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I. Introduction

The purpose of this project was to use observations of the regional gravity field to provide an independent geophysical constraint on versions 2 and 3 of the SCEC 3D Seismic Velocity Model (version 2 released in 2000; version 3 to be developed in 2000-01). This work builds on results summarized in the 1999 Annual Report by Roy and Clayton, which show that gravity data is an important tool for calibrating/constraining the SCEC 3D velocity model. Additionally, we have also shown that simple 2D gravity models along the LARSE line 1 can be used to derive an independent geophysical constraint on inferred crustal velocity (and density variations) from seismic studies (Roy and Clayton, 2000a,b). Many of the inadequacies in version 1 of the velocity model, as highlighted by our gravity studies (see 1999 Annual Report), were addressed in version 2 (e.g., by the inclusion of a better tomographic background, a geotechnical layer, etc.). Below we summarize our findings during research in 2000 and plans for future work.

II. Gravity models along profiles across the Transverse Ranges

This work involves detailed studies along selected profiles to address the discrepancies between observed gravity and forward models of gravity based on densities inferred from seismic velocities. This work was primarily carried out by Nancy Natek, an undergraduate student doing her Senior Thesis with Mousumi Roy at UNM. Preliminary results were presented at the 2000 SCEC Annual Meeting (Natek and Roy, 2000) and as part of Natek's work during her 2000 SCEC Summer Research Internship (final report: www.scec.org/outreach/education/internships/00/index.html). Figure (1) shows the locations of profiles along which our models are located, together with the regional observed Bouguer gravity field. Note that Profile 2 roughly coincides with the location of the LARSE line 1, along which Roy and Clayton (2000a) presented a model of gravity based on tomographic results from the LARSE experiment. Natek's work goes beyond this study in that it tests the regional SCEC 3D velocity model against regional gravity. The 2D models rely in common on a simple empirical velocity-density scaling developed by Magistrale et al. (1996). Therefore, comparing misfits among various profiles, we assess the regional applicability of the empirical scaling relations. Although preliminary model results were presented in Natek's final report for the SCEC Internship, this work continues and we hope to complete this in summer 2001 with a short manuscript submitted to JGR. The SCEC Summer Internship and our work since then has been a great learning experience for Natek, who has now decided to pursue graduate work in Geophysics.

III. Regional gravity model based on 3D SCEC Velocity Model

We developed a regional gravity model based on version 1 of the SCEC 3D velocity model (Roy and Clayton, 1999a&b). Preliminary results based on version 1 of the SCEC

velocity model are summarized in the 1999 Annual Report by Roy and Clayton. These results highlight important inadequacies in version 1 of the velocity model, such as in the representation of the regional velocity (density) contrast between the LA Basin and the Transverse Ranges. Many of these issues are addressed in version 2 of the SCEC velocity model (2.2 released in August 2000), for example, by the inclusion of a better tomographic background and a shallow geotechnical layer. We have begun work on updating our regional model to incorporate the latest version of the SCEC velocity model, and estimate completion of this part of our work in 2001. Our results will be presented at the 2001 SCEC Annual Meeting.

Our preliminary findings indicate that the SCEC velocity model does not adequately represent velocities within the San Fernando and San Bernardino basins (1999 Annual Report, Roy and Clayton). To investigate this further, we plan to construct individual gravity models of each of these basins in order to quantify the amplitude of average density contrasts required in each basin. (Note that lack of resolution in the regional gravity data limits this approach to a study of the average density structure of each basin.) Similarly, gravity can be used to include small- and medium-sized basins in the velocity model in areas where there is sparse coverage by the seismic networks (e.g., in the Mojave desert). For example, if the density of the basin fill is assumed, then gravity can be used to determine the shape of the basin.

Finally, we plan to use fine-scale (10^1 km) details in the residual gravity field to highlight sub-regions within basins or within the Transverse Ranges that might correspond to microbasins and/or shallow geologic domains. This information will be useful in order to refine the shallow geotechnical layer in later versions of the SCEC 3D velocity model.

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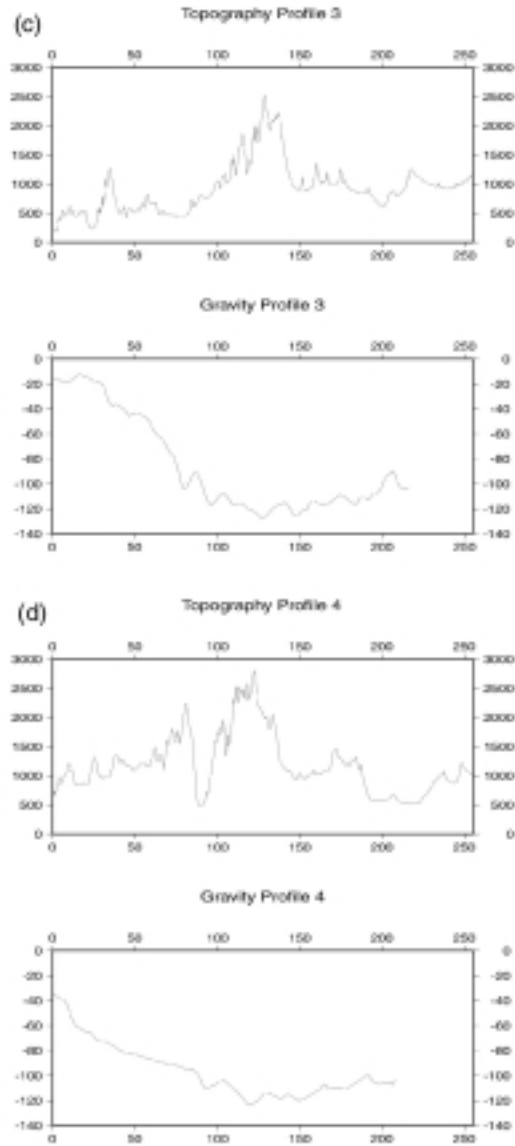
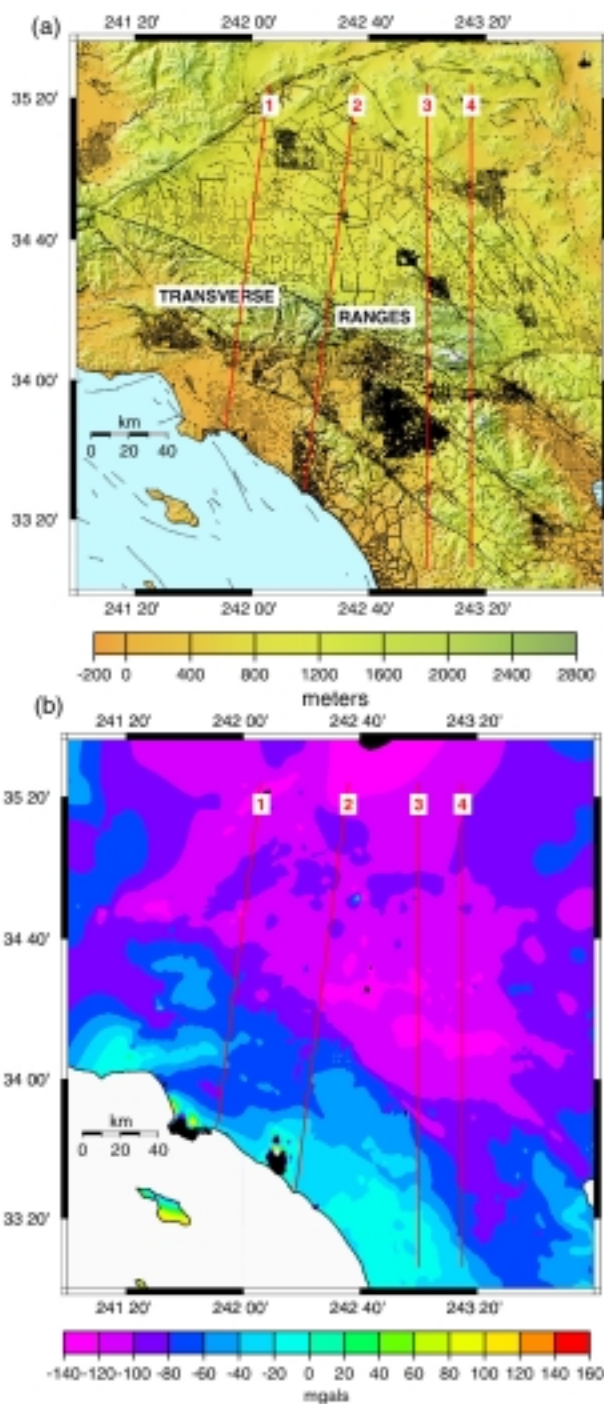


Figure 1. (a) Profile locations in the study area superposed on topography and dots indicating the locations of gravity data points. (b) Observed regional Bouguer gravity field. (c) and (d): Topography and gravity data along Profiles 3 and 4. VERY preliminary model results may be found in Natek's SCEC Summer Internship Final Report (www.scec.org/outreach/education/internships/00/index.html) - this work is currently in progress.