



Talwani: A Profile Modeling Tool Adaptable to Cyberinfrastructure

Authors: Julio C. Olaya, Leonardo Salayandía

Advisors: Dr. Randy Keller, Dr. Ann Gates



Goals

Provide an open-source modeling tool for gravity and magnetic models to couple the recent efforts that have resulted in open-source databases of such data for North America.

Develop the tool with software engineering principles that will allow adaptability of its use to an evolving Cyberinfrastructure.

Introduction

The Talwani software tool is a profile forward modeling application based on the technique of Talwani et al. (1959) and Cady (1980). The previous version of the program (version 2.2) allowed the creation of forward models of gravity profiles; the present version, version 3.0, adds the functionality to create magnetic models.

Modeling Technique

The model consists of 2-D (infinite strike extent) or 2-1/2 (determined strike extent) dimensional bodies. The program is set up to allow complex models to be constructed so that density (not just density contrast) values are assigned to each body. The tool presents a graphical user interface (Figure 1) to allow the user to manipulate the geometry of the model and set the density of individual bodies.

Interface

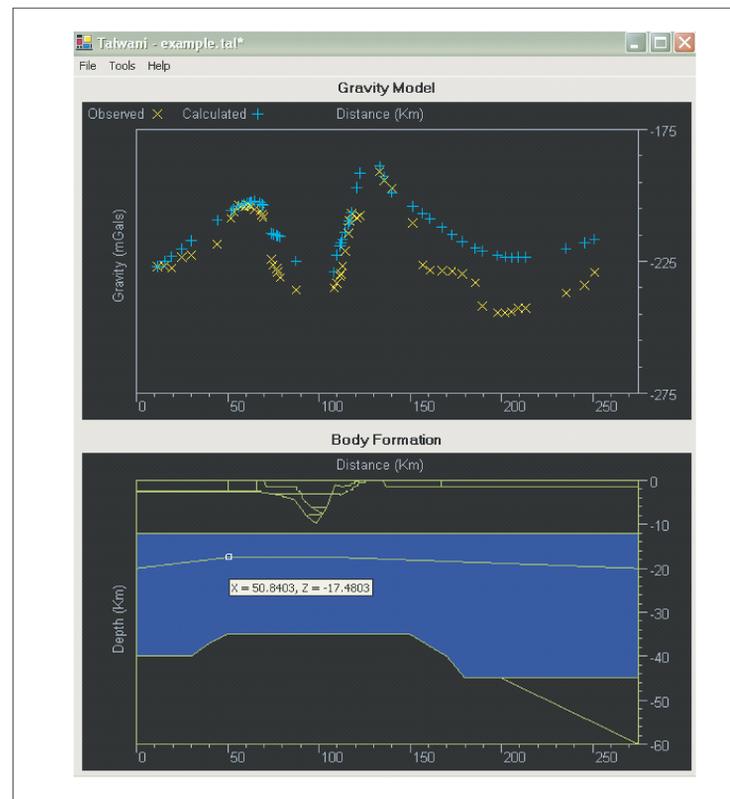


Figure 1. Talwani Version 3.0

Talwani Model

```
<?xml version="1.0" encoding="utf-8"?>
...
<bodies>
  <body>
    <name> ENDBODY EAST LOWER CRUST </name>
    <density> 3 </density>
    <strike-in> 1000 </strike-in>
    <strike-out> 1000 </strike-out>
    <fill> 2 </fill>
    <vertices>
      <x> 275.00 </x> <y> -2.00 </y>
      <x> 1631.03 </x> <y> -20.0 </y>
      <x> 1631.03 </x> <y> -45.0 </y>
    </vertices>
  </body>
  ...
</bodies>
```

Figure 2. Talwani input in XML format

Contributions

Magnetic Data Models

Magnetic data exhibits similar behavior as gravity data, and as a result, the Talwani profile forward modeling technique is applicable to Magnetic data models as well. By introducing a few extra parameters (i.e., Earth magnetic field, inclination angle, and declination angle), we are able to enhance the Talwani tool to model both Gravity and Magnetic data.

XML Models

We envision the use of Cyberinfrastructure efforts such as GEON to share and disseminate models among the scientific community, as well as to facilitate model integration to other resources. As a result, an important enhancement to the Talwani software tool is the support of models in XML format (Figure 2). Supporting a portable XML format will allow the models to be annotated with semantic information, including provenance information, that will facilitate knowledge sharing, model reuse, and determination of trust.

As developers of the tool, we are applying the "design for change" software engineering principle in anticipation of changes as to how the models produced by the tool will be used.

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