INTRODUCTION

This isostatic residual gravity map is part of a regional effort to investigate the tectonics and water resources of the central Coast Range. This map serves as a basis for modeling the shape of basins and for determining the location and geometry of faults in the area. Local spatial variations in the Earth's gravity field (after removing variations caused by instrument drift, earth-tides, latitude, elevation, terrain, and deep crustal structure), as expressed by the isostatic anomaly, reflect the distribution of densities in the mid- to upper crust, which in turn can be related to rock type. Steep gradients in the isostatic gravity field often indicate lithologic or structural boundaries.

Gravity highs reflect the Mesozoic granitic and Franciscan Complex basement rocks that comprise both the northwest-trending Santa Lucia and Gabilan Ranges, whereas gravity lows in Salinas Valley and the offshore basins reflect the thick accumulations of low-density alluvial and marine sediment. Gravity lows also occur where there are thick deposits of low-density Monterey Formation in the hills southeast of Arroyo Seco (>2 km; Marion, 1986). Within the map area, isostatic residual gravity values range from approximately –60 mGal offshore in the northern part of the Sur basin to approximately 22 mGal in the Santa Lucia Range.

DATA SOURCES, REDUCTIONS, AND ACCURACIES

The isostatic gravity map was compiled from 880 gravity stations that have been gridded at 400 m. The distribution of stations throughout the map is not consistent, however. North of lat 36.25° N, station spacing in the valleys is approximately 1 station per 2 km2, whereas station spacing in the ranges and in the offshore areas is approximately only 1 station per 8 km2. South of lat 36.25° N, station spacing is consistent at 1 station per 1.6 km2 and represents data collected by the Defense Mapping Agency. Previously published data are from a regional compilation (Chapman and others, 1990). During 2009, the U.S. Geological Survey (USGS) collected data at 210 gravity stations throughout Salinas Valley and surrounding ranges, as well as along the Monterey Peninsula.

The datum of observed gravity for this map is the International Gravity Standardization Net of 1971 (IGSN 71) as described by Morelli (1974), and the reference ellipsoid is the Geodetic Reference System of 1967 (GRS67; International Union of Geodesy and Geophysics, 1971). Observed gravity data were reduced using standard

gravity methods (Blakely, 1995), and were reduced to isostatic anomalies (Jachens and Roberts, 1981) that emphasize features in the mid- to upper crust, having removed long-wavelength variations due to compensated topography (Simpson and others, 1986). Bouguer, curvature, and terrain corrections were applied to the free-air anomaly at each station to determine the complete Bouguer anomalies at a standard reduction density of 2.67 g/cm3. Finally, a regional isostatic gravity field was removed from the Bouguer field assuming an Airy–Heiskanen model for isostatic compensation of topographic loads (Jachens and Roberts, 1981) with an assumed crustal thickness of 25 km (16 mi), a crustal density of 2.67 g/ cm3, and a density contrast across the base of the model of 0.4 g/ cm3.

Offshore gravity data were reduced to isostatic anomalies in two different ways. Ocean-bottom measurements reduced to complete Bouguer gravity values (Woodson, 1973) were corrected to isostatic anomalies. The ship-track gravity data were reduced by digitizing trackline points intersecting simple Bouguer gravity anomaly contours (Chapman and others, 1990), and then applying the complete Bouguer and isostatic corrections.

The main sources of error in these gravity data result from imprecise elevations and inaccurate terrain corrections. Total terrain corrections for the stations represented in this map average 5.89 mGal, which translates to an estimated uncertainty of 0.3 mGal (or 5% of average total terrain correction). Terrain correction errors for stations in the rugged Santa Lucia Range may be as high as 2.5 mGal. However, the likely uncertainty due to the terrain correction is small (less than 0.2 mGal) for most of the stations. Errors resulting from elevation uncertainty are likely less than 0.5 mGal for most of the previously collected onshore and ocean-bottom stations and less than 0.2 mGal for stations collected by the USGS in 2009. In general,

the uncertainty due to both terrain and elevation errors is less than 1 mGal, although in many areas, particularly the valleys, the data are considerably more accurate. Shiptrack data are notably less accurate, with errors in the gravity measurement alone in excess of 3 mGal (Oliver, 1980, p. 4).

*The gravity data in this map are provided in comma delimited ascii format. Please see accompanying readme file for detailed database information.

ACKNOWLEDGMENTS

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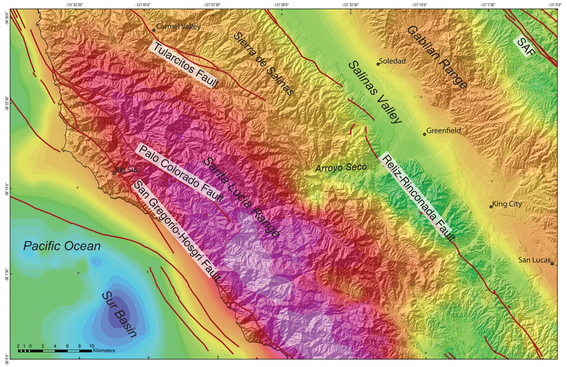
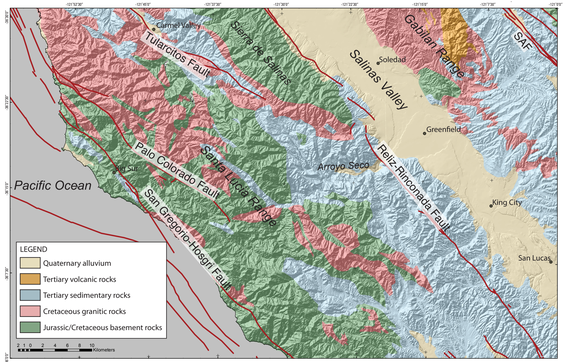


Shaded-relief map of the study area showing isostatic gravity and Quaternary faults (in red, U.S. Geological Survey and California Geological Survey, 2009). SAF, San Andreas Fault. This map represents the same data as shown in the contour map.



Shaded relief map of the study area showing simplified geology (modified after Ludington and others, 2005) and Quaternary faults (in red, U.S. Geological Survey and California Geological Survey, 2009).

GRAVITY EXPLANATION

Gravity anomaly contours. Contour interval, 2 mGal. Hatchered lines indicate gravity low. Contours were computer-generated based on a 400-m grid. Although the data have been edited, caution should be exercised when interpreting anomalies controlled by only a single gravity station.

STATION LOCATIONS

- USGS (collected in 2009)
- Previously published (Chapman and others, 1990)
- Defense Mapping Agency

Topographic base from U.S. Geological Survey 1:100,000 Point Sur quadrangle, 1982.

SCALE 1:100 000

CONTOUR INTERVAL 40 FEET
SUPPLEMENTARY CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAP LOCATION

Mapping compiled in 2009–2010
Manuscript approved for publication February 3, 2011

Isostatic Gravity Map of the Point Sur 30′ x 60′ Quadrangle and Adjacent Areas, California

By
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U.S. Geological Survey