EASTROPAC Atlas

Volume 1  Physical oceanographic and meteorological data from principal participating ships, first
           survey cruise, February–March 1967.

Volume 2  Biological and nutrient chemistry data from principal participating ships, first survey
           cruise, February–March 1967.

Volume 3  Physical oceanographic and meteorological data from principal participating ships, first
           and second meridian cruises, April–July 1967.

Volume 4  Biological and nutrient chemistry data from principal participating ships, first and second
           meridian cruises, April–July 1967.

Volume 5  Physical oceanographic and meteorological data from principal participating ships, second
           survey cruise, August–September 1967.

Volume 6  Biological and nutrient chemistry data from principal participating ships, second survey
           cruise, August–September 1967.

Volume 7  Physical oceanographic and meteorological data from principal participating ships and

Volume 8  Biological and nutrient chemistry data from principal participating ships and Oceanogra-

Volume 9  Physical oceanographic and meteorological data from principal participating ships, third
           survey cruise, February–March 1968.

Volume 10 Biological and nutrient chemistry data from principal participating ships, third survey
           cruise, February–March 1968.

Volume 11 Data from Latin American cooperating ships and ships of opportunity, all cruises, Feb-

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ABSTRACT

This atlas contains charts depicting the distribution of physical, chemical, and biological oceanographic properties and associated
meteorological properties observed during EASTROPAC. EASTROPAC was an international cooperative investigation
of the eastern tropical Pacific Ocean (20° N to 20° S, and from the west coasts of the American continents to 119° W) which was intended
for data necessary for a more effective use of the marine resources of the area, especially tropical
fishery, and also to increase knowledge of the ocean circulation, air-sea interaction, and ecology. The Bureau of Commercial
Fisheries (now National Marine Fisheries Service) was the coordinating agency. The field work, from February 1967 through
March 1968, was divided into seven 2-month cruise periods. During each cruise period one or more ships were operating in the
study area.

On completion of the field work the data proved too numerous for a classical data report. Instead, it was decided to produce
an 11-volume atlas of the results, with 9 volumes containing physical oceanographic and meteorological data from the
principal participating ships, 5 volumes containing biological and nutrient chemistry data from the same ships, and 1 volume
containing all data from Latin American cooperating ships and ships of opportunity. Extractor was used made of a computer
and automatic ploter in preparation of the atlas. Methods used to collect and process the data upon which the atlas is
based are described in detail by the contributors of the following categories of charts: temperature, salinity, and derived
quantities; thickness of the upper mixed layer; dissolved oxygen; meteorology; nutrient chemistry; phytoplankton standing
stocks and production; zooplankton and fish larvae; micronekton; birds, fish schools, and marine mammals.

Cove, James C. Magneto (tripods) near Cove Island.

Photos by John H. Taylor, Scripps Institution of Oceanography.
September 1971

NOTICE TO RECIPIENTS OF THE EASTROPAC ATLAS
VOLUME 3

In the Introduction to this volume the reader is referred to Volume 1 for background information on the EASTROPAC Project, processing of the data, and preparation of the atlas. Volume 1 has not yet been published, but the introductory material referred to has been placed in Volume 4 which was published in November 1970.

Cuthbert M. Love, Editor
EASTROPAC Atlas
FIGURE 20-6-v4 The short contour near the surface between 15°-16° N. should be labeled 650 instead of 550.

FIGURE 20-8-v1 The short, heavy contour near the surface between 4°-5° N. should be labeled 34.0.
EASTROPAC ATLAS

VOLUME 3
PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL DATA FROM
PRINCIPAL PARTICIPATING SHIPS
FIRST AND SECOND MONITOR CRUISES, APRIL-JULY 1967

CUTHBERT M. LOVE, Editor
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WASHINGTON, D.C.
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COORDINATOR, EASTROPAC PROJECT

WARREN S. WOOTER, Scripps Institution of Oceanography, June 27, 1966-May 15, 1967

ATLAS CONTRIBUTORS

ELBERT H. AHSBROOK—National Marine Fisheries Service, Phyl Larvae
MAURICE BLACKBURN—Scripps Institution of Oceanography, Microplankton
WITOLD L. KLAWE—Inter-American Tuna Commission, Ichthyoid Larvae
FORREST R. MILLER—Inter-American Tuna Commission, Meteorology
ROBERT W. OWEN, Jr.—National Marine Fisheries Service, Phytoplankton, Oxygen, Mixed Layer Depth
BRUCE A. TAFT—Scripps Institution of Oceanography, Physical Oceanography
WILLIAM H. THOMAS—Scripps Institution of Oceanography, Nutrient Chemistry
MIZUKI TSUCHIYA—Scripps Institution of Oceanography, Physical Oceanography
BERNIE ZIEZSCHER—Scripps Institution of Oceanography, Phytoplankton

EDITORIAL COMMITTEE

CUTHBERT M. LOVE, National Marine Fisheries Service
BRUCE A. TAFT, Scripps Institution of Oceanography
R. MICHAEL LAUNS, National Marine Fisheries Service
INTRODUCTION

EASTROPAC was an international cooperative investigation of the eastern tropical Pacific Ocean which was intended to provide data necessary for a more effective use of the marine resources of the area, especially tropical tuna, and also to increase knowledge of the ocean circulation, air-sea interaction, and ecology. The National Marine Fisheries Service (NMFS)—the Bureau of Commercial Fisheries (BCF) at the time of the investigation—was the coordinating agency. The field work, from February 1967 through March 1968, was divided into about 6-month cruise periods.

At a meeting of the EASTROPAC Coordinating Committee held at La Jolla in April 1968, it was decided that the data derived from the cruises were so extensive as to render classical data reports impractical and that a comprehensive atlas of the physical and biological results of the project should be produced instead. The atlas has been divided into 11 volumes, with two volumes containing physical oceanographic and meteorological data from the principal participating ships, five volumes containing biological and nutrient chemistry data from the same ships, and one volume containing all data from Latin American cooperating ships and ships of opportunity.

Volume 3 contains physical oceanographic and meteorological data collected mainly by the principal participating ships during the first and second respective cruise periods; cruises 2B, April-May 1967, and cruiser 30, June-July 1967. The companion volume presenting the corresponding biological and nutrient chemistry data is Volume 4. The locations of stations occupied by participating ships are shown in figure 20-1C and figure 20-1D.

Information concerning the history and organization of the EASTROPAC Project, a description of the cruises undertaken, the program of observations, the methods used for preparation of the charts, and remarks on the organization of the atlas are contained in Volume 1 with descriptions of the contributing scientists of the methods used to collect and process the data upon which the atlas charts are based.

CUTHERBERT M. LOVE
Editor
LIST OF FIGURES

Meteorology—Blue pages

FIGURE 26-MW-1.—Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period April 1-15, 1967. Heavy dashed lines are isolobes. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isollobes indicating mean resultant wind speed (kt). Pressure (mb) averaged for 5-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kt) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed band.

FIGURE 26-MW-2.—Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period April 16-30, 1967. Heavy dashed lines are isolobes. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isollobes indicating mean resultant wind speed (kt). Pressure (mb) averaged for 5-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kt) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed band.

FIGURE 26-MW-3.—Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period May 1-10, 1967. Heavy dashed lines are isolobes. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isollobes indicating mean resultant wind speed (kt). Pressure (mb) averaged for 5-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kt) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed band.

FIGURE 26-MW-4.—Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period May 11-31, 1967. Heavy dashed lines are isolobes. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isollobes indicating mean resultant wind speed (kt). Pressure (mb) averaged for 5-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kt) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed band.

FIGURE 26-MT-1.—Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period April 1-15, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed wherever data are sparse. Dark hatchings outlines areas with positive temperature anomalies (computed from mean sea surface temperature averaged over 22 years) greater than 1°C; light hatchings shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C × 10) averaged for 5-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C × 10) is plotted below the symbol.

FIGURE 26-MT-2.—Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period April 16-30, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed wherever data are sparse. Dark hatchings outlines areas with positive temperature anomalies (computed from mean sea surface temperature averaged over 22 years) greater than 1°C; light hatchings shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C × 10) averaged for 5-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C × 10) is plotted below the symbol.

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FIGURE 26-MT-4.—Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period May 11-31, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed wherever data are sparse. Dark hatchings outlines areas with positive temperature anomalies (computed from mean sea surface temperature averaged over 22 years) greater than 1°C; light hatchings shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C × 10) averaged for 5-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C × 10) is plotted below the symbol.
FIGURE 20-M.C.-1—Vertical distribution of the component of geostrophic velocity (cm/sec), relative to 500 db, normal to a section from 12° N., 112°20' W. to Manzanillo, April 29-May 2, 1967. Dark shading indicates flow toward the northeast with a velocity greater than 3 cm/sec.; light shading indicates flow toward the southeast with a velocity greater than 3 cm/sec.

FIGURE 20-M.C.-2—Vertical distribution of the component of geostrophic velocity (cm/sec.), relative to 500 db, normal to a section from Acapulco to 12° N., 112°20' W., May 7-10, 1967. The dark shading indicates flow toward the southeast with a velocity greater than 3 cm/sec.

FIGURE 20-M.C.-3—Vertical distribution of the component of geostrophic velocity (cm/sec.), relative to 500 db, along 105°20' W., May 9-15, 1967. Dark shading indicates outward flow with a velocity greater than 5 cm/sec.; light shading indicates outward flow with a velocity greater than 3 cm/sec.

FIGURE 20-M.C.-4—Vertical distribution of the component of geostrophic velocity (cm/sec.), relative to 500 db, along 98°30' W., May 17-24, 1967. Dark shading indicates outward flow with a velocity greater than 5 cm/sec.; light shading indicates outward flow with a velocity greater than 3 cm/sec.

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FIGURE 20-Q-3—Vertical distribution of oxygen (ml/l) along a section from 12° N., 112°20' W. to Manzanillo, April 29-May 2, 1967.

FIGURE 20-Q-4—Vertical distribution of oxygen (ml/l) along a section from Acapulco to 12° N., 105°20' W., May 7-10, 1967.


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FIGURE 20-UA-1—Vertical section of the atmosphere along 119°20' W., April 14-20, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isobars of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (mb) of each standard pressure surface is plotted for the northern radionucleotide station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.

FIGURE 20-UA-2—Vertical section of the atmosphere along 112°20' W., April 24-29, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isobars of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (mb) of each standard pressure surface is plotted for the northern radionucleotide station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.

FIGURE 20-UA-3—Vertical section of the atmosphere along 105°20' W., May 9-15, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isobars of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (mb) of each standard pressure surface is plotted for the northern radionucleotide station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.

FIGURE 20-UA-4—Vertical section of the atmosphere along 98°30' W., May 17-24, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isobars of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (mb) of each standard pressure surface is plotted for the northern radionucleotide station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.

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FIGURE 30-7'o.—Vertical distribution of temperature (°C) along 97°30' W., July 20-27, 1967. These contours are based on Nansen cast data only.

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FIGURE 30-5'o.—Vertical distribution of salinity (Sov) along 111°30' W., June 28-July 3, 1967.

FIGURE 30-5'o.—Vertical distribution of salinity (Sov) along a section from 12° N., 111°30' W. to Manzanillo, July 4-7, 1967. The contours from stations 132-148 are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of salinity (Sov) along a section from Acapulco to 12° N., 104°30' W., July 10-13, 1967. These contours are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of salinity (Sov) along 97°30' W., July 20-27, 1967. These contours are based on Nansen cast data only.

Thermocline anomaly and geostrophic velocity—Yellow pages

FIGURE 30-5'o.—Vertical distribution of thermocline anomaly, \(A_p\), (°C) along 118°30' W., June 16-26, 1967.

FIGURE 30-5'o.—Vertical distribution of thermocline anomaly, \(A_p\), (°C) along 111°30' W., June 28-July 3, 1967.

FIGURE 30-5'o.—Vertical distribution of thermocline anomaly, \(A_p\), (°C) along a section from 12° N., 111°30' W. to Manzanillo, July 4-7, 1967. The contours from stations 132-148 are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of thermocline anomaly, \(A_p\), (°C) along a section from Acapulco to 12° N., 104°30' W., July 10-13, 1967. These contours are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of thermocline anomaly, \(A_p\), (°C) along 104°30' W., July 13-18, 1967. These contours are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of thermocline anomaly, \(A_p\), (°C) along 97°30' W., July 20-27, 1967. These contours are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of the south component of geostrophic velocity (cm/sec), relative to 500 db, along 118°30' W., June 17-20, 1967. Dark shading indicates westward flow with a velocity greater than 5 cm/sec; light shading indicates eastward flow with a velocity greater than 5 cm/sec.

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FIGURE 30-5'o.—Vertical distribution of the south component of geostrophic velocity (cm/sec), relative to 500 db, normal to a section from 12° N., 111°30' W. to Manzanillo, July 4-7, 1967. Dark shading indicates flow toward the southwest with a velocity greater than 5 cm/sec; light shading indicates flow toward the northwest with a velocity greater than 5 cm/sec.

Oxygen—Green pages

FIGURE 30-5'o.—Vertical distribution of oxygen (ml/l) along 118°30' W., June 17-26, 1967.

FIGURE 30-5'o.—Vertical distribution of oxygen (ml/l) along 111°30' W., June 28-July 4, 1967.

FIGURE 30-5'o.—Vertical distribution of oxygen (ml/l) along a section from 12° N., 111°30' W. to Manzanillo, July 4-7, 1967.

FIGURE 30-5'o.—Vertical distribution of oxygen (ml/l) along a section from Acapulco to 12° N., 104°30' W., July 10-13, 1967. These contours are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of oxygen (ml/l) along 104°30' W., July 13-18, 1967. These contours are based on Nansen cast data only.

FIGURE 30-5'o.—Vertical distribution of oxygen (ml/l) along 97°30' W., July 20-27, 1967. These contours are based on Nansen cast data only.

Meteorology—Blue pages

FIGURE 30-5'o.—Vertical section of the atmosphere along 118°30' W., June 16-27, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isolines of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (m) of each standard pressure surface is plotted for the northernmost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.

FIGURE 30-5'o.—Vertical section of the atmosphere along 111°30' W., June 28-July 7, 1967. Solid lines are isolines of air temperature (°C). Dashed lines are isolines of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (m) of each standard pressure surface is plotted for the northernmost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.
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FIGURE 20-S-160.—Salinity (‰) on the surface, where $t_2 = 160 \text{ cl}./\text{lt.}$, April-May 1967. The table shows the temperature corresponding to each isohaline on the chart.
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FIGURE 20-O2-4168.—Oxygen (ml./l.) on the surface where $t_o = 160$ cl./l., April-May 1967.
FIGURE 20-MW-1. — Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period April 1-15, 1967. Heavy dashed lines are isobars. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isobars indicating mean resultant wind speed (kn.). Pressure (mb) averaged for 3-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kn.) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed band.
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FIGURE 20-MT-1. — Analysis of sea surface temperatures based on averages for 2-degree latitude-longitude squares from all available ship observations for the period April 1-15, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea surface temperatures averaged over 22 years) greater than 1°C; light hatching shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C, x 10) averaged for 5-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C, x 10) is plotted below the symbol.
FIGURE 20-15.2: Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period April 16-30, 1967. Solid lines are sea-surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea-surface temperatures averaged over 22 years) greater than 1°C; light hatching shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C, x 10) averaged for 3-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C, x 10) is plotted below the symbol.
FIGURE 20-MT-3. — Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period May 1-16, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea surface temperatures averaged over 32 years) greater than 1°C. Light hatching shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C x 10) averaged for 5-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C x 10) is plotted below the symbol.
FIGURE 20-MT-4. — Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period May 17-31, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea surface temperatures averaged over 22 years) greater than 1 °C; light hatching shows areas with negative anomalies greater than 1 °C. Sea surface temperature (°C x 10) averaged for 5-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C x 10) is plotted below the symbol.
FIGURE 20-MC-1. — Analyses of the surface dew-point temperature of the air and total cloud cover based on 2 degree (latitude-longitude) averages from all available ship observations for the month of April 1960. Solid lines depict the monthly mean total cloud cover in octas; the lines are dashed where data are sparse. Dash-dot lines are isolines of the mean monthly dew-point temperature at 2 degree (C.) intervals. Areas where 15 percent or more of the ships reported rain of any type at or within sight of the ship are shaded. Dew-point temperature (°C x 10) averaged for 5-degree squares is plotted above the mean position of the square, with total cloud cover (octas) below and rainfall frequency (%) to the right of the symbol.
FIGURE 20-MC.2 — Analyses of the surface dew-point temperature of the air and total cloud cover based on 2-degree (latitude-longitude) averages from all available ship observations for the month of May 1967. Solid lines depict the monthly mean total cloud cover in octas; the lines are dashed where data are sparse. Dash-dot lines are isotherms of the mean monthly dew-point temperature at 2-degree (°C) intervals. Areas where 50% or more of the ships reported rain of any type at or within 8 miles of the ship are shaded. Dew-point temperature (°C, x 10) averaged for 5-degree squares is plotted above the mean position of the square, with total cloud cover (octas) below and rainfall frequency (%) to the right of the symbol.
FIGURE 20-T-v1—Vertical distribution of temperature (°C) along 119°20' W., April 13-21, 1967.

FIGURE 20-T-3.—Vertical distribution of temperature (°C.) along a section from 12° N., 112° 20' W. to Manzanillo, April 29-May 2, 1967.
FIGURE 20.5-vL—Vertical distribution of salinity (‰) along 119° 20' W., April 13-21, 1967.
FIGURE 20.5-v2.—Vertical distribution of salinity (%o) along 112° 20’ W., April 23-29, 1967.

FIGURE 20.5-v3.—Vertical distribution of salinity (%o) along a section from 12° N., 112° 20’ W., to Manzanillo, April 29-May 2, 1967.
FIGURE 20S-3.—Vertical distribution of salinity (%) along 105° 29' W., May 10-13, 1967.

FIGURE 20S-4.—Vertical distribution of salinity (%) along a section from Arapuibo to 12° N., 105° 20' W., May 7-10, 1967.
FIGURE 20A-1. Vertical distribution of thermosteric anomaly, $b_T$, (cL/°C) along 119° 20' W., April 13-21, 1967.
FIGURE 20A—Vertical distribution of thermosteric anomaly, $\delta T$, (m$^2$ s$^{-1}$) along 112° 20' W, April 23-29, 1967.

FIGURE 20A—Vertical distribution of thermosteric anomaly, $\delta T$, (m$^2$ s$^{-1}$) along a section from 12° N, 112° 20' W, to Manzanillo, April 29-May 2, 1967.
FIGURE 2A-3.—Vertical distribution of thermocline anomaly, $t_c$ (c/l) along 105° 20' W., May 10-15, 1967.

FIGURE 2A-4.—Vertical distribution of thermocline anomaly, $t_c$ (c/l) along a section from Acapulco to 12° N., 105° 20' W., May 7-10, 1967.
FIGURE 204-6.—Vertical distribution of thermocline anomaly, hr. (¢/°) along 99° 20' W., May 17-24, 1967.
FIGURE 20-G-1—Vertical distribution of the zonal component of geostrophic velocity (cm./sec.) relative to 500 db. along 119° 20' W., April 13-21, 1967. Dark shading indicates eastward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 5 cm./sec.
FIGURE 20-G-2.—Vertical distribution of the zonal component of geostrophic velocity (cm./sec.), relative to 300 db, along 112° 20' W., April 24-29, 1967. Dark shading indicates westward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 5 cm./sec.

FIGURE 20-G-3.—Vertical distribution of the component of geostrophic velocity (cm./sec.), relative to 300 db, normal to a section from 12° N., 112° 20' W., to Manzanillo, April 24-29, 1967. Dark shading indicates flow toward the southeast with a velocity greater than 5 cm./sec.; light shading indicates flow toward the northwest with a velocity greater than 5 cm./sec.
FIGURE 20.G-v3.—Vertical distribution of the zonal component of geostrophic velocity (cm./sec.), relative to 500 db., along 101° 20' W., May 10-15, 1967. Dark shading indicates eastward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 5 cm./sec.

FIGURE 20.G-v4.—Vertical distribution of the component of geostrophic velocity (cm./sec.), relative to 500 db., normal to a section from Acapulco to 12° N., 101° 20' W., May 7-10, 1967. The dark shading indicates flow toward the southeast with a velocity greater than 5 cm./sec.
FIGURE 20G-v6.—Vertical distribution of the zonal component of geostrophic velocity (cm./sec.), relative to 500 dbar, along 98° 20' W., May 17-24, 1967. Dark shading indicates eastward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 5 cm./sec.
FIGURE 20-Os-v1.—Vertical distribution of oxygen (ml/l) along 119°20' W, April 13-21, 1967.
FIGURE 20-Os-v2.—Vertical distribution of oxygen (ml./l.) along 112°30' W., April 23-29, 1967.

FIGURE 20-Os-v3.—Vertical distribution of oxygen (ml./l.) along a section from 12° N. to 112°20' W. to Manzanillo, April 29-May 2, 1967.
FIGURE 20-UA v1.—Vertical section of the atmosphere along 119° 20' W., April 14-20, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isopleths of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (m) of each standard pressure surface is plotted for the northernmost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.

FIGURE 20-UA v2.—Vertical section of the atmosphere along 112° 20' W., April 24-29, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isopleths of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (m) of each standard pressure surface is plotted for the northernmost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.
FIGURE 20-UA-5—Vertical section of the atmosphere along 105°-20° W., May 9-16, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isopleths of mixing ratio of the air (g./kg.). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (m.) of each standard pressure surface is plotted for the northernmost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.

FIGURE 20-UA-6—Vertical section of the atmosphere along 98°-20° W., May 17-24, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isopleths of mixing ratio of the air (g./kg.). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb). The computed height (m.) of each standard pressure surface is plotted for the northernmost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northern station is shown at each standard level.
FIGURE 30-T-a. — Temperature (°C) at the sea surface, June-July 1967. These contours are based on Nansen cast data.
FIGURE 30 ML — Thickness of the mixed layer in meters, June-July 1967. Dashed lines indicate portions of the cruise track where such data were collected.
FIGURE 30S.-Salinity (‰) at the sea surface, June-July 1967. These contours are based on Nansen-cast data.
FIGURE 30-OxSa-10. — Oxygen saturation (%) at 10 meters, June-July 1967. Areas with less than 100% saturation are shaded.
FIGURE 30-300a.—Depth (m.) of the surface where \( h = 300 \text{ d}./\text{t.} \), June-July 1967.
FIGURE 30S-3000.—Salinity (%) on the surface where $t = 300$ $cl./l$, June-July 1967. The table shows the temperature corresponding to each isohaline on the chart.
FIGURE 30-AP-4300.—Acceleration potential (j/kg), relative to 500 db, on the surface where $\tau_r = 300$ cl./l., June-July 1967. For computing acceleration potential, thermosteric anomaly, $\tau_r$ was used instead of specific volume anomaly, $t$. 
FIGURE 30.5O-3500.-Oxygen (ml/l.) on the surface where $t = 300$ cl./l., June-July 1967.
FIGURE 30-230a.—Depth (m.) of the surface where \( b = 250 \) c.f.t., June-July 1967.
FIGURE 36.S-250.—Salinity (‰) on the surface where \( t_g = 250 \text{ ft./s.} \), June-July 1967. The table shows the temperature corresponding to each isohaline on the chart.
FIGURE 3b-AP-1250.—Acceleration potential (g/kg), relative to 500 db, on the surface where $\frac{a}{r} = 250$ cl./t. June-July 1967. For computing acceleration potential, thermometric anomaly, $a$, was used instead of specific volume anomaly, $\lambda$. 
FIGURE 30-0250.—Oxygen (ml/l.) on the surface where 4 = 250 cl/l., June-July 1967.
FIGURE 30-200-z—Depth (m.) of the surface where $k = 200$ c./s., June-July 1967.
FIGURE 30-S-200.—Salinity (‰) on the surface where \( t_s = 200 \text{ cl}./\text{lt.}, \) June-July 1967. The table shows the temperature corresponding to each isohaline on the chart.
FIGURE 30-AP200.—Acceleration potential (j/ kg.), relative to 500 db., on the surface where \( \phi = 200 \) d. I., June-July 1967. For computing acceleration potential, thermometric anomaly, \( \phi \), was used instead of specific volume anomaly, \( \psi \).
FIGURE 30-O=4200.—Oxygen (ml./l.) on the surface where $t_r = 200$ °C/l., June-July 1967.
FIGURE 30-160-2—Depth (m.) of the surface where $h = 160$ cm./l., June-July 1967.
FIGURE 30-S-160—Salinity (‰) on the surface where $t_s = 160$ °C, June-July 1967. The table shows the temperature corresponding to each isohaline on the chart.
FIGURE 30-AF-160.—Acceleration potential (g/kg.), relative to 500 dbar, on the surface where $\theta_v = 160$ °C, June-July 1967. For computing acceleration potential, thermometric anomaly, $\theta_v$, was used instead of specific volume anomaly, $\lambda$. 
FIGURE 30 Os-4160.—Oxygen (ml./l.) on the surface where \( t = 160 \) el./l., June-July 1967.
FIGURE 30-MW-1. Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 3-degree (latitude-longitude) squares for the period June 1-16, 1967. Heavy dashed lines are isobars. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isochrones indicating mean resultant wind speed (km). Pressure (mb) averaged for 3-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (km) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed band.
FIGURE 30-MW.2 — Analysis of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period June 17-30, 1967. Heavy dashed lines are isobars. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isobars indicating mean resultant wind speed (kn.). Pressure (mb) averaged for 5-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kn.) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed band.
Figure 39-MW-3. - Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period July 1-15, 1967. Heavy dashed lines are isobars. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isotachs indicating mean resultant wind speed (kn). Pressure (mb) averaged for 5-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kn) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed line.
Figure 10-MW-4. - Analyses of the surface air pressure and surface winds from all available ship observations, averaged over 2-degree (latitude-longitude) squares for the period July 16-31, 1967. Heavy dashed lines are isolines. Solid lines are streamlines showing the mean resultant direction of wind flow. Light dash-dot lines are isobars indicating mean resultant wind speed (kn.). Anomalously averaged for 5-degree squares is plotted above the mean position of the square, and resultant wind direction followed by speed (kn.) is plotted below. The monthly climatological position of the intertropical convergence zone is shown by a wide dashed line.
FIGURE 30-MT-1. Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period June 1-16, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea surface temperatures averaged over 22 years) greater than 1° C. Light hatching shows areas with negative anomalies greater than 1° C. Sea surface temperature (°C, x 10) averaged for 2-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C, x 10) is plotted below the symbol.
FIGURE 10-MT-2. — Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period June 15-30, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea surface temperatures averaged over 22 years) greater than 1°C; light hatching shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C x 10) averaged for 3-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C x 10) is plotted below the symbol.
FIGURE 30-MT-3. — Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period July 1-15, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea surface temperatures averaged over 22 years) greater than 1°C. Sea surface temperature (°C x 10) averaged for 1-degree squares is plotted above the mean position of the square; sea temperature minus air temperature difference (°C x 10) is plotted below the symbol.
FIGURE 30-MT-4. Analysis of sea surface temperatures based on averages for 2-degree (latitude-longitude) squares from all available ship observations for the period July 16-31, 1967. Solid lines are sea surface isotherms (°C); the isotherms are dashed where data are sparse. Dark hatching outlines areas with positive temperature anomalies (computed from mean sea surface temperatures averaged over 22 years) greater than 1°C.; light hatching shows areas with negative anomalies greater than 1°C. Sea surface temperature (°C x 10) averaged for 5-degree squares is plotted above the mean position of the square; sea tempe-
FIGURE 18-C1. Analyses of the surface dew-point temperature of the air and total cloud cover based on 2-degree latitude-longitude averages from all available ship observations for the month of June 1967. Solid lines depict the monthly mean total cloud cover in octas, the lines are dashed where data are sparse. Dash-dot lines are isotherms of the mean monthly dew-point temperature at 2-degree (C.) intervals. Areas where 15 percent or more of the ships reported rain of any type at or within sight of the ship are shaded. Dew-point temperature (°C x 10) averaged for 5-degree squares is plotted above the mean position of the square, with total cloud cover (octas) below and rainfall frequency (%) to the right of the symbol.
FIGURE 30-MC-2. — Analyses of the surface dew-point temperature of the air and total cloud cover based on 2-degree (latitude-longitude) average from all available ship observations for the month of July 1963. Bold lines depict the monthly mean total cloud cover in oktas; the lines are dashed where data are sparse. Dash-dot lines are isotherms of the mean monthly dew-point temperature at 2-degree (C.) intervals. Areas where 15 percent or more of the ships reported rain of any type at or within sight of the ships are shaded. Dew-point temperature (°C ± 0.5) averaged for 5-degree squares is plotted above the mean position of the square, with total cloud cover (oktas) below and rainfall frequency (%) to the right of the symbol.
FIGURE 30-1: Vertical distribution of temperature (°C) along 111°30' W, June 28-July 3, 1967.

FIGURE 30-2: Vertical distribution of temperature (°C) along a section from 12° N, 111°30' W, to Mazatlan, July 4-7, 1967. The contours from Stations 132-148 are based on Nansen cast data only.
FIGURE 30-T-5.—Vertical distribution of temperature (°C) along 104°30' W., July 13-18, 1967. These contours are based on Nansen cast data only.

FIGURE 30-T-6.—Vertical distribution of temperature (°C) along a section from Arapahoe to 12° N., 104°30' W., July 10-13, 1967. These contours are based on Nansen cast data only.
FIGURE 30.T-v6.—Vertical distribution of temperature (°C) along 97°-30° W., July 20-27, 1967. These contours are based on Nansen cast data only.
FIGURE 30.5.1—Vertical distribution of salinity (‰) along 118° 30' W., June 16-26, 1967.
FIGURE 30-Sv2.—Vertical distribution of salinity (%) along 111°30' W., June 28-July 3, 1967.

FIGURE 30-Sv3.—Vertical distribution of salinity (%) along a section from 12° N., 111°30' W. to Manusulo, July 4-9, 1967. The contours from Stations 132-148 are based on Nansen cast data only.
FIGURE 30.5-v3 — Vertical distribution of salinity (‰) along 104°30' W., July 13-18, 1967. These contours are based on Nansen cast data only.

FIGURE 30.5-v4 — Vertical distribution of salinity (‰) along a section from Acapulco to 12° N., 104°30' W., July 10-13, 1967. These contours are based on Nansen cast data only.
FIGURE 30-S-6. Vertical distribution of salinity (%) along 97°36' W. July 20-27, 1967. These contours are based on Nansen cast data only.
FIGURE 30.31.—Vertical distribution of thermocline anomaly, °C, (d/10°) along 118°30' W., June 16–26, 1967.
FIGURE 30A+2.—Vertical distribution of thermosteric anomaly, $\tau_r$ (cl.1.) along 111°30' W, June 28-July 3, 1967.

FIGURE 30A+3.—Vertical distribution of thermosteric anomaly, $\tau_r$ (cl.1.) along a section from 12° N, 111°30' W to Manusville, July 4-7, 1967. The contours from Stations 112-148 are based on Nansen cast data only.
FIGURE 30.14.3—Vertical distribution of thermosteric anomaly, $\Delta T$, (c/d/1) along 104° 30' W., July 13-18, 1967. These contours are based on Nansen cast data only.

FIGURE 30.14.4—Vertical distribution of thermosteric anomaly, $\Delta T$, (c/d/1) along a section from Acapulco to 12° N., 104° 30' W., July 10-13, 1967. These contours are based on Nansen cast data only.
FIGURE 50.6-56.—Vertical distribution of thermosteric anomaly, \( k_{t} \) (c.f.) along 97° 30' W., July 20-27, 1967. These contours are based on Nansen cast data only.
FIGURE 30-G-1.—Vertical distribution of the zonal component of geostrophic velocity (cm./sec.), relative to 500 db, along 118°30' W., June 17-26, 1967. Dark shading indicates eastward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 3 cm./sec.
FIGURE 30-G-2.—Vertical distribution of the zonal component of geostrophic velocity (cm./sec.), relative to 300 db., along 111°30′ W., June 26-July 3, 1967. Dark shading indicates eastward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 5 cm./sec.

FIGURE 30-G-3.—Vertical distribution of the component of geostrophic velocity (cm./sec.), relative to 300 db., normal to a section from 12° N., 111°30′ W., to Manzanillo, July 4-7, 1967. Dark shading indicates flow toward the southeast with a velocity greater than 5 cm./sec.; light shading indicates flow toward the northwest with a velocity greater than 5 cm./sec.
FIGURE 30.G-5.—Vertical distribution of the meridional component of geostrophic velocity (cm./sec.), relative to 500 db., along 104°30' W., July 13-18, 1967. Dark shading indicates northward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 5 cm./sec.

FIGURE 30.G-4.—Vertical distribution of the component of geostrophic velocity (cm./sec.), relative to 500 db., normal to a section from Asopolo to 12°N., 104°30' W., July 10-12, 1967. Dark shading indicates flow toward the southwest with a velocity greater than 5 cm./sec.; light shading indicates flow toward the northwest with a velocity greater than 5 cm./sec.
FIGURE 3D-G-v.6.—Vertical distribution of the zonal component of geostrophic velocity (cm./sec.), relative to 500 db., along 97°-99° W., July 20-26, 1962. Dark shading indicates eastward flow with a velocity greater than 5 cm./sec.; light shading indicates westward flow with a velocity greater than 5 cm./sec.
FIGURE 30-O2-v1.—Vertical distribution of oxygen (mL/L) along 110°30' W, June 17-26, 1967.
FIGURE 30-O2+2.—Vertical distribution of oxygen (mL/L) along 111°30' W. June 28-July 4, 1967.

FIGURE 30-O2+3.—Vertical distribution of oxygen (mL/L) along a section from 12° N., 111°30' W. to Manzanillo, July 4-7, 1967.
FIGURE 36-0v5.—Vertical distribution of oxygen (ml/L) along 104°30' W., July 13-18, 1967.

FIGURE 36-Ov4.—Vertical distribution of oxygen (ml/L) along a section from Acapulco to 10° N., 104°30' W., July 10-13, 1967.
FIGURE 30-Oa-v6—Vertical distribution of oxygen (ml/l.) along 97°30' W., July 26-27, 1967.
FIGURE 30-UA-1d—Vertical section of the atmosphere along 118° 30' W., June 16-27, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isopleths of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb.). The computed height (m.) of each standard pressure surface is plotted for the northermost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northermost station is shown at each standard level.

FIGURE 30-UA-2d—Vertical section of the atmosphere along 111° 30' W., June 28 to July 7, 1967. Solid lines are isotherms of air temperature (°C). Dashed lines are isopleths of mixing ratio of the air (g/kg). Surface air temperature is plotted above surface mixing ratio and below a base line representing the surface pressure (mb.). The computed height (m.) of each standard pressure surface is plotted for the northermost radiosonde station of the section. At other stations the difference of computed height minus the corresponding height at the northermost station is shown at each standard level.