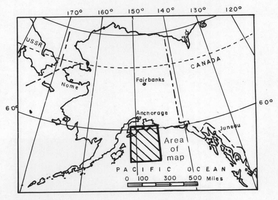
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF—1173



INDEX MAP

MARINE GRAVITY SURVEYS

Ship	Year	Organization	Navigation systems	Gravity meter
R/V SURVEYOR	1972	NOAA	Satellite Loran C Sonar Doppler	LaCoste & Romberg with stabilized platform 2 axis
M/V C.H. GREEN	1975	USGS	Satellite Loran C Sonar Doppler	LaCoste & Romberg with stabilized platform 2 axis
R/V SEA SOUNDER	1976	NAVOCEANO	Satellite Loran C	LaCoste & Romberg with stabilized platform 2 axis
R/V S.P. LEE	1976	USGS	Satellite Loran C Sonar Doppler	LaCoste & Romberg with stabilized platform 3 axis

NAVOCEANO: Navy Oceanographic Office
NOAA: National Oceanic and Atmospheric Administration
USGS: United States Geological Survey

COMPILATION NOTES

Gravity data from the surveys listed above were merged to prepare this free-air gravity map. The gravity data were computer plotted at a scale of 1:250,000 using the Albers equal-area projection. The data from the cruises were merged and hand contoured. The gravity and bathymetric maps were photographically reduced to a scale of 1:500,000 and mosaicked to a base map for publication.

Data Reduction

Observed gravity data were adjusted for instrumental drift, based on harbor gravity station ties, and Eötvös effect, calculated from ship speed and heading. Absolute gravity values were obtained by tying harbor gravity stations to absolute gravity base stations. Free-air gravity was calculated using the 1930 International Gravity Formula (I.G.F.), (Cassinis, 1930). A constant was applied to theses data to approximate the effect of the 1967 I.G.F., (Caputo, 1968). The formula used for the conversion is

$$\text{Free-air gravity}_{(1930)} + 3.2 - 13.6(\sin\theta)^2 = \text{free-air gravity}_{(1967)}$$

where θ is latitude. The conversion factor changes slightly with latitude, from −6.16 mgal at 56°N. to −7.1 mgal at 60.5°N. Minus 7 mgal was selected as a representative value for the entire area. Prior to contouring, −7 mgal was added to all free-air gravity data.

Intersection Difference Evaluation

Line crossing differences for individual cruises have been summarized in the table shown below. Intersection differences were resolved by profiling gravity data near intersecting lines and evaluating irregularities in the data. Intersection errors between lines from different cruises were found to be small, reflecting the general good quality of the data. Overall error is estimated to be ± 2 mgal in most areas.

Cruise	Number of line crossings								
R/V SURVEYOR	44	37	32	35	13	8	8	4	9
M/V C.H. GREEN	24	6	1	1	0	0	0	0	0
R/V SEA SOUNDER	7	2	3	4	1	2	1	1	4
R/V S.P. LEE	0	2	0	0	0	0	0	0	1
Milligal difference	0	1	2	3	4	5	6	7	>7

Albers Equal-Area Projection

The Albers equal-area projection represents areas more accurately than other types of map projections for a region of this size. Edge-join errors between adjacent maps are minimized by this map projection. Standard parallels of 55°N. and 65°N. were used for the construction of the Albers equal-area projection, the same parallels as used in the National Atlas of the United States, (U.S. Geological Survey, 1970).

ACKNOWLEDGMENTS

The authors are indebted to several people whose assistance was essential in the preparation of this map. Rebecca Larsen and Arthur Conradi helped reduce and plot navigation and gravity data. Robert Murray of NAVOCEANO provided SEA SOUNDER 1976 gravity and navigation data. John Dunlavey generously shared the results of his yet unpublished bathymetric chart of the western Gulf of Alaska. T. R. Alpha and Marybeth Gerin were most helpful in providing base maps and information regarding the Albar equal-area map projection. Technical advice and comments were solicited from L. A. Beyer and Thane McCulloh.

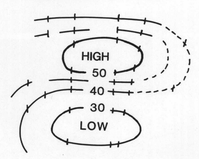
REFERENCES

Cassinis, Gino, 1930, Seur l'adoption d'une formule internationale pour la pesantur normale: Bulletin Géodésique, Paris, France, no. 26, p. 40-49.

Caputo, Michele, and Pieri, L., 1968, The normal gravity formula and the polar flattening according to geodetic reference system 1967: Annali di Geofisica, Rome, Italy, v. 21, no. 1, p. 123-149.

U.S Geological Survey, 1970, The National Atlas of the United States of America: Washington, D.C., U.S. Geological Survey, 417 p.

EXPLANATION



FREE—AIR GRAVITY CONTOURS—Contour interval 10 milligals; long dashed where occasional 5 milligal contours used in areas of low gravity gradient. Short dashed where data widely spread or uncertain. Hachures indicate ship track lines crossing gravity contours.

Bathymetry from unpublished maps and bathymetry data, John Dunlavey and Roland von Huene, 1980

SCALE 1:500 000

10 5 0 10 20 30 40
NAUTICAL MILES

10 0 10 20 30 40 50
KILOMETERS

Bathymetric contour interval 500 meters, long dashed where occasional 100 meter contour interval used

ALBERS EQUAL AREA PROJECTION

FREE–AIR GRAVITY ANOMALY MAP, WESTERN GULF OF ALASKA

By

Nardia Burkhard, Roland von Huene, Graig McHendrie, Byron Ruppel and Terry Bruns

1980

Interior—Geological Survey, Reston, Va.—1980

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