 1 (with limit)
- **Decimals**: Number of decimal digits for the lettering texts.
- **Limit**: Name of the file with limit.

Example:

```
[Contours]
Scale = 500
Smooth = 2
IntermediateLines = 0.5
```

PrincipalLines = 2

IntermediateLineCod = 020123

PrincipalLineCod = 020124

ThereIsLimit = 1

Limit = Limit.bin

ContourLineText = 1

TextHeight = 1.5

TextCode = TXC

TextSeparation = 50

Decimals = 0

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.4. Profiles from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /PRO [output file]
```

The input file should be a digital model file whereon the profiles will be projected.

The output file will be the name with which the longitudinal profiles are saved. The program will save them in the format indicated by the extension BIN (Digi) or DXF (AutoCad).

If the longitudinal profile option is activated, these profiles will be saved with the name "Transversal profiles of", plus the name of the output file and the same format. The projected horizontal alignment will be saved with the name "Projection of", plus the name of the output file and the same format.

If the option Measure the volume of the horizontal alignment is activated, its triangulation will be saved with the name "Horizontal alignment of", plus the name of the output file and format of the digital model. The volume will be saved with the name "Volume of", plus the name of the output file and format of the digital model.

In addition to this sequence, and in order to configure the mode of profile projection, a compulsory line should exist in the file MDTop.INI, with the text *[Profiles]*, and the following fields thereafter:

- **HorizontalAlignment:** Name of the drawing file containing the entities of which the profiles are to be calculated.

- **VerticalAlignmentCode**: Code of the entities making up the profile of the vertical alignment.
- **GroundCode**: Code of the entities making up the ground profile.
- **HorizontalScale**: Denominator of the profiles' horizontal scale.
- **VerticalScale**: Denominator of the profiles' vertical scale.
- **ThereIsAnnotation**: 0 (without annotation) or 1 (with annotation).
- **ThereIsVertical\_Alignment**: 0 (without profile of the vertical alignment) or 1 (with profile of the vertical alignment).
- **ThereAreLongitudinal\_Prof**: 0 (without longitudinal profiles) or 1 (with longitudinal profiles).
- **ThereAreTransversal\_Prof**: 0 (without transversal profiles) or 1 (with transversal profiles).
- **Annotation\_Alignments**: Deactivated option.
- **Annotation\_Height**: Height in meters of the texts of the annotation.
- **Annotation\_NameHeight**: Height in meters of the longitudinal profiles' names.
- **Annotation\_VerticalAlignmentHeight**: 0 or 1
- **Annotation\_GroundHeight**: 0 or 1
- **Annotation\_CutRedHeight**: 0 or 1
- **Annotation\_CutRedHeight**: 0 or 1
- **Annotation\_FillRedHeight**: 0 or 1
- **Annotation\_Dist0**: Distance to the origin in meters.
- **Annotation\_DistOrigin**: 0 or 1

- **Annotation\_PartialDist:** 0 or 1
- **Annotation\_Kms:** Deactivated option.
- **Annotation\_Profiles:** Deactivated option.
- **Annotation\_CompPlaneType:** 0 (absolute height of the comparison plane), 1 (height relative to each profile) or 2 (height relative to all profiles).
- **Annotation\_CompPlaneValue:** Absolute or relative height in meters of the comparison plane.
- **Annotation\_Points:** Deactivated option.
- **Annotation\_AnnotCod:** Codes of the lines of the annotation.
- **Annotation\_InnerLineCod:** Codes of the inner lines of the annotation.
- **Annotation\_OnlyInterval:** 0 (information at all profile's points) or 1 (information only at a certain interval).
- **Annotation\_Interval:** Distance in meters between points where information will be registered.
- **Presents\_ProfileNumber:** Amount of longitudinal profiles per line/column.
- **Presents\_ArrangeLines:** 0 (arrangement by lines) or 1 (arrangement by columns).
- **Presents\_SeparateProfileX:** Separation in meters between profiles at the axis of abscissas.
- **Presents\_SeparateProfileY:** Separation in meters at the axis of ordinates.
- **Cut\_Type:** 0 (do not use cuts with triangles), 1 (use cuts only with breaklines) or 2 (use all cuts with triangles).
- **Interpolate\_Type:** 0 (interpolate the height of the points with the cuts) or 1 (project individually).

- **Transversal\_LeftWidth:** Width in meters on the left of the cross section's axis.
- **Transversal\_RightWidth:** Width in meters on the right of the cross section's axis.
- **Transversal\_MeasureVolume\_HorizontalAlignment:** 0 (do not measure volume) or 1 (measure volume)
- **Transversal\_Distance:** Distance in meters in transversal profiles.
- **Transversal\_HorScale:** Denominator of the transversal profiles' horizontal scale.
- **Transversal\_VerScale:** Denominator of the transversal profiles' vertical scale.
- **Transversal\_ThereIsAscii:** 0 (without ASCII file) or 1 (with ASCII file).
- **Transversal\_ThereIsReport:** 0 (without report) or 1 (with report).
- **Transversal\_RightSuperelevation:** Superelevation in percentage on the right of the transversal profile's axis.
- **Transversal\_LeftSuperelevation:** Superelevation in percentage on the left of the transversal profile's axis.
- **Transversal\_SideslopeX:** Displacement of the side slope in the axis of abscissas.
- **Transversal\_SideslopeY:** Displacement of the side slope in the axis of ordinates.
- **Transversal\_VerticalAlignmentCod:** Code of the entities making up the cross section of the vertical alignment.
- **Transversal\_GroundCod:** Code of the entities making up the transversal profile of the ground.
- **Transversal\_AsciiFile:** Name of the generated ASCII file.

- **Transversal\_AsciiFileType**: Format of the ASCII output file with the transversal profiles: 0 (TopCal), 1 (Clip) or 2 (Genius).
- **Transversal\_ReportFile**: Name of the generated report.
- **Transversal\_Presents\_ProfileNumber**: Number of transversal profiles per line/column.
- **Transversal\_Presents\_ArrangeLines**: 0 (arrangement by lines) or 1 (arrangement by columns)
- **Transversal\_Presents\_SeparateProfileX**: Separation in meters between transversal profiles in the axis of abscissas.
- **Transversal\_Presents\_SeparateProfileY**: Separation in meters between transversal profiles in the axis of ordinates.
- **Transversal\_Cut\_Type**: 0 (do not use cuts with triangles), 1 (use cuts only with breaklines) or 2 (use all cuts with triangles).
- **Transversal\_Interpolate\_Type**: 0 (interpolate height of the points with the cuts) or 1 (project individually).
- **Transversal\_Annotation\_AnnotCod**: Code of the entities in the annotation of the transversal profiles.
- **Transversal\_Annotation\_TextCod**: Code of the transversal profiles' texts.
- **Transversal\_Annotation\_Height**: Height in meters of the texts in the annotation of the transversal profiles.
- **Transversal\_Annotation\_NameHeight**: Height in meters of the transversal profiles' names.
- **Transversal\_Annotation\_FirstProfile**: Ordering number of the first transversal profile.
- **Transversal\_Annotation\_CompPlaneType**: 0 (absolute height of the comparison plane), 1 (height relative to each profile) or 2 (height relative to all profiles).

- **Transversal\_Annotation\_CompPlaneValue:** Absolute or relative height of the comparison plane in meters.

Example:

```
[Profiles]
HorizontalAlignment = line.bin
VerticalAlignmentCode = RASANT
GroundCode = TERREN
HorizontalScale = 1000
VerticalScale = 500
ThereIsAnnotation = 1
ThereIsVertical_Alignment = 1
ThereAreLongitudinal_Prof = 1
ThereAreTransversal_Prof = 1
Annotation_Alignments = 0
Annotation_Height = 2
Annotation_NameHeight = 5
Annotation_VerticalAlignmentCode = 1
Annotation_GroundHeight = 1
Annotation_CutRedHeight = 1
Annotation_FillRedHeight = 1
Annotation_Dist0 = 0
Annotation_DistOrigin = 1
Annotation_PartialDist= 1
Annotation_Kms = 0
```

Annotation\_Profiles = 0  
Annotation\_CompPlaneType = 0  
Annotation\_CompPlaneValue = 900  
Annotation\_Points = 0  
Annotation\_AnnotCod = GUITAR  
Annotation\_InnerLineCod = NO  
Annotation\_OnlyInterval = 1  
Annotation\_Interval = 10  
Presents\_ProfileNumber = 4  
Presents\_ArrangeLines = 1  
Presents\_SeparateProfileX = 2  
Presents\_SeparateProfileY = 2  
Cut\_Type = 2  
Interpolate\_Type = 0  
Transversal\_LeftWidth = 10  
Transversal\_RightWidth = 10  
Transversal\_MesureVolume\_HorizontalAlignment = 1  
Transversal\_Distance = 10  
Transversal\_HorScale = 1000  
Transversal\_VerScale = 500  
Transversal\_ThereIsAscii = 1  
Transversal\_ThereIsReport = 1  
Transversal\_RightSuperelevation = 2  
Transversal\_LeftSuperelevation = 2

Transversal\_SideslopeX = 1  
Transversal\_SideslopeY = 1  
Transversal\_VerticalAlignmentCod = RASANT  
Transversal\_GroundCod = TERREN  
Transversal\_AsciiFile = "Transv.asc"  
Transversal\_AsciiFileType = 0  
Transversal\_ReportFile = "Report.asc"  
Transversal\_Presents\_ProfileNumber = 4  
Transversal\_Presents\_ArrangeLines = 1  
Transversal\_Presents\_SeparateProfileX = 2  
Transversal\_Presents\_SeparateProfileY = 2  
Transversal\_Cut\_Type = 2  
Transversal\_Interpolate\_Type = 0  
Transversal\_Annotation\_AnnotCod = GUITAR  
Transversal\_Annotation\_TextCod = TEXTOS  
Transversal\_Annotation\_Height = 2  
Transversal\_Annotation\_NameHeight = 5  
Transversal\_Annotation\_FirstProfile = 1  
Transversal\_Annotation\_CompPlaneType = 0  
Transversal\_Annotation\_CompPlaneValue = 900

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.5. Volume from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /VOL [output file]
```

The input file should be a digital model file with which the volume will be calculated.

The output file will be the name with which the volume is saved in digital model format.

If the profile option is activated, these will be saved with the name "Profiles of", plus the name of the output file and format depending on the extension: BIN (Digi) or DXF (AutoCad).

In addition to this sequence, and in order to configure the mode of calculation of the volume, there should be a compulsory line in the file MDTop.INI with the text *[Volume]* and the following fields thereafter:

- **DTMFile**: Name of the second digital model with which the volume is going to be calculated.
- **Limit**: Name of the drawing file containing the limit of the volume.
- **CalculationType**: 0 (by triangle intersection) or 1 (by grid).
- **Passage**: Passage in meters of the grid, if this calculation method is used.
- **Profiles**: 0 (without profiles of the volume) or 1 (with profiles of the volume).
- **ThereIsReport**: 0 (without volume report) or 1 (with volume's profiles).

- **Clearing:** Vertical distance in meters of the vegetal layer that will not be taken into account for the determination of the volume.
- **ReportFile:** Name of the ASCII file with the volume report.
- **Profiles\_HorizontalAlignment:** Name of the drawing file containing the entities of which the volume's profiles will be calculated.
- **Profiles\_VerticalAlignmentCode:** Code of the entities making up the profile of the first DTM.
- **Profiles\_GroundCode:** Code of the entities making up the profile of the second DTM.
- **Profiles\_HorizontalScale:** Denominator of the profiles' horizontal scale.
- **Profiles\_VerticalScale:** Denominator of the profiles' vertical scale.
- **Profiles\_ThereIsAnnotation:** 0 (without annotation) or 1 (with annotation).
- **Profiles\_Annotation\_Alignments:** Deactivated option.
- **Profiles\_Annotation\_Height:** Height of the texts of the annotation in meters.
- **Profiles\_Annotation\_NameHeight:** Height of the profiles' names in meters.
- **Profiles\_Annotation\_VerticalAlignmentHeight:** 0 or 1
- **Profiles\_Annotation\_GroundHeight:** 0 or 1
- **Profiles\_Annotation\_CutRedHeight:** 0 or 1
- **Profiles\_Annotation\_FillRedHeight:** 0 or 1
- **Profiles\_Annotation\_Dist0:** Distance at origin in meters.
- **Profiles\_Annotation\_DistOrigin:** 0 or 1

- **Profiles\_Annotation\_PartialDist:** 0 or 1
- **Profiles\_Annotation\_Kms:** Deactivated option
- **Profiles\_Annotation\_Profiles:** Deactivated option.
- **Profiles\_Annotation\_CompPlaneType:** 0 (absolute height of the comparison plane), 1 (height relative to each profile) or 2 (height relative to all profiles)
- **Profiles\_Annotation\_CompPlaneValue:** Absolute or relative height of the comparison plane in meters.
- **Profiles\_Annotation\_Points:** Deactivated option.
- **Profiles\_Annotation\_AnnotCod:** Codes of the lines of the annotation.
- **Profiles\_Annotation\_InnerLineCod:** Codes of the inner lines of the annotation.
- **Profiles\_Annotation\_OnlyInterval:** 0 (information at all points of the profile) or 1 (information at a certain interval).
- **Profiles\_Annotation\_Interval:** Distance in meters between the points where the information will be registered.
- **Profiles\_Presents\_ProfileNumber:** Amount of longitudinal profiles per line/column.
- **Profiles\_Presents\_ArrangeLines:** 0 (arrangement by lines) or 1 (arrangement by columns).
- **Profiles\_Presents\_SeparateProfileX:** Separation in the axis of abscissas between profiles in meters.
- **Profiles\_Presents\_SeparateProfileY:** Separation in the axis of ordinates in meters.
- **Profiles\_Cut\_Type:** 0 (do not use cuts with triangles), 1 (use cuts only with breaklines) or 2 (use all the cuts with triangles).

- **Profiles\_Interpolate\_Type**: 0 (interpolate the height of the points with the cuts) or 1 (project individually).

Example:

[Volume]

DTMFile = radia2.mdt

Limit = limit.bin

Profiles = 1

ThereIsReport = 1

Clearing = 0.20

ReportFile = report.asc

Profiles\_HorizontalAlignment = line.bin

Profiles\_VerticalAlignmentCode = RASANT

Profiles\_GroundCode = TERREN

Profiles\_HorizontalScale = 1000

Profiles\_VerticalScale = 500

Profiles\_ThereIsAnnotation = 1

Profiles\_Annotation\_Alignments = 0

Profiles\_Annotation\_Height = 2

Profiles\_Annotation\_NameHeight = 5

Profiles\_Annotation\_Vertical AlignmentHeight = 1

Profiles\_Annotation\_GroundHeight = 1

Profiles\_Annotation\_CutRedHeight = 1

Profiles\_Annotation\_FillRedHeight = 1

Profiles\_Annotation\_Dist0 = 0

Profiles\_Annotation\_DistOrigin = 1  
Profiles\_Annotation\_PartialDist = 1  
Profiles\_Annotation\_Kms = 0  
Profiles\_Annotation\_Profiles = 0  
Profiles\_Annotation\_CompPlaneType = 0  
Profiles\_Annotation\_CompPlaneValue = 900  
Profiles\_Annotation\_Points = 0  
Profiles\_Annotation\_AnnotCod = GUITAR  
Profiles\_Annotation\_InnerLineCod = NO  
Profiles\_Annotation\_OnlyInterval = 1  
Profiles\_Annotation\_Interval = 10  
Profiles\_Presents\_ProfileNumber = 4  
Profiles\_Presents\_ArrangeLines = 1  
Profiles\_Presents\_SeparateProfileX = 2  
Profiles\_Presents\_SeparateProfileY = 2  
Profiles\_Cut\_Type = 2  
Profiles\_Interpolate\_Type = 0

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.6. Project over DTM from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /PRJ [output file]
```

The input file should be a digital model file, whereon the file will be projected.

The output file will be the name with which the projection is saved in the format indicated by the extension: BIN (Digi) or DXF (AutoCad).

In addition to this sequence, and in order to configure the mode of projection, a compulsory line should exist in the file MDTop.INI with the text *[Project]*, and the following fields thereafter:

- **Input:** Name of the drawing file to be projected over the digital model.
- **ErrorCod:** Code of the error marks.
- **CheckHeight:** 0 (do not check) or 1 (check difference between original height and the projected height).
- **CheckOutside:** 0 (do not check) or 1 (check if any entity gets outside the limits of the digital model).
- **ErrorSize:** Size of the error marks in meters.
- **Errors:** Name of the file with the error marks.
- **Tolerance:** Tolerance in meters to mark an error.
- **Cut\_Type:** 0 (do not use cuts with triangles), 1 (use cuts only with breaklines) or 2 (use all cuts with triangles).
- **Interpolate\_Type:** 0 (interpolate the height of the points with the cuts) or 1 (project individually).

Example:

[Project]

Input = line.bin

ErrorCod = ERR

CheckHeight = 1

CheckOutside = 1

ErrorSize = 2.5

Errors = ERR.bin

Tolerance = 1

Cut\_Type = 2

Interpolate\_Type = 1

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.7. Check DTM from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /CHECK
```

The input file should be a digital model file whose altimetry will be checked.

In addition to this sequence, and in order to configure the checking modality, there should be a compulsory line in the file MDTop.INI with the text *[Check]* and the following fields thereafter:

- **ErrorCod**: Code of the error marks.
- **ErrorFile**: Filename of generated errors.
- **Contour line interval**: Vertical distance in meters of the contour lines generating the digital model.
- **Size**: Size of the error marks in meters.

Example:

[Check]

ErrorCod = ERR

ErrorFile = ERR.bin

Contour line interval = 0.5

Size = 2.5

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.8. Grid from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /GRID [output file]
```

The input file should be a digital model file whereon the grid will be projected.

The output file will be the name with which the grid is saved. The program will save it in the format indicated by the extension: BIN (Digi) or DXF (AutoCad).

In addition to this sequence, and in order to configure the generation mode of the grid, there should be a compulsory line in the file MDTop.INI with the text *[Grid]*, and the following fields thereafter:

- **IncrementX**: Spacing in meters of the grid in the axis of abscissas.
- **IncrementY**: Spacing in meters of the grid in the axis of ordinates.
- **OnlyPoints**: 0 (points) or 1 (lines).
- **Code**: Code of the points or lines.
- **ConfLines\_ThereIsDatum**: 0 (without datum) or 1 (with datum).
- **ConfLines\_ThereAreHorizontal\_Lines**: 0 (without horizontal lines) or 1 (with horizontal lines).
- **ConfLines\_ThereAreVertical\_Lines**: 0 (without vertical lines) or 1 (with vertical lines).
- **ConfLines\_ThereIsSmooth**: 0 (without smoothing lines) or 1 (with smoothing).
- **ConfLines\_Datum**: height of the datum in meters.
- **ConfLines\_Scale**: denominator of the grid scale.
- **ConfLines\_Orientation**: azimuth of the horizontal lines in degrees.
- **ConfLines\_Exaggeration**: degree of height exaggeration.

Example:

[Grid]

IncrementX = 1.5

IncrementY = 1.5

OnlyPoints = 1

Code = N1

ConfLines\_ThereIs Datum = 1

ConfLines\_ThereAreHorizontal\_Lines = 1

ConfLines\_ThereAreVertical\_Lines = 1

ConfLines\_ThereIsSmooth = 1

ConfLines\_Datum = 900

ConfLines\_Scale = 1000

ConfLines\_Orientation = 0

ConfLines\_Exaggeration = 3

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.9. Hypsometrical Tints Map from the Command Line

To execute this tool from the command line, the following sequence should be written:

```
MDTop [input file] /HYP [output file]
```

The input file should be a digital model file whereon the grid will be projected.

The output file will be the name with which the hypsometrical tints map is saved. The program will save it in TIF format.

In addition to this sequence, and in order to configure the generation mode of the shading, there should be a compulsory line in the file MDTop.INI with the text *[Hypsometrical]* and the following fields thereafter:

- **Size**: Size in meters of the output image's pixel.
- **Limit**: Name of the file with limit.
- **CheckLimit**: 0 (without limit) or 1 (with limit).
- **CheckShading**: colour used in the zenithal lighting, represented by its red-green-blue values, separated by commas.
- **Interval[n]**: Sequence of the intervals that will be part of the gamut to use, *n* being a correlative number beginning with 1. First in the sequence will be the height in meters, then the used colour represented by its red-green-blue values, separated by commas.

Example:

```
[Hypsometrical]
Size=1
CheckLimit=0
CheckShading = 0
Interval1=900,0,255,0
Interval2=950,255,255,0
Interval3=1000,255,0,0
```

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

### 3.10. Shading map from the Command Line

To execute this tool from the command line, the following sequence should be written down:

```
MDTop [input file] /SHA [output file]
```

The input file should be a digital model file whereon the grid will be projected.

The output file will be the name with which the shading is saved. The program will save it in TIF format.

In addition to this sequence, and in order to configure the generation mode of the shading, there should be a compulsory line in the file MDTop.INI with the text *[Shading]* and the following fields thereafter:

- **Size**: Size in meters of the output image's pixel.
- **Type**: 0 (zenithal lighting), 1 (oblique lighting) or 2 (combined lighting).
- **Limit**: Name of the file with the limit.
- **CheckLimit**: 0 (without limit) or 1 (with limit).
- **ZenithalColor**: colour used in the zenithal lighting, represented by its red-green-blue values, separated by commas.
- **ObliqueColor**: colour used in the oblique lighting, represented by its red-green-blue values, separated by commas.

Example:

[Shading]

Size=1

Type=2

CheckLimit=0

ZenithalColor=255,0,0

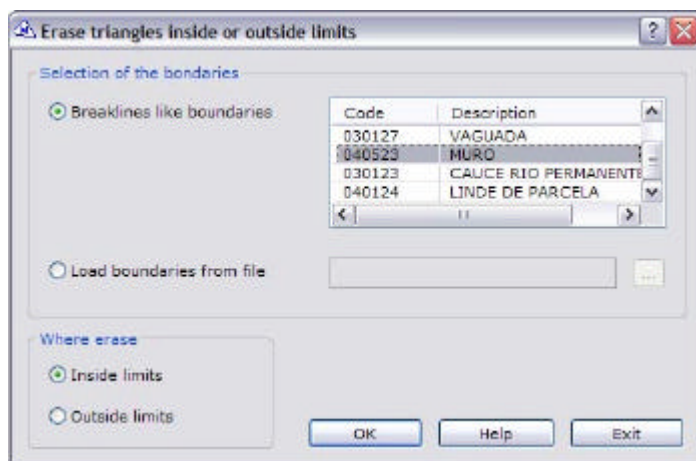
ObliqueColor=0,0,255

Note: It does not matter whether the names of the fields are in uppercase or lowercase letters.

## 4. Triangulation Edition Tools

### 4.1. Erase inside or outside Limits

This tool is of use to erase triangles inside or outside limits. These limits may be defined by breaklines as part of the digital model or they may be stored within closed lines in drawing files (DIGI, AutoCad or MicroStation format). With this tool, information may be erased where one does not want to carry out calculations, for example contours map or profile projections. On executing it, the application will show the following dialog box:



It contains the following fields to be filled in:

- **Selection of the boundaries:** There are two options:

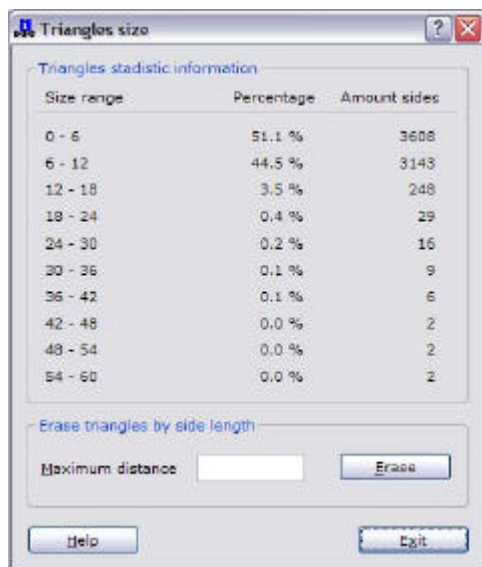
- **Breaklines like boundaries:** The entities selected in the list will be loaded as limits. In this list, the breaklines existing in the digital model are shown. In order for the program to select the limits, these entities should form closed entities.
- **Load boundaries from file:** Drawing entities stored in a file will be loaded. These entities should be closed.
- **Where erase:** It will indicate where the triangles will be erased. There are two options:
  - **Inside limits.**
  - **Outside limits.**

#### 4.2. Calculate Limit of Triangulation

This tool is of use to recalculate the model's limit in case it has been modified, as for instance when erasing triangles.

#### 4.3. Erase Triangles by Side Length

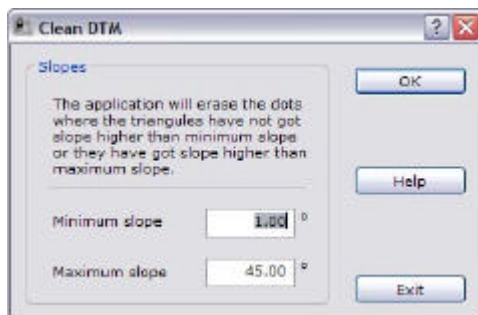
This tool is of use to show information about the size of the triangles' sides and to erase those having side lengths exceeding a certain limit. The following dialog box is displayed:



Those triangles having any side exceeding this magnitude will be erased by indicating a value in meters in the field *Maximal distance* and pressing the button *Erase*.

#### 4.4. Clean Triangulation

This tool is of use to eliminate points of the digital model not furnishing any altimetric information or whose altitude is erroneous. To do that, it is necessary to indicate a minimal slope below which points can be eliminated, and a maximal slope above which it may be estimated that the point is erroneous. On calling the tool, the following dialog box is displayed:



The maximal and minimal slopes will be indicated. If one does not want to eliminate any point in flat zones, the value 0 should be indicated in the field *Minimal Slope*, and if one does not want to eliminate any point of high slope, the value 90 should be indicated in the field *Maximal Slope*.

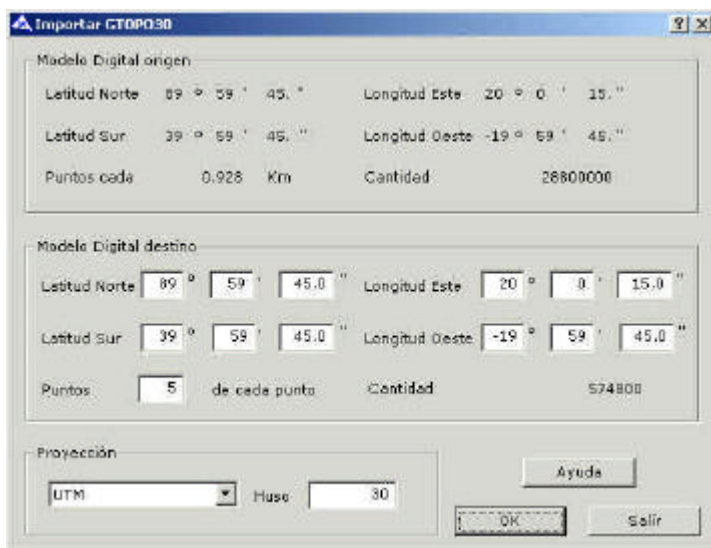
The slope values should be indicated in sexagesimal degrees.

## 5. File Operations

### 5.1. Import GTOPO30 Files

The application allows importation of GTOPO30 files belonging to the USGS. They are point grids, with a separation of 30 sexagesimal seconds, of different world zones. Therefore the digital model is DEM type, and it must be transformed into the MDTop format.

The program displays a dialog box with the zone to be imported and the importation's degree of precision.

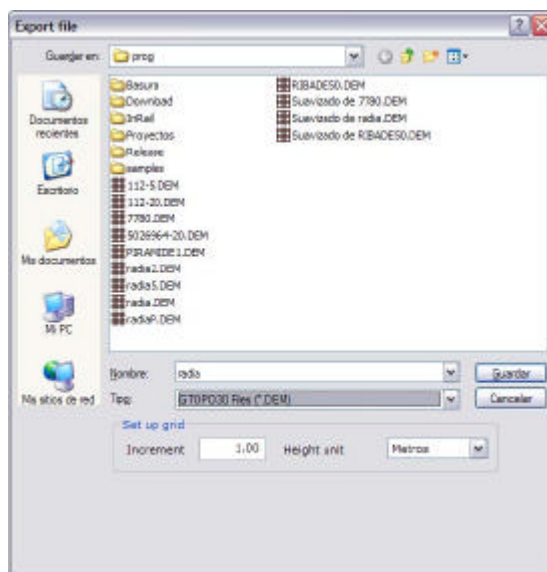


This dialog box contains the following fields to be filled in:

- **Data of digital model origin:**
  - Limits of the digital model in geographic coordinates.
  - Separation of grid points in kilometres.
  - Amount of estimated points. If the zone includes the Oceanic zone, it will have less points.
- **Data of digital model destination:**
  - **Limits of digital model in geographic coordinates:** The limit of the model destination should be indicated, always within the limits of the digital model origin.
  - **Reason of transfer:** The reason of importation should be indicated, namely, every how many points one point will be selected. For example, if 5 is indicated, only one point will be translated for each 5 read points.
  - **Amount of estimated points:** Depending on the destination limits indicated and the reason of transfer, a certain amount of destination points is estimated.
- **Projection:** Here indication should be made of the type of projection the read geographic coordinates will be transformed into. The available types are Geographic, direct Mercator or UTM. If the latter is selected, the zone should be indicated.

## 5.2. Export GTOPO30 Files

The program allows exportation of the generated digital model to the GTOPO30 format, of the USGS. It presents the Windows' explorer to indicate the names of the file and folder. The characteristics of the digital model are to be specified in two fields: *Grid separation* and *Height unit of the points*:

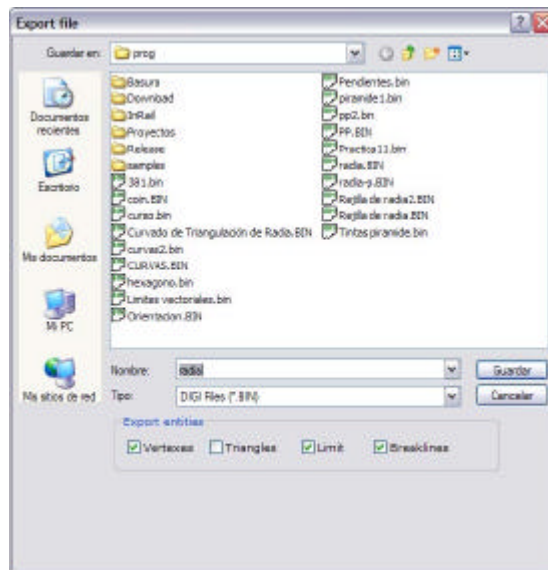


The program will generate two files: one with the point grid and another one with the header, where information is included about the generated digital model.

### 5.3. Export BIN or DXF Files

The application allows exportation of the digital model to a drawing file format for DIGI or AutoCad. With exportation to any of these formats, the information is transformed into drawing entities. For that reason, it will not be possible to be later utilized in calculations with digital models since they are only drawings.

The program displays the following dialog box:



Here the names of the file and folder may be indicated, as well as the type of information one wants to export:

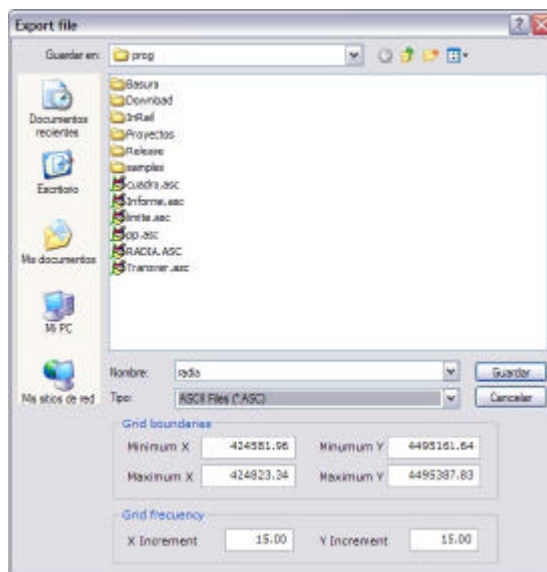
- **Vertices:** The points forming the digital model will be saved as punctual entities.

- **Triangles:** If the exportation is made to the DIGI format, the triangles will be saved as closed entities of four points. If the exportation is made to AutoCad format, the triangles will be saved as 3DFACE entities.
- **Limit:** The inner or outer limits will be saved as entities.
- **Breaklines:** The breaklines that were retained at the moment of realization of the digital model will be saved as entities.

#### 5.4. Export DEM or ASCII Files

The application allows exportation of the digital terrain model as a type DEM digital model that can be understood by other digital model programs. The DEM format is of VirtuaLand application's own and the ASCII format is an easily readable text file.

The program displays the following dialog box with the Windows' explorer to indicate names of file and folder:



Additional information of the digital model should be specified:

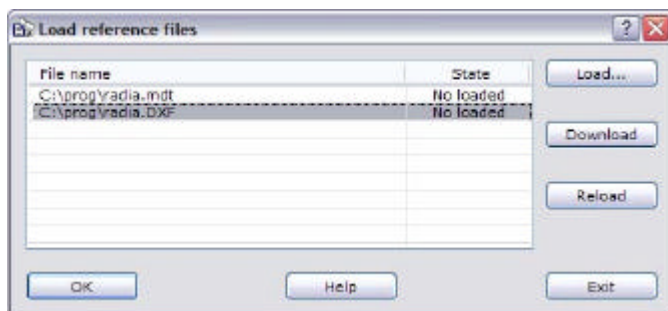
- **Grid limits:** The limits should be indicated in meters. The grid will be rectangular in shape.
- **Grid frequency:** The increments of the grid points in the X and Y axes should be indicated.

## 5.5. Open Reference Files

The program allows loading of reference files to analyze the combination of several files with mapping, for instance to check how the program has curved a digital model or how two adjoining contours map match.

Only drawing files, i.e. files with DIGI, AutoCad or MicroStation formats are allowed to be loaded as reference files.

When this tool is called, the program displays the following dialog box:



From this dialog box, the new reference files can be loaded or the current ones downloaded. For that purpose, a list with the current reference files is displayed. To load new files, the button *Load* should be pressed. To download current files, they will have to be selected first in the list. To do that, the left mouse button is used and with the help of the keys Ctrl and Caps, a multi-selection may be obtained. Then the button *Download* is pressed.



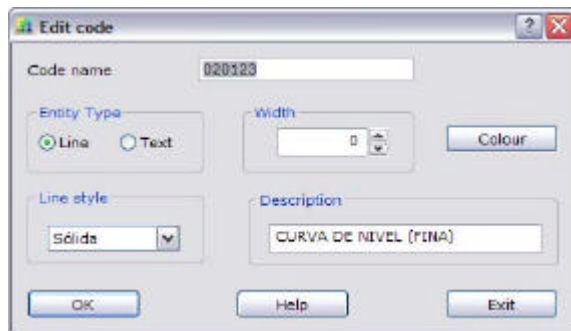
## 6. Other Tools

### 6.1. Dialog Box List of Codes

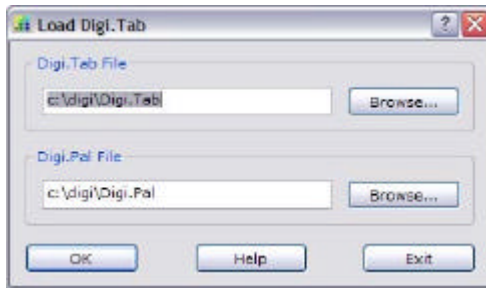
In this dialog box appear the codes the program will use to paint entities on screen. If any code in the documents was not in this list, the entity colour would be grey and with a default weight.

The listed codes may refer to texts or lines. The weight, colour and style of the line may be specified.

New codes may be added and some of the existing ones may be edited or eliminated. When pressing the button **New** or **Edit**, the following dialog box is displayed:



The codes stored in the table DIGI.TAB, belonging to the DIGI program, may also be loaded. The button **Load Digi.Tab** should be pressed. The following dialog box will show up, where the location of the DIGI.TAB and DIGI.PAL files may be indicated. In the DIGI.PAL file the colours are defined.



If the DIGI.PAL is not found, the program will assign the MS-DOS colours.

The changes will only be valid if the button **OK** is pressed to exit.

### 6.1.1. Dialog Box New Code

This dialog box contains the following fields to be filled in:

- **Code name:** If the code is new, its name will be specified. If it is not new, the existing one will be edited.
- **Entity type:** It may be *line* (C) or *text* (T).
- **Weight:** A line weight will be selected between 0 and 10.
- **Line style:** It may be *Solid* (continuous line), *Lines* (stroke line), *Points* (point line), *Line-Point*, *Line-Point-Point*.
- **Colour:** A colour may be specified.
- **Description:** An explanatory text of the new code may be given.

## 6.2. Dialog Box Drawing Document Information

This dialog box contains information concerning the current drawing: maxima and minima in which it is framed, number of points, lines, texts, erased entities and the whole file entities.

It also shows the entity codes and gives information about the entity type (C graphic or T text). It gives information about whether they are included in the current list of codes. If not, they may be included by pressing the button **Add to list**. The dialog box New Code will then show up. These codes may be eliminated from the file by pressing the button **Eliminate**.

## 6.3. Dialog Box Triangulation Document Information

This dialog box contains information concerning the current digital model: maxima and minima in which it is framed, number of points and triangles making up the digital model.

It also shows the codes in which the triangles are registered and the limit of the model. All this may be changed.

## 6.4. Dialog Box Entity Information

This dialog box contains information concerning the selected entity. It shows the code in which it was registered. This code may be changed.

The remainder of the displayed information will be different if the entity is a line or a text.

If the entity is a line, the number of points will also show up, as well as its length and the area of enclosure in the case of a closed entity. A coordinate list of the points making up the entity is also shown.

If the entity is a text, the coordinates of the text's insertion point will appear (left lower corner), as well as the text itself, which can also be changed.

### 6.5. Dialog Box Triangle Information

This dialog box contains information concerning the selected triangle. The coordinates of the points making up the triangle are shown. Only their heights can be changed. The box also shows whether the sides are breaklines and their codes. This information may be modified, namely a side may be activated or deactivated as a breakline or the code of the breakline may be changed.

### 6.6. Dialog Box 3D View

This dialog box is of use to select a different visualization for a file. A rotation value should be indicated around the coordinate axes in the fields *Omega*, *Phi* and *Kappa*. A drawing will appear in the dialog box showing a first view of the rotation under way.

## 6.7. Dialog Box Toolbar

This dialog box is of use to select the visualization options available in the program:

- **Selection of toolbars:** The most frequently used toolbars will be selected, so that their icons and calls will be more easily accessible.
- **Selection of toolbar information:** The program offers three selection alternatives: icon only, icon with explanatory text, text only.
- **Selection of additional options:** Additional information when placing the mouse on the tool. Reproduction of a sound as the calculations are finished.