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Drape DTM 2.0: software to calculate a smooth drape surface for an airborne geophysical survey

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Abstract

Drape_DTM v2.0 calculates a smooth drape surface over the topography of a survey area to be flown by a survey aircraft. The smooth surface is generated by taking into account the aircraft's rate of climb/descent characteristics and its maximum allowable rate of change of slope per second. The smooth surface generated in this manner provides the following benefits:

1) It increases the quality of the survey data by homogenizing the acquisition conditions in the case of multi aircraft survey use.

2) It minimizes the altitude difference between adjacent lines flown in opposite directions and enables the aircraft to fly at the same altitude when flying traverse lines and control lines which cross at a 90 degree angle.

3) It allows the user to simulate survey conditions at the planning stage.

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1. Introduction

A smooth drape surface (Fig. 1), generated by Drape DTM v2.0, approximates the expected flight path and altitude of which a survey aircraft is capable. The first GSC smooth drape survey was flown in the early 1990s. By 1995, it had become a widely accepted practice. All GSC aeromagnetic surveys are now flown using a pre-planned smooth drape surface, calculated from digital terrain models, designed to conform to the maximum rate of climb and descent of the aircraft (Dumont, 2005), approximately 5% for fixed-wing and 30% for helicopter. The drape surface is followed using GPS navigation. The vertical tolerance should not exceed 15 m. As a result, all tie-line intersections will be within 30 m. Minimising height differences helps in the levelling procedure in that the magnetic differences will also be minimized at the intersection points. Furthermore, smooth drape surfaces ensure line-to-line altitudes are consistent, not varying based on topography and flight direction.

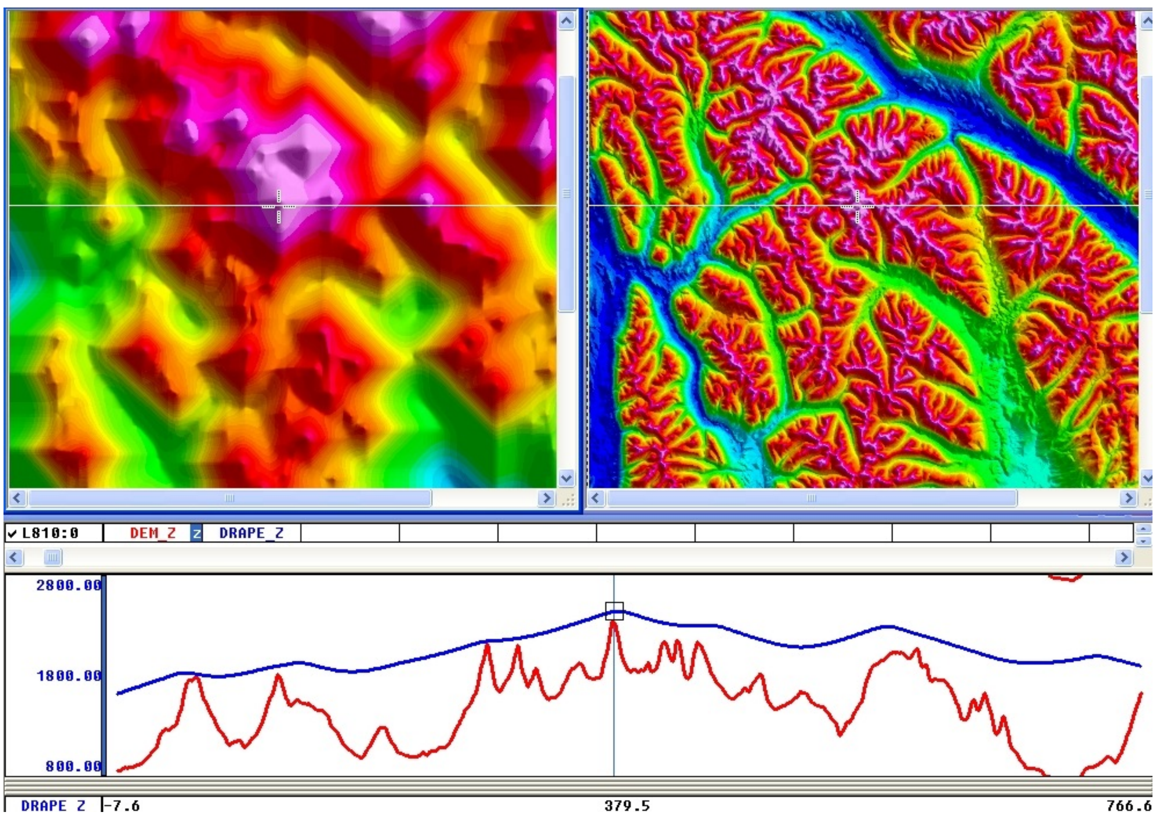

Figure 1. Drape Surface. The digital elevation model (top right) is smoothed to a maximum 5% gradient and the nominal terrain clearance is added (top left). The profile shows the digital terrain model in red and the drape surface in blue.

2. Minimum System Requirements

As a minimum, a dual core processor running Windows XP Service Pack 3 (32-bit) or higher with at least 1GB memory is required. Drape DTM v2.0 is a Geosoft Executable (GX) and requires Geosoft Oasis montaj software, v7.5.1 or higher.

3. Installation

Installing the software is a two-step process:

Step 1 - Copy “drape_dtm.gx” to Geosoft's Oasis montaj “resourcefiles\gx” directory. Typically, this is “C:\Program Files\Geosoft\Oasis montaj\resourcefiles\gx”.

4. Usage

Once the GX (.gx) file has been installed, the software can be accessed through Geosoft’s Oasis montaj software. On the menu, click on the GX tab, then click on ‘Run GX’. Choose ‘drape_dtm.gx’ and run the GX. A dialogue box will appear and prompt for user-specified parameters.

The designated survey area’s digital elevation model (DTM) grid is provided as an input to the program. Prior to executing the program, the DTM grid must be in a Geosoft grid format and projected in UTM

The software’s user-specified parameters are:

Input grid:	File name of the input grid (.grd file). The .grd file should be a digital elevation model (DTM) in Geosoft format in meters above sea level (ASL). X and Y coordinates must also be in meters. The common practice is to use a grid cell size that corresponds to the distance flown in one second. However, for rough topography, the optimum grid cell size may need to be finer so that peak heights are represented more accurately. The user should also be mindful that the DTM quality and reliability may vary depending on the data source.
Output grid:	File name of the output drape surface grid in Geosoft format calculated from the input grid (in meters ASL).
Max Slope:	Maximum rate of climb/descent of aircraft in %.
Max Rate of change:	Maximum rate of change of slope per second in %.

Minimum Valley Width: Valleys narrower than this minimum width will be ignored. The topographic level will be linearly interpolated between the two highest points (m).

Line Azimuth: Azimuth of traverse lines measured clockwise with respect to North (degrees).

Average speed: Average speed of aircraft (m/s).

1D / 2D: The default value is 2D which means that the smoothing will be performed in both control line and traverse line directions. The use of 1D is to restrict the smoothing to the traverse line direction only. This option may be used for certain types of survey where control lines are not necessary.

Nominal terrain clearance Height above the drape surface that you want the aircraft to fly. This constant will be added to the drape grid.

Upon execution of the program, the input DTM grid is smoothed to satisfy the maximum slope constraint. Subsequently, a second horizontal derivative constraint is applied on the rows and columns of the grid. The pre-set program defaults for the maximum slope constraint is 5%, the maximum rate of change of slope per second is 0.5%, and the minimum valley width is set to 2000 m.

References

Dumont, R., 2005. Drape DTM 1.0: software to calculate a smooth drape surface for an airborne geophysical survey: Geological Survey of Canada, Open File 4937.