Oasis montaj Best Practice Guide

VOXI Earth Modelling - Comparing Gradient Controlled Constrained and Upperbound Constrained Inversion Results

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Compare Gradient Controlled Constrained and Upper Bound Constrained Inversion Results

Introduction

The observed data subjected to a 3D inversion is normally collected on a 2D plane, while the modelled volume is three dimensional. This fact makes the inversion inherently underdetermined. The consequence of an underdetermined problem is that many different models can satisfy the same observed data within an acceptable error margin.

Introducing a priori information helps direct the solution towards the known information. This document compares two models produced from the same observed data set; one produced with an upper bound constraint and the other with a gradient controlled constraint.

Compare gradient controlled constrained and upper bound constrained inversion results

Export the susceptibility voxel generated with the gradient constraints settings as well as the voxel generated where only the upper bound constraint has been applied and view them in the same window. One way to illustrate the effect of imposing the constraint is to view isosurfaces of the high susceptibility values.
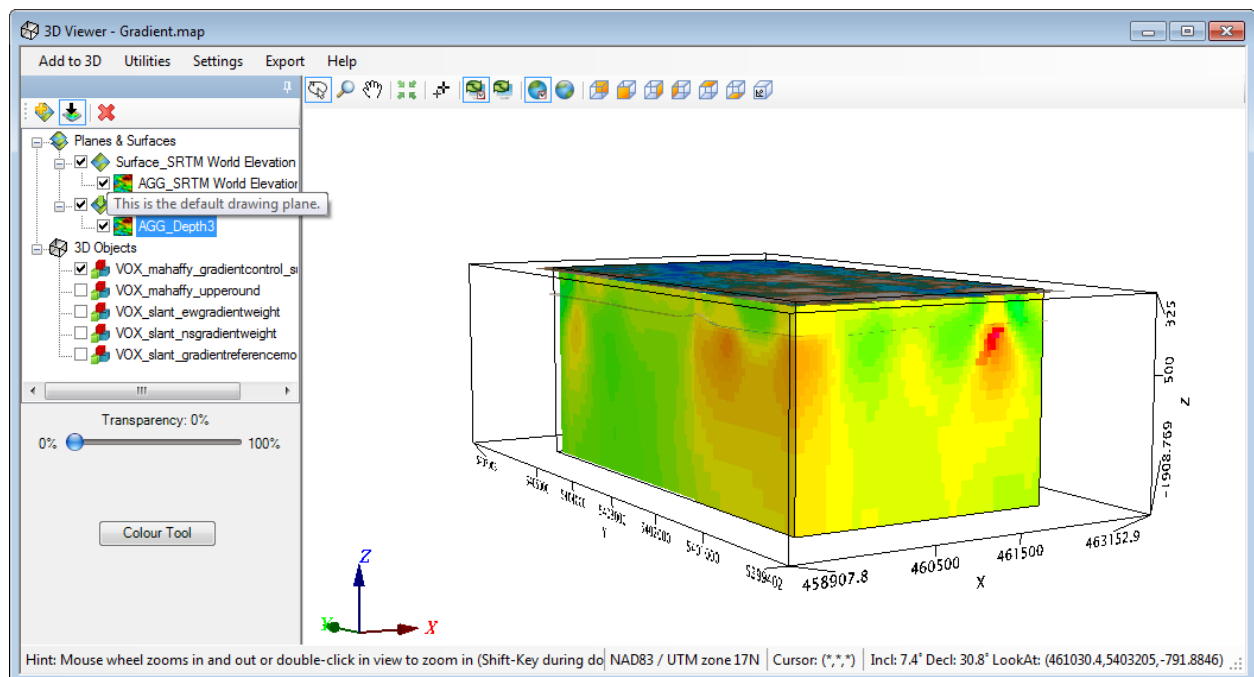
To prepare the data for the 3D View:

1. Export the constrained susceptibility model by right clicking on the susceptibility item in the inversions tree and selecting **Export**. Name the output 3D voxel model *Mahaffy_ GradientConstrained*.

2. If you have not exported the upper bound (only) susceptibility voxel model earlier, export it now by right clicking on the susceptibility item in the inversions tree and selecting **Export**. Name the output 3D voxel model *Mahaffy_UpperboundConstrained*.

To generate the 3D View:

1. From the *Oasis montaj* toolbar, select **3D | Create a new 3D view** and name it *Mahaffy*.

2. Add to the 3D view:

   » The DEM grid as a 3D relief surface,

   » the top-of-conductor depth grid as a 3D relief surface,

   » the constrained susceptibility model on the Run an Inversion with Gradient Weighting inversion, and

   » the unconstrained susceptibility model of the Run an Inversion inversion

3. Create the isosurface for the susceptibility value of 0.015 for both models.

4. Either uncheck the voxel models or increase their transparency to emphasize the isosurfaces.

5. Increase the transparency of the relief surfaces.

   Observe how the high susceptibility volumes of the gradient constrained inversion aligns more closely with the known dyke feature than the upper bound constrained inversion.
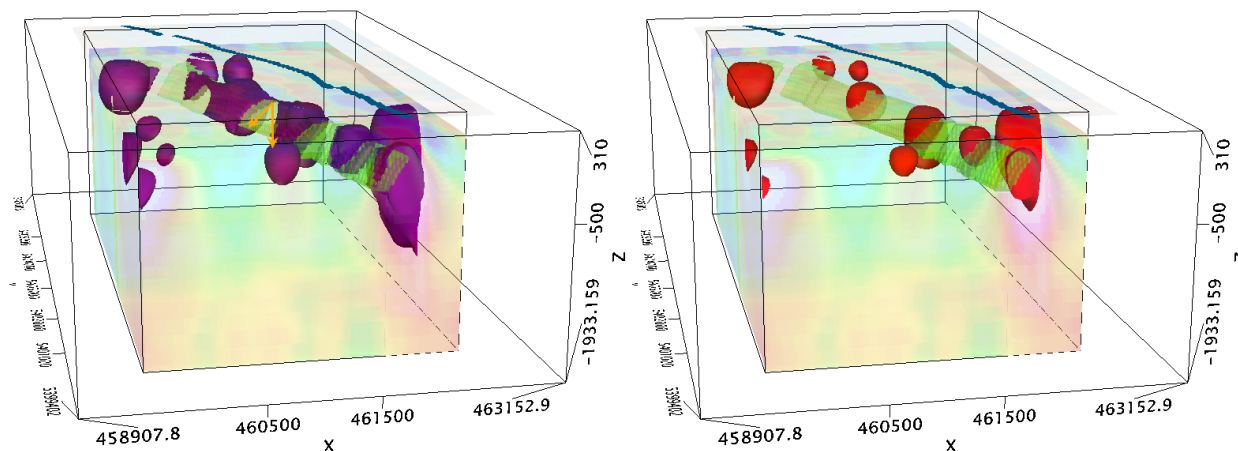

Figure 1: 0.015 SI isosurfaces. On the left, the inversion has gradient weights applied at the dyke contact surfaces while on the right only the upper bound constraint has been imposed. The blue line is the surface trace of the dyke. The interpolated dyke trace is shown in green. The dyke dips ~35° West.