MESOSCALE COMPONENTS OF THE GEOSTROPHIC FLOW AND ITS TEMPORAL AND SPATIAL VARIABILITY IN THE CALIFORNIA CURRENT OFF MONTEREY BAY IN 1973-74

Richard Earl Greer
THESIS

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by

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September 1975

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**Title:** Mesoscale Components of the Geostrophic Flow and Its Temporal and Spatial Variability in the California Current off Monterey Bay in 1973-74

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**Monterey Current System**

**Oceanographic Surveys**

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Seasonal variations of the geostrophic flow and salt transport were congruent with Skogsberg's [1936] annual cycle composed of three distinct oceanographic seasons.

The flow and structure in the area are complex with flow elements less than 10 km in width. The data suggest that observations on a sampling grid length less than 10 km transverse to the current flow, and extensive independent current measurements are required to describe adequately the small-scale features of the flow, structure and its time variations.
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by

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Submitted in partial fulfillment of the requirements for the degree of

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ABSTRACT

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I. INTRODUCTION

Eastern boundary currents, in particular, the California Current, have held the interest of investigators for many years. This is due largely to an avid interest in coastal upwelling, and its important implications on commercial fisheries and related economic enterprises. However, there are other important aspects. Of interest is the poleward countercurrent found close to the prevailing equatorward surface currents. The countercurrent is usually narrower, and found shoreward of the equatorward flow. During the winter months (November through February), and in the absence of prevailing north-northwesterly winds, the poleward countercurrent extends to the surface and is known as the Davidson Current north of Pt. Conception. With the onset of north-northwesterly winds in the spring, upwelling begins to occur along the California coast, and the poleward countercurrent disappears above 200 m. Where the flow is submerged, the countercurrent has been termed an "undercurrent." Of importance is that the poleward countercurrent continues throughout the year at speeds approximately 30 cm/sec or less. Consequently, the water off the California coast tends to have some of the high temperature and salinity characteristics of the low-latitude or "southern waters" (in the Northern Hemisphere). Accordingly, with the poleward transport of warm and salty southern waters, the resulting flow and structure along the California coast will necessarily
be highly complex. In fact, spatially dense observations in consecutive years in a region within 50 km of the continental shelf show a complex structure of southern water undergoing dilution by mixing as it flows northward [Wickham, 1975].

At present, there are many questions still outstanding about the countercurrent, and the resulting highly complex current regime off the California coast. It is the intent of this author to provide answers to a few of them. Specifically, using a data base constructed from spatially dense STD observations off Monterey Bay in 1973-74, an attempt will be made to examine the following,

(1) The patterns of current flow, and their structure with depth,

(2) The temporal variation of the geostrophic flow,

(3) Mesoscale components of the geostrophic current and salt transport.

Additionally, attention will be given to the influence of bottom topography on the direction of flow inside the 1,000 fathom curve, the dependence of geostrophic current on the choice of reference level, and the use of geostrophy to depict small-scale features of the complex flow.
II. THE DATA

A. AREA OF INVESTIGATION AND DATA COLLECTION

The area of investigation is shown in figure 1, in which the major features of the bottom topography are depicted. The major topographical features of the area include Monterey Bay and the Monterey Canyon. The area of investigation lies within the rectangular parallelepiped located just west of the continental shelf off Monterey, California. It extends from the surface to a maximum depth of 725 meters and is bounded by the coordinates, $36^\circ 20'N$, $36^\circ 50'N$, $122^\circ 00'W$, and $123^\circ 00'W$.

The data were obtained from thirteen cruises aboard the Acania, the oceanographic vessel of the U.S. Naval Postgraduate School, during the months August 1973 through August 1974. A cruise was conducted once each month during various days of the thirteen-month period. On each cruise observations were made along a horizontal grid much finer than traditionally used in oceanographic surveys to permit increased horizontal definition. Specifically, stations were located along four constant latitude lines normal to the coast at a maximum spacing of 5.6 km between stations; at least one line of stations being occupied on a cruise. Station positions are shown in figure 2, and listed in table I.
Fig. 2. The Location of Station Positions within the Investigation Area.
<table>
<thead>
<tr>
<th>Station Numbers</th>
<th>Latitude (North)</th>
<th>Longitude (West)</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>36° 20.0'</td>
<td>122° 00.0'</td>
</tr>
<tr>
<td>102</td>
<td>36° 20.0'</td>
<td>122° 03.6'</td>
</tr>
<tr>
<td>103</td>
<td>36° 20.0'</td>
<td>122° 07.3'</td>
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<tr>
<td>104</td>
<td>36° 20.0'</td>
<td>122° 10.9'</td>
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<td>105</td>
<td>36° 20.0'</td>
<td>122° 14.5'</td>
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<td>106</td>
<td>36° 20.0'</td>
<td>122° 18.2'</td>
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<tr>
<td>107</td>
<td>36° 20.0'</td>
<td>122° 21.8'</td>
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<td>108</td>
<td>36° 20.0'</td>
<td>122° 25.4'</td>
</tr>
<tr>
<td>109</td>
<td>36° 20.0'</td>
<td>122° 29.1'</td>
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<td>122° 32.7'</td>
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<td>201 - 217</td>
<td>36° 30.0'</td>
<td>*</td>
</tr>
<tr>
<td>301 - 317</td>
<td>36° 40.0'</td>
<td>*</td>
</tr>
<tr>
<td>401 - 417</td>
<td>36° 50.0'</td>
<td>*</td>
</tr>
</tbody>
</table>

* Station with same last two digits as 100 series have the same longitude with the exception of station 211, which is located at 36° 30.0'N, and 122° 35.8'W.
B. PROCEDURE

The thirteen cruises aboard the Acania during the period August 1973 through August 1974 provided the data base for this study. Original cruise plans called for all thirteen cruises to utilize the Bissett-Berman continuous profiling STD as the primary observational tool in conjunction with reversing thermometers and Nansen samples, which would provide independent measurements for comparison of temperature and salinity and standardization of the STD. Additionally, expendable bathythermograph (XBT) and surface (bucket) temperatures would provide data for further comparisons. However, due to STD malfunction or in the interest of time-saving the original cruise plans were modified. Specifically, seven cruises utilized the STD as their primary observational tool, while five of the remaining six cruises utilized the XBT. The remaining cruise conducted during April 1974 was terminated early due to equipment malfunction and poor weather conditions.

On STD cruises, a Bissett-Berman continuous profiling instrument (STD) sensed the vertical distributions of temperature and salinity. To obtain vertical definition of approximately two meters, the STD was lowered at a rate of 30 meters per minute. Profiles were recorded for both descent and ascent of the STD so that, during the digitizing of analog traces, spurious spikes in the salinity record could be recognized and eliminated by manual trace smoothing techniques described in the section on data processing. The spikes are known to be caused by a mismatch of time constants between the temperature and conductivity sensors.
On other cruises, expendable bathythermograph (XBT) soundings were utilized to delineate the vertical distributions of temperature. To supplement the XBT temperature data, three Nansen casts were conducted per station line at the eastern, western and mid-sectors of the investigation area. Water samples were taken at the following nine depths: 0, 20, 50, 100, 200, 300, 400, 500 and 750 meters. Obviously, the spacing between hydrocast stations and the interval between water sampling depths did not permit the vertical and horizontal definition of salinity achieved on cruises where the STD was primary. However, hydrocast stations added importantly to the information obtained in the study area.

On all thirteen cruises, independent measurements of temperature and salinity were made, respectively, with reversing thermometers and with laboratory conductivity analysis of sea water samples taken from Nansen bottles. Additionally, surface (bucket) and thermograph temperatures were recorded at each station. These independent measurements and their use are discussed later in the section on data processing.

C. INSTRUMENTATION

The STD instrument used was the Bissett-Berman STD Model 9006. Manufacturer's specifications claim an accuracy of \( \pm 0.02^\circ C \) and \( \pm 0.02 \) ppt for temperature and salinity, respectively.

Data were recorded on a continuous analog chart recorder during both descent and ascent of the STD. Data obtained during ascent of the STD were used only to smooth the salinity
record and eliminate false salinity spikes. Although data taken from the up and down casts were in good general agreement, only down trace data were digitized and used for analyses. See Data Processing section for further details.
III. DATA PROCESSING

A. PROCEDURE

Analog strip chart data obtained from the thirteen cruises conducted during August 1973 through August 1974 were manually smoothed, digitized and recorded on a Calma Digitizer 7-track tape recorder. The digitized salinity, temperature and depth data were then read, converted and processed by means of program "DIGISTD" developed for use with the IBM 360 computer. The temperature, salinity and depth data along with calculated values of sound velocity and sigma-t were then grouped according to chronological order and station and written onto 9-track tape. Additionally, salinity and temperature data for every 2.5 meters of depth were output to punched cards for use with a modified version of the HYDRO program to make dynamic height and geostrophic current calculations. These geostrophic current velocities were then used in computations of geostrophic salt transport.

B. DATA PREPARATION

Prior to digitization of the analog data, false salinity spikes caused by the mismatch of time constants between the sensors for temperature and conductivity used to calculate salinity had to be recognized and eliminated. Recognition of spurious salinity spikes was accomplished by comparison of the trace records obtained from the descent and ascent of the STD. Specifically, salinity spikes which were of opposite
sign between the up and down traces of a particular station were assumed to be spurious, and were eliminated. This elimination was accomplished by manually smoothing through the spike along the general trend of the salinity record. This technique involves some qualitative judgment or artistic license; however, salinity trace smoothing was done consistently and appears to represent quite well the true structure. This is borne out by the fact that within the accuracy limitations of the other steps in the digitization process, the densities (sigma-t values) computed from the temperature and smoothed salinity data increased monotonically with increasing depth with few exceptions. The paucity of apparent instabilities, i.e., regions of

\[
\frac{d\sigma_t}{dz} < 0 ,
\]

and the uniformity of the trace-smoothing process tends to justify the data preparation process.

C. DIGITIZATION

Digitization of the cruise data was a portion of the joint (Greer, Blumberg and Hughes) data work-up. Both the STD and XBT strip chart data obtained from the thirteen cruises conducted during August 1973 through August 1974 were digitized on two Calma Digitizers owned by the Fleet Numerical Weather Center, Monterey, California. The Calma Company Model 480 Digitizer reduces analog graphical data to digital form for computer processing and analysis.
To digitize analog graphical data directly on computer compatible 7-track magnetic tape, the operator selects tracer mode and manually traces the graphical data with a moveable stylus/carriage assembly. The movements of the stylus in the X and Y directions are transmitted to magnetic encoders, which convert the stylus movements in 0.01 inches to digital signals. These signals are processed and formatted for output to 7-track computer magnetic tape. The digital data are recorded on tape at a bit density of 556 BPI.

In addition to the digitization tracer mode, the Calma Digitizer has a manual keyboard entry mode for identification of data on the tape, entering inter-record gaps, record errors, and delete records. The keyboard mode was used in conjunction with each digitized trace segment to identify the particular data station number, month and year, temperature, salinity and depth scales, last trace segment, and whether it was a temperature or salinity trace. Consequently, the output tape was constructed so that every other record was a 13-character keyboard mode entry which identified the following data trace record.

The Calma Digitizer variable interval programmer monitors the output recorder and generates signals every 0.01 inches of stylus movement in the X and Y directions if the stylus is moved at a rate less than 125 inches per minute. At higher rates, the data signals are recorded at 0.02 inches of stylus travel. All cruise data were digitized at 0.01 inches of stylus movement.
The STD data were digitized in segments since the temperature and salinity traces were not continuous due to scale changes in salinity, temperature and depth during collection of the data. Typically, an STD trace consisted of four temperature and two salinity segments. In contrast, the XBT traces consisted of one continuous segment. Consequently, digitizing an STD trace took approximately five times as long as an XBT trace.

D. CALIBRATION AND STANDARDIZATION

On all thirteen cruises, independent measurements of temperature and salinity were made, respectively, with reversing thermometers and with laboratory conductivity analysis of sea water samples taken from Nansen bottles. These independent measurements were used for field calibration of the STD, and to provide standardization of the STD and XBT data permitting qualitative discussion and comparison of the seasonal variation over the thirteen-month period.

In standardizing both the STD and XBT data, the Nansen temperatures and salinities were considered to be the actual or correct temperature and salinity values. Upon examination and comparison of the STD data with the Nansen data, the STD was found to read high in temperature by 0.08°C for all primary STD data collection months, and low in salinity by 0.04 ppt for data months November 1973 through January 1974, and August 1974. Consequently, the STD temperatures and salinities were decreased and increased respectively to align the STD data with the independent Nansen data.
Standardization of the XBT data was accomplished in a similar manner. However, independent Nansen data were not available, in all cases, for corresponding XBT data stations. Therefore, when corresponding Nansen data were not available, the XBT was corrected to the already standardized STD. Adjustment of the XBT to the standardized STD data made qualitative discussion and comparison of the seasonal variation over the thirteen-month period possible. The corrections were determined by a best-fit curve developed by a computer routine fitting the XBT data with Nansen data when available or with the standardized STD data. Generally, temperature corrections varied from +0.13°C to -0.37°C for data months August 1973 through August 1974.

E. AUTOMATIC DATA PROCESSING PROGRAMS

Two computer programs, DIGISTD and DIGIXBT, were utilized to read, convert, and process the digitized salinity, temperature and depth data from the 7-track tapes produced on the Calma Digitizers. Both DIGISTD and DIGIXBT are extensively modified versions of an original program MIZ2 by R. G. Paquette. Indicative of their names, DIGISTD processes STD data and DIGIXBT processes expendable bathythermograph data. See appendices A and B for program documentation and listing.

DIGISTD and DIGIXBT convert and store STD and XBT data, respectively, every 0.01 inches of depth on the scale of the digitizer for output to printer, punched card or 9-track tape. Additionally, DIGISTD computes both sound velocity and sigma-t for each set of primary data.
During the data processing phase, all three output media, printer, punched card and 9-track tape, were utilized. Specifically, STD data were output every 0.08 inches of depth (approximately 2.5 meters) to punched card for later direct input into the HYDRO program to compute dynamic heights and geostrophic velocities. Although the number of output data cards produced by punching data points every 2.5 meters appeared to be unwieldy at the outset, this procedure proved manageable, and avoided needless programming problems in getting the correct data off the tape, and in the right order for input to program HYDRO.

F. GEOSTROPHIC CURRENT AND DYNAMIC HEIGHT CALCULATIONS

Geostrophic currents were computed by the dynamic method utilizing a modified version of the computer program, HYDRO, developed for use with the IBM 360 computer by the U.S. Naval Postgraduate School Department of Oceanography. A modified version of the HYDRO program is presented in appendix C. The two basic program modifications are: (1) an increased capability to process temperature and salinity data on a finer vertical scale (approximately 2.5 meters) than traditionally used in oceanographic surveys, and (2) an output card punching routine which produces composite data cards, each containing depth, temperature, salinity, geostrophic velocity, dynamic heights and mass transport values. The composite data cards are useful as input for plotting and contouring computer programs. Specifically, contour and plotting routine, CONTUR, was utilized to display graphically contours of dynamic heights, geostrophic
velocities and geostrophic salt transport on the off-line Calcomp plotter.

Dynamic heights and geostrophic speeds were calculated every ten meters of depth for the first 300 meters of depth, and less frequently for the remaining 200 meters. The ten meter interval proved extremely effective in depicting the complex velocity structure. However, the resulting detailed description of the structure and flow indicated that a larger data interval (every 20 meters for the first 300 meters, and every 50 meters thereafter) would have been sufficient to represent the fine scale structure. Consequently, data in the vertical need not be processed on an interval less than 20 meters. For the investigator processing STD data via cards, this will significantly reduce the number of data cards required for input into HYDRO.

G. GEOSTROPHIC SALT TRANSPORT CALCULATIONS

Geostrophic transport of salt or the salt flux per unit time-area is readily calculated as the product of density, average salinity and geostrophic velocity. Algebraically, the geostrophic salt transport, $F_S$, may be written as:

$$F_S = (V_{gs})(S)(\rho_{st,o})$$

(1)

where

$V_{gs}$ = geostrophic velocity (cm/sec)

$S$ = average salinity (ppt)

$\rho_{st,o}$ = density (gm/cm$^3$)

$F_S$ = geostrophic transport of salt (gm/sec-cm$^2$)
The total salt transport, \( T_s \), or salt flux per unit time in area length, \( \Delta X \), in a layer of thickness, \( \Delta Z \), would be given by,

\[
T_s = \int_{\Delta X} \int_{\Delta Z} F_s \, dz \, dx
\]  

Values of geostrophic transport of salt were calculated for every 20 meters of depth for the first 300 meters beginning at ten meters, and less frequently from 300 to 500 meters. To obtain an average salinity value corresponding to the geostrophic velocity computed between adjacent stations, an arithmetic mean was used. Specifically, to obtain an average salinity value at ten meters' depth between stations A and B, an arithmetic mean was computed using the surface, 10 and 20 meter salinity values at both adjacent stations A and B. This procedure was used to obtain a representative salinity value between adjacent stations, and to avoid using anomalous values of salinity in the salt transport calculations. The other variable, density, was considered constant over the entire vertical column due to its insignificant effect on the computations. A constant value of 1.026 gm/cm\(^3\) was used for density.
IV. DISCUSSION AND RESULTS

A. THE GEOSTROPHIC CURRENT AND ITS LEVEL OF NO MOTION

The computation of geostrophic currents by the dynamic method has been discussed extensively in physical oceanography texts such as Neumann and Pierson [1966], and Stommel [1965]. The computation scheme is based on an equation derived by Sandström and Helland-Hansen [1903] from Bjerknes Circulation Theorem [1900]. In Oceanography, the equation is widely referred to as the Helland-Hansen equation, and has been extensively used to compute the relative field of currents from the observed field of mass. The equation may be written in terms of the horizontal pressure gradient of the geopotential between two levels $P_1$ and $P_2$,

$$V_2 - V_1 = \frac{\int_{P_1}^{P_2} \alpha_A \, dP - \int_{P_1}^{P_2} \alpha_B \, dP}{f \Delta X}$$

where

- $f = 2\omega \sin \phi$, the coriolis parameter (1/sec)
- $\omega$ = the angular velocity of the earth (radians/sec)
- $\phi$ = the geographic latitude (degrees)
- $\Delta X$ = the distance between stations A and B (kilometers)
- $\alpha$ = specific volume ($cm^3/gm$); subscripts A and B refer to stations A and B
- $P$ = pressure (decibars)
- $V_2 - V_1$ = the component of horizontal velocity normal to $\Delta X$ at $P_1$ relative to that at $P_2$ (cm/sec)
Equation (3) may be evaluated to obtain the mean geostrophic flow normal to a horizontal line joining stations A and B. This method permits only the computation of relative velocities. In order to arrive at the absolute currents, either the absolute pressure field or the absolute velocity must be known at least at one level between adjacent stations [Neumann and Pierson, 1966]. The absolute velocity may be found by determining the level or depth at which the currents become zero. In Oceanography, this depth is referred to as the 'level of no motion'. Some methods for estimating this reference level are given in the textbook, The Oceans, by Sverdrup, Johnson and Fleming, 1942, pp. 456-457. However, it is common practice to assume a depth where the currents become zero or to infer it from considerations of continuity.

An obvious way would be to determine the 'level of no motion' by direct measurements. However, this method has limitations due to the presence of other disturbances such as tidal currents, and the difficulty in sensing accurately relatively weak currents. Consequently, several investigators have attempted to corroborate their geostrophic current values, and indirectly their choice of reference level, by independent measurements of the current field by use of parachute drogues. For example, in a study of the California Current System off Baja, California, Reid, Swartzlose and Brown [1963] showed that geostrophic currents computed with respect to a 500 db reference level compared favorably with surface currents independently measured by drogues. On the other hand, other
investigators have found that they agree only roughly. Wickham [1975] in "Observations of the California Countercurrent" found that the local geostrophic current speeds agreed only roughly with the parachute drogue speeds. There are good reasons to expect differences between the actual flow and the results of geostrophy. First, there are obvious non-geostrophic components shown in the drogue speed values; and second, in the investigation area especially near the Monterey Canyon there are large internal waves known to exist, and finally, deformations of the reference isobaric surface (500 db) also must contribute to the difference between actual flow and the results of geostrophy [Wickham, 1975].

For this study, a reference level of 500 db was chosen as the 'level of no motion'. This choice was precipitated by the vertical extent (525 m) of the data in most cases and the success of earlier studies which found the 500 db reference to be suitable for the area.

During the months, January and August 1974, and October through December 1973, STD data were obtained to approximately 735 meters of depth at several stations. These deep station observations permitted geostrophic current calculations using the 700 db, 600 db and the 500 db levels as the reference level of no motion. Tables II through X are the resultant geostrophic currents from the surface to 475 meters relative to the three reference levels, and the velocity shears between the reference levels. To clarify the results contained in Tables II through X, the following variables are defined,
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TABLE VIII

LEVEL OF NO MOTION ANALYSIS

JANUARY 1974 - STATIONS 307-303
### Table IX

**Level of No Motion Analysis**

AUGUST 1974 - STATIONS 317-307

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\[ Z = \text{depth (m)} \]

\[ \text{VEL}.Z = \text{absolute velocity at } Z \text{ (cm/sec)} \]

\[ \text{VEL}.7 = \text{absolute velocity at } Z = \text{700 m (cm/sec)} \]

\[ \text{VEL}.5 = \text{absolute velocity at } Z = \text{500 m (cm/sec)} \]

\[ \text{VEL}.7,Z = \text{velocity at } Z \text{ relative to } \text{700 m (cm/sec)} \]

\[ \text{VEL}.5,Z = \text{velocity at } Z \text{ relative to } \text{500 m (cm/sec)} \]

\[ \text{VEL}.7,5 = \text{velocity at } \text{500 m relative to velocity at} \]
\[ \text{700 m or the velocity shear between } Z = \text{500 m} \]
\[ \text{and } Z = \text{700 m} \]

\[ \text{VEL}.6,5 = \text{velocity at } \text{500 m relative to velocity at} \]
\[ \text{600 m or the velocity shear between } Z = \text{500 m} \]
\[ \text{and } Z = \text{600 m} \]

The preceding variables are related to each other in that the absolute velocity at any depth, \( Z \), is equal to the absolute velocity at \( Z = \text{700 m} \) plus the velocity at \( Z \) relative to 700 m, or symbolically,

\[ \text{VEL}.Z = \text{VEL}.7 + \text{VEL}.7,Z \quad (4) \]

similarly,

\[ \text{VEL}.Z = \text{VEL}.6 + \text{VEL}.6,Z \quad (5) \]

\[ \text{VEL}.Z = \text{VEL}.5 + \text{VEL}.5,Z \quad (6) \]

subtracting equation (6) from (4),

\[ 0 = \text{VEL}.7 - \text{VEL}.5 + \text{VEL}.7,Z - \text{VEL}.5,Z \]

or,

\[ \text{VEL}.5 - \text{VEL}.7 = \text{VEL}.7,Z - \text{VEL}.5,Z \quad (7) \]

1 In fact, velocities are defined on isobaric surfaces where the pressure in db is roughly the same numerically as the given depth in meters. Negative velocities indicate flow to the north in Tables II through X.
but the left-hand side of equation (7) is the velocity shear between \( Z = 500 \text{ m} \) and \( Z = 700 \text{ m} \) or,

\[
\text{VEL.7,5} = \text{VEL.7,Z} - \text{VEL.5,Z}
\]

The velocities at \( Z \) relative to 700 db, 600 db and 500 db are known from dynamic method computations. Thus the velocity shears which provide quantitative differences between the two levels are known. Now, assuming that the 500 db level is the reference level which provides velocities which nearly approximate the actual flow, then comparison of the velocity shears, \( \text{VEL.7,5} \) and \( \text{VEL.6,5} \), to the velocity at \( Z \) relative to 500 m, \( \text{VEL.5,Z} \), respectively, provides a velocity error percentage. For example, Table II shows that if one chose 700 db as a reference level instead of 500 db, the assumed correct level, the calculated surface currents would differ by 37 percent. As expected, the difference percentage tends to increase with greater depths.

In summary, Tables II through X show quantitatively that there are considerable differences in current speeds obtained from geostrophy using 500 db, 600 db, and 700 db as the reference levels. Consequently, if the objective of a study is to obtain current speeds which are correct in magnitude, the selection of a 'level of no motion' should not be a matter of choice but of direct measurement, and of data corroboration via independent measurements. The apparent influence of bottom topography on the flow (see subsection B in Discussion and Results) also suggests that motion persists rather deeper than 500 db and that there may be no simple 'level of no motion'.
B. PATTERNS OF CURRENT FLOW AND THEIR STRUCTURE WITH DEPTH

The patterns of current flow are inferred from geostrophy with respect to the 500 db surface. To obtain a pictorial representation of the current flow and its structure with depth, dynamic heights for data stations along three constant latitude lines, 36° 20'N, 36° 30'N and 36° 40'N, were plotted and height contours drawn for the isobaric surface, 50 db, 100 db, 200 db, 300 db, 375 db and the 425 db surfaces during August 1973. These dynamic height contours of the various surfaces above are shown in figures 3 through 9. The contour lines are labeled with their respective dynamic height values in dynamic centimeters. The contour intervals for each of figures 3 through 9 are different. Consequently, caution should be exercised when interpreting the figures for speed. For example, the closely spaced contours in figures 8 and 9 do not indicate an intense circulation.

Unfortunately, this analysis could not be accomplished for data months other than August 1973 since data observations were made predominantly along one constant latitude line, 36° 40'N, during months September 1973 through August 1974. However, the contours clearly reveal some interesting features of the patterns of the current flow and their structure with depth during August 1973.

The prominent features depicted in figures 3 through 9 are,

(1) The flow branches into a northwesterly and an east-southeasterly component just north of 36° 30'N at all seven depths from the surface to 425 meters.

(2) The general pattern of current flow is similar for all depths from the surface to 375 meters.
Fig. 3. Dynamic Height Contours at the Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 5. Dynamic Height Contours of the 100 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 6. Dynamic Height Contours of the 200 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 7. Dynamic Height Contours of the 300 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 8. Dynamic Height Contours of the 375 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 9. Dynamic Height Contours of the 425 db Surface during August 1973. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
(3) The flow is more intense south of latitude 36° 30'N as evidenced by the dynamic height contour spacing.

(4) The narrow band of poleward flow in the vicinity of longitude 122° 18'W, near stations 106 and 206, appears to be topographically controlled.

Figure 10 depicts the general pattern of current flow relative to the local bathymetry. Figures 3 through 10 suggest that the course of the currents in this area is controlled in part by the local bottom topography. This is evidenced in the following ways,

(1) The flow follows the general north-south topographical orientation south of 36° 30'N.

(2) The flow branches north of 36° 30'N, and follows the generally east-west bathymetric contours.

Furthermore, the currents in the northwest sector of the area appear not to be topographically controlled. This can be explained by the fact that the current speed for the most part is small near 500 m, and it would be difficult to see how bottom topography at depths greater than 1,000 fathoms could influence the currents in this sector. However, in the northeastern sector, where depth decreases toward the coastline, the currents appear to be topographically controlled and follow the principle of conservation of potential vorticity.

Now consider the validity of the current flow inferred from geostrophy. Independent current flow measurements were made using parachute drogues during August 1972 and August 1973 by Wickham [1975]. Drogue trajectories, especially in 1972, confirm that the flow branches into two components, and there appears to be a narrow band of poleward flow in the vicinity of longitude 122° 18'W; and the drogue paths in
Fig. 10. General Pattern of Geostrophic Current Flow during August 1973.
August 1973 tend to confirm a broader poleward flow towards the west. There is also indication in the drogue paths in August 1972 of a strong shear zone and a cyclonic eddy of similar scale to that shown by geostrophy in 1973.

C. TEMPORAL VARIATION OF THE GEOSTROPHIC FLOW

The variation of the geostrophic flow with time is inferred from geostrophic calculations with respect to the 500 db surface. Specifically, dynamic heights were calculated for stations along constant latitude line, 36° 40'N, during each month. These dynamic heights were used to generate a two-dimensional array with the abscissa and ordinate axes specified as station numbers and time, respectively. Dynamic height contours were then constructed for several isobaric surfaces and the geostrophic flow normal to the station line inferred from the contours.

Originally, the dynamic height contours with time were to depict temporal variations over the entire observation period, August 1973 through August 1974. However, the time period had to be divided into two segments due to programming constraints of the program routine, CONTUR. Specifically, the program will contour only the dynamic height values of data months which have an equal number of data stations. Consequently, data months February, June and July 1974, which have dynamic height calculations based on only three Nansen data stations, (vice 16 STD stations for the other months) prohibited depicting variation of flow over the entire time period. Therefore figures 11 through 16, which were constructed from dynamic
Fig. 11. Temporal Variation of Dynamic Height Contours at the Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 12. Temporal Variation of Dynamic Height Contours of the 50 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 13. Temporal Variation of Dynamic Height Contours of the 100 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 15. Temporal Variation of Dynamic Height Contours of the 300 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 16. Temporal Variation of Dynamic Height Contours of the 375 db Surface for August 1973 through January 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
height values based on 16 STD stations per data cruise month, depict the temporal variation of geostrophic flow at several depths for only the period, August 1973 through January 1974. Figures 17 through 21, which were constructed from dynamic height values based on either STD or Nansen data at three data stations per data cruise month, depict the temporal variation of geostrophic flow at several depths over the period January 1974 through August 1974.

The prominent features depicted in figures 11 through 16 are,

1. The general surface flow pattern over the time period, August 1973 through January 1974, is very similar to those found at 50 m, 100 m, 200 m and 300 m.

2. The geostrophic flow is more intense during the period November 1973 through January 1974 than during August through October 1973 in the upper 200 meters of depth.

3. The poleward flow appears to shift to the west with time.

4. The equatorward flow, east of station number 309, during December 1973 through January 1974 appears to be more intense in the upper 200 meters than the poleward flow.

5. A reversal in the flow direction is depicted in the vicinity of station 305 such that the predominant flow east of station 305 is equatorward, and poleward west of the station.

6. A narrow band of poleward flow located between stations 306 and 309 is apparent throughout the period, and from the surface to 375 m.

Now consider figures 17 through 21. Obviously, the small scale structure revealed in figures 11 through 16 cannot be seen in figures 17 through 21 due to the data observation grid size. However, there are a few features that are apparent.

1. The flow is more intense during January, June and August 1974 than during February, March and July 1974.
Fig. 17. Temporal Variation of Dynamic Height Contours at the Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 18. Temporal Variation of Dynamic Height Contours of the 50 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 19. Temporal Variation of Dynamic Height Contours of the 100 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 20. Temporal Variation of Dynamic Height Contours of the 200 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
Fig. 21. Temporal Variation of Dynamic Height Contours of the 300 db Surface for January 1974 through August 1974. (Dynamic heights are in dynamic centimeters, relative to 500 db.)
(2) A reversal in flow direction in the upper 200 meters occurs between June and July 1974.

(3) Current speeds at depth during January through August 1974 are significantly less than speeds at depth during August 1973 through January 1974.

D. GEOSTROPHIC CURRENTS AND SALT TRANSPORT

The vertical structure of geostrophic flow normal to a section at latitude 36° 40'N with respect to the 500 db surface is depicted by monthly vertical cross sections of geostrophic salt transport contours. Initially, both vertical cross sections of salt transport contours, and geostrophic isotachs were constructed. However, with exception of magnitude and dimensional units, the isotachs were nearly identical to the vertical contours of geostrophic salt transport. Consequently, the figures depicting vertical cross sections of geostrophic isotachs have been omitted in favor of the salt transport contours. Accordingly, figures 22 through 33 depict the vertical structure of geostrophic salt transport during August 1973 through February 1974, and June through August 1974.

In the discussion and presentation of results in this section, each monthly vertical cross section will be discussed in terms of its general flow and transport characteristics, its direction and current speeds, and the nature of the water.

To clarify the information presented in figures 22 through 33, the following comments are made,

(1) The dimensional units of salt transport are (gm/sec-cm²).

(2) Generally, every other contour has been labeled according to its particular transport value. Negative values (hatched area) indicate transport to the north, and positive values indicate transport to the south.
Fig. 22. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 111-102 during August 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)
Fig. 23. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 214-202 during August 1973. (Negative transport values (hatched area) in (gm/sec-cm²) indicate transport to North.)
Fig. 24. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 315-302 during August 1973. (Negative transport values (hatched area) in (gm/sec-cm²) indicate transport to North.)
Feb. 25. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during September 1973. (Negative transport values (hatched area) in (gm/sec-cm²) indicate transport to North.)
Fig. 26. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 517-302 during October 1973. (Negative transport values (hatched area) in (gm/sec-cm²) indicate transport to North.)
Fig. 27. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during November 1973. (Negative transport values (hatched area) in (gm/sec-cm$^2$) indicate transport to North.)
Fig. 28. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during December 1973. (Negative transport values (hatched area) in (gm/sec-cm^2) indicate transport to North.)
Fig. 29. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during January 1974. (Negative transport values (hatched area) in (gm/sec-cm²) indicate transport to North.)
Fig. 31. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during June 1974. (Negative transport values (hatched area) in (gm/sec-cm²) indicate transport to North.)
Fig. 32. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317, 307, and 303 during July 1974. (Negative transport values (hatched area) in (gm/sec-cm²) indicate transport to North.)
Fig. 33. Vertical Cross Section of Geostrophic Salt Transport Contours for Stations 317-302 during August 1974. (Negative transport values (hatched area) in (gm/sec·cm²) indicate transport to North.)
The exact contour interval is specified in units, (gm/sec-cm²), at the upper right-hand corner of each figure.

The black dots adjacent to the individual transport values identify the corresponding contour line.

Distance between consecutively numbered adjacent stations is approximately 5.5 km. Note for figures 30 through 32, the distances between stations 303 and 307, and 307 and 317 are approximately 22 km and 55 km, respectively.

Consider the vertical structure of geostrophic flow during August 1973. Figures 22 through 24 depict the vertical structure of geostrophic salt transport contours during August 1973 for stations 111-102, 214-202 and 315-302, respectively.

Examine, first, stations 111-102 along the 36° 20' parallel of latitude depicted in figure 22. Poleward transport (shown by hatched area) located west of longitude 122° 11'W is approximately 20 km in width and extends from the surface to 500 m. A maximum speed and salt transport of approximately 50 cm/sec and 1730 gm/sec-cm², respectively, are indicated at the surface between stations 104 and 105. However, current speeds and salt transport values range generally from 30 cm/sec and 1114 gm/sec-cm² at the surface to 20 cm/sec and 736 gm/sec-cm² at 300 m. To the west of the poleward flow, geostrophy indicates an intense equatorward jet (maximum speed 70 cm/sec) at about longitude 122° 27'W. Farther west the flow is towards the equator with a maximum surface speed of 56 cm/sec decreasing with depth to less than 10 cm/sec at 300 m.

Figure 23 depicts the vertical structure in August 1973 along the 36° 30'N parallel of latitude. Along the entire length of the station line, poleward transport is indicated
by geostrophy with a maximum surface speed of 62 cm/sec decreasing to 15 cm/sec at 300 m in the vicinity of longitude 122° 09'W. Farther to the west the poleward flow is characterized by speed and salt transport surface values of 15 cm/sec and 535.0 gm/sec-cm², respectively.

The vertical structure along the 36° 40'N parallel of latitude during August is depicted by figure 24. East of longitude 122° 22'W the flow is predominantly towards the equator while towards the west the flow is poleward. Maximum current speed and transport surface values are 40 cm/sec and 1320 gm/sec-cm², respectively, towards the equator. While the poleward flow to the west is approximately 35 cm/sec at the surface, it decreases to 10 cm/sec at 300 m.

There is some evidence that the equatorward and poleward jets indicated in figures 22 and 23 are realistic; the author refers to a concurrent study, examining the water mass characteristics by Blumberg [1975]. His findings indicate a sharp front-like water mass boundary along both jet axes. These water mass boundaries are indicated by large angles between isopycnal and isothermal surfaces from the near-surface to approximately 450 m. Additionally, there is theoretical basis for an equatorward jet in a dynamical model for eastern boundary flows [McNider and O'Brien, 1973], and drogue drifts [Wickham, 1975] in the same area also show large shears. These factors tend to support the view that the flow details are real; it should be noted, however, that mass distributions consistent with the calculated dynamic heights could also be produced by internal waves of amplitude 50 m.
Now consider the relation between the flow and structure. The current patterns indicated by both drogues and geostrophy tend to confirm an analysis of the structure which has elongated filaments of southern water flowing poleward in narrow bands, particularly near the coast [Wickham, 1975]. Specifically, drogue paths at 200 m in August 1973 tend to show this tendency.

The vertical structure of geostrophic flow in September 1973 is depicted in figure 25. Unfortunately, only the far eastern sector, stations 302 to 305, of the investigation area is shown. As in the preceding month, the flow in the eastern sector is predominantly to the south. There are maximum speed and salt transports of approximately 20 cm/sec and 650 gm/sec-cm² at 150 m. Towards the coastline there is a poleward flow contained in the upper 150 meters with a maximum current speed of 30 cm/sec at the surface.

Figure 26 depicts the vertical structure of geostrophic flow in October 1973. The flow structure consists of elements of several tens of kilometers in width extending from the surface to 500 m. Poleward flow dominates the first 20 km west of station 305, longitude 122°15'W, with some indications that it is an undercurrent, since a maximum current speed and transport of approximately 20 cm/sec and 790 gm/sec-cm², respectively, lie below the surface from 100 to 200 meters. To the west of station 309 the flow appears to be alternating narrow bands of equatorward and poleward flow. The elements are typically 10 km wide, and extend from the surface to 500 m.

The vertical structure of geostrophic flow in November 1973 is depicted in figure 27. The flow is generally poleward
west of station 307 with a maximum salt transport of approximately 1370 gm/sec-cm², and current speed of approximately 40 cm/sec at the surface. Upon comparing October and November 1973 vertical cross sections, there are indications that the equatorward flow east of station 307 is becoming weaker with current speeds less than 10 cm/sec at the surface. This is evidence that the onset of the Davidson Current period has taken place. The equatorward jet (maximum speed 55 cm/sec) axis located between stations 310 and 311 (longitude 122° 33'W) lies in a region with "northern" characteristics; i.e., it is anomalously cold for its density [Blumberg, 1975].

Figure 28 depicts the vertical structure of geostrophic flow in December 1973. The flow is predominantly poleward east of station 311 with the exception of a narrow-banded intense equator jet (maximum speed 77 cm/sec) located between stations 305 and 306 (longitude 122° 15'W). In this case, the intense equatorward jet axis does not clearly correspond to water of "northern" characteristics. West of station 311 the flow is generally more to the south but weaker than the narrow band of poleward flow. Maximum current speed and salt transport for the narrow band of poleward flow are 30 cm/sec and 1555 gm/sec-cm². Whereas, with few exceptions, equatorward current speeds of less than 20 cm/sec characterize the flow within the upper 300 m.

The vertical structure of geostrophic flow in January 1974 is depicted in figure 29. Typical of the Davidson Current period, the general flow is towards the north. Poleward current
speeds vary from approximately 10 to 30 cm/sec in the upper 300 m. Two narrow jets, poleward and equatorward, have axes which are not unambiguously related to the water mass structure. The poleward jet reaches a maximum speed of 75 cm/sec while the equatorward jet reaches a maximum of 58 cm/sec. West of station 306 the flow structure is complex with regions of weak narrow band equatorward flow interspersed among a predominantly poleward flow.

Figure 30 depicts the flow in February 1974. The geostrophic salt transport contours shown in figure 30 as well as figures 31 and 32 are based on data obtained from three Nansen data stations. Consequently, the small-scale detail seen in previous figures is not recognizable. However, the general flow structure between January and February are similar. From concurrent analysis of water mass characteristics during this month there are indications that upwelling has begun along the coast. Figure 30 also tends to corroborate the onset of upwelling in that the poleward California countercurrent has disappeared, for the most part, above 200 m due to the onset of north-northwesterly winds, and is now in evidence as an undercurrent with a maximum current speed (this being a mean over 20 km) of approximately 4 cm/sec at 300 m. The flow above 100 m is predominantly equatorward with a maximum speed and salt transport of approximately 16 cm/sec and 520 gm/sec-cm², respectively.

The vertical structure of geostrophic flow in June 1974 is depicted in figure 31. The California undercurrent is well
defined and confined below 200 m in the eastern part of the investigation area during June. Maximum current speed (14 cm/sec) and salt transport (490 gm/sec-cm²) occur at 400 m. Farther west the undercurrent tends to surface as evidenced by the maximum speed and transport values occurring between 100 and 200 meters.

Figure 32 depicts the vertical flow structure in July 1974. The undercurrent has pushed closer to the coast, and shows signs of its ascent to the surface. The maximum poleward current speed (9 cm/sec) and salt transport (312 gm/sec-cm²) are located at 300 m. Concurrent analyses of the water mass characteristics indicate that upwelling was not present along the station line at 36° 40'N but was possibly present along the 36° 30'N parallel line. This is not surprising since upwelling tends to be a localized phenomenon. The flow depicted in figure 32 appears to agree with the seasonal period of the California Current System.

The vertical structure of geostrophic flow in August 1974 is depicted in figure 33. The ascending undercurrent depicted in figure 32 has now surfaced with a maximum poleward current speed and salt transport of 53 cm/sec and 1810 gm/sec-cm², respectively, at the surface. The major northward flow between stations 303 and 306 coincides with southern water in a separate analysis [Blumberg, 1975]. Typical of the California Current during transition to the oceanic period, the flow is becoming more equatorward. However, west of station 309 the flow is apparently complex and characterized by narrow bands (less than 10 km wide) of weak poleward and equatorward flow.
From figures 22 through 33, it is apparent that the flow and structure in this area of the California Current System are highly complex. The vertical structure, in many cases, is characterized by what appears to be narrow bands of flow less than 10 km in width and by water mass elements of similar scale. Accordingly, only in surveys with sampling grid lengths less than 10 km could the complex structure and flow be realistically depicted. Of course, there still remains the question whether the results depicted here by geostrophy are correct in regards to the small-scale features. However, a sampling grid length of this order in the construction of a data base, in addition to extensive independent measurements of the current system, seems to be required if the behavior of the southern water and its associated current system are to be described.
V. SUMMARY AND CONCLUSIONS

A. GENERAL

The oceanic region just west of the continental shelf off Monterey Bay was examined in detail during the period August 1973 through August 1974. Observations were made on a horizontal grid much finer than is traditionally used in oceanographic surveys in order to permit horizontal definition of narrow bands of flow, and a continuous STD profiler was used to provide high density vertical sampling. Accordingly, the analyses of the data base over the 13-month period provided a description of the mesoscale components of the apparent geostrophic flow and its temporal and spatial variability in the California Current System. Some of the more interesting features of the flow and its structure with depth are provided below.

B. PATTERNS OF CURRENT FLOW AND THEIR STRUCTURE WITH DEPTH

Patterns of current flow inferred from geostrophy with respect to the 500 db surface in August 1973 showed the surface current flow patterns to be similar to those found at depths from the surface to 375 m. The area studied was characterized by narrow bands of interlacing poleward and equatorward flow. Generally, the flow in this area tended to follow bathymetric contours, and there was evidence that the bottom topography influenced the direction of flow within the 1,000 fathom curve. Additionally, independent current flow

C. TEMPORAL VARIATION OF THE GEOSTROPHIC FLOW

The variation of the geostrophic flow with time inferred from geostrophy with respect to the 500 db surface showed that the general surface flow patterns over the time period, August 1973 through January 1974, are similar to those found at depths from the surface to 300 m. The geostrophic flow was more intense during the period November 1973 through January 1974 than during August 1973 through October 1973 in the upper 200 m. What appear to be narrow bands of poleward and equatorward flow, which could result from transient effects due to the redistribution of mass by internal waves, characterized the study area. Additionally, the equatorward flow in the eastern sector of the area appeared to be more intense in the upper 200 m during December 1973 and January 1974 than the poleward flow. Finally, the time history showed the poleward flow to shift to the west with time.

The variation of the geostrophic flow with time over the period January 1974 through August 1974 showed the flow to be more intense during January, June and August 1974 than during February, March and July 1974. Additionally, current speeds at depth during January through August 1974 were significantly less than speeds at depth during August 1973 through January 1974. And a reversal in flow direction in the upper 200 m was revealed between June and July 1974.
D. GEOSTROPHIC CURRENT AND SALT TRANSPORT

The vertical structure of geostrophic flow, depicted by monthly vertical cross sections of geostrophic salt transport contours, showed three distinct oceanographic seasons, and were consistent with Skogsberg's [1936] annual cycle of the California Current System. The flow and structure inferred from geostrophy in the area appeared highly complex with interlacing narrow bands (many times less than 10 km in width) of poleward and equatorward flow. Additionally, equatorward and poleward jets (speeds up to 77 cm/sec) were found to have axes corresponding to sharp water mass boundaries indicated by large angles between the isopycnal and isothermal surfaces.
TITLE       DIGISTD
PROGRAMMERS R.E.GREER, R.E.BLUMBERG, AND J.G.HUGHES EXTENSIVELY MODIFIED AN
ORIGINAL PROGRAM, MIZZ, BY R.G.PAQUETTE.
DOCUMENTATION R.E.GREER
DATE        26 JUNE 1975
PURPOSE     PROGRAM READS, CONVERTS, AND PROCESSES DIGITIZED SALINITY,
TEMPERATURE, AND DEPTH DATA FROM A CALMA DIGITIZER 7-TRACK
TAPE. DATA ARE COMPUTED AND STORED EVERY 0.01 INCHES OF DEPTH
FOR OUTPUT TO PRINTER, PUNCHED CARD, OR 9-TRACK TAPE. PROGRAM
CONVERTS DEPTH, TEMPERATURE, SALINITY AND COMPUTES SOUND VELOCITY
AND SIGMA-T FOR EACH INDIVIDUAL OCEANOGRAPHIC STATION AND
PRINTS THE DATA IN A STATION DATA SUMMARY.
SEQUENCE    THE PROGRAM PERFORMS ALL FUNCTIONS IN THE FOLLOWING SEQUENCE
OF OPERATIONS:
(A) INITIALIZES ALL ARRAYS AND VARIABLES.
(B) COMPUTES TABLE OF SALINITY AND TEMPERATURE SCALE
CONVERSION FACTORS.
(C) SKIPS XXX NUMBER OF RECORDS IF NSKP VARIABLE SET OTHER
THAN ZERO ON CONTROL DATA CARD.
(D) READS PAIR OF DATA CARDS (LABEL AND DAT) FOR RECORD
BEING PROCESSED.
(E) TERMINATES PROGRAM IF ISTOP=1 OR AT THE END OF
PROCESSING THE NN-TH RECORD.
(F) SKIPS UNREADABLE OR BAD RECORDS IF NRCSKP VARIABLE SET
TO INDIVIDUAL RECORD NUMBER.
(G) READS USEABLE DATA RECORD INTO A-ARRAY.
(H) MOVES BYTES OF A-ARRAY INTO 4-BYTE WORDS OF B-ARRAY TO
ALLOW PROCESSING BY STANDARD FORTRAN.
(I) PROCESSES RAW B-ARRAY.
   (1) IF HEADER RECORD, PROGRAM DECODES HEADER LABEL AND
       COMPARES TO LABEL SUPPLIED BY DATA CARD.
   (2) IF TRACER RECORD, PROGRAM ADDS AND STORES CUMULATIVE
       SUMS OF X AND Y DISTANCE TRAVEL.
   (J) INDEXES THE VALUES OF CUMULATIVE DISTANCE BY INCREASING
       DEPTH UNITS; INTERPOLATES TO FILL GAPS IN THE FINAL ARRAY
       WHICH MAY OCCUR AT THE POINTS OF SCALE CHANGES IN THE
       SEGMENTED RECORD.
   (K) INSERTS MANUALLY ENTERED SURFACE AND NEAR SURFACE DATA
VALUES VIA DATA CARD.
    (L) INCREASES RECORD COUNT AND REPEATS STEPS (D) THRU (K)
    UNTIL ALL RECORDS PROCESSED FOR PARTICULAR STATION.
    (M) ADJUSTS ALL FINAL DATA ARRAYS TO THE LENGTH OF THE
    SHORTEST.
    (O) COMPUTES SOUND VELOCITY.
    (P) COMPUTES SIGMA-
    (Q) COMPUTES CONSECUTIVE RECORD SERIALIZATION FOR TAPE
    OUTPUT AND SUMMERING SCHEME.
    (R) CONVERTS LETTER DESIGNATOR MONTH/YEAR CODE, AMONG, TO
    REAL *8 MONTH/YEAR.
    (S) PRINTS OCEANOGRAPHIC DATA STATION SUMMARY.
    (T) WRITES ALL STATION DATA ON TAPE IF TAPE=.TRUE.
    (U) PUNCHES ALL STATION DATA ON CARDS SUITABLE FOR THESSII
    INPUT IF CARDS=.TRUE.
    (V) PUNCHES DEPTH, TEMPERATURE, AND SALINITY ON CARDS
    SUITABLE FOR INPUT TO HYDROGRAPHIC PROGRAM IF Gcards=.TRUE.
    (W) INITIALIZES ALL ARRAYS AND VARIABLES FOR PROCESSING
    NEXT STATION DATA.
    (X) REPEATS STEPS (D) THRU (W) UNTIL ALL RECORDS PROCESSED,
    ISTOP=1, OR DESIRED RECORD READ.

FEATURES

PROGRAM CONSISTS OF MANY MARKED PROPERTIES WHICH MAKE IT A
HIGHLY VERSATILE PROGRAM FOR PROCESSING OCEANOGRAPHIC DATA
FROM TAPE. SOME OF THESE PROPERTIES ARE LISTED UNDER THE
FOLLOWING SIX GENERAL CATEGORIES:

(A) INPUT
    (1) 7-TRACK CALMA DIGITIZER TAPE IN BCD.
    (2) TWO DATA CARDS REQUIRED PER TRACE SEGMENT OR HEADER
       RECORD. EXAMPLE: AN STD TEMPERATURE TRACE
       CONSISTING OF FOUR SEGMENTS OR RECORDS WILL REQUIRE FOUR
       PAIRS OF DATA CARDS.

(B) SUBROUTINES
    (1) TPRD- AN ASSEMBLER LANGUAGE SUBROUTINE FOR READING
       MAGNETIC TAPE WHICH CANNOT BE READ BY STANDARD METHODS.
       NOTE: TPRD ALLOWS USER TO SKIP BAD RECORDS WHILE TAPRD
       (W.R.CHURCH COMPUTER CENTER SUBROUTINE) DOES NOT.
    (2) CONDENS- CONDENSES INDEXES, AND CONVERTS THE
       CUMULATIVE DISTANCE X AND Y ARRAYS BY INCREASING DEPTH
       UNITS, TO TEMPERATURE AND DEPTH OR SALINITY AND DEPTH.
    (3) QOUTI- PRINTS OCEANOGRAPHIC STATION DATA SUMMARY.
    (4) SVEL- COMPUTES SOUND VELOCITY FROM DEPTH, TEMPERATURE
       AND SALINITY ACCORDING TO WILSON'S EQUATION.
    (5) SIGHT- COMPUTES SIGMA-

(C) AUTOMATIC DATA PROCESSING/HANLDING
(1) Applicable to multiple depth, temperature and salinity scales.
(2) Handles operator mistakes made in tracing STD curves on Calma digitizer.
(3) Skips an initial number of records specified by NSK and individual records (even if unreadable) specified by the array NCSPK.
(4) Decodes 7-track tape header labels and trace records.
(5) Computes data for every 0.01 inches depth but selectable for greater depth interval.
(6) Enters hand-entered data for surface and near-surface values.
(7) Edits out any unfilled array positions.
(8) Computes consecutive record serialization for tape output numbering scheme.
(9) Computes sound velocity and sigma-T.

(D) Diagnostics
(1) Writes first twenty-five values of B-array for inspection purposes.
(2) Writes every twentieth value of std arrays for data inspection purposes.
(3) Writes program statement number in addition to message when significant operations occur.

(E) Trouble-Shooting
(1) Handles multiple keyboard and tracer symbol entries.
(2) Provides for a missed header label or incomplete header label.
(3) Handles missing inter-record gaps.
(4) Handles delete record by incrementing record count and reading same pair of data cards again.
(5) Compares card header label against tape header label and accepts card values if card and tape disagree.

(F) Output
(1) Printer—two printing variables, PRT1 and PRT2.
   (a) Oceanographic data station summaries.
   (b) PRT2, provision only.
(2) Card—two card punching routines, cards and GCards.
   (a) Punched data cards for use with thesis.
   (b) Punched data cards for input to hydrographic program.
(3) Tape—9-track tape
(4) Plotting—provisions for plotting routines actuated by PLT1 and PLT2 are not presently programmed.

Arguments Program consists of many terms, arrays and variables. The following is a brief description of the important arguments listed alphabetically under two general categories.

(A) Arrays
(1) D,T,S,D2,T2,S2 = DEPTH, TEMPERATURE AND SALINITY
(2) DH,TH,SH = HAND-ENTERED SURFACE AND NEAR SURFACE DATA VALUES.
(3) X,Y = CUMULATIVE SUMS OF DISTANCE AND DEPTH TRAVEL.
(4) NRCSPK = NUMBER OF INDIVIDUAL RECOR D SKIPPED
(5) DCNS = DEPTH CONVERSION FACTOR.
(6) CORRS,CORRT = ADDITIVE CORRECTIONS TO SALINITY AND TEMPERATURE ASSOCIATED WITH STD SCALE CHANGES.
(7) IREC = CONSECUTIVE SERIAL RECORD NUMBER.
(8) AMONCA = MONTH/YEAR CODE LETTER.
(9) EVENT = MONTH AND YEAR.

(B) TERMS
(1) CARDS = VARIABLE PERMITS PUNCHING CARDS.
(2) CONTRL = NAMELIST VARIABLE USED FOR INFREQUENTLY CHANGED VARIABLES.
(3) CORD = DEPTH CORRECTION TERM.
(4) DAT = NAMELIST VARIABLE USED FOR FREQUENTLY CHANGED VARIABLES.
(5) DLTREC = DELETE RECORD.
(6) FLAG = INDICATES START OF DATA TRACE.
(7) GCARDS = VARIABLE PERMITS PUNCHING CARDS FOR HYDROGRAPHIC PROGRAM INPUT.
(8) GCRD = NUMBER OF HYDROGRAPHIC CARDS TO BE PUNCHED.
(9) ICODE = NUMBER USED TO IDENTIFY EITHER TEMPERATURE OR SALINITY TRACE RECORD.
(10) ICSQZ = VARIABLE USED TO COMPRESS NUMBER OF DATA VALUES OUTPUT TO CARDS PUNCHING ROUTINE.
(11) IGSQZ = VARIABLE USED TO COMPRESS NUMBER OF DATA VALUES OUTPUT TO GCARDS PUNCHING ROUTINE.
(12) ISQZ = VARIABLE USED TO COMPRESS NUMBER OF DATA VALUES OUTPUT TO PRINTER.
(13) IDEPTH = VARIABLE USED TO IDENTIFY HEADER LABEL OR TRACE RECORD.
(14) ISCL = THE SCALE NUMBER ON THE STD SALINITY SCALE DIAL.
(15) ITSCL = THE SCALE NUMBER ON THE STD TEMPERATURE SCALE DIAL.
(16) IDSCL = THE SCALE NUMBER ON THE STD DEPTH SCALE DIAL.
(17) ISTA = VARIABLE IDENTIFIES STATION NUMBER.
(18) IP = WHEN SET EQUAL TO 1 ON &DAT, IP IS A PRINT COMMAND TO CAUSE DATA TO BE OUTPUT AND VARIABLES INITIALIZED FOR
(19) IH
= NUMBER OF HAND-ENTERED SURFACE OR NEAR-SURFACE DATA VALUES.
(20) IHDR
= WHEN SET EQUAL TO 1 PERMITS ENTERING MISSING OR FAULTY DIGITIZER TAPE HEADER INFO VIA DATA CARD.
(21) ISTOP
= Terminates Program if set equal to 1 on a final Quat Card preceded by a label card.
(22) JREC
= VARIABLE USED TO COUNT RECORDS FOR RECORD SERIALIZATION PURPOSES.
(23) JSKIP
= WHEN SET EQUAL TO 1 ON THE LABEL CARD, CAUSES THE PROGRAM TO ACCEPT DATA ON AN &CONTROL CARD.
(24) KEY
= THE KEYBOARD SYMBOL ON THE DIGITIZER TAPE.
(25) KCRD
= NUMBER OF DATA POINTS TO BE PUNCHED BY CARDS PUNCHING ROUTINE.
(26) KDATA
= NUMBER OF RECORDS PROCESSED FOR PARTICULAR STATION.
(27) LABEL
= HEADER TYPE DATA CARD WHICH IDENTIFIES STATION NUMBER AND TYPE TRACE, TEMPERATURE OR SALINITY.
(28) NCARDS
= NUMBER OF CARDS PUNCHED BY CARDS PUNCHING ROUTINE.
(29) NK
= THE INDEX AT THE LAST USEFUL ARRAY POSITION OF THE X(DEPTH) ARRAY.
(30) NOIRG
= VARIABLE USED TO INDICATE MISSING END OF RECORD GAP ON TAPE.
(31) NSKIP
= NUMBER OF INITIAL RECORDS ON TAPE SKIPPED.
(32) SCON
= SALINITY SCALE CONSTANT.
(33) SCOR
= CORRECTION FACTOR ADDED TO SALINITY DATA VALUES.
(34) TCON
= TEMPERATURE SCALE CONSTANT.
(35) TCOR
= CORRECTION FACTOR ADDED TO TEMPERATURE DATA VALUES.
(36) WMONTH
= MONTH AND YEAR

DATA DECK

THE FOLLOWING IS A SAMPLE DATA DECK REQUIRED BY THIS PROGRAM. SAMPLE BELOW SHOWS DATA CARDS REQUIRED FOR TWO STATIONS, 3070 AND 3080. ALSO SHOWN IS 'STATION END' CARD WITH ISTOP SET EQUAL TO ONE.

&CONTROL NN=400, TAPE=F, CARDS=F, GCARDS=F, ISIZE=01, NSKIP=90, NRCSKIP=103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 1CSQZ=8,
IGSQ2=8, TCR=-0.08, SCOR=0.04, &END
UCM004 INCLUDES STATIONS 3070 THRU 302R MINUS 3080, 3090 AND 3140.

STATION 3070 TEMPERATURE HEADER
&GAT ISTA=307, ANONC='0', IDPETH=99, IDSCL=1, ICODE=0, ITSCL=4, ISCL=3, IP=0,
DH=0.0, TH=11.29, SH=33.40, IH=1, &END
STATION 3070 TEMPERATURE TRACE
&DAT IDPETH=00&END
STATION 3070 TEMPERATURE HEADER
&GAT IDPETH=99, ITSCL=3&END
STATION 3070 TEMPERATURE TRACE
&DAT IDPETH=00&END
STATION 3070 TEMPERATURE HEADER
&GAT IDPETH=99, ITSCL=2&END
STATION 3070 TEMPERATURE TRACE
&DAT IDPETH=00&END
STATION 3070 TEMPERATURE HEADER
&GAT IDPETH=99, ITSCL=2&END
STATION 3070 TEMPERATURE TRACE
&DAT IDPETH=00&END
STATION 3070 SALINITY HEADER
&GAT IDSCL=1, IDPETH=99, ICODE=1, ITSCL=4, &END
STATION 3070 SALINITY TRACE
&DAT IDPETH=00&END
STATION 3070 SALINITY HEADER
&GAT IDPETH=99, ITSCL=2, IP=1, &END
STATION 3070 SALINITY TRACE
&DAT IDPETH=00&END
STATION 3080 TEMPERATURE HEADER
&GAT ISTA=308, ANONC='0', IDPETH=99, IDSCL=1, ICODE=0, ITSCL=4, ISCL=3, IP=0, &END
STATION 3080 TEMPERATURE TRACE
&DAT IDPETH=00&END
STATION 3080 TEMPERATURE HEADER
&GAT IDPETH=99, ITSCL=3, &END
STATION 3080 TEMPERATURE TRACE
&DAT IDPETH=00&END
STATION 3080 TEMPERATURE HEADER
&GAT IDPETH=99, ITSCL=2&END
STATION 3080 TEMPERATURE TRACE
&DAT IDPETH=00&END
STATION 3080 SALINITY HEADER
&GAT IDSCL=1, IDPETH=99, ICODE=1, ITSCL=4, &END
STATION 3080 SALINITY TRACE
&DAT IDPETH=00&END
STATION 3080 SALINITY HEADER
&GAT IDPETH=00&END
STATION 3080 SALINITY HEADER
&GAT IDPETH=00&END
STATION 3080 SALINITY HEADER

THE FOLLOWING IS AN EXAMPLE OF JOB CONTROL LANGUAGE
AND DECK SET-UP REQUIRED TO USE DIGISTD. THIS
PARTICULAR DECK SET-UP WAS USED TO WRITE FILE 6 ON
9-TRACK TAPE, NPS-527. THE 9-TRACK TAPE WAS WRITTEN AT
800 bpi WITH A LRECL OF 40 AND BLKSIZE OF 32,520.
Hindsight indicates that it is desirable to write
the tape at a blksize of 8000 vice 32,520 since it is
extremely advantageous to keep follow on tape
processing programs small (ie less than 100K).

//GUCCSTD6 JOB (2006,0823,OS42), RE GREER SMC 1413', TIME=10,
// TPTRAN=HOLD,
// MSGCLASS=0
// EXEC FORTCLG,REGION.FORT=150K,REGION.GO=350K,DEST=0
// FORT. SYSIN DD *
// GO.FT06F001 DD SPACE=(CYL,(40,03)),SYSOUT=O
// GO.FT07F001 DD DUMMY
// GO.FT08F001 DD UNIT=3400-4, VOLN=SER=NPS527, LABEL=(06, SL, , OUT),
// DISP=(NEW,KEEP), DCB=(DEN=2,RECFM=FB, LRECL=40, BLKSIZE=32520),
// DSN=S2006, UCM7374
// GO.METTAP DD UNIT=2400-1, VOLN=SER=UCM004, DISP=OLD, LABEL=(,NL),
// DCB=(DEN=1, TRICH=ET)
// GO.SYSIN DD *
// (DATA DECK)
// (END OF FILE)
MAIN PROGRAM

****************************************************************************** DIG I S T D ******************************************************************************

DIMENSION X(4001), Y(4001), LABEL(19), SH(50), TH(50), DH(50),
1TH(10), INS(10), NRCSPK(99), DCON(3), CORRS(7), CORRT(7),
2REC(1801), AMONC(13), EVENT(13),
INTEGER B(6001), ZER, DOL, STAR, ONE, FLAG, DLTREC, ZERO, DLR, BLANK, GCRD,
1A(2001), TWO, THREE, FOUR, FIVE, SIX, SEVEN, EIGHT, TEN, ELEVEN, AMONT, FG
LCLOGICAL PRT1, PRT2, PLT1, PLT2, TAPE, ENDFL, CARDS, SKIP, GCARDS
COMMON /CL/ T(1801), S(1801), D(1801), SV(1801), SIGL1801),
1S11(1801), T1(1801), D2(1801), S2(1801), T2(1801)
REAL EVENT, WMONTH
2'JUL 1974', 'AUG 1974'/*
****************************************************************************** DEFINE SYMBOLS ******************************************************************************

DEFINE SYMBOLS, NOTING THAT THE LEFT THREE HEX BYTES IN EACH
ELEMENT OF B END UP FILLED WITH BLANKS
DATA DOL/*$55F*/, STAR/Z4040055C/, KEY/Z4040055F/, ORZ/Z40400561/,
1FLAG/Z40400550/, DLTREC/Z40400560/, MINUS/Z40400561/,
2DOL/Z4040056B/, BLANK/*' ', ZER/Z4040056F/, ONE/Z4040055F/,
3THREE/Z40400565/, FOUR/Z40400566/, FIVE/Z40400567/,
6MTWO/Z40400562/, MTHREE/Z40400563/, MFOUR/Z40400564/, MFIVE/Z40400565,
5STX/Z40400560/, SEVEN/Z40400566/, EIGHT/Z40400567/, NINE/Z40400568/
6TEN/Z40400569/, ELEVEN/Z4040056A/
****************************************************************************** DEFINE CONSTANTS ******************************************************************************

THE FOLLOWING CONVERSION FACTORS ARE IN HUNDREDTHS OF INCHES PER
UNIT OF S OR T. THEY MAY BE OVERRIDDEN BY THE DATA CARDS.
DCON(1) = 3.153
DCON(2) = 1.201
DCON(3) = 0.631
TCUN = 189.680
SCON = 474.200

***************************************************************************
** INITIALIZE ALL TERMS AND VARIABLES ***********
***************************************************************************

DATA CARDS/.FALSE./,CGRD/0.0/ ,ENDFL/.FALSE./,FG/0./,GCARDS/.FALSE./
1 ,ICAVE/0./,ICSCQZ/1./,ISQZ/1./,IH/0./,IHDR/0./,IP/0./,IPS/8000./,ISCL/0./,
2 ,IDPHT/1./,IDSCQZ/1./,ISTA/999./,ITSCL/0./,
3 ,ISQZ/1./,J1TOP/0./,JJJ/0./,JXJ/0./,JREC/0./,JSAV/0./,KBARF/0./,KSCARF/0./
4 ,KUTAF/1./,KDTA/1./,KUTI/1./,KDTH1/1./,KDTH2/1./,KS/1./,KS2/1./
5 ,KS2/1./,KT/1./,KT1/1./,KT2/1./,NE/0./,NOIRG/0./,NSKP/0./,PL1/.FALSE./
6 ,PL2/.FALSE./,PRT1/.TRUE./,PRT2/.FALSE./,SCOR/0.0./,SKIP/.FALSE./
7 ,TAPE/.FALSE./,TCOR/0.0/

***************************************************************************
** INITIALIZE ALL ARRAYS ***********
***************************************************************************

GIVE THE ARRAYS INITIAL VALUES

DO 20 J=1,50
SH(J) = 0.0
TH(J) = -5.0
DH(J) = 0.0
20 CONTINUE

DO 30 J=1,1801
D(J) = 0.0
T(J) = -5.0
S(J) = 0.0
D2(J) = 0.0
T2(J) = -5.0
S2(J) = 0.0
T1(J) = -5.0
S1(J) = 0.0
IREC(J) = 0
30 CONTINUE

DO 40 J=1,99
NRCSKP(J) = 0
40 CONTINUE
40 CONTINUE

DO 50 J=1,7,1
    CORR(J) = 0.0
    CORRT(J) = 0.0
50 CONTINUE

PROVIDE INITIAL INDICES FOR 10 SALINITY SEGMENTS (INSA) AND 10 TEMPERATURE SEGMENTS (INTA).

INSA(1) = 1
INSA(2) = 1
INTA(1) = 1
INTA(2) = 1

DO 60 J=3,10
    INSA(J) = 980
    INTA(J) = 980
60 CONTINUE

COMPUTE A TABLE OF CONVERSION FACTORS FOR SALINITY AND TEMPERATURE. CORRS AND CORRT REPRESENT THE S OR T VALUE AT THE LEFT HAND SIDE OF THE STD TRACE. THE VALUE (J) TO BE USED WILL COME FROM ISCL AND ITSCL. HYTECH STD MODEL 9006 STANDARD TEMPERATURE AND SALINITY SCALES 1 THRU 7 ARE PROVIDED FOR IN THIS PROGRAM IN ADDITION TO DEPTH SCALES 1, 2, AND 3. FOR CONVENIENCE THE SCALES FOR TEMPERATURE, SALINITY, AND DEPTH ARE DEFINED HERE.

TEMPERATURE SCALES:

ISCL 1 = -2 TO 3 (DEG CELSIUS)
ISCL 2 = 2 TO 7 (DEG CELSIUS)
ISCL 3 = 6 TO 11 (DEG CELSIUS)
ISCL 4 = 10 TO 15 (DEG CELSIUS)
ISCL 5 = 14 TO 19 (DEG CELSIUS)
ISCL 6 = 18 TO 23 (DEG CELSIUS)
ISCL 7 = 22 TO 27 (DEG CELSIUS)

SALINITY SCALES:

ISCL 1 = 30.0 TO 32.0 (PPT)
ISCL 2 = 31.5 TO 33.5 (PPT)
ISCL 3 = 33.0 TO 35.0 (PPT)
ISCL 4 = 34.5 TO 36.5 (PPT)
ISCL 5 = 36.0 TO 38.0 (PPT)
ISCL 6 = 37.5 TO 39.5 (PPT)
ISCL 7 = 30.0 TO 40.0 (PPT)

DEPTH SCALES:
DCon(1) = 0.0 TO 300.0 (METERS)
DCon(2) = 0.0 TO 750.0 (METERS)
DCon(3) = 0.0 TO 1500.0 (METERS)

CORRT(7) = 22.0
COrRs(7) = 30.0

DO 70 J=1,6,1
FJ = J
CORRT(J) = -2.0+(FJ-1.0)*4.0
COrRs(J) = 30.0+(FJ-1.0)*1.5
70 CONTINUE

********************************************************************
***** BEGIN PROCESSING; READ INITIAL DATA FROM TWO CARDS **********
*** PROGRAM PROVIDES FOR READING NSKP RECORDS WITHOUT PROCESSING.
*** NSKP, AS WELL THE 99 VALUES OF NRCNKP MUST BE ON THE FIRST
*** CONTROL CARD. A SINGLE CONTROL CARD IS READ HERE TO SET NSKP AND
*** NRCNKP. THERE ALSO MAY BE AN INFORMATIVE LABEL EXPLAINING HOW
*** MANY AND WHICH RECORDS SKIPPED.
*** READ (5,CTRL)
*** READ (5,170) LABEL
*** WRITE (6,180) LABEL

IF TAPE=.TRUE., TAPE MUST BE REWOUND AND APPROPRIATE JCL MUST
BE PROVIDED TO DEFINE IT. SEE JCL FOR EXAMPLE IN PRECEDING
PROGRAM DOCUMENTATION SECTION.
IF (TAPE) REWIND 8
IF (NSKP.EQ.0) GO TO 140

********************************************************************
********************************************************************
START SKIP LOOP ********************************************************************

DO 80 IS=1,NSKP
IIS = IS

THE VARIABLE, IPS, IS SET NEGATIVE DURING THE RECORD SKIP PROCESS.
THIS AVOIDS TPROD STOPPING ON UNREADABLE OR BAD RECORDS. NO DATA
CARDS ARE REQUIRED FOR INITIALLY SKIPPED RECORDS.
IMPORTANT NOTE: INITIALLY SKIPPED RECORDS (NSKP) DIFFER FROM
INDIVIDUALLY SKIPPED RECORDS (NRCNKP) IN THAT NRCNKP REQUIRE
DATA CARDS AND PERMITS 99 INDIVIDUAL RECORDS TO BE SKIPPED WHILE
NSKP DOES NOT REQUIRE DATA CARDS AND PERMITS MULTIPLE RECORDS TO
BE SKIPPED. (IE. NSKP=40, THE FIRST 40 RECORDS ON THE TAPE BEING
READ WILL BE SKIPPED; WHEREAS NRCSPK=22,23,24,50 PERMITS RECORD NUMBERS 22,23,24,50 TO BE SKIPPED INDIVIDUALLY.

IPS = -8000
80 CALL TPRD (A,IPS,&100,&120)

******************************************************************************
** RESET IPS FOR NORMAL TAPE PROCESSING ****************************
******************************************************************************
IPS = 8000
WRITE (6,90) IIS
90 FORMAT (/5X,I5,"RECORDS SKIPPED")
GO TO 140

IF END OR ERROR MESSAGES OCCUR DURING SKIP ROUTINE, PROGRAM STOPS.
100 WRITE (6,110) IIS
110 FORMAT (/5X,"FOUND END OF FILE ON RECORD",I4,"DURING SKIP PROCESS"
        /"
GO TO 1580
120 WRITE (6,130) IIS,A(1),A(2),A(3),A(4)
130 FORMAT (/5X,"READ ERROR ON RECORD",I5,"ERROR STATISTICS ARE:",I4.2
        1"
GO TO 1580

******************************************************************************
** END SKIP LOOP ****************************
******************************************************************************
REDEFINE LOOP INDEX TO START AT ONE.
140 NNN = NN-NSKP

******************************************************************************
** START MAIN LOOP FOR EACH RECORD ****************************
******************************************************************************
IT = 1
150 IF (IT.GT.NNN) GO TO 1580
IPS = 8000
NREC = IT+NSKP
WRITE (6,160) NREC
160 FORMAT (/5X,"LABEL 150; START MAIN LOOP. RECORD NO. ",I3/

PROGRAM PERMITS TREATMENT OF A KNOWN NUMBER OF RECORDS, NN, OR STOPPING WHEN ISTOP=1 ON STATION LABEL CARD. THE LABEL CARD HAS TWO DIGITS FOR CONTROL. THE 77-TH COLUMN IS JSKP; IF JSKP=0, ONLY TWO CARDS ARE READ. THE 78-TH COLUMN IS ISTOP; IF ISTOP=1, THE PROGRAM STOPS. NORMAL TERMINATION OF THE PROGRAM MAY BE ACCOMPLISHED IN TWO DISTINCT WAYS. EITHER SET NN TO DESIRED RECORD TO STOP OR PLACE A 'STATION END' LABEL CARD AT END OF DATA DECK WITH A ONE IN COLUMN 78. THE 79-TH COLUMN IS AMONC; AMONC IS
AN ALPHABETIC LETTER CODE FOR MONTH AND YEAR. THIS CODE IS
CONVERTED TO LITERAL MONTH AND YEAR LATER ON IN PROGRAM.

READ (5,170) LABEL, JSKIP, ISTOP, AMONC
170 FORMAT (19A4, 211, A1)
       IF (ISTOP.GT.0) GO TO 1580
       READ (5, DAT)
       WRITE (6, 180) LABEL
       WRITE (6, DAT)
       NORMALLY TWO CARDS, LABEL AND DAT, ARE READ PER RECORD.
       LESS FREQUENTLY CHANGED VARIABLES ARE ON CONTROL DATA CARD.
       JJJJ = 0
       NOIRG = 0
       IF (JSKIP.EQ.0) GO TO 190
       READ (5, CONTRL)
       WRITE (6, CONTRL)
180 FORMAT (75X, 19A4/)

PROVISION IS MADE HERE FOR A MISSED HEADER LABEL ON TAPE (AN
OPERATOR ERROR). IF IHDR=1, AND ALL INFORMATION REQUIRED IS PLACED
ON PARTICULAR DAT CARD, THE PROGRAM BRANCHES OFF TO 610 AND
WRITES STATION INFORMATION AND MESSAGE THAT HEADER IS MISSING,
AND FINALLY RETURNS TO 150 TO START NORMAL PROCESSING OF TRACE
RECORD DATA. NOTE: RECORD COUNT IS NOT INCREMENTED IN THIS LOOP.

190 IF (IHDR.EQ.1) GO TO 610
200 CONTINUE

NOTE: IN EARLIER VERSIONS OF THIS PROGRAM, THERE WAS AN
INTERPOLATION ROUTINE HERE FOR HAND-ENTERED DATA BUT IT WAS
DELETED SINCE VERY SELDOM ONE HAD CAUSE TO USE IT. HOWEVER, THE
CAPABILITY FOR HAND-ENTERED DATA HAS BEEN RETAINED BUT IN A
DIFFERENT FORM. SEE COMMENTS FOLLOWING STATEMENT NO. 1130.

210 FORMAT (5X, 11F7.2/5X, 11F7.2/5X, 11F7.2/5X, 11F7.2/5X, 11F7.2/5X, 11F7.
      12/7X, 11F7.2/5X, 11F7.2/5X, 3F7.2/5X, 60X, 16)
220 FORMAT (5X, 10I5,'^ INSA^')
230 FORMAT (5X, 10I5,'^ INTA^')
240 FORMAT (5X,' K$, K$1, K$, KT, KT1, KT2, JJJ, NE, KDTH1, KDTH2, KD
      1TA, KDD1, JJJJ'7, 4X, 815, 216, 315)

---------------
IPLACE=245
WRITE (6, 210) (D(J), J=1, 1801, 20)
WRITE (6, 210) (T(J), J=1, 1801, 20), IPLACE

---------------
WRITE (6,210) (S(J),J=1,1801,20),IPLACE
WRITE (6,220) (INSA(J),J=1,10)
WRITE (6,230) (INTA(J),J=1,10)
WRITE (6,240) KS,KS1,KS2,KT,KT1,KT2,JJJ,NE,KDT1,KDT2,KDTA,KDTJ,J
1JJJ

FILL THE A ARRAY WITH DOLLARS

DO 250 I=1,2001
THE 2001 ASSURES THAT THE LAST WORD OF A WILL CONTAIN DOLLARS
SINCE 2000 WORDS OR 8000 BYTES OF DATA ARE READ IN.
A(I) = DOL
250 CONTINUE

FILL B WITH BLANKS

DO 260 I=1,8000
B(I) = BLANK
260 CONTINUE

PROGRAM Examines list of individual bad records, NRCSKP, and
skips them. If NRCSKP(I)=0, the skip routine is by-passed.
Caution: do not remove pairs of data cards for individually
skipped cards.

In using the Calma digitizer, spurious blank records occurred
throughout the tape on numerous occasions. Many of these
occurrences were later traced to equipment malfunction.
However, if a blank record occurs during a header label record
nothing is lost since header info may be inserted by card and
setting IHDR=1. On the other hand, if a blank record occurs
during a trace record the complete station is lost. From
experience, a blank record will generally have two characters.
After the first program run and a determination of blank or
bad records has been made, these may be skipped individually via
NRCSKP routine.
IF (NRCSKP(I),EQ,0) GO TO 320

******************************************************************************
** START INDIVIDUAL RECORD SKIP LOOP ***************************************
******************************************************************************
DO 270 LB=1,99
NRC = NRCSKP(LB)-NSKP
IF (NRC.EQ.IT) GO TO 280
270 CONTINUE
C
GO TO 300
280 IPS = -8000
290 FORMAT (//5X,'LABEL 290. RECORD NO.',I5,' SKIPPED VIA NRCSKP SKIP
1 ROUTINE.'//)
C
WRITE (6,290) IT
CHANGING IPS TO NEGATIVE CAUSES TPRD TO SKIP A RECORD
300 IF (ICODE.EQ.0) GO TO 320
WRITE (6,310) IDEPHT,ICODE,ISCL
310 FORMAT (5X,'SALINITY VERSUS DEPTH'/
1 5X,'STD RECORD STARTS AT ',I3,' METERS'/
2 5X,'CODE = ',I2/
3 5X,'SCALE = ',I2)
C
************************************************************************************
C
************************************************************************************
READ TAPE************************************************************************************
320 CALL TPRD (A,IPS,&350,&330)
C
IPS IS THE MAXIMUM NUMBER OF BYTES OF DATA WHICH WILL BE READ
FROM ONE RECORD OF DIGITIZER TAPE BY TPRD. IPS/2 IS THE MAXIMUM
TOTAL TRAVEL ALONG THE CURVE MEASURED IN 0.01 INCHES IN THE X
AND Y DIRECTION SEPARATELY. 350 IS THE END OF FILE EXIT, AND 330
IS THE READ-ERROR EXIT.
C
GO TO 360
330 WRITE (6,340) A(1),A(2),A(3),A(4)
340 FORMAT (5X,'110 ERROR STATISTICS TABLE IS ',428)
C
350 CONTINUE
360 CONTINUE
C
************************************************************************************
END INDIVIDUAL RECORD SKIP LOOP********************************************************************
C
PROCESS THE LAST RECORD
MOVE THE BYTES OF A INTO THE 4-BYTE WORDS OF B USING CHMOVE.
JJ = 0
Jjj = 0
C
DO 370 II=1,2000
C
DO 370 I=1,4
JJ = JJ+1
CALL CHMOVE (A(I),I,B(J),J,4)
IF (B(J).EQ.DLR) GO TO 380
C THERE MAY BE A STAR BEFORE THE DOLLAR
370 CONTINUE
C 380 CONTINUE
B(8001) = DLR
C
******************************************************************************
****** PREPARE TO PROCESS RAW ARRAY ******************************************
******************************************************************************
C WRITE (6,390) JJ,(B(J),J=1,25)
390 FORMAT (/5X,'LABEL 390. ARRAY B IS FILLED; LOOK FOR MODE CHARAC
1R. THE NUMBER OF ARRAY ELEMENTS PROCESSED INCLUDING STARS AND "/
2 5X,'DOLLARS, JJ= ',I5,'/5X,'FIRST 25 CHARACTERS ARE: ',
3 10(I1X,Z8)/5X,10(I1X,Z8)/5X,5(I1X,Z8)/)
C
******************************************************************************

JJ = 1
GO TO 430
C
******************************************************************************
****** START MISSING IRG ROUTINE *********************************************
******************************************************************************
C THE FOLLOWING ROUTINE READS ANOTHER SET OF CARDS. THIS IS THE
ENTRY FOR THE SITUATIONS IN WHICH THE IRG IS MISSED.
400 READ (5,170) LABEL,JSKIP,ISTOP,AMONC
IF (ISTOP.GT.0) GO TO 1580
IF (JSKIP.EQ.0) GO TO 410
READ (5,DAT)
WRITE (6,180) LABEL
WRITE (6,DAT)
READ (5,CONTRL)
WRITE (6,CONTRL)
C-------
410 IPLACE=410
WRITE (6,210) (D(J),J=1,1801,20)
WRITE (6,210) (T(J),J=1,1801,20),IPLACE
WRITE (6,210) (S(J),J=1,1801,20),IPLACE
WRITE (6,220) (INSA(J),J=1,10)
WRITE (6,230) (INTA(J),J=1,10)
WRITE (6,240) KS,KSI,KSZ,KT,KT1,KT2,JJJ,NE,KDTH1,KDTH2,KDTA,KDT1,J
1JJJ
WRITE (6,420) NOIRG,JJJ
420 FORMAT (/5X,'LABEL 410. PROCESSING SECOND HALF. NOIRG=',I3,
2040,2055
C

NOIRG = 0
JJ = JJJJ

*****************************************************************************
** END MISSING IRG ROUTINE ***********************************************
*****************************************************************************

INITIALIZE ADDERS, ETC.

SUMD = 0.
SUMD = 0.
SUMT = 0.
N = 0.
KK = 0.

*****************************************************************************
** MODE SYMBOL CHECK ***********************************************
*****************************************************************************

430 IF (B(JJ).EQ.KEY) GO TO 490
THE FIRST ELEVEN VALUES OF THE B-ARRAY ARE CHECKED FOR A
KEYBOARD SYMBOL SINCE IT IS POSSIBLE TO HAVE GARBAGE VALUES AHEAD
OF THE KEYBOARD SYMBOL. IF ALL ELEVEN VALUES ARE NOT KEYS
THEN JJ IS RESET TO 1 AND THE RECORD IS PROCESSED AS A TRACE.
HOWEVER, IF ONE OF THE ELEVEN VALUES ARE A KEY, PROGRAM BRANCHES
TO 490, AND PROCESSES AS A HEADER. AT FIRST GLANCE, THIS
PROCEDURE APPEARS TO ASSUME THAT IT IS IMPOSSIBLE TO HAVE A
KEY SYMBOL APPEAR IN THE FIRST ELEVEN CHARACTERS OF A TRACE
RECORD. THIS IS NOT A BAD ASSUMPTION SINCE THE OPERATOR HAS TO
GO OUT OF HIS WAY TO INITIATE KEYBOARD MODE DURING TRACE MODE.
HOWEVER, LEAVING NOTHING TO CHANCE THE PROGRAM WILL KEEP
CHECKING FOR KEY OR TRACER UNTIL OPERATOR MAKES UP HIS MIND
WHICH MODE IS CORRECT. IF NO TRACER SYMBOLS APPEAR AFTER PROGRAM
FINDS A KEY, THEN RECORD WILL BE PROCESSED AS A HEADER. ON THE
OTHER HAND, IF NO KEY SYMBOLS APPEAR AFTER PROGRAM FINDS A TRACER
THEN THE RECORD WILL BE PROCESSED AS A TRACE.

JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 490
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 490
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 490
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 490
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 490
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 490
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 490
DEFINE INDICES FOR DECODING THE LABEL.

1) DEPT = 0
2) STA = 0

SKP=1 PERMITS NAMELIST DATA TO OVERRIDE HEADING DATA. ALL THE
HEADING DATA MUST THEN BE ON THE NAMELIST CARDS.

INTEGER

PROCEED KEYBOARD ENTRIES, CHANGE THE WORDS TO

*************** START KEYBOARD DECODE *********************

*************** END KEYBOARD DECODE ***********************

60 TO 440

TRY AGAIN

IF (A'(1,2)) KEY, (E0.8)缺 (60 TO 870)
SYMBOLS ON A TAPE PER RECORD.

IF (A'(1,2)) KEY, (E0.8)缺 (60 TO 870)
SYMBOLS ON A TAPE PER RECORD.

IF (A'(1,2)) KEY, (E0.8)缺 (60 TO 870)
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SYMBOLS ON A TAPE PER RECORD.

IF (A'(1,2)) KEY, (E0.8)缺 (60 TO 870)
SYMBOLS ON A TAPE PER RECORD.

IF (A'(1,2)) KEY, (E0.8)缺 (60 TO 870)
SYMBOLS ON A TAPE PER RECORD.
KY1 = JJ
KY2 = KY1+2
KY3 = KY1+3
KY4 = KY1+4
KY5 = KY1+5
KY6 = KY1+6
KY7 = KY1+7
KY8 = KY1+8
KY9 = KY1+9
KY10 = KY1+10
KY11 = KY1+11

C
DLTREC ARE FOUND HERE IN THE HEADER. IF DLTREC OCCURS, READ IN
A NEW RECORD AND USE SAME CARDS.

C
DO 510 J=KY1,KY10
IF (B(J).EQ.DLTREC) GO TO 520
510 CONTINUE

C
GO TO 550
520 WRITE (6,530)
530 FORMAT (/5X,'DLTREC IN HEADER. REPEAT, USING SAME CARDS.'/)
540 IT = IT+1
GO TO 200
550 KT2 = 10
KS2 = 10

C
THESE TWO STATEMENTS GIVE MAXIMUM VALUES TO KT2 AND KS2 SO THAT
THEY WILL ALWAYS BE DEFINED, EVEN IF ONLY ONE VARIABLE IS TRACED
DO THE CONVERSION, COMPARE WITH VALUES READ FROM THE CARDS, ACCEPT
THE CARDS.

C
DO 560 J=KY1,KY2
B(J) = B(J)-ZER
IB = B(J)
ISTAA = ISTAA+IB*10**(KY2-J)
560 CONTINUE

C
AMONT = B(KY3)
C
DO 570 J=KY4,KY5
B(J) = B(J)-ZER
IB = B(J)
IDEPT = IDEPT+IB*10**(J-KY4)
CONTINUE

C
IDSC = B(KY6) - ZER
ICOD = B(KY7) - ZER
ITSL1 = B(KY8) - ZER
ISCL1 = B(KY9) - ZER
IPP = B(KY10) - ZER

C
IF THERE IS A DISAGREEMENT, WRITE A MESSAGE.
IF (ISTAA .NE. ISTA) GO TO 590
IF (IDEPT .NE. IDEPHT) GO TO 590
IF (IDSC .NE. IDSCL) GO TO 590
IF (ICOD .NE. ICODE) GO TO 590
IF (ITSL1 .NE. ITSL1) GO TO 590
IF (ISP .NE. ISP) GO TO 590

580 FORMAT (5X, 'LABEL = '580. CARD INPUTS EQUALLED TAPE HEADER FOR
1 STATION '13, '13, A1/5X, '13/)
WRITE (0, 580) ISTA, AMONC, IDEPHT
GO TO 610

590 WRITE (6, 600) ISTA, AMONC, IDEPHT, IDSCL, ICODE, ITSL1, ISCL, IP, ISTAA, AM
ION1, IDEPHT, IDSC, ICOD, ITSL1, ISCL, IPP
600 FORMAT (/3X, "CARD AND TAPE DISAGREE; CARD ON TOP, '"13, ISTA, AMON
C1, IDEPHT, IDSCL, ICODE, ITSL1, ISCL, IP, '"13, A7, 17/3X, 17)
2 .A7, 17/17/

C
WRITE THE RESULTS
610 WRITE (6, 620) ISTA, AMONC, IDEPHT

620 FORMAT (5X, 'LABEL 610. HEADER PROCESSING COMPLETE EXCEPT SEARCH F
10R ERRORS ON STATION '13, A1/5X, '13/)

C
IT IS POSSIBLE THAT NO IRG EXISTS AFTER THE HEADER. IF SO,
THE PROGRAM HAS FILLED THE B ARRAY WITH BOTH THE HEADER AND TEMP.
CK SALINITY TRACE. ASSUME THERE IS A TRACER SYMBOL IN POSITION
12. IF SO, CONTINUE TO PROCESS THE B-ARRAY
IF (B(KY11) .NE. STAR) GO TO 640

JJJJ = KY11
WRITE (6, 630)

630 FORMAT (5X, 'NO IRG AFTER HEADER; CONTINUE TO PROCESS B ARRAY. /
GO TO 400

640 IF (IHDR .EQ. 0) GO TO 660

C
THIS BRANCH RETURNS TO 150 IF MISSED HEADER AND IHDR SET EQUAL 1.
WRITE (6, 650)

650 FORMAT (/5X, 'HEADER MISSING; INFO INSERTED WITH CARDS. /
IHDR = 0
GO TO 150

660 CONTINUE
GO TO 1550

******************************************************************************
******************************************************************************
END KEYBOARD DECODE
******************************************************************************
******************************************************************************

******************************************************************************
******************************************************************************
START OF NORMAL TRACE PROCESSING
******************************************************************************
******************************************************************************

THE FOLLOWING PROCEDURE PERMITS THE PRESENCE OF ANY REASONABLE
NUMBER OF TRACER SYMBOLS (STAR) INCLUDING NONE.

670 NE = 0
NF = 0
NSTAR = 0
680 IF (B(JJ).EQ.STAR) GO TO 700

C COUNT STARS AND WRITE MESSAGE
WRITE (6,690) NSTAR

690 FORMAT (/9X, 'START TRACER MODE; NO. OF TRACER SYMBOLS =',I2/)  
WHERE THERE ARE NO MORE STARS, START TESTING FOR COUNT SYMBOLS ETC
GO TO 710

700 JJ = JJ+1
NSTAR = NSTAR+1
C WE CONTINUE TO TEST FOR STARS UNTIL NO MORE APPEAR.
GO TO 680

C THE NEXT BLOCK OF OPERATIONS TO STATEMENT NO. 950 LOOPS BACK TO
C 710 CONTINUALLY; TESTING EACH CHARACTER FOR IDENTITY AND
C CONTINUING TO ADD OR SUBTRACT FROM THE CUMULATIVE Y AND X COUNTS
C UNTIL A DELETE-RECORD SYMBOL OR A STAR OR A DOLLAR INDICATES
C THE END OF DATA. THE FLAG IS PLACED AT THE POINT WHERE THE TRACE
C ENTERS THE CROSS-SECTIONED AREA; PREVIOUS COUNTS RESULT FROM THE
C TRACER TRAVELLING FROM THE COORDINATE ZERO TO THIS POINT.

710 IF (B(JJ).EQ.ONE) GO TO 730
IF (B(JJ).EQ.BLANK) GO TO 740
IF (B(JJ).EQ.MINUS) GO TO 750
IF (B(JJ).EQ.FLAG) GO TO 900
C THE NEXT GROUP OF STATEMENTS ALLOW FOR OCCASIONAL COUNTS GREATER
C THAN + OR - 1.
C IF (B(JJ).EQ.TWO) GO TO 760
IF (B(JJ).EQ.TREE) GO TO 770
IF (B(JJ).EQ.FOUR) GO TO 780
IF (B(JJ).EQ.FIVE) GO TO 790
IF (B(JJ).EQ.SIX) GO TO 800
IF (B(JJ).EQ.SEVEN) GO TO 810
IF (B(JJ).EQ.EIGHT) GO TO 820
IF (B(JJ).EQ.NINE) GO TO 830
IF (B(JJ).EQ.TEN) GO TO 840
IF (B(JJ).EQ.ELEVEN) GO TO 850
IF (B(JJ).EQ.MTWO) GO TO 860
IF (B(JJ).EQ.MTHREE) GO TO 870
IF (B(JJ).EQ.MFOUR) GO TO 880
IF (B(JJ).EQ.MFIVE) GO TO 890
IF (B(JJ).EQ.DLTHREE) GO TO 970
IF (B(JJ).EQ.KEY) GO TO 440
720 FORMAT (///5X,'SYMBOL NOT RECOGNIZED = ',Z8///)
WRITE (6,720) B(JJ)
C IF SYMBOL IS NOT RECOGNIZED, STATION DATA IS NOT PRINTED IF IP=1.
C PROGRAM BRANCHES AND RE-INITIALIZES ALL VARIABLES FOR PROCESSING
C NEXT STATION IF IP=1. OTHERWISE, IT RETURNS TO READ NEXT RECORD.
IF (IP.EQ.1) GO TO 1510
900 JJJ = NE
JJ = JJ+1
FG = 1
GO TO 710

C PROGRAM ADDS AND STORES CUMULATIVE SUMS. ONE UNIT EQUALS 0.01
C INCH.
C 910 N = N+1
C NE = N/2
C NF = NE*2
C IF (NF.EQ.N) GO TO 920
C THIS FIDDLING AROUND DETERMINES IF THE COUNT IS EVEN OR ODD.
C START COUNTING IN THE ORDER XYYY. X AND Y HAVE NORMAL
C ORIENTATIONS ON THE STRIP CHART. HOWEVER, X AND Y ARE INVERTED
C WITH RESPECT TO THE CALMA DIGITIZER. SPECIFICALLY, DEPTH
C INCREASES ALONG THE POSITIVE X-AXIS AND TEMP AND SALINITY ARE
C INCREASING FUNCTIONS ALONG THE Y-AXIS ON THE CALMA DIGITIZER.
C WARNING: DIGITIZE TRACES ACCORDING TO ABOVE ORIENTATION OR BE
C PREPARED TO RE-DIGITIZE TAPE LATER AFTER DISCOVERING GOOF.
C IF ODD
C SUMD = SUMD+RX
C ODD INDEX IS INCREASED TO KEEP IT SAME AS EVEN.
C NE = NE+1
C Y(NE) = SUMD
C JJ = JJ+1
C GO TO 930
C IF EVEN
C 920 SUMT = SUMT+RX
C X(NE) = SUMT
C JJ = JJ+1
C IF STAR OR DOLLAR FOUND, END OF DATA HAS BEEN REACHED.
C 930 IF (B(JJ).EQ.DLR) GO TO 990
C ***************************************************************
Cgia END OF NORMAL TRACE PROCESSING ***************************************************************
C ***************************************************************
C*************************************************************** BEGIN TROUBLE-SHOOTING ***************************************************************
C IF THERE IS NO IRG AT END OF HEADER BUT THERE IS A TRACER SYMBOL,
C THE PROGRAM SEPARATES THE TWO RECORDS BY FIRST SETTING NOIRG=1
C AND PROCESSING FIRST PART OF B-ARRAY AND THEN READING A NEW SET
C OF CARDS TO PROCESS SECOND PART OF B-ARRAY.
C IF (B(JJ).NE.STAR) GO TO 950
C NOIRG = 1
C SAVE THE INDEX OF THE START OF THE SECOND HALF, JJJJ.
C JJJJ = JJ
C WRITE (9,940)
C 940 FORMAT (I/5X,'FOUND A STAR AT END OF TRACER ASSUME THERE IS NO IRG.'
1' /5X, 'PROCESS RECORD IN TWO PARTS; READING CARDS FOR BOTH PARTS.' /

GO TO 990

950 IF (BJJ).NE.KEY) GO TO 710
JJ = JJ - 1
WRITE (6, 960)

960 FORMAT ('/5X, 'FOUND A KEYBOARD SYMBOL. PROCESS NEXT PORTION OF B-A
IRAY AFTER READING NEW CARDS.' )
NU = 1
GO TO 990

C

970 WRITE (6, 980) JJ

980 FORMAT ('/5X, 'FOUND DELETE RECORD SYMBOL AT JJ = ', I5)
C
IF DELETE RECORD FOUND, PROGRAM INCREMENTS RECORD COUNT, IT,
C
AND RESTARTS PROCESSING BUT DOES NOT READ A NEW PAIR OF CARDS.

GO TO 540

990 JJ = JJ - 1

C

**********************************************************************
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UP TO THIS POINT, PROCESSING IS IDENTICAL FOR S AND T.

START CONVERTING T AND D TO SCIENTIFIC UNITS

WRITE (6, 1000) JJ, NE, Y(NE), X(NE)

1000 FORMAT ('/5X, 'LABEL 1000. START CONDENSING UNCONVERTED ARRAY AND CO
INATING TO SCIENTIFIC UNITS.' )/5X,'THE TRACER ENTERED THE FRAME (F
4LAG) AT JJ = ' , I5/5X,'THE END OF THE TRACE HAS INDEX NE = ' , I5/
3 5X,'LAST (UNCONVERTED) DEPTH AND TEMP ARE: ', F7.1, 2X, F7.1/'

C

C

CHECK TO SEE IF FLAG WAS FOUND.
IF (FG).EQ.1 GO TO 1020

WRITE (6, 1010)

1010 FORMAT ('/5X, 'NO FLAG FOUND; PROCESS ANYWAY.'/')

1020 WRITE (6, 1030)

1030 FORMAT ('/5X')

FG = 0

C

THE X AND Y ARRAYS ARE FILLED AND THE START AND END OF THIS BATCH
OF DATA ARE LABELLED WITH JJJ AND NE.

CONVERT THE ARRAYS INDEXED ON 0.01-INCH DEPTH SPACINGS.
SUBROUTINE CONDONS SERVES THIS PURPOSE ALTHOUGH IT NO LONGER
CONDENSES A SECOND ARRAY TO SMALLER SIZE, NOR DOES IT PAD THE
GAP BETWEEN ARRAYS, BUT WITHIN ONE SEGMENT, IT DOES INTERPOLATE
TO FILL ANY BLANK ARRAY POSITIONS.

C

C

TO THOSE FAMILIAR WITH EARLIER VERSIONS OF THIS PROGRAM, THE

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FOLLOWING CONDENSE Routines WILL NOT EVEN APPEAR REMOTELY SIMILAR. THE EARLIER VERSION HAD TO BE EXTENSIVELY MODIFIED TO PERMIT MULTIPLE DEPTH SCALES. SPECIFICALLY, WHEN USING MULTIPLE DEPTH SCALES ONE'S DEPTH AXIS REFERENCE CHANGES AND CONSEQUENTLY IN CONSTRUCTING THE S AND D OR T AND D ARRAYS THIS ROUTINE WORKS WELL.

IF (ICODE.EQ.0) GO TO 1080

* S****************************************************************************************************************************************************************************************************S
CONDENSE THE X AND Y ARRAYS INTO S AND D
S****************************************************************************************************************************************************************************************************S

* 
KS = KS+2
KS1 = KS+1
KS2 = KS+1
IF (IDSCL.EQ.1) GO TO 1040
KDT1 = KSCARF+1
GO TO 1050

1040 KDT1 = INSA(KS1)
1050 CALL CONDNS (X,Y,S1,JJJ,NE,KDT1,KDTH1,KDTH2)

KDTA = KOTH1+1
K = KDTH1
IF (IDSCL.EQ.1) GO TO 1060
K = KDT1

1060 DO 1070 J=KOTH1,KDTH2

DK = (J-1)/DCON(IDSCL)+CORD
SK = SI(J)/SCON+CORR{ISCL}+SCOR
K = K+1
KSCARF = K

1070 CONTINUE

INSQ(KS) = KDTH1
INSQ(KS2) = KDTH2
GO TO 1130

* T****************************************************************************************************************************************************************************************************T
CONDENSE THE X AND Y ARRAYS INTO T AND D
T****************************************************************************************************************************************************************************************************T

* 
KT = KT+2
KT1 = KT-1
KT2 = KT+1
IF (IDSCL.EQ.1) GO TO 1090
KDT1 = KBARF+1
GO TO 1100

1090
1090 KDT1 = INTA(KT1)
1100 CALL CONDNS (X;Y,T1,JJJ,NE,KDT1,KDTH1,KDTH2)
   KDTH = KDTH1+1
   K = KDTH1
   IF (IDSCL.EQ.1) GO TO 1110
   K = KDT1

   C
1110 DO 1120 J=KDTH1,KDTH2
   D(K) = (J-1)/DCON(IDSCL)+COR
   T(K) = T1(J)/TCON+CUTRT(IDSCL)+TCOR
   K = K+1
   KDARF = K
1120 CONTINUE

   C
*INTA(KT) = KDTH1
   INTA(KT2) = KDTH2

   C
*CONVERSION OF X AND Y ARRAYS INTO T AND S ARRAYS IS COMPLETE.
   AT THIS POINT, SURFACE AND NEAR-SURFACE DATA WILL BE INSERTED.
   NORMALLY, ONLY SURFACE VALUES NEED TO BE INSERTED DUE TO THE
   DIGITIZER OPERATOR BEGINNING TO TRACE SLIGHTLY BELOW HIS ZERO
   DEPTH REFERENCE POINT. SURFACE DATA VALUES ARE INSERTED BY
   CHECKING THE VALUE OF IH. IF IH=0, DATA IS NOT INSERTED. IF IH=1,
   SURFACE DEPTH, TEMP, AND SALINITY VALUES ARE INSERTED VIA EDAT
   DATA CARD FOR PARTICULAR STATION.
   CAUTION: HAND-ENTERED DATA VALUES SHOULD BE CORRECTED VALUES
   IF CORRECTIONS,TCOR AND SCOR, ARE APPLICABLE.
   INFREQUENTLY, DATA VALUES BELOW THE SURFACE MUST BE INSERTED.
   PROVISION IS MADE FOR NEAR-SURFACE DEPTHS DOWN TO APPROXIMATELY
   13 METERS. THIS OCCURS DUE TO THE SAME REASON AS ABOVE,IE. A NOT
   SO Meticulous OPERATOR BEGAN DIGITIZING BELOW ZERO REFERENCE
   POINT.). SINCE THIS OCCURS Seldom, AND INVOLVES A SIGNIFICANT
   AMOUNT OF LABOR TO MANUALLY READ THE STD TRACE, CORRECT THE
   VALUES IF NEEDED AND PLACE ON EDAT DATA CARD, THIS OPERATION WILL
   ONLY BE DONE FOR FINAL OUTPUT TO TAPE,CARD OR PRINTER.
   CONSEQUENTLY, TO INSERT NEAR-SURFACE DATA ISQZ MUST EQUAL 1,
   IH MUST BE GREATER THAN OR EQUAL TO 2, DH/TH, AND SH WERE
   DIMENSIONED AT 30 THIS ROUTINE TO APPROXIMATELY 15 METERS.
   ISQZ=1 WAS CHOSEN AS DETERMINING VALUE DUE ALL ELEMENTS OF D,T,
   AND S ARRAYS ARE PRINTED OUT VIA OUT1. THIS ELIMINATES

   C
'GUESSWORK' OF WHICH VALUES SHOULD BE INSERTED. IN OTHER WORDS,
ALL OF THEM ARE INSERTED.
IF (IH.EQ.0) GO TO 1150
S(1) = SH(1)
T(1) = TH(1)
IF (IH.LT.2) GO TO 1150
IF (ISQZ.GT.1) GO TO 1150
DO 1140 J=2, IH
S(J) = SH(J)
T(J) = TH(J)
D(J) = OH(J)
1140 CONTINUE
1150 CONTINUE
C-------------------------------------
IPLACE=1155
WRITE (6,210) (D(J),J=1,1801,20)
WRITE (6,210) (T(J),J=1,1801,20), IPLACE
WRITE (6,210) (S(J),J=1,1801,20), IPLACE
WRITE (6,220) (INSA(J),J=1,10)
WRITE (6,230) (INTA(J),J=1,10)
WRITE (6,240) KS, KS1, KS2, KT, KT1, KT2, JJJ, NE, KDTH1, KDTH2, KDTA, KDT1, J
1jjj
C-------------------------------------
IF (IP.EQ.1) GO TO 1160
IF (NOIRG.EQ.1) GO TO 400
GO TO 1570
1160 IN1 = KBARF
IN2 = KSCARF
KDTA = MIN0(IN1, IN2)
1170 FORMAT (5X,'LABEL=1170.', 317//)
WRITE (6,1170) IN1, IN2, KDTA
C ******************************************************
C ** EDITING OF UNWANTED ZERO DATA VALUES **********************
C ******************************************************
C IN DIGITIZING TEMP AND SALINITY SEGMENTS OF TRACES ONE CAN NOT
C AVOID GETTING GAPS SOMETIMES BETWEEN TRACE SEGMENTS. WHEN THIS
C HAPPENS THE OUTPUT PRINTOUT WILL SHOW -5.0 AND 0.0 FOR THE
C TEMPERATURE AND SALINITY VALUES RESPECTIVELY. THESE VALUES ARE
C THE PRE-INITIALIZED VALUES OF THE T AND S ARRAYS, AND INDICATE
C NO ATTEMPT HAS BEEN MADE TO PLACE DATA IN THE PARTICULAR ARRAY
C POSITION (IE A GAP IN DATA). IT IS DESIRABLE THAT THESE UNWANTED
C VALUES OR GAPS BE ELIMINATED PRIOR TO WRITING A TAPE OR PUNCHING
A CARD. THUS A CHECK IS MADE TO SEE IF T(J) OR S(J) ARE -5.0 OR
0.0 RESPECTIVELY. IF T(J) AND S(J) ARE NOT -5.0 OR 0.0
RESPECTIVELY, THE VALUES ALONG WITH DEPTH ARE PLACED INTO D2,T2,
AND S2 ARRAYS. IF GAPS DO EXIST, THE VALUES ARE WRITTEN OUT AND
COUNTED BUT NOT PUT INTO THE D2,T2, AND S2 ARRAYS. THIS PROCESS
IN EFFECT DISCARDS THE GAPS IN THE DATA. THE D,T, AND S ARRAYS
ARE THEN RE-INITIALIZED, AND THE D2,T2, AND S2 ARRAYS ARE PUT BACK
INTO THE D,T, AND S ARRAYS. NOTE, THE VALUE OF KDTA WHICH
IS EQUAL TO TOTAL NUMBER OF RECORDS IS REDUCED BY NUMBER OF
UNWANTED RECORDS BY MAKING USE OF THE VARIABLE KDTAF.

K = 0
L = 1

DO 1200 J=1,KDTA
IF ((T(J) .EQ. -5.0) .OR. (S(J) .EQ. 0.0)) GO TO 1180
D2(L) = D(J)
T2(L) = T(J)
S2(L) = S(J)
L = L+1
GO TO 1200

1180 WRITE (6,1190) D(J),T(J),S(J),J
K = K+1
JSAV = K

1190 FORMAT ('/5X,3F7.2,16,'/)

1200 CONTINUE

C

1210 FORMAT ('/5X, JSAV= ',16,'/')
WRITE (6,1210) JSAV
KDTAF = KDTA-JSAV
KDTA = KDTAF

C

DO 1220 J=1,1801
D(J) = 0.0
T(J) = -5.0
S(J) = 0.0

1220 CONTINUE

C

DO 1230 J=1,KDTA
D(J) = D2(J)
T(J) = T2(J)
S(J) = S2(J)

1230 CONTINUE
*--------------------------------------------------*
<p>| PREPARE SOUND VELOCITY AND SIGMA-T Routines      |
| PRODUCE SOUND VELOCITY AND SIGMA-T WHEN IP.EQ.1  |
| CALL SVEL (D,T,S1,SV1,KDTA)                      |</p>
<table>
<thead>
<tr>
<th>CALL SIGMT (S,T,SIG,KDTA)</th>
</tr>
</thead>
</table>
| **-----------------------------------------------**
<p>| <strong>CONSECUTIVE RECORD SERIALIZATION ROUTINE</strong>     |
| ARRAYS ARE COMPLETE AT THIS POINT FROM INDEX 1  |
| TO THE END OF THE SMALLER OF THE SALINITY OR    |
| TEMPERATURE ARRAYS.                              |
| GENERATE SERIAL NUMBERS FOR THE RECORDS.         |
| IF (JREC.GT.18) GO TO 1240                       |
| JREC = 1                                         |
| CONTINUE                                         |
| DO 1250 J=1,KDTA                                 |
| JREC = JREC+1                                    |
| IREC(J) = JREC                                  |</p>
<table>
<thead>
<tr>
<th>CONTINUE</th>
</tr>
</thead>
</table>
| **-----------------------------------------------**
<p>| <strong>OUTPUT</strong>                                      |
| THIS SECTION CONVERTS THE LETTER DESIGNATOR FOR  |
| MONTH(AMONC) FROM THE SINGLE LETTER CODE ON THE  |
| DIGITIZED TAPE TO THE APPROPRIATE MONTH AND YEAR |</p>
<table>
<thead>
<tr>
<th>IN PREPARATION FOR WRITING THE OUTPUT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO 1260 J=1,13</td>
</tr>
<tr>
<td>IF (AMONC.EQ.AMONCA(J)) GO TO 1280</td>
</tr>
<tr>
<td>CONTINUE</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>1270 FORMAT (15X,'AMONC NEVER DID EQUAL AMONC(J).</td>
</tr>
<tr>
<td>CONSEQUENTLY, 1WMONTH WILL NOT BE DEFINED.')</td>
</tr>
<tr>
<td>WRITE (6,1270)</td>
</tr>
<tr>
<td>GO TO 1290</td>
</tr>
<tr>
<td>1280 WMONTH = EVENT(J)</td>
</tr>
<tr>
<td>CONTINUE</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
</tbody>
</table>
*************** OCEANOGRAPHIC DATA STATION SUMMARIES ***************

IF (.NOT.PRT1) GO TO 1300

PRINT DATA
WRITE (6,1560)
THE PARAMETER ISQZ PERMITS CONDENSING THE PRINTED DATA BY THE
FACTOR ISQZ
CALL OUTI (D,T,S,SV,SIG,KDTA,ISTA,WMONTH,IREC,JREC,ISQZ)

****************************************************************************** WRITE TAPE *********************

1300 IF (.NOT.TAPE) GO TO 1340
TAPE MUST BE TRUE ONLY ONCE, AT THE BEGINNING OF TAPE WRITING.
WRITE HEADER STATION LABEL HERE.
WRITE (8,1310) ISTA,WMONTH,KDTA
1310 FORMAT (15,A12,16,17X)
WRITE (8,1320) (D(J),T(J),S(J),SV(J),SIG(J),J=1,KDTA)
1320 FORMAT (F6.2,2F6.3,F7.2,F7.4,8X)
LENCL WILL BE 40 DIGITS IN LENGTH. PROVIDE APPROPRIATE JCL.
WRITE (6,1330) ISTA,WMONTH,JREC
1330 FORMAT (5X,'DATA FOR STATION ',A15,A12,' WRITTEN ON TAPE UP TO 1
RECORD ',I6)

****************************************************************************** DATA CARD PUNCH ROUTINE ******

1340 IF (.NOT.CARDS) GO TO 1430
THE PUNCH DATA IS COMPRESSED BY FACTOR ICSQZ. FORMAT FOR TWO
DATA SETS ON A CARD. KCRD BECOMES THE NUMBER OF DATA PRINTED IF
IT IS EVENLY DIVISIBLE. OTHERWISE, LAST DATUM POINT IS PUNCHED.
SUPPLY JCL FOR CARD PUNCHING
KCRD = KDTA/ICSQZ
NCARDS = KCRD/2
IDIF = KCRD-2*NCARDS
IF (IDIF.EQ.0) GO TO 1360
KCRC = KCRD+1
1350 FORMAT (24X,'OCEANOGRAPHIC DATA FROM U C M II',//)
1360 WRITE (7,1350)
WRITE (7,1370) KCRD,ISTA,WMONTH,ICSQZ
1370 FORMAT (1X,I4,1X,'VALUES OF D,T,S,SV,SIGMT FOR STATION ',I4,A12,
1 ' COMPRESSED BY ',I4,I3/A)
1380 FORMAT (2X,'DEPHT',3X,'DEPHT',1X,'SALNTY',1X,'SND.VEL',1X,
1 'SIGMA-T',3X,'DEPHT',2X,'DEPHT',1X,'SALNTY',1X,'SND.VEL',1X,
2 'SIGMA-T')
1390 FORMAT (2X,'METERS',2X,'DEG.C',1X,'PPT',4X,'M/SEC',13X,'METERS',)
1  LX,'DEG.C.',1X,'PPT.',4X,'M/SEC',10X,/
   WRITE (7,1380)
   WRITE (7,1390)
   ICS2 = ICSQZ+2
   J = 1
   K1 = 1
   KK = ICSQZ
   WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1),D(KK),T(KK),S(KK),
   1SV(KK),SIG(KK)
   J = 3
1410  IF (J.GT.NCRDS) GO TO 1420
   K1 = (J-1)*ICSQ2
   KK = K1+ICSQZ
   WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1),D(KK),T(KK),S(KK),
   1SV(KK),SIG(KK)
   J = J+1
   GO TO 1410
1420  IF (IDIF.EQ.0) GO TO 1430
   K1 = KDATA
   WRITE (7,1400) D(K1),T(K1),S(K1),SV(K1),SIG(K1)
   C
   ***********************************************
   HYDROGRAPHIC PROGRAM CARD PUNCH
   ***********************************************
1430  IF (.NOT.GCARDS) GO TO 1500
   GCRD = KDATA/ICSQZ
   WRITE (7,1350)
1440  FORMAT (1X,14,'VALUES OF D , T , AND S FOR STATION ',I4,A12,
   1' COMPRESSED BY ',I3,/,)
   WRITE (7,1440) GCRD,ISTA,WMONTH,ICSQZ
1450  FORMAT (2X,'DEPTH',7X,'TEMP.',4X,'SALINITY',15X,'STATION',4X,'DATE
   1',5X,'VALUE',9X)
1460  FORMAT (2X,'METERS',6X,'DEG.C.',5X,'PPT.',51X,/
   WRITE (7,1450)
   WRITE (7,1460)
   J = 1
1470  K1 = 1
   FORMAT (1X,F7.1,2X,F9.2,1X,F10.3,18X,I3,A12,'
   WRITE (7,1470) D(K1),T(K1),S(K1),I3,WMONTH,K1,J
   J = 2
1480  K1 = (J-1)*ICSQZ
   IF (K1.GE.KDATA) GO TO 1490
   WRITE (7,1470) D(K1),T(K1),S(K1),I3,WMONTH,K1,J
   J = J+1
   IF (J.GE.500) GO TO 1490
   GO TO 1480
1490  K1 = KDATA
WRITE (7,1470) D(K1),T(K1),S(K1),ISTA,WMONTH,K1,J

C
C
C ***************************************************************
C JREC IS INCREMENTED HERE BY 1 TO ACCOUNT FOR TAPE ID LABEL FOR
C NEXT STATION TO BE PROCESSED. THIS KEEPS SERIALIZATION OF
C RECORDS ON TAPE CONSECUTIVE AND INCLUDES LABELS FOR EACH STATION.
C
1500 JREC = JREC+1
C ***************************************************************

1510 IF (ENDFL) END FILE 8
C
C NORMALLY, ENDFL MUST BE TRUE ONCE ON THE LAST TAPE WRITING
C OPERATION. HOWEVER, IT IS NOT REQUIRED BY IBM. IT IS WRITTEN
C ALWAYS AFTER LAST TAPE WRITING OPERATION WITHOUT COMMAND.
C
C ***************************************************************
C ******** INITIALIZE VARIABLES AND ARRAYS FOR NEXT STATION *******

C
C DO 1520 J=1,1801
C D(J) = 0.0
C T(J) = -5.0
C S(J) = 0.0
C D2(J) = 0.0
C T2(J) = -5.0
C S2(J) = 0.0
C T1(J) = -5.0
C S1(J) = 0.0
C IREC(J) = 0
1520 CONTINUE
C
C INS(1) = 1
C INS(2) = 1
C INTA(1) = 1
C INTA(2) = 1
C KBARF = 0
C KSCAF = 0
C
C DO 1530 J=3,10
C INS(1) = 980
C INTA(1) = 980
1530 CONTINUE
C
KS = 1
KT = 1

DO 1540 J=1,50
SH(J) = 0.0
TH(J) = -5.0
DH(J) = 0.0
1540 CONTINUE

SKIP = .FALSE.
JSAV = 0
KDTAF = 1
IDEPTH = 0
IH = 0
IP = 0
IF (NOIRG.EQ.1) GO TO 400
GO TO 1570

1550 CONTINUE
1560 FORMAT (1)
1570 IT = IT+1
GO TO 150
1580 STOP
END
SUBROUTINE CHMOVE

C SUBROUTINE CHMOVE (A, I, B, J)
C THIS SUBROUTINE RETURNS A LOGICAL*1 VARIABLE TO A 4-BYTE ADDRESS
C IN THE MAIN PROGRAM, UNPACKING THE ORIGINAL 4-BYTE WORDS A
C BYTE AT A TIME.
C LOGICAL *1A(I), B(J)
C B(J) = A(I)
C RETURN
C END
SUBROUTINE SVEL MOD.1, JUNE 73

SUBROUTINE SVEL (AA, BB, CC, SV, K1)

THIS Computes Sound Velocity FROM Depth, Temperature AND Salinity

According TO WILSON'S EQUATION

DIMENSION AA(1), BB(1), CC(1), SV(1)

DO 30 J=1, K1

Z = AA(J)
T = BB(J)
S = CC(J)

IF (T, LT, 1.99, OR, S, LT, 0.1) GO TO 20

P = 1.027*Z+1.282E-7*T*Z

T3 = T2*T

VT = 4.5721*T-4.4532E-2*T2-2.6045E-4*T3+7.9851E-6*T3*T

P2 = P**P

P3 = P2**P

P4 = P2**P2

VP = 0.160272*P+1.0268E-5*P2+3.5216E-9*P3-3.3603E-12*P4

SR = S-35.

VS = 1.39799*SR+1.69202E-3*SR*SR

VSTP = SR*(-1.1244E-2*T+7.7711E-7*T2+7.7016E-5*P-1.2943E-7*P2+3.15

180E-8*P*P+1.5799E-9*P*T2)+P*(-1.8607E-4*T+7.4812E-6*T2+4.5283E-8*T3

2J+P2*(-2.5294E-7*T+1.8563E-9*T2)+P3*(-1.9646E-10*T)

SV(J) = 1.44914+VT+VP+VSTP+VS

GO TO 30

20 SV(J) = 0.

30 CONTINUE

RETURN
END
SUBROUTINE SIGMT (AA, BB, SIG, K1)

THIS SUBROUTINE COMPUTES SIGMA-T FROM SALINITY AND TEMPERATURE ACCORDING TO H. 0. 614 P. 91

DIMENSION AA(1), BB(1), SIG(1)

DO 30 J=1, K1
  S = AA(J)
  T = BB(J)
  IF (T, LT, -1.99, OR, S, LT, 0.1) GO TO 20
  CL = (S - 0.03) / 1.805
  B = T * (18.03 - 0.8164 * T + 0.01667 * T ** 2) * 10. ** (-6)
  A = T * (4.7667 - 0.098185 * T + 0.0010843 * T ** 2) * 10. ** (-3)
  SG = -0.069 + 1.4708 * CL - 0.001570 * CL ** 2 + 0.0000398 * CL ** 3
  SGA = -(T - 3.98) ** 2 / 503.57 * ((T + 283) / (T + 67.26))
  SIG(J) = SGA + (SG + 0.1324) * (1 - A + B * (SG - 0.1324))
  GO TO 30
20 SIG(J) = 0.
30 CONTINUE
RETURN
END
SUBROUTINE CONDNS (X,Y,I1,JJJ,NE,KDT1,KDTH1,KDTH2)

SUBROUTINE CONDNS MOD. 3, 17 SEP 74 BY R. G. PAQUETTE.

THIS SUBROUTINE FINDS THE ARRAY LOCATIONS FOR X, INDEXED
SEQUENTIALLY FOR EACH UNIT OF Y. EACH UNIT OF Y IS 1.0 AND
CORRESPONDS TO .01 INCHES OF TRAVEL IN THE DEPTH DIRECTION.
MOD. 3 FILLS IN BLANK ARRAY POSITIONS DUE TO THE DIGITIZER STEPP-
ING AHEAD MORE THAN .01 INCHES AT A STEP AND WRITES A MESSAGE
ON THE PRINTER.

DIMENSION X(1), Y(1), T1(1), KINS(10), KNO(10)

IF FIRST INDEX IS ZERO OR NEGATIVE THERE IS A MISBEHAVIOR ELSE-
WHERE IN THE PROGRAM. RESET JJJ TO 1.

IF (JJJ.GE.1) GO TO 30
JJJ = 1
WRITE (6,20)
20 FORMAT (/5X,'***** JJJ RESER TO ONE - SOMETHING WRONG *****/')

KDTH1 BECOMES THE INDEX OF THE START OF THIS ARRAY SEGMENT.

30 KDTH1 = Y(JJJ)+1.50

IF KDTH1 BECOMES ZERO OR LESS (THE ORIGIN OF MEASUREMENT IS
POSITIVE WITH RESPECT TO THE START OF TRAC)), USE THE START
OF THE CURVE AS THE ORIGIN OF INDEXING.

THIS CAUSES AN OVERLAP BETWEEN ARRAYS, BUT IT SHOULD BE SMALL.

XINC = 0.
IF (KDTH1.GT.0) GO TO 40
XINC = FLOAT(1-KDTH1)
KDTH1 = 1

40 JJI = JJJ+1
NEI = NE-1
FORM SUBSCRIPTS FROM THE DEPTH INCREMENTS AND STORE X'S AT THOSE
ARRAY LOCATIONS.
SEARCH FOR BLANKS IN ARRAY BETWEEN INDEXES KDTH1 AND KDTH2.

KCT COUNTS THE NUMBER OF BLANKS

KCT = 0
KS4V = KDTH1
KINS(J) IS THE NUMBER OF THE ARRAY POSITION FILLED.

DO 50 J=1,10
KNO(J) = 0
50 KINS(J) = 0
DO 80 J=JJ1,NE1
KDTH = Y(J)+1.50+XINC
T1(KDTH) = X(J)
C TEST TO SEE IF INDEX IS THE SAME OR ONE GREATER THAN THE LAST
C ONE.  IF NOT, INTERPOLATE VALUES.
NREP = KDTH-KSAV
IF (NREP.LE.1) GO TO 70
KCT = KCT+1
IF (KCT.GT.10) KCT = 10
KNI(KCT) = NREP
KINS(KCT) = KDTH
II = KSAV+1
IJI = KDTH-1
E = FLOAT(NREP)
G = T1(KDTH)
F = G-T1(KSAV)
C
DO 60 I=JI,JJI
60 T1(I) = (FLOAT(I-KSAV)/E)*F+T1(KSAV)
C
70 KSAV = KDTH
80 CONTINUE
C
KDTH2 = Y(NE)+1.50+XINC
C INSERT THE FIRST POINT, WHICH OTHERWISE WOULD BE THE LAST
C ONE FOR WHICH Y(J).LT.1.
T1(KDTH1) = X(JJ1)
T1(KDTH2) = X(NE)
C SAVE INDEX OF END OF ARRAY.
C
WRITE DOWN NUMBER AND LOCATIONS OF INTERPOLATED VALUES.
WRITE (6,90) KCT,(KINS(I),I=1,KCT),(KNO(I),I=1,KCT)
90 FORMAT (6,9X,'BLANK ARRAY POSITIONS FILLED IN ','I3',' PLACES. BEGIN
NING INDEXES AND NO. OF STEPS'/5X,'I10 EACH') ARE: ',5X,10I6/
2 5X,10I6/
RETURN
END
SUBROUTINE TPRD

TPRD IS A MODIFIED VERSION OF TAPRD, WHICH ALLOWS THE USER TO
READ MAGNETIC TAPE RECORDS WHICH CANNOT BE READ BY STANDARD
METHODS. TPRD DIFFERS FROM TAPRD ONLY IN THAT IT ALLOWS
RECORDS TO BE SKIPPED. THIS IS ACCOMPLISHED BY ALTERING THE
FOLLOWING CARDS:

<table>
<thead>
<tr>
<th>CARD NO.</th>
<th>TAPRD VERSION</th>
<th>TPRD VERSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPR01430</td>
<td>TAPRD CSECT</td>
<td>TPRD CSECT</td>
</tr>
<tr>
<td>TPR01910</td>
<td>MVI TPCCH, X'3f'</td>
<td>MVI TPCCH, X'37'</td>
</tr>
<tr>
<td>TPR02990</td>
<td>TAPRD CSECT</td>
<td>TPRD CSECT</td>
</tr>
</tbody>
</table>

OTHERWISE, THE PROGRAMS ARE IDENTICAL. A LISTING OF TPRD VERSION
MINUS THE DOCUMENTATION IS PROVIDED BELOW. SEE W.R.CHURCH
COMPUTER CENTER LIBRARY FOR LISTING OF TAPRD AND APPLICABLE
DOCUMENTATION.

MACRO
REGS
LCLA &N
LCLG &SYM
ADJP
.*LOCP
&SYM
SETC '&N' &N+1
EQU &SYM
AIF (&N LT 16).LOOP
MEND
SPACE 2

TPRD CSECT
SPACE 2
SPACE 2
REGS
SPACE 2
STM R14, R12, 12(R13)
LR R12, R15
USING TPRD, R12
LA R11, SAV1
ST R13+4(R11)
ST R11:8(R13)
LR R13, R11
LR R11, R1
USING ARG5, R11
GET ADDRESS OF ARGUMENT LIST
L R10, AADD
ST R10, SHOVAAD
PUT IN LIST FOR SHOVE CALL
L R10, ALADD
L R10, 0(R10)
ST R10, SHOVALN
PUT LENGTH IN SAME LIST
TPR01300
TPR01310
TPR01320
TPR01330
TPR01340
TPR01350
TPR01360
TPR01370
TPR01380
TPR01390
TPR01400
TPR01410
TPR01420
TPR01430
TPR01440
TPR01450
TPR01460
TPR01470
TPR01480
TPR01490
TPR01500
TPR01510
TPR01520
TPR01530
TPR01540
TPR01550
TPR01560
TPR01570
TPR01580
TPR01590
TPR01600
LA R10, TPDCB
USING IHADCDB,R10
TM DCBFLG3,X'10' HAS DCB BEEN OPENED?
B0 OOKK YES
TM BAUBOMB,X'AA' HAS THERE BEEN PREVIOUS CATASTROPHE?
BNO ONWITHIT NOPE, GO AND OPEN IT
SPACE 2
KIKIT ABEND 3,DUMP SHOULDN'T EVER GET HERE, CRASH
SPACE 2
ONWITHIT OPEN (TPDCB,INPUT) DID STUPID THING OBEY?
BNO KIKIT NOPE, GO PUNT
L R9,DCBDEVBAD GET POINTER AND DEVICE STATISTICS TABLE
L R9,32(R9) GET UCB ADDR OUT OF DEB
SR R6,R5
IC R6,9(R9) GET STAT TABLE POINTER
MH R0,=H'10' POINTER * 10
L R9,16 POINTER TO CVT
L R9,112(R9) POINTER TO STAT TABLE START
LA R9,0(R6,R9) GOTCHA STAT TABLE
ST R9,STATTAB SAVE ADDRESS OF STAT TABLE
MVC OLUSTAT,0(R9) SAVE ITS INFO
SPACE 2
OOKK 4,R0,SHOVALN GET BLKSIZE FOR TAPE EXCP BUFFER
STH R0,BYCNCT PUT DATA LENGTH INTO CCW
L R1,SHOVAAD
ST R1,TPBUFLOC
MVC TPBLOC,TPBUFLOC+1 PUT BUFFER LOC IN CCW
LTR R0,R0
B0 OOKKK
MVI TPCGW,X'37'
BAL R9,TPGET
MVI TPCGW,X'02'
BAL R9,TPWAIT
B RETURN
SPACE 2
OOKKK BAL R9,TPGET GO READ A BUFFER
SPACE 2
BAL R9,TPWAIT GO WAIT TILL READ FINISHED
RETURN LA R15,0 NORMAL RETURN, MODIFIED ELSEWHERE
L R13,4(R13) RESTORE REGISTERS
L R14,12(R13)
LM R0,R12,20(R13)
BR R14
SPACE 2
TPEOF MVI RETURN+3,X'04' SET EOF RETURN
SPACE 2
OUT CLOSE TPDCB
SPACE 2
MVI BADBOMB,X'AA' TURN ON FLAG
B RETURN
SPACE 2
GETSTAT L R9,STATTAB ARRIVE HERE ON BAD READ
MVC NEWSTAT,O(R9) GET CURRENT STAT TABLE
L R9,SHOVAAD MOVE OLD AND NEW STAT TABLES TO FTN
MVC O(R9),OLDSTAT ARRAY BEFORE ERROR RETURN
MVI RETURN+3,X'08' SET I/O ERROR RETURN
B OUT
SPACE 2
TPGET MVI TPECB,X'00' CLEAR ECB
MVC TPEXCP,TPCCW
MVI RDFLAG,X'FF' TURN ON READ FLAG
EXCP TPDB BR R9 RETURN
SPACE 2
TPWAIT TN TPECB,X'40' IS IT ALREADY DONE?
BU NOWAIT YES
WAIT ECB=TPECB NO, WAIT FOR IT
NOWAIT CLI TPECB,X'7F' DID IT DO IT OK?
BE OK1 YES, CONTINUE
SPACE 2
CLI TPCS W+3,X'0D' PROBABLE EOF IF CHAN-DEV END & UNIT EXCEPT
BNE GETSTAT NOPE, GO FIND ERROR
CLI FLAGS1,X'04' EXCEPTIONAL CONDITION BIT ON? (=EOF)
BNE GETSTAT NO EOF
LCTR R1,DCBLKCT DECREMENT DCLBLKCT SO IT MATCHES TAPE
ST R1,DCBLKCT TRAILER LABELS
EOV TPDCB YES, EOF - FORCE CONTROL TO EODAD RTN
SPACE 2
OK1 BR R9 RETURN
SPACE 2
SAV1 DC 18F'0'
SPACE 2
OLDSTAT DC D'0' COPY OF STAT TABLE AFTER OPEN
NEWSTAT DC D'0' COPY OF STAT TABLE UPON ERROR
SPACE 2
TPEXCP DC D'0' LOC CONTAINING CCW BEING USED
TPCCW DC X'02' READ
TPBLOC DC A31'0' DATA ADDRESS
FLGS DC X'20' SUPPRESS INCORRECT LNGTH
BYTCNT DC H'0' BYTE COUNT
SPACE 2
SHOVSMF DC A(0) LOC OF SMF INFO
SHOVAAD DC A(0) ADDR OF FORTRAN ARRAY
SHOVALN DC F'0' BYTE LENGTH OF FORTRAN ARRAY
TPBUFLGC DC A(0) LOC OF DBCBLKSI LENGTH TAPE BUFFER
STATTAB DC A(0) LOC OF STAT TABLE
RDFLG DC X'00' =X'FF' AFTER READ, BEFORE WAIT
BADDONB DC X'00' FLAG TO TELL WHETHER DDB USED BEFORE
TPDCB DDB DDBNAME=METTAP,MACRF=(E),EODAD=TP EOF,DSORG=PS,
        LOBAD=TP10B,DEVD=TA
TP10B DS OCL32
FLAG1 DC X'00'
FLAG2 DC X'00'
SENSE1 DC X'00'
SENSE2 DC X'00'
ECBCOD DC X'00'
ECBADD DC AL3(TPECB)
FALGS3 DC X'00'
TPCSW DC 7X'00'
SIODQDE DC X'00'
EXCPADD DC AL3(TPEXP)
RESERC DC X'00'
DCBADDR DC AL3(TPDCB)
REPOMD DC X'00'
RESTART DC AL3(0)
BLINC DC H'1'
ERRORTN DC H'0'
TPECB DC F'0'
ARGS DSECTION
AADD DC A(0) ADDRESS OF FORTRAN ARRAY
ALADD DC A(0) ADDRESS OF LENGTH OF FORTRAN ARRAY
PRINT NOGEN
DCBO DSORG=PS,DEVD=TA
PRINT GEN
TPRD CSECTION
     LTORG
     END
APPENDIX B

TITLE DIGIXBT

PROGRAMERS R.E. BLUMBERG, R.E. GREER. ADAPTED FROM DIGISTD PROGRAM
WHICH WAS AN EXTENSIVE MODIFICATION OF AN ORIGINAL
PROGRAM, MIZZ, BY R.G. PAQUETTE.

DOCUMENTATION R.E. BLUMBERG

DATE 26 JUNE 1975

PURPOSE PROGRAM READS AND PROCESSES DIGITIZED TEMPERATURE AND
DEPTH DATA FROM A CALMA DIGITIZER 7-TRACK TAPE. THE
DATA IS COMPUTED AND STORED FOR EVERY 0.01 OF AN INCH
OF DEPTH INCREMENT ON THE XBT TRACE. PROGRAM COMPUTES
DEPTH AND TEMPERATURE FOR EACH INDIVIDUAL
OCEANOGRAPHIC STATION AND PERMITS PRINTED, PUNCHED
CARD OR 9-TRACK TAPE OUTPUT. NOTE, THIS PROGRAM IS
SET UP TO PROCESS WATER TEMPS BETWEEN 1 AND 25 DEGREES
CELSIUS.

SEQUENCE THE PROGRAM PERFORMS THESE FUNCTIONS IN THE FOLLOWING
SEQUENCE:
(A) INITIALIZES ALL ARRAYS AND VARIABLES
(B) SKIPS XXX NUMBER OF RECORDS IF NSKP=GREATER THAN
ZERO.
(C) READ PAIR OF DATA CARDS (LABEL AND DAT) FOR
RECORD BEING PROCESSED. COUNT RECORDS.
(D) PROGRAM TERMINATES IF ISTOP=1 OR DESIRED NUMBER
OF RECORDS PROCESSED.
(E) HEADER INFO MISSING ON TAPE, INSERT ON CARDS BY
SETTING IMBR=1.
(F) SKIP UNREADABLE OR BAD RECORD IF NRCKP SET
EQUAL TO THE BAD RECORD NUMBER.
(G) READ USABLE RECORD INTO THE A ARRAY
(H) MOVE BYTES OF A ARRAY INTO 4-BYTE WORDS OF B
ARRAY TO ALLOW PROCESSING BY STANDARD FORTRAN.
(1) PROCESS RAW B ARRAY
   (1) IF HEADER RECORD, PROGRAM DECODES HEADER
       LABEL AND COMPARES TO LABEL SUPPLIED BY DATA
       CARD.
   (2) IF TRACER RECORD, PROGRAM ADDS AND STORES
       CUMULATIVE SUMS OF X AND Y DISTANCE TRAVEL.
       SUBROUTINE CONDNS INDEXES THE VALUES OF
CUMULATIVE DISTANCE BY INCREASING DEPTH UNITS.
(J) CONVERT THE X AND Y ARRAYS TO DEPTH AND
TEMPERATURE.
(K) MANUALLY INSERT SURFACE AND NEAR SURFACE VALUES
VIA DATA CARDS.
(L) ELIMINATE EXCESSIVELY HIGH OR LOW VALUES.
(M) COMPUTE CONSECUTIVE RECORD SERIALIZATION FOR
TAPE OUTPUT NUMBERING SCHEME.
(N) CONVERTS LETTER DESIGNATOR MONTH/YEAR CODE,
AMONG, TO REAL*8 MONTH AND YEAR.
(O) DATA OUTPUT IN EITHER REGULAR PRINTOUT, TAPE, OR
PUNCHED CARDS. CARD OUTPUT SUITABLE FOR THESSI.
(P) INITIALIZE ARRAYS AND VARIABLES FOR PROCESSING
NEXT STATION'S DATA.
(Q) REPEAT STEPS (C),THRU (P) UNTIL ALL RECORDS ARE
PROCESSED, ISTOP=1, OR THE NUMBER OF DESIRED
RECORDS (NN) ARE READ.

FEATURES

THIS IS A HIGHLY VERSATILE PROGRAM FOR PROCESSING
OCEANOGRAPHIC DATA FROM 7-TRACK TAPE. FEATURES OF THE
PROGRAM ARE LISTED UNDER THE FOLLOWING SIX GENERAL
CATEGORIES:
(A) INPUT
(1) 7-TRACK CALMA DIGITIZER TAPE IN BCD.
(2) TWO DATA CARDS REQUIRED PER TRACE SEGMENT
RECORD OR HEADER LABEL RECORD. AN XBT TRACE
REQUIRES 4 CARDS, ONE PAIR FOR THE HEADER AND
ONE PAIR FOR THE TRACE. THE FOLLOWING IS A
SAMPLE DATA CARD SHOWING DATA CARDS FOR STATION
207 AND 208. ALSO SHOWN IS THE 'STATION END'
CARD WITH ISTOP SET EQUAL TO ONE. THIS IS
FOLLOWED BY THE JCL NECESSARY TO READ THE 7-
TRACK TAPE. COLUMN 1 IS BLANK ON THE DATA CARDS.

&CONTROL NN=104, IDSCL=1, ICODE=0, ITSCL=1, ISCL=1, IP=1, ISQZ=01,
ICSQZ=3, TAPE=3, CARDS=2, TCR=1.1, XBTCR=0.0, NSKP=6, &END

UCMS RT STATIONS 207V THRU 317V TAPE UCM011
HEAD XBT
&p IDT DEPTH=97, ISTA=207, AMONC='V', &END
TRACER XBT
&p IDT DEPTH=00, DH=0.0, TH=12, 12, IH=1, &END
HEADER XBT
&p IDT DEPTH=99, ISTA=208, AMONC='V', &END
TRACER XBT
&p IDT DEPTH=00, &END
STATION END

// CDB=$(DEN=1, TRCH=ET)
(B) SUBROUTINES

420
(1) TPRED-READS THE 7-TRACK MAGNETIC TAPE.
(2) CHMOVE- TAKES THE DATA THAT HAS BEEN READ
    INTO THE A ARRAY AND STORES IT IN USABLE FORM
    IN THE B ARRAY.
(3) CUMSUM- INDEXES THE VALUES OF CUMULATIVE
    DISTANCE BY INCREASING DEPTH UNITS.
(4) OUT2- PRINTS OUT GEOPHYSICAL STATION DATA.

(A) AUTOMATIC DATA PROCESSING/HANDLING
(1) HANDLES OPERATOR MISTAKES MADE IN TRACING XBT
    CURVES ON CALMA DIGITIZER.
(2) SKIPS INITIAL NUMBER AND INDIVIDUAL BAD
    RECORDS ON 7-TRACK TAPE.
(3) DECODES 7-TRACK TAPE HEADER LABELS AND TRACE
    RECORDS.
(4) COMPUTES DATA FOR EVERY 0.01 INCH OF CALMA
    DIGITIZER STYLUS MOVEMENT.
(5) ALLOWS ENTRY OF HAND ENTERED DATA FOR
    SURFACE AND NEAR SURFACE VALUES.
(6) EDITS OUT EXCESSIVELY LOW & HIGH VALUES.
(7) PROVIDES CONSECUTIVE RECORD SERIALIZATION
    FOR TAPE OUTPUT.

(D) DIAGNOSTICS
(1) WRITES FIRST TWENTY FIVE VALUES OF DEPTH AND
    TEMPERATURE FOR DATA INSPECTION.

(E) TROUBLE-SHOOTING
(1) HANDLES MULTIPLE KEYBOARD AND TRACER SYMBOL
    ENTRIES.
(2) PROVIDES FOR A MISSED OR INCOMPLETE HEADER
    LABEL.
(3) HANDLES MISSING INTER-RECORD GAP (IRG).
(4) HANDLES DELETION OF RECORD BY INCREASING RECORD
    COUNT AND READING SAME PAIR OF CARDS AGAIN.
(5) COMPARES CARD HEADER LABEL AND TAPE HEADER
    LABEL AND ACCEPTS CARD VALUES IF CARD AND TAPE
    DISAGREE.

(F) OUTPUT
(1) PRINTER- TWO PRINTING VARIABLES, PRT1 AND
    PRT2. PRT2 PROVISION ONLY.
(2) CARD-PUNCH ED DATA CARDS SUITABLE FOR USE WITH
    THESIS.
(3) TAPE- 9-TRACK TAPE
(4) PLOTTING- PROVISION FOR PLOTTING ROUTINES
    ACTUATED BY PLT1 AND PLT2 ARE NOT PRESENTLY
    PROGRAMMED.

ARGUMENTS

PROGRAM CONSISTS OF MANY TERMS, ARRAYS, AND VARIABLES.
SOME OF THESE VARIABLES ARE USED IN THE DIGISOD
PROGRAM. THEY WERE INCLUDED IN THIS PROGRAM TO KEEP
THE HEADER LABEL PROCESSING ON THE CALMA DIGITIZER
THE SAME FOR BOTH STD AND XBT TRACES. THESE VARIABLES
ARE IDENTIFIED BELOW AND ARE SET EQUAL TO A CONSTANT
IN THIS PROGRAM.
THE FOLLOWING IS A BRIEF DESCRIPTION OF THE
IMPORTANT ARGUMENTS LISTED ALPHABETICALLY UNDER TWO
GENERAL CATEGORIES:

(A) ARRAYS

D,T = DEPTH, TEMPERATURE
DHST = HAND-ENTERED SURFACE OR NEAR SURFACE
     DATA
X,Y = CUMULATIVE SUMS OF DISTANCE TRAVELED BY
     THE DIGITIZER STYLUS. STORAGE IS
     PROVIDED FOR 20 INCHES TOTAL TRAVEL
     OF THE STYLUS ON EACH COORDINATE
     AXIS. THIS INCLUDES BOTH PLUS AND MINUS
     DIRECTIONS.
NRCSKP = NUMBER OF THE INDIVIDUAL RECORD SKIPPED
DCON = DEPTH CONSTANT NUMBER OF 0.01 INCHES
     PER UNIT OF DEPTH.
IREC = CONSECUTIVE SERIAL RECORD NUMBER FOR
     TAPE
AMONCA = MONTH/YEAR CODE LETTER.
EVENT = MONTH AND YEAR.

(B) VARIABLES

CARDS = PERMITS PUNCHING CARDS
CTRL = NAMELIST VARIABLE USED FOR INFREQUENTLY
       CHANGED VARIABLES.
DCOR = DEPTH CORRECTION TERM.
DAT = NAMELIST VARIABLE USED FOR
       FREQUENTLY CHANGED VARIABLES.
DLTREC = DELETE RECORD
FLAG = INDICATES START OF DATA TRACE.
ICODE = VARIABLE HELD OVER FROM DIGISTD
        ICODE IS A CONSTANT = ZERO.
ICSQZ = VARIABLE USED TO COMPRESS NUMBER OF
        DATA POINTS PUNCHED ON CARDS.
IDENT = VARIABLE USED TO IDENTIFY HEADER
        LABEL, (IDENT = 99) OR TRACE RECORD
        (IDENT = 00).
IDSCL = VARIABLE HELD OVER FROM DIGISTD PROGRAM
        IDSCL IS A CONSTANT = 1.
IH = NUMBER OF HAND ENTERED SURFACE OR
     NEAR-SURFACE DATA VALUES.
IHDR = VARIABLE USED TO IDENTIFY MISSED HEADER
       LABEL ON TAPE. ALLOWS MISSING INFO TO BE
      
C
C = INSERTED ON CARDS.
C = VARIABLE IDENTIFIES LAST RECORD OF
C PARTICULAR STATION. SINCE XBT IS A
C SINGLE TRACE IP IS A CONSTANT = 1.
C = VARIABLE HELD OVER FROM DIGISTD
C PROGRAM ISQL IS A CONSTANT = 1.
C = VARIABLE USED TO COMPRESS NUMBER
C OF DATA POINTS PRINTED BY PRINTER.
C = VARIABLE IDENTIFIES STATION NUMBER.
C = VARIABLE TERMINATES PROGRAM IF = 1 ON
C FINAL &DATA CARD.
C = VARIABLE HELD OVER FROM DIGISTD PROGRAM
C ITSL IS A CONSTANT = 1.
C = VARIABLE USED TO COUNT RECORDS FOR
C RECORD SERIALIZATION PURPOSES.
C = VARIABLE USED TO CONTROLL NUMBER OF
C DATA CARDS READ.
C = KEYBOARD SYMBOL ON THE DIGITIZED TAPE.
C = NUMBER OF RECORD PROCESSED FOR
C PARTICULAR STATION.
C = HEADER TYPE DATA CARD WHICH
C IDENTIFIES STATION NUMBER, MONTH, ETC.
C = NUMBER OF CARDS PUNCHED BY CARDS
C PUNCHING ROUTINE.
C = INDEX AT THE LAST USEFUL ARRAY
C POSITION OF THE X[DEPTH] ARRAY.
C = VARIABLE USED TO INDICATE MISSING
C END OF RECORD GAP ON TAPE.
C = NUMBER OF DATA POINTS TO BE PUNCHED
C BY CARDS PUNCHING ROUTINE.
C = NUMBER OF INITIAL RECORDS ON TAPE
C TO BE SKIPPED.
C = CORRECTION FACTOR ADDED TO
C TEMPERATURE DATA VALUES.
C = REAL*8 - MONTH AND YEAR
C
C -------------------------
C SUBROUTINE TPRD -------------
C
C TPRD IS IN ASSEMBLER LANGUAGE AND REQUIRES SPECIAL JCL.
C THE COMMENT CARDS ARE INCLUDED HERE BECAUSE NO COMMENT CARDS ARE
C ALLOWED TO BE MIXED WITH ASSEMBLER LANGUAGE SUBROUTINE.
C A /* FOLLOWED BY A //ASH-SYSIN DD */ MUST PRECEDE THE DECK.
C THIS DECK IS RUN UNDER // EXEC PORTCALG.
C TPRD IS A MODIFIED VERSION OF TAPRD, WHICH ALLOWS THE USER TO
C READ MAGNETIC TAPE RECORDS WHICH CANNOT BE READ BY STANDARD
C METHODS. TPRD DIFFERS FROM TAPRD ONLY IN THAT IT ALLOWS
C RECORDS TO BE SKIPPED. THIS IS ACCOMPLISHED BY ALTERING THE
C FOLLOWING CARDS:
C
C CARD NO. TAPRD VERSION TPRD VERSION

136
GIVE THE ARRAYS INITIAL VALUES

DO 20 J=1,12
TH(J) = 0.1
DH(J) = 0.
20 CONTINUE

DO 30 J=1,1801
D(J) = 0.
T(J) = 0.
30 CONTINUE

DO 40 J=1,99
NRCSKP(J) = 0
40 CONTINUE

READ (5,CONT1)
READ (5,140) LABEL
WRITE (6,150) LABEL
REWIND HERE IF TAPE IS USED. NOTE THAT IF TAPE=T, JCL
MUST BE PROVIDED TO DEFINE IT.
IF (TAPE)REWIND 0
IF (NSKP.EQ.0) GO TO 110

******************************************************************************
***(B) SKP RECORDS.******************************************************************************

NOTE: THE PROGRAM DIFFERENTIATES BETWEEN INITIALLY SKIPPED
RECORDS (NSKP) AND BAD RECORDS (NRCSKP). NRCSKP
REQUIRES DATA CARDS FOR BAD RECORDS SKIPPED AND NSKP
DOESN'T. PLUS NRCSKP ONLY SKIPS A SINGLE RECORD FOR EACH
VALUE ASSIGNED TO NRCSKP, WHEREAS NSKP SKIPS MULTIPLE
RECORDS (IE. NSKP=40, THE FIRST 40 RECORDS ON THE TAPE

DO 50 I5=1,NSKP
I5 = I5
IPS IS SET NEGATIVE DURING THE SKIP PROCESS. THIS AVOIDS TPRD
STOPPING ON UNREADABLE RECORDS. IPS IS THE MAXIMUM NUMBER OF
BYTES OF DATA WHICH WILL BE READ FROM ONE RECORD OF DIGITIZER
TAPE BY TPRD. IPS/2 IS THE MAXIMUM TOTAL TRAVEL ALONG THE CURVE
MEASURED IN HUNDREDTHS OF AN INCH IN THE X AND Y DIRECTIONS
SEPARATELY. NO DATA CARDS ARE NEEDED FOR SKIPPED RECORDS.
IPS = -8000
50 CALL TPRD (A,IPS,670,690)

RESET IPS FOR NORMAL TAPE READING
IPS = 8000
WRITE (6,60) I5
60 FORMAT (/5X,'I5 RECORDS SKIPPED')
GO TO 110

END AND ERROR MESSAGES. PROGRAM STOPS
70 WRITE (6,80) I5
80 FORMAT (/5X,'FOUND END OF FILE ON RECORD',I4,'DURING SKIP PROCESS'/'
1
GO TO 1370
90 WRITE (6,100) I5,A(1),A(2),A(3),A(4)
100 FORMAT (/5X,'READ ERROR ON RECORD',I5,'ERROR STATISTICS ARE:',I4,8)
1
GO TO 1370

REDEFINE LOOP INDEX TO START AT ONE.
110 NNN = NN-NSKP

************************************************************

*(C) READ CARDS AND START MAIN LOOP. COUNT RECORDS.************************************************************

*(D) TERMINATE PROGRAM IF ISTOP=1 OR NUMBER OF RECORDS PROCESSED.****

IT = 1
120 IF (IT.GT.NNN) GO TO 1370
IPS = 8000
NREC = IT*NSKP
WRITE (6,130) NREC
130 FORMAT (/5X,'LABEL 130 : START MAIN LOOP. RECORD NO. ',13/)
THE NUMBER OF RECORDS TREATED IS DETERMINED BY SETTING
NREC. NO RECORDS ON THE CONTROL CARD. OR THE PROGRAM MAY
BE STOPPED BY SETTING ISTOP = 0 ON THE LABEL CARD.
THE LABEL CARD HAS THE LAST FOUR COLUMNS FOR CONTROL ALTHOUGH
ONLY THREE ARE USED HERE. THE 77-TH COLUMN IS JSKIP; IF IT
IS ZERO, ONLY TWO CARDS ARE READ. IF IT IS 1 AN ADDITIONAL CARD,
AN &CTRL CARD, CAN ALSO BE READ. THE 78-TH COLUMN IS ISTOP;
IF IT IS =1 THE PROGRAM STOPS. THE 79-TH COLUMN IS AMONG;
IT IS AN ALPHABETIC CHARACTER THAT DESIGNATES THE MONTH
IN WHICH THE DATA WERE TAKEN. NOTE THAT THIS NEEDS TO BE
ON THE LAST CARD SET READ BEFORE PRINTING. AMONG MAY ALTERNATELY
BE ADDED ON THE &DAT HEADER CARD.
READ (5,140) LABEL, JSKIP, ISTOP, AMONG
140 FORMAT (19A4,211,A1)
IF (ISTOP.GT.0) GO TO 1370
READ (5,DAT)
WRITE (6,150) LABEL
WRITE (6,DAT)
NORMALLY TWO DATA CARDS ARE EXPECTED TO BE READ PER RECORD,
LABEL AND DAT. LESS FREQUENTLY CHANGED NUMBERS ARE ON CTRL.
JJJJ = 0
NOIRG = 0
IF (JSKIP.EQ.0) GO TO 160
READ (5,CTRL)
WRITE (6,CTRL)
150 FORMAT (/5X,19A4/)
C
C******************************************************
C**(E) HEADER INFO MISSING.******************************************************
C******************************************************
C
C
IHDR=1 ON &DAT PROVIDES FOR MISSED HEADER INSERT ALL THE
HEADER INFO ON CARDS, BRANCH TO 540 AND THEN RETURN TO START AT
120 WITHOUT INCREASING THE RECORD COUNT.
160 IF (IHDR.EQ.1) GO TO 540
170 CONTINUE
C
C DIAGNOSTIC WRITE STATEMENTS FOLLOW:
C
C
180 FORMAT (5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.
12/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.2/5X,11F7.
2000)
2005)
2010)
2015)
2020)
2025)
2030)
FILL THE A ARRAY WITH DOLLARS

DO 200 I = 1, 2001
THE 2001 ASSURES THAT THE LAST WORD OF A WILL CONTAIN DOLLARS
SINCE WE READ IN ONLY 8000 BYTES OF DATA.
200 A(I) = DOL

FILL B WITH BLANKS

DO 210 I = 1, 8000
210 B(I) = BLANK

********************
C***(F) SKIP BAD RECORDS.*******************************
C***THE LIST OF BAD RECORDS IS EXAMINED AND SKIPPED.*
C**DO NOT REMOVE THE DATA CARDS FOR THE BAD RECORD.
C*NOTE THAT IF NRCSKP(I) IS ZERO, THE TEST IS SKIPPED.*
C**IF (NRCSKP(I), EQ. 0) GO TO 250
C
DO 220 J = 1, 99
NRCSKP = NRCSKP(J) - NSKP
IF (NRCSKP, EQ. 10) GO TO 230
220 CONTINUE
C
GO TO 250
C***CHANGING IPS TO NEGATIVE CAUSES TPRD TO SKIP A RECORD
C**230 IPS = -8000
C**240 FORMAT (/5X, 'LABEL 240. RECORD NO.', I5, ' SKIPPED VIA NRCSKP SKIP
C**1 ROUTINE.'),/)
C**WRITE (6, 240) IT
C
C****(G) READ USABLE RECORD INTO A ARRAY.**************************
C 250 CALL TPRD (A,IPS,&280,&260)
C IPS IS THE MAXIMUM SIZE OF THE ORIGINAL BCD RECORD. THIS SIZE
/ 200 IS THE MAXIMUM DISTANCE THE STYLUS CAN TRAVEL, + AND/OR -, 
IN EITHER THE X OR THE Y DIRECTION; 60 IS THE END-OF-FILE EXIT,
2 IS THE READ-ERROR EXIT.
GO TO 290
260 WRITE (6,270) A(1),A(2),A(3),A(4)
270 FORMAT (5X,'THE ERROR STATISTICS TABLE IS ',4Z8)
280 CONTINUE
290 CONTINUE
C
C******************************************************************************
C*** (H) MOVE BYTES OF A ARRAY INTO B ARRAY.******************************************************************************
C JJ = 0
C JJ = JJ + 0
C DO 300 II=1,2000
C DO 300 I=1,4
C JJ = JJ + 1
C CALL CMOVE (A(I),I,B(JJ),4)
C IF (B(JJ),EQ.,DLR) GO TO 310
C END OF DATA DETECTED
C 300 CONTINUE
C 310 CONTINUE
C B(8001) = DLR
C******************************************************************************
C*** (I) PROCESS B ARRAY.******************************************************************************
C A DIAGNOSTIC WRITE STATEMENT FOLLOWS:
C WRITE (6,320) JJ,(B(J),J=1,25)
C 320 FORMAT (5X,'LABEL 320. ARRAY B IS FILLED; LOOK FOR MODE CHARACTER
1. THE NUMBER OF ARRAY ELEMENTS PROCESSED INCLUDING STARS AND '*/
25X,'DOLLARS, JJ= ',/5X,'FIRST 25 CHARACTERS ARE: ',
3 10(IX,28),/5X,10(IX,28),'/5X,5(IIX,28)/
C TEST TO SEE IF THIS IS A KEYBOARD ENTRY OR A STAR (TRACER)

AND PERMIT THE POSSIBILITY THAT EITHER 'KEYBOARD' OR 'TRACER'
BUTTONS HAVE BEEN PUSHED TWICE.

IN USING THE CALMA DIGITIZER, SPURIOUS BLANK RECORDS WOULD
APPEAR AT RANDOM THROUGHOUT THE TAPE. WHEN THESE BLANK RECORDS
OCUR DURING A HEADER RECORD NOTHING IS LOST SINCE HEADER
ENTRY IS EASILY INSERTED VIA DATA CARDS BY SETTING IMOR=1.
HOWEVER, IF A BLANK RECORD OCCURS DURING A TRACE RECORD THE
COMPLETE STATION IS LOST. FROM EXPERIENCE A BLANK RECORD
NORMALLY WILL HAVE TWO CHARACTERS (IE. JJ=2). AFTER THE FIRST
RUN THE BLANK RECORDS CAN BE LOCATED AND CAN THEN BE SKIPPED
INDIVIDUALLY OR THE ENTIRE STATION CAN BE SKIPPED DEPENDING
ON WHETHER THE BLANK RECORD IS IN THE HEADER OR TRACE.
THIS PROBLEM IS SUSPECTED TO BE THE RESULT OF MECHANICAL
PROBLEMS WITH THE DIGITIZER ITSELF AND SHOULD NOT BE A
RECURRING PROBLEM.

JJ = 1
GO TO 360

THE FOLLOWING ROUTINE READS ANOTHER SET OF CARDS. THIS IS THE
ENTRY FOR THE SITUATIONS IN WHICH THE IRG IS MISSED.

330 READ (5,140) ISTOP, JSKIP, AMONG
IF (ISTOP.GT.0) GO TO 1370
IF (JSKIP.EQ.0) GO TO 340
READ (5,DAT)
WRITE (6,150) LABEL
WRITE (6,DAT)
READ (5,CTRL)
WRITE (6,CTRL)

DIAGNOSTIC WRITE STATEMENTS FOLLOW:

340 IPLACE = 185
WRITE (6,180) (D(J), J=1,1801,20), IPLACE
WRITE (6,180) (T(J), J=1,1801,20), IPLACE
WRITE (6,190) JJ, NE, KOTH1, KOTH2, JJJJ

C
WRITE (6,350) NOIRG, JJJJ
350 FORMAT (/5X,'LABEL 185. PROCESSING SECOND HALF. NOIRG=',1X,'JJjj',1X,'
JJ = JJJJ
C
INITIALIZE ADDERS, ETC.

360 SUMD = 0
SUMT = 0
N = 0
KL = 0
C
**********************************************************************************
C*** (1) DECODE HEADER LABEL

DIAGNOSTIC WRITE STATEMENTS FOLLOW:

370 FORMAT (5X,'6(JJ)=",2B/)
380 FORMAT (5X,' 15/)
WRITE (6,280) JJ
WRITE (6,370) B(JJ)

LOOK FOR KEYBOARD SYMBOL.
CHECK THE FIRST 11 VALUES OF THE B ARRAY FOR A KEYBOARD
SYMBOL SINCE IT IS POSSIBLE TO HAVE BAD OR INVALID SYMBOLS AHEAD
OF KEYBOARD SYMBOL OF HEADER. IF ALL ELEVEN VALUES ARE NOT KEYS,
RESET JJ TO 1 (IE. JJ=JJ-10) AND PROCESS AS A TRACE. HOWEVER
IF ONE OF THE VALUES 1 THRU 11 IS A KEY GO TO 264 AND
PROCESS AS A HEADER.

IF A TRACER SYMBOL IMMEDIATELY FOLLOWS A KEY SYMBOL, THE HEADER
IS PROBABLY MISSING AND THE SEGMENT IS PROCESSED AS A TRACE.
(Note 1: In the case of a header JJ is not reset to 1.

390 IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ+1
IF (B(JJ).EQ.KEY) GO TO 850
JJ = JJ-10

400 FORMAT (5X,' LABEL 400.',5X)
WRITE (6,400) JJ
IF (KL.EQ.1) GO TO 430
IF (KL.EQ.2) GO TO 430

NO KEYBOARD SYMBOL MAY HAVE FORGOTTEN IT. TEST THE 5TH AND
6TH SYMBOLS (IDEPHT). IF BOTH ARE NINES CALL IT A KEYBOARD
ANYWAY.

IF (B(15).EQ.NINE AND B(6).EQ.NINE) GO TO 410
GO TO 590
410   IJ = JJ + 12
420   WRITE (*, 420) (B(I), I = JJ, IJ)
420   FORMAT (/S5, 'AT 410; MISSING KEY. B(1) TO B(13) = ', 13A1/)

C   PROCESS KEYBOARD ENTRIES. CHANGE THE WORDS TO INTEGER FORM BY SUBTRACTING 240404040 AND CREATE MULTI-DIGIT INTEGERS.
C   SKIP = 1 PERMITS NAMFLIST DATA CARDS TO OVERRIDE TAPE HEADING INFO. ALL HEADING DATA MUST THEN BE PUT ON THE CARDS.
C   IF (SKIP) GO TO 540
C   IS = A 0
C   IDENT = 0
C   DEFINE INDICES FOR DECODING THE LABEL
   KY1 = JJ
   KY2 = KY1 + 2
   KY3 = KY1 + 3
   KY4 = KY1 + 4
   KY5 = KY1 + 5
   KY6 = KY1 + 6
   KY7 = KY1 + 7
   KY8 = KY1 + 8
   KY9 = KY1 + 9
   KY10 = KY1 + 10
   KY11 = KY1 + 11

C   IF THERE IS A DLTREC IN THE HEADER, IT IS FOUND HERE. READ IN A NEW RECORD, AND USE THE SAME CARDS.

C   DO 440 J = KY1, KY10
   IF (B(J + 1) .EQ. DLTREC) GO TO 450
   CONTINUE

C   GO TO 480

C   WRITE (*, 460)
C   460   FORMAT (/S5, 'DLTREC IN HEADER. REPEAT, USING SAME CARDS.'/
C   470   IT = IT + 1
C   GO TO 170
C   DO THE CONVERSION, COMPARE WITH VALUES READ FROM THE CARDS, ACCEPT THE CARDS.
C
C   480   CONTINUE
DO 490 J=KY1,KY2
B(J) = B(J)-ZER
IB = B(J)
490 ISTAA = ISTAA+IB*10**(KY2-J)

AMONT = B(KY3)

DO 500 J=KY4,KY5
B(J) = B(J)-ZER
IB = B(J)
500 IDENT = IDENT+IB*10**(J-KY4)

I5SC = B(KY6)-ZER
I5OD = B(KY7)-ZER
I5SCL1 = B(KY8)-ZER
I5CL1 = B(KY9)-ZER
I5P = B(KY10)-ZER

IF THERE IS A DISAGREEMENT, WRITE A MESSAGE.
IF (ISTAA.NE.ISTA) GO TO 520
IF (IDENT.NE.IDEN) GO TO 520
IF (IDSCL.NE.IDSCL) GO TO 520
IF (ICOD.NE.ICODE) GO TO 520
IF (I5CL1.NE.I5CL1) GO TO 520
IF (I5CL1.NE.I5CL1) GO TO 520
IF (I5P.NE.I5P) GO TO 520
510 FORMAT (5X,'LABEL=510. CARD INPUTS EQUALLED TAPE HEADER FOR
1 STATION ','I3,A1/5X,'IDEPHT= ','I3/)
WRITE (6,510) ISTA,AMONC,IDEN
GO TO 540
520 WRITE (6,520) ISTA,AMONC,IDEN,IDSCL,ICOD,ITSC,ISCL,IP,ISTAA,AMON
IT,IDENT,IDSCL,ICOD,ITSC,ISCL,IP
530 FORMAT (/3X,'CARD AND TAPE DISAGREE, CARD ON TOP',/3X,STA,AMON
1C,IDENT,IDSCL,ICOD,ITSC,ISCL,IP',/3X,17,A7,617/3X,17
2 A4,110,517/)
WRITE THE RESULTS
540 WRITE (6,550) ISTA,AMONC,IDEN
550 FORMAT (5X,'LABEL 550. HEADER PROCESSING COMPLETE EXCEPT SEARCH
1 FOR ERRORS ON STATION ','I3,A1/5X,'IDEN= ','I3/)
C
C CONSIDER IT POSSIBLE THAT NO IRG EXISTS AFTER THE HEADER.
THE PROGRAM HAS FILLED THE B ARRAY WITH BOTH THE HEADER AND
TEMPERATURE TRACE. ASSUME THERE IS A TRACER SYMBOL IN POSI-
TION 12. IF THIS IS SO, CONTINUE TO PROCESS THE B ARRAY.

IF (B(KY11).NE.STAR) GO TO 570
JJJJ = KY11
WRITE (6,560)
560 FORMAT (/5X,'NO IRG AFTER HEADER; CONTINUE TO PROCESS B ARRAY.')
GO TO 350
570 IF (IDR.EQ.0) GO TO 1360
C
THIS BRANCH RETURNS TO 120 IF THE HEADER IS MISSING. SET IDR=1
ON THE CARD.
WRITE (6,580)
580 FORMAT (/5X,'HEADER MISSING; INFO INSERTED WITH CARDS.')
GO TO 120
C
*****************************************************************************
C(2) PROCESS TRACE BY SUMMING X AND Y.*****************************************************************************
C
THE FOLLOWING PROCEDURE PERMITS THE PRESENCE OF ANY REASONABLE
NUMBER OF TRACER SYMBOLS (STAR) INCLUDING NONE.

590 NE = 0
NF = 0
NSTAR = 0
600 IF (B(JJ).EQ.STAR) GO TO 620
C
COUNT STARS AND WRITE MESSAGE
WRITE (6,610) NSTAR
610 FORMAT (/5X,'START TRACER MODE; NO. OF TRACER SYMBOLS = ',I2)
C
WHEN THERE ARE NO MORE STARS, START TESTING FOR COUNT SYMBOLS ETC
GO TO 630
620 JJ = JJ+1
NSTAR = NSTAR+1
C
CONTINUE TO TEST FOR STARS UNTIL NO MORE APPEAR.
GO TO 600
C
THE NEXT BLOCK OF OPERATIONS TO JUST BEYOND 620 LOOPS BACK TO
630 CONTINUING TO ADD OR SUBTRACT FROM THE CUMULATIVE Y AND X COUNTS
UNTIL A DELETE-RECORD SYMBOL OR A STAR OR A DOLLAR INDICATES
THE END OF DATA. THE FLAG IS PLACED AT THE POINT WHERE THE TRACE
ACTUALLY BEGINS TO RECORD T VS D. PREVIOUS COUNTS RESULT
FROM THE TRACER TRAVELING FROM THE COORDINATE ORIGIN TO THIS
POINT.

630 IF (B(JJ).EQ.ONE) GO TO 650
IF (B(JJ).EQ.BLANK) GO TO 660
IF (B(JJ).EQ.MINUS) GO TO 670
IF (B(JJ).EQ.FLAG) GO TO 820
IF (B(JJ).EQ.KEY) GO TO 390
C THE NEXT GROUP OF STATEMENTS ALLOW FOR OCCASIONAL COUNTS GREATER
C THAN + CR - 1.
IF (B(JJ).EQ.TWO) GO TO 680
IF (B(JJ).EQ.THREE) GO TO 690
IF (B(JJ).EQ.FOUR) GO TO 700
IF (B(JJ).EQ.FIVE) GO TO 710
IF (B(JJ).EQ.SIX) GO TO 720
IF (B(JJ).EQ.SEVEN) GO TO 730
IF (B(JJ).EQ.EIGHT) GO TO 740
IF (B(JJ).EQ.NINE) GO TO 750
IF (B(JJ).EQ.TEN) GO TO 760
IF (B(JJ).EQ.ELEVEN) GO TO 770
IF (B(JJ).EQ.TWO) GO TO 780
IF (B(JJ).EQ.MTHREE) GO TO 790
IF (B(JJ).EQ.MFOUR) GO TO 800
IF (B(JJ).EQ.MFIVE) GO TO 810
IF (B(JJ).EQ.DLTREC) GO TO 920
WRITE (6,640) B(JJ)
640 FORMAT ('**X',*SYMBOL NOT RECOGNIZED = ',?8//')
C WE ELIMINATE PRINTING OF THIS STATION AND INITIALIZE VARIABLES
C IF IP ALSO IS EQUAL TO 1.
IF (IP.EQ.1) GO TO 1330
650 RX = 1.
GO TO 860
660 RX = 0.
GO TO 860
670 RX = -1.
GO TO 860
680 RX = 2.
GO TO 860
690 RX = 3.
GO TO 860
700 RX = 4.
GO TO 860
710 RX = 5.
GO TO 860
720 RX = 6.
GO TO 860
730 RX = 7.
GO TO 860
740 RX = 8.
GO TO 860
750 RX = 9.
GO TO 860
760 RX = 10.
GO TO 860
770 RX = 11.
GO TO 860
780 RX = -2.
GO TO 860
790 RX = -3.
GO TO 860
800 RX = -4.
GO TO 860
810 RX = -5.
GO TO 860
820 JJJ = NE
JJ = JJ+1
FG = 1
GO TO 630
C CHECK HERE FOR MULTIPLE KEYBOARD SYMBOLS. IF NUMBER EXCEEDS
C EIGHT TERMINATE THE PROGRAM. THE NUMBER EIGHT IS ARBITRARY.
C SELDOM DOES ONE GET MORE THAN THREE KEYBOARD SYMBOLS ON THE TAPE
C ACCIDENTALLY.
830 WRITE (6,840)
840 FORMAT (5X,'FOUND EIGHT KEYBOARD SYMBOLS IN SEQUENCE. STOP. ')
GO TO 1260
850 KL = KL+1
JJ = JJ+1
IF (KL.EQ.8) GO TO 830
IF (BJ(JJ).EQ.0) GO TO 590
C TRY AGAIN
GO TO 390
C THE ADDING IS DONE HERE AND THE CUMULATIVE SUM STORED, ONE
C UNIT PER .01 INCH.
860 N = N+1
NE = N/2
NF = NE+2
IF (NF.EQ.N) GO TO 870
C THIS FIDDLING AROUND DETERMINES IF THE COUNT IS EVEN OR ODD.
C START COUNTING IN THE ORDER XXYX (BECAUSE THE CHART IS READ
C SIDEWAYS. X AND Y IN THIS PROGRAM HAVE THE NORMAL ORIENTATIONS
C ON THE STRIP CHART. THEY ARE INVERTED WITH RESPECT TO THE
C CALMA DIGITIZER. SPECIFICALLY DEPTH DECREASES ALONG THE
C POSITIVE X AXIS AND TEMP INCREASES ALONG THE POSITIVE Y AXIS
C ON THE CALMA DIGITIZER.
C IF ODD
SUMD = SUMD+RX
C INCREASE THE ODD INDEX TO KEEP IT THE SAME AS THE EVEN.
NE = NE+1
Y(NE) = SUMD
`JJ = JJ+1
GO TO 880`
950 FORMAT (5X,'LABEL 950. START CONDENSING UNCONVERTED ARRAY AND CO
1NVESTIGATING SCIENTIFIC UNITS.'/5X,'THE TRACER ENTERED THE FRAME (F
2LAG) AT JJJ='/15/5X,'THE END OF THE TRACE HAS INDEX NE='/15/
3 5X,'LAST (UNCONVERTED) DEPTH AND TEMP ARE: ','F7.1,2X,F7.1'/)

CHECK TO SEE IF FLAG WAS FOUND.

IF (FG.EQ.1) GO TO 970

WRITE (6,960)

960 FORMAT (5X,'NO FLAG FOUND; PROCESS ANYWAY.'/)

970 WRITE (6,980)

980 FORMAT (5X)

FG = 0

THE X AND Y ARRAYS ARE FILLED AND THE START AND END OF THIS BATCH
OF DATA ARE LABELED WITH JJJ AND NE. THE ARRAYS ARE INDEXED
ON 0.01 INCH DEPTH SPACING. SUBROUTINE CONDNS INTERPOLATES TO
FILL ANY BLANK ARRAY POSITIONS.

CALL CONDNS (X,Y,T, JJJ, NE, KDTH1, KDTH2)

DO 1060 J=KDTH1,KDTH2

1040 (J-1)/DCON(DUSCL)*DCOR

SUBROUTINE WLP2, LOCATED IN THE SUBROUTINE LIBRARY OF THE W. R.
CHURCH COMPUTER CENTER WAS USED TO DETERMINE THE COEFFICIENTS
FOR A BEST FIT SECOND DEGREE POLYNOMIAL THAT DESCRIBED THE
RELATIONSHIP BETWEEN THE TEMP AND THE MOVEMENT OF THE STYLUS
AS MEASURED IN HUNDREDS OF INCHES.

A SINGLE POLYNOMIAL DID NOT ACCURATELY DESCRIBE
THIS RELATIONSHIP. THEREFORE, IT WAS NECESSARY TO BREAK THE TRACE INTO
FIVE SEGMENTS. THE FIRST EQUATION WAS DETERMINED FOR TEMPS FROM
1 TO 5 DEG.; THE NEXT EQUATION FROM 5 TO 10 DEG., ETC., UP TO A
MAXIMUM OF 25 DEG. BY USING SEGMENTS THE EQUATIONS ARE ACCURATE
TO WITHIN AT LEAST 0.01 DEG.

TCOR IS A TEMP CORRECTION WHICH MAY BE APPLIED TO A SINGLE
STATION IF NEEDED. A SINGLE STATION MAY BE IN ERROR DUE
TO IMPROPER DIGITIZING. THIS CORRECTION ENHANCES THE OPERATOR'S ABILITY TO
TRACE AT A POINT WHICH IS NOT THE ORIGIN. CONDNS INTERPOLATES TO A
SHIFT THE TRACE BACK TO THE ORIGIN.

XBTCOR IS A CORRECTION DESIGNED TO MAKE THE XBT READING
AGREE WITH A STANDARD, EITHER WITH A NANSEN CAST OR A
STANDARDIZED STD TRACE WHICH WAS MADE AT THE SAME TIME.

GENERALLY THE XBT TEMP WAS NOTICABLY HIGHER THAN THE TEMPS
RECORDED BY THE OTHER TWO METHODS. THIS CORRECTION ENABLES ONE TO
COMPARE TEMPS TAKEN BY DIFFERENT METHODS.
VALUES ARE INSERTED. IF THERE IS A GAP BETWEEN HAND ENTERED
DATA AND XBT DATA, IT IS NOT FILLED.

IF (IH.EQ.0) GO TO 1080
T(J) = TH(J)
IF (IH.LT.2) GO TO 1080
IF (ISQZ.GT.1) GO TO 1080

DU 1070 J=2,IH
D(J) = DH(J)
T(J) = TH(J)
1070 CONTINUE

1080 CONTINUE

DIAGNOSTIC WRITE STATEMENTS FOLLOW:

IPLACE = 1080
WHITE (6,180) (D(J),J=1,1801,20),IPLACE
WHITE (6,180) (T(J),J=1,1801,20),IPLACE
WHITE (6,190) JJJJ,NE,KDTH1,KDTH2,JJJJ

***************************************************************************
***ELIMINATE UNWANTED DATA.***************************************************************************

IN DIGITIZING TEMP SEGMENTS ONE FREQUENTLY GETS UNUSUAL VALUES
AT THE TOP OR BOTTOM OF THE TRACE SEGMENT (ZERO OR VERY HIGH). IT
IS DESIRABLE THAT THESE UNWANTED VALUES BE ELIMINATED PRIOR TO
WRITING A TAPE OR PUNCHING CARDS. THUS A CHECK IS MADE TO SEE
IF T(J) IS ZERO OR GREATER THAN 25.

THESE VALUES ARE WRITTEN OUT
AND COUNTED FOR RECORD PURPOSES BUT ARE DISCARDED FROM THE
D AND T ARRAYS. NOTE THE VALUE OF KDTH2, WHICH IS EQUAL TO THE
TOTAL NUMBER OF RECORDS; IS REDUCED BY THE NUMBER OF UNWANTED
RECORDS.

K = 0
L = 1

DC 1110 J=1,KDTH2
IF (((T(J).EQ.0.0).OR.(T(J).GT.25.0)) GO TO 1090
D(L) = D(J)
T(L) = T(J)
L = L+1
GO TO 1110

1090 WRITE (6,1100) D(J),T(J),J
K = K+1
JSAV = K
1100 FORMAT (/5X,2F7.2,16,/)  
1110 CONTINUE

C

1120 FORMAT (/5X,'JSAV=',16,/)  
WRITE (6,1120) JSAV
KDTH2 = KDTH2-JSAV

C

C **************************** *****************************************************
C(M)  GENERATE SERIAL NUMBERS FOR TAPE OUTPUT. ****************************
C
C  GENERATE SERIAL NUMBERS FOR THE RECORDS.  A RECORD IS
C  EITHER A HEADER FOR A STATION OR THE VALUES (D AND T) FOR
C  A SINGLE DEPTH.
C
C  DO 1130 J=1,KDTH2
C  JREC = JREC+1
C  IREC(J) = JREC
C 1130 CONTINUE

C

C **************************** *****************************************************
C(N)  CONVERT LETTER CODE TO MONTH/YEAR. ****************************
C
C  THIS SECTION CONVERTS THE LETTER DESIGNATOR FOR MONTH (AMONC)
C  FROM THE SINGLE LETTER CODE ON THE DIGITIZED TAPE TO THE
C  APPROPRIATE MONTH AND YEAR IN PREPARATION FOR WRITING THE OUTPUT.
C
C  DO 1140 J=1,13
C  IF (AMONC.EQ.AMONCA(J)) GO TO 1160
C 1140 CONTINUE

C

C 1150 FORMAT (15X,'AMONC NEVER DID EQUAL AMONCA(J) CONSEQUENTLY,'
1 WMONTH WILL NOT BE DEFINED*/
WRITE (6,1150)
GO TO 1170
1160 WMONTH = EVENT(J)
1170 CONTINUE
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++5395
C*(U) OUTPUT,++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++5430
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++5435
CPRINT DATA
CTHE PARAMETER ISQZ PERMITS CONDENSING THE PRINTED DATA BY THE
CFACTOR ISQZ
CIF (. NOT. PRT1) GO TO 1190
CWRITE (6,1180)
1180 FORMAT ('1')
CALL OUT2 (D,T,KDTH2,ISTA,WMONTH,IREC,JREC,ISQZ)
CWRITE TAPE
TAPE MUST BE TRUE ONLY ONCE, AT THE BEGINNING OF TAPE WRITING.
The program expects JCL to write card images on the tape
in records 20 digits long.
1190 IF (. NOT. TAPE) GO TO 1230
CWRITE THE HEADER INFO HERE.
WRITE (8,1200) ISTA,WMONTH,KDTH2
1200 FORMAT (14,49,16)
WRITE (8,1210) (D(J),T(J),J=1,KDTH2)
1210 FORMAT (F8.2,F6.2)
WRITE (6,1220) ISTA,WMONTH,JREC
1220 FORMAT (5X,'DATA FOR STATION ',15,'A12'," WRITTEN ON TAPE UP TO
1 RECORD ",16)
CPUNCH CARDS
COMPRESSION THE PUNCHED DATA BY A FACTOR ICSQZ. FORMAT FOR FOUR
DATA SETS ON A CARD. NPTS BECOMES THE NUMBER OF DATA PRINTED
IF IT IS EVENLY DIVISIBLE. OTHERWISE THE LAST DATUM IS ALSO
PUNCHED. SUPPLY JCL FOR CARD PUNCHING.
1230 IF (. NOT. CARDS) GO TO 1330
CTHE NUMBER OF POINTS TO BE RETAINED AFTER CONDENSATION IS
1*(N-1)/ISQZ. IF THIS DOES NOT COME OUT INTEGRAL ADD THE LAST
POINTS.
NPTS = (KDTH2-1)/ICSQZ
NPT1 = KDTH2-1-ICSQZ*NPTS
NPTS = NPTI+1
WRITE A HEADER CARD

1240 FORMAT (1X,'OCEANOGRAPHIC DATA FROM U C M II',/)
1250 FORMAT (1X,14,' VALUES OF D,T FOR XBT STA.',13,18,' COMRESSED BY',
1 13,/)
1260 FORMAT (4X,'DEPTH',5X,'TEMP.',2X,'DEPTH',5X,'TEMP.',2X,'DEPTH',
1 2X,'TEMP.',2X,'DEPTH',5X,'TEMP.',")
1270 FORMAT (4X,'METERS',5X,'DEG.C.',5X,'METERS',5X,'DEG.C.',5X,'METERS'
1,5X,'DEG.C.',5X,'METERS',5X,'DEG.C.',")
WRITE (7,1240)
WRITE (7,1250) NPTS,ISTA,WMONTH,ICSQZ
WRITE (7,1260)
WRITE (7,1270)

NOW FIND THE NUMBER OF CARDS
NCARDS = NPTS/4
NCRD1 = NPTI-4*NCARDS

THERE WILL BE ONE MORE CARD IF NCRD1.NE.0.
INCR = 4*ICSQZ
J = 1-INCR
K = 0
1280 J = J+INCR
K = K+1
J1 = J+ICSQZ
J2 = J1+ICSQZ
J3 = J2+ICSQZ
WRITE (7,1290) D(J1),T(J1),D(J2),T(J2),D(J3),T(J3),ISTA,
1 WMONTH,JKEC
IF (K.LT.NCARDS) GO TO 1280
IF (NCRD1.EQ.0) GO TO 1320
WRITE THE LAST CARD
J = J3+ICSQZ
WRITE (7,1290) D(J),T(J)
IF (J.EQ.KDTH2) GO TO 1320
J = J+ICSQZ
1300 FORMAT (1H+,16X,F8.2,F6.2)
WRITE (7,1300) D(J),T(J)
IF (J.EQ.KDTH2) GO TO 1320
J = J+ICSQZ
1310 FORMAT (1H+,30X,F8.2,F6.2)
WRITE (7,1310) D(J),T(J)
1320 CONTINUE

IF (ENDFL) END FILE 8
C
C ENDFL MUST BE TRUE ONCE ON THE LAST TAPE WRITING OPERATION.

**********
C****(P) INITIALIZE VARIABLES FOR NEXT STATION.*************************
C
C    JREC = JREC+1
C
C    DO 1340 J=1,1801
C    D(J) = 0.
C    T(J) = 0.
C    1340 CONTINUE
C
C    DO 1350 J=1,12
C    TH(J) = 0.
C    DH(J) = 0.
C    1350 CONTINUE
C
C    SKIP = .FALSE.
C    IDEN = 0
C    IH = 0
C    IP = 0
C    JSAV = 0
C    IF (NOIRG.EQ.1) GO TO 330
C
C    1360 IT = IT+1
C    GO TO 120
C    1370 STOP
C    END

C------------------SUBROUTINE OUT2------------------
C
C      THIS OUTPUT SUBROUTINE FOR DIG1XBT PRINTS DEPTHS AND TEMPS
C      FOUR COLUMNS TO A PAGE.
C
C      SUBROUTINE OUT2 (D,T,KDTH2,ISTA,WMONTH,IREC,JREC,ISQZ)
C      REAL *8WMONTH
C      DIMENSION D(1801), T(1801), IREC(1801)
C
C      PRODUCE HEADING
C      20 FORMAT (14X,'OCEANOGRAPHIC DATA FROM U C M II',/)
C      30 FORMAT (1X,'VALUES OF D,T FOR XBT STA.',13,14,'COMPRESSED BY',13,13,/)
40 FORMAT (4X,'DEPH',2X,'TEMP.',2X,'DEPH',2X,'TEMP.',2X,'DEPH', 1 2X,'TEMP.',2X,'DEPH',2X,'TEMP.') 60
50 FORMAT (4X,'METERS',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',1X,'METERS 1',1X,'DEG.C.',1X,'METERS',1X,'DEG.C.',/)
NPTS = NPTS+1 70
INCR = 4*ISQZ 75
WRITE (6,20) 80
WRITE (6,30) NPTS,ISTA,WMONTH,ISQZ 90
WRITE (6,40)
WRITE (6,50) 100

C COMPUTE NUMBER OF FULL LINES
NLNS = (KDTH2-1)/INCR 105
NLN1 = KDTH2-1-(4*NLNS-1)*ISQZ 110
J = 1-INCR 115
K = 0 120
60 J = J+INCR 125
K = K+1 130
J1 = J+ISQZ 135
J2 = J1+ISQZ 140
J3 = J2+ISQZ 145
70 FORMAT (2X,4(F8.2,F6.2),10X,216) 150
WRITE (6,170) D(J),T(J),D(J1),T(J1),D(J2),T(J2),D(J3),T(J3),IREC(J) 155
170,IREC(J3)
1,IREC(J3)
175
1,IREC(J3)
IF (K.LT.NLNS) GO TO 60 180
C IF (NLN1.EQ.0) GO TO 120 185
C WRITE THE LAST LINE
J = J3+ISQZ 190
WRITE (6,70) D(J),T(J)
195
IF (J.EQ.KDTH2) GO TO 110 200
J = J+ISQZ 205
80 FORMAT (1H+,15X,F8.2,F6.2) 210
WRITE (6,80) D(J),T(J)
215
IF (J.EQ.KDTH2) GO TO 110 220
J = J+ISQZ 225
90 FORMAT (1H+,29X,F8.2,F6.2) 230
WRITE (6,90) D(J),T(J)
235
100 FORMAT (1H+,73X,I6) 240
110 WRITE (6,100) IREC(J) 245
120 CONTINUE 250
C COUNT RECORDS
130 FORMAT (///5X,'THIS STATION CONTAINS RECORDS ','I5',' TO ','I5',' INCLUD 255
1IVE. '/)
WRITE (6,130) IREC(1),JREC 260
140 FORMAT (1H1) 265
WRITE (6,140)
--- SUBROUTINE CONDNS ---

THIS SUBROUTINE FINDS THE ARRAY LOCATIONS FOR X, INDEXED
SEQUENTIALLY FOR EACH UNIT OF Y, EACH UNIT OF Y IS 1.0 AND
CORRESPONDS TO .01 INCHES OF TRAVEL IN THE DEPTH DIRECTION.

SUBROUTINE CONDNS (X,Y,T,JJJ,NE,KDTH1,KDTH2)
DIMENSION X(1), Y(1), T(1), KINS(10), KN0(10)

IF FIRST INDEX IS ZERO OR NEGATIVE THERE IS A MISBEHAVIOR ELSE-
WHERE IN THE PROGRAM. RESET JJJ TO 1.
IF (JJJ. GE. 1) GO TO 30
JJJ = 1
WRITE (6,20)
20 FORMAT (/5X,'***** JJJ RESET TO ONE - SOMETHING WRONG *****'/)

KDTH1 BECOMES THE INDEX OF THE START OF THIS ARRAY SEGMENT.
KDTH1 = Y(JJJ)+1.50

BUT IN CASE KDTH1 BECOMES ZERO OR LESS, USE THE START OF THE
CURVE AS THE ORIGIN OF INDEXING.

THIS CAUSES AN OVERLAP BETWEEN ARRAYS, BUT IT SHOULD BE SMALL.
XINC = 0.
IF (KDTH1. GT. 0) GO TO 40
XINC = FLOAT(1-KDTH1)
KDTH1 = 1

JJJ = JJJ+1
NE = NE-1

FORM SUBSCRIPTS FROM THE DEPTH INCREMENTS AND STORE X'S AT THOSE
ARRAY LOCATIONS.
SEARCH FOR BLANKS IN ARRAY BETWEEN INDEXES KDTH1 AND KDTH2.
KCT COUNTS THE NUMBER OF BLANKS
KCT = 0
KSAVE = KDTH1
KINS(J) IS THE NUMBER OF THE ARRAY POSITION FILLED.

DO 50 J=1,10
KNO(J) = 0
50 KINS(J) = 0

RETURN
END
C DO 80 J=J1,NE
K0TH = Y(J)+1.50+XINC
T(K0TH) = X(J)
C TEST TO SEE IF INDEX IS THE SAME OR ONE GREATER THAN THE LAST
ONE. IF NOT, INTERPOLATE VALUES.
NREP = K0TH-KSAV
IF (NREP.LE.1) GO TO 70
KCT = KCT+1
IF (KCT.GT.10) KCT = 10
KNO(KCT) = NREP
KINS(KCT) = K0TH
I1 = KSAV+1
I1 = K0TH-1
E = FLOAT(NREP)
G = T(K0TH)
F = G-T(KSAV)
C DO 60 I=I1,I1
60 T(I) = (FLOAT(I-KSAV)/E)*F+G
C C
70 KSAV = K0TH
80 CONTINUE
C
K0TH2 = Y(NE)+1.50+XINC
PUT IN THE FIRST POINT, WHICH OTHERWISE WOULD BE THE LAST
ONE FOR WHICH Y(J).LT.1.
T(K0TH1) = X(JJJ)
T(K0TH2) = X(NE)
SAVE INDEX OF END OF ARRAY.
C WRITE DOWN NUMBER AND LOCATIONS OF INTERPOLATED VALUES.
WRITE (6,90) KCT,(KINS(I),I=1,KCT),(KNO(I),I=1,KCT)
90 FORMAT (/5X,'BLANK ARRAY POSITIONS FILLED IN ','I3',' PLACES. BEGIN
INING INDEXES AND NO. OF STEPS'/5X,'(10 EACH) ARE: ',5X,10I6/
2 5X,10I6/)
RETURN
END
SUBROUTINE CMOVE (A, I, B, J)

THIS SUBROUTINE RETURNS A LOGICAL *1 VARIABLE TO A 4-BYTE ADDRESS
IN THE MAIN PROGRAM, UNPACKING THE ORIGINAL 4-BYTE WORDS A
BYTE AT A TIME.
LOGICAL *1 A(I), B(J)
B(J) = A(I)
RETURN
END

MACRO REGS LCL A &N
LCLC &SYM
LCP ANOP &SYM
SETC &N
EQU &SYM
SETA &N+1
AIF (&N LT 16) . LOOP
MEND SPACE 2

CSECT SPACE 2
REGS SPACE 2
STM R14, R12, 12(R13)
LR R12, R15
USING TPR0, R12
LA R11, SAV1
ST R13, 4(R11)
ST R11, 8(R13)
LR R13, R11
LR R11, R1
USING ARGS, R1
L R10, AADD
ST R10, SHOVAAD
L R10, ALADD
L R10, 0(R10)
ST R10, SHOVALN
LA R10, TPRCB
USING IHADC, R10
TM DCBOFLAGS, X'10' HAS DCB BEEN OPENED?
BO  OOKK  YES
TM  BADBOMB,X*AA*  HAS THERE BEEN PREVIOUS CATASTROPHE?
BNO  ONWITHIT  NOPE, GO AND OPEN IT
SPACE  2
KIKIT
ABEND  3,DUMP  SHOULDN'T EVER GET HERE, CRASH
SPACE  2
ONWITHIT
OPEN  (TPDCB, INPUT)
TM  DCBOFLGS,X*10'  DID STUPID THING OBEY?
BNO  KIKIT  NOPE, GO PUNT
L  R9,DCBDEBAD  GET POINTER AND DEVICE STATISTICS TABLE
L  R9,32(R9)  GET UCB ADDR OUT OF DEB
SR  R6,R6
IC  R9,9(R9)  GET STAT TABLE POINTER
MH  R6,H'10'  POINTER * 10
L  R9,16  POINTER TO CVT
L  R9,112(R9)  POINTER TO STAT TABLE START
LA  R9,0(R6,R9)  GOTCHA STAT TABLE
ST  R9,STATTAB  SAVE ADDRESS OF STAT TABLE
MVC  OLDSTAT,0(R9)  SAVE ITS INFO
SPACE  2
OOKK
L  R0,SHOVALN  GET BLKSIZE FOR TAPE EXCP BUFFER
STH  R0,BYTCNT  PUT DATA LENGTH INTO CCW
L  R1,SHOVAAD
ST  R1,TPBUFLOC
MVC  TPLLOC,TPLBUFLOC+1  PUT BUFFER LOC IN CCW
LTR  R0,R0
BP  OOKK
MVI  TPCCW,X'37'
BAL  R9,TPGET
MVI  TPCCW,X'02'
BAL  R9,TPWAIT
B  RETURN
SPACE  2
OOKKK
BAL  R9,TPGET  GO READ A BUFFER
SPACE  2
BAL  R9,TPWAIT  GO WAIT TILL READ FINISHED
RETURN
LA  R15,0  NORMAL RETURN, MODIFIED ELSEWHERE
L  R13,4(R13)  RESTORE REGISTERS
L  R14,12(R13)
LM  R0,R12,20(R13)
BR  R14  ALL RETURNS THRU HERE
SPACE  2
TPEDF
MVI  RETURN+3,X'04'  SET EOC RETURN
SPACE  2
OUT
CLOSE  TPDCB
SPACE  2
MVI  BADBOMB,X*AA*  TURN ON FLAG
STATABB
SPACE 2
DC A(0)
LOC OF STAT TABLE
SPACE 2
SPACE 2
RDFLG
DC X'00'
= X'FF' AFTER READ, BEFORE WAIT
BADBMB
DC X'00'
FLAG TO TELL WHETHER DCB USED BEFORE
SPACE 2
TPDCB
DCB DDNAME=METTAP, MACRF=(E), EODAD=TPEOF, DSORG=PS,
CPUAD=TPIOB, DEVD=TA
SPACE 2
DS GF
TPIOB
DS OCL32
FLAGS1
DC X'00'
FALGS2
DC X'00'
SENSE1
DC X'00'
SENS2
DC X'00'
EGBCDD
DC X'00'
EGBADD
DC AL3(TPECB)
FALGS3
DC X'00'
TPC0WM
DC TX'00'
SI0CODE
DC X'00'
EXCPADD
DC AL3(TPEXCP)
RESEN
DC X'00'
DGBADDR
DC AL3(TPDCB)
REPROMD
DC X'00'
RESTAB
DC AL3(0)
BLCINC
DC H'1'
EKORCNT
DC H'0'
TPECB
SPACE 2
DC E'0'
SPACE 2
ARGS
DSECT
AADD
DC A(0)
ADDRESS OF FORTRAN ARRAY
ALADD
DC A(0)
ADDRESS OF LENGTH OF FORTRAN ARRAY
SPACE 2
PRINT NOGEN
DCB DSORG=PS, DEVD=TA
SPACE 2
PRINT GEN
TPRD
CSECT
LTORG
END

TPRD2600
TPRD2610
TPRD2620
TPRD2630
TPRD2640
TPRD2650
TPRD2660
TPRD2670
TPRD2680
TPRD2690
TPRD2700
TPRD2710
TPRD2720
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TPRD2800
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TPRD2990
TPRD3000
TPRD3010
APPENDIX C

C TITLE HYDRO - A MODIFIED VERSION

C PROGRAMMER R. E. GREER MODIFIED AN ORIGINAL PROGRAM, HYDRO, DEVELOPED
C BY THE U.S. NAVAL POSTGRADUATE SCHOOL, DEPARTMENT OF
C OCEANOGRAPHY.

C PURPOSE THE PROGRAM READS AND INTERPOLATES TEMPERATURE AND
C SALINITY DATA FOR 'STANDARD DEPTHS' AND CALCULATES
C SIGMA-T, SPECIFIC VOLUME ANOMALY, SOUND VELOCITY,
C DYNAMIC HEIGHT, DYNAMIC HEIGHT ANOMALY, AND GEOSTROPHIC
C CURRENTS AND TRANSPORT.

C MODIFICATIONS THE ORIGINAL PROGRAM HYDRO HAS BEEN MODIFIED TO
C INCLUDE AN INCREASED CAPABILITY TO PROCESS TEMPERATURE
C AND SALINITY DATA ON A VERTICAL DEPTH SCALE INTERVAL AS
C FINE AS 2.5 METERS, AND A CARD PUNCHING ROUTINE WHICH
C PRODUCES COMPOSITE DATA CARDS, EACH CONTAINING DEPTH,
C TEMPERATURE, SALINITY, GEOSTROPHIC VELOCITY, DYNAMIC
C HEIGHTS, AND MASS TRANSPORT. MODIFICATIONS AFFECT ONLY
C THE MAIN PROGRAM AND SUBROUTINE GEOCUR.

C DATE 26 JUNE 1975

REAL *8 ITL(12), INFO(200,4)
DIMENSION ID(200), IT(200), IS(200), IQ(200)
DIMENSION DI(200), IT(200), IS(200), IQ(200), SNDV(98)
DIMENSION SD(98), ST(98), SS(98), ST(98), SV(98), SVA(98)
DIMENSION SD(200), DT(98), BDFH(98), DDFH(98), SLEV(98), BSVA(98)
DIMENSION NPA(48), NPB(48), NPA(48), NPB(48), NPA(48), NPB(48), NPA(48), NPB(48)
DIMENSION ALN(48), ALN(48), ALN(48), ALN(48), ALN(48), ALN(48), ALN(48), ALN(48)
COMMON /INFO/ ASST(200), ASGT(200), ADH(98)

8 FORMAT (IH1, 'STATION', '3A4', ' LATITUDE', '12, F5.1', 'N LONGITUDE', '113, F5.1', 'W DATE', '3A4/5X', 'TU', '3A4', ' LATITUDE', '12, F5.1',
2 'N LONGITUDE', '113, F5.1', 'W DATE', '3A4//')
9 FORMAT (81X, 212, 'F5.01')
10 FORMAT (IH1, 'STATION', '3A4', ' LATITUDE =', '12, F5.1', 'N LONGITUDE =', '114, F5.1', 'W DATE', '3A4//')
11 FORMAT (10X,* INDICATES ADJUSTED VALUE*)
12 FORMAT (10X,*? INDICATES QUESTIONABLE VALUE*)
99 FORMAT (10X,*X INDICATES NO VALUE*)
13 FORMAT (14, 'A4', 'F4.0', 'F4.0', 'F5.1', '3A4')
15 FORMAT (F5.1, A1, I1X, 'F9.2', A1, 'F10.3', A1, 'F9.3', A1, '7X', '4A8')
16 FORMAT (10X,'DEPTH TEMPERATURE SALINITY SIGMA-T OXYGEN'//)
17 FORMAT (20X,'OBSERVED VALUES'//)
18 FORMAT (10X,'INTERPOLATED VALUES'//)
19 FORMAT (10X,'DEPTH TEMPERATURE SALINITY SIGMA-T SND VEL SPE
1C VOL SPEC V ANOM MEAN SVA DELTA D DYNAMIC HEIGHT'//)
12F12.6)
DATA SD/0.5,10,15,20,25,30,35,40,45,50,55,60,65,70,
175,80,85,90,95,100,105,110,115,120,125,130,135,140,
2145,150,155,160,165,170,175,180,185,190,195,200,205,
4275,280,285,290,295,300,310,320,330,340,350,375,400,
5425,450,475,500,525,550,575,600,625,650,675,700,725,
6750,775,800,825,850,900,1000,1100,1200,1300,1500,1700,
72000,2500,3000,4000,5000./

READ THE NUMBER OF GEOSTROPHIC CURRENTS & TRANSPORTS
TO BE CALCULATED

READ (5,13) NGC
IF(NGC.EQ.0) GO TO 410
READ (5,9) (NPA(I),NPB(I),SLEV(I),I=1,NGC)
410 NPA(NGC+1)=0
M=1
KB=1
999 FORMAT(1X,' KB = ',KB,///)
WRITE(6,999) KB
DO 41 L=1,48

READ HEADING CARD, CHECK FOR END OF DATA, THEN
READ NOV DATA CARDS.

READ (5,13) NOV,(NSTA(L,K),K=1,3),ALT(L),ALM(L),ALN(L),ANM(L),
1(IDATE(L,K),K=1,3)
1 IF (NOV) 32,32,24
24 DO 25 I=1,NOV
READ (5,15) D(I),ID(I),T(I),IT(I),S(I),IS(I),O2(I),ID(I),
1(INFQ(I),I=1,N)
SGTSVA IS SUBROUTINE TO COMPUTE SIGMA-T, SPECIFIC VOLUME
AND SPECIFIC VOLUME ANOMALY
25 CALL SGTSVA (T(I),S(I),D(I),SGP(I),SVNO,SVNO)
LGTP IS SUBROUTINE TO COMPUTE INTERPOLATED VALUES
CALL LGTP(NOV,D,T,SD,ST,NA)
CALL LGTP(NOV, D, S, SD, SS, NB)
NC(L) = NA
DO 27 I = 1, NA

SNDVEL IS SUBROUTINE TO COMPUTE SOUND VELOCITY

CALL SNDVEL(ST(I), SS(I), SD(I), SNDV(I))
CALL SGTSVA(ST(I), SS(I), SD(I), SGT(I), SV(I), SVA(I))

27 CONTINUE
NLT = ALT(L)
NLN = ALN(L)
WRITE (6, 10) (NSTA(L, K), K = 1, 3), NLT, ALM(L), NLN, ANM(L),
1(IDATE(L, K), K = 1, 3)
WRITE (6, 18)
WRITE (6, 19)
NA = NA - 1
DH(I) = 0
DO 30 I = 1, NA
BSVA(I) = (SVA(I) + SVA(I + 1)) * 5
DD(I) = BSV(D(I)) * (SD(I + 1) - SD(I))
30 DH(I + 1) = DH(I) + DD(I)
DO 31 1 = 1, NA
DHT(L, I) = DH(I)
ASS(M) = SS(I)
ASGT(M) = SGT(I)
AST(M) = ST(I)
M = M + 1

31 WRITE (6, 20) SD(I), ST(I), SS(I), SGT(I), SNDV(I), SV(I), SVA(I), DH(I),
1 BSVA(I), DD(I)
I = NA + 1
DHT(L, I) = DH(I)
ASS(M) = SS(I)
ASGT(M) = SGT(I)
AST(M) = ST(I)
M = M + 1
WRITE (6, 20) SD(I), ST(I), SS(I), SGT(I), SNDV(I), SV(I), SVA(I), DH(I)
3 FFORMAT(1X, 'M = ', I4, ///)
WRITE(6, 23) M
41 CONTINUE
IF (NGC .EQ. 0) GO TO 33

32 DO 42 L = 1, 48
IF (NPA(L) .EQ. 0) GO TO 33
BASE = SLEV(L)
N1 = NPA(L)
N2 = NPA(L)
N3 = NPA(L)
NU1 = NQ(N1)
NU2 = NQ(N2)
DO 43 I = 1, NU1

43 ADH(1) = DHT(N1, 1)
44 DO 44 I = 1, NU2
44 BDH(I) = DHT(N2, I)
      NLT = ALT(N1)
      NLN = ALN(N1)
      MLT = ALT(N2)
      MLN = ALN(N2)
130 FORMAT (1X, 3A4, 14)
      ISAVE = (NU1/2.0) + 1.0
      IF (ISAVE .EQ. 37) GO TO 131
      ISAVE = 37
131 WRITE (6, 130) (NSTA(N1, K), K = 1, 3), ISAVE
      WRITE (6, 130) (NSTA(N1, K), K = 1, 3), ISAVE
      WRITE (6, B) (NSTA(N1, K), K = 1, 3), NLT, ALM(N1), NLN, ANM(N1),
      1 (IDATE(N1, K), K = 1, 3), (NSTA(N2, K), K = 1, 3), MLT, ALM(N2), MLN,
      2 ANM(N2), (IDATE(N2, K), K = 1, 3)
      ALAT = ALT(N1) + ALM(N1)/60.
      ALON = ALN(N1) + ANM(N1)/60.
      BLAT = ALT(N2) + ALM(N2)/60.
      BLON = ALN(N2) + ANM(N2)/60.

DSTSTA IS SUBROUTINE TO COMPUTE DISTANCE BETWEEN STATIONS

CALL DSTSTA (ALAT, ALON, BLAT, BLON, X2, DIST)

GEOCUR IS SUBROUTINE TO COMPUTE GEOSTROPHIC CURRENTS
AND TRANSPORTS

42 CALL GEOCUR(NU1, ADH, NU2, BDH, SD, BASE, X2, NNN, DIST)
33 STOP
END
SUBROUTINE: GEOCUR (NA, ADH, NB, BDH, SD, BASE, X2, NNN, DIST)

DIMENSION ADH(NA), BDH(NB), SD(98), RVEL(98), VEL(98), AMB(98), AVT(98)


10 FORMAT (13X, 'DEPTH', 'DYN HT DYN HT DIFF HT REL VEL ABS
1VEL ABS VOL', 14X, 'M.', STA A STA B A-B CM/SEC
2 CM/SEC TRANSPORT *//)
11 FORMAT (13X, F5.0, 2X, 3(F9.5, 1X), 2(F8.2, 2X), /72X, F9.5)
12 FORMAT ('***** LEVEL OF NO MOTION MUST BE EQUAL TO A STANDARD DEPT
1H *****')
13 FORMAT ('', 10X, 'TOTAL VOLUME TRANSPORT IS COMPUTED BY SUMMING INCR
1EMENTAL TRANSPORTS ABOVE LEVEL OF NO MOTION: //5X, 'TOTAL TRANSPORT
2 PERPENDICULAR TO THE PLANE OF THE STATIONS IS ', F7.3, ' SVERDRUPS
3 RELATIVE TO ', F5.0, ' METERS.')
15 FORMAT ('', 6, 12)

IF (NA .LE. NB) GO TO 51

N = NB
GO TO 52

51 N = NA
52 DO 53 I = 1, N
   AMB(I) = ADH(I) - BDH(I)
53 RVEL(I) = -AMB(I) * X2
   DC 54 I = 1, 98
   IF (BASE .EQ. SD(I)) GO TO 55
54 CONTINUE
   WRITE (6, 12)
   GO TO 70
55 NM = I
   IF (NM .GT. N) NM = N
   BASE = SD(NM)
   DC 56 I = 1, N
56 VEL(I) = RVEL(I) - RVEL(NM)
   DC 553 I = 2, N
   J = I - 1
553 AVEL = (VEL(I) + VEL(J)) * 0.005
   J = I - 1
554 AVT(J) = AVEL * DIST * (SD(I) - SD(J)) * 1.0E-03
   N = NM - 1
555 VT = 0.
   DC 57 I = 1, NM
57 VT = VT + AVT(I)

IF STATION A IS TO THE RIGHT OF STATION B AS AN OBSERVER LOOKS AT
THE PLANE OF THE STATIONS, A POSITIVE CURRENT FLOWS AWAY FROM THE
OBSERVER.

58 WRITE (6, 10)
   N = N - 1
   DO 60 I = 1, N
60 WRITE (6,11) SD(I),ADH(I),BDH(I),AMB(I),RVEL(I),VEL(I),AVT(I)
   N=N+1
   I=I
WRITE (6,11) SD(I),ADH(I),BDH(I),AMB(I),RVEL(I),VEL(I)
NNN=N
WRITE(6,15)
WRITE(6,14)VT,BASE
100 FORMAT(1X,F4.0,2F8.3,F9.2,F7.0,2F5.0,F7.2,F8.2,F10.5,2I4)
110 FORMAT(1X, 'SD', 3X, 'SS', 16X, 'SGT', 16X, 'VEL', 5X, 'VEL', 3X, 'ADH', 2X,
120 FORMAT('*')
125 FORMAT('*')
130 FORMAT(1X,F4.0,2F8.3,F9.2,F7.0,2F5.0,F7.2,F8.2,10X,2I4)
WRITE(6,120)
WRITE(6,125)
WRITE(6,110)
K=1
5 FORMAT(1X, 'KB = ', I4, //)
WRITE(6,5) KB
45 DO 50 J=1,N,2
   ADH(J)=(ADH(J-1)-ADH(J))/=100
   BDH(J)=(BDH(J-1)-BDH(J))/=100
WRITE(6,100) SD(J),ASS(KB),ASGT(KB),VEL(J),VEL(J),ADH(J),BDH(J),
   1AST(KB),RVEL(J),AVT(J),J,K
WRITE(7,100) SD(J),ASS(KB),ASGT(KB),VEL(J),VEL(J),ADH(J),BDH(J),
   1AST(KB),RVEL(J),AVT(J),J,K
K=K+1
JSCAR=J
KB=KB+2
50 CONTINUE
J=JSCAR+1
KB=KB-1
ADH(N)=0.0
BDH(N)=0.0
WRITE(6,130) SD(N),ASS(KB),ASGT(KB),VEL(N),VEL(N),ADH(N),BDH(N),
   1AST(KB),RVEL(N),J,K
WRITE(7,130) SD(N),ASS(KB),ASGT(KB),VEL(N),VEL(N),ADH(N),BDH(N),
   1AST(KB),RVEL(N),J,K
KB=KB+1
70 RETURN
END
SUBROUTINE DSTSTA(SATI, ONGI, SATII, ONGII, X2, DIST)
IMPLICIT REAL*4 (K)
REAL*8 A, E
DATA A/111132.09/, B/566.05/, C/1.20/, D/1.002/
DATA E/11415.13/, F/94.55/, G/0.012/
10 FORMAT (10X,'MEAN LATITUDE = ',F6.2/15X,'DISTANCE = ',F6.2,1' KILOMETERS')
CCL=2*3.1416/360
AAFI=SATI*CON
AAFII=SATII*CON
$MERRI=A-B*COS(2*AATI)+C*COS(4*AATI)-D*COS(6*AATI)
PARR=E*COS(AATII)-F*COS(3*AATII)+G*COS(5*AATII)
$MERRII=A-B*COS(2*AATII)+C*COS(4*AATII)-D*COS(6*AATII)
PARRII=E*COS(AATIIII)-F*COS(3*AATIIII)+G*COS(5*AATIIII)
ALLAT=($MERRI+$MERRII)/2
ALLCN=(PARR+PARRII)/2
DLAT=SATI-SATII
DLON=ONGI-ONGII
KLAT=DLAT*ALLAT/1000
KLONG=DLON*ALLON/1000
KDIKIX=SQRT(KLAT**2+KLONG**2)
DIST=KDIKIX
W2=1.458E-4
PSI=(SATI+SATII)*0.5
PSI=(2.0*3.14159/360.)*PSI
SPSI=SIN(PSI)
IF(SPSI.LT.0.1) SPSI=0.1
X2=1./*(W2*SPSI*KDIKIX)
WRITE(6,10) PSI, KDIKIX
RETURN
END
SUBROUTINE LGTP(N,D,V,SD,CV,NN)
DIMENSION D(N),V(N),CV(98),SD(98)

111 DO 188 J=1,98
112 DO 186 I=1,N
113 IF(SD(J)-D(I))113,115,190
115 CV(J)=V(N)
GO TO 191
113 IF(SD(J)-D(I))114,114,116
114 CV(J)=V(I)
GO TO 188
116 IF(SD(J)-D(I+1))120,118,186
118 CV(J)=V(I+1)
GO TO 188
120 IF(I-1)122,132,126
126 XA=(SD(J)-D(I))*(SD(J)-D(I+1))*V(I-1)/
1((D(I)-D(I+1))*(D(I)-D(I+1))
XB=(SD(J)-D(I-1))*(SD(J)-D(I+1))*V(I)/
1((D(I)-D(I-1))*(D(I)-D(I+1))
XC=(SD(J)-D(I-1))*(SD(J)-D(I))*V(I+1)/
1((D(I+1)-D(I-1))*(D(I+1)-D(I)))
ANSU=XA+XB+XC
132 IF((I+2)-N)133,133,134
133 YA=(SD(J)-D(I+1))*(SD(J)-D(I+2))*V(I)/
1((D(I+1)-D(I+1))*(D(I+1)-D(I+1))
YB=(SD(J)-D(I))*(SD(J)-D(I+2))*V(I+1)/
1((D(I+1)-D(I))*(D(I+1)-D(I+2))
YC=(SD(J)-D(I))*((SD(J)-D(I+1))*V(I+2)/
1((D(I+2)-D(I))*(D(I+2)-D(I+1)))
ANSD=YA+YB+YC
134 ZA=(SD(J)-D(I+1))*V(I)/(D(I)-D(I+1))
ZB=(SD(J)-D(I))*V(I+1)/(D(I+1)-D(I))
ANSL=ZA+ZB
136 CV(J)=(ANSO+ANSL)/2.
DLL=ANSO+ANSL+ANSL)/3.
GO TO 188
138 IF((I+2)-N)140,140+142
140 CV(J)=(ANSO+ANSD+ANSL)/3.
UD=(ANSO+ANSD)/2.
GO TO 188
142 CV(J)=(ANSO+ANSL)/2.
ULL=(ANSO+ANSL+ANSL)/3.
GO TO 188
SUBROUTINE SGTSVA (T, S, D, SGT, SV, SVA)
ST=(((T-3.98)**2)/503.57)*((T+283.0)/(T+67.26))
CL=(S-.030)/1.805
SO=-.069+1.4708*CL-.00157*CL**2+3.98E-5*CL**3

ALTERNATE METHOD OF COMPUTING SIGMA-ZERO: 
SO=-0.093+0.8149*S-.000482*S**2+6.8E-6*S**3

AT=T*(4.7867-.098185*T+.010843*T**2)*1.E-3
BT=T*(18.030-.8164*T+.01667*T**2)*1.E-6
SGT=ST*(SO+.1324)*(1.-AT+BT*(SO-.1324))
AFST=1./(1.+SGT*1.E-3)
A=D*AFST*1.E-9
B=4E86./(1.*1.83E-5*0)
C=227.+28.33*T-.551*T**2+.004*T**3
E=D*1.E-4
G=(SO-.28.)*10.
H=147.3-.2.72*T+.04*T**2
U=105.5+9.5*T-.158*T**2
V=1.5*D*2*T*1.E-8
W=32.4-.87*T+.02*T**2
X=4.5-.1*T
Y=1.8-.06*T
SV=AFST-A*(B-C+E*U-V-G*(H-E*W)+G**2*(X-E*Y))
AZ=.972643
YA=-227.*+.01055*D
YB=.0126*(147.3-.00324*D)
AP=AZ-D*AZ*(B+YA-YB)*1.E-9
SVA=SV-AP
RETURN
END


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