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Vertical Sections of Semimonthly Mean Temperature on the San Francisco-Honolulu Route: From Expendable Bathythermograph Observations, June 1966-December 1974

J. F. T. Saur, L. E. Eber, D. R. McLain,
and C. E. Dorman

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

National Marine Fisheries Service, Special Scientific Report—Fisheries

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671. Coastal upwelling indices, west coast of North America, 1946-71. By Andrew Bakun. June 1973, iv + 103 p., 6 figs., 3 tables, 45 app. figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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U.S. DEPARTMENT OF COMMERCE
Juanita M. Kreps, Secretary

National Oceanic and Atmospheric Administration
Richard A. Frank, Administrator
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J. F. T. SAUR,[1] L. E. EBER,[2] D. R. McLAIN,[3] and C. E. DORMAN[4]

ABSTRACT

Frequently repeated sections of expendable bathythermograph observations between San Francisco and Honolulu, taken by merchant vessels during the period June 1966 through December 1974, were analyzed to obtain mean seasonal cycles. Results are depicted in a set of semimonthly vertical sections of mean temperatures to 500 m and in a set of corresponding sections of 30-day mean temperature changes to 200 m. In addition, seasonal cycles at selected depths are included along with mean monthly vertical profiles for seven typical locations along the route.

The analyses reveal geographic and temporal facets of the mean thermal structure, including: 1) depth of the surface mixed layers in winter, 2) growth and decay of the seasonal thermocline, 3) decrease in depth of the permanent thermocline from Oahu to the California coast, 4) a region of temperature inversions or very weak vertical temperature gradients that develops between 50 and 100 m during the spring in the Transition Zone, and 5) the location and movement of warming and cooling regions during the year.

Vertical mixing appears to be the dominant process along most of the route for transmitting the annual surface warming and cooling cycle downwards to depths of 100 to 150 m. However, advective processes are active in the California Current.

Tables of semimonthly mean temperatures are given in an Appendix.

INTRODUCTION

Vertical sections of mean subsurface temperatures from the surface to 500 m, presented here, were derived from a time-series of sections of expendable bathythermograph (XBT) observations made from June 1966 through December 1974 by merchant ships between San Francisco, Calif., and Honolulu, Hawaii (Fig. 1). The observational program was developed by Saur and the data collected under the direction of the National Marine Fisheries Service (NMFS). With technical assistance from the Fleet Numerical Weather Central (FNWC), XBT systems were placed on merchant ships and observations were made routinely by the ship's mates. Saur and Stevens (1972) described the XBT system, observational procedures, and early projects for obtaining observations from cooperating ships.

Collection of subsurface temperature observations on the San Francisco-Honolulu route began when the first production models of the XBT system became available. The work started as a 1- to 2-yr feasibility and development project on the use of the system aboard merchant vessels. It was then continued as an ocean monitoring project, and is now a part of a coordinated program among FNWC, NMFS, and NORPAX (North Pacific Experiment) programs to obtain XBT observations in the Pacific. The data are now routinely collected

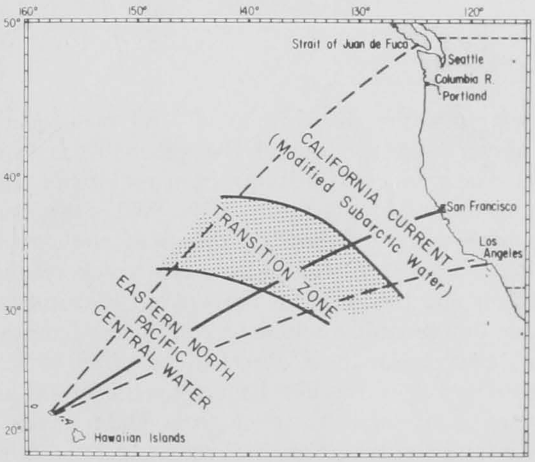

Figure 1.—Three great circle routes between Honolulu and U.S. west coast ports, on which frequent XBT observations have been made by cooperating merchant ships, and a schematic representation of the three upper ocean regimes in the area. Mean subsurface temperatures reported here are for the San Francisco-Honolulu route for which the longest time series—starting in June 1966—exists.

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and selected vertical sections of the temperature distribution, with individual XBT profiles, have been published regularly in *Fishing Information*[5] since March 1972.

The ship routes between Honolulu and U.S. west coast ports cross the eastern limb of the major anticyclonic gyre of the North Pacific Ocean. If we confine our attention to the upper ocean, from the surface to a few hundred meters, we can identify three oceanic regimes: the California Current and the Eastern North Pacific Central waters separated by a Transition Zone (Fig. 1).

The waters in the California Current are mainly cooler, lower salinity waters of subarctic origin that are modified in their slow southeastward movement along the California coast. The Eastern North Pacific Central waters are warmer, higher salinity waters that occupy about the southwestern one-half of the route.

The Transition Zone is a complex region, not yet fully understood. In our region of interest it is bounded on the south and southwest by the subtropical front (Roden 1971, 1975). On the north and northeast it is bounded, respectively, by the subarctic front (Dodimead et al. 1963) and some type of southeastward extension of this feature, which LaFond and LaFond (1971) called the California Front. Saur (1974) described criteria for identifying these regimes from the XBT profiles, changes in slopes of isotherms in the vertical sections, and accompanying surface salinity observations. Laurs and Lynn (1977) discussed features of the Transition Zone from oceanographic observations made in June of several different years by fishery research vessels.

Mean temperatures presented here provide a base for study of temperature anomalies (Dorman and Saur 1977, 1978) and for further research on the relation of temperature variability to air-sea interaction and the changing environment of marine organisms.

METHODS

Observations

The time-distance distribution of XBT observations for the period June 1966 through December 1974 is shown in Fig. 2. The great circle distance from a reference point near Oahu was used for location. About 90% of the observations were made by ships on the great circle route. Some departures from the great circle track resulted from storms and the fact that tankers of Chevron Shipping Company generally followed a rhumb line (constant heading) course. For these observations taken at locations displaced from the usual route by 100 to 150 km, the use of great circle distance from Oahu tends to minimize temperature errors, because the general orientation of isotherms in the upper layers is northwest-

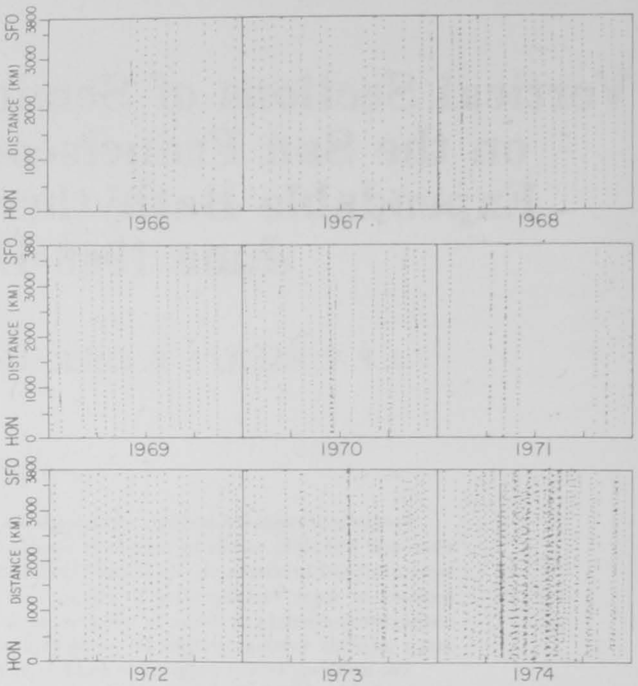


Figure 2.—The time-distance distribution of XBT observations on or near the San Francisco-Honolulu route from June 1966 through December 1974. Location of an observation is measured by its great circle distance from an offshore reference point (lat. 21°12′N, long. 157°42′W) near Honolulu.

southeast. The San Francisco end of our section is a point on the edge of the continental shelf a short distance south-southwest of the Farallon Islands and 3,800 km (2,050 n.mi.) from the reference point.

With the exception of the first year and one-half when only four observations per day were scheduled, the XBT observations were taken on a 4-h schedule related to the ship's watch, rather than at prespecified "stations." Thus the location of observations along the route differs from one section to another. Also, the distance between observations depended upon the ship's speed. Of those ships cooperating in the program, normal speeds were either about 16 to 17 kn or about 22 kn, so that the distance between observations was about 120 km (65 n.mi.) or 165 km (90 n.mi.), respectively. The slower ships would generally get 27 to 30 observations per transit and the faster ships about 17 to 20 observations. A few sections with more closely spaced observations for special studies were made when scientific personnel were aboard.

The frequency of sections reflects the growth and change in character of the project. With the exception of six sections made by oil tankers in the summer of 1970, all of the observations from the beginning of the project in June 1966 through January 1971 were made from one vessel, *Californian,* a bulk-cargo and container vessel of Matson Navigation Company. This 17-kn ship made a round trip about every 18 to 21 days, generally making observations on one 5-day leg only. During this period several gaps of 4 to 8 wk duration occurred because of ship repair schedules, short labor strikes, and equipment failures.

[5]*Fishing Information* is a National Marine Fisheries Service monthly publication, containing fishery advisory information and environmental charts for the equatorial and North Pacific Ocean. It is compiled and distributed by the Southwest Fisheries Center, National Marine Fisheries Service, NOAA, P.O. Box 271, La Jolla, CA 92038.

A prolonged maritime strike in 1971 interrupted the series for two periods of nearly 3 and 5 mo each. A faster (22 kn) ship, *Hawaiian Enterprise,* made most of the sections in 1971 and 1972, resulting in more frequent sections but with greater spacing between observations. As a part of the International Decade of Ocean Exploration (IDOE) programs, we began instrumenting other ships in late 1972 for other routes, but which also would make sections irregularly on the San Francisco route. Using these ships, the frequency of sections on the San Francisco route was increased in 1973 and intense coverage was obtained in 1974.

For the entire period from June 1966 through December 1974 there was a total of 4,913 observations (Table 1). A number of the sections did not have complete coverage, with the coverage generally being poorest near either end of the route. This should be considered when interpreting the computer analyses which will be presented.

Instrumentation

The basic sensing and recording system used throughout the period was the Sippican XBT system. Progressive improvements were made in the recorder by the manufacturer—some partially due to the field experiences from this project—during the first few years, 1966-68. Since then, the recorder, with pressure sensitive paper and an option switch for 460 m (1,500 ft) or 760 m (2,500 ft) depth recording, has remained essentially unchanged.

The XBT system initially installed aboard the *Californian* included an experimental digitizer (developed by FNWC) with analog signal input from a retransmitting slidewire in the XBT recorder and digital output onto a 5-level punched paper tape at depth intervals of slightly less than 3 m (Saur and Stewart 1967). This was a dual purpose output for testing radio transmission of data to FNWC and for subsequent computer conversion, ashore, onto magnetic tape for permanent archives. The digitizer system became unstable after April 1969 which made the output unsuitable for archiving data. Although commercial digitizing systems were tried with some of the new recorders installed on other ships in 1971 and 1972, all of the data used herein from May 1969 onward were derived from the analog traces.

Sippican model T-4 XBT probes (460 m) were used during the first 1.5 yr of the project. We switched to use of model T-7 probes (760 m) in November 1967, to try to minimize probe-to-probe temperature errors by correcting deep temperatures to a smoothed deep level temperature (e.g., 600 or 700 m). This plan proved to be unworkable because the deep level temperatures could be offset to warmer temperatures by insulation failures on the wire and such a bias could not always be recognized with certainty by examination of the analog traces or vertical sections. At a later date mesoscale eddies were discovered and appeared to have deep

Table 1.—Number of expendable bathythermograph (XBT) sections by cooperating ship and total observations by year on the San Francisco-Honolulu route.

	Year									Total
	1966	1967	1968	1969	1970	1971	1972	1973	1974	sections
Matson Navigation Co.										
Californian	10	15	18	15	15	5			6	84
Hawaiian Enterprise						4	[1]18	19	[2]26	67
Hawaiian Citizen									1	1
Hawaiian Queen									10	10
Chevron Shipping Co.										
Idaho Standard					3					3
Washington Standard					2					2
McGarragill					1					1
Chevron Californian							1	2	1	4
Chevron Mississippi							1	4		5
States Lines										
Michigan						1				1
Idaho						1				1
American President Line										
President Cleveland						1				1
Pacific Far East Line										
Monterey								2	1	3
Mariposa									9	9
U.S. Coast Guard										
USCGC *Midgett*								2		2
Total sections	10	15	18	15	21	12	20	29	54	194
Total observations	204	329	550	435	592	229	453	635	1,486	4,913

[1]11-16 February 1968 section had two XBT drops at each 4-h interval.
[2]Includes one special section, 27 April-1 May 1974, with hourly observations by R. L. Bernstein and C. A. Collins.

temperature changes equal to or greater than temperature error of the probes manufactured in 1968 and later.

As the cost of probes rose in the early 1970's we returned to using T-4 probes. With the merchant ships the amount of wire on the probe was the limiting factor on depth of the XBT observation. We found that the manufacturer's safety margin of excess wire on the probe usually permitted a reliable determination of temperature to 500 m.

Initial Processing

The procedures for initial processing of the observations into digital form on magnetic tape evolved as the project developed.

As noted earlier, the XBT system used during 1966-69 aboard the *Californian* included an experimental digitizer with a punched paper tape output. Most of the observations through April 1969 were computer translated from this output, which was regularly calibrated with the manufacturer's test canister on the visit to the ships before and after each voyage. In cases of digitizer failure significant points were read by eye from the analog traces, as were all observations for May-December 1969. Some sets of observations from 1967 to 1968 were semiautomatically digitized by FNWC in the early stages of development of its XBT digitizing system for computer determination of temperature-depth inflection points.

When the NMFS Pacific Environmental Group (PEG) was established in Monterey, the 1970 and later observations were digitized on an analog-digital table, under the supervision of McLain and using the facilities and computers of FNWC. The digitizing procedures generally followed those used at FNWC, described by Dale and Stevens (1970), except as modified by McLain at PEG to handle the NMFS data separately from FNWC data, to digitize analogs from T-4 probes to 500 m, and to plot vertical sections.

Quality Control

Preliminary vertical sections of the distribution of temperature were constructed, at first by hand and later by computer, for quality control. Saur reviewed each data set for possible errors utilizing the preliminary sections, analog traces, and continuity from section to section. Locations of observations were plotted to help check positions and an independent check of time and distance between observations was made against the ship's speed. For observations through 1970, copies of marine weather logs on which positions of 6-h weather observations were logged independently of XBT logs were also used to correct time and position errors.

The data checks were made to eliminate large errors due to instrument failure not detected before digitizing. These were of several types: 1) erroneously high temperatures throughout a trace due to defective thermistors or insulation failure from the start, 2) insulation failure during the probe descent which would introduce bias toward higher temperatures in the remainder of an analog record, and 3) slippage of the friction clutch on the chart drive, which occurred mainly in early years before we became more experienced with the XBT system. Corrections were made at a later time when temperature values were interpolated at 5-m intervals between the surface and 300 m and at 10-m intervals between 300 and 500 m depth, for the computer analysis of temperature fields.

Computational Procedures

The determination of the vertical sections of mean subsurface temperature presented herein involved three steps: 1) Conversion of observed temperatures from each section to temperatures on a standard grid; 2) computation of a seasonally varying mean at each grid point by least squares fit of 12-, 6-, and 4-mo harmonics; and 3) reconstruction of gridded temperature fields from the harmonics, spatial smoothing, and contouring of vertical sections. The computer programs used for this were adaptations by Eber of those he prepared at SWFC to map environmental variables in marine weather observations for presentation in *Fishing Information.*

1. Conversion to a standard grid.—It was previously mentioned that observations were not taken at the same predetermined location from section to section. The first step was to analyze observed values from each section to a standard rectangular grid, using a procedure from Eber's EDMAP[6] (Environmental Data Manipulation, Analysis, and Plotting) program.

The grid was selected with a distance interval of 92.5 km (50 n.mi.) and a depth interval of 10 m. This resulted in a grid of 42 by 51 points representing a vertical section 3,800 km (2,050 n.mi.) by 500 m. Distance and depth were converted to grid coordinate units for the temperature analysis.

The procedure scanned the data list and fitted temperature values to the grid. Each observation contributed to the values at its nearest grid points according to an inverse weighting scheme based on distance from the observation to each of the grid points. The weighting factor decreased to zero at one grid length. If no observation was found within one grid length of a grid point, it was flagged as a "no data" point in that section.

The procedure can be viewed as a refinement of centering the observational data within 185-km (100 n.mi.) by 20-m blocks that have a 50% overlap between adjacent (both vertically and horizontally) blocks. However, if there is more than one observation within a block, each is weighted according to the distance to the center of the block and the number of grid points it will affect. (The

[6]Unpublished documentation of the EDMAP program is on file at the Southwest Fisheries Center, National Marine Fisheries Service, NOAA, La Jolla, CA 92038.

procedure gives somewhat greater weight to an observation near a grid point than would a weighting of $1-R^2$, where R is the distance in fractions of a grid length.) If there is only one observation within a unit grid area and there are no observations in any of the surrounding grid areas, the observed value would be assigned to each of the four nearest grid points.

The middate of the observations in a given section was assigned to its corresponding grid field for later use in determining harmonic coefficients. Thus the maximum time error for data at either end of the section would be about 2.0 to 2.5 days.

2. Least squares harmonic fit.—In order to establish a smooth mean seasonal cycle for each gridpoint, a least squares fit was made for the harmonic function

$$T_{i,j} = (A_o)_{i,j} + \sum_{n=1}^{3} (A_n \cos n\omega t + B_n \sin n\omega t)_{i,j}$$

where $\omega = 2\pi/365$, t is the day of the year, and i and j are gridpoint indices. Robinson (1976) also used the first three harmonics of the Fourier function for time smoothing of monthly mean values of mechanical bathythermograph data (to 400 ft) for the North Pacific Ocean. Since our initial gridded fields were not distributed at equal intervals in time, the terms which normally disappear in harmonic analysis of evenly spaced data (due to orthogonality) are not zero when applying the least squares fit. Seven simultaneous equations for least squares fit were solved to determine the seven unknown constants to represent the mean temperature and the12-, 6-, and 4-mo cycles.

To avoid overweighting certain years because of greater sampling frequency, a set of harmonic constants was determined for each of three time periods: June 1966-December 1970, 1971-73, and 1974. The first period was selected because of the consistency of the sampling mentioned earlier. The year 1974 was analyzed separately because of the unusually high-density sampling. The observations from 1971 and 1972 were considered as 1 yr and combined with 1973.

Constants from the three periods were weighted and combined by Dorman to provide the mean constants representative of the 1966-74 period. Weights assigned to the periods were as follows:

Period	*Weight*
June 1966-December 1970	4.5
1971-1973	2.0
1974	1.0

3. Vertical sections of mean temperature and mean temperature change.—Appendix 1 contains vertical sections of the mean temperature structure along the Honolulu-San Francisco route, to depths of 500 m, for 24 equally spaced times throughout a year. (For convenience of identification these are labeled as 01 January, mid-January, 01 February, etc., to mid-December.)

The data field for each of the 24 mean vertical sections was reconstructed from the harmonic functions at each grid point. Because the time smoothing by the least squares fit was independent from point to point, a spatial smoothing was applied to the grid field before contouring.

The spatial smoothing was done with one pass of a 5 × 5 point (370 km by 40 m) smoother in the EDMAP program. The smoother was a two-step numerical filter, after Shapiro (1970), which was mostly effective for reducing amplitudes of perturbations with wave lengths of less than about four grid lengths. Its response was zero at a wave length of two grid lengths, 0.45 at three grid lengths, and 0.75 at four grid lengths. The response was 0.96, or greater, at wave lengths of seven grid lengths or more.

The contouring part of the EDMAP program divided each grid square into 25 subsquares, whose corner values were determined by Bessel's central difference formula for double quadratic interpolation. The intersection of each contour with the boundary of a subsquare it transects was determined by linear interpolation. The isotherms were computer plotted and are reproduced herein, with drafting touch-up only for clarity of presentation. The isotherms were not changed subjectively.

The major changes in the seasonally varying mean temperature were found to occur in the upper 200 m of the water column. The figures of Appendix 1 also show the distribution of the "30-day" temperature changes for the upper 200 m. The changes were computed from the spatially smoothed data (described on page 7) and are centered on the date of the vertical section in the upper panel. Note that there is a 50% overlap between two consecutive temperature change charts.

4. Tables of mean temperature.—Mean temperature values, in °C, for selected depths and alternating grid points (intervals of 185 km) are presented in Appendix 2. The values are those reconstructed from the fitted harmonics for the given grid point (distance and depth) and extracted before the grid was spatially smoothed for contouring. The tables are identified as 01 January, mid-January, etc., to mid-December, as were the vertical sections of Appendix 1.

RESULTS

This section discusses some of the general features of the mean temperature distributions in Appendix 1. Further, we have selected seven locations, each of which has vertical temperature structure and cycles characteristic of a part of the route. For each of these, Figure 3a-g shows the seasonally varying mean temperature for eight depths from the surface to 500 m, and Figure 4a-g shows the mean monthly vertical profiles of temperature for the warming and cooling periods.

Annual Cycles

At the surface the annual period is predominant at all locations (Fig. 3a-g). The annual range was smallest (about 4°C) near Oahu, largest (about 7°C) in the Transition Zone, and again smaller near the California coast (about 5°C). From near Oahu to the California front, the cycles at 50 m diminished in amplitude and the summer maximum lagged that at the surface by 1 to 2 mo. At the low salinity core of the California Current (Fig. 3f) the summer maximum penetrated almost simultaneously from the surface to 200 m. In the inshore area, California Current (Fig. 3g), the temperature range at 50 m was small (about 1°C). Here the minimum and the maximum temperatures lagged those at the surface by about 4 mo, and appear to be related to the occurrence of upwelling and the subsurface countercurrent, respectively.

Mixed Layers and Thermoclines

The surface mixed layers reach their maximum depth in winter, mid-February through early April, Appendix 1. Depths of the mixed layers were generally at least 100 m, except they decreased to 75 m near California. They were deepest, about 150 m, in the central part of the section (2,000 to 2,200 km) in the neighborhood of the subtropical front.

We consider the permanent thermocline to be the region of the maximum vertical temperature gradient in winter (January through March); vertical sections of Appendix 1 and profiles of Figure 4. In the western half of the section it was deeper (200 to 250 m) and warmer (15° to 17°C) than in the California Current region where it lay at depths of 100 to 120 m and had temperature to 13°C. The seasonal thermoclines are formed by ing in spring and summer (May through Septemb are generally confined to the upper 50 to 100 m wh vertically mixed in winter. In the California C region the seasonal thermocline merged with the nent thermocline into a single feature, whereas Transition Zone the two thermoclines were separ the spring by temperature inversions (next sectio later by a near thermostad (vertically isothermal Figure 4d. The latter was particularly evident summer (July through August) sections by the slope of the 15°-19°C isotherms at depths from 50 m at distances of 2,000 to 3,000 km from Honolulu Eastern North Pacific Central waters from Hono near 1,800 to 2,000 km along the route, a layer o vertical temperature gradient occurred betwe seasonal and permanent thermoclines.

Temperature Inversions

A characteristic feature found by Saur (1974) individual profiles in the Transition Zone (betwee and 3,000 km from Honolulu) was the occurrence plex vertical thermal structure, especially in the months. The thermocline would often be interru isothermal layers and temperature inversions ap in some profiles. These were attributed to interl by horizontal mixing, of layers of cool, low-salinit with warmer, higher salinity water of nearly th density. These features usually are relatively sma and transient, so that during our computation of they were generally smoothed out. However,

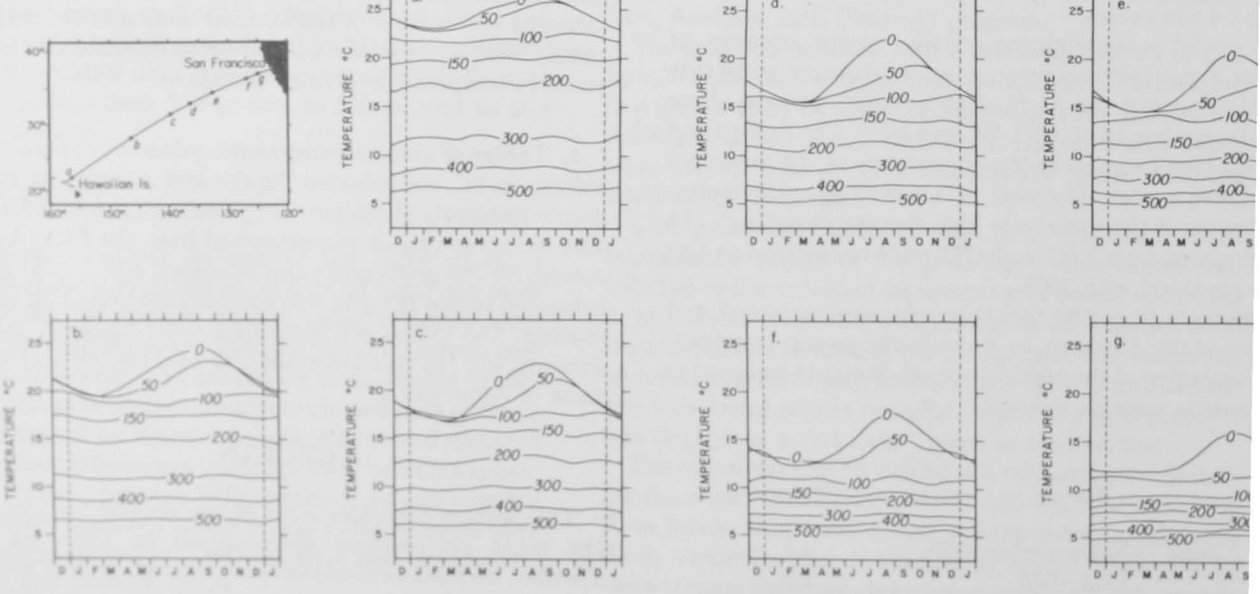
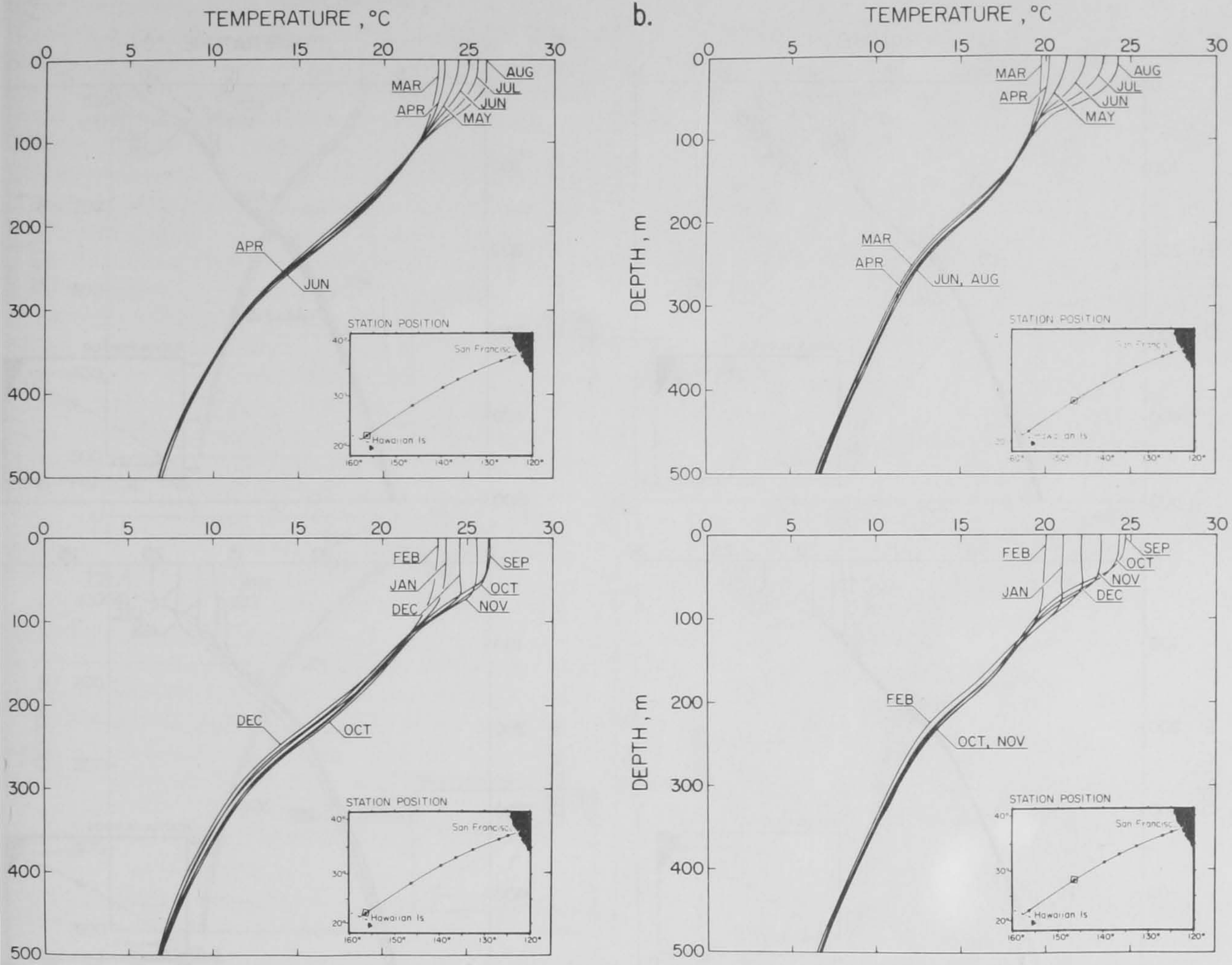


Figure 3.—Station position chart and mean temperature cycles at selected depths (meters) for seven typical locations, great circle from offshore reference point (lat. 21°12′N, long. 157°42′W) near Honolulu, and geographic coordinates: a. Near Oahu: 185 km (1 lat. 22°10′N, long. 156°15′W. b. Eastern North Pacific Central Water: 1,390 km (750 n.mi.); lat. 28°17′N, long. 146°20′W. c. Subtropi 2,130 km (1,150 n.mi.); lat. 31°39′N, long. 139°42′W. d. Transition Zone: 2,500 km (1,350 n.mi); lat. 33°12′N, long. 136°12′W. e. front: 2,870 km (1,550 n.mi.); lat. 34°39′N, long. 132°35′W. f. Low salinity core, California Current: 3,430 km (1,850 n.mi.); lat. 36°3 126°55′W. g. Inshore region, California Current: 3,615 km (1,950 n.mi.); lat. 37°12′N, long. 124°59′W.



re 4.—Monthly profiles of mean temperature (°C), for warming and cooling periods at seven typical locations (shown by diamond on inset t); distance from offshore reference point near Honolulu and geographic coordinates as in Figure 3. a. Near Oahu. b. Eastern North fic Central Water. c. Subtropical front. d. Transition Zone. e. California front. f. Low-salinity core of the California Current. ıshore region of California Current.

ıperature inversions remained in the vertical sections Appendix 1, e.g., the 15°C isotherm in the 01 April secn, the 15°-17°C isotherms in the mid-April section, 16°-17°C isotherms in the 01 May section, and the 'C isotherm in the mid-May section. It appears that, the average, when surface warming begins in the ing and vertical mixing is suppressed, the warmer, her salinity Eastern North Pacific Central waters ead toward the California coast around 100 m, underıning the low-salinity, modified subarctic waters ich are still cool around 50 m.

n winter months, e.g., mid-January section of Appen- 1, there appeared to be a temperature maximum at base of the mixed layer between 1,200 and 3,000 km ng the section. From an examination of individual files it was found that these were not typical of usual ıditions. There was almost always an isothermal layer the top of the thermocline. The apparent maximum ulted from the tendency of the three harmonics to give ar-surface temperatures for this area in winter which were slightly low, 0.1° to 0.2°C. The weak horizontal temperature gradients and vertical exaggeration of the section, amplified the effect in the computer contoured sections.

Structure Below the Permanent Thermocline

Below the permanent thermocline, the slopes of the isotherms can be used to separate the section into two regions. The 10°C isotherm is typical. In the western part of the section from Honolulu to about 1,800 km it generally changed depth by less than 50 m, i.e., the slope was less than 3 m/100 km. In the eastern part of the section, from a point at 2,200 km on the section to near San Francisco (3,800 km) the depth of the 10°C isotherm decreased by 150 to 200 m, or a slope of greater than 9 m/100 km. The smaller slopes are associated with the Eastern North Pacific Central waters, while the steeper slopes were associated with both the California Current and Transition Zone regions.

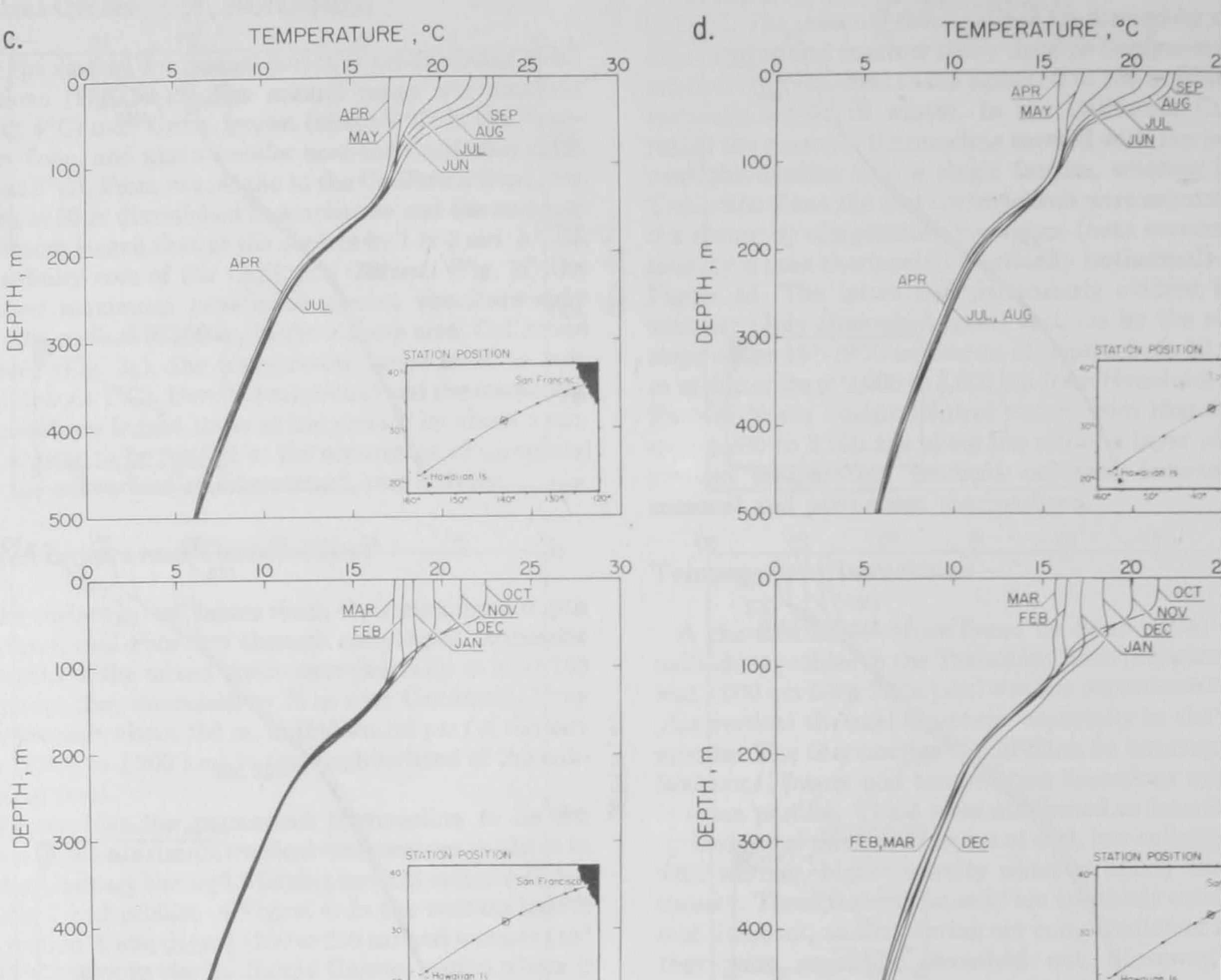


Figure 4.—Continued.

Coastal Upwelling

Reid et al. (1958) have described upwelling and the subsurface countercurrent along the California coast from repeated detailed oceanographic observations by the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program. Some effects of upwelling also appear in XBT mean temperatures, although sampling was poor at the California end of the route. In January, Appendix 1, the 9°C isotherm was closest to the surface (about 130 m) some 200 km from the California coast, but bent downward to 150 m at the coast. About late March the 9°C isotherm began to rise and reached a depth of about 120 m at the coast by mid-June, so that it then had nearly a uniform upward trend approaching the coast. Starting in September it began to sink again at the coast and the "ridge" in the isotherm again moved gradually offshore and by mid-November had returned to the position 200 km offshore where it was in January.

Coastal upwelling causes a delay in the onset of summer warming and a reduced range of the seasonally varying mean temperature. In the inshore area of the California Current (Fig. 3g), after a nearly constant winter temperature of about 12°C, summer warming at the surface did not begin until late May or early June pared with April or May farther offshore (Fig. 3 in the inshore area the September temperat imum reached only 16°C, for an annual rang 4°C, whereas farther offshore (Fig. 3f) it reach for an annual range exceeding 5°C.

California Subsurface Countercurrent

In the vertical sections of Appendix 1 the d ing of the 6°, 7°, and 8°C isotherms from 200 kn the California coast shows warmer water ag coast (at depths of 200 to 500 m) than offsh agrees with observations of Reid et al. (1 reported the existence of a narrow northwar undercurrent against the California coast and m. An exception occurred during April and M the 8°C isotherm rose to about 200 m at the c indicates that upwelling normally reached to t during these months. Another exception was t level approach to the coast of the 8°C isotherm August to mid-September. This may reflect a l summer upwelling period, but might just be th inadequate sampling immediately adjacent to t

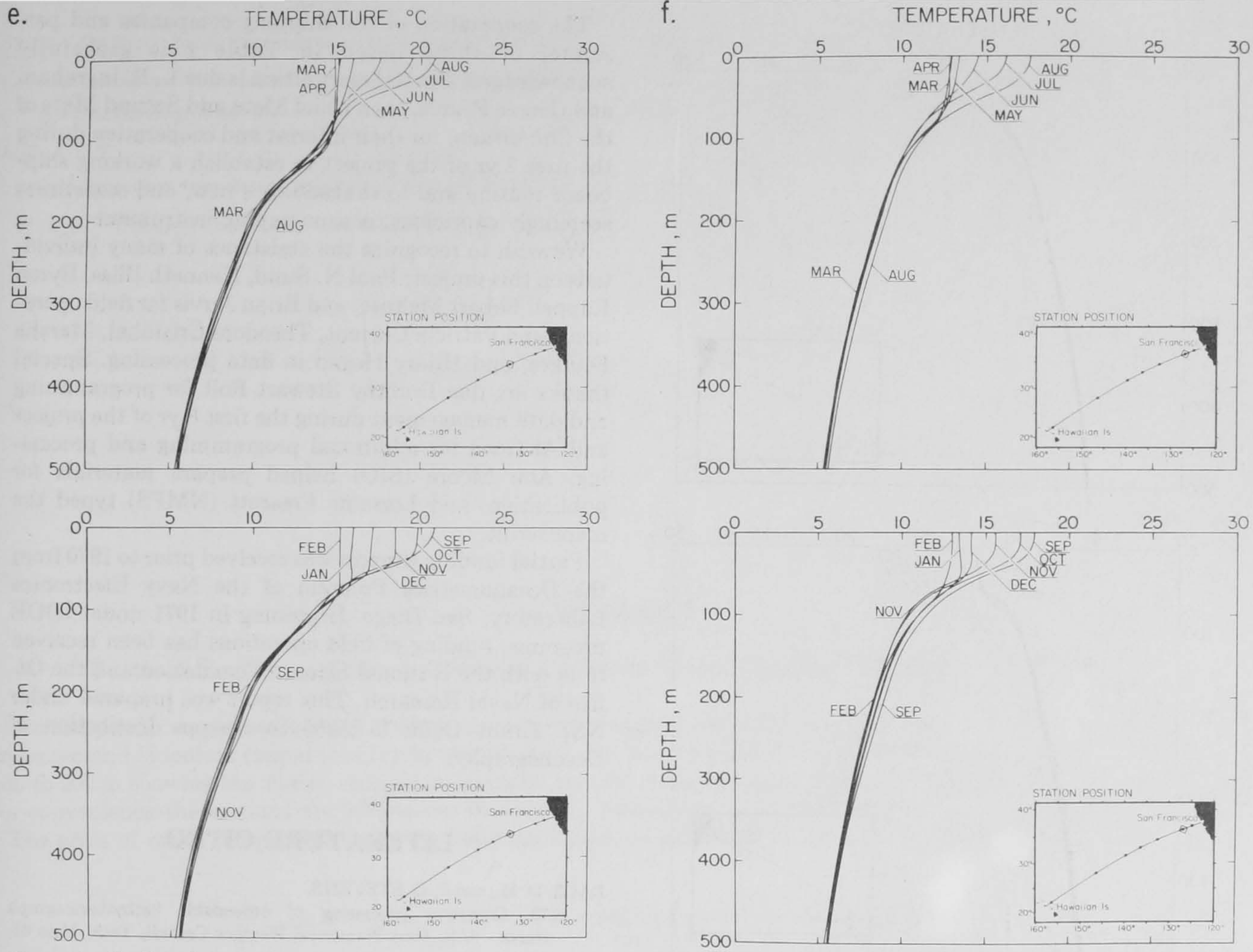


Figure 4.—Continued.

The 30-Day Temperature Changes

The lower panels of the figures in Appendix 1 show contours of temperature change in the upper 200 m during 30-day periods (of a 360-day yr). The maximum rate of warming was 2°C/mo in June at the surface near 2,600 km, which is in the Transition Zone. The maximum rate of cooling was just over 1.5°C/mo during November and December in the same area. The rate of cooling was smaller because the cooling takes place over a depth of at least 50 m whereas the warming is confined to a shallower layer of about 25 m. There was very little temperature change at any depth throughout the section from mid-March to mid-April, but there was no corresponding period in the fall.

In the fall period the downward mixing of heat into the upper thermocline as the surface cools is evident over most of the route in the temperature changes (Appendix 1) and in the vertical profiles (Fig. 4a-g). Beginning in August a subsurface maximum of warming appeared just above 50 m throughout most of the section. The level of maximum warming moved downward during the fall reaching 100 m in December. During this time the surface was cooling and a strong gradient of temperature change developed between the surface cooling and the subsurface warming. The maximum subsurface warming decreased as its depth increased with time, and subsurface warming essentially disappeared by February.

The patterns of temperature change in the California Current region differ from those over most of the section. For example, from September through November and at distances of 3,200 to 3,400 km along the route, cooling extended downward from the surface to 200 m, at least. This created a break in the pattern of the warming maximum at 50 m, which existed over the rest of the section. A secondary center of cooling below 100 m occurred at 2,700 to 2,900 km on the route. These changes were associated with the development of a wave pattern in the isotherms along the permanent thermocline. The centers of cooling were associated with a steepening of the slope of the isotherms in the corresponding vertical sections, whereas in between these centers the isotherms flatten out. The steepening and flattening indicate a splitting of the broad flow of the California Current into filaments of stronger and weaker flow, respectively. The cooling pattern propagated westward along the section at a speed of about 100 km/mo (3.8 cm/s).

There was a counterpart center of warming which appeared in mid-December in the California Current region (around 3,400 km and 90 m) and which could be followed

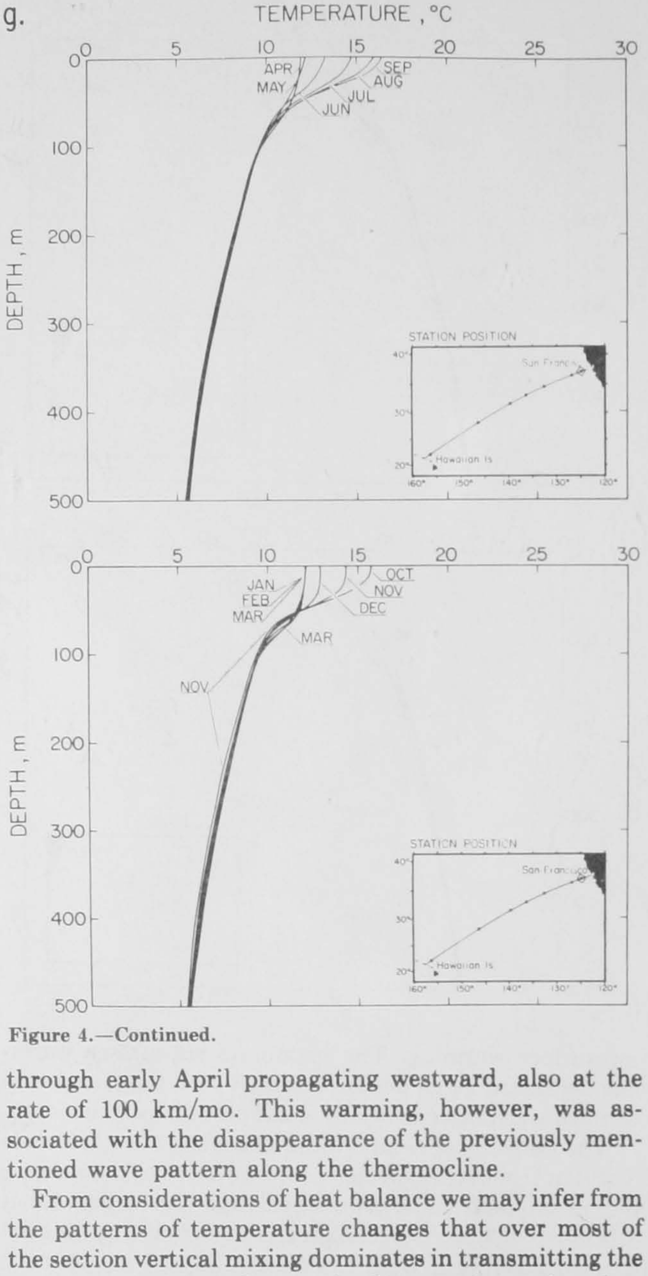


Figure 4.—Continued.

through early April propagating westward, also at the rate of 100 km/mo. This warming, however, was associated with the disappearance of the previously mentioned wave pattern along the thermocline.

From considerations of heat balance we may infer from the patterns of temperature changes that over most of the section vertical mixing dominates in transmitting the surface warming-cooling cycle downward to subsurface levels of 100 to 150 m. In contrast, horizontal advection of heat may be dominant in the California Current to depths of 200 to 300 m. The cause of the growth and decay of the wave pattern on the thermocline in the eastern part of the sections should be investigated.

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The cooperation of the shipping companies and personnel of ships listed in Table 1 is gratefully acknowledged. Special recognition is due L. E. Ingraham and George Pearce, then Chief Mate and Second Mate of the *Californian*, for their interest and cooperation during the first 2 yr of the project to establish a working shipboard routine and to shakedown a new, and sometimes seemingly capricious, oceanographic instrument.

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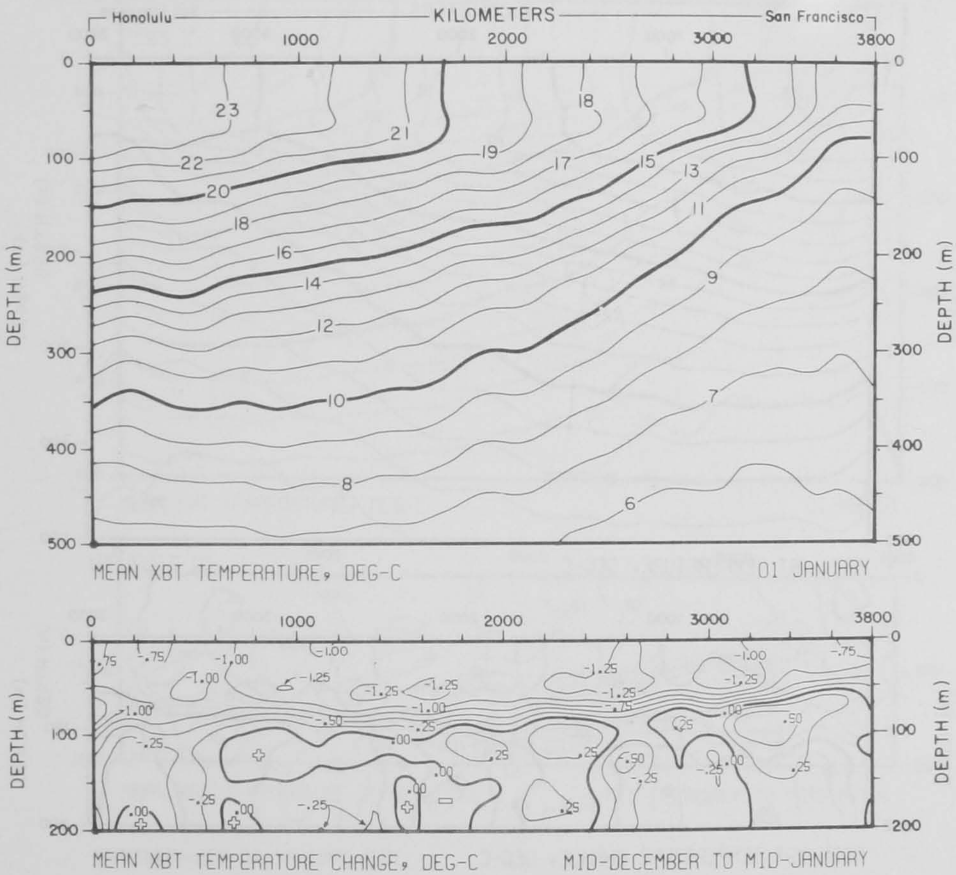
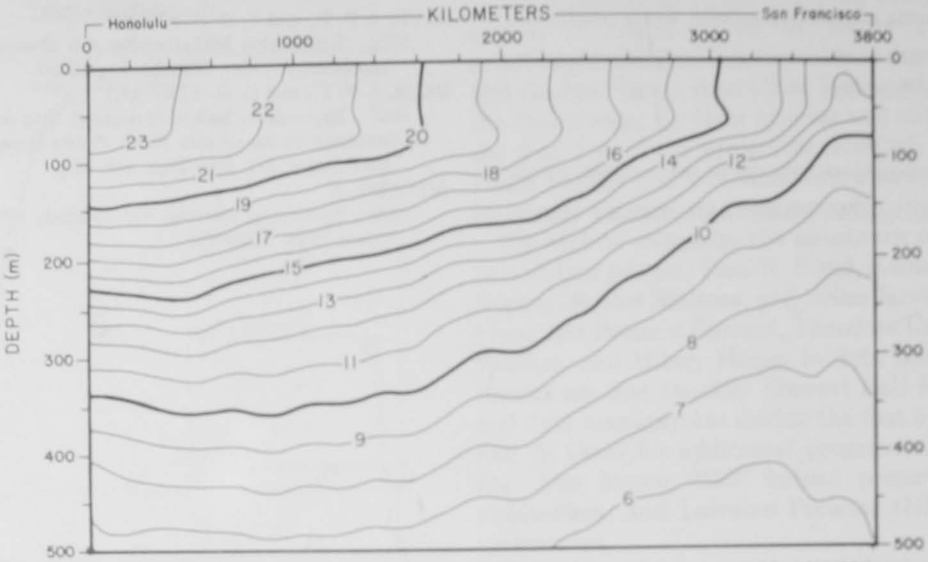
APPENDIX 1

Vertical Sections of Mean Temperature and Mean "30-day" Temperature Change

This Appendix contains 24 vertical sections of mean temperature (°C), from the surface to 500 m, between San Francisco and Honolulu (upper panel) and spaced at 15-day intervals of a 360-day yr. The lower panel is a vertical section to 200 m showing the 30-day changes in temperature and centered on the date of the temperature section above it. For convenience the sections are labeled as: 01 January, mid-January, 01 February, etc., through mid-December.

The grids of mean temperature were spatially smoothed, as explained in the text, before being contoured.





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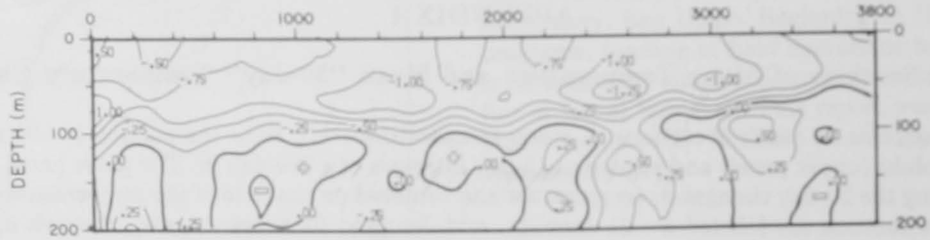

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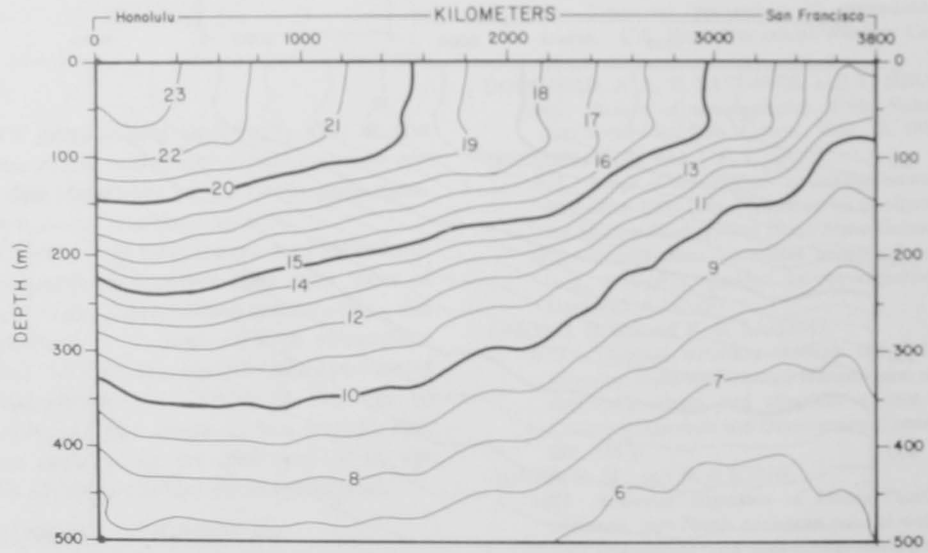

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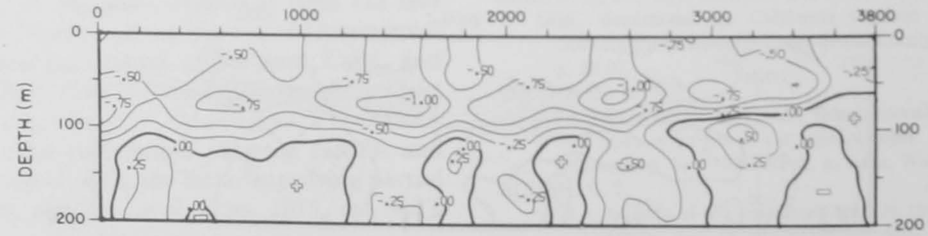

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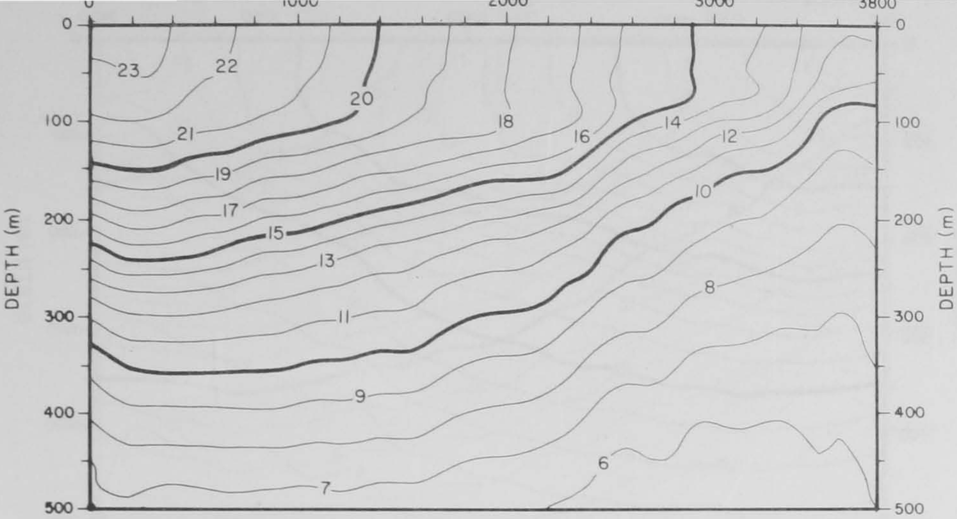

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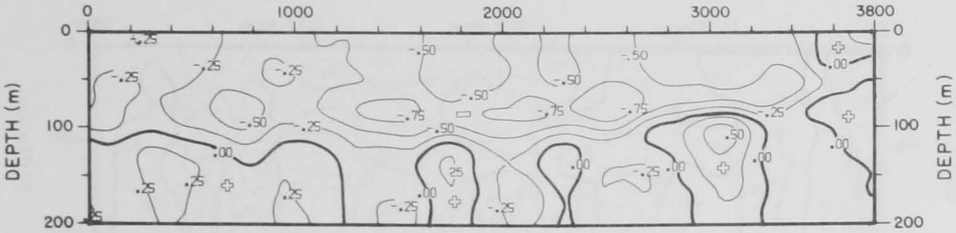

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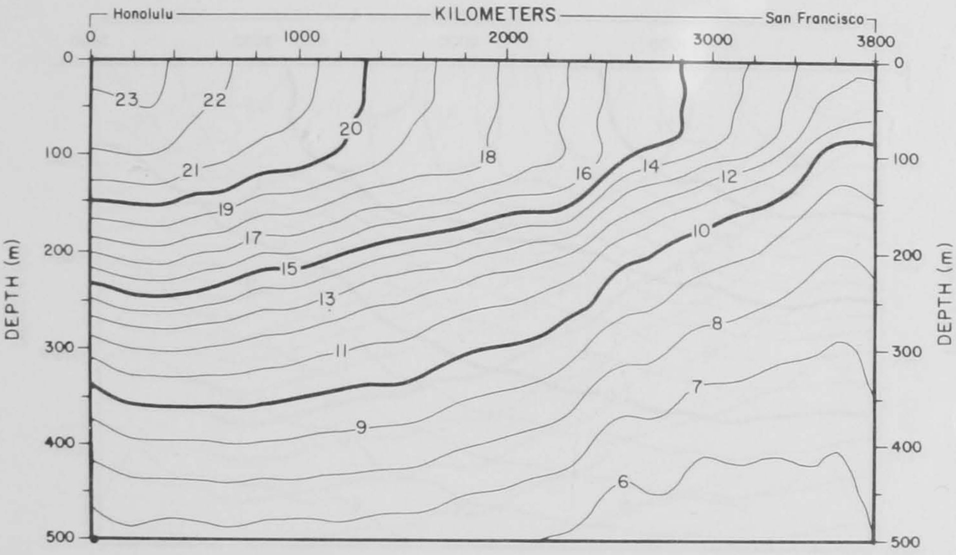

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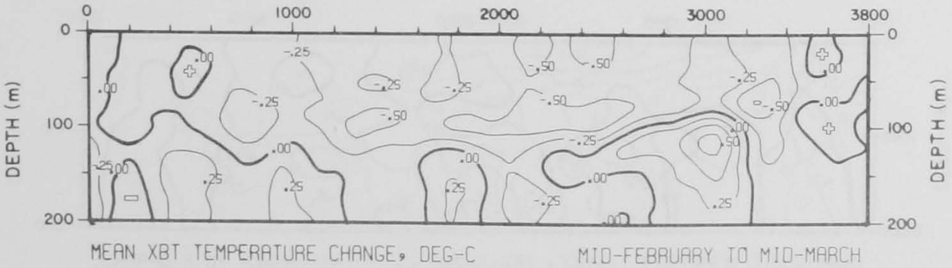

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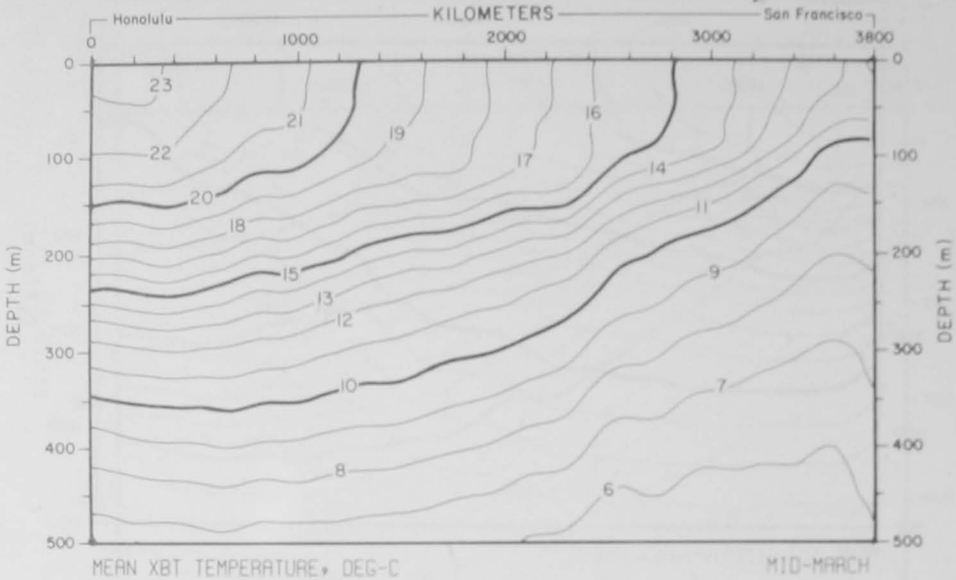
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San Francisco
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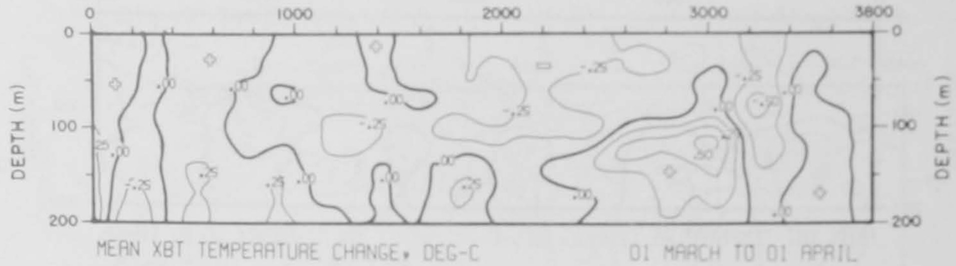
MID-MARCH


DEPTH (m)
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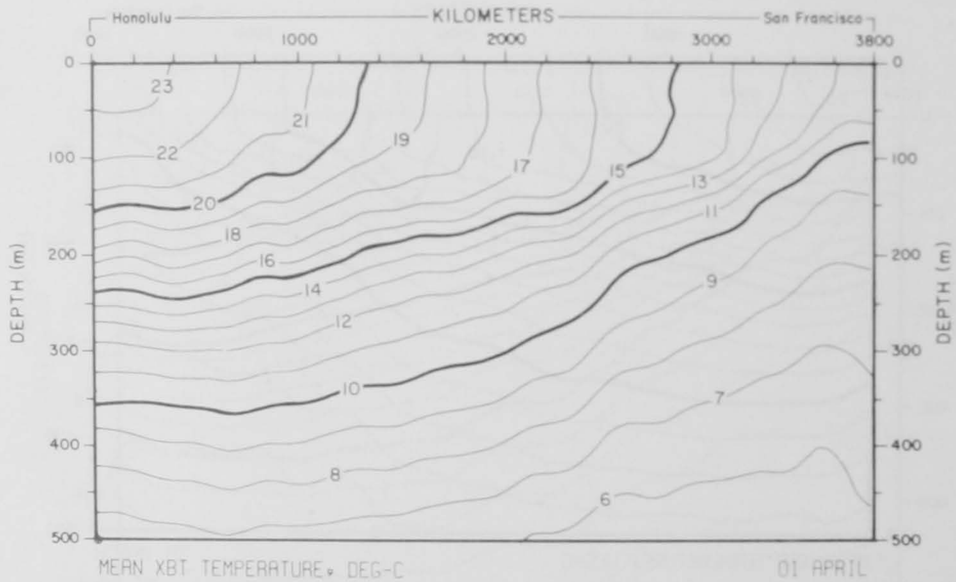
01 MARCH TO 01 APRIL


Honolulu
KILOMETERS
San Francisco
DEPTH (m)
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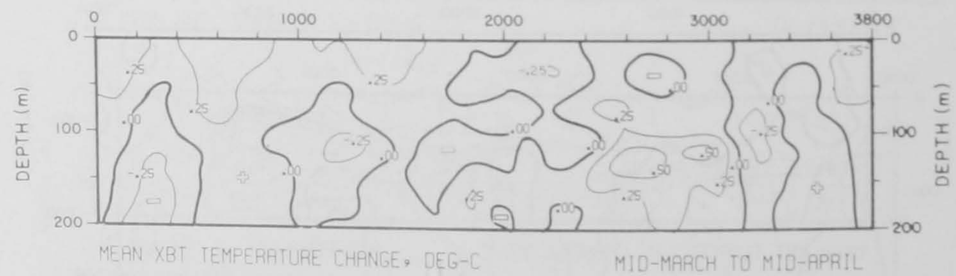
01 APRIL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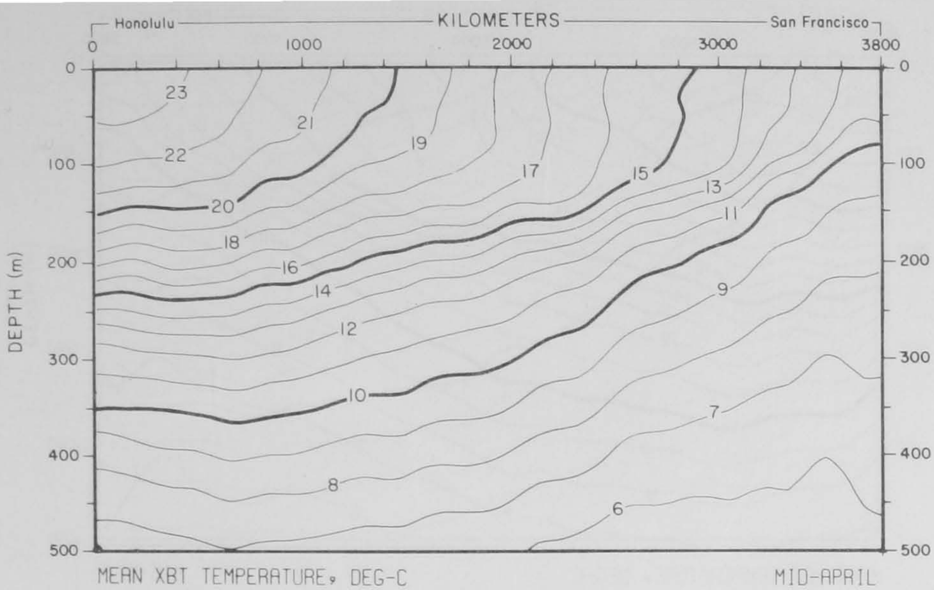
MID-MARCH TO MID-APRIL



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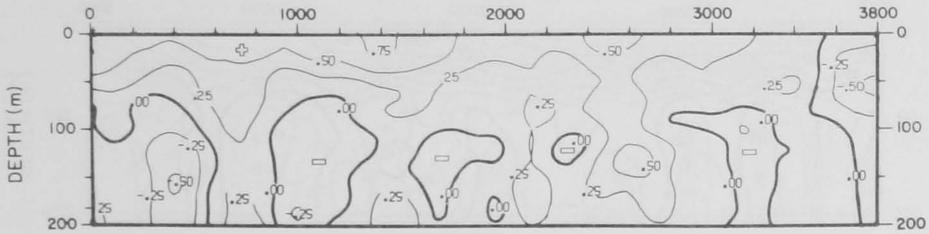

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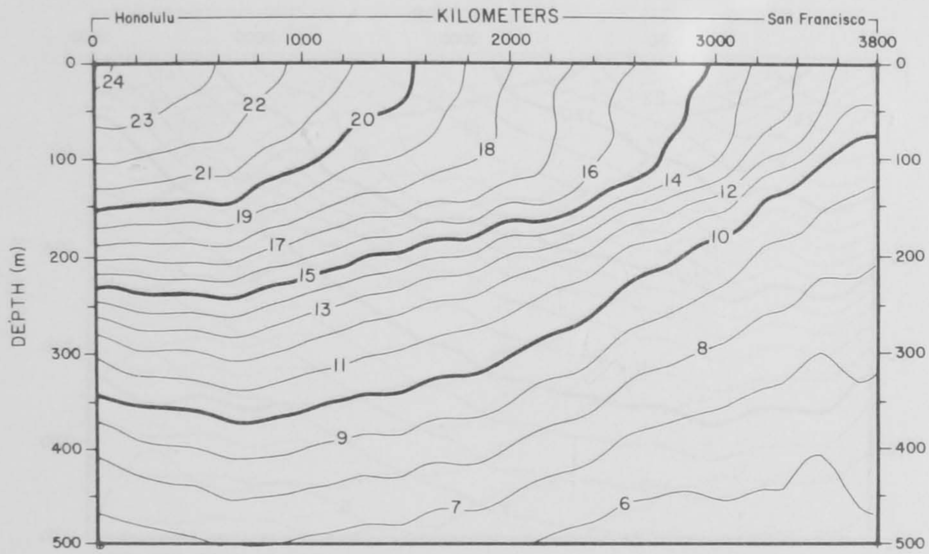

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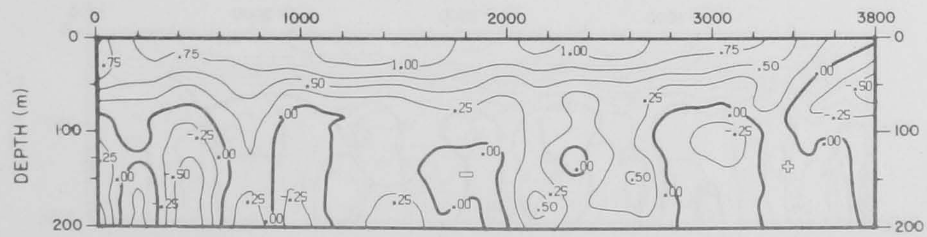

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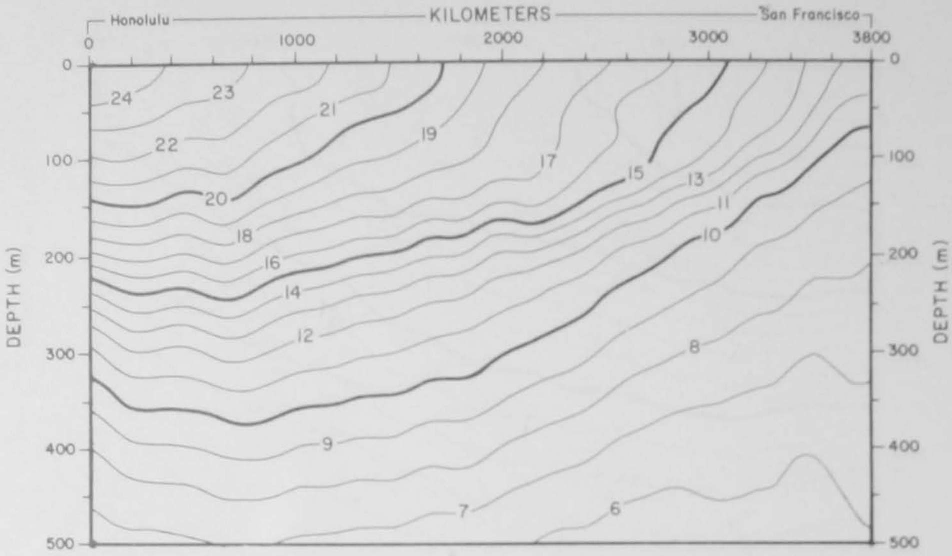

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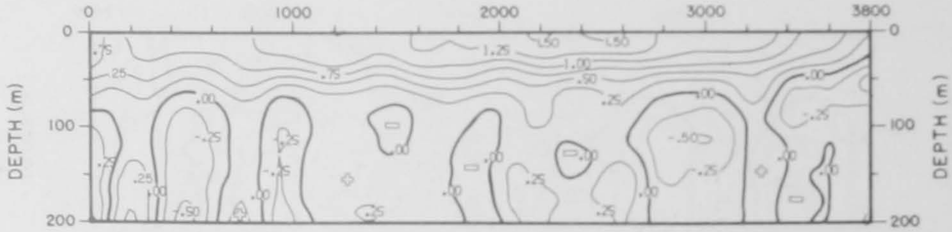

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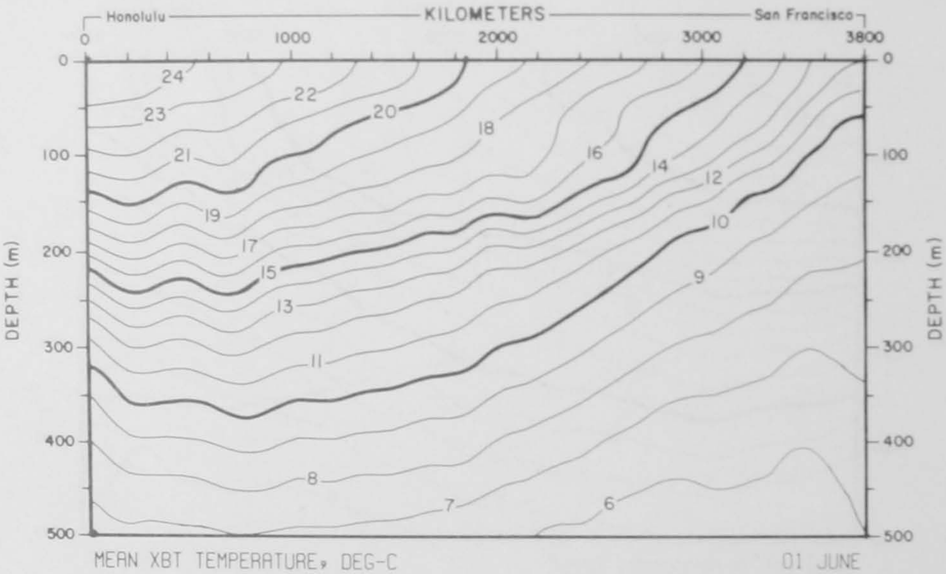

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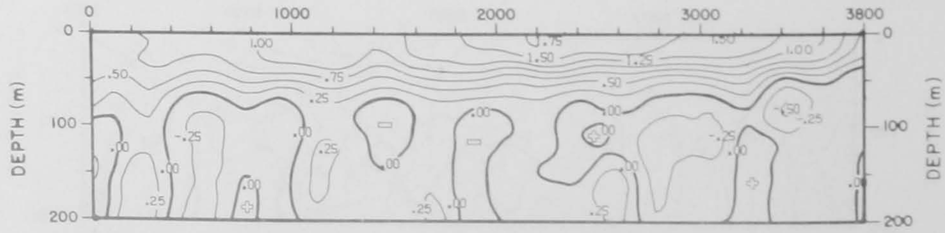

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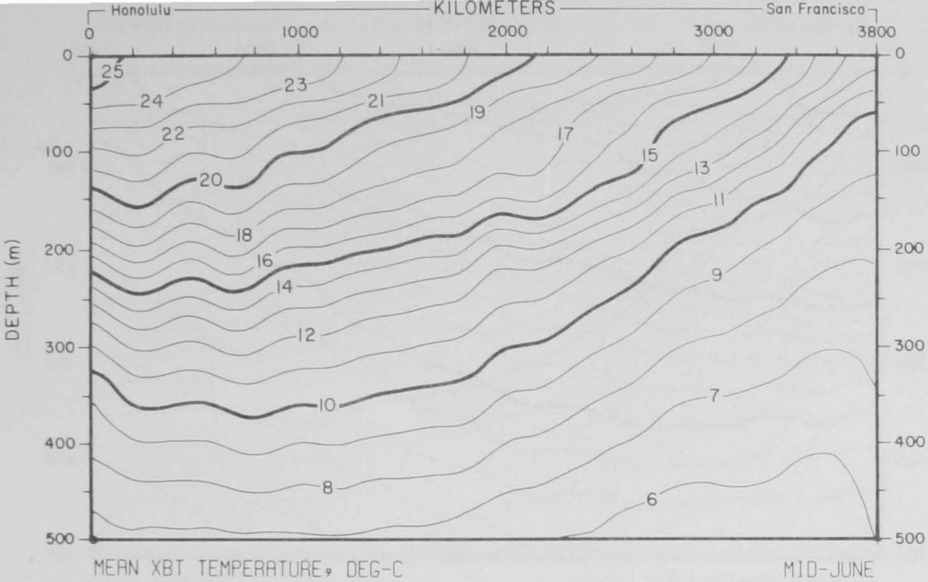
Honolulu
KILOMETERS
San Francisco
DEPTH (m)
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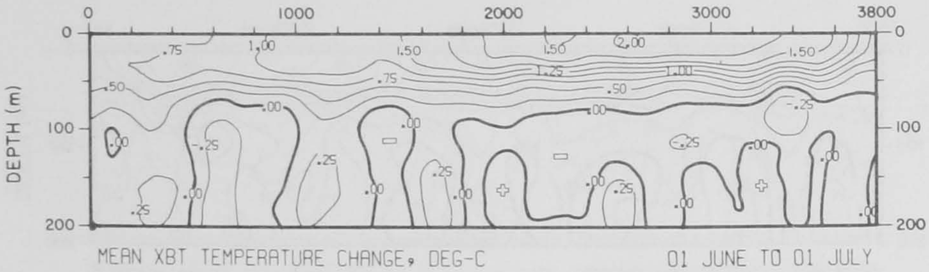
MID-JUNE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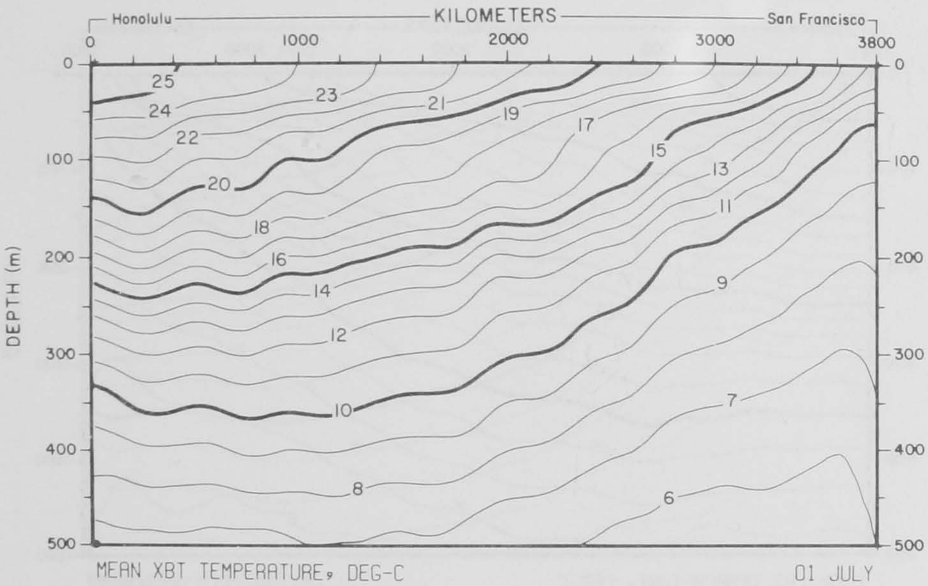
01 JUNE TO 01 JULY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KILOMETERS
San Francisco
DEPTH (m)
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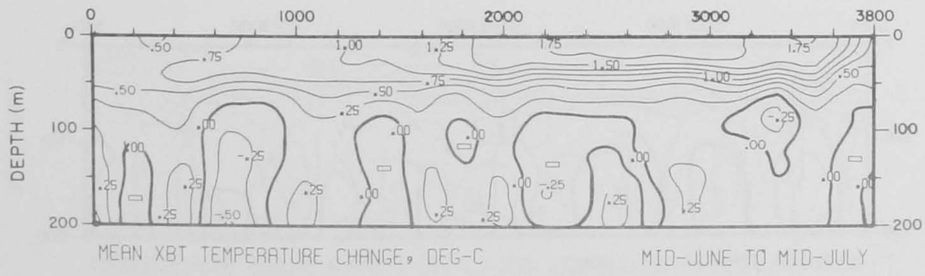
01 JULY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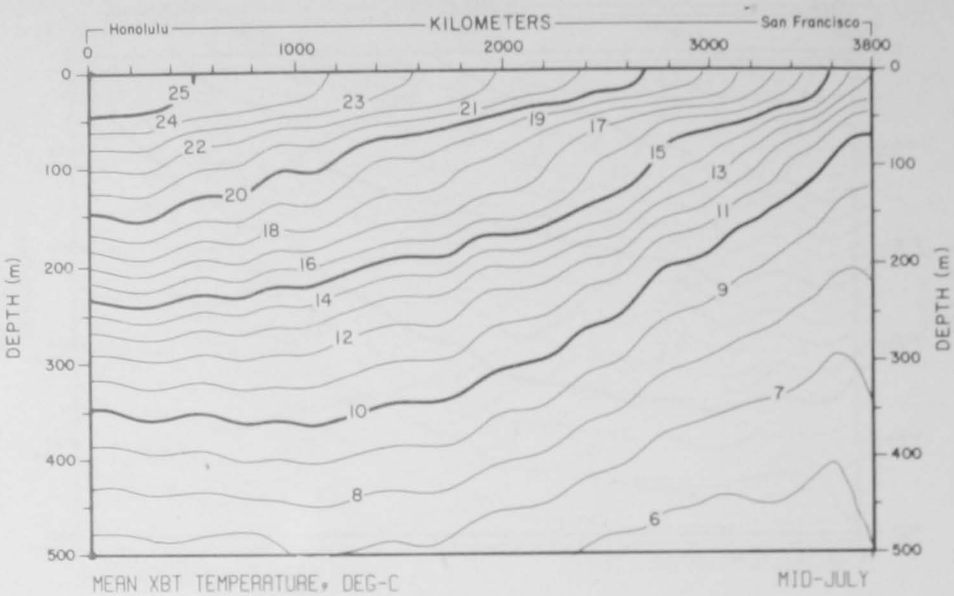
MID-JUNE TO MID-JULY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San Francisco
DEPTH (m)
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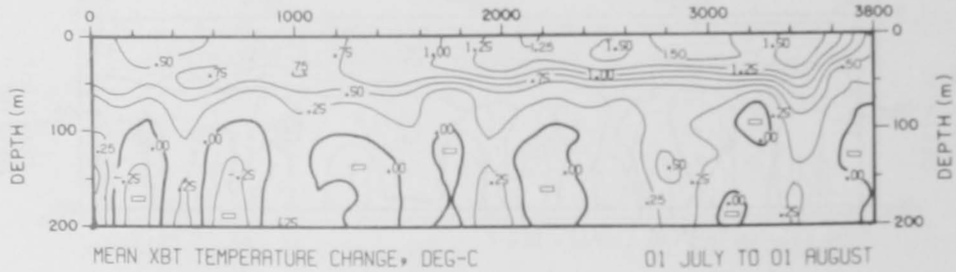
MID-JULY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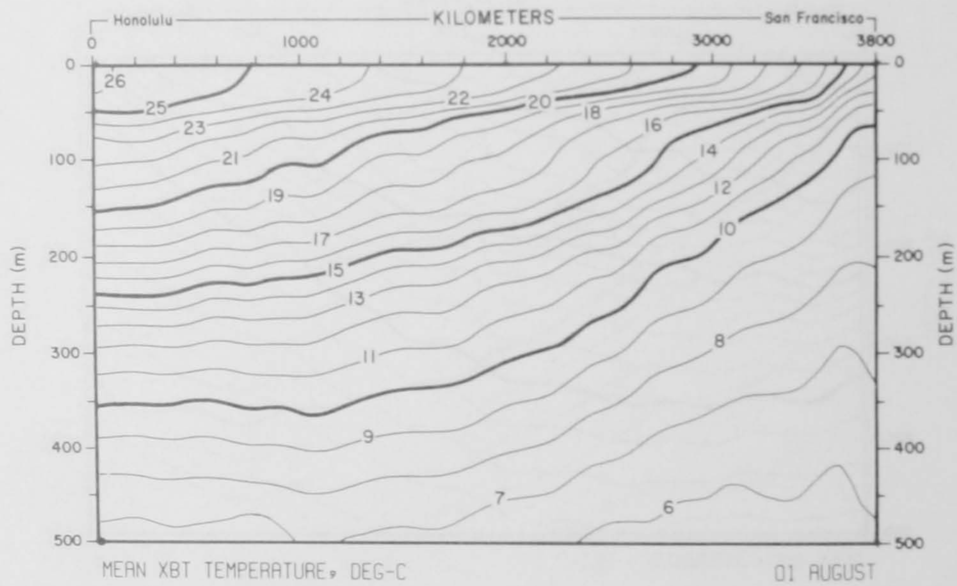
01 JULY TO 01 AUGUST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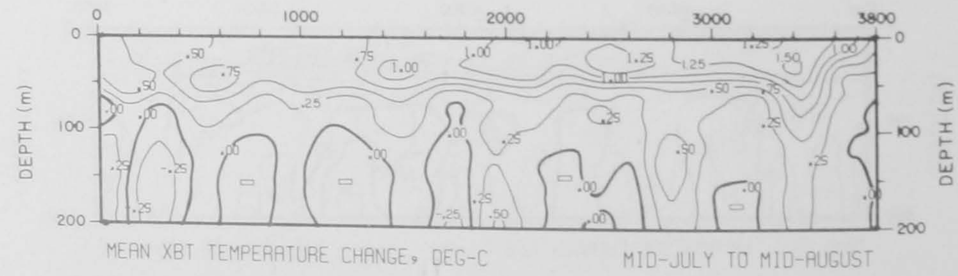
01 AUGUST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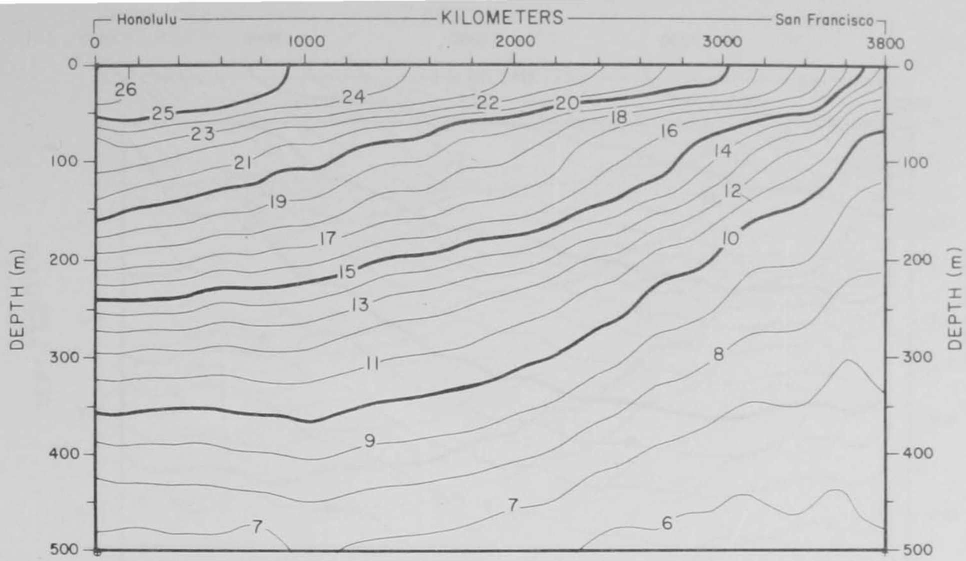
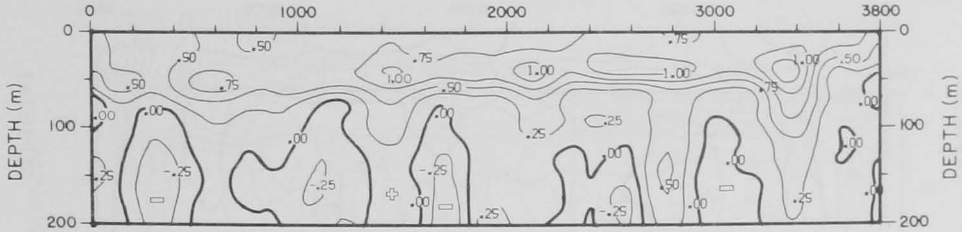
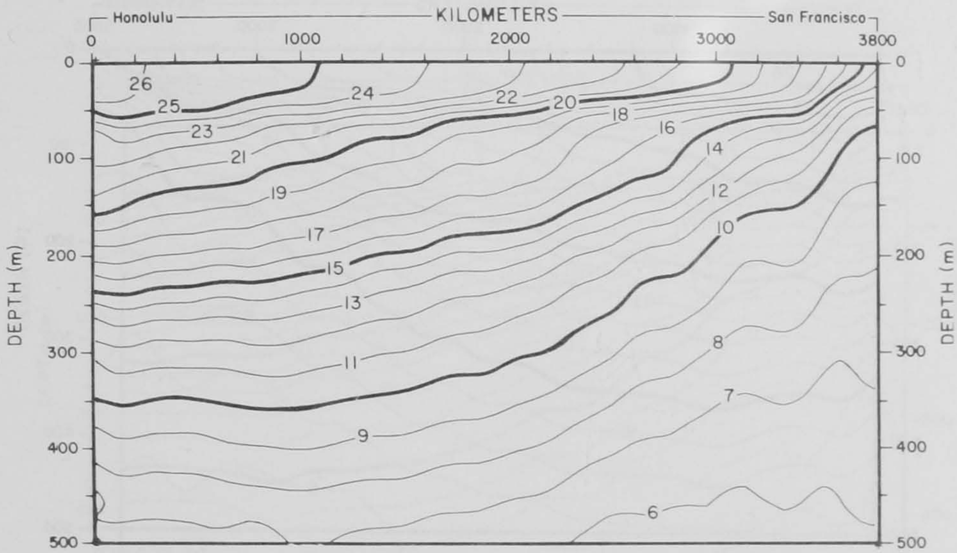
MEAN XBT TEMPERATURE CHANGE, DEG-C
MID-JULY TO MID-AUGUST



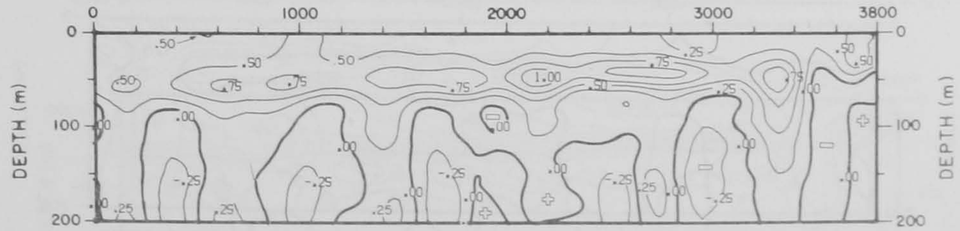
MEAN XBT TEMPERATURE, DEG-C MID-AUGUST



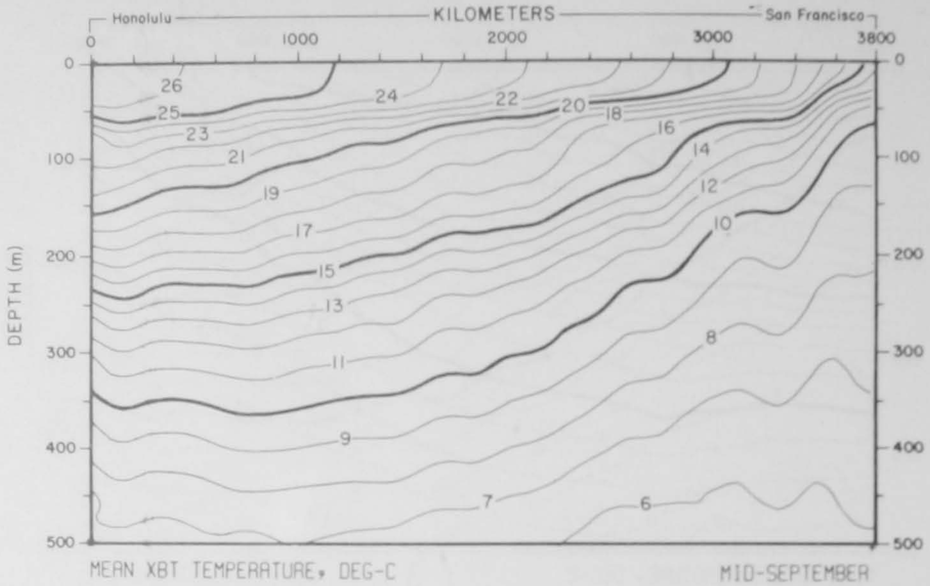
MEAN XBT TEMPERATURE CHANGE, DEG-C 01 AUGUST TO 01 SEPTEMBER



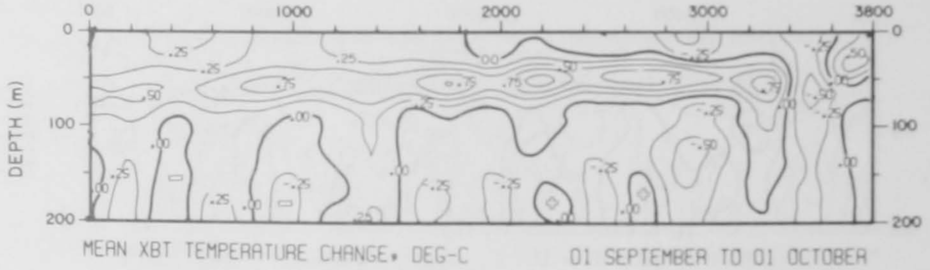
MEAN XBT TEMPERATURE, DEG-C 01 SEPTEMBER



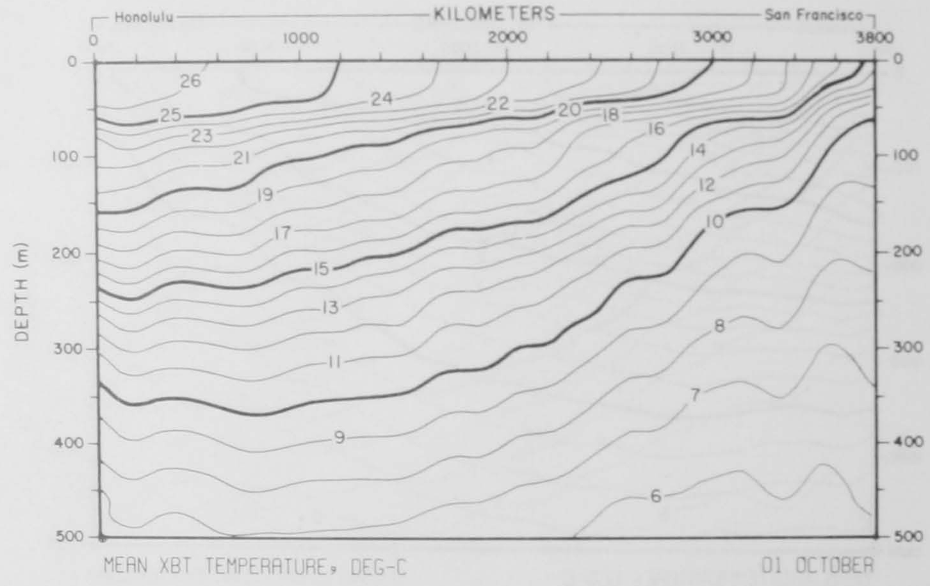
MEAN XBT TEMPERATURE CHANGE, DEG-C MID-AUGUST TO MID-SEPTEMBER



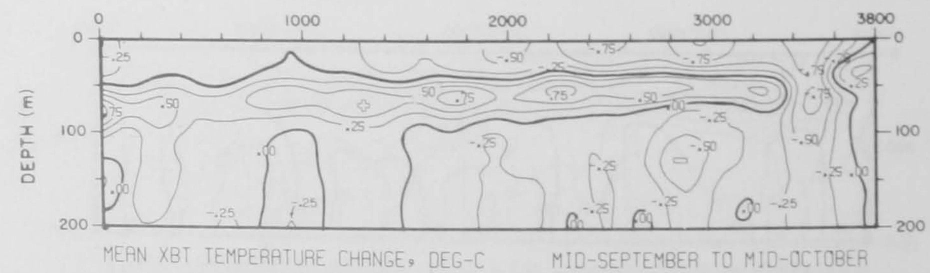
Honolulu
KILOMETERS
San Francisco
0
1000
2000
3000
3800
DEPTH (m)
0
100
200
300
400
500
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
MEAN XBT TEMPERATURE, DEG-C
MID-SEPTEMBER



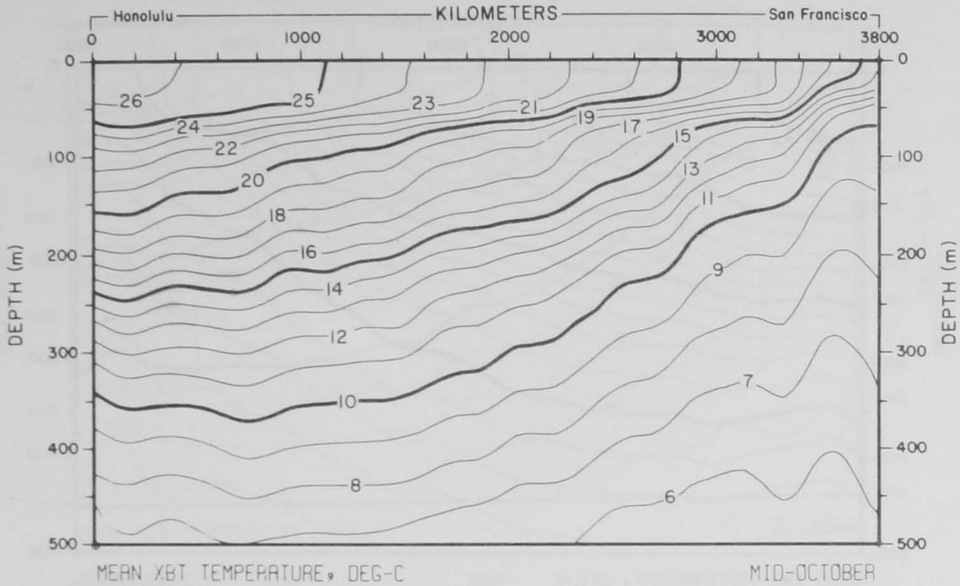
0
1000
2000
3000
3800
DEPTH (m)
0
100
200
MEAN XBT TEMPERATURE CHANGE, DEG-C
01 SEPTEMBER TO 01 OCTOBER

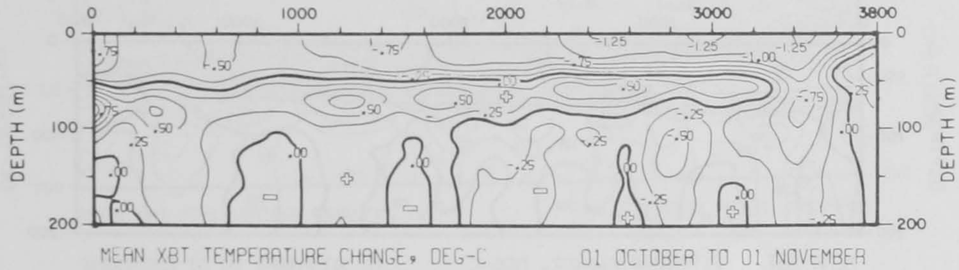


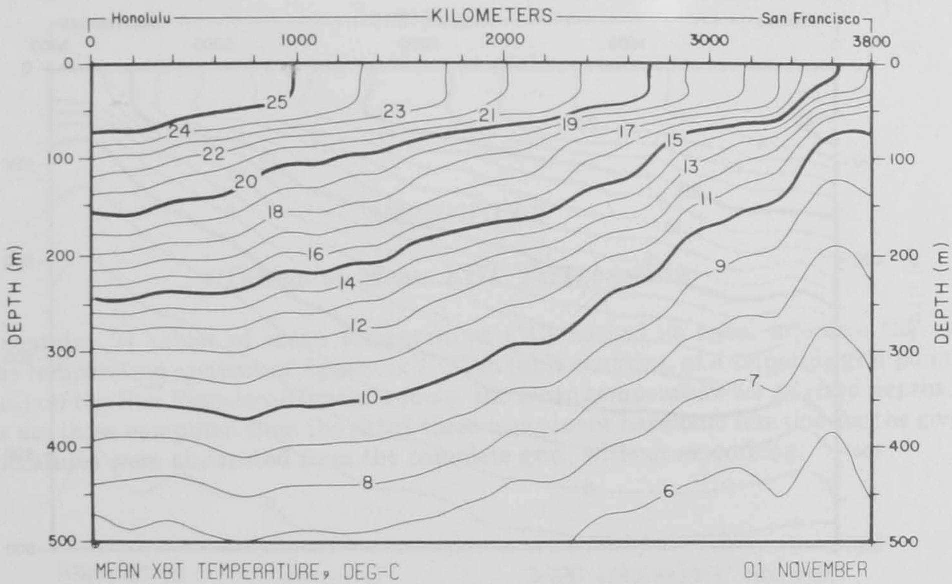
Honolulu
KILOMETERS
San Francisco
0
1000
2000
3000
3800
DEPTH (m)
0
100
200
300
400
500
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
MEAN XBT TEMPERATURE, DEG-C
01 OCTOBER

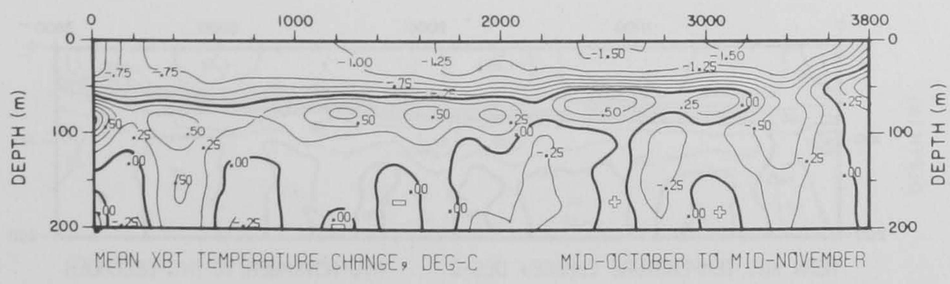


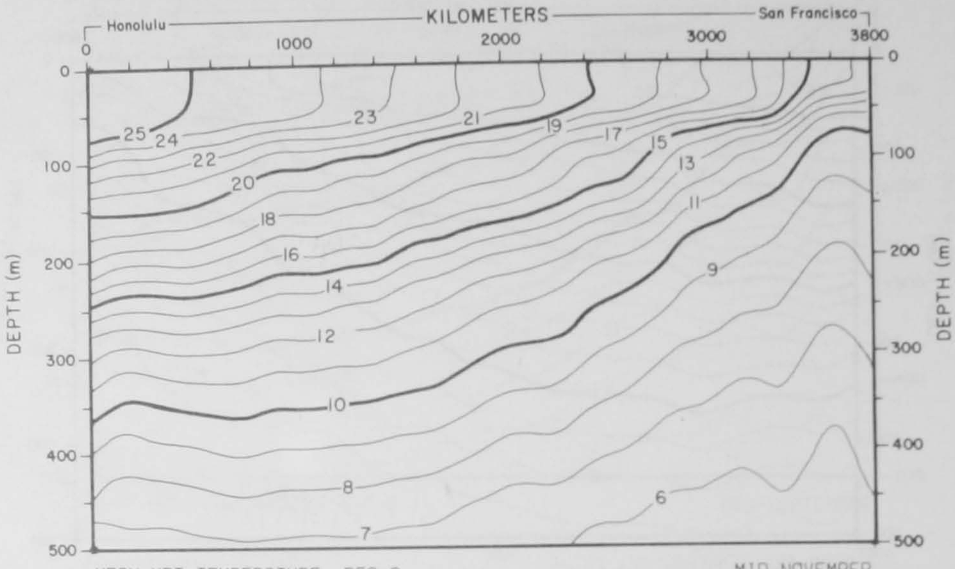
0
1000
2000
3000
3800
DEPTH (m)
0
100
200
MEAN XBT TEMPERATURE CHANGE, DEG-C
MID-SEPTEMBER TO MID-OCTOBER


Honolulu
KILOMETERS
San Francisco
DEPTH (m)
MEAN XBT TEMPERATURE, DEG-C
MID-OCTOBER

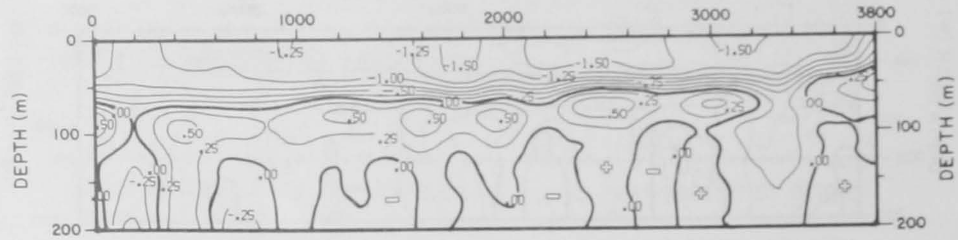

DEPTH (m)
MEAN XBT TEMPERATURE CHANGE, DEG-C
01 OCTOBER TO 01 NOVEMBER


Honolulu
KILOMETERS
San Francisco
DEPTH (m)
MEAN XBT TEMPERATURE, DEG-C
01 NOVEMBER

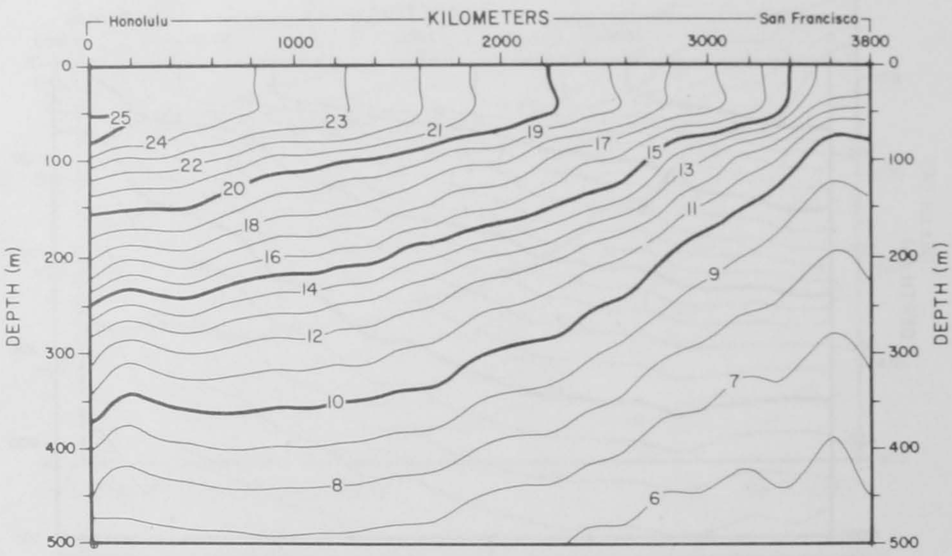

DEPTH (m)
MEAN XBT TEMPERATURE CHANGE, DEG-C
MID-OCTOBER TO MID-NOVEMBER



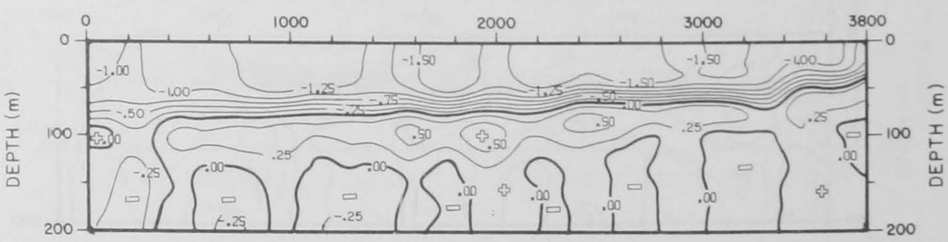
MEAN XBT TEMPERATURE, DEG-C MID-NOVEMBER



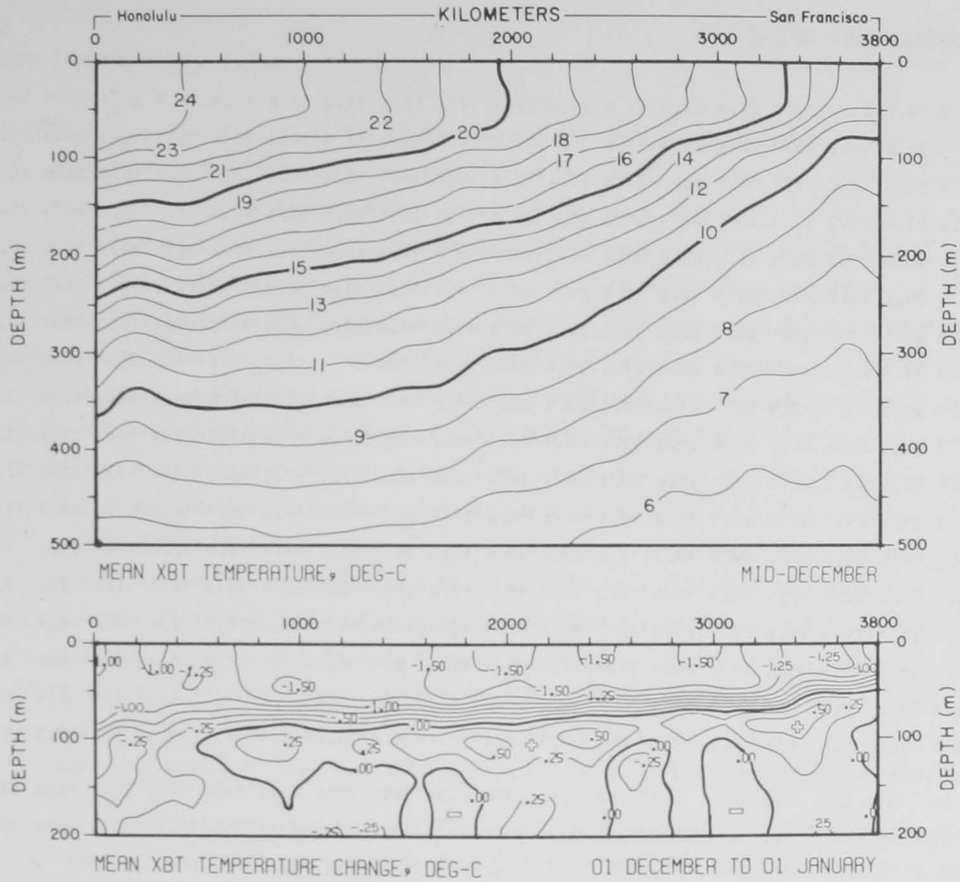
MEAN XBT TEMPERATURE CHANGE, DEG-C 01 NOVEMBER TO 01 DECEMBER



MEAN XBT TEMPERATURE, DEG-C 01 DECEMBER



MEAN XBT TEMPERATURE CHANGE, DEG-C MID-NOVEMBER TO MID-DECEMBER



APPENDIX 2

Tables of Mean XBT Temperature

his Appendix contains 24 tables of mean temperatures (°C) spaced at equal intervals throughout the year, esponding to the temperature sections of Appendix 1. Each table contains, at alternating grid points, i.e., intervals 85 km (100 n.mi.) on the San Francisco-Honolulu route, the mean temperature for selected depths, in meters. The an temperatures are those computed from the fitted three-component harmonic function for the given distance and th. These temperatures were abstracted from the complete grid, without smoothing.

MEAN XBT TEMPERATURE, DEG-C

01 JANUARY

	0	23.9	23.9	23.2	23.0	22.6	22.3	21.8	21.4	20.9	19.8	19.3	18.9	18.2	17.7	16.7	16.4	15.5	14.9	13.7	12.3
	10	23.9	23.8	23.2	23.0	22.6	22.3	21.8	21.4	20.8	19.8	19.3	18.9	18.2	17.6	16.7	16.3	15.5	14.9	13.8	12.3
	20	23.9	23.8	23.2	23.1	22.5	22.3	21.8	21.4	20.8	19.7	19.3	18.9	18.2	17.6	16.7	16.3	15.5	15.0	13.8	12.2
	30	23.9	23.8	23.2	23.1	22.5	22.3	21.8	21.4	20.8	19.7	19.3	18.9	18.1	17.6	16.8	16.2	15.5	15.0	13.8	12.2
	40	23.9	23.8	23.2	23.1	22.5	22.2	21.8	21.3	20.8	19.7	19.3	18.9	18.1	17.7	16.9	16.1	15.6	15.0	13.9	12.1
	50	24.0	23.8	23.2	23.1	22.5	22.2	21.8	21.4	20.9	19.7	19.3	19.0	18.3	17.8	17.0	16.3	15.7	15.0	13.9	11.9
D	60	24.0	23.7	23.2	23.1	22.5	22.2	21.9	21.4	20.9	19.8	19.4	19.0	18.4	17.9	17.1	16.2	15.7	14.8	13.5	11.4
E	70	24.0	23.7	23.2	23.1	22.4	22.1	21.9	21.4	21.0	19.8	19.5	18.9	18.3	17.8	16.8	15.7	15.4	14.5	12.8	10.6
P	80	23.8	23.4	23.1	22.9	22.1	21.8	21.6	21.1	20.7	19.6	19.4	18.8	18.0	17.5	16.4	15.4	14.4	13.7	11.9	10.0
T	90	23.3	22.9	22.8	22.5	21.6	21.4	21.0	20.7	20.2	19.2	19.2	18.4	17.6	17.0	15.7	14.5	13.3	12.7	11.3	9,7
H	100	22.8	22.4	22.3	22.0	21.1	20.8	20.3	20.1	19.7	18.8	18.8	17.9	17.2	16.4	15.0	13.9	12.6	12.0	11.0	9.5
	120	21.5	21.1	21.1	20.6	20.1	19.7	19.1	18.9	18.6	17.5	17.9	17.1	16.2	15.1	14.2	13.0	11.7	11.0	10.1	9.1
(M)	150	20.0	19.6	19.7	19.2	18.6	18.2	17.7	17.4	17.0	16.2	16.2	15.8	14.7	13.9	12.8	11.6	10.4	9.9	9.4	8.8
	200	17.2	17.2	17.4	16.5	16.1	15.8	15.2	15.0	14.5	13.4	13.2	12.9	12.0	11.3	10.5	9.9	9.2	9.0	8.6	8.1
	250	13.9	14.1	14.7	13.6	13.4	13.2	12.7	12.5	12.3	11.6	11.1	11.0	10.4	10.0	9.4	9.0	8.4	8.1	7.9	7.5
	300	11.4	11.5	11.9	11.6	11.6	11.5	11.2	11.1	10.9	10.5	9.9	9.9	9.4	9.0	8.4	8.0	7.6	7.4	7.2	7.0
	400	8.4	8.6	8.8	8.9	8.9	8.9	8.8	8.6	8.6	8.3	7.8	7.8	7.4	7.1	6.7	6.5	6.4	6.2	6.2	6.2
	500	6.7	6.6	6.6	6.6	6.8	6.8	6.7	6.5	6.6	6.4	6.2	6.3	5.9	5.7	5.5	5.6	5.5	5.5	5.6	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C

MID-JANUARY

	0	23.6	23.6	22.9	22.7	22.2	21.9	21.5	20.9	20.4	19.4	18.9	18.5	17.8	17.2	16.4	15.9	15.0	14.6	13.4	12.1
	10	23.6	23.6	22.9	22.7	22.2	21.9	21.5	20.9	20.4	19.4	18.9	18.5	17.7	17.2	16.3	15.9	15.0	14.5	13.5	12.0
	20	23.6	23.6	22.9	22.7	22.1	21.9	21.4	20.9	20.4	19.4	18.9	18.5	17.7	17.1	16.3	15.9	15.0	14.6	13.5	11.9
	30	23.6	23.6	22.8	22.7	22.1	21.9	21.4	20.9	20.3	19.3	18.9	18.5	17.7	17.1	16.4	15.8	14.9	14.5	13.5	11.9
	40	23.6	23.5	22.8	22.7	22.1	21.8	21.4	20.8	20.3	19.3	18.8	18.5	17.6	17.1	16.5	15.7	15.0	14.5	13.6	11.9
	50	23.5	23.5	22.8	22.7	22.0	21.8	21.4	20.8	20.3	19.3	18.9	18.5	17.7	17.2	16.5	15.8	15.1	14.6	13.6	11.8
D	60	23.5	23.4	22.8	22.7	22.0	21.7	21.4	20.8	20.4	19.4	19.0	18.6	17.8	17.3	16.6	15.9	15.2	14.5	13.4	11.5
E	70	23.5	23.3	22.8	22.7	22.0	21.7	21.4	20.9	20.4	19.4	19.1	18.6	17.9	17.3	16.6	15.7	15.1	14.5	12.8	10.8
P	80	23.3	23.0	22.7	22.6	21.9	21.6	21.2	20.8	20.3	19.4	19.1	18.6	17.9	17.3	16.3	15.5	14.3	13.9	12.1	10.1
T	90	23.1	22.6	22.4	22.3	21.6	21.3	20.9	20.5	20.0	19.3	19.0	18.4	17.7	17.0	15.7	14.7	13.3	13.0	11.5	9.8
H	100	22.6	22.2	22.1	21.9	21.2	20.8	20.3	20.0	19.5	19.0	18.8	18.0	17.3	16.4	15.0	14.0	12.5	12.3	11.1	9.6
	120	21.4	21.1	21.0	20.7	20.2	19.8	19.2	18.9	18.6	17.7	18.0	17.1	16.2	15.1	14.0	13.0	11.5	11.1	10.3	9.2
(M)	150	20.0	19.7	79.5	19.3	18.6	18.2	17.7	17.3	17.1	16.2	16.2	15.9	14.8	13.7	12.7	11.5	10.2	10.0	9.5	8.8
	200	17.3	17.4	17.2	16.7	16.1	15.8	15.2	14.9	14.5	13.4	13.3	12.9	12.0	11.1	10.5	9.8	9.1	9.0	8.6	8.1
	250	14.1	14.3	14.6	13.8	13.5	13.2	12.7	12.4	12.3	11.5	11.1	11.0	10.4	9.9	9.4	8.9	8.4	8.2	7.9	7.6
	300	11.5	11.7	11.9	11.7	11.6	11.4	11.2	11.1	11.0	10.4	9.9	10.0	9.3	8.9	8.4	8.0	7.5	7.4	7.2	7.0
	400	8.4	8.7	8.9	8.9	9.0	8.8	8.8	8.6	8.7	8.2	7.9	7.9	7.3	7.0	6.6	6.4	6.3	6.2	6.1	6.3
	500	6.8	6.6	6.6	6.7	6.7	6.7	6.8	6.5	6.6	6.4	6.2	6.3	5.8	5.6	5.5	5.5	5.5	5.4	5.5	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 FEBRUARY

	0	23.4	23.5	22.7	22.4	21.9	21.7	21.2	20.4	19.9	19.1	18.6	18.2	17.4	16.8	16.1	15.5	14.6	14.3	13.2	12.1
	10	23.3	23.4	22.7	22.4	21.9	21.6	21.1	20.4	19.9	19.1	18.5	18.2	17.4	16.7	16.0	15.4	14.6	14.2	13.2	12.0
	20	23.3	23.4	22.6	22.4	21.8	21.6	21.1	20.4	19.9	19.1	18.5	18.1	17.4	16.7	16.0	15.4	14.5	14.2	13.2	11.9
	30	23.3	23.4	22.6	22.4	21.8	21.6	21.1	20.4	19.9	19.1	18.5	18.1	17.3	16.6	16.1	15.4	14.5	14.1	13.2	11.9
	40	23.2	23.3	22.5	22.3	21.8	21.5	21.0	20.3	19.9	19.1	18.4	18.1	17.3	16.6	16.1	15.4	14.5	14.1	13.2	11.8
	50	23.2	23.3	22.5	22.4	21.7	21.4	21.0	20.2	19.8	19.0	18.5	18.1	17.2	16.5	16.0	15.4	14.5	14.1	13.2	11.8
D	60	23.1	23.1	22.4	22.3	21.7	21.3	20.9	20.2	19.8	19.0	18.5	18.1	17.3	16.6	16.1	15.5	14.6	14.2	13.0	11.5
E	70	23.0	23.0	22.4	22.3	21.6	21.3	20.8	20.3	19.7	19.1	18.6	18.2	17.4	16.7	16.1	15.5	14.6	14.3	12.7	10.9
P	80	22.9	22.7	22.2	22.2	21.6	21.2	20.8	20.3	19.7	19.1	18.6	18.2	17.5	16.7	16.0	15.4	14.1	13.9	12.1	10.2
T	90	22.7	22.4	22.0	22.0	21.4	21.0	20.7	20.1	19.5	19.2	18.6	18.2	17.5	16.6	15.6	14.8	13.4	13.2	11.6	9.8
H	100	22.3	22.0	21.8	21.7	21.1	20.7	20.3	19.8	19.2	19.0	18.6	17.9	17.3	16.3	14.9	14.1	12.6	12.5	11.2	9.6
	120	21.3	21.2	20.9	20.7	20.2	19.8	19.3	18.9	18.5	17.9	18.0	17.1	16.3	15.0	13.8	12.9	11.5	11.2	10.4	9.2
(M)	150	19.9	19.8	19.4	19.4	18.6	18.4	17.8	17.3	17.1	16.4	16.1	15.8	14.8	13.5	12.6	11.4	10.1	10.1	9.5	8.8
	200	17.4	17.6	17.1	16.9	16.1	15.9	15.3	14.7	14.4	13.5	13.3	12.9	12.0	10.9	10.4	9.7	9.1	9.0	8.6	8.1
	250	14.3	14.5	14.6	14.0	13.5	13.2	12.8	12.4	12.2	11.5	11.1	11.1	10.4	9.7	9.3	8.8	8.3	8.2	7.9	7.6
	300	11.7	11.9	12.0	11.8	11.6	11.4	11.3	11.0	11.0	10.3	9.9	10.0	9.3	8.8	8.3	7.8	7.5	7.4	7.2	7.0
	400	8.6	8.8	8.9	8.9	9.0	8.8	8.8	8.6	8.7	8.2	7.9	7.9	7.3	6.8	6.6	6.2	6.2	6.1	6.2	6.2
	500	6.9	6.6	6.6	6.7	6.6	6.6	6.7	6.5	6.6	6.4	6.1	6.2	5.9	5.5	5.4	5.4	5.4	5.3	5.4	5.6
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

DISTANCE

MEAN XBT TEMPERATURE, DEG-C — MID-FEBRUARY

	0	23.3	23.3	22.7	22.3	21.7	21.5	20.9	20.0	19.6	19.0	18.3	17.9	17.2	16.4	15.8	15.1	14.3	14.0	13.1	12.1
	10	23.2	23.3	22.6	22.3	21.7	21.5	20.9	20.0	19.6	19.0	18.3	17.9	17.2	16.3	15.8	15.1	14.3	13.9	13.1	12.1
	20	23.2	23.3	22.6	22.2	21.7	21.4	20.9	20.0	19.6	19.0	18.3	17.9	17.1	16.3	15.8	15.1	14.3	13.9	13.0	12.1
	30	23.1	23.3	22.5	22.2	21.6	21.4	20.8	20.0	19.6	18.9	18.2	17.8	17.2	16.2	15.8	15.2	14.3	13.8	13.0	12.0
	40	23.1	23.2	22.4	22.1	21.6	21.3	20.8	19.9	19.5	18.9	18.2	17.8	17.1	16.2	15.8	15.2	14.2	13.8	12.9	11.8
	50	23.0	23.2	22.3	22.1	21.5	21.2	20.7	19.9	19.5	19.0	18.2	17.7	17.0	16.1	15.7	15.1	14.2	13.7	12.7	11.7
D	60	22.8	23.0	22.2	22.0	21.4	21.1	20.6	19.8	19.3	18.9	18.2	17.7	16.9	16.0	15.7	15.2	14.2	13.9	12.6	11.5
E	70	22.7	22.8	22.1	21.9	21.3	21.0	20.5	19.8	19.2	18.8	18.2	17.7	17.0	16.1	15.7	15.3	14.2	13.9	12.4	11.0
P	80	22.6	22.6	22.0	21.9	21.3	21.0	20.4	19.8	19.2	18.8	18.2	17.8	17.2	16.2	15.7	15.2	13.9	13.7	12.0	10.3
T	90	22.4	22.3	21.8	21.8	21.2	20.8	20.4	19.7	19.1	18.9	18.2	17.8	17.2	16.2	15.4	14.8	13.5	13.1	11.6	9.9
H	100	22.1	22.0	21.6	21.5	20.9	20.6	20.1	19.5	18.9	18.9	18.3	17.6	17.1	16.0	14.9	14.1	12.8	12.5	11.1	9.6
	120	21.3	21.3	20.9	20.7	20.2	19.9	19.4	18.8	18.3	18.1	17.9	16.9	16.4	14.9	13.6	12.9	11.6	11.3	10.4	9.2
(M)	150	19.9	20.0	19.5	19.5	18.6	18.5	17.9	17.3	17.0	16.6	16.0	15.7	14.9	13.3	12.3	11.3	10.2	10.1	9.4	8.8
	200	17.5	17.7	17.1	17.1	16.1	16.0	15.4	14.6	14.2	13.7	13.2	12.7	12.1	10.7	10.3	9.6	9.2	9.0	8.5	8.1
	250	14.5	14.7	14.6	14.2	13.4	13.3	12.9	12.3	12.1	11.5	11.1	11.0	10.5	9.6	9.2	8.7	8.3	8.2	7.8	7.5
	300	11.9	12.1	12.1	11.9	11.6	11.4	11.3	11.0	10.9	10.3	10.0	9.9	9.3	8.6	8.3	7.7	7.5	7.4	7.2	7.0
	400	8.6	8.9	8.9	9.0	9.0	8.8	8.8	8.6	8.6	8.1	7.9	7.8	7.3	6.7	6.6	6.2	6.2	6.1	6.2	6.1
	500	6.8	6.7	6.7	6.8	6.5	6.5	6.7	6.6	6.6	6.4	6.1	6.1	5.9	5.5	5.5	5.3	5.4	5.3	5.4	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

DISTANCE

MEAN XBT TEMPERATURE, DEG-C 01 MARCH

0	23.3	23.2	22.6	22.2	21.6	21.3	20.7	19.8	19.3	18.8	18.1	17.6	17.0	16.0	15.6	14.9	14.2	13.8	13.0	12.2
10	23.2	23.2	22.6	22.2	21.6	21.3	20.7	19.7	19.3	18.8	18.1	17.6	17.0	15.9	15.5	14.9	14.1	13.7	12.9	12.2
20	23.1	23.2	22.6	22.1	21.6	21.3	20.6	19.7	19.3	18.8	18.1	17.6	16.9	15.9	15.6	14.9	14.1	13.6	12.9	12.2
30	23.1	23.2	22.5	22.1	21.5	21.2	20.6	19.7	19.3	18.8	18.1	17.5	17.0	15.9	15.6	15.0	14.2	13.6	12.8	12.1
40	23.0	23.1	22.4	22.0	21.5	21.2	20.6	19.7	19.3	18.8	18.1	17.5	17.0	15.9	15.5	15.0	14.1	13.6	12.7	11.9
50	22.9	23.1	22.3	21.9	21.4	21.1	20.6	19.7	19.2	18.9	18.1	17.4	16.9	15.8	15.4	15.0	14.1	13.5	12.5	11.7
D 60	22.7	22.9	22.2	21.8	21.3	21.0	20.4	19.6	19.1	18.8	18.0	17.4	16.8	15.7	15.3	14.9	14.0	13.5	12.3	11.4
E 70	22.6	22.8	22.1	21.7	21.1	20.9	20.3	19.5	18.9	18.6	17.9	17.3	16.8	15.7	15.4	15.0	14.0	13.5	12.2	11.0
P 80	22.4	22.6	21.9	21.7	21.0	20.8	20.2	19.4	18.8	18.6	17.9	17.3	16.8	15.7	15.3	14.9	13.9	13.4	12.0	10.4
T 90	22.2	22.3	21.7	21.5	20.9	20.7	20.1	19.3	18.7	18.6	17.9	17.4	16.9	15.8	15.2	14.7	13.7	13.0	11.5	9.9
H 100	21.9	22.0	21.5	21.3	20.7	20.5	19.9	19.2	18.6	18.6	17.9	17.3	16.9	15.7	14.9	14.1	13.1	12.4	11.0	9.6
120	21.3	21.5	21.0	20.7	20.1	19.9	19.3	18.6	18.1	18.1	17.7	16.7	16.5	14.9	13.6	13.0	11.9	11.2	10.3	9.2
(M) 150	19.9	20.1	19.8	19.6	18.6	18.6	18.0	17.3	16.9	16.7	15.9	15.5	15.0	13.1	12.2	11.3	10.5	10.1	9.3	8.7
200	17.4	17.7	17.3	17.1	16.1	16.2	15.5	14.6	14.0	13.9	13.2	12.5	12.1	10.7	10.2	9.6	9.3	9.0	8.5	8.0
250	14.5	14.7	14.7	14.3	13.4	13.4	12.9	12.3	12.0	11.6	11.2	10.9	10.5	9.6	9.2	8.6	8.3	8.2	7.8	7.5
300	11.9	12.1	12.1	11.9	11.6	11.5	11.3	10.9	10.8	10.3	10.0	9.8	9.3	8.6	8.3	7.7	7.5	7.4	7.1	6.9
400	8.7	8.9	8.9	9.0	8.9	8.9	8.8	8.6	8.5	8.2	7.9	7.7	7.4	6.7	6.6	6.2	6.2	6.1	6.2	6.1
500	6.7	6.7	6.7	6.8	6.5	6.6	6.6	6.5	6.5	6.3	6.1	6.0	6.0	5.5	5.6	5.3	5.4	5.3	5.4	5.5
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C MID-MARCH

0	23.4	23.2	22.7	22.2	21.6	21.2	20.5	19.7	19.1	18.7	17.9	17.3	16.8	15.8	15.4	14.8	14.1	13.5	12.9	12.2
10	23.3	23.1	22.6	22.1	21.6	21.2	20.5	19.7	19.1	18.7	17.9	17.3	16.8	15.7	15.3	14.8	14.1	13.5	12.8	12.2
20	23.2	23.1	22.6	22.1	21.5	21.1	20.5	19.6	19.1	18.7	17.9	17.2	16.7	15.7	15.3	14.8	14.1	13.4	12.7	12.2
30	23.2	23.1	22.6	22.1	21.5	21.1	20.4	19.6	19.1	18.7	17.9	17.2	16.8	15.7	15.3	14.8	14.2	13.4	12.7	12.1
40	23.1	23.1	22.5	22.0	21.4	21.1	20.4	19.6	19.1	18.7	18.0	17.2	16.8	15.7	15.3	14.8	14.2	13.4	12.6	11.9
50	23.0	23.0	22.4	21.9	21.4	21.1	20.4	19.6	19.1	18.8	18.0	17.2	16.8	15.7	15.2	14.8	14.1	13.3	12.4	11.6
D 60	22.8	22.9	22.3	21.8	21.2	21.0	20.3	19.6	19.0	18.7	17.9	17.1	16.8	15.6	15.2	14.8	14.0	13.2	12.3	11.3
E 70	22.6	22.7	22.1	21.7	21.0	20.8	20.2	19.4	18.8	18.5	17.8	17.1	16.7	15.5	15.2	14.8	14.0	13.1	12.2	11.0
P 80	22.4	22.6	21.9	21.6	20.9	20.7	20.1	19.2	18.7	18.4	17.8	17.1	16.6	15.5	15.1	14.8	14.0	13.0	12.0	10.5
T 90	22.1	22.3	21.8	21.4	20.7	20.6	19.9	19.1	18.6	18.3	17.7	17.0	16.7	15.5	15.1	14.7	13.9	12.7	11.6	10.0
H 100	21.9	21.9	21.6	21.2	20.5	20.4	19.7	19.0	18.4	18.3	17.7	17.0	16.7	15.5	14.9	14.3	13.5	12.2	11.0	9.6
120	21.3	21.5	21.1	20.8	19.9	19.8	19.1	18.5	18.0	18.0	17.5	16.6	16.5	14.9	13.9	13.3	12.4	11.0	10.2	9.2
(M) 150	20.0	20.1	20.0	19.6	18.6	18.6	18.0	17.3	16.8	16.8	15.9	15.5	15.1	13.2	12.1	11.5	10.8	10.0	9.3	8.7
200	17.3	17.6	17.5	17.2	16.1	16.3	15.6	14.6	13.9	14.0	13.2	12.4	12.1	10.8	10.2	9.6	9.4	8.9	8.5	8.1
250	14.4	14.7	14.8	14.3	13.4	13.5	12.9	12.2	11.8	11.7	11.3	10.8	10.5	9.6	9.2	8.7	8.4	8.1	7.8	7.5
300	11.8	12.0	12.1	12.0	11.7	11.5	11.2	10.9	10.7	10.3	10.1	9.7	9.4	8.6	8.3	7.8	7.6	7.3	7.1	6.9
400	8.7	8.9	8.9	9.1	8.9	8.9	8.7	8.6	8.4	8.2	7.9	7.6	7.5	6.7	6.6	6.3	6.2	6.2	6.2	6.0
500	6.6	6.6	6.7	6.9	6.6	6.6	6.6	6.5	6.5	6.3	6.2	5.9	5.9	5.6	5.7	5.3	5.4	5.3	5.5	5.5
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 APRIL

	0	23.5	23.2	22.8	22.3	21.7	21.2	20.5	19.9	19.1	18.7	17.8	17.1	16.7	15.7	15.3	14.9	14.2	13.4	12.8	12.1
	10	23.5	23.2	22.7	22.2	21.6	21.2	20.5	19.8	19.1	18.7	17.8	17.1	16.6	15.6	15.3	14.8	14.1	13.3	12.7	12.1
	20	23.4	23.2	22.7	22.2	21.6	21.1	20.4	19.8	19.1	18.7	17.8	17.1	16.6	15.6	15.2	14.8	14.2	13.3	12.7	12.0
	30	23.3	23.1	22.7	22.2	21.5	21.1	20.3	19.7	19.1	18.7	17.8	17.1	16.6	15.7	15.2	14.8	14.2	13.3	12.7	12.0
	40	23.2	23.1	22.6	22.1	21.4	21.1	20.3	19.7	19.1	18.7	17.9	17.1	16.7	15.7	15.2	14.8	14.2	13.3	12.6	11.8
	50	23.1	23.0	22.5	22.0	21.4	21.0	20.3	19.7	19.1	18.7	17.9	17.1	16.8	15.7	15.2	14.8	14.2	13.2	12.5	11.5
D	60	22.9	22.8	22.4	21.9	21.2	21.0	20.2	19.6	19.0	18.6	17.9	17.1	16.8	15.6	15.2	14.8	14.1	13.0	12.4	11.2
E	70	22.8	22.7	22.2	21.8	21.0	20.8	20.2	19.4	18.9	18.5	17.9	17.0	16.7	15.6	15.2	14.7	14.1	12.9	12.3	10.9
P	80	22.5	22.5	22.0	21.7	20.9	20.7	20.0	19.2	18.8	18.3	17.8	17.0	16.6	15.5	15.1	14.7	14.1	12.7	12.1	10.5
T	90	22.2	22.2	21.8	21.5	20.7	20.5	19.7	19.1	18.6	18.2	17.7	17.0	16.6	15.5	15.1	14.7	14.1	12.5	11.7	10.0
H	100	21.9	21.9	21.6	21.3	20.5	20.3	19.5	18.9	18.4	18.1	17.6	16.9	16.6	15.4	15.1	14.5	13.8	12.0	11.1	9.6
	120	21.4	21.4	21.1	20.8	19.9	19.7	18.9	18.4	17.9	17.9	17.4	16.7	16.5	15.0	14.2	13.6	12.8	10.9	10.2	9.2
(M)	150	20.0	20.0	20.0	19.7	18.7	18.6	18.0	17.3	16.8	16.8	15.9	15.6	15.2	13.3	12.2	11.7	11.1	9.8	9.3	8.8
	200	17.2	17.5	17.6	17.2	16.2	16.3	15.6	14.6	13.9	14.0	13.2	12.4	12.1	10.9	10.2	9.8	9.4	8.8	8.5	8.1
	250	14.2	14.6	14.8	14.4	13.5	13.4	12.9	12.2	11.8	11.7	11.3	10.8	10.6	9.7	9.2	8.8	8.5	8.1	7.8	7.5
	300	11.7	11.9	12.1	12.1	11.7	11.6	11.2	10.9	10.6	10.4	10.1	9.6	9.5	8.6	8.3	7.9	7.7	7.3	7.1	7.0
	400	8.6	8.8	8.9	9.2	8.9	8.9	8.7	8.6	8.3	8.2	8.0	7.5	7.5	6.8	6.6	6.5	6.4	6.2	6.2	6.1
	500	6.5	6.6	6.7	6.9	6.7	6.7	6.6	6.5	6.4	6.3	6.2	5.9	5.9	5.6	5.7	5.4	5.5	5.4	5.5	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — MID-APRIL

	0	23.7	23.4	23.0	22.5	21.9	21.4	20.6	20.2	19.4	18.9	17.9	17.2	16.7	15.9	15.5	15.0	14.3	13.4	12.8	12.0
	10	23.7	23.4	22.9	22.4	21.9	21.4	20.6	20.2	19.3	18.8	17.9	17.1	16.7	15.8	15.3	14.9	14.3	13.4	12.7	11.9
	20	23.6	23.3	22.9	22.4	21.8	21.3	20.5	20.1	19.3	18.8	17.9	17.1	16.6	15.8	15.2	14.9	14.3	13.3	12.7	11.8
	30	23.6	23.2	22.8	22.4	21.7	21.2	20.4	20.1	19.2	18.8	17.8	17.1	16.6	15.8	15.2	14.8	14.3	13.3	12.7	11.8
	40	23.4	23.2	22.7	22.3	21.6	21.1	20.3	20.0	19.2	18.7	17.9	17.1	16.6	15.8	15.2	14.8	14.3	13.3	12.7	11.6
	50	23.3	23.0	22.6	22.2	21.5	21.0	20.2	19.9	19.2	18.6	17.9	17.2	16.7	15.8	15.2	14.9	14.3	13.2	12.7	11.3
D	60	23.1	22.8	22.4	22.0	21.3	21.0	20.2	19.7	19.1	18.6	17.9	17.2	16.8	15.8	15.3	14.8	14.3	13.0	12.6	11.1
E	70	22.9	22.6	22.3	22.0	21.1	20.9	20.1	19.5	19.1	18.5	17.9	17.2	16.8	15.8	15.3	14.8	14.2	12.8	12.4	10.8
P	80	22.6	22.4	22.1	21.8	21.0	20.7	19.9	19.3	18.9	18.3	17.9	17.1	16.7	15.7	15.2	14.8	14.2	12.7	12.1	10.5
T	90	22.3	22.1	21.9	21.6	20.7	20.5	19.7	19.2	18.7	18.1	17.8	17.1	16.6	15.7	15.2	14.7	14.1	12.4	11.7	10.0
H	100	22.1	21.8	21.6	21.4	20.5	20.3	19.4	18.9	18.5	18.0	17.6	17.0	16.6	15.5	15.2	14.6	13.9	11.9	11.1	9.7
	120	21.4	21.2	20.9	20.9	19.8	19.6	18.7	18.4	17.9	17.7	17.3	16.8	16.4	15.2	14.5	13.9	13.0	10.7	10.1	9.2
(M)	150	19.9	19.9	19.8	19.8	18.7	18.4	17.9	17.3	16.8	16.7	15.9	15.8	15.2	13.5	12.5	11.8	11.2	9.7	9.4	8.8
	200	17.1	17.3	17.5	17.2	16.3	16.2	15.6	14.7	14.0	14.0	13.2	12.6	12.1	11.0	10.3	9.9	9.5	8.8	8.6	8.2
	250	14.1	14.5	14.6	14.5	13.7	13.3	12.9	12.3	11.8	11.7	11.4	10.8	10.5	9.8	9.3	9.0	8.6	8.1	7.9	7.6
	300	11.5	11.8	11.9	12.2	11.8	11.5	11.2	10.9	10.6	10.4	10.2	9.7	9.5	8.8	8.3	8.0	7.8	7.3	7.2	7.1
	400	8.5	8.8	8.9	9.2	9.0	8.9	8.7	8.6	8.3	8.2	8.0	7.6	7.5	6.9	6.6	6.6	6.5	6.3	6.2	6.2
	500	6.6	6.7	6.8	7.0	6.8	6.7	6.6	6.5	6.4	6.3	6.2	5.9	5.8	5.6	5.7	5.5	5.6	5.5	5.5	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 MAY

DEPTH (M)																				
0	24.0	23.7	23.3	22.8	22.3	21.8	21.1	20.7	19.9	19.2	18.3	17.6	17.1	16.4	15.9	15.4	14.7	13.7	12.9	12.0
10	24.0	23.7	23.2	22.8	22.3	21.7	21.0	20.7	19.8	19.2	18.2	17.5	17.0	16.3	15.7	15.3	14.6	13.6	12.9	11.9
20	23.9	23.7	23.2	22.7	22.2	21.7	20.9	20.7	19.8	19.2	18.2	17.4	16.9	16.2	15.6	15.2	14.6	13.5	12.9	11.7
30	23.9	23.5	23.0	22.6	22.0	21.5	20.8	20.5	19.7	19.1	18.0	17.4	16.8	16.1	15.4	15.0	14.4	13.4	12.8	11.6
40	23.7	23.4	22.8	22.5	21.8	21.3	20.6	20.3	19.5	19.0	18.0	17.4	16.8	16.0	15.4	15.0	14.4	13.4	12.9	11.4
50	23.5	23.1	22.6	22.4	21.6	21.1	20.4	20.1	19.4	18.8	18.0	17.4	16.8	16.0	15.4	15.0	14.3	13.3	12.8	11.2
60	23.2	22.8	22.5	22.3	21.5	21.0	20.2	19.8	19.3	18.7	18.0	17.4	16.8	16.0	15.4	14.9	14.3	13.1	12.7	10.9
70	23.0	22.6	22.2	22.1	21.3	20.8	20.1	19.6	19.2	18.6	18.0	17.4	16.9	16.0	15.5	14.9	14.3	13.0	12.4	10.7
80	22.7	22.3	22.0	21.9	21.1	20.6	19.9	19.5	19.1	18.4	18.0	17.4	16.8	16.0	15.4	14.8	14.2	12.7	12.1	10.4
90	22.4	22.1	21.8	21.8	20.8	20.4	19.6	19.3	18.8	18.2	17.9	17.3	16.7	15.9	15.3	14.7	14.0	12.4	11.7	10.0
100	22.1	21.8	21.4	21.5	20.5	20.2	19.3	19.0	18.5	18.1	17.7	17.2	16.7	15.7	15.3	14.6	13.9	11.8	11.1	9.7
120	21.4	21.1	20.7	20.9	19.9	19.5	18.7	18.4	18.0	17.7	17.2	17.0	16.4	15.3	14.7	13.9	12.9	10.7	10.1	9.3
150	19.9	19.8	19.5	19.8	18.8	18.3	17.8	17.4	16.8	16.7	15.9	16.0	15.3	13.7	12.8	11.8	11.2	9.7	9.4	8.9
200	17.1	17.3	17.2	17.4	16.4	15.9	15.6	14.8	14.2	14.0	13.1	12.8	12.1	11.1	10.5	9.9	9.5	8.7	8.6	8.3
250	14.0	14.4	14.4	14.7	13.9	13.3	12.9	12.5	12.0	11.8	11.4	10.9	10.5	9.8	9.4	9.0	8.7	8.1	7.9	7.6
300	11.4	11.8	11.8	12.3	11.9	11.5	11.3	11.0	10.7	10.5	10.2	9.8	9.5	8.9	8.4	8.1	7.8	7.4	7.2	7.2
400	8.4	8.8	8.9	9.2	9.1	8.9	8.8	8.6	8.3	8.3	8.1	7.6	7.4	7.0	6.6	6.6	6.5	6.3	6.1	6.3
500	6.6	6.7	6.8	7.0	7.0	6.8	6.7	6.6	6.4	6.3	6.2	5.9	5.8	5.6	5.6	5.5	5.7	5.6	5.4	5.6
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — MID-MAY

DEPTH (M)																				
0	24.3	24.2	23.7	23.3	22.9	22.3	21.8	21.3	20.5	19.8	18.9	18.3	17.7	17.1	16.6	16.0	15.2	14.3	13.3	12.2
10	24.3	24.2	23.7	23.2	22.8	22.3	21.7	21.3	20.5	19.8	18.8	18.2	17.6	17.0	16.4	15.8	15.1	14.1	13.2	12.0
20	24.3	24.1	23.5	23.1	22.7	22.2	21.5	21.2	20.4	19.7	18.7	18.1	17.5	16.8	16.2	15.7	15.0	14.0	13.1	11.8
30	24.2	24.0	23.3	23.0	22.5	22.0	21.4	21.0	20.3	19.6	18.5	17.9	17.3	16.6	15.9	15.5	14.8	13.8	13.1	11.7
40	24.0	23.7	23.0	22.8	22.2	21.7	21.1	20.6	20.0	19.4	18.3	17.8	17.1	16.3	15.7	15.3	14.6	13.6	13.0	11.5
50	23.7	23.4	22.7	22.6	21.9	21.3	20.7	20.3	19.8	19.2	18.2	17.7	17.0	16.2	15.6	15.1	14.4	13.5	12.8	11.1
60	23.4	23.1	22.4	22.5	21.7	21.1	20.4	19.9	19.5	19.0	18.1	17.7	16.9	16.2	15.6	15.0	14.4	13.3	12.5	10.7
70	23.0	22.7	22.2	22.2	21.5	20.8	20.1	19.7	19.3	18.8	18.0	17.6	16.9	16.2	15.6	14.9	14.3	13.2	12.2	10.5
80	22.7	22.4	21.9	22.0	21.2	20.6	19.9	19.5	19.1	18.6	18.0	17.6	16.9	16.1	15.5	14.8	14.1	12.9	11.8	10.2
90	22.5	22.1	21.6	21.8	20.9	20.4	19.7	19.3	18.9	18.4	17.9	17.5	16.8	16.0	15.3	14.6	13.9	12.4	11.4	10.0
100	22.1	21.8	21.2	21.5	20.6	20.1	19.4	19.0	18.6	18.2	17.7	17.4	16.7	15.8	15.2	14.4	13.6	11.9	11.0	9.7
120	21.4	21.1	20.4	20.9	19.9	19.4	18.7	18.5	18.0	17.7	17.1	17.2	16.3	15.4	14.7	13.7	12.7	10.8	10.1	9.3
150	19.9	19.9	19.1	19.8	18.8	18.2	17.7	17.4	16.9	16.8	15.8	16.2	15.3	13.9	13.1	11.7	11.1	9.7	9.4	9.0
200	17.2	17.4	16.8	17.5	16.5	15.8	15.5	15.0	14.4	14.1	13.0	13.0	12.1	11.1	10.6	9.8	9.5	8.8	8.6	8.3
250	14.0	14.5	14.1	14.8	14.0	13.3	12.9	12.6	12.1	11.9	11.3	11.0	10.6	9.9	9.4	9.0	8.7	8.1	7.9	7.7
300	11.4	12.0	11.8	12.4	12.0	11.5	11.4	11.1	10.8	10.6	10.2	9.9	9.5	8.9	8.4	8.1	7.8	7.4	7.2	7.2
400	8.4	8.9	8.9	9.2	9.3	8.9	8.9	8.7	8.5	8.4	8.1	7.8	7.4	7.0	6.7	6.5	6.5	6.3	6.0	6.3
500	6.7	6.7	6.9	7.0	7.0	6.8	6.8	6.7	6.5	6.4	6.2	6.0	5.8	5.7	5.5	5.6	5.7	5.6	5.4	5.6
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 JUNE

0	24.7	24.6	24.1	23.7	23.4	22.9	22.4	21.9	21.2	20.5	19.6	19.1	18.5	17.9	17.3	16.6	15.9	14.9	13.8	12.6
10	24.6	24.6	24.1	23.6	23.3	22.8	22.3	21.8	21.1	20.4	19.5	19.0	18.4	17.8	17.1	16.5	15.8	14.8	13.6	12.4
20	24.6	24.5	23.9	23.5	23.2	22.7	22.2	21.7	21.1	20.3	19.4	18.9	18.2	17.5	16.9	16.3	15.6	14.6	13.5	12.2
30	24.5	24.3	23.6	23.3	22.9	22.5	22.0	21.5	20.9	20.1	19.1	18.5	17.9	17.1	16.5	16.0	15.3	14.2	13.4	12.0
40	24.3	24.1	23.3	23.1	22.6	22.1	21.6	21.0	20.4	19.9	18.7	18.2	17.6	16.7	16.1	15.7	15.0	14.0	13.1	11.6
50	23.9	23.7	22.9	22.8	22.3	21.6	21.1	20.5	20.1	19.6	18.6	18.0	17.3	16.5	15.9	15.3	14.6	13.8	12.7	11.1
D 60	23.5	23.3	22.5	22.5	21.9	21.2	20.6	20.1	19.7	19.2	18.3	17.9	17.1	16.3	15.8	15.1	14.4	13.6	12.3	10.6
E 70	23.1	23.0	22.1	22.2	21.6	20.9	20.3	19.8	19.4	19.0	18.1	17.7	17.0	16.3	15.7	14.9	14.2	13.4	11.9	10.4
P 80	22.7	22.6	21.7	21.9	21.2	20.6	20.0	19.5	19.1	18.7	18.0	17.7	16.9	16.2	15.5	14.7	14.0	12.9	11.5	10.1
T 90	22.4	22.2	21.4	21.7	20.9	20.3	19.7	19.3	18.9	18.5	17.8	17.6	16.9	16.0	15.3	14.5	13.7	12.5	11.1	9.9
H 100	22.1	21.9	21.1	21.4	20.6	20.0	19.5	19.0	18.6	18.3	17.6	17.5	16.7	15.9	15.2	14.2	13.4	11.9	10.7	9.7
120	21.3	21.2	20.3	20.8	20.0	19.4	18.8	18.5	18.1	17.8	17.1	17.2	16.3	15.4	14.6	13.4	12.4	10.9	10.0	9.4
(M) 150	19.9	20.1	19.0	19.8	18.9	18.3	17.8	17.5	17.0	16.9	15.8	16.2	15.2	14.0	13.1	11.6	11.0	9.8	9.3	9.0
200	17.4	17.6	16.6	17.5	16.6	15.8	15.5	15.1	14.5	14.3	12.8	13.1	12.2	11.2	10.6	9.8	9.5	8.8	8.5	8.3
250	14.1	14.7	14.0	14.9	14.0	13.4	13.0	12.7	12.3	12.1	11.3	11.1	10.6	9.9	9.4	8.9	8.7	8.1	7.8	7.7
300	11.5	12.1	11.8	12.4	12.0	11.6	11.5	11.2	10.9	10.7	10.2	10.0	9.5	9.0	8.4	8.0	7.8	7.4	7.1	7.1
400	8.4	8.9	9.0	9.2	9.3	8.9	9.0	8.8	8.6	8.5	8.1	7.9	7.4	7.0	6.7	6.5	6.5	6.3	6.0	6.2
500	6.8	6.7	6.9	6.9	6.9	6.8	6.8	6.7	6.7	6.5	6.1	6.1	5.9	5.7	5.5	5.5	5.7	5.5	5.3	5.6
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — MID-JUNE

0	25.0	25.0	24.5	24.1	23.9	23.4	23.0	22.4	21.9	21.2	20.5	20.0	19.5	18.8	18.2	17.5	16.7	15.8	14.5	13.2
10	25.0	24.9	24.5	24.0	23.8	23.4	23.0	22.3	21.8	21.1	20.3	19.9	19.3	18.7	18.1	17.3	16.6	15.6	14.3	13.0
20	24.9	24.8	24.3	23.9	23.7	23.3	22.8	22.2	21.8	21.1	20.2	19.7	19.0	18.4	17.8	17.0	16.3	15.3	14.1	12.8
30	24.9	24.7	24.0	23.7	23.4	23.1	22.6	21.9	21.5	20.8	19.9	19.3	18.7	17.7	17.3	16.6	16.0	14.9	13.8	12.5
40	24.6	24.5	23.6	23.4	23.1	22.6	22.1	21.3	21.0	20.4	19.4	18.7	18.2	17.1	16.6	16.0	15.4	14.5	13.3	11.9
50	24.1	24.1	23.1	23.0	22.6	21.9	21.5	20.7	20.4	20.0	19.0	18.3	17.7	16.7	16.2	15.4	14.9	14.1	12.7	11.2
D 60	23.6	23.7	22.6	22.6	22.1	21.4	20.9	20.2	19.9	19.5	18.6	18.0	17.3	16.5	16.0	15.1	14.5	13.8	12.1	10.6
E 70	23.2	23.3	22.1	22.2	21.6	21.0	20.5	19.8	19.5	19.1	18.3	17.8	17.1	16.3	15.7	14.8	14.2	13.4	11.6	10.3
P 80	22.8	22.8	21.7	21.8	21.2	20.6	20.1	19.5	19.2	18.8	18.0	17.7	16.9	16.1	15.5	14.5	13.8	13.0	11.2	10.0
T 90	22.4	22.5	21.3	21.5	20.9	20.3	19.8	19.2	18.9	18.6	17.8	17.6	16.8	16.0	15.3	14.3	13.6	12.5	10.8	9.8
H 100	22.0	22.1	21.0	21.2	20.5	20.0	19.6	18.9	18.6	18.3	17.6	17.4	16.7	15.9	15.1	14.0	13.2	12.0	10.5	9.7
120	21.2	21.3	20.3	20.6	19.9	19.4	19.0	18.4	18.1	17.9	17.0	17.2	16.3	15.4	14.5	13.2	12.3	11.0	9.9	9.3
(M) 150	19.9	20.2	19.0	19.6	18.8	18.4	17.9	17.5	17.1	17.0	15.8	16.2	15.2	14.1	13.0	11.5	10.9	10.0	9.3	8.9
200	17.4	17.8	16.6	17.4	16.5	15.9	15.5	15.1	14.5	14.5	12.8	13.1	12.3	11.3	10.6	9.7	9.5	8.9	8.5	8.3
250	14.2	14.8	14.0	14.8	13.9	13.5	13.0	12.7	12.4	12.2	11.2	11.2	10.7	10.0	9.4	8.8	8.6	8.2	7.8	7.6
300	11.6	12.2	11.8	12.3	12.0	11.6	11.5	11.2	11.0	10.8	10.2	10.0	9.5	9.0	8.5	8.0	7.8	7.4	7.1	7.1
400	8.4	9.0	9.0	9.1	9.3	8.9	9.0	8.8	8.7	8.6	8.1	7.9	7.5	7.0	6.8	6.4	6.4	6.3	6.1	6.1
500	6.8	6.7	6.8	6.8	6.8	6.9	6.9	6.8	6.8	6.6	6.1	6.1	6.0	5.8	5.5	5.5	5.7	5.5	5.4	5.6
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 JULY

	0	25.4	25.3	24.9	24.5	24.3	23.9	23.6	22.9	22.6	22.0	21.4	21.0	20.6	19.9	19.2	18.6	17.7	16.8	15.4	14.0
	10	25.4	25.2	24.8	24.5	24.3	23.9	23.5	22.8	22.5	21.9	21.3	20.9	20.4	19.7	19.1	18.4	17.6	16.6	15.2	13.9
	20	25.3	25.2	24.7	24.4	24.2	23.8	23.4	22.7	22.4	21.8	21.2	20.7	20.1	19.4	18.8	18.0	17.3	16.2	14.9	13.6
	30	25.3	25.1	24.5	24.1	24.0	23.6	23.2	22.4	22.2	21.6	20.9	20.1	19.7	18.5	18.1	17.5	17.0	15.7	14.6	13.0
	40	25.0	24.8	24.1	23.8	23.5	23.1	22.6	21.8	21.6	21.1	20.2	19.2	18.8	17.6	17.1	16.4	16.0	15.1	13.7	12.2
	50	24.4	24.4	23.5	23.2	22.9	22.3	21.9	21.1	20.8	20.3	19.5	18.6	18.0	17.0	16.5	15.7	15.2	14.5	12.9	11.3
D	60	23.8	24.0	22.8	22.6	22.2	21.6	21.2	20.4	20.2	19.7	19.0	18.2	17.6	16.7	16.2	15.2	14.7	13.9	12.2	10.7
E	70	23.4	23.5	22.3	22.1	21.6	21.1	20.7	19.9	19.7	19.3	18.5	17.9	17.2	16.4	15.8	14.8	14.2	13.4	11.5	10.3
P	80	22.9	23.1	21.8	21.7	21.1	20.7	20.3	19.5	19.3	18.9	18.2	17.7	16.9	16.1	15.5	14.5	13.8	12.9	11.0	10.0
T	90	22.4	22.7	21.4	21.3	20.7	20.4	19.9	19.1	19.0	18.6	17.9	17.5	16.7	16.0	15.3	14.2	13.5	12.4	10.7	9.8
H	100	22.0	22.2	21.1	21.0	20.4	20.1	19.6	18.8	18.7	18.3	17.7	17.3	16.6	15.8	15.1	13.9	13.2	12.0	10.4	9.6
	120	21.2	21.4	20.4	20.4	19.8	19.5	19.1	18.4	18.2	18.0	17.1	17.0	16.3	15.4	14.4	13.1	12.3	11.1	9.9	9.3
(M)	150	20.0	20.3	19.2	19.4	18.8	18.6	18.0	17.4	17.2	17.1	15.9	16.0	15.1	14.2	12.9	11.6	10.9	10.1	9.2	8.9
	200	17.5	17.9	16.8	17.1	16.5	16.1	15.5	15.1	14.6	14.6	12.9	13.1	12.3	11.5	10.5	9.8	9.5	9.0	8.5	8.2
	250	14.3	14.8	14.1	14.4	13.7	13.7	13.0	12.7	12.4	12.3	11.3	11.2	10.7	10.2	9.4	8.8	8.7	8.3	7.8	7.6
	300	11.6	12.2	11.9	12.1	11.9	11.7	11.5	11.1	11.0	10.9	10.2	10.0	9.6	9.0	8.4	8.0	7.8	7.5	7.2	7.0
	400	8.5	8.9	8.9	9.0	9.2	9.0	9.0	8.8	8.7	8.7	8.2	8.0	7.6	7.1	6.8	6.5	6.4	6.3	6.2	6.0
	500	6.7	6.6	6.7	6.7	6.6	7.0	6.9	6.8	6.9	6.6	6.2	6.2	6.0	5.8	5.7	5.5	5.5	5.5	5.5	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — MID-JULY

	0	25.7	25.4	25.1	24.8	24.6	24.3	24.0	23.4	23.0	22.6	22.1	21.7	21.3	20.6	20.0	19.4	18.5	17.5	16.2	14.7
	10	25.7	25.4	25.1	24.8	24.6	24.2	23.9	23.3	23.0	22.5	22.0	21.6	21.1	20.5	19.8	19.2	18.4	17.3	15.9	14.5
	20	25.6	25.3	25.0	24.7	24.5	24.1	23.8	23.1	22.9	22.4	21.9	21.3	20.8	20.2	19.6	18.8	18.1	17.0	15.6	14.1
	30	25.6	25.3	24.8	24.5	24.3	24.0	23.6	22.8	22.7	22.2	21.6	20.7	20.4	19.2	18.8	18.1	17.7	16.5	15.3	13.4
	40	25.4	25.1	24.5	24.2	23.8	23.5	23.0	22.2	22.0	21.6	20.8	19.7	19.2	18.1	17.5	16.8	16.5	15.6	14.3	12.4
	50	24.8	24.7	23.9	23.5	23.1	22.6	22.2	21.5	21.1	20.5	19.8	18.8	18.3	17.3	16.7	15.9	15.5	14.8	13.4	11.4
D	60	24.1	24.2	23.1	22.7	22.2	21.8	21.5	20.7	20.4	19.8	19.3	18.4	17.7	16.9	16.3	15.4	14.9	14.0	12.6	10.8
E	70	23.5	23.6	22.5	22.2	21.6	21.3	20.9	20.0	19.9	19.3	18.8	18.0	17.3	16.5	15.9	14.9	14.4	13.4	11.8	10.3
P	80	23.0	23.1	22.0	21.7	21.1	20.9	20.4	19.5	19.5	18.9	18.4	17.7	16.9	16.2	15.6	14.5	13.8	12.8	11.2	10.0
T	90	22.5	22.7	21.6	21.3	20.7	20.5	20.0	19.1	19.1	18.5	18.1	17.5	16.7	16.0	15.3	14.3	13.5	12.3	10.8	9.8
H	100	22.1	22.2	21.2	20.9	20.3	20.2	19.6	18.8	18.8	18.2	17.8	17.3	16.6	15.9	15.1	13.9	13.2	11.9	10.5	9.6
	120	21.2	21.4	20.5	20.2	19.7	19.6	19.1	18.3	18.3	17.9	17.2	17.0	16.3	15.5	14.5	13.2	12.4	11.2	10.0	9.3
(M)	150	20.0	20.2	19.4	19.2	18.7	18.7	18.1	17.4	17.3	17.0	16.1	15.9	15.1	14.2	12.8	11.8	11.0	10.1	9.3	8.8
	200	17.4	17.8	16.9	16.8	16.4	16.3	15.6	15.0	14.6	14.6	13.1	13.1	12.3	11.7	10.5	9.9	9.5	9.1	8.6	8.2
	250	14.3	14.7	14.1	14.0	13.6	13.8	13.1	12.6	12.4	12.3	11.4	11.2	10.7	10.3	9.4	8.9	8.7	8.3	7.9	7.5
	300	11.7	12.0	11.9	11.8	11.8	11.8	11.4	11.1	11.0	10.9	10.3	10.0	9.6	9.1	8.4	8.1	7.8	7.5	7.3	6.9
	400	8.6	8.9	8.8	8.9	9.0	9.1	9.0	8.8	8.7	8.7	8.2	8.0	7.6	7.2	6.8	6.5	6.4	6.4	6.3	6.0
	500	6.7	6.6	6.6	6.6	6.6	7.1	6.9	6.8	6.8	6.6	6.3	6.2	6.1	5.8	5.8	5.5	5.5	5.5	5.6	5.6
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 AUGUST

	0	25.9	25.6	25.2	25.1	24.9	24.5	24.2	23.8	23.5	23.1	22.7	22.2	22.0	21.3	20.6	20.2	19.3	18.1	16.9	15.3
	10	25.9	25.6	25.3	25.1	24.9	24.5	24.2	23.8	23.4	23.0	22.6	22.1	21.8	21.2	20.5	20.0	19.1	17.9	16.7	15.1
	20	25.9	25.5	25.2	25.0	24.8	24.4	24.1	23.6	23.3	22.9	22.5	21.9	21.5	20.9	20.3	19.6	18.9	17.7	16.4	14.6
	30	25.9	25.5	25.1	24.9	24.7	24.3	23.9	23.3	23.1	22.7	22.2	21.4	20.9	20.0	19.4	18.8	18.3	17.2	16.1	13.7
	40	25.7	25.3	24.9	24.6	24.2	23.9	23.3	22.7	22.5	22.0	21.4	20.2	19.6	18.7	18.1	17.2	17.0	16.2	15.1	12.5
	50	25.2	24.9	24.3	23.8	23.3	22.9	22.5	21.9	21.5	20.7	20.2	19.2	18.5	17.6	17.0	16.1	15.8	15.0	14.0	11.5
D	60	24.5	24.3	23.5	23.0	22.3	22.1	21.6	20.9	20.6	19.8	19.5	18.7	17.8	17.0	16.5	15.6	15.1	14.1	13.2	11.0
E	70	23.7	23.6	22.8	22.3	21.6	21.5	21.0	20.2	20.1	19.3	18.9	18.2	17.4	16.7	16.1	15.1	14.5	13.4	12.3	10.4
P	80	23.1	23.1	22.3	21.8	21.1	21.0	20.5	19.7	19.7	18.8	18.6	17.9	17.0	16.3	15.8	14.7	13.9	12.8	11.6	10.1
T	90	22.7	22.6	21.8	21.3	20.7	20.6	20.0	19.3	19.3	18.5	18.3	17.6	16.7	16.1	15.5	14.4	13.6	12.3	11.2	9.9
H	100	22.2	22.2	21.4	20.9	20.3	20.2	19.6	18.9	19.0	18.2	18.0	17.4	16.6	15.9	15.3	14.1	13.3	11.9	10.8	9.6
	120	21.4	21.2	20.6	20.1	19.7	19.6	19.0	18.3	18.3	17.8	17.4	17.0	16.3	15.6	14.6	13.4	12.5	11.2	10.3	9.2
(M)	150	20.1	20.0	19.5	19.0	18.6	18.7	18.1	17.4	17.4	16.9	16.3	16.0	15.1	14.3	12.8	12.0	11.0	10.1	9.5	8.8
	200	17.5	17.6	17.1	16.5	16.3	16.4	15.6	14.9	14.7	14.4	13.4	13.1	12.2	11.8	10.5	10.1	9.5	9.1	8.8	8.2
	250	14.4	14.5	14.2	13.7	13.6	13.8	13.1	12.5	12.4	12.2	11.5	11.2	10.7	10.3	9.4	9.1	8.7	8.4	8.0	7.5
	300	11.8	11.8	11.8	11.6	11.7	11.8	11.3	11.0	10.9	10.8	10.3	10.0	9.6	9.2	8.5	8.2	7.8	7.6	7.4	6.9
	400	8.7	8.7	8.7	8.9	8.9	9.1	8.9	8.7	8.6	8.6	8.2	8.0	7.6	7.3	6.8	6.6	6.4	6.4	6.4	6.1
	500	6.6	6.6	6.6	6.6	6.6	7.2	6.9	6.7	6.8	6.6	6.3	6.2	6.0	5.8	5.8	5.6	5.4	5.5	5.7	5.6
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

DISTANCE

MEAN XBT TEMPERATURE, DEG-C — MID-AUGUST

	0	26.2	25.8	25.5	25.4	25.2	24.8	24.5	24.3	23.8	23.5	23.1	22.6	22.4	21.9	21.1	20.7	19.8	18.6	17.5	15.8
	10	26.2	25.7	25.5	25.4	25.1	24.8	24.5	24.2	23.7	23.5	23.1	22.5	22.2	21.8	21.0	20.5	19.7	18.4	17.3	15.6
	20	26.2	25.7	25.5	25.3	25.1	24.7	24.4	24.1	23.6	23.4	23.0	22.4	21.9	21.5	20.8	20.1	19.4	18.2	17.1	14.9
	30	26.1	25.7	25.4	25.3	25.0	24.6	24.2	23.9	23.5	23.2	22.7	21.9	21.4	20.7	20.0	19.4	18.8	17.9	16.7	13.8
	40	26.0	25.6	25.3	25.1	24.5	24.2	23.7	23.3	23.0	22.5	21.9	20.9	19.9	19.4	18.7	17.8	17.4	16.6	15.8	12.5
	50	25.5	25.1	24.7	24.3	23.5	23.3	22.8	22.4	21.9	20.9	20.5	19.8	18.7	17.9	17.3	16.5	16.0	15.3	14.7	11.5
D	60	24.8	24.4	23.8	23.3	22.5	22.3	21.8	21.3	20.9	19.8	19.6	19.0	17.9	17.2	16.6	15.8	15.2	14.2	13.8	11.1
E	70	23.9	23.6	23.0	22.6	21.7	21.6	21.0	20.5	20.3	19.2	19.0	18.5	17.4	16.8	16.2	15.3	14.6	13.5	12.9	10.4
P	80	23.3	22.9	22.4	22.0	21.2	21.1	20.5	19.9	19.8	18.8	18.7	18.1	17.1	16.5	15.9	14.9	14.0	12.9	12.1	10.1
T	90	22.9	22.4	21.9	21.5	20.8	20.6	20.0	19.5	19.4	18.5	18.4	17.8	16.8	16.3	15.6	14.6	13.6	12.4	11.6	9.9
H	100	22.4	22.0	21.5	21.0	20.3	20.3	19.6	19.1	19.1	18.2	18.1	17.5	16.6	16.1	15.4	14.3	13.3	12.0	11.2	9.6
	120	21.5	21.0	20.6	20.1	19.6	19.6	19.0	18.4	18.4	17.6	17.5	17.1	16.3	15.6	14.8	13.6	12.6	11.2	10.5	9.2
(M)	150	20.2	19.8	19.5	18.9	18.6	18.6	18.0	17.4	17.4	16.7	16.5	16.1	15.0	14.3	13.0	12.2	11.0	10.1	9.7	8.8
	200	17.5	17.3	17.1	16.4	16.3	16.3	15.7	14.9	14.7	14.1	13.7	13.2	12.2	11.8	10.6	10.2	9.4	9.1	9.0	8.2
	250	14.5	14.3	14.2	13.5	13.7	13.6	13.1	12.5	12.3	12.0	11.6	11.2	10.7	10.3	9.4	9.2	8.7	8.4	8.2	7.5
	300	11.9	11.6	11.7	11.5	11.8	11.7	11.3	11.0	10.9	10.7	10.4	10.1	9.6	9.2	8.5	8.2	7.8	7.6	7.5	6.9
	400	8.8	8.6	8.7	8.9	8.9	9.1	8.9	8.7	8.6	8.5	8.2	8.0	7.6	7.3	6.8	6.7	6.4	6.5	6.4	6.2
	500	6.7	6.7	6.6	6.6	6.6	7.2	6.9	6.7	6.7	6.5	6.4	6.1	6.0	5.7	5.8	5.6	5.4	5.6	5.7	5.7
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

DISTANCE

MEAN XBT TEMPERATURE, DEG-C — 01 SEPTEMBER

0	26.3	26.0	25.7	25.7	25.4	25.1	24.8	24.6	24.1	23.8	23.4	22.9	22.6	22.2	21.4	20.9	20.1	18.8	17.8	16.1
10	26.4	26.0	25.7	25.6	25.4	25.1	24.7	24.5	24.0	23.8	23.3	22.8	22.5	22.1	21.3	20.7	20.0	18.7	17.7	15.8
20	26.3	25.9	25.7	25.6	25.3	25.0	24.6	24.4	23.9	23.7	23.3	22.7	22.3	21.9	21.1	20.4	19.7	18.6	17.5	15.0
30	26.3	25.9	25.7	25.6	25.2	24.9	24.5	24.3	23.8	23.5	22.9	22.4	21.7	21.3	20.5	19.8	19.1	18.3	17.2	13.9
40	26.2	25.8	25.5	25.4	24.8	24.6	24.0	23.8	23.4	22.9	22.2	21.5	20.4	20.0	19.3	18.4	17.7	17.1	16.4	12.5
50	25.8	25.3	25.1	24.7	23.9	23.7	23.1	22.8	22.3	21.3	20.8	20.4	19.0	18.3	17.7	16.9	16.2	15.6	15.2	11.5
D 60	25.1	24.5	24.2	23.8	22.8	22.6	21.9	21.6	21.1	20.1	19.7	19.4	18.0	17.3	16.7	15.9	15.2	14.4	14.2	11.0
E 70	24.1	23.6	23.3	22.9	21.9	21.7	21.0	20.7	20.3	19.2	19.0	18.7	17.5	16.8	16.3	15.4	14.6	13.6	13.3	10.5
P 80	23.4	22.9	22.5	22.2	21.4	21.1	20.4	20.1	19.8	18.8	18.7	18.3	17.1	16.6	16.0	15.1	14.0	13.0	12.4	10.1
T 90	23.1	22.3	22.0	21.6	20.9	20.6	20.0	19.7	19.4	18.5	18.4	18.0	16.9	16.4	15.7	14.7	13.6	12.5	11.9	9.9
H 100	22.5	21.9	21.5	21.2	20.4	20.2	19.6	19.3	19.0	18.2	18.1	17.8	16.7	16.2	15.5	14.4	13.2	12.0	11.4	9.6
120	21.6	20.9	20.6	20.2	19.7	19.5	18.9	18.5	18.3	17.5	17.6	17.2	16.2	15.6	14.9	13.7	12.5	11.3	10.7	9.2
(M) 150	20.2	19.6	19.3	19.0	18.6	18.4	18.0	17.5	17.3	16.6	16.5	16.1	15.0	14.2	13.2	12.1	10.9	10.1	9.8	8.8
200	17.7	17.2	17.0	16.5	16.4	16.1	15.8	15.0	14.7	13.9	13.9	13.3	12.1	11.6	10.7	10.2	9.4	9.1	9.0	8.2
250	14.7	14.2	14.1	13.6	13.9	13.5	13.2	12.6	12.3	11.8	11.7	11.2	10.6	10.2	9.5	9.2	8.6	8.4	8.3	7.5
300	12.0	11.6	11.6	11.6	11.8	11.6	11.4	11.1	10.9	10.6	10.4	10.1	9.5	9.2	8.5	8.2	7.7	7.7	7.5	7.0
400	8.9	8.6	8.6	8.9	9.0	9.1	8.9	8.7	8.6	8.3	8.2	8.0	7.5	7.2	6.8	6.6	6.4	6.5	6.4	6.3
500	6.7	6.7	6.6	6.7	6.7	7.1	6.8	6.7	6.6	6.5	6.4	6.1	5.9	5.6	5.7	5.6	5.5	5.6	5.7	5.7
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — MID-SEPTEMBER

0	26.4	26.2	25.9	25.9	25.6	25.3	25.0	24.7	24.2	23.9	23.4	23.0	22.5	22.2	21.5	20.7	20.1	18.9	17.8	16.2
10	26.5	26.2	25.9	25.8	25.6	25.3	24.9	24.7	24.2	23.9	23.4	23.0	22.5	22.1	21.4	20.6	20.0	18.8	17.8	15.9
20	26.4	26.1	25.9	25.8	25.6	25.3	24.8	24.6	24.1	23.8	23.3	22.9	22.4	22.0	21.3	20.4	19.8	18.7	17.6	15.2
30	26.4	26.1	25.9	25.7	25.5	25.2	24.7	24.5	24.0	23.7	23.0	22.7	21.9	21.6	20.8	19.9	19.2	18.5	17.4	14.0
40	26.3	26.0	25.7	25.6	25.1	24.9	24.4	24.1	23.7	23.2	22.4	22.0	20.8	20.5	19.8	19.0	18.0	17.4	16.6	12.6
50	26.0	25.5	25.3	25.1	24.2	24.2	23.6	23.2	22.7	21.8	21.1	21.0	19.4	18.7	18.1	17.3	16.5	15.9	15.3	11.5
D 60	25.4	24.8	24.5	24.3	23.2	23.0	22.2	22.0	21.4	20.5	19.9	19.8	18.2	17.5	16.9	16.1	15.2	14.7	14.2	11.0
E 70	24.4	23.8	23.5	23.2	22.3	21.9	21.1	21.1	20.4	19.4	19.0	19.0	17.5	16.9	16.3	15.4	14.5	13.8	13.3	10.4
P 80	23.6	23.0	22.6	22.4	21.6	21.1	20.4	20.4	19.7	18.8	18.6	18.4	17.2	16.6	16.0	15.1	13.9	13.1	12.5	10.1
T 90	23.2	22.4	21.9	21.8	21.0	20.6	20.1	19.9	19.3	18.5	18.3	18.1	16.9	16.4	15.7	14.7	13.5	12.6	12.0	9.9
H 100	22.6	21.9	21.4	21.3	20.5	20.2	19.7	19.5	18.9	18.2	18.0	17.9	16.7	16.2	15.5	14.4	13.1	12.1	11.5	9.6
120	21.6	20.9	20.5	20.4	19.7	19.4	18.9	18.7	18.2	17.5	17.5	17.3	16.2	15.5	14.9	13.5	12.3	11.3	10.7	9.2
(M) 150	20.3	19.6	19.2	19.1	18.6	18.3	17.9	17.6	17.2	16.4	16.4	16.1	14.9	14.0	13.4	11.9	10.7	10.1	9.8	8.7
200	17.8	17.1	16.9	16.8	16.4	15.9	15.8	15.1	14.7	13.7	13.8	13.3	12.1	11.4	10.8	10.1	9.3	9.1	9.0	8.1
250	14.9	14.1	14.0	13.9	14.0	13.4	13.3	12.7	12.3	11.7	11.6	11.2	10.6	10.0	9.5	9.2	8.5	8.3	8.3	7.5
300	12.1	11.7	11.6	11.8	11.9	11.5	11.5	11.2	10.9	10.4	10.4	10.1	9.5	9.1	8.6	8.1	7.6	7.6	7.5	7.0
400	9.0	8.6	8.7	9.0	9.1	9.0	8.9	8.8	8.6	8.2	8.2	7.9	7.5	7.1	6.8	6.5	6.3	6.5	6.3	6.3
500	6.8	6.7	6.7	6.9	6.8	7.0	6.8	6.7	6.5	6.4	6.3	6.1	5.9	5.6	5.6	5.6	5.5	5.5	5.6	5.7
N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C 01 OCTOBER

	0	26.4	26.2	26.1	25.9	25.7	25.4	25.0	24.6	24.2	23.8	23.2	22.9	22.3	21.9	21.3	20.3	19.9	18.7	17.6	16.0
	10	26.4	26.2	26.0	25.8	25.7	25.4	25.0	24.6	24.1	23.8	23.2	22.9	22.3	21.9	21.2	20.2	19.7	18.6	17.5	15.8
	20	26.4	26.2	26.0	25.8	25.6	25.4	24.9	24.5	24.1	23.8	23.1	22.8	22.3	21.8	21.1	20.1	19.6	18.6	17.4	15.2
	30	26.4	26.2	25.9	25.7	25.6	25.3	24.8	24.5	24.1	23.7	22.9	22.7	21.9	21.5	20.9	19.9	19.1	18.4	17.2	14.1
	40	26.3	26.1	25.8	25.6	25.3	25.1	24.6	24.2	23.8	23.3	22.4	22.3	21.2	20.7	20.1	19.3	18.2	17.6	16.4	12.8
	50	26.1	25.7	25.5	25.3	24.6	24.5	23.9	23.4	23.0	22.3	21.3	21.4	19.9	19.1	18.6	17.6	16.8	16.3	15.1	11.5
D	60	25.6	25.1	24.7	24.6	23.7	23.4	22.5	22.4	21.7	21.0	20.0	20.2	18.5	17.7	17.1	16.2	15.3	15.0	14.0	10.8
E	70	24.6	24.2	23.6	23.5	22.6	22.0	21.4	21.4	20.4	19.7	19.0	19.2	17.6	16.9	16.3	15.4	14.4	13.9	13.0	10.4
P	80	23.7	23.3	22.7	22.6	21.7	21.2	20.6	20.6	19.6	18.9	18.5	18.5	17.1	16.6	15.9	14.9	13.8	13.2	12.2	10.0
T	90	23.2	22.6	22.0	21.9	21.1	20.6	20.1	20.0	19.1	18.5	18.1	18.1	16.9	16.3	15.6	14.5	13.4	12.7	11.7	9.8
H	100	22.6	22.1	21.4	21.4	20.6	20.1	19.7	19.6	18.7	18.1	17.8	17.9	16.7	16.1	15.4	14.1	13.0	12.1	11.2	9.6
	120	21.6	21.1	20.5	20.5	19.8	19.3	19.0	18.8	18.1	17.5	17.3	17.2	16.1	15.4	14.7	13.2	12.0	11.3	10.6	9.2
(M)	150	20.3	19.8	19.2	19.3	18.6	18.2	17.9	17.7	17.1	16.4	16.2	16.0	14.8	13.8	13.4	11.5	10.6	10.1	9.7	8.7
	200	17.9	17.2	16.8	17.0	16.4	15.8	15.8	15.3	14.5	13.7	13.6	13.1	12.1	11.2	10.8	9.9	9.3	9.0	8.8	8.1
	250	14.9	14.2	14.0	14.2	14.1	13.4	13.3	12.9	12.3	11.6	11.5	11.2	10.5	9.9	9.5	9.0	8.5	8.3	8.1	7.4
	300	12.2	11.8	11.7	11.9	11.9	11.5	11.5	11.2	10.9	10.4	10.3	10.0	9.5	8.9	8.6	7.9	7.6	7.6	7.4	7.0
	400	8.9	8.6	8.7	9.1	9.2	9.0	8.9	8.8	8.7	8.2	8.1	7.8	7.5	7.0	6.8	6.4	6.3	6.4	6.3	6.2
	500	6.9	6.7	6.8	6.9	6.8	6.9	6.8	6.8	6.5	6.4	6.2	6.1	6.0	5.6	5.6	5.5	5.5	5.5	5.5	5.7
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C MID-OCTOBER

	0	26.3	26.1	26.0	25.7	25.5	25.3	24.8	24.3	23.9	23.5	22.8	22.5	21.9	21.4	20.8	19.7	19.3	18.3	17.0	15.6
	10	26.3	26.1	25.9	25.7	25.5	25.3	24.8	24.2	23.9	23.4	22.8	22.5	21.9	21.3	20.7	19.6	19.2	18.3	17.0	15.5
	20	26.3	26.1	25.9	25.6	25.5	25.3	24.7	24.2	23.9	23.4	22.7	22.5	21.9	21.3	20.7	19.6	19.1	18.2	16.9	15.1
	30	26.2	26.1	25.8	25.5	25.5	25.2	24.7	24.2	23.9	23.4	22.6	22.5	21.7	21.2	20.6	19.5	18.9	18.1	16.7	14.2
	40	26.2	26.0	25.7	25.4	25.3	25.1	24.6	24.0	23.7	23.2	22.3	22.2	21.3	20.7	20.1	19.3	18.3	17.6	16.0	13.0
	50	26.0	25.8	25.5	25.2	24.8	24.7	24.1	23.4	23.1	22.6	21.4	21.5	20.3	19.4	18.8	17.8	17.0	16.5	14.8	11.6
D	60	25.6	25.3	24.8	24.7	24.0	23.7	22.9	22.7	21.9	21.4	20.3	20.4	18.9	17.9	17.3	16.3	15.6	15.2	13.5	10.7
E	70	24.9	24.6	23.8	23.7	22.9	22.3	21.8	21.7	20.6	20.0	19.2	19.3	17.8	17.1	16.3	15.2	14.4	13.9	12.6	10.3
P	80	24.0	23.8	22.8	22.8	21.9	21.3	20.9	20.7	19.7	19.1	18.5	18.5	17.2	16.6	15.8	14.6	13.8	13.1	11.8	10.0
T	90	23.3	23.0	22.1	22.0	21.2	20.7	20.3	20.1	19.1	18.5	18.1	18.1	16.8	16.3	15.5	14.3	13.4	12.6	11.3	9.7
H	100	22.5	22.3	21.5	21.4	20.6	20.1	19.8	19.7	18.7	18.1	17.7	17.8	16.6	16.0	15.2	13.8	12.9	12.0	10.9	9.5
	120	21.6	21.3	20.7	20.6	19.8	19.3	19.0	18.9	18.0	17.5	17.1	17.1	16.1	15.3	14.5	12.9	11.9	11.2	10.3	9.2
(M)	150	20.3	19.9	19.4	19.4	18.7	18.2	17.9	17.8	17.0	16.4	16.0	15.8	14.8	13.7	13.3	11.2	10.5	10.1	9.5	8.6
	200	17.9	17.3	17.0	17.2	16.4	15.8	15.8	15.5	14.4	13.7	13.3	12.9	12.1	11.1	10.8	9.7	9.3	9.0	8.6	8.0
	250	14.8	14.3	14.2	14.4	14.0	13.4	13.3	13.0	12.3	11.7	11.4	11.1	10.6	9.8	9.5	8.9	8.4	8.2	7.9	7.4
	300	12.1	11.9	11.8	12.1	11.8	11.5	11.5	11.3	10.9	10.4	10.2	9.9	9.5	8.9	8.6	7.8	7.6	7.5	7.3	6.9
	400	8.8	8.7	8.7	9.1	9.2	8.9	8.9	8.8	8.7	8.2	8.1	7.7	7.5	7.0	6.8	6.3	6.3	6.3	6.3	6.1
	500	6.8	6.7	6.8	6.9	6.8	6.8	6.8	6.8	6.6	6.3	6.2	6.0	6.0	5.6	5.6	5.5	5.5	5.5	5.4	5.6
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 NOVEMBER

	Depth	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	0	26.0	25.8	25.6	25.3	25.2	24.9	24.4	23.8	23.5	22.9	22.2	21.9	21.3	20.6	20.1	19.0	18.6	17.7	16.3	15.1
	10	26.0	25.8	25.6	25.3	25.1	24.9	24.4	23.8	23.5	22.8	22.2	21.9	21.3	20.6	20.0	19.0	18.6	17.7	16.3	15.0
	20	26.0	25.8	25.6	25.3	25.1	24.9	24.4	23.7	23.5	22.8	22.2	21.9	21.3	20.6	20.0	19.0	18.6	17.7	16.2	14.8
	30	25.9	25.8	25.6	25.2	25.1	24.9	24.4	23.7	23.4	22.8	22.1	21.9	21.3	20.6	20.0	19.0	18.5	17.6	16.1	14.1
	40	25.9	25.7	25.5	25.1	25.0	24.8	24.4	23.7	23.4	22.8	22.0	21.8	21.1	20.4	19.7	19.0	18.2	17.4	15.4	13.1
	50	25.8	25.6	25.3	25.0	24.8	24.6	24.0	23.3	23.0	22.5	21.4	21.4	20.4	19.5	18.9	17.9	17.2	16.6	14.5	11.7
D	60	25.5	25.4	24.7	24.6	24.2	23.8	23.1	22.8	22.1	21.6	20.4	20.4	19.3	18.2	17.6	16.3	15.8	15.4	13.2	10.7
E	70	25.1	24.9	23.9	23.8	23.1	22.5	22.3	21.9	20.9	20.3	19.4	19.3	18.1	17.4	16.4	15.1	14.7	13.9	12.2	10.2
P	80	24.2	24.2	23.1	22.9	22.0	21.6	21.3	20.9	20.0	19.3	18.7	18.5	17.3	16.7	15.7	14.5	13.9	13.1	11.4	9.9
T	90	23.4	23.4	22.4	22.1	21.2	20.8	20.4	20.3	19.3	18.6	18.2	18.0	16.8	16.3	15.4	14.0	13.3	12.4	10.9	9.7
H	100	22.6	22.6	21.8	21.5	20.7	20.3	19.9	19.7	18.7	18.1	17.7	17.6	16.5	15.9	15.1	13.5	12.8	11.9	10.5	9.4
	120	21.6	21.4	20.9	20.6	19.8	19.4	19.1	18.9	18.0	17.5	17.0	16.9	16.0	15.3	14.4	12.6	11.9	11.1	10.0	9.1
(M)	150	20.2	20.1	19.7	19.4	18.6	18.2	18.0	17.8	16.9	16.3	15.9	15.6	14.7	13.7	13.1	11.1	10.6	10.0	9.3	8.6
	200	17.7	17.4	17.3	17.1	16.3	15.8	15.7	15.6	14.2	13.8	13.0	12.7	12.1	11.1	10.7	9.6	9.3	9.0	8.5	7.9
	250	14.6	14.3	14.4	14.3	13.8	13.4	13.2	13.0	12.2	11.7	11.3	11.0	10.6	9.8	9.5	8.8	8.5	8.2	7.8	7.3
	300	11.9	11.9	11.9	12.0	11.7	11.5	11.4	11.3	10.9	10.5	10.1	9.8	9.5	8.8	8.5	7.8	7.6	7.4	7.2	6.8
	400	8.7	8.7	8.8	9.1	9.1	9.0	8.9	8.8	8.7	8.3	7.9	7.7	7.6	7.0	6.8	6.3	6.3	6.2	6.3	6.0
	500	6.7	6.6	6.8	6.9	6.8	6.7	6.8	6.8	6.6	6.3	6.1	6.0	6.1	5.7	5.6	5.6	5.5	5.5	5.5	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — MID-NOVEMBER

	Depth	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	0	25.6	25.3	25.1	24.8	24.6	24.3	23.8	23.2	22.9	22.1	21.5	21.1	20.5	19.8	19.2	18.3	17.8	17.0	15.6	14.3
	10	25.5	25.3	25.1	24.8	24.6	24.3	23.8	23.2	22.9	22.1	21.4	21.1	20.5	19.8	19.1	18.3	17.8	17.0	15.6	14.3
	20	25.5	25.3	25.1	24.8	24.6	24.3	23.8	23.2	22.9	22.1	21.5	21.2	20.6	19.8	19.1	18.3	17.9	17.0	15.5	14.3
	30	25.5	25.3	25.1	24.7	24.6	24.3	23.8	23.2	22.8	22.1	21.5	21.1	20.6	19.9	19.2	18.3	17.9	17.0	15.4	13.8
	40	25.5	25.3	25.0	24.7	24.5	24.4	23.8	23.1	22.8	22.1	21.5	21.1	20.6	19.9	19.1	18.4	17.8	17.0	14.9	13.1
	50	25.4	25.3	24.9	24.6	24.5	24.2	23.7	23.1	22.6	22.0	21.1	20.9	20.3	19.4	18.7	17.7	17.2	16.5	14.3	11.8
D	60	25.3	25.2	24.6	24.3	24.0	23.7	23.2	22.8	22.1	21.5	20.5	20.2	19.5	18.5	17.7	16.4	16.1	15.3	13.1	10.8
E	70	25.1	25.0	24.0	23.8	23.1	22.7	22.6	22.1	21.2	20.5	19.7	19.3	18.4	17.7	16.6	15.2	15.0	14.0	12.1	10.2
P	80	24.4	24.4	23.3	23.1	22.1	21.8	21.7	21.1	20.3	19.5	19.0	18.6	17.5	17.0	15.8	14.5	14.1	13.0	11.3	9.9
T	90	23.5	23.6	22.7	22.2	21.3	21.1	20.7	20.4	19.6	18.7	18.5	18.0	16.9	16.4	15.4	13.9	13.3	12.3	10.7	9.7
H	100	22.7	22.8	22.1	21.6	20.7	20.4	20.0	19.8	19.0	18.1	17.9	17.5	16.5	15.9	15.0	13.4	12.8	11.8	10.3	9.4
	120	21.5	21.5	21.1	20.6	19.8	19.4	19.0	18.9	18.1	17.5	17.1	16.8	16.0	15.3	14.3	12.6	11.9	10.9	9.8	9.1
(M)	150	20.2	20.1	19.9	19.3	18.6	18.2	17.9	17.8	16.9	16.3	15.9	15.4	14.7	13.7	12.9	11.2	10.7	10.0	9.2	8.6
	200	17.5	17.3	17.5	17.0	16.2	15.9	15.5	15.5	14.2	13.8	12.9	12.6	12.1	11.2	10.7	9.7	9.3	8.9	8.4	7.9
	250	14.3	14.2	14.6	14.1	13.7	13.5	13.0	12.9	12.2	11.7	11.2	10.9	10.6	9.9	9.5	8.8	8.5	8.1	7.7	7.3
	300	11.7	11.7	12.0	11.9	11.6	11.6	11.3	11.3	10.9	10.5	10.0	9.8	9.6	8.9	8.5	7.9	7.7	7.4	7.2	6.8
	400	8.5	8.7	8.8	9.1	9.0	9.0	8.9	8.8	8.6	8.3	7.9	7.6	7.6	7.1	6.8	6.4	6.3	6.2	6.3	6.0
	500	6.6	6.6	6.7	6.8	6.8	6.8	6.7	6.7	6.6	6.3	6.1	6.1	6.1	5.8	5.7	5.6	5.5	5.5	5.5	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — 01 DECEMBER

	0	25.1	24.8	24.5	24.2	23.9	23.7	23.2	22.6	22.2	21.3	20.7	20.4	19.8	19.1	18.3	17.7	17.1	16.3	14.9	13.6
	10	25.1	24.8	24.5	24.2	23.9	23.7	23.1	22.6	22.2	21.3	20.7	20.4	19.8	19.1	18.3	17.7	17.1	16.3	14.9	13.6
	20	25.1	24.8	24.5	24.2	23.9	23.7	23.2	22.6	22.2	21.3	20.8	20.4	19.8	19.1	18.3	17.6	17.1	16.3	14.9	13.6
	30	25.1	24.8	24.5	24.2	23.9	23.7	23.2	22.6	22.2	21.3	20.8	20.4	19.8	19.1	18.3	17.6	17.3	16.4	14.8	13.4
	40	25.0	24.8	24.5	24.2	23.9	23.7	23.2	22.6	22.2	21.3	20.9	20.4	19.9	19.2	18.4	17.7	17.3	16.4	14.6	12.9
	50	25.0	24.8	24.5	24.2	24.0	23.7	23.2	22.7	22.2	21.3	20.6	20.3	19.8	19.1	18.3	17.4	17.0	16.2	14.2	11.9
D	60	25.0	24.9	24.3	24.0	23.7	23.4	23.0	22.5	22.0	21.1	20.4	20.0	19.4	18.6	17.7	16.4	16.2	15.2	13.2	10.9
E	70	25.0	24.8	23.9	23.7	23.0	22.7	22.7	22.0	21.4	20.4	19.8	19.3	18.6	18.0	16.8	15.3	15.3	14.1	12.2	10.3
P	80	24.4	24.3	23.5	23.1	22.2	22.0	21.9	21.3	20.7	19.6	19.4	18.7	17.7	17.3	16.0	14.7	14.3	13.1	11.3	9.9
T	90	23.5	23.6	22.9	22.4	21.4	21.3	20.9	20.6	19.9	18.8	18.9	18.1	17.1	16.6	15.5	14.0	13.3	12.3	10.8	9.7
H	100	22.8	22.8	22.4	21.7	20.8	20.6	20.1	19.9	19.3	18.3	18.2	17.5	16.7	16.0	15.0	13.5	12.8	11.7	10.4	9.4
	120	21.5	21.4	21.3	20.6	19.9	19.5	19.0	18.9	18.2	17.4	17.3	16.8	16.1	15.3	14.3	12.7	12.0	10.8	9.7	9.0
(M)	150	20.1	19.9	20.0	19.3	18.6	18.2	17.9	17.7	16.9	16.2	16.0	15.4	14.7	13.8	12.8	11.3	10.7	9.9	9.1	8.6
	200	17.3	17.3	17.7	16.7	16.1	15.9	15.4	15.4	14.2	13.7	12.9	12.6	12.1	11.3	10.6	9.7	9.3	8.9	8.4	8.0
	250	14.0	14.2	14.7	13.9	13.5	13.4	12.9	12.8	12.2	11.7	11.1	10.9	10.6	10.0	9.5	8.9	8.5	8.1	7.7	7.4
	300	11.5	11.6	12.0	11.8	11.6	11.6	11.2	11.2	10.8	10.5	10.0	9.8	9.6	8.9	8.4	8.0	7.7	7.3	7.2	6.8
	400	8.4	8.7	8.8	9.0	9.0	9.0	8.8	8.7	8.6	8.4	7.8	7.6	7.6	7.2	6.7	6.5	6.4	6.2	6.3	6.0
	500	6.6	6.6	6.6	6.7	6.8	6.8	6.7	6.7	6.7	6.3	6.1	6.1	6.0	5.9	5.7	5.6	5.5	5.6	5.6	5.4
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

MEAN XBT TEMPERATURE, DEG-C — MID-DECEMBER

	0	24.5	24.3	23.8	23.6	23.2	22.9	22.4	22.0	21.5	20.5	20.0	19.6	18.9	18.3	17.4	17.0	16.3	15.5	14.3	12.9
	10	24.5	24.3	23.8	23.6	23.2	22.9	22.4	22.0	21.5	20.4	20.0	19.5	18.9	18.3	17.4	17.0	16.3	15.6	14.3	12.9
	20	24.5	24.3	23.8	23.6	23.2	22.9	22.4	22.0	21.5	20.4	20.0	19.5	18.9	18.3	17.4	16.9	16.3	15.6	14.3	12.8
	30	24.5	24.2	23.8	23.6	23.2	22.9	22.4	22.0	21.5	20.4	20.0	19.6	18.9	18.4	17.5	16.9	16.4	15.7	14.3	12.8
	40	24.5	24.3	23.9	23.7	23.2	23.0	22.4	22.0	21.5	20.5	20.1	19.6	19.0	18.5	17.6	16.8	16.5	15.7	14.2	12.5
	50	24.5	24.3	23.9	23.6	23.3	23.0	22.5	22.1	21.5	20.5	20.0	19.7	19.1	18.5	17.7	16.9	16.5	15.7	14.1	11.9
D	60	24.6	24.3	23.8	23.6	23.1	22.9	22.6	22.1	21.6	20.5	20.0	19.6	19.1	18.4	17.5	16.4	16.1	15.1	13.4	11.2
E	70	24.6	24.3	23.7	23.5	22.8	22.5	22.5	21.8	21.4	20.2	19.8	19.2	18.6	18.1	16.9	15.5	15.5	14.3	12.5	10.5
P	80	24.2	23.9	23.4	23.1	22.2	22.0	21.9	21.3	20.9	19.6	19.5	18.8	17.9	17.5	16.2	15.0	14.4	13.3	11.6	9.9
T	90	23.5	23.3	23.0	22.5	21.5	21.4	21.0	20.8	20.2	19.1	19.2	18.3	17.4	16.9	15.7	14.2	13.3	12.4	11.0	9.7
H	100	22.9	22.6	22.5	21.9	21.0	20.8	20.2	20.0	19.6	18.5	18.6	17.7	16.9	16.2	15.0	13.7	12.7	11.8	10.6	9.5
	120	21.5	21.2	21.2	20.6	20.0	19.6	19.0	18.9	18.4	17.4	17.6	16.9	16.1	15.3	14.3	12.9	11.9	10.9	9.9	9.1
(M)	150	20.1	19.7	19.9	19.2	18.6	18.2	17.8	17.5	17.0	16.1	16.1	15.6	14.7	13.9	12.8	11.5	10.6	9.9	9.2	8.7
	200	17.2	17.2	17.6	16.6	16.1	15.8	15.3	15.2	14.4	13.5	13.1	12.7	12.0	11.4	10.5	9.8	9.3	8.9	8.5	8.0
	250	13.9	14.1	14.7	13.7	13.4	13.3	12.8	12.6	12.2	11.7	11.1	10.9	10.5	10.0	9.5	8.9	8.5	8.1	7.8	7.4
	300	11.4	11.5	12.0	11.7	11.5	11.5	11.2	11.2	10.9	10.5	9.9	9.8	9.5	9.0	8.4	8.0	7.7	7.3	7.2	6.9
	400	8.3	8.6	8.8	8.9	8.9	8.9	8.8	8.7	8.6	8.3	7.8	7.7	7.5	7.2	6.7	6.5	6.4	6.2	6.2	6.1
	500	6.6	6.6	6.6	6.7	6.9	6.8	6.7	6.6	6.6	6.4	6.2	6.2	5.9	5.8	5.7	5.6	5.5	5.6	5.6	5.5
	N MI	50	150	250	350	450	550	650	750	850	950	1050	1150	1250	1350	1450	1550	1650	1750	1850	1950
	KM	93	278	463	649	834	1019	1205	1390	1575	1761	1946	2131	2317	2502	2687	2872	3058	3243	3428	3614

D I S T A N C E

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