AN OBJECTIVE METHOD TO
ANALYZE OCEANIC VARICLINES AND
THEIR STATISTICAL RELATION TO
SURFACE WINDS

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THESIS

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by

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Thesis Advisors: Dale Leipper/Noel Boston

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An Objective Method to Analyze Oceanic Variclines
and
Their Statistical Relation to Surface Winds

by

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ABSTRACT

Oceanographic and meteorologic data, namely expendable or mechanical bathythermograph traces and wind reports have been systematically collected for years and every day more observations are made.

To handle such a large amount of information, it is advantageous to set up a computerized model which is: (1) automatic, (2) performs an objective analysis of XBT/BT traces to identify the most significant thermal features, such as thermoclines and inversions, (3) restricts the human participation to an initial stage dealing with organization of data available and selection of proper values for the parameters of the model, and (4) preserves the initial information.

A FORTRAN IV program takes into consideration the above requirements to: (1) perform objective analyses of XBT/BT digital traces, (2) process wind information, (3) study the statistical characteristics of the original and processed data, and (4) plot the generated fields.

The digital model was tested and its application may be extended to the study of any environmental variable continuously distributed along a vertical or horizontal axis.

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TABLE OF SYMBOLS AND ABBREVIATIONS

BT	Mechanical Bathythermograph
D	Time variable
e	2.718281 ...
k	Any positive integer
L	Second length variable for tri-dimensional distribution
m	Median of a Gaussian distribution
n	Any positive integer
π	3.14159 ...
S	Length variable for two-dimensional distribution
S(b)	Value of the length variable at location b of a given distribution
S(V)	Length variable as a function of the environmental variable
S_{bI}	Value of the length variable at bottom of an inversion
S_{bV}	Value of the length variable at bottom of a varicline
S_{cV}	Value of the length variable at center of a varicline
S_{eI}	Value of the length variable at point of symmetry of an inversion
S_{tI}	Value of the length variable at top of an inversion
S_{tV}	Value of the length variable at top of a varicline
ΔS_I	Range (length) of an inversion
ΔS_V	Range (length) of a varicline
σ	Standard deviation

T	Temperature variable (environmental variable)
T_n	Nth value of temperature read off a trace
ΔT_T	Thermal magnitude of a thermocline
V	Environmental variable
V_n	Nth value of V read off a trace
$V(V_n)$	Nth value of V read off a trace
$V(a)$	Value of V at location a of a given distribution
ΔV	Magnitude of the mesh increment
ΔV_I	Variable magnitude of an inversion
ΔV_V	Variable magnitude of a varicline
XBT	Expendable Bathythermograph
Z	Depth (length variable) increases downwards from the sea surface
$Z(T)$	Depth as a function of temperature
Z_{bT}	Depth of the bottom of a thermocline
Z_{cT}	Depth of the center of a thermocline
Z_{tT}	Depth of the top of a thermocline

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I. OBJECTIVE OF THE THESIS

The study of oceanographic phenomena occurring in an area west of the Strait of Gibraltar from Cabo Finisterra (in Europe) to Canary Islands (in Africa) (Figure 1) based on climatological information, constituted the initial purpose of this thesis.

Later, the availability of oceanographic and meteorologic data from Fleet Numerical Weather Central (in Monterey), broadened the descriptive nature of the above intention giving opportunity to investigate the variations of the oceanic thermal structure taking place in the upper layers.

The large amount of accessible data, namely expendable bathythermograph traces and surface uncorrected geostrophic wind fields, were processed using a digital model and presented in a form simple to analyze. Initially, the model was set up to study the distribution of temperature with depth; soon, it became evident that it could be applied to other studies dealing with the continuous vertical distribution of any environmental parameter (sound velocity, salinity, light extinction, etc.).

The lack of information about air-sea temperature differences made impossible the transformation of the uncorrected geostrophic wind into "friction velocity" and cut short the last part of the study, which was to establish the statistical interrelation between the corrected wind information and the thermal features given by the objective analysis of traces.

Figure 1. Eastern North Atlantic Ocean

The new objective of the thesis then is defined in two parts:

a. To develop a digital model to analyze the continuous vertical distribution of any environmental parameter, to process the wind data and to present the generated information in a tractable form to reveal geophysical phenomena and their statistical connections.

b. To test the capability of the computer program by means of data available.

II. OBJECTIVE ANALYSIS OF DIGITAL TRACES

A. REVIEW OF PRESENT IDEAS

1. Introduction

The mechanical bathythermograph, BT, first introduced by Rossby and Montgomery [1935] and developed by Spilhaus [1938] provided one of the first successful attempts to obtain a continuous graphical record of an oceanic variable, namely the distribution of temperature with depth. The expendable bathythermograph, XBT, introduced by Francis and Campbell [1965] increased the continuous thermal record to a maximum depth of 457 meters. More sophisticated devices with greater depth ranges have been used to record continuously the vertical distribution of salinity, temperature and sound velocity as discussed by Magruder [1970]. Recently, Tucker and Shepard [1971] presented results from continuous registration of light transmission versus depth.

Continuous horizontal distribution of current speed, temperature, bathymetry and gravity are among the other variables that have been measured with sensors which are carried or towed in one direction at the sea surface or along other horizontal reference planes below or above the sea surface.

It is important to note that although these distributions are usually labelled as temperature (or other variable) versus depth (or other horizontal or vertical axis), the independent variable is the depth or the

successive positions where the sensor measures the oceanographic variable. A significant characteristic of a continuous distribution of a given variable along a length axis compared to time distributions is the absence of regularity or law of repetition, which means that distinct phenomena or different intensities of the same phenomenon are taking place along the sensed axis and makes impossible the application of time series analysis techniques.

The small cost of some equipment, namely BTs, their reliability and easy maintenance, together with a recording operation that does not require great ability from an observer led to widespread use; an immediate consequence was enormous accumulation of BT traces.

Recent development in automatic processing techniques of bathythermographic data is due to LaFond's [1951] pioneering efforts to establish a standardized method for processing BT traces and in predicting the need for automatic technology. Sauer [1964] described the Bathythermograph Card Processor which automatically transposes the BT record to an aperture card. Sauer and Hope [1967] gave a detailed account of the "BT Digitizer" operation which produces semiautomatic digitization of BT aperture cards. Dale and Stevens [1970] presented the Fleet Numerical Weather Central technique to digitize the XBT traces by the definition of the linear portions of the curve.

The analysis of a continuous record, BT or XBT, requires an acute visual sense, experience and superior

understanding of oceanographic processes. The researcher looks for characteristic geometric features of the trace; usually he follows the evolution of one feature throughout a set of records to assure consistency of reasoning. The human system is slow, inaccurate for subtle variations, reactive to routine procedures and subjective.

Efforts towards an automatic analysis of BT traces have been described among others by Boston [1966] who identified the most significant features in the thermal structure of oceanic upper layers and derived mathematical schemes to define the depth of the mixed layer, single and multiple thermoclines, transients and inversions. The mathematical schemes are based on: (1) an assumption of Gaussian or Normal distribution of temperature as a function of depth (Figure 2), and (2) a finite difference method. Grosfils [1968] translated into a computer program the schemes above outlined and Denham [1969] applied the same principles to a digital analysis of internal waves. Boston initially developed and applied his method while examining nearshore internal waves.

2. Evaluation of Boston's Concepts

The first part of this thesis generalizes some of Boston's [1966] concepts and their presentation. An evaluation will outline and help to understand the purpose of the present research.

a. Significant Features in the Thermal Structure

Boston defined the significant features of the thermal structure obtainable with a BT within the upper 300 meters of the ocean as

Figure 2. The Gaussian Thermocline and its Frequency Function [Boston, 1966]

(1) Primary features or those characteristics common to most oceanic regions. The thermal structure is simply approximated by an upper isothermal layer, a thermocline and a lower region of nearly constant temperature. Three parameters describe this type of structure, namely (a) the depth of the mixed layer (upper isothermal), Z_{tT} , (b) the depth of the "bottom" of the thermocline, Z_{bT} , and (c) the thermal magnitude of the thermocline is

$$\Delta T_T = T_{tT} - T_{bT} \quad (1)$$

if T_{tT} is the temperature at Z_{tT} and T_{bT} is the temperature at Z_{bT} .

(2) Secondary features are variations occurring in the primary structure at any point and classified as (a) transients or thermal fluctuations less than one degree Celsius and localized at the upper isothermal layer, (b) multiple thermoclines which are the result of heating and mixing conditions and (c) inversions or a type of structure occurring below the main thermocline where the temperature decreases with depth to a minimum, then increases and sometimes regains the decreasing trend.

b. Analytical Techniques

The analytical methods developed by Boston are based on (1) a Gaussian or Normal distribution of temperature with depth, and (2) a finite difference approach.

(1) The Gaussian distribution is described by the well-known frequency function; Figure 2,

$$\frac{dT(Z)}{dZ} = \frac{1}{\sqrt{2\sigma\pi}} e^{-\frac{(Z-m)^2}{2\sigma^2}} \quad (2)$$

where σ and m are constants. The function (2) has (a) symmetry about $Z = m$, (b) points of inflection at $Z = m \pm \sigma$ and (c) maximum rate of change at $Z = m \pm \sigma\sqrt{3}$. Application of the Gaussian distribution requires that the central moments of odd order be zero.

(2) The finite difference scheme implies the substitution of analog trace $Z(T_n) = f(T_n)$ by a discrete set of successive positions $(T_n, Z(T_n))$ obtained through a constant increment, ΔT , of the independent variable, T_n . The first finite difference of $Z(T_n)$ will be defined as

$$\Delta Z(T_n) = Z(T_{n+1}) - Z(T_n) \quad (3)$$

and the second finite difference as

$$\Delta^2 Z(T_n) = \Delta Z(T_{n+1}) - \Delta Z(T_n) \quad (4)$$

The value of the increment ΔT will vary according to the desired accuracy of the scheme.

c. Application of the Analytical Techniques to the Thermal Structure

The above concepts may be applied to the analysis of the thermal structure. It is assumed that the BT trace is replaced by a discrete set of ordered points (T, Z) from the surface and taken at equal thermal increment, ΔT .

(1) The Gaussian Thermocline. In accordance with the Normal or Gaussian distribution of temperature with

depth, $T \left(\frac{Z-m}{\sigma} \right)$, (a) the center of the thermocline is located at

$$Z_{cT} = -m \quad (5)$$

(b) the top and the bottom of the thermocline are considered to be at the points of the maximum rate of change of the slope of the $T \left(\frac{Z-m}{\sigma} \right)$ curve or at

$$Z_{tT} = -m + \sigma\sqrt{3} \quad (6)$$

$$Z_{bT} = -m - \sigma\sqrt{3} \quad (7)$$

(2) The Non-Gaussian Thermocline. The analysis of the non-Gaussian thermocline makes use of the variation in sign of the second finite difference scheme, equation (4), to find the point of inflection of the (T,Z) curve. This point identifies the center of the thermocline, Z_{cT} . The top of the thermocline, Z_{tT} , is determined using the technique outlined in (1) and generating an artificial Gaussian distribution around Z_{cT} by reflection of the upper part of the trace ($Z \leq Z_{cT}$). The bottom of the thermocline, Z_{bT} , is obtained in the same way but making use of the lower part of the (T,Z) curve, ($Z \geq Z_{cT}$). Figure 3 shows the successive steps of this analysis.

(3) Transients are recognized by the sign changes of the second finite difference, $\Delta^2 Z(T_n)$. A sign change from positive to negative signifies the end of one transient and the beginning of the next one.

(4) Multiple Thermoclines. An examination of the sign changes of the second finite difference, as made in

a. A NON-GAUSSIAN THERMOCLINE SHOWING TOP, CENTER AND BOTTOM AS DETERMINED BY FINITE DIFFERENCE PROCEDURE.

b. THERMOCLINE USED TO COMPUTE Z_t .

c. THERMOCLINE USED TO COMPUTE Z_b .

Figure 3. A Non-Gaussian Thermocline Showing Top, Center, and Bottom as Determined by Finite Difference Procedure [Boston, 1966]

(2), will reveal the points of inflection of the (T,Z) curve. These correspond to the centers of the thermoclines. The top and the bottom of each thermocline are found applying the method explained in (2). The separation between thermoclines is determined by the location of successive points where the first finite difference attains a maximum value. Examples of multiple thermoclines are illustrated in Figure 4.

(5) Inversions. The sign change of the first finite difference of the (T,Z) curve indicates the existence of an inversion. The upper and lower limits of any inversion delineate a continuum where the representative trace is double-valued (same temperature at two depths) but outside the region the distribution of temperature with depth is single-valued (one temperature and one depth). The main features investigated by this method are shown in Figure 5.

d. Remarks about Boston's Concepts

(1) The problem of automatic processing of bathythermograph data is well stated and represents a remarkable contribution.

(2) The objective digital analysis of the thermal structure requires application of several methods, each one is independent from the others and each describes a distinct thermal feature. More general objective schemes to analyze other features in the thermal structure would be even more useful and might be extended to the objective study of other oceanographic variables with vertical or horizontal axial distributions.

TABLE IV. Multiple thermocline analysis.

Table IV(a).

n	T_n	$Z(T_n)$	$\Delta Z(T_n)$	$\Delta^2 Z(T_n)$	
1	19	5	39		
2	18	44	0	-39	
3	17	44		1	Z_c
4	16	45	1	0	
5	15	46	4	3	
6	14	50	8	4	
7	13	58	32	24	
8	12	90

Table IV(b).

n	T_n	$Z(T_n)$	$\Delta Z(T_n)$	$\Delta^2 Z(T_n)$	
1	19	40	28		
2	18	68	4	-24	
3	17	72	8	-4	Z_{c1}
4	16	80	40	32	
5	15	120	14	-26	Z_{12}
6	14	134	10	-4	
7	13	144	10	-0	Z_{c2}
8	12	154

Table IV(c).

n	T_n	$Z(T_n)$	$\Delta Z(T_n)$	$\Delta^2 Z(T_n)$	
1	19.0	28	10		
2	18.5	38	6	-4	
3	18.0	44	12	-6	Z_{c1}
4	17.5	56	30	18	
5	17.0	86	4	-26	Z_{12}
6	16.5	90	4	-0	Z_{c2}
7	16.0	94	4	0	
8	15.5	98	4	0	
9	15.0	102	10	6	
10	14.5	112	18	8	Z_{23}
11	14.0	130	6	-12	
12	13.5	136	4	-2	
13	13.0	140	10	-6	Z_{c3}
14	12.5	150	10	0	
15	12.0	160	20	10	
16	11.5	180	50	30	
17	11.0	230			

Figure 4. Thermal Structure with One, Two, and Three Thermoclines [Boston, 1966]

FIGURE 5. Inversion Illustrating Main Features [Boston, 1966]

(3) The Gaussian or normal distribution of temperature with depth constitutes an interesting investigation. Its application to the definition of a thermocline is restricted depending upon whether or not a condition of symmetry around the first moment does exist. If this provision is not fulfilled there is not any thermal normal distribution with depth. However, in this case of non-Gaussian thermocline the top and the bottom of the thermocline are determined by means of an artificial reflected construction of normal distribution around the center which distorts slightly the initial information.

(4) The finite difference technique explores conveniently the behavior of first and second order schemes which give a familiar feeling for fluctuations of slope and points of inflection of the original trace. The development and study of higher order schemes may indicate interesting variations associated with significant features of any curve.

(5) The digitization of the analog trace by the selection of depths at uniform temperature intervals appears to be advantageous because the data is in a form where it may readily be processed by the finite difference technique. The thermal increment should be chosen as small as possible but compatible with the accuracy of the sensor.

B. AN OBJECTIVE MODEL

The primary purpose of this chapter is the presentation and development of general concepts which may be utilized

in the objective analysis of any given two-dimensional trace.

1. Significant Features in a Two-dimensional Trace

A two-dimensional trace presents the distribution of any oceanographic variable, V , with depth or along a horizontal axis, S , as shown in Figure 6. A peculiarity of the trace consists in the continuous increase in S with fluctuations in V . Such curves (V,S) show three general characteristics, namely: (1) trend, (2) varicline, and (3) inversion.

a. Trend

The trend indicates the general direction of development of the curve (V,S) in Figure 6: (1) between the beginning of the record, a , and g , the variable V is decreasing at different rates to the left of the figure; (2) $g - h$, the variable V is increasing and the trace is directed to the right; and (3) the final position of the curve between h and i again shows a decrease of V .

b. Varicline

Varicline was derived from the composition of the words: relative "variation" of the slope or "inclination"; it identifies portions of the curve where the slope increases relative to the neighbor regions. In Figure 6, parts $b - c$ and $d - e$ of the curve are variclines. Considering varicline $d - e$, the limiting parameter values are (1) the top, b ,

$$S_{tV} = S(d) \quad (8)$$

Figure 6. A Two-dimensional Trace

(2) the bottom, e,

$$S_{bV} = S(e) \quad (9)$$

(3) the range, ΔS_V ,

$$\Delta S_V = S(e) - S(d) \quad (10)$$

(4) the center,

$$S_{cV} = S(d) + \Delta S/2 \quad (11)$$

(5) the variable magnitude, ΔV_V ,

$$\Delta V_V = V(e) - V(d) \quad (12)$$

and (6) the gradient,

$$G_V = \Delta V_V / \Delta S_V \quad (13)$$

c. Inversion

An inversion identifies a segment of the curve (V,S) where there exists an approximately symmetrical distribution of the oceanographic variable, V with length S around a point, namely location g in Figure 6. The point of symmetry is found by examination of the variation of the trend: it is a relative maximum or minimum of V . Referring to Figure 6 again, the point g constitutes a relative minimum. The most important parameters of an inversion are (1) the top, f ,

$$S_{tI} = S(f) \quad (14)$$

(2) the bottom, h ,

$$S_{bI} = S(h) \quad (15)$$

(3) the location of the extreme value of V in the inversion, g ,

$$S_{eI} = S(g) \quad (16)$$

(4) the variable magnitude, ΔV_I

$$\Delta V_I = |V(g) - V(f)| \quad (17)$$

$$= |V(g) - V(h)| \quad (18)$$

and (5) the range, ΔS_I ,

$$\Delta S_I = S(h) - S(f) \quad (19)$$

2. The Finite Difference Technique

The finite difference technique investigates the variation of a two-dimensional distribution. The original analog record is previously digitized according to semi-automatic procedures. The digital trace constitutes an ordered and discrete set of positions.

a. The Preparation of the Mesh

The finite difference technique requires an organized two-dimensional distribution or mesh such that the values of one variable V , chosen as independent, are read at constant interval ΔV together with the correspondent values of the other variable $S(V)$, dependent, Figure 7. The magnitude of the increment ΔV is directly related to the accuracy of the record and it is unrealistic to select a small but incompatible value. The digital trace may present the structure as a satisfactory mesh with values at constant intervals; if not, it must be altered accordingly. Assuming that the digital trace has a linear variation, the mesh points will be obtained by a simple linear interpolation. However, the selected constant interval may introduce an alteration to the original trace and ΔV must be small enough as shown in Figure 8.

Figure 7. The Mesh

A.

B.

C.

Figure 8. The Linear Interpolation of a Digital Trace: A. Digital Trace, B. Mesh (increment $V = 2$ arbitrary units), C. Mesh (increment $V = 1$ arbitrary unit)

b. Finite Difference Schemes

A mesh consists of an ordered set of points at fixed intervals of variable and two consecutive positions define one linear segment. Each segment is specified by (a) the length component and (b) the variable component as illustrated in Figure 9A.

(1) First Finite Difference of V

The first finite difference of $V(V_n)$ is defined as

$$\Delta V(V_n) = V(V_{n+1}) - V(V_n) \quad (20)$$

and may be positive (pointing to the right) or negative (directed to the left), as shown in Figure 9C.

(2) First Finite Difference of S

The first finite difference of $S(V_n)$ is stated as

$$\Delta S(V_n) = S(V_{n+1}) - S(V_n) \quad (21)$$

and is always positive, Figure 9B.

(3) Second Finite Difference of S

The second finite difference of $S(V_n)$ is described as

$$\Delta^2 S(V_n) = \Delta S(V_{n+1}) - \Delta S(V_n) \quad (22a)$$

$$= S(V_{n+2}) - 2S(V_{n+1}) + S(V_n) \quad (22b)$$

and employs three points, n , $n+1$, $n+2$, from the mesh. The three points define two linear segments, whose relative arrangement will be related to the negative, positive or null value of $\Delta^2 S(V_n)$, Figure 10.

A.

B.

C.

Figure 9. The Mesh and Its Components:
A. Segments of the Mesh
B. Length Components
C. Variable Components

A.

	S(V)	Δ	Δ^2
N	10	15	0
N+1	25	15	
N+2	40		

B.

	$\Sigma(V)$	Δ	Δ^2
N	10	15	-12
N+1	25		
N+2	28	3	

C.

	S(V)	Δ	Δ^2
N	10	15	18
N+1	25	33	
N+2	58		

Figure 10. Schemes of the Second Finite Differences: A. Constant Slope, B. Increasing Slope, C. Decreasing Slope

(4) Third Finite Difference of S

The third finite difference of $S(V_n)$ is specified as

$$\Delta^3 S(V_n) = \Delta^2 S(V_{n+1}) - \Delta^2 S(V_n) \quad (23a)$$

$$= \Delta S(V_{n+2}) - 2\Delta S(V_{n+1}) + \Delta S(V_n) \quad (23b)$$

$$= S(V_{n+3}) - 3S(V_{n+2}) + 3S(V_{n+1}) - S(V_n) \quad (23c)$$

and requires four points, $n, n+1, n+2, n+3$, from the mesh.

The $\Delta^3 S(V_n)$ summarizes the relative disposition between three linear segments, defined by four points. Five basic schemes of the $\Delta^3 S(V_n)$ are presented in Figure 11.

(5) Higher Order Finite Difference of S

Higher order finite difference of S,

$$\Delta^k S(V_n) = \Delta^{k-1} S(V_{n+1}) - \Delta^{k-1} S(V_n) \quad (24)$$

will demand more points from the mesh, namely the number of the order plus one and concurrently the analysis of the relative structure will increase in complexity. The development of the finite difference schemes up to the third order seems to constitute adequate advancement for the operational needs in the present research.

3. Two-dimensional Objective Analysis

The finite difference schemes above introduced, will be applied to the significant features of a two-dimensional trace and illustrated by schematic diagrams.

a. Trend

As explained before, the trend shows the tendency of the independent variable, V , which is investigated by the

A.

	ΣIVI	Δ	Δ^2	Δ^3
N	10	10	0	0
N+1	20	10		
N+2	30	10	0	
N+3	40	10		

B.

	ΣIVI	Δ	Δ^2	Δ^3
N	10	10	-3	-1
N+1	20	7		
N+2	27		-4	
N+3	30	3		

C.

	ΣIVI	Δ	Δ^2	Δ^3
N	10	10	2	2
N+1	20	12		
N+2	32	16	4	
N+3	48			

D.

	ΣIVI	Δ	Δ^2	Δ^3
N	10	10	7	-20
N+1	20	17		
N+2	37	4	-13	
N+3	41			

E.

	ΣIVI	Δ	Δ^2	Δ^3
N	10	10	- 5	12
N+1	20	5		
N+2	25	12	7	
N+3	37			

Figure 11. Schemes of the Third Finite Differences:
 A. Constant Slope, B. Successive Increase of the Slope, C. Successive Decrease of the Slope, D. Successively Decreasing and Increasing the Slope, E. Successively Increasing and Decreasing the Slope

use of its first finite difference, $\Delta V(V_n)$ expressed in (20). Assuming that V increases to the right, as shown in Figure 6, the analysis of V may be summarized as follows:

(1) Variation

(a) $\Delta V(V_n) < 0 : V_{n+1} < V_n$, V is decreasing or directed to the left of the graph.

(b) $\Delta V(V_n) = 0 : V_{n+1} = V_n$, V is constant or parallel to the length axis.

(c) $\Delta V(V_n) > 0 : V_{n+1} > V_n$, V is increasing or tending to the right.

(2) Extreme values

The change in sign of the first finite difference of V indicates that the trend has changed direction and defines an extreme feature:

(a) $V(V_{n+1}) < 0$ and $V(V_n) > 0$: relative maximum at point $n+1$.

(b) $V(V_{n+1}) > 0$ and $V(V_n) < 0$: relative minimum at point $n+1$.

(c) The largest and the least of the V values above found with the values of V at the beginning and end of the trace give the absolute maximum and minimum of the trace.

b. Varicline

The basic concept of the objective varicline is presented in Figure 11E composed of three segments and, although their relative arrangement is unchangeable the middle part can be divided into more than one segment. The analysis of the characteristics,

(1) $\Delta^2 V(V_n) < 0$: top of varicline at point $n+1$.

(2) $\Delta^2 V(V_{n+1}) > 0$: base or bottom of varicline

at point $n+2$ is indicated in Figure 11.

c. Inversion

The analysis of the trend indicates whether or not there are maxima and minima present in the record. The maxima and minima (excluding the values of V in the beginning and the end of the trace) evidence areas of approximate symmetry of V around the extrema. Referring to Figure 6 the analysis of the trend gave (a) the absolute minimum at g , (b) a relative maximum at h , and (c) the absolute maximum value in V was found at a , the beginning of the trace. It is evident that locations f and h define a region of approximate symmetry of V around the relative minimum g . An inversion is characterized by a portion of the (V,S) curve where the trend changes sign, illustrated by the layer $g - h$ in Figure 6. The limits of the approximate symmetry are established by comparison of the variable magnitudes, ΔV 's (17 or 18) determined using the point of symmetry of the extrema in consideration, g , and the adjacent positions defining extreme values in V , namely a and h . The least ΔV is chosen as the variable magnitude of the inversion.

d. Complex type

The complex type of trace combines the basic investigations of trend, variclines and inversions. The method of procedure is outlined in three stages:

(1) Objective analysis of the trend.

Figure 12. Computer Output Plot of a Digital Trace Showing the Tops (squares) and the Bottoms (triangles) of Analyzed Variclines. (The control of the conditions limiting the bottom of a varicline allows: A. identification of all the variclines present, and B. definition of the significant features)

(2) Objective analysis of inversions.

(3) Objective analysis of variclines, which may be conducted throughout the entire trace or be restricted to those portions outside the symmetrical regions.

4. Tri-dimensional Objective Analysis

The two-dimensional objective analysis studies the distribution of a given variable V along a length axis S . The availability of a collection of traces spread out in time, D , or along a horizontal, L , or vertical, S , direction illustrated in Figure 13, makes possible the investigation of a tri-dimensional distribution of V in (a) length (V, S, L) and in (b) length and time (V, S, D). An objective analysis of this tri-dimensional distribution is possible if the law of variation of V is known or the interval (in time or length) between consecutive traces is small enough to assume a linear interpolation or digitization of the new trace. One of the above requirements is fundamental to generate a mesh and to apply the concepts of the two-dimensional objective analysis to each one of the new traces, shown in Figure 13B.

5. The Problem of Filtering

Usually a trace shows a complicated form with small variations superimposed on a general pattern. The small fluctuations may have physical significance or may simply represent an artificial response of the sensor; however, it may be impossible to distinguish whether a regular feature is valid or invalid. The most common approach

A.

LENGTH, L OR TIME, D

B.

C.

Figure 13. Tri-dimensional Analysis: A. The Tri-dimensional Distribution, B. A New Trace, C. The Projection of Two-dimensional Traces Along a Given Axis

FILTERING STEPS	
1	δ or $\sigma, \theta = \tan \omega$
2	α or $\beta = \tan \omega$

Figure 14. The Filtering Parameters of Variclines

Figure 15. Computer Output Plot of the Linear Field of Isotherms for One Cruise or the Average Linear Field of Isotherms for a Given Number of Cruises

consists in the identification of the general pattern of the trace and this outlines a problem of scale: if the investigator is interested in microstructure, his main efforts are concentrated in the improvement of the accuracy of the sensor. The technique of suppressing the small features has not found definite and complete solution. It reveals a compromise established between the need to avoid small fluctuations and the unfortunate results when those variations were physically meaningful and their filtering has introduced artificial values. The best approach requires a good understanding of the geophysical phenomena and a suitable application of the filtering methods.

In this thesis study, analytical filters such as the binomial expansion and the least square polynomial approximation were used to smooth the generated mesh but they introduced severe modifications which (as presented in Figure 16B) completely deformed the original information, and their further application was avoided.

The discussion of the filtering capability of the finite difference technique constitutes the purpose of the present chapter.

a. The Mesh

The generated mesh depends upon the selection of the constant increment ΔV : (a) a large value erases the small features but introduces distortion in the digital trace, and (b) a small value (compatible with the accuracy of the sensor) keeps the details and reproduces closely the digital trace, as shown in Figure 8.

A.

XBT STATIONS ALONG CROSS SECTION AXIS →

B.

5TH. DEGREE POL. APP. (FULL)

Figure 16. Computer Output Plots of: A. The Interpolated Digital Traces Along a Cross Section for a Given Cruise, and B. The Fifth Order Least Square Polynomial Approximation of the Same Digital Traces

b. Significant Features

Generically, significant features like inversions and variclines may be filtered out by specification of filtering parameters or the minimum values of (a) the defining parameters (8 - 11) and (b) the separation in length between consecutive and identical features (bottom of one and the top of the next).

Specifically, the filtering of variclines may be obtained by:

(1) The conditions limiting the top and the bottom of variclines (especially the bottom) and expressed in II.B.3.b., may be modified and extended to more points of the mesh above and below the feature resulting in its more clear definition, as evidenced in Figure 12.

(2) The filtering parameters illustrated in Figure 14:

(a) ALPHA or the minimum variable magnitude limiting the varicline.

(b) BETA or the minimum gradient defining the varicline.

(c) DELTA or the minimum separation in length between consecutive variclines.

(d) THETA or the minimum gradient selecting the variclines to be merged, using simultaneously the SIGMA parameter.

(e) SIGMA or the maximum separation in length between variclines to be merged and already defined by the THETA parameter.

C. A COMPUTER PROGRAM

The investigation of the vertical distribution of temperature in the upper oceanic layers can provide a digital model which applies the concepts of objective analysis described above.

Usually the data available is too non-uniformly distributed in time and length to make possible the use of a tri-dimensional objective analysis; however, a two-dimensional type may be utilized to examine each trace and to plot the result of the investigation (of all the traces obtained in a cruise or passage along a cross section) in a way which allows a subjective analysis.

An introduction of the model, its characteristics and operation is summarized in the next presentation.

1. Description

a. The Basic Computer Model

The computer model is organized in two parts: (a) the main program, and (b) the subroutines. The main program presents in a logical way a sequence of events concerning the execution of the job. This arrangement is a compromise between the space available in the computer memory and the least time of execution. The subroutines deal with specific stages of that execution.

The following description outlines the major operations of the model and their implementation must be monitored closely by the use of the flow diagram presented in Appendix B, with the symbols explained in Appendix A.

(1) "START" to "NORDER = 1"

The computer program receives the general information about the number identifying the cross section in study (ICSEC), the number of cruises per cross section (ICRUI), the number (ISO) and the values (TI) of isotherms, the mesh interval (DTW) and the number (NBT) and location (X) of stations for the cross section.

(2) "DO 460" Loop

The computer program processes the complete set of information about the thermal structure and wind field for a given cross section, cruise after cruise:

(a) "ITITLE'S" reads the titles of the plots drawn per cruise.

(b) "DO 250" loop reads the location (ISTA), the number (NOP) and pairs of points (ZO,TO) defining each digital trace in the cruise and processes the information about the depth of each isothermal value (GTVALU or ARTFT1). This scheme applies to all digital traces of a cruise.

(c) "CALL PLOTIT" receives the above generated data for the whole cruise and plots the field of isotherms (TI).

(d) "DO 350" loop reads the location (ISTA), the number (NOP) and pairs of points (ZO,TO) defining each digital trace in the cruise and prepares the mesh for that trace (LINTPS), plots the obtained mesh (PLOTBT) and analyzes it to identify thermoclines (THERMC).

(e) "CALL PLOTFT" receives the above generated data for the whole cruise and plots the field of thermocline isopleths.

(f) "DO 450" loop reads the location (ISTA) and the wind observations (WIND); determines the components of the wind along and perpendicular to the next coastline at the day of XBT/BT drop and one day before (WIND01), two days before (WIND02), three days before (WIND03), five days before (WIND05) and ten days before (WIND10); plots the wind and its components.

(g) "NPLOT = 3" to "460" completes the drawing of the wind information for a cruise and sets in the process for a new cruise.

(3) "IKONTR" to "IKONTR = 0"

This step controls the execution of the remaining part of the program. If the IKONTR value is zero the job ends.

(4) "IERIOD ..." to "CALL STATCS"

The computer program reads the required information to start the statistical study (STATCS) between any two parameters (KEK = 1, KEK = 2) and to plot the scatter diagram and the least square regression lines in the same graph (ITITL5). The continuation of the statistical study relies on the value of KRK read if different from zero.

(5) "ILONTR" to "ILONTR = 0"

This part controls the execution of the last part of the program. If the IONTR value is zero, the job ends.

(6) "ITITL6" to "PLTMIT"

The program receives the generated data of the whole cross section and plots the average field of isotherms (PLTMIT) with a printed label (ITITL6).

(7) "ICSEC" to "STORAGE"

The program indicates that the study of the cross section (ICSEC) is completed and ends the job by the storage in a disk of the original and generated information (STORAGE).

b. Other Subroutines Available

Other subroutines are available to improve or to modify the operation of the basic model but keeping its main structure.

(1) Subroutine TREND

The subroutine TREND, Appendixes D, G and M, analyzes the digital trace using the finite difference technique to locate the maxima and the minima.

(2) Subroutine INVERS

The subroutine INVERS, Appendixes E, G and M, determines the inversion parameters for each minimum identified by subroutine TREND.

(3) Subroutine PROPAR

The subroutine PROPAR, Appendixes H and K, computes the friction velocity, roughness parameter and stability length from wind speed and air-sea temperature difference data.

(4) Subroutine ITRATE

The subroutine ITRATE, Appendixes I and L, calculates the friction velocity, inflow angle, roughness parameter and stability length from the large scale synoptic parameters.

(5) Subroutine DRAW

The subroutine DRAW, Appendix J, neutralizes the "IBM subroutine DRAW" avoiding output plots.

2. Input

The form of input to this program consists in data deck.

a. Main Program

The input to the main program is identified by the symbol READ shown in Appendix A. The flow diagram of the main program, Appendix B, gives the ordered sequence of the data deck. The format of individual input is specified in the computer program, Appendix F.

b. Subroutine THERMC

The subroutine THERMC requires the insertion of chosen values for the filtering parameters (ALPHA, BETA, DELTA, SIGMA, THETA) before running the program.

c. Subroutine PROPAR

The subroutine PROPAR requires special data described in Appendix H, which must be read together with the wind information as shown in Appendix K.

d. Subroutine ITRATE

The subroutine ITRATE needs large scale synoptic information pictured in Appendix I, which must be read together with the wind data as presented in Appendix L.

3. Output

The forms of putput from this program are (1) printouts, (2) plots, and (3) storage in disk.

a. Printouts

The printouts are identified by the symbol PRINTOUT, in Appendix A. The flow diagrams show the occurrence of printouts and their formats are specified in the computer programs.

The inclusion of the DUMMY card, Appendix P.a. neutralizes this form of output.

b. Plots

The basic program presents six types of plots which appear according to the execution of the following subroutines:

(1) PLOTIT

The subroutine PLOTIT plots the linear field of isotherms per cruise, as shown in Figure 15.

(2) PLOTBT

The subroutine PLOTBT plots the interpolated digital traces obtained in a given cruise, Figure 16.

(3) PLOTFT

The subroutine PLOTFT plots the linear field of isopleths defining the top, the mean depth and the bottom of the thermoclines analyzed from the interpolated digital traces of a given cruise, Figure 17.

(4) PLTMIT

The subroutine PLTMIT plots the average linear field of isotherms for a specified number of cruises, Figure 15.

Figure 17. Computer Output Plots of the Linear Field of Isopleths Defining the Top (T), the Mean Depth (M), and the Bottom (B) of the Three Shallowest Thermoclines for Different Values of the Filtering Parameters

(5) RLINE and STATCS

The subroutines RLINE and STATCS plot the least square regression lines (RLINE) and the scatter diagram (STATCS) in the same graph to illustrate the statistical relation between two given variables, Figure 18.

(6) WINDOO, WINDO1, WINDO2, WINDO3, WINDO5, WIND10

The subroutines WINDOO, WINDO1, WINDO2, WINDO3, WINDO5 and WIND10 plot the wind vector and its components (along and perpendicular to the direction of the near coastline) measured at given station and day of XBT observation and at one, two, three, five and ten days before. The drawings are made in the same diagram for a specific cruise, Figure 19.

(7) DRAW

The insertion of the subroutine DRAW, Appendix J, will avoid this type of output.

c. Storage in Disk

The initial and processed data are stored in allocated space of disk depending upon the inclusion of the Job Control Language instructions shown in Appendix O.b, c,d.

4. Operation

a. Characteristics of the Basic Program

(1) Source Language

The computer program is written in FORTRAN IV (H) and the calculations are performed in real single precision arithmetic.

Figure 18. Computer Output Plot of the Least Square Regression Lines and the Scatter Diagram (+) for Two Given Parameters: Variable 1 and Variable 2

Figure 19. Computer Output Plot of the Wind Vector and its Components (along and perpendicular to the direction of the near coastline) Measured at Same Station and Day of XBT Observation and One, Two, Three, Five and Ten Days Before

(2) Subroutines and Functions Subprograms

The computer program uses subroutines and functions subprograms that had been compiled or been added to a library under OS/MVT. If the source deck of subroutine MISR had not been precompiled, it might be accessed (in Naval Postgraduate School Computer Facility) by concatenation in the FORTRAN compile step using the Job Control Language cards shown in Appendix N.d,e.

(3) Core

The basic computer program processes information for twenty cruises, each containing twelve stations and requires 288 K in core dimension, demanding the FORTRAN compilation step 150 K which must be requested by means of the Job Control Language card presented in Appendix N.b.

The space available is divided in five "COMMON" labelled areas which enables (a) the exchange of information between the main program, and (b) an economic and profitable use of the computer memory.

(4) Time

The time required to process (without statistical study) a set of seventeen cruises, each with nine stations, is about three minutes and thirty-four seconds. This time is distributed by (a) the compilation (one minute and forty-one seconds), (b) the linkage (three seconds), and (c) the execution (one minute and fifty seconds).

(5) Disk

The storage of the initial and processed information in a disk is obtained by the use of the Job Control Language cards shown in Appendix O.b,c,d. The requested space in disk corresponds to one cylinder or IBM 2314.

b. Equipment

The basic equipment used was:

- (1) IBM 360/Model 67, OS - MVT with a
- (2) CALCOMP Plotter, Model 765.

III. APPLICATION OF THE OBJECTIVE MODEL

The computer model was tested by the use of bathythermographic and wind information available from Fleet Numerical Weather Central for the geographical area shown in Figure 1.

The XBTs were taken during three years of passages between Canary Islands and Ferrol (Bay of Biscay) and Canary Islands and Barcelona (Mediterranean Sea) by Spanish ships. The XBT traces, in digital form and FORTRAN format compatible with this program, were organized in three cross sections, each one describing the normal routing of the survey ships and containing ten stations. In total, about 750 XBT traces were ready for further processing. Values for the filtering parameters of the thermocline analysis were previously chosen, namely

$$\text{ALPHA} = 0.3^{\circ}\text{C}$$

$$\text{BETA} = 0.015^{\circ}\text{C}/\text{meter}$$

$$\text{DELTA} = 10.0 \text{ meters}$$

$$\text{THETA} = 0.027^{\circ}\text{C}/\text{meter}$$

$$\text{SIGMA} = 25.0 \text{ meters}$$

and applicable to all seasons and stations of the area. Finally, the objective analysis of the bathythermograph information was performed.

For each station of the cross sections, geostrophic wind data were computed from surface pressure analysis in FNWC. The wind obtained was not corrected for instability due to lack of information concerning the air-sea temperature

difference and according to Cardone [1969], such correction is fundamental to assure reliable wind data, specifically "friction velocity". Without this transformation, further handling of wind was decided to be inappropriate.

The final part of the application of the model, which is a statistical study between the wind and the thermal fields, as well as the computation of the first, second, third and fourth statistical moments (to infer known statistical distributions) of each field for a given station of the area could not be physically concluded due to the lack of proper wind data. Otherwise, the difficulties pointed out the importance of valid wind information and motivated the inclusion of subroutines, developed by Cardone[1969], to calculate "friction velocity" from large scale synoptic information (ITRATE) or ship reports (PROPAR).

IV. CONCLUSIONS

A FORTRAN IV program was developed and tested to handle large amounts of wind and bathythermographic information in an automatic way without distorting the initial data and restricting the human participation to a preparation phase dealing with organization of the information available and selection of values for the parameters of the model. The program performs objective analysis of XBT/BT digital traces, processes wind information, studies the statistical characteristics of the original and processed data and plots the generated fields.

The objective analysis of XBT/BT traces makes use of finite difference schemes which requires preceeding transformation of the analog trace into digital form. The same concepts may be extended to analyze the distribution of any environmental variable (similar to the bathythermograph) along vertical or horizontal directions.

V. RECOMMENDATIONS

It is recommended that bathythermograph data be analyzed by an objective method before any subjective interpretations are made.

The objective analysis of XBT/BT traces may be performed aboard ships by the use of digital computers requiring a small memory but, the pre-digitization of the analog trace constitutes a fundamental prerequisite for processing.

APPENDIX A

FLOW DIAGRAM SYMBOLS

LIMITS

READ

PRINT OUT

DECISION

LOOP

STORAGE IN DISK

CONNECTION

SUBROUTINE OR FUNCTION

END OF LOOP

PROCESS

APPENDIX B

FLOW DIAGRAM OF THE FORTRAN IV BASIC COMPUTER PROGRAM

FLOW DIAGRAM OF THE THERMOCLINE ANALYSIS

FLOW DIAGRAM OF THE TREND ANALYSIS

FLOW DIAGRAM OF THE INVERSION ANALYSIS

FORTRAN IV BASIC PROGRAM FOR IBM 360/OS

```

MAIN0010
MAIN0020
MAIN0030
MAIN0040
MAIN0050
MAIN0060
MAIN0070
MAIN0080
MAIN0090
MAIN0100
MAIN0110
MAIN0120
MAIN0130
MAIN0140
MAIN0150
MAIN0160
MAIN0170
MAIN0180
MAIN0190
MAIN0200
MAIN0210
MAIN0220
MAIN0230
MAIN0240
MAIN0250
MAIN0260
MAIN0270
MAIN0280
MAIN0290
MAIN0300
MAIN0310
MAIN0320
MAIN0330
MAIN0340
MAIN0350
MAIN0360
MAIN0370
MAIN0380
MAIN0390
MAIN0400
MAIN0410
MAIN0420
MAIN0430
MAIN0440
MAIN0450
MAIN0460
MAIN0470
MAIN0480

.....
MAIN PROGRAM

GENERAL PURPOSE
(1) TWO-DIMENSIONAL OBJECTIVE ANALYSIS OF BT/XBT DIGITAL TRACE
    TO DETERMINE THE THERMOCLINES AND THE DEPTH OF THE MIXED LAYER
    USING THE FINITE DIFFERENCE TECHNIQUE. (THE ANALYSIS MAY BE
    EXTENDED TO INVESTIGATE THE DIGITAL AND INVERSIONS) THERMAL FIELD
(2) REPRESENTATION OF THE DIGITAL TRACES, THE ISOTHERMAL FIELD
    AND THE FIELD OF ISOPLETHS OF THE THERMOCLINE ANALYSIS AT GIVEN
    POSITIONS ALONG A LENGTH (CROSS SECTION OR TIME AXIS) ALLOWING
    A SUBJECTIVE ANALYSIS.
(3) WIND DATA (INITIATION OF OBSERVATION) RELATIVE TO THE BT/XBT
    GEOGRAPHICAL POSITION IS SEPARATED IN TWO
    COMPONENTS: (A) ALONG AND (B) PERPENDICULAR TO THE DIRECTION
    OF THE NEAR CCASTLINE. THE WIND AND ITS COMPONENTS ARE
    PRESENTED AT THE GIVEN POSITION.
    FOR A SUBJECTIVE INVESTIGATION.
(4) THE ORIGINAL DATA WITH THE INFORMATION RESULTANT FROM THE
    ABOVE PROCESS ARE STATISTICALLY INTERRELATED TO EVIDENCE
    ANY CONNECTION.

DESCRIPTION OF PARAMETERS
DTW - INPUT VALUE OF THE THERMAL INTERVAL OF THE MESH
IBEGIN - INPUT VALUE CONTAINING THE MONTH, DAY AND YEAR OF THE
        BEGINNING OF THE STUDY
ICRUI - INPUT NUMBER OF CRUISES PER CROSS SECTION
ICSEC - INPUT NUMBER OF IDENTIFICATION OF THE CROSS SECTION
IEND - INPUT VALUE CONTAINING THE MONTH, DAY AND YEAR OF THE
        END OF THE STUDY
IERIOD - INPUT VALUE CONTAINING THE NUMBER OF DAYS CONCERNING
        THE DURATION OF THE STUDY
IKONTR - INPUT VALUE CONTROLLING THE EXECUTION OF THE
        STATISTICAL STUDY (IF IKONTR.EQ.0 : 'NO STUDY')
ILONTR - INPUT VALUE CONTROLLING THE PLOT OF THE MEAN LOCATIONS
        OF ISOTHERMS (FOR A GIVEN PERIOD) ALONG A CROSS
        SECTION OR TIME AXIS
IORDER - INPUT VALUE CONTAINING THE NUMBER OF THE CRUISE TO
        INITIATE THE STATISTICAL STUDY
ISO - INPUT NUMBER OF ISOTHERMS
ISTA - INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
        SECTION
ITITL1 - INPUT VECTOR OF LENGTH '12' CONTAINING THE TITLE FOR
        PLOT OF DIGITAL TRACES ALONG A CROSS SECTION OR TIME

```


MAIN0970
MAIN0980
MAIN0990
MAIN1000
MAIN1010
MAIN1020
MAIN1030
MAIN1040
MAIN1050
MAIN1060
MAIN1070
MAIN1080
MAIN1090
MAIN1100
MAIN1110
MAIN1120
MAIN1130
MAIN1140
MAIN1150
MAIN1160
MAIN1170
MAIN1180
MAIN1190
MAIN1200
MAIN1210
MAIN1220
MAIN1230
MAIN1240
MAIN1250
MAIN1260
MAIN1270
MAIN1280
MAIN1290
MAIN1300
MAIN1310
MAIN1320
MAIN1330
MAIN1340
MAIN1350
MAIN1360
MAIN1370
MAIN1380
MAIN1390
MAIN1400
MAIN1410
MAIN1420
MAIN1430
MAIN1440

KEK2 -- INPUT VALUE INDICATING THE SECOND OF TWO VARIABLES TO
BE INTERRELATED
KKK -- INPUT VALUE CONTROLLING THE PLOT OF THE WIND VECTOR
(IF K*NE.G : 'NO PLOT')
KKR -- INPUT VALUE CONTROLLING THE CONTINUATION OF THE
STATISTICAL STUDY. (IF KRK*EQ.Q : 'NO MORE STUDY')
K98 -- ACTUAL NUMBER OF PROCESSED CRUISES
LABEL -- INPUT SHORT IDENTIFICATION OF A PLOTTED CURVE
LAST -- OUTPUT VALUE IDENTIFYING AN INFORMATION ABOUT THE
SUCCESS OF A PLOT (IF K*EQ.Q : 'COMPLETED')
MCRDR -- INPUT VALUE CONTAINING THE NUMBER OF THE CRUISE TO
END THE STATISTICAL STUDY
M60 -- OUTPUT NUMBER OF PAIRS (T, Z) COMPUTED FROM THE DIGITAL
TRACE BY (A) A CONTINUOUS INCREMENT 'DTW' OF
TEMPERATURE BEGINNING AT SEA SURFACE AND (B) THE
DEPTHS OF THE ABOVE PAIRS ARE OBTAINED BY LINEAR
INTERPOLATION BETWEEN NEAR POINTS OF THE ORIGINAL
DIGITAL TRACE
NBT -- INPUT NUMBER OF STATIONS ALONG THE CROSS SECTION OR
THE TIME AXIS
NOP -- INPUT NUMBER OF PAIRS (TC, ZC) DEFINING A DIGITAL TRACE
NORDER -- ACTUAL NUMBER OF PROCESSED CRUISES
NPLOT -- INPUT VALUE INDICATING THE NUMBER OF CURVES PER PLOT
(INFORMATION REQUIRED BY SUBROUTINE 'DRAW')
N10 -- ACTUAL NUMBER OF WIND PLOTS
P00 -- INPUT NUMBER OF SIZE 'NBT*ICRUI' CONTAINING THE WIND
SPEED AT DAY OF BT/XBT OBSERVATION, FOR A GIVEN
STATION AND CRUISE NUMBER
KEK2=16
R001 -- INPUT MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIND
SPEED (ALONG THE COAST) AT DAY OF BT/XBT OBSERVATION,
FOR A GIVEN STATION AND CRUISE NUMBER
KEK2=25
R002 -- INPUT MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIND
SPEED (PERP. TO THE COAST) AT DAY OF BT/XBT OBSERVATION
, FOR A GIVEN STATION AND CRUISE NUMBER
KEK2=26
R01 -- INPUT MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIND
SPEED AT ONE DAY BEFORE THE DAY OF BT/XBT OBSERVATION,
FOR A GIVEN STATION AND CRUISE NUMBER
KEK2=17
R011 -- INPUT MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIND
SPEED (ALONG THE COAST) AT ONE DAY BEFORE THE DAY OF
BT/XBT OBSERVATION, FOR A GIVEN STATION AND CRUISE
NUMBER
KEK2=27
R012 -- INPUT MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIND
SPEED (PERP. TO THE COAST) AT ONE DAY BEFORE THE DAY

CC

[illegible]

83

[illegible]

ZTH3S	KEK1=15 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH BOTTOM OF SHALLOW THERMOCLINE	MAIN2410 MAIN2420 MAIN2430 MAIN2440 MAIN2450 MAIN2460 MAIN2470 MAIN2480 MAIN2490 MAIN2500 MAIN2510 MAIN2520 MAIN2530 MAIN2540 MAIN2550 MAIN2560 MAIN2570 MAIN2580 MAIN2590 MAIN2600 MAIN2610 MAIN2620 MAIN2630 MAIN2640 MAIN2650 MAIN2660 MAIN2670 MAIN2680 MAIN2690 MAIN2700 MAIN2710 MAIN2720 MAIN2730 MAIN2740 MAIN2750 MAIN2760 MAIN2770 MAIN2780 MAIN2790 MAIN2800 MAIN2810 MAIN2820 MAIN2830 MAIN2840 MAIN2850 MAIN2860 MAIN2870 MAIN2880
ZTH3I	KEK1=16 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH BOTTOM OF INTERMEDIATE THERMOCLINE	
ZTH3D	KEK1=17 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH BOTTOM OF DEEP THERMOCLINE	
ZTHWS	KEK1=18 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE RANGE SHALLOW THERMOCLINE	
ZTHWI	KEK1=19 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE RANGE INTERMEDIATE THERMOCLINE	
ZTHWD	KEK1=20 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE RANGE DEEP THERMOCLINE	
ZTHVS	KEK1=24 -OUTPUT THERMAL	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIDTH OF THE SHALLOW THERMOCLINE	
ZTHVI	KEK1=25 -OUTPUT THERMAL	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIDTH OF THE INTERMEDIATE THERMOCLINE	
ZTHVD	KEK1=26 -OUTPUT THERMAL	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE WIDTH OF THE DEEP THERMOCLINE	
ZMIXLR	KEK1=27 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH MIXED LAYER	
YA	KEK1=28 -VECTOR ARTIFICIAL	POINTS TWO CONTAINING THE ORDINATES OF TWO COMPLETE THE WIND PLOTS	
Z11CS	-OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH 11 DEG CELSIUS SHA-LOW ISOTHERM	
Z11CI	-OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH 11 DEG CELSIUS INTERMEDIATE ISOTHERM	
Z11CD	-OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH 11 DEG CELSIUS DEEP ISOTHERM	
Z12CS	KEK1=35 -OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH 12 DEG CELSIUS SHALLOW ISOTHERM	
Z12CI	-OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH 12 DEG CELSIUS INTERMEDIATE ISOTHERM	
Z12CD	-OUTPUT OF THE	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH 12 DEG CELSIUS DEEP ISOTHERM	
Z13CS	KEK1=30 -OUTPUT	MATRIX OF SIZE 'NBT*ICRUI' CONTAINING THE DEPTH	

CC

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MAI N4330
MAI N4340
MAI N4350
MAI N4360
MAI N4370
MAI N4380
MAI N4390
MAI N4400
MAI N4410
MAI N4420
MAI N4430
MAI N4440
MAI N4450
MAI N4460
MAI N4470
MAI N4480
MAI N4490
MAI N4500
MAI N4510
MAI N4520
MAI N4530
MAI N4540
MAI N4550
MAI N4560
MAI N4570
MAI N4580
MAI N4590
MAI N4600
MAI N4610
MAI N4620
MAI N4630
MAI N4640
MAI N4650
MAI N4660
MAI N4670
MAI N4680
MAI N4690
MAI N4700
MAI N4710
MAI N4720
MAI N4730
MAI N4740
MAI N4750
MAI N4760
MAI N4770
MAI N4780
MAI N4790
MAI N4800

uuu

MA IN 4720
MA IN 4730
MA IN 4740
MA IN 4750
MA IN 4760
MA IN 4770
MA IN 4780
MA IN 4790
MA IN 4800


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MAIN4810
MAIN4820
MAIN4830
MAIN4840
MAIN4850
MAIN4860
MAIN4870
MAIN4880
MAIN4890
MAIN4900
MAIN4910
MAIN4920
MAIN4930
MAIN4940
MAIN4950
MAIN4960
MAIN4970
MAIN4980
MAIN4990
MAIN5000
MAIN5010
MAIN5020
MAIN5030
MAIN5040
MAIN5050
MAIN5060
MAIN5070
MAIN5080
MAIN5090
MAIN5100
MAIN5110
MAIN5120
MAIN5130
MAIN5140
MAIN5150
MAIN5160
MAIN5170
MAIN5180
MAIN5190
MAIN5200
MAIN5210
MAIN5220
MAIN5230
MAIN5240
MAIN5250
MAIN5260
MAIN5270
MAIN5280

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```

9 READ(5,9)(I(I10),I10=1,ISO)
  FCRMAT(8F10.0)
10 WRITE(6,10)(I10,II(I10),I10=1,ISO)
  FCRMAT(I10,30X,II(I10),I10=1,F5.1)
11 READ(5,11) DTW
  FCRMAT(F10.0)
15 WRITE(6,15) DTW
  FCRMAT(I10,30X,THERMAL INCREMENT =,F5.2)
17 READ(5,17) NBT
  FCRMAT(I10)
19 WRITE(6,19) NBT
  FCRMAT(I10,30X,NO. CF STATIONS ALONG THE CROSS SECTION =,I3)
21 READ(5,21)(X(I12),I12=1,NBT)
  FCRMAT(8F10.0)
23 WRITE(6,23)(I12,X(I12),I12=1,NBT)
  FCRMAT(I10,30X,X(I12),I12=1,F5.2)

  BEGINNING CF CROSS SECTION STUDY

  NCRDER=1
  DC 460 K98=1,ICRUI

  CRUISE INFORMATION

25 READ(5,25)(ITITL1(I),I=1,12)
  FCRMAT(6A8)
27 READ(5,27)(ITITL2(I),I=1,12)
  FCRMAT(6A8)
29 READ(5,29)(ITITL3(I),I=1,12)
  FCRMAT(6A8)
31 READ(5,31)(ITITL4(I),I=1,12)
  FCRMAT(6A8)

  PROCESSING THE FIELD OF ISOTHERMS

  DC 250 J7=1,NBT
  READ(5,33) ISTA,NOP
  FCRMAT(2I3)
  IF(NOP.EQ.0) GO TO 240
  WRITE(6,35) ISTA,NOP
  FCRMAT(I10,30X,STATION NO. =,I3,I10X,NO. CF POINTS DEFINING XBT
  * TRACE =,I3)
  READ(5,41)(ZO(I50),TO(I50),I50=1,NCP)
  FCRMAT(F6.0,F9.0,F9.0,F6.0,F9.0,F9.0,F9.0)
  WRITE(6,42)
  FCRMAT(I10,30X,
  * OBSERVED PAIRS FROM XBT TRACE * * *
  * ,//)
  WRITE(6,43)(I40,TO(I40),I40,ZO(I40),I40=1,NCP)

```

C C C C C C C C

MAIN5290
MAIN5300
MAIN5310
MAIN5320
MAIN5330
MAIN5340
MAIN5350
MAIN5360
MAIN5370
MAIN5380
MAIN5390
MAIN5400
MAIN5410
MAIN5420
MAIN5430
MAIN5440
MAIN5450
MAIN5460
MAIN5470
MAIN5480
MAIN5490
MAIN5500
MAIN5510
MAIN5520
MAIN5530
MAIN5540
MAIN5550
MAIN5560
MAIN5570
MAIN5580
MAIN5590
MAIN5600
MAIN5610
MAIN5620
MAIN5630
MAIN5640
MAIN5650
MAIN5660
MAIN5670
MAIN5680
MAIN5690
MAIN5700
MAIN5710
MAIN5720
MAIN5730
MAIN5740
MAIN5760

```

43  FORMAT(' ',30X,'TO(',I2,',',I2,',',F5.2,10X,'ZO(',I2,',',F6.2)
    TSFC(ISTA,NCRDER)=TC{1}
    CALL GTVALU(ISO,NOP,J7,ISTA,NORDER)
    GC TO 250
240  WRITE(6,244) ISTA
244  FCRMAT('0',2X,'ISTA =',I3,10X,'NO XET TRACE')
250  CALL ARTFT1(ISO,J7,ISTA,NORDER)
    CONTINUE
    CALL PLOTIT(ISO,NBT,LABEL,ITITL2)

```

C
C
C
PROCESSING THE DIGITAL TRACES AND THE THERMOCCLINE ANALYSIS

```

DO 350 J8=1,NBT
  READ(5,33) ISTA,NOP
  IF(NOP.EQ.0) GO TO 340
  WRITE(6,35) ISTA,NOP
  READ(5,41) ZC(I50),TO(I50),I50=1,NOP)
  WRITE(6,42)
  WRITE(6,43) (I40,TO(I40),I40,ZO(I40),I40=1,NCP)
  CALL LINTPS(NOP,DTW,M60)
  CALL PLOTBT(M60,J8,NBT,ITITL1,LABEL)
  CALL THERMC(NORDER,ISTA,J8,M60)
  GC TO 350
340  WRITE(6,344) ISTA
344  FCRMAT('0',2X,'ISTA =',I3,10X,'NO XBT TRACE')
    CALL ARTFT2(NORDER,ISTA,J8)
    M60=C
    CALL PLOTBT(M60,J8,NBT,ITITL1,LABEL)
    CCNTINUE
350  CALL PLOTFT(NBT,LABEL,ITITL3)
    N10=1
    DO 450 J3=1,NBT

```

C
C
C
WIND INFORMATION

```

37  READ(5,37) ISTA
    FCRMAT('13)
39  WRITE(6,39) ISTA,STATION NO. =',I3)
    READ(5,310) R00(NORDER,ISTA),KANGC0((NORDER,ISTA),R01(NORDER,ISTA)
    *,KANGC01(NORDER,ISTA),R02(NORDER,ISTA),KANGC02(NORDER,ISTA)
    *,R03(NORDER,ISTA),KANGC03(NORDER,ISTA),R10(NCRDER,ISTA),
    *,R05(NORDER,ISTA),KANGC05(NORDER,ISTA),R10(NCRDER,ISTA),
    *,KANGC10(NORDER,ISTA),XGRID,YGRID,KAMMAL,KK
310 * 11)
    FCRMAT('F7.0,I3,F7.0,I3,F7.0,I3,F7.0,I3,2F5.0,I3,

```

C
C
C
PROCESSING THE WIND FIELD

U

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C      CALL STATCS(ISTA,IORDER,MORDER,KEK1,KEK2,ITITL5,LABEL,ICSEC,IERIOD
      *,IBEGIN,IEND)
      IF(KRK.NE.0) GO TO 602
      READ(5,612) ILONTR
612    FCRMAT(13)
      IF(ILONTR.EQ.0) GO TO 1000
      READ(5,900)(ITITL6(I),I=1,12)
900    FCRMAT(6A8)
      CALL PLTMIT(ISO,NBT,LABEL,ITITL6)
C      END OF STATISTICAL STUDY
C
C      WRITE(6,995) ICSEC
995    FCRMAT(//,50X,'*' END OF STATISTICAL STUDY
      * OF STUDY FOR CROSS SECTION ',12,'*')
C      STORAGE OF PROCESSED AND ORIGINAL DATA
C
C      1000
      WRITE(9) ZTH1S,ZTH1I,ZTH1D
      WRITE(9) ZTH2S,ZTH2I,ZTH2D
      WRITE(9) ZTH3S,ZTH3I,ZTH3D
      WRITE(9) ZTHWS,ZTHWI,ZTHWD
      WRITE(9) ZTHVS,ZTHVI,ZTHVD
      WRITE(9) ZMIXLR,TSFC,RCO
      WRITE(9) KANG00,RC1,KANG01
      WRITE(9) RC2,KANG02,RC3
      WRITE(9) KANG03,RC5,KANG05
      WRITE(9) R10,KANG10,RC01
      WRITE(9) RQ02,RC01,RC12
      WRITE(9) RQ21,RC22,RC31
      WRITE(9) RQ32,RC51,RC52
      WRITE(9) R101,RC102,Z11CS
      WRITE(9) Z11CI,Z11CD,Z112CS
      WRITE(9) Z112CI,Z112CD,Z113CS
      WRITE(9) Z113CI,Z113CD,Z114CS
      WRITE(9) Z114CI,Z114CD,Z115CS
      WRITE(9) Z115CI,Z115CD,Z116CS
      WRITE(9) Z116CI,Z116CD,Z117CS
      WRITE(9) Z117CI,Z117CD,Z118CS
      WRITE(9) Z118CI,Z118CD,Z119CS
      WRITE(9) Z119CI,Z119CD,Z120CS
      WRITE(9) Z220CI,Z220CD,Z221CS
      WRITE(9) Z221CI,Z221CD,Z222CS
      WRITE(9) Z222CI,Z222CD,Z223CS
      WRITE(9) Z223CI,Z223CD,Z224CS
      WRITE(9) Z224CI,Z224CD,Z225CS
      WRITE(9) Z225CI,Z225CD,Z1TUCS

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```

WRITE (9) ZTUCI,ZTUCD,ZTLCS
WRITE (9) ZTLCI,ZTLCD,ZSUCS
WRITE (9) ZSUCI,ZSUCD,ZSLCS
WRITE (9) ZSLCI,ZSLCD,ZTTMD
STOP
END
.....
SUBROUTINE ARTFT1
.....
PURPOSE
  IN THE ABSENCE OF A DIGITAL TRACE, ARTIFICIAL INFORMATION IS
  GENERATED TO FILL IN THE ALLOCATED SPACE FOR THE FIELD OF
  ISOTHERMS
.....
USAGE
  CALL ARTFT1(ISO,J1,ISTA,NORDER)
.....
DESCRIPTION OF PARAMETERS
  ISO -INPUT NUMBER OF ISOTHERMS
  J1  -ACTUAL NUMBER OF DIGITAL TRACES PROCESSED AT A GIVEN
       CRUISE
  ISTA -INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
       SECTION
  NORDER-ACTUAL NUMBER OF PROCESSED CRUISES
.....
SUBROUTINES REQUIRED
  NONE
.....

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MAIN6730
MAIN6740
MAIN6750
MAIN6760
MAIN6770
MAIN6780
ART10010
ART10020
ART10030
ART10040
ART10050
ART10060
ART10070
ART10080
ART10090
ART10100
ART10110
ART10120
ART10130
ART10140
ART10150
ART10160
ART10170
ART10180
ART10190
ART10200
ART10210
ART10220
ART10230
ART10240
ART10250
ART10260

```

```

SUBROUTINE ARTFT1(ISO,J1,ISTA,NORDER)
COMMON/WORKA/IO(60),ZO(60),ZSHAL(20,20),ZINTR(20,20),ZDEEP(20,20),
*ZA(10),BLANS1(122)
COMMON/WORKC/ZTH1S(20,12),ZTH1I(20,12),ZTH1D(20,12),ZTH2S(20,12),
*ZTH2I(20,12),ZTH2D(20,12),ZTH3S(20,12),ZTH3I(20,12),ZTH3D(20,12),
*ZTHWS(20,12),ZTHWI(20,12),ZTHWD(20,12),TTHVS(20,12),TTHVI(20,12),
*TTHVD(20,12),ZMIXLR(20,12),TSFC(20,12)
DC 40 J2=1,ISO
ZSHAL(J1,J2)=-5.
ZINTR(J1,J2)=-5.
ZDEEP(J1,J2)=-5.
WRITE(6,41) J1,J2,ZSHAL(J1,J2),J1,J2,ZINTR(J1,J2),J1,J2,
*ZDEEP(J1,J2)
41 FORMAT(' ',2X,'ZSHAL(',12,',',12,') =' ,2X,F11.7,10X,'ZINTR(',12,

```

```

ART10270
ART10280
ART10290
ART10300
ART10310
ART10320
ART10330
ART10340
ART10350
ART10360
ART10370
ART10380
ART10390
ART10400

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CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

ART20420
ART20430
ART20440
ART20450
ART20460
ART20470
ART20480
ART20490
ART20500
ART20510
ART20520
ART20530
ART20540
ART20550
ART20560
ART20570
ART20580
ART20590
ART20600
ART20610
ART20620
ART20630
ART20640
ART20650
ART20660
GTVL00100
GTVL00200
GTVL00300
GTVL00400
GTVL00500
GTVL00600
GTVL00700
GTVL00800
GTVL00900
GTVL01000
GTVL01100
GTVL01200
GTVL01300
GTVL01400
GTVL01500
GTVL01600
GTVL01700
GTVL01800
GTVL01900
GTVL02000
GTVL02100
GTVL02200
GTVL02300

ZAH2S(J1)=-5.
ZAH2I(J1)=-5.
ZAH2D(J1)=-5.
ZAH3S(J1)=-5.
ZAH3I(J1)=-5.
ZAH3D(J1)=-5.
ZTHIS(NORDER, ISTA)=-5.
ZTH1I(NORDER, ISTA)=-5.
ZTH1D(NORDER, ISTA)=-5.
ZTH2S(NORDER, ISTA)=-5.
ZTH2I(NORDER, ISTA)=-5.
ZTH2D(NORDER, ISTA)=-5.
ZTH3S(NORDER, ISTA)=-5.
ZTH3I(NORDER, ISTA)=-5.
ZTH3D(NORDER, ISTA)=-5.
ZTHWS(NORDER, ISTA)=-5.
ZTHWI(NORDER, ISTA)=-5.
ZTHWD(NORDER, ISTA)=-5.
TTHVS(NORDER, ISTA)=-5.
TTHVI(NORDER, ISTA)=-5.
TTHVD(NORDER, ISTA)=-5.
ZMIXLR(NORDER, ISTA)=-5.
ZAIXL(R(J1))=-5.
RETURN
END

SUBROUTINE GTVALU

PURPOSE ANALYZE A DIGITAL TRACE TO LOCATE THE DEPTHS OF GIVEN
THERMAL VALUES. THE INVESTIGATION IS EXTENDED TO ALL DIGITAL
TRACES OF A GIVEN CRUISE AND ASSUMING A LINEAR VARIATION
BETWEEN CONSECUTIVE TRACES FOR THE SAME THERMAL VALUES, THE
FIELD OF ISOTHERMS ALONG THE CROSS SECTION IS OBTAINED

USAGE CALL GTVALU(ISO,NPT,J1,ISTA,NORDER)

DESCRIPTION OF PARAMETERS

ISO - INPUT NUMBER OF ISOTHERMS
NPT - INPUT NUMBER OF PAIRS (TO,ZO) DEFINING A DIGITAL TRACE
J1 - ACTUAL NUMBER OF DIGITAL TRACES PROCESSED AT A GIVEN
CRUISE
ISTA - INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
SECTION
NORDER - ACTUAL NUMBER OF PROCESSED CRUISES

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

GTVL0240
GTVL0250
GTVL0260
GTVL0270
GTVL0280
GTVL0290
GTVL0300
GTVL0310
GTVL0320
GTVL0330
GTVL0340
GTVL0350
GTVL0360
GTVL0370
GTVL0380
GTVL0390
GTVL0400
GTVL0410
GTVL0420
GTVL0430
GTVL0440

REMARKS
(1) EACH ISOTHERM IS CHARACTERIZED AT THREE POSSIBLE DEPTHS
(A) SHALLOW, (B) INTERMEDIATE AND (C) DEEP TO TAKE INTO
ACCOUNT THE OCCURRENCE OF INVERSIONS. IF SUCH FEATURE DOES
NOT EXIST, THE SINGLE VALUE IS TAKEN AS 'DEEP' AND TO THE
SHALLOW AND INTERMEDIATE DEPTHS ARE ASSIGNED NEGATIVE
ARTIFICIAL VALUES.
(2) THIS SUBROUTINE USES 'COMMON' LABELLED AREAS TO RECEIVE
INFORMATION FROM THE MAIN PROGRAM AND TO GIVE BACK PROCESSED
DATA

SUBROUTINES REQUIRED
LINE

METHOD
LINEAR INTERPOLATION BETWEEN TWO CONSECUTIVE POSITIONS OF A
DIGITAL TRACE

.....

SUBROUTINE GTVALU(ISO,NPT,J1,ISTA,NCRDER)
COMMON/WORKA/T0(60),Z0(60),ZSHAL(20,20),ZINTR(20,20),ZDEEP(20,20),
*ZA(10),BLANK(122),TI(19)
COMMON/WORKB/X(20),Z11CI(20,12),Z113CI(20,12),Z115CI(20,12),
*Z117CI(20,12),Z119CI(20,12),Z120CI(20,12),Z122CI(20,12),
*Z124CI(20,12),Z126CI(20,12),Z128CI(20,12),Z130CI(20,12),
*Z132CI(20,12),Z134CI(20,12),Z136CI(20,12),Z138CI(20,12),
*Z140CI(20,12),Z142CI(20,12),Z144CI(20,12),Z146CI(20,12),
*Z148CI(20,12),Z150CI(20,12),Z152CI(20,12),Z154CI(20,12),
*Z156CI(20,12),Z158CI(20,12),Z160CI(20,12),Z162CI(20,12),
*Z164CI(20,12),Z166CI(20,12),Z168CI(20,12),Z170CI(20,12),
*Z172CI(20,12),Z174CI(20,12),Z176CI(20,12),Z178CI(20,12),
*Z180CI(20,12),Z182CI(20,12),Z184CI(20,12),Z186CI(20,12),
*Z188CI(20,12),Z190CI(20,12),Z192CI(20,12),Z194CI(20,12),
*Z196CI(20,12),Z198CI(20,12),Z200CI(20,12),Z202CI(20,12),
*Z204CI(20,12),Z206CI(20,12),Z208CI(20,12),Z210CI(20,12),
*Z212CI(20,12),Z214CI(20,12),Z216CI(20,12),Z218CI(20,12),
*Z220CI(20,12),Z222CI(20,12),Z224CI(20,12),Z226CI(20,12),
*Z228CI(20,12),Z230CI(20,12),Z232CI(20,12),Z234CI(20,12),
*Z236CI(20,12),Z238CI(20,12),Z240CI(20,12),Z242CI(20,12),
*Z244CI(20,12),Z246CI(20,12),Z248CI(20,12),Z250CI(20,12),
*Z252CI(20,12),Z254CI(20,12),Z256CI(20,12),Z258CI(20,12),
*Z260CI(20,12),Z262CI(20,12),Z264CI(20,12),Z266CI(20,12),
*Z268CI(20,12),Z270CI(20,12),Z272CI(20,12),Z274CI(20,12),
*Z276CI(20,12),Z278CI(20,12),Z280CI(20,12),Z282CI(20,12),
*Z284CI(20,12),Z286CI(20,12),Z288CI(20,12),Z290CI(20,12),
*Z292CI(20,12),Z294CI(20,12),Z296CI(20,12),Z298CI(20,12),
*Z300CI(20,12),Z302CI(20,12),Z304CI(20,12),Z306CI(20,12),
*Z308CI(20,12),Z310CI(20,12),Z312CI(20,12),Z314CI(20,12),
*Z316CI(20,12),Z318CI(20,12),Z320CI(20,12),Z322CI(20,12),
*Z324CI(20,12),Z326CI(20,12),Z328CI(20,12),Z330CI(20,12),
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IF(J2,EEQ,5)	GO TO 90	GTVL1180
IF(J2,EEQ,6)	GO TO 100	GTVL1190
IF(J2,EEQ,7)	GO TO 110	GTVL1200
IF(J2,EEQ,8)	GO TO 120	GTVL1210
IF(J2,EEQ,9)	GO TO 130	GTVL1220
IF(J2,EEQ,10)	GO TO 140	GTVL1230
IF(J2,EEQ,11)	GO TO 150	GTVL1240
IF(J2,EEQ,12)	GO TO 160	GTVL1250
IF(J2,EEQ,13)	GO TO 170	GTVL1260
IF(J2,EEQ,14)	GO TO 180	GTVL1270
IF(J2,EEQ,15)	GO TO 190	GTVL1280
IF(J2,EEQ,16)	GO TO 200	GTVL1290
IF(J2,EEQ,17)	GO TO 210	GTVL1300
IF(J2,EEQ,18)	GO TO 220	GTVL1310
IF(J2,EEQ,19)	GO TO 230	GTVL1320
IF(J2,EEQ,20)	GO TO 240	GTVL1330
Z25CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1340
Z25CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1350
Z25CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1360
Z24CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1370
Z24CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1380
Z24CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1390
Z23CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1400
Z23CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1410
Z23CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1420
Z22CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1430
Z22CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1440
Z22CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1450
Z21CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1460
Z21CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1470
Z21CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1480
Z20CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1490
Z20CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1500
Z20CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1510
Z19CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1520
Z19CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1530
Z19CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1540
Z18CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1550
Z18CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1560
Z18CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1570
Z17CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1580
Z17CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1590
Z17CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1600
Z16CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1610
Z16CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1620
Z16CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1630
Z15CS(NORDER, I STA)=ZSHAL(J1,J2)		GTVL1640
Z15CI(NORDER, I STA)=ZINTR(J1,J2)		GTVL1650
Z15CD(NORDER, I STA)=ZDEEP(J1,J2)		GTVL1660


```

130 ZI7CS(NORDER, ISTA)=ZSHAL(J1, J2)
   ZI7CI(NCRDER, ISTA)=ZINTR(J1, J2)
   ZI7CD(NORDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
140 ZI16CS(NORDER, ISTA)=ZSHAL(J1, J2)
   ZI16CI(NCRDER, ISTA)=ZINTR(J1, J2)
   ZI16CD(NORDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
150 ZI15CS(NORDER, ISTA)=ZSHAL(J1, J2)
   ZI15CI(NORDER, ISTA)=ZINTR(J1, J2)
   ZI15CD(NORDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
160 ZI14CS(NCRDER, ISTA)=ZSHAL(J1, J2)
   ZI14CI(NCRDER, ISTA)=ZINTR(J1, J2)
   ZI14CD(NCRDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
170 ZI13CS(NORDER, ISTA)=ZSHAL(J1, J2)
   ZI13CI(NORDER, ISTA)=ZINTR(J1, J2)
   ZI13CD(NORDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
180 ZI12CS(NORDER, ISTA)=ZSHAL(J1, J2)
   ZI12CI(NORDER, ISTA)=ZINTR(J1, J2)
   ZI12CD(NORDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
190 ZI11CS(NCRDER, ISTA)=ZSHAL(J1, J2)
   ZI11CI(NCRDER, ISTA)=ZINTR(J1, J2)
   ZI11CD(NCRDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
200 ZI1LCS(NORDER, ISTA)=ZSHAL(J1, J2)
   ZI1LCI(NORDER, ISTA)=ZINTP(J1, J2)
   ZI1LCD(NORDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
210 ZI1UCS(NCRDER, ISTA)=ZSHAL(J1, J2)
   ZI1UCI(NORDER, ISTA)=ZINTR(J1, J2)
   ZI1UCD(NCRDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
220 ZI1LCS(NCRDER, ISTA)=ZSHAL(J1, J2)
   ZI1LCI(NCRDER, ISTA)=ZINTP(J1, J2)
   ZI1LCD(NCRDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
230 ZI1UCS(NORDER, ISTA)=ZSHAL(J1, J2)
   ZI1UCI(NORDER, ISTA)=ZINTR(J1, J2)
   ZI1UCD(NCRDER, ISTA)=ZDEEP(J1, J2)
   GO TO 40
40  CCNT INUE
   RETURN
   END

```

CC


```

SUBROUTINE LINE
PURPOSE
  LINEAR INTERPOLATION BETWEEN TWO GIVEN POSITIONS
LSAGE
  CALL LINE(A01,Q01,A02,Q02,AW,QW)
DESCRIPTION OF PARAMETERS
  A01 -INPUT VALUE CONTAINING THE ABCISSA OF THE FIRST OF
        TWO GIVEN POSITIONS
  Q01 -INPUT VALUE CONTAINING THE ORDINATE OF THE FIRST
        OF TWO GIVEN POSITIONS
  A02 -INPUT VALUE CONTAINING THE ABCISSA OF THE SECOND OF
        TWO GIVEN POSITIONS
  Q02 -INPUT VALUE CONTAINING THE ORDINATE OF THE FIRST
        OF TWO GIVEN POSITIONS
  AW  -INPUT VALUE CONTAINING THE ABCISSA OF THE INTERPOLATED
        POSITION
  QW  -OUTPUT VALUE CONTAINING THE ORDINATE OF THE
        INTERPOLATED POSITION
SUBROUTINES REQUIRED
  NONE
METHOD
  SYSTEM OF TWO LINEAR EQUATIONS SATISFYING THE INPUT PARAMETERS
  .....

```

CCCCCCCCCCCCCCCCCCCC

```

SUBROUTINE LINE(A01,Q01,A02,Q02,AW,QW)
DC6=Q01-Q02
DA6=AC1-AC2
Q2A1=Q02*AO1
Q1A2=Q01*AO2
QW=DQ6*(AW/DA6)+(Q2A1-Q1A2)/DA6
RETURN
END
.....
SUBROUTINE LINTPS
PURPOSE
  TO GENERATE A MESH FROM A DIGITAL TRACE FOR A GIVEN INCREMENT
  .....

```

CCCCCCCC

LNTS0080
LNTS0090
LNTS0100
LNTS0110
LNTS0120
LNTS0130
LNTS0140
LNTS0150
LNTS0160
LNTS0170
LNTS0180
LNTS0190
LNTS0200
LNTS0210
LNTS0220
LNTS0230
LNTS0240
LNTS0250
LNTS0260
LNTS0270
LNTS0280
LNTS0290
LNTS0300
LNTS0310
LNTS0320
LNTS0330
LNTS0340
LNTS0350
LNTS0360
LNTS0370
LNTS0380
LNTS0390
LNTS0400

USAGE
CALL LINTPS(NPT,DTW,M60)

DESCRIPTION OF PARAMETERS
NPT - INPUT NUMBER OF PAIRS (TO,ZO) DEFINING A DIGITAL TRACE
DTW - INPUT VALUE OF THE THERMAL INTERVAL OF THE MESH
M60 - OUTPUT NUMBER OF PAIRS (T,Z) COMPUTED FROM THE DIGITAL TRACE BY (A) A CONTINUOUS INCREMENT 'DTW' OF TEMPERATURE BEGINNING AT SEA SURFACE AND (B) THE DEPTHS OF THE ABOVE PAIRS ARE OBTAINED BY LINEAR INTERPOLATION BETWEEN NEAR POINTS OF THE ORIGINAL DIGITAL TRACE

REMARKS
THIS SUBROUTINE USES A 'COMMON' LABELLED AREA TO RECEIVE THE SET OF CROPEED PAIRS (ZO,TO) DEFINING THE DIGITAL TRACE FROM THE MAIN PROGRAM AND TO GIVE BACK THE ORDERED PAIRS OF THE GENERATED MESH. THE SAME 'COMMON' LABELLED AREA ENABLES AN EXCHANGE OF INFORMATION BETWEEN THIS SUBROUTINE AND THE CALLED SUBROUTINES.

SUBROUTINES AND FUNCTIONS REQUIRED
ABS (IBM SCIENTIFIC LIBRARY)
LINTP1
LINTP2

METHOD
LINEAR INTERPOLATION BETWEEN TWO CONSECUTIVE POSITIONS OF THE DIGITAL TRACE

.....

SUBROUTINE LINTPS(NPT,DTW,M60)
COMMON/WORKA/TO(60),ZO(60),T(120),Z(120),ZAH1S(20),ZAH1I(20),
*ZAH1D(20),ZAH2S(20),ZAH2I(20),ZAH2D(20),ZAH3S(20),ZAH3I(20),
*ZAH3D(20),ZAXLR(20),BLAN3(892)
TW=TO(1)
ZW=ZO(1)
M51=1
NPT1=NPT-1

LCOP SET UP TO DESCRIBE THE DIGITAL TRACE BY A CONTINUOUS INCREMENT OF THE TEMPERATURE FROM THE SEA SURFACE

DC 8018 I51=1,40

LNTS0410
LNTS0420
LNTS0430
LNTS0440
LNTS0450
LNTS0460
LNTS0470
LNTS0480
LNTS0490
LNTS0500
LNTS0510
LNTS0520
LNTS0530

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

CCCC


```

      TW=TW3
      GO TO 8018
      M51=M51-1
      GC TO 8018
      8014  GC TO 8018
      8019  IF (TO(I51+2).GT.0.AND.TW.GT.TO(I51+1)) GO TO 500
      IF (TO(I51+2).GT.0.AND.TW.LT.TO(I51+1)) GO TO 502
      GO TO 8018
      500  TW=TW-2.*ABS(TW-TO(I51+1))
      GC TO 8018
      502  TW=TW+2.*ABS(TW-TO(I51+1))
      GC TO 8018
      8013  M51=M51-1
      8018  CCNTINUE
      MCQ=M51
      WRITE(6,30)(K,T(K),K,Z(K),K=1,M60)
      30  FORMAT(' ',IX,'T(',I3,') =',F11.7,4X,'Z(',I3,') =',F11.7)
      RETURN
      END
      .....
      SUBROUTINE LINTPI
      .....
      PURPOSE
      TO GENERATE A MESH BETWEEN TWO GIVEN POSITIONS OF A DIGITAL
      TRACE. THIS METHOD IS NOT APPLICABLE TO THE LAST TWO LOCATIONS
      OF THE TRACE
      .....
      USAGE
      CALL LINTPI(A01,Q01,A02,Q02,A03,Q03,AW,CAW,I81,M81,AW2,M82)
      .....
      DESCRIPTION OF PARAMETERS
      A01 - INPUT VALUE CONTAINING THE ABCISSA (TEMPERATURE) OF
            THE FIRST OF THREE GIVEN POSITIONS
      Q01 - INPUT VALUE CONTAINING THE ORDINATE (DEPTH) OF THE
            FIRST OF THREE POSITIONS
      A02 - INPUT VALUE CONTAINING THE ABCISSA OF THE SECOND OF
            THREE GIVEN POSITIONS
      Q02 - INPUT VALUE CONTAINING THE ORDINATE OF THE SECOND OF
            THREE GIVEN POSITIONS
      A03 - INPUT VALUE CONTAINING THE ABCISSA OF THE THIRD OF
            THREE GIVEN POSITIONS
      Q03 - INPUT VALUE CONTAINING THE ORDINATE OF THE THIRD OF
            THREE GIVEN POSITIONS
      AW  - INPUT VALUE CONTAINING THE ABCISSA OF THE INITIAL
            INTERPOLATED POSITION BETWEEN THE FIRST TWO OF THREE
            GIVEN LOCATIONS OF THE DIGITAL TRACE
      CAW - INPUT VALUE CONTAINING THE INCREMENT OF THE MESH
      .....

```

```

LNTS1020
LNTS1030
LNTS1040
LNTS1050
LNTS1060
LNTS1070
LNTS1080
LNTS1090
LNTS1100
LNTS1110
LNTS1120
LNTS1130
LNTS1140
LNTS1150
LNTS1160
LNTS1170
LNTS1180
LNTS1190
LNT10010
LNT10020
LNT10030
LNT10040
LNT10050
LNT10060
LNT10070
LNT10080
LNT10090
LNT10100
LNT10110
LNT10120
LNT10130
LNT10140
LNT10150
LNT10160
LNT10170
LNT10180
LNT10190
LNT10200
LNT10210
LNT10220
LNT10230
LNT10240
LNT10250
LNT10260
LNT10270
LNT10280
LNT10290
LNT10300

```

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CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

```


LNT10310
 LNT10320
 LNT10330
 LNT10340
 LNT10350
 LNT10360
 LNT10370
 LNT10380
 LNT10390
 LNT10400
 LNT10410
 LNT10420
 LNT10430
 LNT10440
 LNT10450
 LNT10460
 LNT10470
 LNT10480
 LNT10490
 LNT10500
 LNT10510
 LNT10520
 LNT10530
 LNT10540
 LNT10550
 LNT10560
 LNT10570
 LNT10580
 LNT10590
 LNT10600

181 -INPUT VALUE CONTAINING THE ACTUAL NUMBER OF GROUPS OF
 THREE DIGITAL POSITIONS ALREADY PROCESSED
 M81 -INPUT VALUE CONTAINING THE ACTUAL NUMBER OF POINTS
 AW2 GENERATED FOR THE MESH
 -OUTPUT CONTAINING THE LAST VALUE OF ABSCISSA, LOCATED
 BETWEEN THE SECOND AND THIRD GIVEN POSITIONS OF THE
 DIGITAL TRACE
 M82 -OUTPUT VALUE CONTAINING THE ACTUAL NUMBER OF POSITIONS
 GENERATED FOR THE MESH

REMARKS
 (1) THIS SUBROUTINE USES A 'COMMON' LABELLED AREA TO GIVE BACK
 TO THIS SUBROUTINE LINTPS THE GENERATED MESH
 (2) THIS SUBROUTINE USES THREE POSITIONS FROM THE DIGITAL
 TRACE; IT INTERPOLATES A MESH BETWEEN THE FIRST TWO POSITIONS;
 THE LAST TWO POSITIONS DEFINE THE ACTUAL ABSCISSA OF THE
 INCREMENT

SUBROUTINES AND FUNCTIONS REQUIRED

LINE
 TINC1
 TINC2
 ABS (IBM SCIENTIFIC LIBRARY)

METHOD
 LINEAR INTERPOLATION BETWEEN TWO CONSECUTIVE POSITIONS OF THE
 DIGITAL TRACE

.....

LNT10610
 LNT10620
 LNT10630
 LNT10640
 LNT10650
 LNT10660
 LNT10670
 LNT10680
 LNT10690
 LNT10700
 LNT10710
 LNT10720
 LNT10730
 LNT10740
 LNT10750
 LNT10760

SUBROUTINE LINTP1(AC1,Q01,A02,Q02,A03,Q03,AW,DAW,I81,M81,
 *AW2,M82)
 COMMON/WORKA/TO(60),ZO(60),T(120),Z(120),ZAH1S(20),ZAH1I(20),
 *ZAH1D(20),ZAH2S(20),ZAH2I(20),ZAH2D(20),ZAH3S(20),ZAH3I(20),
 *ZAH3D(20),ZAHXLR(20),BLAN31(892)
 IF(I81.EQ.1) GO TO 9029
 IF(AW.EQ.A01) GO TO 9008
 CALL LINE(AC1,Q01,AC2,Q02,AW,QW)
 9005 GO TO 9010
 9008 AW=A01
 9008 QW=Q01
 9010 T(M81)=AW
 9010 Z(M81)=QW
 9020 M81=M81+1
 9020 AW2=AW

CC

MISSING DATA POINTS. THE USER IDENTIFIES THE MISSING DATA
 BY MEANS OF A NUMERIC CODE. THOSE VALUES HAVING THIS CODE
 ARE SKIPPED IN COMPUTING THE STATISTICS. IN THE CASE OF THE
 CORRELATION COEFFICIENTS, ANY PAIR OF VALUES ARE SKIPPED IF
 EITHER ONE OF THEM ARE MISSING.

100 MISR
 110 MISR
 120 MISR
 130 MISR
 140 MISR
 150 MISR
 160 MISR
 170 MISR
 180 MISR
 190 MISR
 200 MISR
 210 MISR
 220 MISR
 230 MISR
 240 MISR
 250 MISR
 260 MISR
 270 MISR
 280 MISR
 290 MISR
 300 MISR
 310 MISR
 320 MISR
 330 MISR
 340 MISR
 350 MISR
 360 MISR
 370 MISR
 380 MISR
 390 MISR
 400 MISR
 410 MISR
 420 MISR
 430 MISR
 440 MISR
 450 MISR
 460 MISR
 470 MISR
 480 MISR
 490 MISR
 500 MISR
 510 MISR
 520 MISR
 530 MISR
 540 MISR
 550 MISR
 560 MISR
 570 MISR

USAGE
 CALL MISR (NO,M,X,CODE,XBAR,STD,SKEW,CURT,R,N,A,B,S,IER)

DESCRIPTION OF PARAMETERS
 NO - NUMBER OF OBSERVATIONS
 M - NUMBER OF VARIABLES
 X CODE - INPUT DATA MATRIX OF SIZE NO X M. CONTAINS A NUMERIC
 MISSING DATA CODE FOR EACH VARIABLE. ANY OBSERVATION
 FOR A GIVEN VARIABLE HAVING A VALUE EQUAL TO THE CODE
 WILL BE DROPPED FOR THE COMPUTATIONS. MEANS
 OUTPUT VECTOR OF LENGTH M CONTAINING STANDARD DEVI-
 STD - OUTPUT VECTOR OF LENGTH M CONTAINING SKEWNESS
 SKEW - VECTOR OF LENGTH M CONTAINING KURTOSIS
 CURT - VECTOR OF LENGTH M CONTAINING CORRELATION
 R - OUTPUT MATRIX OF PRODUCT-MOMENT CORRELATION
 COEFFICIENTS. THIS WILL BE THE UPPER TRIANGULAR
 MATRIX ONLY. SINCE THE M X M MATRIX OF COEFFICIENTS
 IS SYMMETRIC, (STORAGE MODE 1)
 N - OUTPUT MATRIX OF NUMBER OF PAIRS OF OBSERVATIONS USED
 IN COMPUTING THE CORRELATION COEFFICIENTS. ONLY THE
 UPPER TRIANGULAR PORTION OF THE MATRIX IS GIVEN.
 (STORAGE MODE 1)
 A - OUTPUT MATRIX (M BY M) CONTAINING INTERCEPTS OF
 REGRESSION LINES (A) OF THE FORM $Y=A+BX$. THE FIRST
 SUBSCRIPT OF THIS MATRIX REFERS TO THE INDEPENDENT
 VARIABLE AND THE SECOND TO THE DEPENDENT VARIABLE.
 FOR EXAMPLE, A(1,3) CONTAINS THE INTERCEPT OF THE
 REGRESSION LINE AND VARIABLE 3 IS DEPENDENT. NOTE
 IS INDEPENDENT LINE AND VARIABLE 3 IS DEPENDENT.
 THAT MATRIX A IS STORED IN A VECTOR FORM.
 B - OUTPUT MATRIX (M BY M) CONTAINING REGRESSION
 COEFFICIENTS (B) CORRESPONDING TO THE VALUES OF
 INTERCEPTS CONTAINED IN THE OUTPUT MATRIX A.
 S - OUTPUT MATRIX (M BY M) CONTAINING STANDARD ERRORS
 OF REGRESSION COEFFICIENTS CORRESPONDING TO THE
 COEFFICIENTS CONTAINED IN THE OUTPUT MATRIX B.
 IER - NO ERROR.
 1, IF NUMBER OF NON-MISSING DATA ELEMENTS FOR J-TH
 VARIABLE IS TWO OR LESS. IN THIS CASE, STD(J), ALL
 SKEW(J), AND CURT(J) ARE SET TO 10*75.

CC

580 MISR
590 MISR
600 MISR
610 MISR
620 MISR
630 MISR
640 MISR
650 MISR
660 MISR
670 MISR
680 MISR
690 MISR
700 MISR
710 MISR
720 MISR
730 MISR
740 MISR
750 MISR
760 MISR
770 MISR
780 MISR
790 MISR

VALUES OF R, A, B, AND S RELATED TO THIS VARIABLE
ARE ALSO SET TO 10**75.
2, IF VARIANCE OF J-TH VARIABLE IS LESS THAN
10**(-20). IN THIS CASE, STD(J), SKEW(J), AND
CURT(J) ARE SET TO 10**75. ALL VALUES OF R, A,
B, AND S RELATED TO THIS VARIABLE ARE ALSO SET TO
10**75.

REMARKS
THIS SUBROUTINE CANNOT DISTINGUISH A BLANK AND A ZERO.
THEREFORE, IF A BLANK IS SPECIFIED AS A MISSING DATA CODE IN
INPUT CARDS, IT WILL BE TREATED AS 0 (ZERO).

SUBROUTINES AND FUNCTION SUBPROGRAMS REQUIRED
NONE

METHOD
LEAST SQUARES REGRESSION LINES AND PRODUCT-MOMENT CORRE-
LATION COEFFICIENTS ARE COMPUTED.

.....

SUBROUTINE MISR (NO,M,X,CODE,XBAR,STD,SKEW,CURT,R,N,A,B,S,IER)
DIMENSION X(1),CODE(1),XBAR(1),STD(1),SKEW(1),CURT(1),R(1),N(1)
DIMENSION A(1),B(1),S(1)

COMPUTE MEANS

IER=0
L=0
DO 20 J=1,M
FN=0.0
XBAR(J)=0.0
DO 15 I=1,NC
L=L+1
IF(X(L)-CODE(J)) 12, 15, 12
FN=FN+1.0
XBAR(J)=XBAR(J)+X(L)
CCNT INUE
IF(FN) 16, 16, 17
XBAR(J)=0.0
GC TO 20
XBAR(J)=XBAR(J)/FN
CCNT INUE

800 MISR
810 MISR
820 MISR
830 MISR
840 MISR
850 MISR
860 MISR
870 MISR
880 MISR
890 MISR
900 MISR
910 MISR
920 MISR
930 MISR
940 MISR
950 MISR
960 MISR
970 MISR
980 MISR
990 MISR
1000 MISR
1010 MISR
1020 MISR
1030 MISR

CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC

C C C C

C

SET-UP WORK AREAS AND TEST WHETHER DATA IS MISSING

MISSRI1040
MISSRI1050
MISSRI1060
MISSRI1070
MISSRI1080
MISSRI1090
MISSRI1100
MISSRI1110
MISSRI1120
MISSRI1130
MISSRI1140
MISSRI1150
MISSRI1160
MISSRI1170
MISSRI1180
MISSRI1190
MISSRI1200
MISSRI1210
MISSRI1220
MISSRI1230
MISSRI1240
MISSRI1250
MISSRI1260
MISSRI1270
MISSRI1280
MISSRI1290
MISSRI1300
MISSRI1310
MISSRI1320
MISSRI1330
MISSRI1340
MISSRI1350
MISSRI1360
MISSRI1370
MISSRI1380
MISSRI1390
MISSRI1400
MISSRI1410
MISSRI1420
MISSRI1430
MISSRI1440
MISSRI1450
MISSRI1460
MISSRI1470
MISSRI1480
MISSRI1490
MISSRI1500
MISSRI1510

C
C

```
L=0
DO 55 J=1,M
  LJJ=NO*(J-1)
  SKEW(J)=0.0
  CURT(J)=0.0
  KI=M*(J-1)
  KJ=J-M
  DO 54 I=1,J
    KI=KI+1
    KJ=KJ+M
    SUMX=0.0
    SUMY=0.0
    TI=0.0
    TJJ=0.0
    TJJJ=0.0
    TJJJ=0.0
    NIJ=0
    LI=NO*(I-1)
    LJ=LJJ
    L=L+1
  DO 38 K=1,NC
    LI=LI+1
    LJ=LJ+1
    IF(X(LI)-CODE(I)) 30, 38, 30
    IF(X(LJ)-CODE(J)) 35, 38, 35
  30 IF(X(LJ)-CODE(J)) 35, 38, 35
```

C
C
C

BOTH DATA ARE PRESENT

```
35 XX=X(LI)-XBAR(I)
   YY=X(LJ)-XBAR(J)
   TI=TI+XX
   TII=TI+XX**2
   TJJ=TI+YY
   TJJJ=TI+YY**2
   TJJJ=TI+YY**2
   NIJ=NIJ+1
   SUMX=SUMX+X(LI)
   SUMY=SUMY+X(LJ)
   IF(I-J) 37, 37, 37
   SKEW(J)=SKEW(J)+YY**3
   CURT(J)=CURT(J)+YY**4
   CCNT=CCNT+1
38
```

C
C
C

COMPUTE SUM OF CROSS-PRODUCTS OF DEVIATIONS


```

C C C C      COMPUTE STANDARD DEVIATION, SKEWNESS, AND KURTOSIS
40 IF(I-J) 47, 41, 47
41 IF(NIJ-2) 42, 42, 43
42 IER=1
   R(L)=1.0E75
   A(KI)=1.0E75
   B(KI)=1.0E75
   S(KI)=1.0E75
   GO TO 45
C
43 STD(J)=R(L)
   R(L)=1.0
   A(KI)=0.0
   B(KI)=1.0
   S(KI)=0.0
C
44 IF(STD(J)-(1.0E-20)) 44, 44, 46
45 IER=2
   STD(J)=1.0E75
   SKEW(J)=1.0E75
   CURT(J)=1.0E75
   GO TO 55
C
46 WORK=STD(J)/FN
   SKEW(J)=(SKEW(J)/FN)/(WORK*SQRT(WORK))
   CURT(J)=((CURT(J)/FN)/(WORK**2)-3.0
   STD(J)=SQRT(STD(J)/(FN-1.0))
   GO TO 55
C C C C      COMPUTE REGRESSION COEFFICIENTS
47 IF(NIJ-2) 48, 48, 50
48 IER=1
49 R(L)=1.0E75
   A(KI)=1.0E75
   B(KI)=1.0E75
   S(KI)=1.0E75
   A(KJ)=1.0E75
   B(KJ)=1.0E75
   S(KJ)=1.0E75

```



```

C      GC TO 54
50      IF(TII-(1.0E-20)) 52,52,51
51      IF(TJJ-(1.0E-20)) 52,52,53
52      IER=2
C      GC TO 49
53      SUMX=SUMX/FN
        SUMY=SUMY/FN
        B(KI)=R(L)/TII
        A(KI)=SUMY-B(KI)*SUMX
        B(KJ)=R(L)/TJJ
        A(KJ)=SUMX-B(KJ)*SUMY
C      COMPUTE CORRELATION COEFFICIENTS
C      R(L)=R(L)/(SQRT(TII)*SQRT(TJJ))
C      COMPUTE STANDARD ERRORS OF REGRESSION COEFFICIENTS
C      RR=R(L)**2
        SUMX=(TJJ-TJJ*RR)/(FN-2)
        S(KI)=SQRT(SUMX/TII)
        SUMY=(TII-TII*RR)/(FN-2)
        S(KJ)=SQRT(SUMY/TJJ)
C      CCNTINUE
54      CCNTINUE
55      RETURN
        END
C      SUBROUTINE PLOTIT
C      PURPOSE
C      TO PLOT THE LINEAR FIELD OF ISOTHERMS GENERATED BY
C      SUBROUTINE GIVALU (FOR A GIVEN CRUISE)
C      LSAGE
C      CALL PLOTIT(ISO,NBT,LABEL,ITITL2)
C      DESCRIPTION OF PARAMETERS
C      ISO - INPUT NUMBER OF ISOTHERMS
C      NBT - INPUT NUMBER OF STATIONS ALONG THE CROSS SECTION OR
C           THE TIME AXIS
C      LABEL - INPUT SHORT IDENTIFICATION OF A PLOTTED CURVE
C      ITITL2 - INPUT VECTOR OF LENGTH 12, CONTAINING THE TITLE FOR
C              PLOT OF ISOTHERMS ALONG A CROSS SECTION OR TIME AXIS

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MISR2000
MISR2010
MISR2020
MISR2030
MISR2040
MISR2050
MISR2060
MISR2070
MISR2080
MISR2090
MISR2100
MISR2110
MISR2120
MISR2130
MISR2140
MISR2150
MISR2160
MISR2170
MISR2180
MISR2190
MISR2200
MISR2210
MISR2220
MISR2230
MISR2240
MISR2250
MISR2260
MISR2270
MISR2280
MISR2290
MISR2300
PLTT0010
PLTT0020
PLTT0030
PLTT0040
PLTT0050
PLTT0060
PLTT0070
PLTT0080
PLTT0090
PLTT0100
PLTT0110
PLTT0120
PLTT0130
PLTT0140
PLTT0150
PLTT0160
PLTT0170

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PLTT0180
PLTT0190
PLTT0200
PLTT0210
PLTT0220
PLTT0230
PLTT0240
PLTT0250
PLTT0260
PLTT0270
PLTT0280
PLTT0290
PLTT0300
PLTT0310
PLTT0320
PLTT0330

REMARKS
(1) THIS SUBROUTINE RECEIVES THE REQUIRED INFORMATION FROM THE
MAIN PROGRAM BY MEANS OF COMMON, LABELLED AREAS
(2) SUBROUTINE GIVALU COMPUTES (FOR EACH STATION OF A GIVEN
CROSS SECTION) THE DEPTH OF SPECIFIED ISOTHERMS. THE PRESENT
SUBROUTINE (PLCIT) PLOTS THE FIELD OF ISOTHERMS ALONG A GIVEN
CROSS SECTION IN THE FOLLOWING WAY: CONNECTING BY STRAIGHT
LINES THE POINTS WITH THE SAME ISOTHERMAL VALUE LOCATED AT
SUCCESSIVE GEOGRAPHICAL POSITIONS

SUBROUTINES REQUIRED
DRAW (IBM SCIENTIFIC LIBRARY)

.....

SUBROUTINE PLCIT(ISC,NBT,LABEL,ITITL2)
REAL*8 ITITL2(12)
COMMON/WCRKA/TO(60),ZO(60),ZSHAL(20,20),ZINTR(20,20),ZDEEP(20,20),
*XU(20),XV(20),XW(20),ZU(20),ZW(20),XX(6),ZZ(6)
COMMON/WCRKB/X(20),TI(19)
L31=1
I9=0
DO 400 I9=1,ISO

PROCESSING A GIVEN THERMAL VALUE

L13=1
K9=0

PLOT OF THE DEEP ISOTHERM

DO 100 K9=1,NBT
IF(ZDEEP(K9,I9).LT.0.0)OR(ZDEEP(K9,I9).GT.457.) GO TO 70
ZU(L13)=-(ZDEEP(K9,I9)/230.+1.)
XU(L13)=X(K9)
GO TO 72

70

L12=L13-1
IF(L12.GE.2) GO TO 80
GO TO 90

72

L13=L13+1
IF(K9.NE.NBT) GO TO 100

80

L12=L13-1
IF(L12.GE.1) GO TO 90
IF(L131.GE.2) L31=2
CALL DRAW(L12,XU,ZU,L31,0,LABEL,ITITL2,1.0,1.0,5.0,2.2,8.5,0, LAST)

PLTT0340
PLTT0350
PLTT0360
PLTT0370
PLTT0380
PLTT0390
PLTT0400
PLTT0410
PLTT0420
PLTT0430
PLTT0440
PLTT0450
PLTT0460
PLTT0470
PLTT0480
PLTT0490
PLTT0500
PLTT0510
PLTT0520
PLTT0530
PLTT0540
PLTT0550
PLTT0560
PLTT0570
PLTT0580
PLTT0590
PLTT0600
PLTT0610
PLTT0620
PLTT0630

CCCCCCCCCCCCCCCC

CCC

CCC


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PRNT0150
PRNT0160
PRNT0170
PRNT0180
PRNT0190
PRNT0200
PRNT0210
PRNT0220
PRNT0230
PRNT0240
PRNT0250
PRNT0260
PRNT0270

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```

IEND -INPUT VALUE CONTAINING THE MONTH,DAY AND YEAR OF THE
      END OF THE STUDY
ISTA -INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
      SECTION
ICSEC -INPUT NUMBER OF IDENTIFICATION OF THE CROSS SECTION
PERIOD-INPUT VALUE CONTAINING THE NUMBER OF DAYS CONCERNING
      THE DURATION OF THE STUDY

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SUBROUTINES REQUIRED
NONE

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SUBROUTINE PRINT(IBEGIN,IEND,ISTA,ICSEC,PERIOD)
  L1=IBEGIN/100
  M1=IEND/100
  IYEARB=IBEGIN-L1*100
  IYEARE=IEND-M1*100
  ICAYB=L1/100
  ICAYE=M1/100
  L2=IDAYB*100
  M2=IDAYE*100
  IMONTB=L1-L2
  IMONTE=M1-M2
  WRITE(6,10) ICSEC,ISTA,IDAYB,IMONTB,IYEARB,IMONTE,IYEARE,
    *PERIOD
10  FORMAT('1,//////,1X,'CROSS SECTION NO.',11,27X,'STATION NO.',
    *I2,/,1X,'BEGIN:',I2,/,12,9X,'END:',I2,/,12,9X,/,
    *PERIOD:',I3,1X,'DAYS:',1X,'SOURCE OF DATA:FNWC (MONTEREY-USA),
    *////,6X,'LINEAR STATISTICAL STUDY BETWEEN THE VARIABLES :/,/
  RETURN
END

```

```

PRNT0280
PRNT0290
PRNT0300
PRNT0310
PRNT0320
PRNT0330
PRNT0340
PRNT0350
PRNT0360
PRNT0370
PRNT0380
PRNT0390
PRNT0400
PRNT0410
PRNT0420
PRNT0430
PRNT0440
PRNT0450
PRNT0460
PTBT0010
PTBT0020
PTBT0030
PTBT0040
PTBT0050
PTBT0060
PTBT0070
PTBT0080
PTBT0090
PTBT0100
PTBT0110
PTBT0120
PTBT0130
PTBT0140

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SUBROUTINE PLOTBT

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PURPOSE
  TO PLOT THE TRACES GENERATED BY SUBROUTINE LINTPS FOR A GIVEN
  CRUISE

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```

  USAGE
  CALL PLOTBT(N,L5C,NBT,ITITL1,LABEL)

```

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  DESCRIPTION OF PARAMETERS
  N -OUTPUT NUMBER OF PAIRS (T,Z) COMPUTED FROM THE DIGITAL

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CCCCCCCCCCCCCCCC

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CCCCCCCCCCCCCCCC

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PTBT0150
PTBT0160
PTBT0170
PTBT0180
PTBT0190
PTBT0200
PTBT0210
PTBT0220
PTBT0230
PTBT0240
PTBT0250
PTBT0260
PTBT0270
PTBT0280
PTBT0290
PTBT0300
PTBT0310
PTBT0320
PTBT0330
PTBT0340
PTBT0350
PTBT0360
PTBT0370
PTBT0380
PTBT0390
PTBT0400

TRACE BY (A) A CONTINUOUS INCREMENT 'DTW' OF
TEMPERATURE BEGINNING AT SEA SURFACE AND (B) THE
DEPTHS OF THE ABOVE PAIRS ARE OBTAINED BY LINEAR
INTERPOLATION BETWEEN NEAR POINTS CF THE ORIGINAL
DIGITAL TRACE

-ACTUAL NUMBER OF DIGITAL TRACES PROCESSED FOR A GIVEN

L50

-CRUISE

-INPUT NUMBER OF STATIONS ALONG THE CROSS SECTION OR
THE TIME AXIS

NBT

ITITL1-INPUT VECTOR OF LENGTH 'I2' CONTAINING THE TITLE FOR
PLOT OF DIGITAL TRACES ALONG A CROSS SECTION OR TIME

AXIS

LABEL -INPUT SHORT IDENTIFICATION OF A PLCTED CURVE

LABEL

REMARKS

(1) THIS SUBROUTINE RECEIVES THE REQUIRED INFORMATION FROM THE
MAIN PROGRAM BY MEANS OF A 'COMMON' LABELLED AREA
(2) THIS SUBROUTINE CONDENSES THREE-DIMENSIONAL INFORMATION
(T,Z,X) INTO TWO-DIMENSIONAL (T/X,Z) BY USING THE HORIZONTAL
AXIS SIMULTANEOUSLY AS TEMPERATURE AND CRUISE LOCATION AXIS

SUBROUTINES REQUIRED

DRAW (IBM SCIENTIFIC SUBROUTINE LIBRARY)

.....

SUBROUTINE PLOTBT(N,L50,NBT,ITITL1,LABEL)

REAL*8 ITITL1(12)

COMMON/WCRKA/TO(60),ZO(60),T(120),ZAH1S(20),ZAH1I(20),

*ZAH1D(20),ZAH2S(20),ZAH2I(20),ZAH2D(20),ZAH3I(20),

*ZAH3D(20),ZAHXLR(20),XA(200),ZA(200),BLAN5(492)

CCMMCN/WORK0/X(20),TI(19)

IF(N.EQ.0) GO TO 50

PROCESSING THE REQUIRED INFORMATION

XA(1)=X(L50)

DXA=X(L50)-T(1)/15.

ZA(1)=-Z(1)/230.+1.

DC 1 I49=2,N

XA(I49)=T(I49)/15.+DXA

ZA(I49)=-Z(I49)/230.+1.

CONTINUE

GO TO 2

1

50

N=2

XA(1)=0.

PTBT0410
PTBT0420
PTBT0430
PTBT0440
PTBT0450
PTBT0460
PTBT0470
PTBT0480
PTBT0490
PTBT0500
PTBT0510
PTBT0520
PTBT0530
PTBT0540
PTBT0550
PTBT0560
PTBT0570
PTBT0580
PTBT0590
PTBT0600

CCCCCCCCCCCCCCCCCCCC

CCC

C

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SUBROUTINE PLOTFT(NBT,LABEL,ITITL3)
REAL*8 ITITL3(12)
COMMON/WORKA/TO(60),ZO(60),T(120),ZAH1S(20),ZAH1I(20),
*ZAH1D(20),ZAH2S(20),ZAH2I(20),ZAH2D(20),ZAH3S(20),ZAH3I(20),
*ZAH3D(20),ZAXLR(20),ZAX(20),ZB(20),ZC(20),ZC(20),
*XD(20),ZD(20),XE(20),ZF(20),XG(20),ZG(20),XU(20),
*ZU(20),XV(20),ZV(20),XW(20),ZX(6),ZZ(6),ZLAN8(480)
COMMON/WORKB/X(20),TI(19)
L31=1
L13=1
K9=0
PROCESSING THE ISOPLETH DEFINING THE TOP OF DEEP THERMOCLINE
DC 100 K9=1,NBT
IF(ZAH1D(K9).LT.0..OR.ZAH1D(K9).GT.457.) GO TO 70
ZU(L13)=-((ZAH1D(K9)/230.+1.)
XU(L13)=X(K9)
GO TO 72
L12=L13-1
IF(L12.GE.2) GO TO 80
GO TO 90
L13=L13+1
IF(K9.NE.NBT) GO TO 100
L12=L13-1
IF(L12.EQ.1) GO TO 90
IF(L13.GE.2) L31=2
CALL DRAW(L12,XU,ZU,L31,C,LABEL,ITITL3,1.0,1.0,5.0,2.2,8.5,0, LAST)
L31=L31+1
WRITE(6,1000) LAST
WRITE(6,82)(L81,L12,ZU(L81),XU(L81),L81=1,L12)
FORMAT(' ',2X,'TOP OF DEEP THERMOCLINE DEFINED BY ',2X,I2
*,2X,'OF ',2X,I2,2X,'PGINTS AT Z=',F5.1,2X,'AT X=',F5.1)
L13=1
CCNTINUE
K10=0
L23=1
PROCESSING THE ISOPLETH DEFINING THE BOTTOM OF DEEP THERMOCLINE
CC 200 K10=1,NBT
IF(ZAH3D(K10).LT.0..OR.ZAH3D(K10).GT.457.) GO TO 170
ZV(L23)=-((ZAH3D(K10)/230.+1.)
XV(L23)=X(K10)
GO TO 172

```

UUU

uuu

PTFT0840
PTFT0850
PTFT0860
PTFT0870
PTFT0880
PTFT0890
PTFT0900
PTFT0910
PTFT0920
PTFT0930
PTFT0940
PTFT0950
PTFT0960
PTFT0970
PTFT0980
PTFT0990
PTFT1000
PTFT1010
PTFT1020
PTFT1030
PTFT1040
PTFT1050
PTFT1060
PTFT1070
PTFT1080
PTFT1090
PTFT1100
PTFT1110
PTFT1120
PTFT1130
PTFT1140
PTFT1150
PTFT1160
PTFT1170
PTFT1180
PTFT1190
PTFT1200
PTFT1210
PTFT1220
PTFT1230
PTFT1240
PTFT1250
PTFT1260
PTFT1270
PTFT1280
PTFT1290
PTFT1300
PTFT1310

```

170 L22=L23-1
    IF(L22.GE.2) GO TO 180
    GO TO 190
172 L23=L23+1
    IF(K10.NE.NBT) GO TO 200
    L22=L23-1
    IF(L22.EQ.1) GO TO 190
    IF(L31.GE.2) L31=2
    CALL DRAW(L22,XV,ZV,L31,0,LABEL,ITITL3,1.0,1.0,5,0,2,2,8,5,0, LAST)
    WRITE(6,1000) LAST
    L21=0
    WRITE(6,102)(L21,L22,ZV(L21),XV(L21),L21=1,L22)
102 FORMAT(' ',2X,'BOTTOM OF DEEP THERMOCLINE DEFINED BY ',2X
*,12,2X,'OF ',2X,I2,2X,'POINTS AT Z=',F5.1,2X,'AT X=',F5.1)
190 L23=1
200 CCNTINUE
    K11=0
    L33=1

C
C
C
PROCESSING THE ISOPLETH DEFINING THE AVERAGE DEPTH OF DEEP
THERMOCLINE
DO 300 K11=1,NBT
  IF(ZAH2D(K11).LT.0..OR.ZAH2D(K11).GT.457.) GO TO 270
  ZW(L33)=-((ZAH2D(K11)/230.+1.)
  XW(L33)=X(K11)
  GO TO 272
270 L22=L33-1
    IF(L32.GE.2) GO TO 280
    GO TO 290
272 L33=L33+1
    IF(K11.NE.NBT) GO TO 300
    L32=L33-1
    IF(L32.EQ.1) GO TO 290
    IF(L31.GE.2) L31=2
    CALL DRAW(L32,XW,ZW,L31,0,LABEL,ITITL3,1.0,1.0,5,0,2,2,8,5,0, LAST)
    L31=L31+1
    WRITE(6,1000) LAST
    L61=0
    WRITE(6,202)(L61,L32,ZW(L61),XW(L61),L61=1,L32)
202 FORMAT(' ',2X,'MEAN DEPTH OF DEEP THERMOCLINE DEFINED BY
*,12,2X,'OF ',2X,I2,2X,'POINTS AT Z=',F5.1,2X,'AT X=',F5.1)
290 L33=1
300 CCNTINUE
    L43=1
    K12=0
C

```



```

C      PROCESSING THE ISOPLETH DEFINING THE TOP OF SHALLOW THERMOCLINE
C
DC 400 K12=1,NBT
IF(ZAH1S(K12)).LT.0..OR.ZAH1S(K12).GT.457.) GO TO 370
ZA(L43)=-((ZAH1S(K12)/230.+1.)
XA(L43)=X(K12)
GO TO 372
370 L42=L43-1
    IF(L42.GE.2) GO TO 380
    GO TO 390
372 L43=L43+1
    IF(K12.NE.NBT) GO TO 400
    L42=L43-1
    IF(L42.EQ.1) GO TO 390
    IF(L43.GE.2) L31=2
    CALL DRAW(L42,XA,ZA,L31,0,LABEL,ITITL3,1.0,5,0,2,2,8,5,0, LAST)
    L31=L31+1
    WRITE(6,1000) LAST
    WRITE(6,382)(L81,L42,ZA(L81),XA(L81),L81=1,L42)
    FCRMAT(' ',2X,'TOP OF SHALLOW THERMOCLINE DEFINED BY ',2X,I2,2X,'OF
382 *,2X,I2,2X,'POINTS AT Z=',F5.1,2X,'AT X=',F5.1)
390 L43=1
400 CONTINUE
    L53=1
    K13=0

C      PROCESSING THE ISOPLETH DEFINING THE BOTTOM OF SHALLOW
C      THERMOCLINE
C
DO 500 K13=1,NBT
IF(ZAH3S(K13)).LT.0..OR.ZAH3S(K13).GT.457.) GO TO 470
ZB(L53)=-((ZAH3S(K13)/230.+1.)
XB(L53)=X(K13)
GO TO 472
470 L52=L53-1
    IF(L52.GE.2) GO TO 480
    GO TO 490
472 L53=L53+1
    IF(K13.NE.NBT) GO TO 500
    L52=L53-1
    IF(L52.EQ.1) GO TO 490
    IF(L53.GE.2) L31=2
    CALL DRAW(L52,XB,ZB,L31,0,LABEL,ITITL3,1.0,1,0,5,0,2,2,8,5,0, LAST)
    L31=L31+1
    WRITE(6,1000) LAST
    WRITE(6,482)(L21,L52,ZB(L21),XB(L21),L21=1,L52)
    FCRMAT(' ',2X,'BOTTOM OF SHALLOW THERMOCLINE DEFINED BY ',2X,I2,2X,
482 *,2X,I2,2X,'POINTS AT Z=',F5.1,2X,'AT X=',F5.1)

```



```

490 L53=1
500 CCNTINUE
    L63=1
    K14=0
C
C
C
PROCESSING THE ISOPLETH DEFINING THE MEAN DEPTH OF SHALLOW
THERMOCLINE
DO 600 K14=1,NBT
  IF(ZAH2S(K14).LT.C.OR.ZAH2S(K13).GT.457.) GO TO 570
  ZC(L63)=-((ZAH2S(K14)/230.+1.)
  XC(L63)=X(K14)
  GO TO 572
570 L62=L63-1
    IF(L62.GE.2) GO TO 580
    GO TO 590
572 L63=L63+1
    IF(K14.NE.NBT) GO TO 600
    L62=L63-1
580 IF(L62.EQ.1) GO TO 590
    IF(L63.GE.2) L31=2
    CALL DRAW(L62,XC,ZC,L31,0,LABEL,ITITL3,1.0,1.0,5.0,2.2,8.5,0,5.0, LAST)
    L31=L31+1
    WRITE(6,1000) LAST
    WRITE(6,582)(L61,L62,ZC(L61),XC(L61),L61=1,L62)
582 * ,2X,'OF',2X,I2,2X,'PCINTS AT Z=',F5,1,2X,'AT X=',F5.1)
590 L63=1
600 CCNTINUE
    L73=1
    K15=0
C
C
C
PROCESSING THE ISOPLETH DEFINING THE TOP OF INTERMEDIATE
THERMOCLINE
DO 700 K15=1,NBT
  IF(ZAH1I(K15).LT.0.OR.ZAH1I(K15).GT.457.) GO TO 670
  ZC(L73)=-((ZAH1I(K15)/230.+1.)
  XD(L73)=X(K15)
  GO TO 672
670 L72=L73-1
    IF(L72.GE.2) GO TO 680
    GO TO 690
672 L73=L73+1
    IF(K15.NE.NBT) GO TO 700
    L72=L73-1
680 IF(L72.EQ.1) GO TO 690
    IF(L731.GE.2) L31=2

```

```

PTFT1800
PTFT1810
PTFT1820
PTFT1830
PTFT1840
PTFT1850
PTFT1860
PTFT1870
PTFT1880
PTFT1890
PTFT1900
PTFT1910
PTFT1920
PTFT1930
PTFT1940
PTFT1950
PTFT1960
PTFT1970
PTFT1980
PTFT1990
PTFT2000
PTFT2010
PTFT2020
PTFT2030
PTFT2040
PTFT2050
PTFT2060
PTFT2070
PTFT2080
PTFT2090
PTFT2100
PTFT2110
PTFT2120
PTFT2130
PTFT2140
PTFT2150
PTFT2160
PTFT2170
PTFT2180
PTFT2190
PTFT2200
PTFT2210
PTFT2220
PTFT2230
PTFT2240
PTFT2250
PTFT2260
PTFT2270

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```

GO TO 890
L93=L93+1
IF(K17.NE.NBT) GO TO 900
L92=L93-1
IF(L92.EQ.1) GO TO 890
IF(L931.GE.2) L31=2
CALL DRAW(L92,XF,ZF,L31,0,LABEL,ITITL3,1.0,1.0,5,0,2,2,8,5,0, LAST)
L31=L31+1
WRITE(6,1000) LAST
WRITE(6,882)(L61,L92,ZF(L61),XF(L61),L61=1,L92)
FORMAT(' ',2X,'MEAN DEPTH OF INTERMEDIATE THERMOCLINE DEFINED BY',
*2X,I2,2X,'OF',2X,I2,2X,'POINTS AT Z=',F5.1,2X,'AT X=',F5.1)
L93=1
CGNTINUE
N93=1
M17=C
C
C
C
PROCESSING THE ISOPLETH DEFINING THE MIXED LAYER DEPTH
DO 935 M17=1,NBT
IF(ZAIXLR(M17).LT.0.000R,ZAIXLR(M17).GT.457.0) GO TO 915
ZG(N93)=-(ZAIXLR(M17)/230.0+1.0)
XG(N93)=X(M17)
GO TO 920
915 N92=N93-1
IF(N92.GE.2) GO TO 925
GO TO 930
920 N93=N93+1
IF(M17.NE.NBT) GO TO 935
N92=N93-1
IF(N92.EQ.1) GO TO 930
IF(L931.GE.2) L31=2
CALL DRAW(N92,XG,ZG,L31,0,LABEL,ITITL3,1.0,1.0,5,0,2,2,8,5,0, LAST)
L31=L31+1
WRITE(6,1000) LAST
WRITE(6,932)(L61,N92,ZG(L61),XG(L61),L61=1,N92)
FORMAT(' ',2X,'MIXED LAYER DEPTH DEFINED BY',2X,I2,2X,'OF',2X,I2,
*2X,'POINTS AT Z=',F5.1,2X,'AT X=',F5.1)
N93=1
CGNTINUE
C
C
C
ARTIFICIAL VALUES TO COMPLETE THE PLOT
940 ZZ(1)=-1.0
ZZ(2)=-((100.0/230.0+1.0)
ZZ(3)=-((200.0/230.0+1.0)
ZZ(4)=-((300.0/230.0+1.0)
ZZ(5)=-((400.0/230.0+1.0)

```


PTFT3240
PTFT3250
PTFT3260
PTFT3270
PTFT3280
PTFT3290
PTFT3300
PTFT3310
PTFT3320
PTFT3330
PTFT3340
PTFT3350
PTFT3360
PTIT0010
PTIT0020
PTIT0030
PTIT0040
PTIT0050
PTIT0060
PTIT0070
PTIT0080
PTIT0090
PTIT0100
PTIT0110
PTIT0120
PTIT0130
PTIT0140
PTIT0150
PTIT0160
PTIT0170
PTIT0180
PTIT0190
PTIT0200
PTIT0210
PTIT0220
PTIT0230
PTIT0240
PTIT0250
PTIT0260
PTIT0270
PTIT0280
PTIT0290
PTIT0300
PTIT0310
PTIT0320
PTIT0330
PTIT0340
PTIT0350

```

ZZ(6)=- (500./230.+1.)
XX(1)=0.
XX(2)=0.
XX(3)=0.
XX(4)=0.
XX(5)=0.
XX(6)=0.
IF(L31.EQ.1) GO TO 960
CALL DRAW(6,XX,ZZ,3,4,LABEL,ITITL3,1.0,1.0,5,0,2,8,5,0, LAST)
WRITE(6,1000) LAST
FORMAT(0,30X,'LAST =',I1)
RETURN
END
1000
960

SUBROUTINE PLTMIT
PURPOSE
  TO PLOT THE AVERAGE LINEAR FIELD OF ISOTHERMS GENERATED BY
  SUBROUTINE STACS (FOR A SPECIFIED NUMBER OF CRUISES)
USAGE
  CALL PLTMIT(ISO,NBT,LABEL,ITITL6)
DESCRIPTION OF PARAMETERS
  ISO - INPUT NUMBER OF ISOTHERMS ALONG THE CROSS SECTION OR
  NBT - INPUT NUMBER OF STATIONS ALONG THE CROSS SECTION OR
        THE TIME AXIS
  LABEL - INPUT SHORT IDENTIFICATION OF A PLOTTED CURVE
  ITITL6 - INPUT VECTOR OF LENGTH 12, CONTAINING THE TITLE FOR
        PLOT OF THE AVERAGE DEPTHS OF ISOTHERMS (FOR A GIVEN
        PERIOD) ALONG A CROSS SECTION OR TIME AXIS
REMARKS
  (1) THIS SUBROUTINE RECEIVES THE REQUIRED INFORMATION FROM THE
  MAIN PROGRAM AND SUBROUTINE STACS BY MEANS OF 'COMMON'.
  LABELLED AREAS. STACS COMPUTES (FOR EACH STATION OF A GIVEN
  CROSS SECTION) THE AVERAGE DEPTH OF SPECIFIED ISOTHERMS. THE
  CROSS SECTION) THE AVERAGE DEPTH OF SPECIFIED ISOTHERMS. THE
  PRESENT SUBROUTINE (PLTMIT) PLOTS THE FIELD OF ISOTHERMS
  ALONG A GIVEN CROSS SECTION IN THE FOLLOWING WAY: CONNECTING
  BY STRAIGHT LINES THE POINTS WITH THE SAME ISOTHERMAL VALUE
  LOCATED AT SUCCESSIVE GEOGRAPHICAL POSITIONS
SUBROUTINES REQUIRED
  DRAW (IBM SCIENTIFIC LIBRARY)

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1000
960

CC

126


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ZZ(2)=- (100./230.+1.)
ZZ(3)=- (200./230.+1.)
ZZ(4)=- (300./230.+1.)
ZZ(5)=- (400./230.+1.)
ZZ(6)=- (500./230.+1.)
XX(1)=0.
XX(2)=0.
XX(3)=0.
XX(4)=0.
XX(5)=0.
XX(6)=0.
CALL DRAW(6,XX,ZZ,3,4,LABEL,ITITL2,1.0,1.0,5,0,2,2,8,5,0,LAST)
WRITE(6,1000) LAST
FCRMAT('0',30X,'LAST =',I1)
RETURN
END
1000

.....
SUBROUTINE RLNE
PURPOSE
  TO PLOT THE LEAST SQUARE REGRESSION LINES
USAGE
  SUBROUTINE RLNE(ITITL5,LABEL,SCALE3)
DESCRIPTION OF PARAMETERS
  ITITL5- INPUT VECTOR OF LENGTH '12' CONTAINING THE TITLE FOR
          PLOT OF SCATTER DIAGRAM AND REGRESSION LINES AS THE
          RESULT OF STATISTICAL STUDY BETWEEN TWO VARIABLES
  LABEL - INPUT SHORT IDENTIFICATION OF A PLOTTED CURVE
  SCALE3- INPUT CONTAINING A SCALE VALUE WHICH ALLOWS THE PLOT
          OF THE SCATTER DIAGRAM AND REGRESSION LINES IN THE
          SAME GRAPH
REMARKS
  (1) THIS SUBROUTINE USES A 'COMMON' LABELLED AREA TO RECEIVE
      THE REQUIRED DATA FROM SUBROUTINE STATICS.
  (2) THE SCATTER DIAGRAM (PLOTTED BY STATICS) AND THE REGRESSION
      LINES (PLOTTED BY RLNE) ARE DRAWN IN THE SAME DIAGRAM.
SUBROUTINES REQUIRED
  DRAW (IBM SCIENTIFIC LIBRARY)
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SLBROUTINE RLINE(ITITL5, LABEL, SCALE3)
REAL*8 ITITL5(12), AUX(400), XBAR(10), STD(10), SKEW(10), CURT(10),
CMMCN/WORKA/CODE(2), BB(2,2), SS(2,2), X2(100), Y2(100), X3(100), Y3(100),
*RR(4), NN(4), AA(4), BB(2,2), SS(2,2), X2(100), Y2(100), X3(100), Y3(100),
*XX2(100), YY3(100), BLAN30(370)
NRP=50
XX2(1)=-0.5*SCALE3
YY3(1)=-0.5*SCALE3
X2(1)=-0.5
Y3(1)=-0.5
DO 10 N13=1, NRP
IF (N13.EQ.1) GO TO 8
X2(N13)=XX2(N13)/SCALE3
Y3(N13)=YY3(N13)/SCALE3
8 X2(N13)=AA(2)/SCALE3+BB(2,1)*X2(N13)
X3(N13)=AA(3)/SCALE3+BB(1,2)*Y3(N13)
IF (N13.EQ.NRP) GO TO 10
X2(N13+1)=XX2(1)+N13*50.
Y3(N13+1)=YY3(1)+N13*50.
10 CONTINUE
CALL DRAW(NRP, X2, Y2, 2, 0, LABEL, ITITL5, 0.5, 0.5, 4, 2, 2, 8, 8, 0, LAST1)
CALL DRAW(NRP, X3, Y3, 3, 0, LABEL, ITITL5, 0.5, 0.5, 4, 2, 2, 8, 8, 0, LAST2)
WRITE(6,15) LAST1, LAST2
15 *FORMAT('0', 10X, '1ST REGRESSION LINE =', I1, 10X, '2ND REGRESSION LINE
      =', I1)
      RETURN
      END
      .....
SUBROUTINE STATCS
PURPOSE
  TO STUDY BY MEANS OF STATISTICS ONE GIVEN PARAMETER (1ST, 2ND,
  3RD AND 4TH MOMENTS) OR THE INTERRELATION BETWEEN TWO GIVEN
  PARAMETERS (CORRELATION AND REGRESSION COEFFICIENTS, LEAST
  SQUARE REGRESSION LINES AND SCATTER DIAGRAM)
USAGE
  SUBROUTINE STATCS(ISTA, IORDER, MORDER, KEK1, KEK2, ITITL5, LABEL,
  ICSEC, IERIOD, IBEGIN, IEND)
DESCRIPTION OF PARAMETERS
  ISTA - INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
  SECTION
  IORDER- INPUT VALUE CONTAINING THE NUMBER OF THE CRUISE TO
  MORDER- INITIATE THE STATISTICAL STUDY
  MORDER- INPUT VALUE CONTAINING THE NUMBER OF THE CRUISE TO

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CCCCCCCCCCCCCCCCCCCCCCCCCCCC


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END THE STATISTICAL STUDY
-INPUT VALUE INDICATING THE FIRST OF TWO VARIABLES TO
  KEK1 BE INTERRELATED
-INPUT VALUE INDICATING THE SECOND OF TWO VARIABLES TO
  KEK2 BE INTERRELATED
ITITL5-INPUT VECTOR OF LENGTH '12' CONTAINING THE TITLE FOR
  PLOT OF SCATTER DIAGRAM AND REGRESSION LINES AS THE
  RESULT OF STATISTICAL STUDY BETWEEN TWO VARIABLES
LABEL -INPUT SHORT IDENTIFICATION OF A PLOTTED CURVE
ICSEC -INPUT NUMBER OF IDENTIFICATION OF THE CROSS SECTION
IERIOD-INPUT VALUE CONTAINING THE NUMBER OF DAYS CONCERNING
  THE DURATION OF THE STUDY
IBEGIN-INPUT VALUE CONTAINING THE MONTH, DAY AND YEAR OF THE
  BEGINNING OF THE STUDY
IEND -INPUT VALUE CONTAINING THE MONTH, DAY AND YEAR OF THE
  END OF THE STUDY

REMARKS
(1) THIS SUBROUTINE USES 'COMMON' LABELLED AREAS TO RECEIVE THE
  REQUIRED DATA FROM THE MAIN PROGRAM AND TO GIVE PROCESSED
  INFORMATION TO SUBROUTINE RLINE.
(2) THE SCATTER DIAGRAM (PLOTTED BY STATCS) AND THE REGRESSION
  LINES (PLOTTED BY RLINE) ARE DRAWN IN THE SAME DIAGRAM.
(3) THIS SUBROUTINE IDENTIFIES NEGATIVE VALUES AS MISSING DATA.

SUBROUTINES AND FUNCTIONS REQUIRED
PRINT (IBM SCIENTIFIC SUBROUTINE -IBRARY)
MISR (IBM SCIENTIFIC SUBROUTINE -IBRARY)
AMOD (IBM SCIENTIFIC LIBRARY)
AMAX1 (IBM SCIENTIFIC LIBRARY)
DRAW (IBM SCIENTIFIC LIBRARY)
RLINE

METHOD SEE SUBROUTINE MISR
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SUBROUTINE STATCS(ISTA, IORDER, MORDER, KEK1, KEK2, ITITL5, LABEL, ICSEC,
*IERIOD, IBEGIN, IEND)
  REAL*8 ITITL5(12)
  COMMON/WORKA/CODE(2), AUX(400), XBAR(10), STD(10), SKEW(10), CURT(10),
*RRR(4), NN(4), AA(4), BB(2,2), SS(2,2), BUX(400), X1(100), Y1(100),
*BLAN20(350)
  COMMON/WORKC/ZTH1S(20,12), ZTH1I(20,12), ZTH1O(20,12), ZTH2S(20,12),
*ZTH2I(20,12), ZTH2D(20,12), ZTH3S(20,12), ZTH3I(20,12), ZTH3D(20,12),

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STC SI1160
STC SI1170
STC SI1180
STC SI1190
STC SI1200
STC SI1210
STC SI1220
STC SI1230
STC SI1240
STC SI1250
STC SI1260
STC SI1270
STC SI1280
STC SI1290
STC SI1300
STC SI1310
STC SI1320
STC SI1330
STC SI1340
STC SI1350
STC SI1360
STC SI1370
STC SI1380
STC SI1390
STC SI1400
STC SI1410
STC SI1420
STC SI1430
STC SI1440
STC SI1450
STC SI1460
STC SI1470
STC SI1480
STC SI1490
STC SI1500
STC SI1510
STC SI1520
STC SI1530
STC SI1540
STC SI1550
STC SI1560
STC SI1570
STC SI1580
STC SI1590
STC SI1600
STC SI1610
STC SI1620
STC SI1630

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IF (KEK1.EQ.33) GO TO 688
IF (KEK1.EQ.34) GO TO 692
IF (KEK1.EQ.35) GO TO 710
IF (KEK1.EQ.36) GO TO 714
IF (KEK1.EQ.37) GO TO 718
IF (KEK1.EQ.38) GO TO 722
IF (KEK1.EQ.39) GO TO 726
IF (KEK1.EQ.40) GO TO 730
IF (KEK1.EQ.41) GO TO 734
IF (KEK1.EQ.42) GO TO 738
IF (KEK1.EQ.43) GO TO 742
IF (KEK1.EQ.44) GO TO 746
IF (KEK1.EQ.45) GO TO 750
IF (KEK1.EQ.46) GO TO 754
IF (KEK1.EQ.47) GO TO 758
IF (KEK1.EQ.48) GO TO 762
GO TO 990
608 WRITE(6,616)
610 FORMAT(9X,'(1) DEPTH OF THE TOP OF SHALLOW THERMOCLINE',/)
DC 609 NCRDER=ICRDER,MCRDER
AUX(NORDE)=ZTH1S(NCRDER,ISTA)
CCNT INUE
609 GO TO 704
612 WRITE(6,614)
614 FORMAT(9X,'(1) DEPTH OF THE TOP OF INTERMEDIATE THERMOCLINE',/)
DC 613 NCRDER=ICRDER,MCRDER
AUX(NORDE)=ZTH1I(NCRDER,ISTA)
CCNT INUE
613 GO TO 704
616 WRITE(6,618)
618 FORMAT(9X,'(1) DEPTH OF THE TOP OF DEEP OR UNIQUE THERMOCLINE',/)
DC 617 NCRDER=ICRDER,MCRDER
AUX(NORDE)=ZTH1D(NCRDER,ISTA)
CCNT INUE
617 GO TO 704
620 WRITE(6,622)
622 FORMAT(9X,'(1) MEAN DEPTH OF THE SHALLOW THERMOCLINE',/)
DC 621 NCRDER=ICRDER,MCRDER
AUX(NORDE)=ZTH2S(NCRDER,ISTA)
CCNT INUE
621 GO TO 704
624 WRITE(6,626)
626 FORMAT(9X,'(1) MEAN DEPTH OF THE INTERMEDIATE THERMOCLINE',/)
DC 625 NCRDER=ICRDER,MCRDER
AUX(NORDE)=ZTH2I(NCRDER,ISTA)
CCNT INUE
625 GO TO 704
628 WRITE(6,630)

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630 FORMAT(9X,'(1) MEAN DEPTH OF THE DEEP OR UNIQUE THERMOCLINE','/')
CC 629 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZTH2D(NCRDER,ISTA)
629 CONTINUE
CC TO 704
632 WRITE(6,634)
634 FORMAT(9X,'(1) DEPTH OF THE BOTTOM OF SHALLOW THERMOCLINE','/')
CC 633 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZTH3S(NCRDER,ISTA)
633 CONTINUE
CC TO 704
636 WRITE(6,638)
638 FORMAT(9X,'(1) DEPTH OF THE BOTTOM OF INTERMEDIATE THERMOCLINE','/
*)
DO 637 NORDER=ICRDER,MORDER
AUX(NORDER)=ZTH3I(NCRDER,ISTA)
637 CONTINUE
CC TO 704
640 WRITE(6,642)
642 FORMAT(9X,'(1) DEPTH OF THE BOTTOM OF DEEP OR UNIQUE THERMOCLINE','/
*)
DO 641 NCRDER=ICRDER,MORDER
AUX(NCRDER)=ZTH3D(NCRDER,ISTA)
641 CONTINUE
CC TO 704
644 WRITE(6,646)
646 FORMAT(9X,'(1) WIDTH OF THE SHALLOW THERMOCLINE','/')
CC 645 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZTHWS(NORDER,ISTA)
645 CONTINUE
CC TO 704
648 WRITE(6,650)
650 FORMAT(9X,'(1) WIDTH OF THE INTERMEDIATE THERMOCLINE','/')
CC 649 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZTHWI(NCRDER,ISTA)
649 CONTINUE
CC TO 704
652 WRITE(6,654)
654 FORMAT(9X,'(1) WIDTH OF THE DEEP OR UNIQUE THERMOCLINE','/')
CC 653 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZTHWD(NCRDER,ISTA)
653 CONTINUE
CC TO 704
656 WRITE(6,658)
658 FORMAT(9X,'(1) THERMAL VARIATION OF THE SHALLOW THERMOCLINE','/')
CC 657 NCRDER=ICRDER,MORDER
AUX(NORDER)=TTHVS(NORDER,ISTA)
657 CONTINUE

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STCS1640
STCS1650
STCS1660
STCS1670
STCS1680
STCS1690
STCS1700
STCS1710
STCS1720
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STCS1760
STCS1770
STCS1780
STCS1790
STCS1800
STCS1810
STCS1820
STCS1830
STCS1840
STCS1850
STCS1860
STCS1870
STCS1880
STCS1890
STCS1900
STCS1910
STCS1920
STCS1930
STCS1940
STCS1950
STCS1960
STCS1970
STCS1980
STCS1990
STCS2000
STCS2010
STCS2020
STCS2030
STCS2040
STCS2050
STCS2060
STCS2070
STCS2080
STCS2090
STCS2100
STCS2110


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GO TO 704
660 WRITE(6,662)
662 FORMAT(9X,'(1) THERMAL VARIATION OF THE INTERMEDIATE THERMOCLINE,')
*,,)
DC 661 NCRDER=ICRDER,MORDER
AUX(NORDER)=TTHVI(NORDER,ISTA)
CCNT INUE
661 GO TO 704
664 WRITE(6,666)
666 FORMAT(9X,'(1) THERMAL VARIATION OF THE DEEP OR UNIQUE THERMOCLINE
*,,)
DC 665 NCRDER=ICRDER,MORDER
AUX(NORDER)=TTHVD(NORDER,ISTA)
CCNT INUE
665 GO TO 704
668 WRITE(6,672)
672 FORMAT(9X,'(1) DEPTH OF THE MIXED LAYER,')
*,,)
DC 669 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZMIXLR(NORDER,ISTA)
CCNT INUE
669 GO TO 704
672 WRITE(6,674)
674 FORMAT(9X,'(1) TEMPERATURE AT SEA SURFACE,')
*,,)
DC 673 NCRDER=ICRDER,MORDER
AUX(NORDER)=TSFC(NORDER,ISTA)
CCNT INUE
673 GO TO 704
676 WRITE(6,678)
678 FORMAT(9X,'(1) DEPTH OF THE 12 DEG CELSIUS ISCTHERM,')
*,,)
DC 677 NCRDER=ICRDER,MORDER
AUX(NORDER)=Z12CD(NORDER,ISTA)
CCNT INUE
677 GO TO 704
680 WRITE(6,682)
682 FORMAT(9X,'(1) DEPTH OF THE TOP OF SARDINE HABITAT,')
*,,)
DC 681 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZSUCC(NORDER,ISTA)
CCNT INUE
681 GO TO 704
684 WRITE(6,686)
686 FORMAT(9X,'(1) DEPTH OF THE BOTTOM OF SARDINE HABITAT,')
*,,)
DC 685 NCRDER=ICRDER,MORDER
AUX(NORDER)=ZSLCD(NORDER,ISTA)
CCNT INUE
685 GO TO 704
688 WRITE(6,690)
690 FORMAT(9X,'(1) DEPTH OF THE TOP OF TUNA HABITAT,')
*,,)
DC 689 NCRDER=ICRDER,MORDER

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STCS2120
STCS2130
STCS2140
STCS2150
STCS2160
STCS2170
STCS2180
STCS2190
STCS2200
STCS2210
STCS2220
STCS2230
STCS2240
STCS2250
STCS2260
STCS2270
STCS2280
STCS2290
STCS2300
STCS2310
STCS2320
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STCS2380
STCS2390
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STCS2470
STCS2480
STCS2490
STCS2500
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STCS2520
STCS2530
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STCS2560
STCS2570
STCS2580
STCS2590

[illegible]


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813 IF(DAUX.LE.(-180.)) GO TO 1813
      CCNTINUE
      IND=0
      GO TO 904
816 WRITE(6,818)
818 *FCRMT(9X, '(2) DIRECTION OF THE SURFACE WIND AT 2 DAYS BEFORE DAY
      *XBT OBS. ', /)
      DC 817 NCRDER=ICRDER, MCRDER
      AUX(NCRDER+JORDER)=KANG02(NCRDER, ISTA)
      IF(NCRDER.NE.IORDER) GO TO 1816
      AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      GO TO 817
1816 DAUX=AUX(NCRDER+JORDER)-AUX(NCRDER+JORDER-1)
1817 IF(DAUX.LE.(-180.)) AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      CAUX=AUX(NCRDER+JORDER)-AUX(NCRDER+JORDER-1)
      IF(DAUX.LE.(-180.)) GO TO 1817
      CCNTINUE
      IND=1
      GO TO 904
820 WRITE(6,822)
822 *FCRMT(9X, '(2) DIRECTION OF THE SURFACE WIND AT 3 DAYS BEFORE DAY
      *XBT OBS. ', /)
      DC 821 NCRDER=ICRDER, MCRDER
      AUX(NCRDER+JORDER)=KANG03(NCRDER, ISTA)
      IF(NCRDER.NE.IORDER) GO TO 1820
      AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      GO TO 821
1820 DAUX=AUX(NCRDER+JORDER)-AUX(NCRDER+JORDER-1)
1821 IF(DAUX.LE.(-180.)) AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      CAUX=AUX(NCRDER+JORDER)-AUX(NCRDER+JORDER-1)
      IF(DAUX.LE.(-180.)) GO TO 1821
      CCNTINUE
      IND=0
      GO TO 904
824 WRITE(6,826)
826 *FCRMT(9X, '(2) DIRECTION OF THE SURFACE WIND AT 5 DAYS BEFORE DAY
      *XBT OBS. ', /)
      DC 825 NCRDER=ICRDER, MCRDER
      AUX(NCRDER+JORDER)=KANG05(NCRDER, ISTA)
      IF(NCRDER.NE.IORDER) GO TO 1824
      AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      GO TO 825
1824 DAUX=AUX(NCRDER+JORDER)-AUX(NCRDER+JORDER-1)
1825 IF(DAUX.LE.(-180.)) AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      CAUX=AUX(NCRDER+JORDER)-AUX(NCRDER+JORDER-1)
      IF(DAUX.LE.(-180.)) GO TO 1825
      CCNTINUE
      IND=0

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GC TO 904
828 WRITE(6,830)
830 *FCRMT(9X,:(2) DIRECTION OF THE SURFACE WIND AT 10 DAYS BEFORE DAY
      XBT OBS.:(/))
      DC 829 NCRDER=ICRDER,MCRDER
      AUX(NCRDER+JORDER)=KANGIU(NORDER,ISTA)
      IF(NCRDER.NE.IORDER) GO TO 1828
      AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      GO TO 829
1828 DAUX=AUX(NCRDER+JORDER)-AUX(NORDER+JORDER-1)
1829 IF(DAUX.LE.(-180.)) AUX(NCRDER+JORDER)=AUX(NCRDER+JORDER)+360.
      IF(DAUX.LE.(-180.)) GO TO 1829
      CCNTINUE
      IND=Q
      GO TO 904
832 WRITE(6,834)
834 *FCRMT(9X,:(2) INTENSITY OF THE SURFACE WIND AT DAY XBT OBS.:(/))
      DC 833 NCRDER=ICRDER,MORDER
      AUX(NCRDER+JORDER)=R00(NORDER,ISTA)
      CCNTINUE
      GO TO 904
836 WRITE(6,838)
838 *FCRMT(9X,:(2) INTENSITY OF THE SURFACE WIND AT 1 DAY BEFORE DAY
      XBT OBS.:(/))
      DC 837 NCRDER=ICRDER,MORDER
      AUX(NCRDER+JORDER)=R01(NORDER,ISTA)
      CCNTINUE
      GO TO 904
840 WRITE(6,842)
842 *FCRMT(9X,:(2) INTENSITY OF THE SURFACE WIND AT 2 DAYS BEFORE DAY
      XBT OBS.:(/))
      DC 841 NCRDER=ICRDER,MORDER
      AUX(NCRDER+JORDER)=R02(NORDER,ISTA)
      CCNTINUE
      GO TO 904
844 WRITE(6,846)
846 *FCRMT(9X,:(2) INTENSITY OF THE SURFACE WIND AT 3 DAYS BEFORE DAY
      XBT OBS.:(/))
      DC 845 NCRDER=ICRDER,MORDER
      AUX(NCRDER+JORDER)=R03(NORDER,ISTA)
      CCNTINUE
      GO TO 904
848 WRITE(6,850)
850 *FCRMT(9X,:(2) INTENSITY OF THE SURFACE WIND AT 5 DAYS BEFORE DAY
      XBT OBS.:(/))
      DC 849 NCRDER=ICRDER,MORDER
      AUX(NCRDER+JORDER)=R05(NORDER,ISTA)

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TCS4520
 STCS4530
 STCS4540
 STCS4550
 STCS4560
 STCS4570
 STCS4580
 STCS4590
 STCS4600
 STCS4610
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 STCS4630
 STCS4640
 STCS4650
 STCS4660
 STCS4670
 STCS4680
 STCS4690
 STCS4700
 STCS4710
 STCS4720
 STCS4730
 STCS4740
 STCS4750
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 STCS4930
 STCS4940
 STCS4950
 STCS4960
 STCS4970
 STCS4980
 STCS4990


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* XBT OBS. ',/'
853 DC 853 NCRDER=ICRDER,MORDER
  AUX(NORDER+JCRDER)=R01(NORDER,ISTA)
  CONTINUE
  GO TO 904
856 WRITE(6,858)
858 FORMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (ALONG THE COAST) AT
* DAY XBT OBS.',/)
  DC 857 NCRDER=ICRDER,MORDER
  AUX(NORDER+JCRDER)=R01(NORDER,ISTA)
  CONTINUE
  GO TO 904
860 WRITE(6,862)
862 FORMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (PERP. TO THE COAST)
* AT DAY OF XBT OBS.',/)
  DC 861 NCRDER=ICRDER,MORDER
  AUX(NORDER+JCRDER)=R02(NORDER,ISTA)
  CONTINUE
  GO TO 904
864 WRITE(6,866)
866 FORMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (ALONG THE COAST) AT
* 1 DAY BEFORE DAY XBT OBS.',/)
  DC 865 NCRDER=ICRDER,MORDER
  AUX(NORDER+JCRDER)=R01(NORDER,ISTA)
  CONTINUE
  GO TO 904
868 WRITE(6,870)
870 FORMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (PERP. TO THE COAST)
* AT 1 DAY BEFORE DAY XBT OBS.',/)
  DC 869 NCRDER=ICRDER,MORDER
  AUX(NORDER+JCRDER)=R012(NORDER,ISTA)
  CONTINUE
  GO TO 904
872 WRITE(6,874)
874 FORMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (ALONG THE COAST) AT
* 2 DAYS BEFORE DAY XBT OBS.',/)
  DC 873 NCRDER=ICRDER,MORDER
  AUX(NORDER+JCRDER)=R021(NORDER,ISTA)
  CONTINUE
  GO TO 904
876 WRITE(6,876)
876 FORMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (PERP. TO THE COAST)
* AT 2 DAYS BEFORE DAY XBT OBS.',/)
  DC 877 NCRDER=ICRDER,MORDER

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877 AUX(NORDER+JORDER)=R022(NORDER, ISTA)
    CCNTINUE
880 GC TO 904
882 WRITE(6,882)
    FCRMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (ALONG THE COAST) AT
    *3 DAYS BEFORE DAY XBT OBS.',/)
    DC 881 NCRDER=ICRDER,MORDER
    AUX(NORDER+JORDER)=R031(NORDER, ISTA)
881 CCNTINUE
884 GC TO 904
886 WRITE(6,886)
    FCRMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (PERP. TO THE COAST)
    *AT 3 DAYS BEFORE DAY XBT OBS.',/)
    DC 885 NCRDER=ICRDER,MORDER
    AUX(NORDER+JORDER)=R032(NORDER, ISTA)
885 CCNTINUE
888 GC TO 904
890 WRITE(6,890)
    FCRMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (ALONG THE COAST) AT
    *5 DAYS BEFORE DAY XBT OBS.',/)
    DC 889 NCRDER=ICRDER,MORDER
    AUX(NORDER+JORDER)=R051(NORDER, ISTA)
889 CCNTINUE
892 GC TO 904
894 WRITE(6,894)
    FCRMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (PERP. TO THE COAST)
    *AT 5 DAYS BEFORE DAY XBT OBS.',/)
    DC 893 NCRDER=ICRDER,MORDER
    AUX(NORDER+JORDER)=R052(NORDER, ISTA)
893 CCNTINUE
896 GC TO 904
898 WRITE(6,898)
    FCRMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (ALONG THE COAST) AT
    *10 DAYS BEFORE DAY XBT OBS.',/)
    DC 897 NCRDER=ICRDER,MORDER
    AUX(NORDER+JORDER)=R101(NORDER, ISTA)
897 CCNTINUE
900 GC TO 904
902 WRITE(6,902)
    FCRMAT(9X,'(2) INTENSITY OF THE SURFACE WIND (PERP. TO THE COAST)
    *AT 10 DAYS BEFORE DAY XBT OBS.',/)
    DC 901 NCRDER=ICRDER,MORDER
    AUX(NORDER+JORDER)=R102(NORDER, ISTA)
901 CCNTINUE
904 GC TO 904
    NOBS=(MORDER-IORDER)+1
    CCODE(1)=-5.
    CCODE(2)=-5.

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STCS5480
 STCS5490
 STCS5500
 STCS5510
 STCS5520
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 STCS5540
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 STCS5570
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 STCS5590
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 STCS5640
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 STCS5660
 STCS5670
 STCS5680
 STCS5690
 STCS5700
 STCS5710
 STCS5720
 STCS5730
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 STCS5870
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 STCS5900
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 STCS5920
 STCS5930
 STCS5940
 STCS5950


```

CALL MISR(NOBS,2,AUX, CODE,XBAR,STD,SKEW,CURT,RR,NN,AA,BB,SS,IER)
REDUCING THE ANGULAR PROCESSED DATA TO AN ANGLE LESS THAN 360
IF(IND.EQ.0.AND.XBAR(1).GE.360.) XBAR(1)=AMOD(XBAR(1),360.)
IF(IND.EQ.0.AND.XBAR(2).GE.360.) XBAR(2)=AMOD(XBAR(2),360.)

AVERAGE DEPTH OF A GIVEN ISOTHERM (AT A KNOWN STATION)
IF(KEK1.EQ.30) ZTTMDC(14,ISTA)=XBAR(1)
IF(KEK1.EQ.31) ZTTMDC(16,ISTA)=XBAR(1)
IF(KEK1.EQ.32) ZTTMDC(17,ISTA)=XBAR(1)
IF(KEK1.EQ.33) ZTTMDC(18,ISTA)=XBAR(1)
IF(KEK1.EQ.34) ZTTMDC(19,ISTA)=XBAR(1)
IF(KEK1.EQ.35) ZTTMDC(15,ISTA)=XBAR(1)
IF(KEK1.EQ.36) ZTTMDC(13,ISTA)=XBAR(1)
IF(KEK1.EQ.37) ZTTMDC(12,ISTA)=XBAR(1)
IF(KEK1.EQ.38) ZTTMDC(11,ISTA)=XBAR(1)
IF(KEK1.EQ.39) ZTTMDC(10,ISTA)=XBAR(1)
IF(KEK1.EQ.40) ZTTMDC(9,ISTA)=XBAR(1)
IF(KEK1.EQ.41) ZTTMDC(8,ISTA)=XBAR(1)
IF(KEK1.EQ.42) ZTTMDC(7,ISTA)=XBAR(1)
IF(KEK1.EQ.43) ZTTMDC(6,ISTA)=XBAR(1)
IF(KEK1.EQ.44) ZTTMDC(5,ISTA)=XBAR(1)
IF(KEK1.EQ.45) ZTTMDC(4,ISTA)=XBAR(1)
IF(KEK1.EQ.46) ZTTMDC(3,ISTA)=XBAR(1)
IF(KEK1.EQ.47) ZTTMDC(2,ISTA)=XBAR(1)
IF(KEK1.EQ.48) ZTTMDC(1,ISTA)=XBAR(1)
WRITE(6,910)
910 * FCRMAT(///,1X,'VARIABLES MEAN STD DEVIATION SKEWNESS
      KURTOSIS')
912 * WRITE(6,912)(I13,XBAR(I13),STD(I13),SKEW(I13),CURT(I13),I13=1,2)
      FCRMAT(' ',11,' ',5X,F10.1,8X,F10.1,6X,F10.1)
      I32=1
922 * WRITE(6,922) NN(I32),NN(I32+1),NN(I32+2)
      FCRMAT(///,1X,'NO. OF PAIRS OF CBS.',14X,I3,9X,I3,9X,I3)
918 * WRITE(6,918) RR(I32),RR(I32+1),RR(I32+2)
      FCRMAT(' ',CORRELATION COEFFICIENTS',5X,F11.2,1X,F11.2,1X,F11.2,
      * 1X,F11.2)
930 * WRITE(6,930) BB(I32,J32),BB(I32+1,J32),BB(I32,J32+1),8B(I32+1,J32+
      * 1)
      FCRMAT(' ',REGRESSION COEFFICIENTS',6X,F11.2,1X,F11.2,1X,F11.2,1X
      * ,F11.2)
934 * WRITE(6,934) SS(I32,J32),SS(I32+1,J32),SS(I32,J32+1),SS(I32+1,J32+
      * 1)
      FCRMAT(' ',STD ERRORS REGRES. COEF.',5X,F11.2,1X,F11.2,1X,F11.2,
      * 1X,F11.2)

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STCS55960
STCS55970
STCS55980
STCS55990
STCS60000
STCS60010
STCS60020
STCS60030
STCS60040
STCS60050
STCS60060
STCS60070
STCS60080
STCS60090
STCS61000
STCS61010
STCS61020
STCS61030
STCS61040
STCS61050
STCS61060
STCS61070
STCS61080
STCS61090
STCS62000
STCS62010
STCS62020
STCS62030
STCS62040
STCS62050
STCS62060
STCS62070
STCS62080
STCS62090
STCS63000
STCS63010
STCS63020
STCS63030
STCS63040
STCS63050
STCS63060
STCS63070
STCS63080
STCS63090
STCS64000
STCS64010
STCS64020
STCS64030

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959 WRITE(6,908) IER
908 FORMAT('G',I0X,' IER =',I1,/)
954 CALL RLINEL(ITITL5,LABEL,SCALE3)
IND=1
GO TO 993
990 WRITE(6,991)
991 FORMAT(9X,' NO VARIABLE(S). PLEASE CHECK DATA.',/)
993 RETURN
END
.....
SUBROUTINE THERMC
PURPOSE
TWO DIMENSIONAL (Z,T) OBJECTIVE ANALYSIS OF A DIGITAL TRACE
(BEGINNING AT SEA SURFACE) TO IDENTIFY THERMOCLINES
LSAGE
CALL THERMC(NORDER,ISTA,J1,NGP)
DESCRIPTION OF PARAMETERS
NORDER - ACTUAL NUMBER OF PROCESSED CRUISES
ISTA - INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
SECTION
J1 - ACTUAL NUMBER OF DIGITAL TRACES PROCESSED FOR A GIVEN
CRUISE
NGP - OUTPUT NUMBER OF PAIRS (T,Z) COMPUTED FROM THE DIGITAL
TRACE BY (A) A CONTINUOUS INCREMENT 'DTW' OF
TEMPERATURE BEGINNING AT SEA SURFACE AND (B) THE
DEPTHS OF THE ABOVE PAIRS ARE OBTAINED BY LINEAR
INTERPOLATION BETWEEN NEAR POINTS OF THE ORIGINAL
DIGITAL TRACE
REMARKS
(1) THIS SUBROUTINE USES 'COMMON' LABELLED AREAS TO EXCHANGE
INFORMATION WITH THE MAIN PROGRAM.
(2) THIS SUBROUTINE REQUIRES THE PROCESSING OF THE DIGITAL
TRACE INTO A MESH AS PERFORMED BY SUBROUTINE LINTPS.
(3) THE SETTING UP OF THE CONDITIONS TO DEFINE (A) THE TOP AND
THE BOTTOM OF THE THERMOCLINE AND (B) THE FILTERING PARAMETERS
REQUIRES CONSULTATION OF:
SALDANHA, J.M., 1971, OBJECTIVE DIGITAL ANALYSIS OF A
TRACE, M.S. THESIS, NAVAL POSTGRADUATE SCHOOL,
MONTEREY, CALIFORNIA
(4) THE SELECTED VALUES FOR THE FILTERING PARAMETERS MUST BE
INTRODUCED IN THE SUBROUTINE. THE FILTERING PARAMETERS ARE:
(A) ALPHA-MINIMUM THERMAL MAGNITUDE DEFINING THERMOCLINE

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CC

THMC0400
THMC0410
THMC0420
THMC0430
THMC0440
THMC0450
THMC0460
THMC0470
THMC0480
THMC0490
THMC0500
THMC0510
THMC0520
THMC0530
THMC0540
THMC0550
THMC0560
THMC0570

(B) BETA -MINIMUM GRADIENT DEFINING THERMOCLINE
(C) DELTA-MAXIMUM SEPARATION (VERTICAL DISTANCE)
(D) THETA-MINIMUM GRADIENT SELECTING THERMOCLINE (WITH
SIGMA PARAMETER)
(E) SIGMA-MAXIMUM SEPARATION BETWEEN THERMOCLINES TO BE
MERGED (WITH THE THETA PARAMETER)
(5) THIS SUBROUTINE STORES THE PROCESSED INFORMATION RELATIVE
TO THE THREE SHALLOWEST THERMOCLINES.

FUNCTIONS REQUIRED
ABS (IBM SCIENTIFIC LIBRARY)

METHOD
ITERATIVE PROCESS TO APPLY THE FINITE DIFFERENCE TECHNIQUE TO
THE MESH

.....

SUBROUTINE THERMC(NCORDER, ISTA, J1, NGP)
COMMON/WORKA/TO(60),ZO(60),T(120),ZAH1S(20),ZAH1I(20),
*ZAH1D(20),ZAH2S(20),ZAH2I(20),ZAH2D(20),ZAH3I(20),
*ZAH3D(20),ZAHXLR(20),Z1(150),Z2(150),Z3(150),ZAXT(15),ZAXB(15),
*ZAXXC(15),ZAXXR(15),TAUXR(15),TAUXG(15),ZANGE(15),
*TAUXT(15),TAUXB(15),ZAUBT(15),ZAUBC(15),ZAUBR(15),
*TAUBR(15),TAUBG(15),ZANBEI(15),ZANBEI(15),TAUBT(15),
*TAUCB(15),TAUCR(15),ZAUCR(15),ZAUCC(15),TAUCT(15),
COMMON/WORKC/ZTH1S(20,12),ZTH1I(20,12),ZTH1C(20,12),ZTH2S(20,12),
*ZTH2I(20,12),ZTH2D(20,12),ZTH3S(20,12),ZTH3I(20,12),ZTH3D(20,12),
*ZTHWS(20,12),ZTHWI(20,12),ZTHWD(20,12),TTHVS(20,12),TTHVI(20,12),
*TTHVD(20,12),ZMXLR(20,12),TSFC(20,12)
ALPHA: MINIMUM THERMAL MAGNITUDE DEFINING THERMOCLINE
ALPHA=0.3
BETA: MINIMUM GRADIENT DEFINING THERMOCLINE
BETA=0.015
DELTA: MAXIMUM SEPARATION (VERTICAL DISTANCE) BETWEEN THERMOCLINES
TO BE MERGED
DELTA=10.
THETA: MINIMUM GRADIENT SELECTING THERMOCLINE

CCCCCCCCCCCCCCCC

CCCC CCCC CCCC CCCC


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C
C
C
IF(N.LE.M) GO TO 10
IF(N.GT.M) GO TO 41
DEFINING THE CONDITIONS TO LOCATE THE TOP OF A THERMOCLINE
12 IF(Z2(N).LT.C.O.AND.K.EQ.O) GO TO 16
N=N+1
16 GO TO 10
N TOP=N+1
K=1
ZAUBT(NR)=Z(NTOP)
TAUBT(NR)=T(NTOP)
WRITE(6,18) NR,Z(NTOP)
18 FORMAT(///30X,'THERMOCLINE NO.',I2,/31X,'TOP AT DEPTH =',F5.1)
ANALYSIS OF THE BOTTOM OF THERMOCLINE
N=NTOP
20 IF(Z2(N).GT.C.O) GO TO 22
N=N+1
IF(N.LE.M) GO TO 20
IF(N.GT.M) GO TO 41
DEFINING THE CONDITIONS TO LOCATE THE BOTTOM OF A THERMOCLINE
22 IF((Z2(N).GT.O.O.AND.K.EQ.1).AND.Z2(N+1).GE.O.O) GO TO 26
24 N=N+1
GO TO 20
26 N BOT=N+1
TAUBB(NR)=T(NBOT)
ZAUBB(NR)=Z(NBOT)
WRITE(6,28) Z(NBOT)
28 FORMAT(,30X,'BOTTOM AT DEPTH =',F5.1)
COMPUTATION OF THERMOCLINE PARAMETERS
VERTICAL SPACEMENT OF THERMOCLINE
ZANBE(NR)=ABS(ZAUBB(NR)-ZAUBT(NR))
ZAUBR(NR)=ZANBE(NR)
WRITE(6,30) ZANBE(NR)
30 FORMAT(,30X,'VERTICAL SPACEMENT BETWEEN TOP AND BOTTOM =',F5.1)
HALF SPACEMENT
ZANBE1(NR)=C.O5*ZANBE(NR)
DEPTH OF THERMOCLINE MEAN (DEFINED BY LINEAR AVERAGE BETWEEN TOP

```



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C AND BOTTCM)
C ZAUBC(NR)=Z(NTOP)+ZANBE1(NR)
C TEMPERATURE VARIATION OF THERMOCLINE
C
C TAUBR(NR)=ABS(TAUBT(NR)-TAUBB(NR))
C WRITE(6,32) TAUBR(NR)
C FCRMAT(1,30X,TEMPERATURE VARIATION =',F5.1)
C WRITE(6,34) ZAUBC(NR)
C FCRMAT(1,30X,DEPTH OF THERMOCLINE MEAN =',F5.1)
C
C TAUXG:THERMOCLINE GRADIENT (DEGREES CENT./METERS)
C
C TAUBG(NR)=TAUBR(NR)/ZANBE(NR)
C WRITE(6,40) TAUBG(NR)
C FCRMAT(1,30X,THERMOCLINE GRADIENT =',F10.6)
C NR=NR+1
C K=0
C IF(N.LE.M) GO TO 10
C NR=NR-1
C IF(NR.GT.1) GO TO 42
C IF(NR.EQ.0) JCOUNT=1
C IF(NR.EQ.1) JCOUNT=2
C
C PROCESSING THE FILTERING OF THE IDENTIFIED THERMOCLINES
C
C GO TO 46
C NS=1
C NZ=0
C NW=0
C
C SELECTION OF THERMOCLINES BASED UPON (A) VERTICAL SEPARATION OR
C (B) VERTICAL SEPARATION AND MINIMUM GRADIENT
C
C DO 44 I10=1,NR
C IF(I10.EQ.NR) GO TO 43
C DELTZ=ABS(ZAUBT(I10+1)-ZAUBB(I10))
C IF(DELTZ.LE.DELTA) GO TO 39
C IF(DELTZ.LE.SIGMA) GO TO 48
C GO TO 43
C IF((NZ.EQ.0).AND.((TAUBG(I10).GE.THETA).AND.(TAUBG(I10+1).GE.TAUBG
C * (I10)))) GO TO 39
C IF((NZ.EQ.1).AND.((TAUCG(NS).GE.THETA).AND.(TAUBG(I10+1).GE.TAUCG
C * NS)))) GO TO 39
C GO TO 43
C IF(NZ.EQ.0.AND.I10.GT.1) NS=NS+1

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THMC1820
 THMC1830
 THMC1840
 THMC1850
 THMC1860
 THMC1870
 THMC1880
 THMC1890
 THMC1900
 THMC1910
 THMC1920
 THMC1930
 THMC1940
 THMC1950
 THMC1960
 THMC1970
 THMC1980
 THMC1990
 THMC2000
 THMC2010
 THMC2020
 THMC2030
 THMC2040
 THMC2050
 THMC2060
 THMC2070
 THMC2080
 THMC2090
 THMC2100
 THMC2110
 THMC2120
 THMC2130
 THMC2140
 THMC2150
 THMC2160
 THMC2170
 THMC2180
 THMC2190
 THMC2200
 THMC2210
 THMC2220
 THMC2230
 THMC2240
 THMC2250
 THMC2260
 THMC2270
 THMC2280
 THMC2290


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IF(NZ.EQ.0) ZAUCT(NS)=ZAUBT(I10)
IF(NZ.EQ.0) TAUCT(NS)=TAUBT(I10)
IF(I10.EQ.0) (NR-1) NW=1
ZAUCCB(NS)=ZAUCCB(I10+1)
ZAUCCB(NS)=ABS(ZAUCCB(NS))-ZAUCCB(NS)
ZAUCCB(NS)=0.5*ZAUCCB(NS)
ZAUCCB(NS)=ZAUCCB(I10+1)
ZAUCCB(NS)=ABS(ZAUCCB(NS))-ZAUCCB(NS)
ZAUCCB(NS)=TAUCCB(NS)/ZAUCCB(NS)
WRITE(6,18) NS,ZAUCCB(NS)
WRITE(6,28) ZAUCCB(NS)
WRITE(6,30) ZAUCCB(NS)
WRITE(6,32) ZAUCCB(NS)
WRITE(6,34) ZAUCCB(NS)
WRITE(6,40) ZAUCCB(NS)
NZ=1
GO TO 44
IF(NZ.EQ.1) AND.NW.EQ.1) GO TO 44
IF(NZ.EQ.1) AND.I10.EQ.1) GO TO 44
IF(NZ.EQ.1) GO TO 47
IF(I10.GT.1) NS=NS+1
I11=I10
ZAUCCB(NS)=ZAUCCB(I11)
ZAUCCB(NS)=ABS(ZAUCCB(NS))-ZAUCCB(NS)
ZAUCCB(NS)=0.5*ZAUCCB(NS)
ZAUCCB(NS)=ZAUCCB(I11)
ZAUCCB(NS)=TAUCCB(NS)-ZAUCCB(NS)
ZAUCCB(NS)=ABS(ZAUCCB(NS))-ZAUCCB(NS)
ZAUCCB(NS)=TAUCCB(NS)
WRITE(6,18) NS,ZAUCCB(NS)
WRITE(6,28) ZAUCCB(NS)
WRITE(6,30) ZAUCCB(NS)
WRITE(6,32) ZAUCCB(NS)
WRITE(6,34) ZAUCCB(NS)
WRITE(6,40) ZAUCCB(NS)
NZ=0
CCNT INUE
JCCNT=1

```

```

SELECTION OF FILTERED THERMOCLINES BASED ON (A) MINIMUM THERMAL
MAGNITUDE OR (B) MINIMUM GRADIENT

DC 45 I12=1,NS
IF(TAUCR(I12)).LT.ALPHA) GO TO 45
IF(TAUCG(I12)).LT.BETA) GO TO 45

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THMC2780
THMC2790
THMC2800
THMC2810
THMC2820
THMC2830
THMC2840
THMC2850
THMC2860
THMC2870
THMC2880
THMC2890
THMC2900
THMC2910
THMC2920
THMC2930
THMC2940
THMC2950
THMC2960
THMC2970
THMC2980
THMC2990
THMC3000
THMC3010
THMC3020
THMC3030
THMC3040
THMC3050
THMC3060
THMC3070
THMC3080
THMC3090
THMC3100
THMC3110
THMC3120
THMC3130
THMC3140
THMC3150
THMC3160
THMC3170
THMC3180
THMC3190
THMC3200
THMC3210
THMC3220
THMC3230
THMC3240
THMC3250

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ZAXT(JCOUNT)=ZAUCT(I12)
ZAXB(JCOUNT)=ZAUCB(I12)
ZAXR(JCOUNT)=ZAUCR(I12)
ZANG1(JCOUNT)=ZANCE1(I12)
ZAXC(JCOUNT)=ZAUC(I12)
ZAXT(JCOUNT)=TAUCT(I12)
ZAXB(JCOUNT)=TAUCB(I12)
ZAXR(JCOUNT)=TAUCR(I12)
ZAXG(JCOUNT)=TAUCG(I12)
WRITE(6,18) JCOUNT,ZAXT(JCOUNT)
WRITE(6,28) ZAXB(JCOUNT)
WRITE(6,30) ZAXR(JCOUNT)
WRITE(6,32) TAUCT(I12)
WRITE(6,34) ZAXC(JCOUNT)
WRITE(6,40) ZAXG(JCOUNT)
JCOUNT=JCOUNT+1
CCNTINJE
45 JTCOUNT=JCOUNT-1
46 WRITE(6,55) JTCOUNT
55 FORMAT(/,3CX,'NO. OF THERMOCLINES =' ,I2,////)

```

END OF THERMOCLINE ANALYSIS

STORAGE OF THE THERMOCLINE PROCESSED DATA

- (1) NO THERMOCLINE (NEGATIVE ARTIFICIAL VALUES)
- (2) 1 THERMOCLINE (SHALLOW)
- (3) 2 THERMOCLINES (SHALLOW+INTERMEDIATE)
- (4) 3 THERMOCLINES (SHALLOW+INTERMEDIATE+DEEP)

```

JCOUNT=JTCOUNT+1
IF(JCOUNT.GT.1) GO TO 60
ZAH1S(J1)=-5.
ZAH1I(J1)=-5.
ZAH1D(J1)=-5.
ZAH2S(J1)=-5.
ZAH2I(J1)=-5.
ZAH2D(J1)=-5.
ZAH3S(J1)=-5.
ZAH3I(J1)=-5.
ZAH3D(J1)=-5.
ZTH1S(NORDER,ISTA)=-5.
ZTH1I(NORDER,ISTA)=-5.
ZTH1D(NORDER,ISTA)=-5.
ZTH2S(NORDER,ISTA)=-5.
ZTH2I(NORDER,ISTA)=-5.
ZTH2D(NORDER,ISTA)=-5.

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CCCCCCCCCCCC

THMC3260
THMC3270
THMC3280
THMC3290
THMC3300
THMC3310
THMC3320
THMC3330
THMC3340
THMC3350
THMC3360
THMC3370
THMC3380
THMC3390
THMC3400
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THMC3640
THMC3650
THMC3660
THMC3670
THMC3680
THMC3690
THMC3700
THMC3710
THMC3720
THMC3730

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ZTH3S(NORDER, I STA)=-5.
ZTH3I(NORDER, I STA)=-5.
ZTH3D(NORDER, I STA)=-5.
ZTHWS(NORDER, I STA)=-5.
ZTHWI(NORDER, I STA)=-5.
ZTHWD(NORDER, I STA)=-5.
ZTHVS(NCRDER, I STA)=-5.
ZTHVI(NCRDER, I STA)=-5.
ZTHVD(NORDER, I STA)=-5.
ZMIXLR(NCRDER, I STA)=-5.
ZAI XLR(J1)=-5.
GO TO 100
60 IF(JCOUNT.GT.2) GO TO 65
   JCOUNT=JCOUNT-1
   ZAH1S(J1)=ZAXXT(JCOUNT)
   ZAH1I(J1)=-5.
   ZAH1D(J1)=-5.
   ZAH2S(J1)=ZAXXC(JCOUNT)
   ZAH2I(J1)=-5.
   ZAH2D(J1)=-5.
   ZAH3S(J1)=ZAXB(JCOUNT)
   ZAH3I(J1)=-5.
   ZAH3D(J1)=-5.
   ZAI XLR(J1)=ZAXXT(JCOUNT)
   ZTH1S(NORDER, I STA)=ZAXXT(JCOUNT)
   ZTH1I(NORDER, I STA)=-5.
   ZTH1D(NORDER, I STA)=-5.
   ZTH2S(NCRDER, I STA)=ZAXXC(JCOUNT)
   ZTH2I(NCRDER, I STA)=-5.
   ZTH2D(NCRDER, I STA)=-5.
   ZTH3S(NCRDER, I STA)=ZAXB(JCOUNT)
   ZTH3I(NORDER, I STA)=-5.
   ZTH3D(NORDER, I STA)=-5.
   ZTHWS(NORDER, I STA)=ZAXXR(JCOUNT)
   ZTHWI(NORDER, I STA)=-5.
   ZTHVD(NORDER, I STA)=-5.
   ZTHVI(NORDER, I STA)=-5.
   ZTHVD(NORDER, I STA)=-5.
   ZMIXLR(NCRDER, I STA)=ZAXXT(JCOUNT)
GO TO 100
65 IF(JCOUNT.GT.3) GO TO 70
   JCOUNT=JCOUNT-2
   ZAH1S(J1)=ZAXXT(JCOUNT)
   ZAH1I(J1)=ZAXXT(JCOUNT+1)
   ZAH1D(J1)=-5.
   ZAH2S(J1)=ZAXXC(JCOUNT)
   ZAH2I(J1)=ZAXXC(JCOUNT+1)

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THMC3740
 THMC3750
 THMC3760
 THMC3770
 THMC3780
 THMC3790
 THMC3800
 THMC3810
 THMC3820
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 THMC3850
 THMC3860
 THMC3870
 THMC3880
 THMC3890
 THMC3900
 THMC3910
 THMC3920
 THMC3930
 THMC3940
 THMC3950
 THMC3960
 THMC3970
 THMC3980
 THMC3990
 THMC4000
 THMC4010
 THMC4020
 THMC4030
 THMC4040
 THMC4050
 THMC4060
 THMC4070
 THMC4080
 THMC4090
 THMC4100
 THMC4110
 THMC4120
 THMC4130
 THMC4140
 THMC4150
 THMC4160
 THMC4170
 THMC4180
 THMC4190
 THMC4200
 THMC4210

ZAH2D(J1)=-5.
 ZAH3S(J1)=ZAXB(JCOUNT)
 ZAH3I(J1)=ZAXB(JCOUNT+1)
 ZAH3C(J1)=-5.
 ZAI XLR(J1)=ZAXT(JCOUNT)
 ZTH1S(NCRDER, I STA)=ZAXT(JCOUNT)
 ZTH1I(NCRDER, I STA)=ZAXT(JCOUNT+1)
 ZTH1D(NCRDER, I STA)=-5.
 ZTH2S(NCRDER, I STA)=ZAXC(JCOUNT)
 ZTH2I(NCRDER, I STA)=ZAXC(JCOUNT+1)
 ZTH2D(NCRDER, I STA)=-5.
 ZTH3S(NCRDER, I STA)=ZAXB(JCOUNT)
 ZTH3I(NCRDER, I STA)=ZAXB(JCOUNT+1)
 ZTH3D(NCRDER, I STA)=-5.
 ZTHWS(NCRDER, I STA)=ZAXR(JCOUNT)
 ZTHWI(NCRDER, I STA)=ZAXR(JCOUNT+1)
 ZTHWD(NCRDER, I STA)=-5.
 TTHVS(NCRDER, I STA)=TAUXR(JCOUNT)
 TTHVI(NCRDER, I STA)=TAUXR(JCOUNT+1)
 TTHVD(NCRDER, I STA)=-5.
 ZMI XLR(NCRDER, I STA)=ZAXT(JCCUNT)
 GO TO 100
 JCOUNT=1
 ZAH1S(J1)=ZAXT(JCOUNT)
 ZAH1I(J1)=ZAXT(JCOUNT+1)
 ZAH1D(J1)=ZAXC(JCOUNT+2)
 ZAH2S(J1)=ZAXC(JCOUNT)
 ZAH2I(J1)=ZAXC(JCOUNT+1)
 ZAH2D(J1)=ZAXC(JCOUNT+2)
 ZAH3S(J1)=ZAXB(JCOUNT)
 ZAH3I(J1)=ZAXB(JCOUNT+1)
 ZAH3D(J1)=ZAXB(JCOUNT+2)
 ZAI XLR(J1)=ZAXT(JCOUNT)
 ZTH1S(NCRDER, I STA)=ZAXT(JCOUNT)
 ZTH1I(NCRDER, I STA)=ZAXT(JCOUNT+1)
 ZTH1D(NCRDER, I STA)=ZAXC(JCOUNT+2)
 ZTH2S(NCRDER, I STA)=ZAXC(JCOUNT+1)
 ZTH2I(NCRDER, I STA)=ZAXC(JCOUNT+2)
 ZTH2D(NCRDER, I STA)=ZAXB(JCOUNT+1)
 ZTH3S(NCRDER, I STA)=ZAXB(JCOUNT+2)
 ZTH3I(NCRDER, I STA)=ZAXB(JCOUNT+1)
 ZTH3D(NCRDER, I STA)=ZAXB(JCOUNT+2)
 ZTHWS(NCRDER, I STA)=ZAXR(JCOUNT)
 ZTHWI(NCRDER, I STA)=ZAXR(JCOUNT+1)
 ZTHWD(NCRDER, I STA)=ZAXR(JCOUNT+2)
 TTHVS(NCRDER, I STA)=TAUXR(JCOUNT+1)
 TTHVI(NCRDER, I STA)=TAUXR(JCOUNT+2)
 TTHVD(NCRDER, I STA)=TAUXR(JCOUNT+2)


```

100 *ZAH2D(J1),ZAH3S(J1),ZAH1I(J1),ZAH1D(J1),ZAH2S(J1),ZAH2I(J1),
9999 FORMAT(1,5X,10F6.2)
      WRITE(6,9998) ZTHS(NCRDER,ISTA),ZTH1I(NCRDER,ISTA),
      *ZTH1D(NCRDER,ISTA),ZTH2S(NCRDER,ISTA),ZTH2I(NCRDER,ISTA),
      *ZTH2D(NCRDER,ISTA),ZTH3S(NCRDER,ISTA),ZTH3I(NCRDER,ISTA),
      *ZTH3D(NCRDER,ISTA),ZTHWS(NCRDER,ISTA),ZTHWI(NCRDER,ISTA),
      *ZTHWD(NCRDER,ISTA),ZTHVS(NCRDER,ISTA),ZTHVI(NCRDER,ISTA),
      *ZTHVD(NCRDER,ISTA),ZMXLR(NCRDER,ISTA)
9998 FCRMAT(1,5X,10F6.2,/6X,6F6.2)
      WRITE(6,9997)
9997 FORMAT(///,40X,'*      END OF THE THERMOCLINE ANALYSIS      *')
      RETURN
      END
.....
SUBROUTINE TINC1
.....
PURPOSE
  TO INCREMENT (MESH INTERVAL) A GIVEN ABCISSA (TEMPERATURE)
  LOCATED BETWEEN TWO KNOWN POSITIONS OF THE DIGITAL TRACE. THE
  RESULTANT ABCISSA REMAINS IN BETWEEN THE TWO GIVEN POSITIONS
.....
USAGE
  CALL TINC1(A01,A02,AW,DAW,M81,AW3)
.....
DESCRIPTION OF PARAMETERS
  A01 - INPUT VALUE CONTAINING THE ABCISSA (TEMPERATURE) OF
        THE FIRST OF TWO GIVEN POSITIONS
  A02 - INPUT VALUE CONTAINING THE ABCISSA OF THE LAST OF
        TWO GIVEN POSITIONS
  DAW - INPUT VALUE CONTAINING THE INCREMENT OF THE MESH
  M81 - INPUT VALUE CONTAINING THE ACTUAL NUMBER OF POINTS
        GENERATED FOR THE MESH
  AW3 - OUTPUT VALUE CONTAINING THE ACTUAL ABCISSA (TEMP.)
        RESULTANT FROM THE INCREMENT OF A GIVEN ABCISSA
.....
SUBROUTINES REQUIRED
  NCNE
.....
METHOD
  ACCORDING TO THE ORIENTATION OF THE TREND (DEFINED BY TWO
  KNOWN DIGITAL POSITIONS) THE VALUE OF A GIVEN ABCISSA,
  LOCATED IN BETWEEN THE ABOVE POSITIONS, IS INCREASED OR
  DECREASED BY THE MESH INTERVAL
.....

```

```

THMC4220
THMC4230
THMC4240
THMC4250
THMC4260
THMC4270
THMC4280
THMC4290
THMC4300
THMC4310
THMC4320
THMC4330
THMC4340
THMC4350
THMC4360
TNC10010
TNC10020
TNC10030
TNC10040
TNC10050
TNC10060
TNC10070
TNC10080
TNC10090
TNC10100
TNC10110
TNC10120
TNC10130
TNC10140
TNC10150
TNC10160
TNC10170
TNC10180
TNC10190
TNC10200
TNC10210
TNC10220
TNC10230
TNC10240
TNC10250
TNC10260
TNC10270
TNC10280
TNC10290
TNC10300
TNC10310
TNC10320
TNC10330

```

CC


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TNC20260
TNC20270
TNC20280
TNC20290
TNC20300
TNC20310
TNC20320
TNC20330
TNC20340
TNC20350
TNC20360
TNC20370
TNC20380
TNC20390

```

RESULTANT FROM THE INCREMENT OF A GIVEN ABCISSA

SUBROUTINES REQUIRED
NONE

METHOD

ACCORDING TO THE ORIENTATION OF THE TREND (DEFINED BY THREE
KNOWN DIGITAL POSITIONS) THE VALUE OF A GIVEN ABCISSA,
LOCATED IN BETWEEN THE FIRST TWO POSITIONS, IS INCREASED OR
DECREASED BY THE MESH INTERVAL AND THE FINAL ABCISSA IS
LOCATED IN BETWEEN THE TWO LAST DIGITAL POSITIONS

.....

SUBROUTINE TINC2(A02,A03,DA2,DAW,AW2)
DA5=A03-A02

COMPARE DA5 WITH ZERO. ZERO IS DEFINED BY THE OPEN INTERVAL
BETWEEN -0.005 AND 0.005

IF(DA5.GE.0.005.OR.DA5.LE.(-0.005)) GO TO 9070

GC TO 9080

IF(DA5.GT.0.0) GO TO 9074

AW2=A02-(DAW-DA2)

GC TO 9080

AW2=A02+(DAW-DA2)

RETURN

END

.....

SUBROUTINE VECTOR

PURPOSE

TO COMPUTE THE SINE AND THE COSINE OF A GIVEN ANGLE

USAGE

CALL VECTOR(M77,A,B)

DESCRIPTION OF PARAMETERS

M77 -INPUT CONTAINING THE VALUE OF THE ANGLE (DEGREES)

A -OUTPUT CONTAINING THE VALUE OF THE SIN(M77)

B -OUTPUT CONTAINING THE VALUE OF THE COS(M77)

FUNCTIONS REQUIRED

SIN (IBM SCIENTIFIC LIBRARY)

```

TNC20400
TNC20410
TNC20420
TNC20430
TNC20440
TNC20450
TNC20460
TNC20470
TNC20480
TNC20490
TNC20500
TNC20510
TNC20520
TNC20530
VCTR0010
VCTR0020
VCTR0030
VCTR0040
VCTR0050
VCTR0060
VCTR0070
VCTR0080
VCTR0090
VCTR0100
VCTR0110
VCTR0120
VCTR0130
VCTR0140
VCTR0150
VCTR0160
VCTR0170
VCTR0180

```



```

C
C
C
COS (IBM SCIENTIFIC LIBRARY)
.....
VCTR0190
VCTR0200
VCTR0210
VCTR0220

```

```

SUBROUTINE VECTOR(M77,A,B)
PI=3.14159265
PI1=PI/2.
PI3=3.*PI1
1 IF(M77.GE.360) M77=M77-360
ASSIGNING A QUADRANT
IF(M77.GE.0.AND.M77.LT.90) GO TO 4
IF(M77.GE.90.AND.M77.LT.180) GO TO 5
IF(M77.GE.180.AND.M77.LT.270) GO TO 6
IF(M77.GE.270.AND.M77.LT.360) GO TO 7
IF(M77.GE.360) GO TO 1
GO TO 9

```

```

CCOMPUTING THE SINE AND COSINE

```

```

4 A77=M77*PI/180.
A=SIN(A77)
B=CCS(A77)
CC TO 10
5 A77=M77*PI/180.
A=COS(A77-PI1)
B=-SIN(A77-PI1)
CC TO 10
6 A77=M77*PI/180.
A=-SIN(A77-PI)
B=-COS(A77-PI)
CC TO 10
7 A77=M77*PI/180.
A=-COS(A77-PI3)
B=SIN(A77-PI3)
GO TO 10
9 A=0.
B=0.
10 RETURN
END

```

```

.....
SUBROUTINE WIND00
PURPOSE

```

```

VCTR0230
VCTR0240
VCTR0250
VCTR0260
VCTR0270
VCTR0280
VCTR0290
VCTR0300
VCTR0310
VCTR0320
VCTR0330
VCTR0340
VCTR0350
VCTR0360
VCTR0370
VCTR0380
VCTR0390
VCTR0400
VCTR0410
VCTR0420
VCTR0430
VCTR0440
VCTR0450
VCTR0460
VCTR0470
VCTR0480
VCTR0490
VCTR0500
VCTR0510
VCTR0520
VCTR0530
VCTR0540
VCTR0550
VCTR0560
VCTR0570
VCTR0580
VCTR0590
W00 0010
W00 0020
W00 0030
W00 0040
W00 0050

```


TC PROCESS THE WIND VELOCITY MEASURED AT THE SAME DAY OF THE
 DIGITAL TRACE AND AT THE SAME GEOGRAPHICAL POSITION. TO PLOT
 THE WIND VECTOR AND ITS COMPONENTS (ALONG AND PERPENDICULAR
 TO THE DIRECTION OF THE NEAR CCAST)
 USAGE
 CALL WIND00(NORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
 KAMMA1, N41)
 DESCRIPTION OF PARAMETERS
 NORDER--ACTUAL NUMBER OF PROCESSED CRUISES
 ISTA --INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
 SECTION
 XGRID --INPUT VALUE CONTAINING THE LOCATION OF THE STATION
 (ALONG THE CROSS SECTION OR TIME AXIS) WHERE THE WIND
 DATA IS REPORTED TO
 YGRID --INPUT CONTAINING THE VALUE OF THE ORDINATE TO LOCATE
 THE WIND VECTORS IN THE PLOT
 KKK --INPUT VALUE CONTROLLING THE PLOT OF THE WIND VECTOR
 (IF KKK=0, NO PLOT)
 N40 --INPUT ACTUAL NUMBER OF WIND PLOTS
 LABEL --INPUT SHORT IDENTIFICATION OF A PLOTTED CURVE
 ITITL4--INPUT VECTOR OF LENGTH 12, CONTAINING THE TITLE FOR
 PLOT OF WIND DATA ALONG A CROSS SECTION OR TIME AXIS
 KAMMA1--INPUT VALUE CONTAINING THE DIRECTION OF THE NEAR
 CCAST LINE
 N41 --OUTPUT ACTUAL NUMBER OF WIND PLOTS

REMARKS
 (1) THIS SUBROUTINE USES A 'COMMON' LABELLED AREA TO RECEIVE
 THE REQUIRED DATA FROM THE MAIN PROGRAM AND TO GIVE BACK
 THE PROCESSED INFORMATION.
 (2) THE WIND VECTOR AND ITS COMPONENTS ARE PLOTTED IN A TWO
 DIMENSIONAL DIAGRAM: (A) THE ABSCISSA OR THE POSITION ALONG THE
 CRUISE WHERE THE WIND IS REPORTED TO AND (B) THE ORDINATE OR
 THE RELATIVE TIME (IN DAYS) THAT ELAPSES FROM THE DAY WHEN
 THE WIND WAS MEASURED UNTIL THE DAY THE DIGITAL TRACE IS
 OBTAINED.
 SUBROUTINES REQUIRED
 VECTOR
 DRAW (IBM SCIENTIFIC LIBRARY)
 METHOD
 THE COMPONENTS OF THE WIND VECTOR ARE COMPUTED USING
 TRIGONOMETRIC RELATIONSHIPS

CC


```

SUBROUTINE WINDOC(NORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
*KAMMA1, N41)
REAL*8, ITITL4(12)
DIMENSION XAUX1(2), YAUX1(2), XAUX3(2), YAUX3(2), XAUX4(2), YAUX4(2)
COMMON/WORKD/R00(20,12), KANG00(20,12), R01(20,12), KANG01(20,12),
*R02(20,12), KANG02(20,12), R03(20,12), KANG03(20,12), R05(20,12),
*KANG05(20,12), R10(20,12), KANG10(20,12), R001(20,12), R002(20,12),
*R011(20,12), R012(20,12), R021(20,12), R022(20,12), R031(20,12),
*R032(20,12), R051(20,12), R052(20,12), R101(20,12), R102(20,12)

CCOMPUTATION OF COORDINATES DEFINING THE LOCAL WIND VECTOR

IF((R00(NORDER, ISTA).LT.0.).OR.(KANG00(NORDER, ISTA).LT.0)) GO TO
*300
IF(KKK.GT.0) GO TO 3
KANG1=KANG00(NORDER, ISTA)
CALL VECTOR(KANG1, ALPH1, BET1)
DELTIX1=R00(NORDER, ISTA)*ALPH1/45.
DELTYY1=R00(NORDER, ISTA)*BET1/45.
XAUX1(1)=XGRID
XAUX1(2)=XAUX1(1)+DELTIX1
YAUX1(1)=YGRID
YAUX1(2)=YAUX1(1)+DELTYY1
IF(N40.EQ.1) NPLOT=1
IF(N40.GT.1) NPLOT=2
CALL DRAW(2, XAUX1, YAUX1, NPLOT, 0, LABEL, ITITL4, 1., 1., 0, 0, 2, 2, 8, 6, 0,
*LAST)
N40=N40+1
WRITE(6,2) LAST

FINDING THE COMPONENTS OF THE LOCAL WIND VECTOR ALONG TWO PRE-
DEFINED DIRECTIONS (I.e., ALONG THE COAST AND PERPENDICULAR TO
THIS DIRECTION)

KAMMA: ANGULAR DIFFERENCE BETWEEN THE WIND VECTOR (KANG) AND THE
DIRECTION ALONG THE COAST (KAMMA1)

IF(KAMMA1.LT.0) GO TO 300
IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
KANMA=KANG00(NORDER, ISTA)-KAMMA1
KANMA5=IABS(KAMMA)
IF(KAMMA5.LE.90) GO TO 4
IF(KAMMA.LT.(-90)) GO TO 6
KAMMA1=KAMMA1+180
GO TO 3

```

3


```

6 KAMMA1=KAMMA1-180
GC TO 3
4 CALL VECTOR(KAMMA5,ALPH2,BET2)

RXX1: ALONG THE COAST COMPONENT (INTENSITY) OF LOCAL WIND
RXX2: PERPENDICULAR TO COAST CCOMPONENT (INTENSITY) OF LOCAL WIND

RQ01(NORDER,ISTA)=RQ0(NORDER,ISTA)*BET2
RQ02(NORDER,ISTA)=RQ0(NORDER,ISTA)*ALPH2
IF(KAMMA1.LT.0) KAMMA1=KAMMA1+360
IF(ETA1=KAMMA1)
IF(ETA1+GE.360) IETA1=IETA1-360
IF(KAMMA5.EQ.0) GO TO 11
IF(KKK.GT.0) GO TO 8
CALL VECTOR(IETA1,ALPH3,BET3)
DELTIX3=RQ01(NORDER,ISTA)*ALPH3/45.
DELTIX3=RQ01(NORDER,ISTA)*BET3/45.
XAX3(1)=XGRID
XAX3(2)=XAX3(1)+DELTIX3
YAX3(1)=YGRID
YAX3(2)=YAX3(1)+DELTIX3
IF(N40.EQ.1) NPLOT=1
IF(N40.GT.1) NPLOT=2
CALL DRAW(2,XAX3,YAX3,NPLOT,0,LABEL,ITITL4,1.0,1.0,0,2,2,8,6,0,
* LAST)
N40=N40+1
WRITE(6,2) LAST
IF(KANG00(NORDER,ISTA).LT.KAMMA1) IETA2=KAMMA1-90
IF(KANG00(NORDER,ISTA).GT.KAMMA1) IETA2=KAMMA1+90
IF(IETA2.GE.360) IETA2=IETA2-360
IF(IETA2.LT.0) IETA2=IETA2+360
KAMMA7=IABS(KANG00(NORDER,ISTA)-IETA2)
IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
IF(KANG00(NORDER,ISTA).GE.360) KANG00(NORDER,ISTA)=KANG00(NORDER,
* IETA)-360
IF(KAMMA7.EQ.0) GO TO 14
IF(KKK.GT.0) GO TO 10
CALL VECTOR(IETA2,ALPH4,BET4)
DELTIX4=RQ02(NORDER,ISTA)*ALPH4/45.
DELTIX4=RQ02(NORDER,ISTA)*BET4/45.
XAX4(1)=XGRID
XAX4(2)=XAX4(1)+DELTIX4
YAX4(1)=YGRID
YAX4(2)=YAX4(1)+DELTIX4
WRITE(6,511) XAX1(1),XAX1(2),XAX3(1),XAX3(2),XAX4(1),XAX4(2)
*,YAX1(1),YAX1(2),YAX3(1),YAX3(2),YAX4(1),YAX4(2)
511 FCRMAT(8F1F.3)
IF(N40.EQ.1) NPLOT=1

```


[illegible]

W01 0010
W01 0020
W01 0030
W01 0040
W01 0050
W01 0060
W01 0070
W01 0080
W01 0090
W01 0100
W01 0110
W01 0120
W01 0130
W01 0140
W01 0150
W01 0160
W01 0170
W01 0180
W01 0190
W01 0200
W01 0210
W01 0220
W01 0230
W01 0240
W01 0250
W01 0260
W01 0270
W01 0280
W01 0290
W01 0300
W01 0310
W01 0320
W01 0330
W01 0340
W01 0350
W01 0360
W01 0370
W01 0380
W01 0390
W01 0400
W01 0410
W01 0420
W01 0430
W01 0440
W01 0450
W01 0460
W01 0470
W01 0480

SUBROUTINE WIND01

PURPOSE
TO PROCESS THE WIND VELOCITY MEASURED AT ONE DAY BEFORE THE
DAY OF THE DIGITAL TRACE AND AT THE SAME GEOGRAPHIC POSITION.
TO PLOT THE WIND VECTOR AND ITS COMPONENTS (ALONG AND
PERPENDICULAR TO THE DIRECTION OF THE NEAR COASTLINE)

LSAGE
CALL WIND01(NRORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
KAMMA1, N41)

DESCRIPTION OF PARAMETERS
NRORDER--ACTUAL NUMBER OF PROCESSED CRUISES
ISTA --INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
SECTION
XGRID --INPUT VALUE CONTAINING THE LOCATION OF THE STATION
(ALONG THE CROSS SECTION OR TIME AXIS) WHERE THE WIND
DATA IS REPORTED TO
YGRID --INPUT CONTAINING IN THE VALUE OF THE ORDNATE TO LOCATE
THE WIND VECTORS IN THE PLOT
KKK --INPUT VALUE CONTROLLING THE PLOT OF THE WIND VECTOR
(IF K=NE0 : 'NO PLOT')
N40 --INPUT ACTUAL NUMBER OF WIND PLCTS
LABEL --INPUT SHORT IDENTIFICATION OF A PLOTTED CURVE
ITITL4--INPUT VECTOR OF LENGTH 12, CONTAINING THE TITLE FOR
PLOT OF WIND DATA ALONG A CROSS SECTION OR TIME AXIS
KAMMA1--INPUT VALUE CONTAINING THE DIRECTION OF THE NEAR
COASTLINE
N41 --OUTPUT ACTUAL NUMBER OF WIND PLCTS

REMARKS
(1) THIS SUBROUTINE USES A 'COMMON' LABELLED AREA TO RECEIVE
THE REQUIRED DATA FROM THE MAIN PROGRAM AND TO GIVE BACK
PROCESSED INFORMATION.
(2) THE WIND VECTOR AND ITS COMPONENTS ARE PLOTTED IN A TWO
DIMENSIONAL DIAGRAM: (A) THE ABSCISSA OR THE POSITION ALONG THE
CRUISE WHERE THE WIND IS REPORTED TO AND (B) THE ORDINATE OR
THE RELATIVE TIME (IN DAYS) THAT ELAPSES FROM THE DAY WHEN
THE WIND WAS MEASURED UNTIL THE DAY THE DIGITAL TRACE IS
OBTAINED.

SUBROUTINES REQUIRED
VECTOR
DRAW (IBM SCIENTIFIC LIBRARY)

CC

W01 0490
W01 0500
W01 0510
W01 0520
W01 0530
W01 0540

METHOD
THE COMPONENTS OF THE WIND VECTOR ARE COMPUTED USING
TRIGONOMETRIC RELATIONSHIPS

CCCCC

W01 0550
W01 0560
W01 0570
W01 0580
W01 0590
W01 0600
W01 0610
W01 0620
W01 0630
W01 0640
W01 0650
W01 0660
W01 0670
W01 0680
W01 0690
W01 0700
W01 0710
W01 0720
W01 0730
W01 0740
W01 0750
W01 0760
W01 0770
W01 0780
W01 0790
W01 0800
W01 0810
W01 0820
W01 0830
W01 0840
W01 0850
W01 0860
W01 0870
W01 0880
W01 0890
W01 0900
W01 0910
W01 0920
W01 0930
W01 0940

```

SUBROUTINE WIND01(NORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
* KAMMA1, N41)
  REAL*8 ITITL4(12)
  DIMENSION XAUX1(2), YAUX1(2), XAUX3(2), YAUX3(2), XAUX4(2), YAUX4(2)
  COMMON/WORKD/R00(20,12), R01(20,12), KANG00(20,12), KANG01(20,12),
  * R02(20,12), KANG02(20,12), R03(20,12), KANG03(20,12), R05(20,12),
  * KANG05(20,12), R10(20,12), KANG10(20,12), R001(20,12), R002(20,12),
  * R011(20,12), R012(20,12), R021(20,12), R022(20,12), R031(20,12),
  * R032(20,12), R051(20,12), R052(20,12), R101(20,12), R102(20,12)

  COMPUTATION OF COORDINATES DEFINING THE LOCAL WIND VECTOR

  IF((R01(NORDER, ISTA).LT.0.).OR.(KANG01(NORDER, ISTA).LT.0)) GO TO
  * 300
  IF(KKK.GT.0) GO TO 3
  KANG1=KANG01(NORDER, ISTA)
  CALL VECTOR(KANG1, ALPHA1, BET1)
  DELTX1=R01(NORDER, ISTA)*ALPHA1/45.
  DELTY1=R01(NORDER, ISTA)*BET1/45.
  XAUX1(1)=XGRID
  XAUX1(2)=XAUX1(1)+DELT X1
  YAUX1(1)=YGRID+0.4
  YAUX1(2)=YAUX1(1)+DELT Y1
  IF(N40.EQ.1) NPL0T=1
  IF(N40.GT.1) NPL0T=2
  CALL DRAW(2, XAUX1, YAUX1, NPL0T, 0, LABEL, ITITL4, 1., 1., 0., 0., 2., 2., 8., 6., 0.,
  * LAST)
  N40=N40+1
  WRITE(6,2) LAST

  FINDING THE COMPONENTS OF THE LOCAL WIND VECTOR ALONG TWO PRE-
  -DEFINED DIRECTIONS (I.E., ALONG THE COAST AND PERPENDICULAR TO
  THIS DIRECTION)

  KAMMA: ANGULAR DIFFERENCE BETWEEN THE WIND VECTOR (KANG) AND THE
  DIRECTION ALONG THE COAST (KAMMA1)

  IF(KAMMA1.LT.0) GO TO 300
  IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
  3 KAMMA=KANG01(NORDER, ISTA)-KAMMA1

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KAMMA5=IABS(KAMMA)
IF(KAMMA5.LE.9C) GO TO 4
IF(KAMMA.LT.(-90)) GO TO 6
KAMMA1=KAMMA1+180
GO TO 3
6 KAMMA1=KAMMA1-180
GO TO 3
4 CALL VECTOR(KAMMA5,ALPH2,BET2)

RXX1: ALCNG THE COAST COMPONENT (INTENSITY) OF LOCAL WIND
RXX2: PERPENDICULAR TO COAST COMPONENT (INTENSITY) OF LOCAL WIND

RC11(NCRDER, ISTA)=RC1(NCRDER, ISTA)*BET2
RC12(NCRDER, ISTA)=RC1(NCRDER, ISTA)*ALPH2
IF(KAMMA1.LT.0) KAMMA1=KAMMA1+360
IF(IHETA1=KAMMA1) IHETA1=IHETA1-360
IF(KAMMA5.EQ.0) GO TO 11
IF(KKK.GT.0) GO TO 8
CALL VECTOR(IHETA1,ALPH3,BET3)
DELT X3=RC11(NCRDER, ISTA)*ALPH3/45.
DELT Y3=RC11(NCRDER, ISTA)*BET3/45.
XAXX3(1)=XGRID
YAXX3(2)=YGRID+0.4*DELT X3
YAXX3(1)=YAXX3(1)+DELT Y3
IF(N40.EQ.1) NPLOT=1
IF(N40.GT.1) NPLOT=2
CALL DRAW(2,XAXX3,YAXX3,NPLOT,0,LABEL,ITITL4,1,1,0,0,2,2,8,6,C,
*LAST)
N40=N40+1
WRITE(6,2) LAST
8 IF(KANGQ1(NCRDER, ISTA).LT.KAMMA1) IHETA2=KAMMA1-90
IF(KANGQ1(NCRDER, ISTA).GT.KAMMA1) IHETA2=KAMMA1+90
IF(IHETA2.GE.360) IHETA2=IHETA2-360
IF(IHETA2.LT.0) IHETA2=IHETA2+360
KAMMA7=IABS(KANGQ1(NCRDER, ISTA)-IHETA2)
IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
IF(KANGQ1(NCRDER, ISTA).GE.360) KANGQ1(NCRDER, ISTA)=KANGQ1(NCRDER,
* ISTA)-360
IF(KAMMA7.EQ.0) GO TO 14
IF(KKK.GT.0) GO TO 10
CALL VECTOR(IHETA2,ALPH4,BET4)
DELT X4=RC12(NCRDER, ISTA)*ALPH4/45.
DELT Y4=RC12(NCRDER, ISTA)*BET4/45.
XAXX4(1)=XGRID
YAXX4(2)=YAXX4(1)+DELT X4
YAXX4(1)=YGRID+0.4

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1900
YAUX4(2)=YAUX4(1)+DELTY4
WRITE(6,511) XAX1(1),XAX1(2),XAX3(1),XAX3(2),XAX4(1),XAX4(2)
* ,YAUX1(1),YAUX1(2),YAUX3(1),YAUX3(2),YAUX4(1),YAUX4(2)
511 *FCRMA1(8F10.3)
IF(N40.EQ.1) NPL0T=1
IF(N40.GT.1) NPL0T=2
CALL DRAW(2,XAX4,NPL0T,0,LABEL,ITITL4,1,1,0,0,2,2,8,6,0,
*LAST)
N40=N40+1
WRITE(6,2) LAST
2 FCRMA1(10,30X,1LAST =,11)
GC TO 10
300 R011(NORDER,ISTA)=-5.
R012(NORDER,ISTA)=-5.
IFETA1=-5.
IFETA2=-5.
10 N41=N40
WRITE(6,12) NORDER,ISTA,KAMMA1,R01(NCRDER,ISTA),
* KANG01(NORDER,ISTA),R011(NORDER,ISTA),IHETA1,R012(NCRDER,ISTA),
* IHETA2
12 FCRMA1(10,45X,1** SURFACE WIND AT 1 DAY BEFORE DAY XBT OBS
* ,2CX,1CRUISE NO.=,13,2CX,1STATION NO.=,13,2CX,
* ,COAST DIRECTION =,13,2CX,1SURFACE WIND =,2CX,1INTENSITY =,
* F5.1,35X,DIRECTION =,13,2CX,1SURFACE WIND COMPONENTS =,/,
* 35X,1,ALONG THE COAST =,10X,1INTENSITY =,F5.1,10X,1DIRECTION =,
* 13,/,35X,1PERPENDICULAR TO COAST =,10X,1INTENSITY =,F5.1,10X,
* ,DIRECTION =,13)
GC TO 16
11 N41=N40
WRITE(6,13) NORDER,ISTA,KAMMA1,R01(NCRDER,ISTA),
* KANG01(NORDER,ISTA),R011(NORDER,ISTA),KANG01(NORDER,ISTA),
* R012(NORDER,ISTA),KANG01(NORDER,ISTA)
13 FCRMA1(10,45X,1** SURFACE WIND AT 1 DAY BEFORE DAY XBT
* ,2CX,1CRUISE NO.=,13,2CX,1STATION NO.=,13,2CX,
* ,COAST DIRECTION =,13,2CX,1SURFACE WIND =,2CX,1INTENSITY =,
* F5.1,35X,DIRECTION =,13,2CX,1SURFACE WIND COMPONENTS =,/,
* 35X,1,ALONG THE COAST =,10X,1INTENSITY =,F5.1,10X,1DIRECTION =,
* 13,/,35X,1PERPENDICULAR TO COAST =,10X,1INTENSITY =,F5.1,10X,
* ,DIRECTION =,13,1(+ OR -90):)
GC TO 16
14 N41=N40
WRITE(6,15) NORDER,ISTA,KAMMA1,R01(NCRDER,ISTA),
* KANG01(NORDER,ISTA),R011(NCRDER,ISTA),KANG01(NORDER,ISTA),
* R012(NORDER,ISTA),KANG01(NORDER,ISTA)
15 FCRMA1(10,45X,1** SURFACE WIND AT 1 DAY BEFORE DAY XBT
* ,2CX,1CRUISE NO.=,13,2CX,1SURFACE WIND =,2CX,1INTENSITY =,
* F5.1,25X,DIRECTION =,13,
* ,COAST DIRECTION =,13,
* F5.1,25X,DIRECTION =,13,

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*MENTS :',/ ,35X,'ALCNG THE COAST :',,10X,'INTENSITY =',F5.1,10X,'
*'DIRECTION =',I3,'(+ OR -90)',/,25X,'PERPENDICULAR TO COAST :',
*10X,'INTENSITY =',F5.1,10X,'DIRECTION =',I3)
16 RETURN
END

SUBROUTINE WIND02
.....
PURPOSE
TO PROCESS THE WIND VELOCITY MEASURED AT TWO DAYS BEFORE THE
DAY OF THE DIGITAL TRACE AND AT THE SAME GEOGRAPHICAL
POSITION. TO PLOT THE WIND VECTOR AND ITS COMPONENTS (ALONG
AND PERPENDICULAR TO THE DIRECTION OF THE NEAR COASTLINE)

USAGE
CALL WIND02(NORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
KAMMA1, N41)

DESCRIPTION OF PARAMETERS
NORDER--ACTUAL NUMBER OF PROCESSED CRUISES
ISTA - INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
SECTION
XGRID - INPUT VALUE CONTAINING THE LOCATION OF THE STATION
(Along the cross section or time axis) where the wind
data is reported to the value of the ordinate to locate
YGRID - INPUT CONTAINING IN THE PLOT
KKK - INPUT VALUE CONTROLLING THE PLOT OF THE WIND VECTOR
(IF KKK.NE.0 : 'NO PLOT')
N40 - INPUT ACTUAL NUMBER OF WIND PLOTS
LABEL - INPUT IDENTIFICATION OF A PLOTTED CURVE
ITITL4--INPUT SHORT IDENTIFICATION '12' CONTAINING THE TITLE FOR
PLOT OF WIND DATA ALONG A CROSS SECTION OR TIME AXIS
KAMMA1- INPUT VALUE CONTAINING THE DIRECTION OF THE NEAR
COASTLINE
N41 -OUTPUT ACTUAL NUMBER OF WIND PLOTS

REMARKS
(1) THIS SUBROUTINE USES A 'COMMON' LABELLED AREA TO RECEIVE
THE REQUIRED DATA FROM THE MAIN PROGRAM AND TO GIVE BACK
THE PROCESSED INFORMATION.
(2) THE WIND VECTOR AND ITS COMPONENTS ARE PLOTTED IN A TWO
DIMENSIONAL DIAGRAM: (A) THE ABSCISSA OR THE POSITION ALONG THE
CRUISE WHERE THE WIND IS REPORTED TO AND (B) THE ORDINATE OR
THE RELATIVE TIME (IN DAYS) THAT ELAPSES FROM THE DAY WHEN
THE WIND WAS MEASURED UNTIL THE DAY THE DIGITAL TRACE IS
OBTAINED.

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W02

METHOD
THE CCMPONENTS OF THE WIND VECTOR ARE COMPUTED USING
TRIGONOMETRIC RELATIONSHIPS

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SUBROUTINE WIND02(NORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
*KAMMA1, N41)
  REAL*8 ITITL4(12)
  DIMENSION XAX1(2), YAX1(2), XAX3(2), YAX3(2), XAX4(2), YAX4(2)
  COMMON/WORKD/R00(20,12), KANG00(20,12), R01(20,12), KANG01(20,12),
  *R02(20,12), KANG02(20,12), R03(20,12), KANG03(20,12), R05(20,12),
  *KANG05(20,12), R09(20,12), KANG09(20,12), R001(20,12), R002(20,12),
  *R011(20,12), R012(20,12), R021(20,12), R022(20,12), R031(20,12),
  *R032(20,12), R051(20,12), R052(20,12), R101(20,12), R102(20,12)
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  COMPUTATION OF COORDINATES DEFINING THE LOCAL WIND VECTOR
  IF((R02(NORDER, ISTA).LT.0.).OR.(KANG02(NORDER, ISTA).LT.0)) GO TO
  *300
  IF(KKK.GT.0) GO TO 3
  KANG1=KANG02(NORDER, ISTA)
  CALL VECTOR(KANG1, ALPH1, BET1)
  DELTX1=R02(NORDER, ISTA)*ALPH1/45.
  DELTY1=R02(NORDER, ISTA)*BET1/45.
  XAX1(1)=XGRID
  XAX1(2)=XAX1(1)+DELTXT1
  YAX1(1)=YGRID+0.8
  YAX1(2)=YAX1(1)+DELTXT1
  IF(N40.EQ.1) NPLCT=1
  IF(N40.GT.1) NPLCT=2
  CALL DRAW(2, XAX1, NPLCT, 0, LABEL, ITITL4, 1., 1., 0, 0, 2, 2, 8, 6, 0,
  *LAST)
  N40=N40+1
  WRITE(6,2) LAST
```

FINDING THE COMPONENTS OF THE LOCAL WIND VECTOR ALONG TWO PRE-
DEFINED DIRECTIONS (I.E., ALONG THE COAST AND PERPENDICULAR TO
THIS DIRECTION)

KAMMA: ANGULAR DIFFERENCE BETWEEN THE WIND VECTOR (KANG) AND THE

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W02


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C C
C DIRECTION ALONG THE COAST (KAMMA1)
  IF(KAMMA1.LT.0) GO TO 300
  IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
  KAMMA=KANGQ2(NORDER, ISTA)-KAMMA1
  KAMMA5=IABS(KAMMA)
  IF(KAMMA5.LE.90) GO TO 4
  IF(KAMMA.LT.(-90)) GO TO 6
  KAMMA1=KAMMA1+180
  GO TO 3
6 KAMMA1=KAMMA1-180
  GO TO 3
4 CALL VECTOR(KAMMA5,ALPH2,BET2)

C C C
C RXX1: ALONG THE COAST COMPONENT (INTENSITY) OF LOCAL WIND
C RXX2: PERPENDICULAR TO COAST COMPONENT (INTENSITY) OF LOCAL WIND
  RQ21(NORDER, ISTA)=RQ2(NORDER, ISTA)*BET2
  RQ22(NORDER, ISTA)=RQ2(NORDER, ISTA)*ALPH2
  IF(KAMMA1.LT.0) KAMMA1=KAMMA1+360
  IHETA1=KAMMA1
  IF(IHETA1.GE.360) IHETA1=IHETA1-360
  IF(KAMMA5.EQ.0) GO TO 11
  IF(KKK.GT.0) GO TO 8
  CALL VECTOR(IHETA1,ALPH3,BET3)
  DELTX3=RQ21(NORDER, ISTA)*ALPH3/45.
  DELTY3=RQ21(NORDER, ISTA)*BET3/45.
  XAUX3(1)=XGRID
  XAUX3(2)=XAUX3(1)+DELT X3
  YAUX3(1)=YGRID+0.8
  YAUX3(2)=YAUX3(1)+DELT Y3
  IF(N4C.EQ.1) NPLOT=1
  IF(N4C.GT.1) NPLOT=2
  CALL DRAW(2,XAUX3,YAUX3,NPLOT,0,LABEL,ITITL4,1,1,0,0,2,2,8,6,0,
  *LAST)
  N4=N4C+1
  WRITE(6,2) LAST
8 IF(KANGQ2(NORDER, ISTA).LT.KAMMA1) IHETA2=KAMMA1-90
  IF(KANGQ2(NORDER, ISTA).GT.KAMMA1) IHETA2=KAMMA1+90
  IF(KANGQ2.GE.360) IHETA2=IHETA2-360
  IF(IHETA2.LT.0) IHETA2=IHETA2+360
  KAMMA7=IABS(KANGQ2(NORDER, ISTA)-IHETA2)
  IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
  IF(KANGQ2(NORDER, ISTA).GE.360) KANGQ2(NORDER, ISTA)=KANGQ2(NORDER,
  *ISTA)-360
  IF(ISTA).EQ.0) GO TO 14
  IF(KAMMA7.EQ.0) GO TO 10
  IF(KKK.GT.0) GO TO 10
  CALL VECTOR(IHETA2,ALPH4,BET4)

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0560	W03
0570	W03
0580	W03
0590	W03
0600	W03
0610	W03
0620	W03
0630	W03
0640	W03
0650	W03
0660	W03
0670	W03
0680	W03
0690	W03
0700	W03
0710	W03
0720	W03
0730	W03
0740	W03
0750	W03
0760	W03
0770	W03
0780	W03
0790	W03
0800	W03
0810	W03
0820	W03
0830	W03
0840	W03


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* 'DIRECTION =', I3, ' (+ OR -90) '
GC TO 16
14 N41=N40
WRITE(6,15) NORDER, ISTA, KAMMAL, RQ3(NORDER, ISTA),
* KANGQ3(NORDER, ISTA), RQ31(NORDER, ISTA), KANGQ3(NORDER, ISTA),
* RQ32(NORDER, ISTA), KANGQ3(SURFACE, ISTA)
15 FORMAT('0', //, 45X, '*** SURFACE WIND AT 3 DAY BEFORE DAY XBT OBS',
* '*** DIRECTION =', I3, //, 20X, 'STATION NO. =', I3, 20X, 'INTENSITY =', I3, 20X,
* 'COAST DIRECTION =', I3, //, 20X, 'SURFACE WIND //, 20X, 'SURFACE WIND COMPO',
* 'F5.1, 25X, 'DIRECTION =', I3, ' (+ OR -90) ', //, 25X, 'PERPENDICULAR TO COAST :',
* 'DIRECTION =', I3, ' (+ OR -90) ', //, 25X, 'PERPENDICULAR TO COAST :',
* '10X, 'INTENSITY =', I3, 10X, 'DIRECTION =', I3)
16 RETURN
END
SUBROUTINE WINDC5
PURPOSE
TO PROCESS THE WIND VELOCITY MEASURED AT FIVE DAYS BEFORE THE
DAY OF THE DIGITAL TRACE AND AT THE SAME GEOGRAPHICAL
POSITION. TO PLOT THE WIND VECTOR AND ITS COMPONENTS (ALONG
AND PERPENDICULAR TO THE DIRECTION OF THE NEAR COASTLINE)
USAGE
CALL WINDC5(NORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
KAMMAL, N41)
DESCRIPTION OF PARAMETERS
NORDER- ACTUAL NUMBER OF PROCESSED CRUISES
ISTA - INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
XGRID - SECTION VALUE CONTAINING THE LOCATION OF THE STATION
( ALONG THE CROSS SECTION OR TIME AXIS) WHERE THE WIND
DATA IS REPORTED TO
YGRID - INPUT VALUE CONTAINING THE VALUE OF THE ORDINATE TO LOCATE
THE WIND VECTORS IN THE PLOT
KKK - INPUT VALUE CONTROLLING THE PLOT OF THE WIND VECTOR
( IF K=0, NO PLOT )
N40 - INPUT ACTUAL NUMBER OF WIND PLOTS
LABEL - INPUT IDENTIFICATION OF A PLOTTED CURVE
ITITL4- INPUT SHORT OF LENGTH, 12, CONTAINING THE TITLE FOR
KAMMAL- PLOT OF WIND DATA ALONG A CROSS SECTION OR TIME AXIS
N41 - INPUT VALUE CONTAINING THE DIRECTION OF THE NEAR
COASTLINE
- OUTPUT ACTUAL NUMBER OF WIND PLOTS

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CALL DRAW(2,XAUX1,YAUX1,NPLOT,0,LABEL,ITITL4,1.,1.,0,0,2,2,8,6,0,
*LAST)
N40=N40+1
WRITE(6,2) LAST
C
FINDING THE COMPONENTS OF THE LOCAL WIND VECTOR ALONG TWO PRE-
DEFINED DIRECTIONS (I.E., ALONG THE COAST AND PERPENDICULAR TO
THIS DIRECTION)
C
KAMMA: ANGULAR DIFFERENCE BETWEEN THE WIND VECTOR (KANG) AND THE
DIRECTION ALONG THE COAST (KAMMA1)
C
IF(KAMMA1.LT.0) GO TO 300
IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
3 KAMMA=KANG*5(NORDER,ISTA)-KAMMA1
KAMMA5=IABS(KAMMA)
IF(KAMMA5.LE.90) GO TO 4
IF(KAMMA.LT.(-90)) GO TO 6
KAMMA1=KAMMA1+180
GO TO 3
6 KAMPA1=KAMMA1-180
GO TO 3
4 CALL VECTOR(KAMMA5,ALPH2,BET2)
C
RX1: ALONG THE COAST COMPONENT (INTENSITY) OF LOCAL WIND
RX2: PERPENDICULAR TO COAST COMPONENT (INTENSITY) OF LOCAL WIND
C
R051(NORDER,ISTA)=R05(NORDER,ISTA)*BET2
R052(NORDER,ISTA)=R05(NORDER,ISTA)*ALPH2
IF(KAMMA1.LT.0) KAMMA1=KAMMA1+360
IF(ETA1=KAMMA1
IF(ETA1.GE.360) IHETA1=IHETA1-360
IF(KAMMA5.EQ.0) GO TO 11
IF(KKK.GT.0) GO TO 8
CALL VECTOR(IHETA1,ALPH3,BET3)
DELTX3=R051(NORDER,ISTA)*ALPH3/45.
DELTYS3=R051(NORDER,ISTA)*BET3/45.
XAUX3(1)=XGRID
XAUX3(2)=XAUX3(1)+DELTX3
YAUX3(1)=YGRID+1.6
YAUX3(2)=YAUX3(1)+DELTYS3
IF(N40.EQ.1) NPLOT=1
IF(N40.GT.1) NPLOT=2
CALL DRAW(2,XAUX3,YAUX3,NPLOT,0,LABEL,ITITL4,1.,1.,0,0,2,2,8,6,0,
*LAST)
N40=N40+1
WRITE(6,2) LAST
8 IF(KANG*5(NCRDER,ISTA).LT.0 KAMMA1) IHETA2=KAMMA1-90
C
C
C

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IF(KANG05(NORDER, ISTA).GT.KAMMA1) IHETA2=KAMMA1+90
IF(IHETA2.GE.360) IHETA2=IHETA2-360
IF(IHETA2.LT.0) IHETA2=IHETA2+360
KAMMA7=IABS(KANG05(NORDER, ISTA)-IHETA2)
IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
IF(KANG05(NORDER, ISTA).GE.360) KANG05(NORDER, ISTA)=KANG05(NORDER,
* ISTA)-360
IF(KAMMA7.EQ.0) GO TO 14
IF(KKK.GT.0) GO TO 10
CALL VECTOR(IHETA2,ALPH4,BET4)
DELTX4=RC52(NORDER, ISTA)*ALPH4/45.
DELTXY4=RC52(NORDER, ISTA)*BET4/45.
XAX4(1)=XGRID
XAX4(2)=XAX4(1)+DELTX4
YAX4(1)=YGRID+1.6
YAX4(2)=YAX4(1)+DELTXY4
WRITE(6,51) XAX1(1),XAX1(2),XAX3(1),XAX3(2),XAX4(1),XAX4(2)
*,YAX1(1),YAX1(2),YAX3(1),YAX3(2),YAX4(1),YAX4(2)
511 FCRMAT(8F10.3)
IF(N40.EQ.1) NPLOT=1
IF(N40.GT.1) NPLOT=2
CALL DRAW(2,XAX4,YAX4,NPLOT,0,LABEL,ITITL4,1,1,0,0,2,2,8,6,0,
* LAST)
N40=N40+1
WRITE(6,2) LAST
2 FCRMAT(10,30X,'LAST =',11)
GO TO 10
300 RC51(NORDER, ISTA)=-5.
RC52(NORDER, ISTA)=-5.
IHETA1=-5.
IHETA2=-5.
N41=N40
10 WRITE(6,12) NORDER, ISTA,KAMMA1,RC51(NORDER, ISTA),
*KANG05(NORDER, ISTA),IHETA1,RC52(NORDER, ISTA),
* IHETA2
12 FCRMAT(10,45X,'**' SURFACE WIND AT 5 DAY BEFORE DAY XBT CBS
* ** CRUISE NO. =',13,20X,'STATION NO. =',13,20X,
* COAST DIRECTION =',13,20X,'SURFACE WIND =',20X,'INTENSITY =',
* F5.1,35X,'DIRECTION =',13,20X,'SURFACE WIND COMPONENTS :',/,
* F5.1,35X,'ALONG THE COAST :',10X,'INTENSITY =',F5.1,10X,
* I3,20X,'PERPENDICULAR TO COAST :',10X,'INTENSITY =',F5.1,10X,
* DIRECTION =',13)
GO TO 16
11 N41=N40
WRITE(6,13) NORDER, ISTA,KAMMA1,RC51(NORDER, ISTA),
*KANG05(NORDER, ISTA),RC52(NORDER, ISTA),
* RC52(NORDER, ISTA),KANG05(NORDER, ISTA)
13 FCRMAT(10,45X,'**' SURFACE WIND AT 5 DAY BEFORE DAY XBT CBS

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***, //, 20X, CRUISE NO. =, I3, 20X, STATION NO. =, I3, 20X, INTENSITY =, W05 1760
* COAST DIRECTION =, I3, //, 20X, SURFACE WIND : , 20X, INTENSITY =, W05 1770
* F5.1, 35X, DIRECTION =, I3, //, 20X, SURFACE WIND COMPONENTS : , /, W05 1780
* 35X, ALONG THE COAST : , I3, 20X, INTENSITY =, F5.1, 10X, DIRECTION =, W05 1790
* I3, //, 35X, PERPENDICULAR TO COAST : , I3, 20X, INTENSITY =, F5.1, 10X, W05 1800
* DIRECTION =, I3, (+ OR -90) W05 1810
GO TO 16 W05 1820
14 N41=N40 W05 1830
WRITE(6, 15) NORDER, ISTA, KAMMA1, RQ5(NORDER, ISTA), W05 1840
* KANGQ5(NORDER, ISTA), RQ51(NORDER, ISTA), KANGQ5(NORDER, ISTA), W05 1850
* RQ52(NORDER, ISTA), KANGQ5(NORDER, ISTA) W05 1860
15 FORMAT( //, 45X, '*** SURFACE WIND AT 5 DAY BEFORE DAY X83 022 W05 1870
* ** //, 20X, CRUISE NO. =, I3, 20X, STATION NO. =, I3, 20X, INTENSITY =, W05 1880
* COAST DIRECTION =, I3, //, 20X, SURFACE WIND : , 20X, INTENSITY =, W05 1890
* F5.1, 25X, DIRECTION =, I3, 20X, SURFACE WIND COMPONENTS : , /, W05 1900
* NENTS : , /, 35X, ALONG THE COAST : , I3, 20X, SURFACE WIND COMPONENTS : , /, W05 1910
* DIRECTION =, I3, (+ OR -90) W05 1920
* I3, 20X, INTENSITY =, F5.1, 10X, PERPENDICULAR TO COAST : , W05 1930
* 10X, INTENSITY =, F5.1, 10X, DIRECTION =, I3) W05 1940
RETURN W05 1950
16 END W05 1960
SUBROUTINE WINDIO W10 0020
PURPOSE W10 0030
TO PROCESS THE WIND VELOCITY MEASURED AT TEN DAYS BEFORE THE W10 0040
DAY OF THE DIGITAL TRACE AND AT THE SAME GEOGRAPHICAL W10 0050
POSITION. TO PLOT THE WIND VECTOR AND ITS COMPONENTS (ALONG W10 0060
AND PERPENDICULAR TO THE DIRECTION OF THE NEAR COASTLINE) W10 0070
W10 0080
W10 0090
W10 0100
W10 0110
W10 0120
W10 0130
W10 0140
W10 0150
W10 0160
W10 0170
W10 0180
W10 0190
W10 0200
W10 0210
W10 0220
W10 0230
W10 0240
W10 0250
W10 0260
W10 0270
W10 0280
USAGE
CALL WINDIO(NORDER, ISTA, XGRID, YGRID, KKK, N40, LABEL, ITITL4,
KAMMA1, N41)
DESCRIPTION OF PARAMETERS
NORDER- ACTUAL NUMBER OF PROCESSED CRUISES
ISTA - INPUT NUMBER IDENTIFYING A STATION ALONG A CROSS
SECTION
XGRID - INPUT VALUE CONTAINING THE LOCATION OF THE STATION
(ALONG THE CROSS SECTION OR TIME AXIS) WHERE THE WIND
DATA IS REPORTED TO
YGRID - INPUT CONTAINING THE VALUE OF THE ORDINATE TO LOCATE
THE WIND VECTORS IN THE PLOT
KKK - INPUT VALUE CONTROLLING THE PLOT OF THE WIND VECTOR
(IF K=0: NO PLOT)
N40 - INPUT ACTUAL NUMBER OF WIND PLOTS
LABEL - INPUT IDENTIFICATION OF A PLOTTED CURVE
ITITL4- INPUT SHORT VECTOR OF LENGTH '12' CONTAINING THE TITLE FOR

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XAX1(2)=XAX1(1)+DELTX1
YAX1(1)=YGRID+2.0
YAX1(2)=YAX1(1)+DEITY1
IF(N40.EQ.1) NPL0T=1
IF(N40.GT.1) NPL0T=2
CALL DRAW(2,XAX1,NPL0T,0,LABEL,ITITL4,1.0,0.0,2.2,8.6,0.0,
*LAST)
N40=N40+1
WRITE(6,2) LAST

FINDING THE COMPONENTS OF THE LOCAL WIND VECTOR ALONG TWO PRE-
DEFINED DIRECTIONS (I.E., ALONG THE COAST AND PERPENDICULAR TO
THIS DIRECTION)

KAMMA: ANGULAR DIFFERENCE BETWEEN THE WIND VECTOR (KANG) AND THE
DIRECTION ALONG THE COAST (KAMMAL)

IF(KAMMAL.LT.0) GO TO 300
IF(KAMMAL.GE.360) KAMMAL=KAMMAL-360
KAMMA=KANG10(NORDER,ISTA)-KAMMAL
KAMMA5=IABS(KAMMA)
IF(KAMMA5.LE.90) GO TO 4
IF(KAMMA.LT.(-90)) GO TO 6
KAMMAL=KAMMAL+180
GO TO 3

3 KAMMAL=KAMMAL-180
GO TO 3

4 CALL VECTOR(KAMMA5,ALPH2,BET2)

RXX1: ALONG THE COAST COMPONENT (INTENSITY) OF LOCAL WIND
RXX2: PERPENDICULAR TO COAST COMPONENT (INTENSITY) OF LOCAL WIND

R101(NORDER,ISTA)=R10(NORDER,ISTA)*BET2
R102(NORDER,ISTA)=R10(NORDER,ISTA)*ALPH2
IF(KAMMAL.LT.0) KAMMAL=KAMMAL+360
IHETA1=KAMMAL
IF(IHETA1.GE.360) IHETA1=IHETA1-360
IF(KAMMA5.EQ.0) GO TO 11
IF(KKK.GT.0) GO TO 8
CALL VECTOR(IHETA1,ALPH3,BET3)
DELTXY3=R101(NORDER,ISTA)*ALPH3/45.
DELTXY3=R101(NORDER,ISTA)*BET3/45.
XAX3(1)=XGRID
XAX3(2)=XAX3(1)+DELTX3
YAX3(1)=YGRID+2.0
YAX3(2)=YAX3(1)+DEITY3
IF(N40.EQ.1) NPL0T=1
IF(N40.GT.1) NPL0T=2

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```

CALL DRAW(2,XAUX3,YAUX3,NPLOT,0,LABEL,ITITL4,1,1,0,0,2,2,8,6,0,
*LAST)
N40=N40+1
WRITE(6,2) LAST
8 IF(KANG10(NORDER,ISTA).LT.KAMMA1) IHETA2=KAMMA1-90
IF(KANG10(NORDER,ISTA).GT.KAMMA1) IHETA2=KAMMA1+90
IF(IHETA2.GE.360) IHETA2=IHETA2-360
IF(IHETA2.LT.0) IHETA2=IHETA2+360
KAMMA7=IABS(KANG10(NORDER,ISTA)-IHETA2)
IF(KAMMA1.GE.360) KAMMA1=KAMMA1-360
IF(KANG10(NORDER,ISTA).GE.360) KANG10(NORDER,ISTA)=KANG10(NORDER,
*ISTA)-360
IF(KAMMA7.EQ.0) GO TO 14
IF(KKK.GT.0) GO TO 10
CALL VECTOR(IHETA2,ALPH4,BET4)
DELTX4=R102(NORDER,ISTA)*ALPH4/45.
DELTXY4=R102(NORDER,ISTA)*BET4/45.
XAUX4(1)=XGRID
XAUX4(2)=XAUX4(1)+DELTX4
XAUX4(1)=YGRID+2.0
XAUX4(2)=YAUX4(1)+DELTXY4
WRITE(6,511) XAUX1(1),XAUX1(2),XAUX3(1),XAUX3(2),XAUX4(1),XAUX4(2)
* ,YAUX1(1),YAUX1(2),YAUX3(1),YAUX3(2),YAUX4(1),YAUX4(2)
511 FORMAT(8F10.3)
FCRMAT=8F10.3
IF(N40.EQ.1) NPLOT=1
IF(N40.GT.1) NPLOT=2
CALL DRAW(2,XAUX4,YAUX4,NPLOT,0,LABEL,ITITL4,1,1,0,0,2,2,8,6,0,
*LAST)
N40=N40+1
WRITE(6,2) LAST
2 FORMAT(10,30X,'LAST =' ,I1)
GO TO 10
300 R101(NORDER,ISTA)=-5.
R102(NORDER,ISTA)=-5.
IHETA1=-5.
IHETA2=-5.
10 N41=N40
WRITE(6,12) NORDER,ISTA,KAMMA1,R101(NORDER,ISTA),
* KANG10(NORDER,ISTA),R102(NORDER,ISTA),
* IHETA2
12 FCRMAT('G',//,45X,'**' SURFACE WIND AT 10 DAY BEFORE DAY XBT OBS
* ,//,20X,'CRUISE NO.=',I3,20X,'STATION NO.=',I3,20X,
* ,COAST DIRECTION=',I3,//,20X,'SURFACE WIND :',2CX,'INTENSITY=',I3,20X,
* ,F5.1,35X,'DIRECTION=',I3,//,20X,'SURFACE WIND COMPONENTS :',/,
* ,35X,'ALONG THE COAST :',I3,20X,'INTENSITY=',F5.1,10X,'DIRECTION=',
* ,I3,20X,'PERPENDICULAR TO COAST :',I3,20X,'INTENSITY=',F5.1,10X,
* ,DIRECTION=',I3)
GO TO 16

```



```

11 N41=N40
   WRITE(6,13) NORDER, ISTA, KAMMAL, R10(NORDER, ISTA),
      *R101(NORDER, ISTA), R101(NORDER, ISTA),
      *R102(NORDER, ISTA), KANGLO(NORDER, ISTA),
13 FORMAT('O', //, 45X, '*** NO.', I3, 20X, SURFACE WIND AT 10 DAY BEFORE DAY XBT OBS
      ** COAST DIRECTION =, I3, //, 20X, CRUISE NO. =, I3, 20X, STATION NO. =, I3, 20X,
      ** F5.1, 35X, DIRECTION =, I3, //, 20X, SURFACE WIND : , 20X, INTENSITY =,
      ** 35X, ALONG THE COAST : , I3, //, 20X, SURFACE WIND COMPONENTS : , /,
      ** I3, //, 35X, PERPENDICULAR TO COAST : , I3, //, 20X, INTENSITY =, F5.1, 10X, DIRECTION =,
      ** DIRECTION =, I3, ' (+ OR -90)', )
      GC TO 16
14 N41=N40
   WRITE(6,15) NORDER, ISTA, KAMMAL, R10(NORDER, ISTA),
      *R101(NORDER, ISTA), R101(NORDER, ISTA),
      *R102(NORDER, ISTA), KANGLO(NORDER, ISTA),
15 FORMAT('O', //, 45X, '*** NO.', I3, 20X, SURFACE WIND AT 10 DAY BEFORE DAY XBT OBS
      ** COAST DIRECTION =, I3, //, 20X, CRUISE NO. =, I3, 20X, STATION NO. =, I3, 20X,
      ** F5.1, 25X, DIRECTION =, I3, //, 20X, SURFACE WIND : , 20X, INTENSITY =,
      ** F5.1, 35X, ALONG THE COAST : , I3, //, 20X, SURFACE WIND COMPONENTS : , /,
      ** 35X, PERPENDICULAR TO COAST : , I3, //, 20X, INTENSITY =, F5.1, 10X, DIRECTION =,
      ** DIRECTION =, I3, ' (+ OR -90)', )
      GC TO 16
16 RETURN
END
```


FORTRAN IV SUBPROGRAM TREND FOR IBM 360/OS

```

.....
SUBROUTINE TREND
PURPOSE
TWO DIMENSIONAL (Z,T) OBJECTIVE ANALYSIS OF A DIGITAL TRACE
(BEGINNING AT SEA SURFACE) TO IDENTIFY THE TREND, THE EXTREMA
AND THE INVERSIONS
LSAGE
CALL TREND(NGP)
DESCRIPTION OF PARAMETERS
NGP - INPUT NUMBER OF PAIRS (T,Z) DEFINING A TRACE
REMARKS
(1) THIS SUBROUTINE USES 'COMMON' LABELLED AREAS TO RECEIVE
INFORMATION FROM THE MAIN PROGRAM AND TO COMMUNICATE THE
PROCESSED DATA TO THE SUBROUTINE INVERS
(2) THIS SUBROUTINE ANALYSIS THE ORIGINAL DIGITAL TRACE OR
THE EQUIVALENT MESH
(3) THE SETTING UP OF THE CONDITIONS TO DEFINE (A) THE TREND
AND (B) THE EXTREMA REQUIRES CONSULTATION OF:
SALDANHA, J.M., 1971, 'OBJECTIVE DIGITAL ANALYSIS OF A
TRACE', M.S. THESIS, NAVAL POSTGRADUATE SCHOOL,
MCNTEREY, CALIFORNIA 93940
SUBROUTINES AND FUNCTIONS REQUIRED
INVERS
MAXO (IBM SCIENTIFIC LIBRARY)
METHOD
ITERATIVE PROCESS TO APPLY THE FINITE DIFFERENCE TECHNIQUE
TO THE ORIGINAL DIGITAL TRACE OR MESH
.....
SUBROUTINE TREND(NGP)
COMMON/WCRKA/TO(60),ZO(60),BLA37(1332)
COMMON/WORKF/SEXT(50),VEXT(50),STOP(50),VISO(50),V1(50),
*SMAX(50),VMAX(50),SMIN(50),VMIN(50)
PROCESSING THE FIRST FINITE DIFFERENCES OF T
I=NGP+1
LQ1=I-NGP

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TRND0470
TRND0480
TRND0490
TRND0500
TRND0510
TRND0520
TRND0530
TRND0540
TRND0550
TRND0560
TRND0570
TRND0580
TRND0590
TRND0600
TRND0610
TRND0620
TRND0630
TRND0640
TRND0650
TRND0660
TRND0670
TRND0680
TRND0690
TRND0700
TRND0710
TRND0720
TRND0730
TRND0740
TRND0750
TRND0760
TRND0770
TRND0780
TRND0790
TRND0800
TRND0810
TRND0820
TRND0830
TRND0840
TRND0850
TRND0860
TRND0870
TRND0880
TRND0890
TRND0900
TRND0910
TRND0920
TRND0930
TRND0940

```

LQ2=I-2
DC 4 N=LQ1,LQ2
VI(N)=TC(N+1)-TO(N)
4 CC CONTINUE

K: ACTUAL NUMBER OF ISOTHERMAL LAYERS
K=1

L: ACTUAL NUMBER OF EXTREMA (MAXIMA AND MINIMA)
L=2

M: ACTUAL NUMBER OF FIRST FINITE DIFFERENCE SEGMENTS USED IN
  THE ANALYSIS
M=2

ANALYSIS OF EXTREMA AND ISOTHERMAL LAYERS

6 IF(VI(M-1).LE.0.) GO TO 10
  IF(VI(M).GE.0.) GO TO 10
  (VI(M-1).GT.0) AND (VI(M).LT.0)
  (VEXT,SEXT): POSITION OF MAXIMUM OR MINIMUM
  IF(L.EQ.2) VEXT(1)=TO(1)
  IF(L.EQ.2) SEXT(1)=ZO(1)

J=5: THE FIRST EXTREMA IS A MAXIMUM AND THE INITIAL POSITION
    OF THE TRACE IS CONSIDERED A MINIMUM

  IF(L.EQ.2) J=5
  VEXT(L)=TO(M)
  SEXT(L)=ZO(M)
  L=L+1
  10 GC TO 40
  IF(VI(M-1).GE.0.) GO TO 20
  IF(VI(M).LE.0.) GO TO 20
  (VI(M-1).LT.0) AND (VI(M).GT.0)

  IF(L.EQ.2) VEXT(1)=TO(1)
  IF(L.EQ.2) SEXT(1)=ZO(1)

J=50: THE FIRST EXTREMA IS A MINIMUM AND THE INITIAL POSITION
    OF THE TRACE IS CONSIDERED A MAXIMUM

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IF(L.EQ.2) J=50
VEXT(L)=TO(M)
SEXT(L)=ZO(M)
L=L+1

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```

GO TO 40

```

```

20 IF(V1(M-1).LE.0.) GO TO 30
IF(V1(M).NE.0.) GO TO 30

```

C

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(V1(M-1).EQ.0) AND (V1(M).EQ.0)

```

C

C

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```

(VISO,STOP/SBOT): LOCATION OF ISOTHERMAL LAYER

```

```

STOP(K)=ZO(M)
VISO(K)=TO(M)

```

```

24 M=M+1

```

```

IF(M.GT.LQ2) GO TO 50
IF(V1(M).GT.0.) GO TO 39
IF(V1(M).LT.0.) GO TO 26

```

```

GO TO 24

```

```

26 IF(L.EQ.2) VEXT(1)=TO(1)
IF(L.EQ.2) SEXT(1)=ZO(1)

```

```

IF(L.EQ.2) J=5

```

```

VEXT(L)=TO(M)

```

```

SEXT(L)=ZO(M)

```

```

L=L+1

```

```

GO TO 39

```

```

30 IF(V1(M-1).GE.0.) GO TO 37
IF(V1(M).NE.0.) GO TO 37

```

```

STOP(K)=ZO(M)

```

```

VISO(K)=TO(M)

```

```

34 M=M+1

```

```

IF(M.GT.LQ2) GO TO 50

```

```

IF(V1(M).LT.0.) GO TO 39

```

```

IF(V1(M).GT.0.) GO TO 36

```

```

GO TO 34

```

```

36 IF(L.EQ.2) VEXT(1)=TO(1)
IF(L.EQ.2) SEXT(1)=ZO(1)

```

```

IF(L.EQ.2) J=50

```

```

VEXT(L)=TO(M)

```

```

SEXT(L)=ZO(M)

```

```

L=L+1

```

```

GO TO 39

```

```

37 IF(V1(M-1).NE.0.) GO TO 40
IF(V1(M).NE.0.) GO TO 40

```

```

STOP(K)=ZO(M)

```

```

VISO(K)=TO(M)

```

```

TRND0950
TRND0960
TRND0970
TRND0980
TRND0990
TRND1000
TRND1010
TRND1020
TRND1030
TRND1040
TRND1050
TRND1060
TRND1070
TRND1080
TRND1090
TRND1100
TRND1110
TRND1120
TRND1130
TRND1140
TRND1150
TRND1160
TRND1170
TRND1180
TRND1190
TRND1200
TRND1210
TRND1220
TRND1230
TRND1240
TRND1250
TRND1260
TRND1270
TRND1280
TRND1290
TRND1300
TRND1310
TRND1320
TRND1330
TRND1340
TRND1350
TRND1360
TRND1370
TRND1380
TRND1390
TRND1400
TRND1410
TRND1420

```



```

TRND1430
TRND1440
TRND1450
TRND1460
TRND1470
TRND1480
TRND1490
TRND1500
TRND1510
TRND1520
TRND1530
TRND1540
TRND1550
TRND1560
TRND1570
TRND1580
TRND1590
TRND1600
TRND1610
TRND1620
TRND1630
TRND1640
TRND1650
TRND1660
TRND1670
TRND1680
TRND1690
TRND1700
TRND1710
TRND1720
TRND1730
TRND1740
TRND1750
TRND1760
TRND1770
TRND1780
TRND1790
TRND1800
TRND1810
TRND1820
TRND1830
TRND1840
TRND1850
TRND1860
TRND1870
TRND1880
TRND1890
TRND1900

```

```

38 M=M+1
   IF(M.GT.LQ2) GO TO 50
   IF(V1(M).EQ.0.) GO TO 38
39 SBOT(K)=ZO(M)
40 K=K+1
   N=M+1
   IF(M.GT.NGP) GO TO 50
   GO TO 6
50 IF(L.LE.2) GO TO 95
   VEXT(L)=TC(NGP)
   SEXT(L)=ZO(NGP)

   SELECTING THE EXTREMA IN MAXIMA (VMAX,SMAX) OR MINIMA (VMIN,
   SMIN)

80 I1=1
   I1=2*(I1-1)+1
   IF(N1.GT.L) GO TO 85
   IF(J.EQ.5) VMIN(I1)=VEXT(N1)
   IF(J.EQ.5) SMIN(I1)=SEXT(N1)
   IF(J.EQ.50) VMAX(I1)=VEXT(N1)
   IF(J.EQ.50) SMAX(I1)=SEXT(N1)
   I1=I1+1
   GO TO 80
85 I1=I1-1
   I2=1
   N2=2*I2
   IF(N2.GT.L) GO TO 90
   IF(J.EQ.5) VMAX(I2)=VEXT(N2)
   IF(J.EQ.5) SMAX(I2)=SEXT(N2)
   IF(J.EQ.50) VMIN(I2)=VEXT(N2)
   IF(J.EQ.50) SMIN(I2)=SEXT(N2)
   I2=I2+1
   GO TO 88
90 I2=I2-1
   N5=MAX0(I1,I2)
   WRITE(6,91)(I3,VMIN(I3),SMIN(I3),VMAX(I3),SMAX(I3),I3=1,N5)
91 *11X,'MAX(','I2,') LOCATED AT (',F5.2,',',F6.2,',',/,
   FCRMAT('I2,') LOCATED AT (',F5.2,',',F6.2,',',/,
   GO TO 100
95 CV=TC(NGP)-TO(1)
   IF(DV.LT.0.) GO TO 96
   IF(DV.GT.0.) GO TO 97
   WRITE(6,101)
101 FORMAT('O',I3X,'TREND : V CONSTANT')
   GC TO 100
96 WRITE(6,102)
102 FORMAT('O',I3X,'TREND : V DECREASES')

```

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C

UUUU

UUU UUU UUUUUUU UU UU UU

INVR0850
 INVR0860
 INVR0870
 INVR0880
 INVR0890
 INVR0900
 INVR0910
 INVR0920
 INVR0930
 INVR0940
 INVR0950
 INVR0960
 INVR0970
 INVR0980
 INVR0990
 INVR1000
 INVR1010
 INVR1020
 INVR1030
 INVR1040
 INVR1050
 INVR1060
 INVR1070
 INVR1080
 INVR1090
 INVR1100
 INVR1110
 INVR1120
 INVR1130
 INVR1140
 INVR1150
 INVR1160
 INVR1170
 INVR1180
 INVR1190
 INVR1200
 INVR1210
 INVR1220
 INVR1230
 INVR1240
 INVR1250
 INVR1260
 INVR1270
 INVR1280
 INVR1290
 INVR1300
 INVR1310
 INVR1320

```

C      SBNI(L2)=SEXT(N3)
      IF(K.EQ.1) GO TO 16
      K1=K
      I4=1
10     IF(I4.GT.K1) GO TO 16
      IF(VMNI(L2).NE.VISO(I4)) GO TO 15
      IF(SBNI(L2).NE.SBOT(I4)) GO TO 15
C
C      STNI: DEPTH OF THE TOP OF THE MINIMUM THERMAL VALUE OF INVERSION
      STNI(L2)=STOP(I4)
      GO TO 17
15     I4=I4+1
      GO TO 10
16     STNI(L2)=SBNI(L2)
17     I5=1
      N1=1
18     IF(I5.GT.NGP) GO TO 120
      IF(SBNI(L2).NE.ZO(I5)) GO TO 22
      IF(VMNI(L2).NE.TO(I5)) GO TO 22
20     IF(VMXI(L2).LE.TO(I5+N1)) GO TO 21
      N1=N1+1
      GO TO 20
21     A2=TO(I5+N1)
      B2=ZO(I5+N1)
      A1=TO(I5+N1-1)
      B1=ZO(I5+N1-1)
      GO TO 28
22     I5=I5+1
      GO TO 18
C
C      SBXI: DEPTH OF THE BOTTOM OF THE MAXIMUM THERMAL VALUE OF
      INVERSION
28     CALL LINE(A1,B1,A2,B2,VEXT(N2),SBXI(L2))
C
C      DSXI: RANGE OF THE INVERSION
      DSXI=SBXI(L2)-STXI(L2)
C
C      DVMI: THERMAL WIDTH OF THE INVERSION
      DVMI=ABS(VMXI(L2)-VMNI(L2))
      WRITE(6,30) L2,DSXI,VMXI(L2),STXI(L2),SBXI(L2)
30     FCORMAT(0,10X,INVERSION NO.,I2,/,15X,RANGE=,F6.2,/,15X,
      *,'DEFINING POSITIONS:',10X,('F5.2,',F6.2,')',10X,('F5.2,
      *,',F6.2,')')
  
```



```

32 WRITE(6,32) DVMI, VMNI(L2), STNI(L2), VMNI(L2), SBNI(L2)
   FORMAT(/,15X,'THERMAL WIDTH =',F6.2,'/',15X,'MINIMUM THERMAL VALUE D
   *EF5.2,' ',F6.2,'')
   GO TO 80
34 IF(ABS(V1-V2).LE.0.005) GO TO 50
   V1=GT.V2
   VMXI(L2)=VEXT(N4)
   VMNI(L2)=VEXT(N3)
   SBNI(L2)=SEXT(N3)
   IF(K.EQ.1) GO TO 36
   I6=1
   K1=K
37 IF(I6.GT.K1) GO TO 36
   IF(VMNI(L2).NE.VISO(I6)) GO TO 35
   IF(SBNI(L2).NE.SBOT(I6)) GO TO 35
   STNI(L2)=STOP(I6)
   GO TO 38
35 I6=I6+1
   GO TO 37
36 STNI(L2)=SBNI(L2)
38 N2=1
   I10=1
47 IF(I10.GT.NGP) GO TO 120
   IF(STNI(L2).NE.ZO(I10)) GO TO 39
   IF(VMNI(L2).NE.TO(I10)) GO TO 39
45 IF(VMXI(L2).LE.TO(I5-N1)) GO TO 46
   N2=N2+1
   GO TO 45
46 D1=TO(I5-N2)
   F1=ZO(I5-N2)
   D2=TO(I5-N2+1)
   F2=ZO(I5-N2+1)
   GO TO 41
39 I10=I10+1
   GO TO 47
41 CALL LINE(D1,F1,D2,F2,VEXT(N4),STXI(L2))
40 IF(K.EQ.1) GO TO 43
   I7=1
   K1=K
49 IF(I7.GT.K1) GO TO 43
   IF(VEXT(N4).NE.VISO(I7)) GO TO 42
   IF(SEXT(N4).NE.SBOT(I7)) GO TO 42
   SBXI(L2)=STCP(I7)
   GO TO 44
42 I7=I7+1

```

C
C
C

INVR1810
INVR1820
INVR1830
INVR1840
INVR1850
INVR1860
INVR1870
INVR1880
INVR1890
INVR1900
INVR1910
INVR1920
INVR1930
INVR1940
INVR1950
INVR1960
INVR1970
INVR1980
INVR1990
INVR2000
INVR2010
INVR2020
INVR2030
INVR2040
INVR2050
INVR2060
INVR2070
INVR2080
INVR2090
INVR2100
INVR2110
INVR2120
INVR2130
INVR2140
INVR2150
INVR2160
INVR2170
INVR2180
INVR2190
INVR2200
INVR2210
INVR2220
INVR2230
INVR2240
INVR2250
INVR2260
INVR2270
INVR2280

```

GC TO 49
SBXI(L2)=SEXT(N4)
43 DSXI(L2)=SBXI(L2)-STXI(L2)
44 DVM I=ABS(VMXI(L2))-VMNI(L2))
WRITE(6,30)L2,DSXI,VMXI(L2),STXI(L2),VMXI(L2),SBXI(L2)
WRITE(6,32)DVM I,VMNI(L2),STNI(L2),VMNI(L2),SBNI(L2)
GO TO 80

V1.EQ.V2

50 VMXI(L2)=VEXT(N2)
STXI(L2)=VEXT(N2)
VMNI(L2)=VEXT(N3)
SBNI(L2)=SEXT(N3)
IF(K.EQ.1) GO TO 56
I8=1
K1=K
53 IF(I8.GT.K1) GO TO 56
IF(VMNI(L2).NE.VISO(I8)) GO TO 55
IF(SBNI(L2).NE.SBOT(I8)) GO TO 55
STNI(L2)=STOP(I8)
GO TO 58
55 I8=I8+1
GO TO 53
56 STNI(L2)=SBNI(L2)
58 IF(K.EQ.1) GO TO 63
K1=K
I9=1
60 IF(I9.GT.K1) GO TO 63
IF(VEXT(N4).NE.VISO(I9)) GO TO 62
IF(SEXT(N4).NE.SBOT(I9)) GO TO 62
SBXI(L2)=STOP(I9)
GO TO 65
62 I9=I9+1
GO TO 60
63 SBXI(L2)=SEXT(N4)
65 DSXI=SBXI(L2)-STXI(L2)
DVM I=ABS(VMXI(L2))-VMNI(L2))
WRITE(6,30)L2,DSXI,VMXI(L2),STXI(L2),VMXI(L2),SBXI(L2)
WRITE(6,32)DVM I,VMNI(L2),STNI(L2),VMNI(L2),SBNI(L2)
L2=L2+1
I2=I2+1
GO TO 2

END OF THE ITERATIVE PROCESS

80
98 WRITE(6,99)
99 FORMAT('Q',10X,'L=2 : NO INVERSIONS')
```

CC

CC


```

100 GO TO 120
101 WRITE(6,101)
101 FORMAT('0','J IS UNDEFINED')
120 WRITE(6,121)
121 FORMAT('0','END OF INVERSION ANALYSIS')
      RETURN
      END

```

```

INVR2290
INVR2300
INVR2310
INVR2320
INVR2330
INVR2340
INVR2350

```


FORTRAN IV SUBPROGRAM PROPAR FOR IBM 360/OS

```

PRPR0010
PRPR0020
PRPR0030
PRPR0040
PRPR0050
PRPR0070
PRPR0080
PRPR0090
PRPR0100
PRPR0110
PRPR0120
PRPR0130
PRPR0140
PRPR0150
PRPR0160
PRPR0170
PRPR0180
PRPR0190
PRPR0200
PRPR0210
PRPR0220
PRPR0230
PRPR0240
PRPR0250
PRPR0260
PRPR0270
PRPR0280
PRPR0290
PRPR0300
PRPR0310
PRPR0320
PRPR0330
PRPR0340
PRPR0350
PRPR0360
PRPR0370
PRPR0380
PRPR0390

PRPR0400
PRPR0410
PRPR0420
PRPR0430
PRPR0440
PRPR0450
PRPR0460

.....
SUBROUTINE PROPAR
PURPOSE
  TO COMPUTE THE FRICTION VELOCITY, THE ROUGHNESS PARAMETER AND
  STABILITY LENGTH FROM WIND SPEED AND AIR-SEA TEMPERATURE
  DIFFERENCE DATA
USAG
  CALL PROPAR(UW,ZM,TD,ZTM,VST,ZO,SLN)
DESCRIPTION OF PARAMETERS
  UW - INPUT VALUE CONTAINING THE WIND SPEED (FT/SEC)
  ZM - INPUT VALUE CONTAINING THE ANEMOMETER HEIGHT (FT)
  TD - INPUT VALUE CONTAINING THE AIR-SEA TEMPERATURE
      DIFFERENCE (CELSIUS)
  ZTM - INPUT VALUE CONTAINING THE THERMOMETER HEIGHT (FT)
  VST - OUTPUT VALUE CONTAINING THE FRICTION VELOCITY (FT/SEC)
  ZO - OUTPUT VALUE CONTAINING THE ROUGHNESS PARAMETER (FT)
  SLN - OUTPUT VALUE CONTAINING THE STABILITY LENGTH (FT)
REMARKS
  TO NOTICE THE UNITS OF THE PARAMETERS
SURROUTINES AND FUNCTIONS REQUIRED
  PSI(P)
  SHP(PS)
  ABS (IBM SCIENTIFIC LIBRARY)
  LOG (IBM SCIENTIFIC LIBRARY)
METHOD AND SOURCE
  CARDONE, V.J., 1969, 'SPECIFICATION OF THE WIND DISTRIBUTION IN
  THE MARINE BOUNDARY LAYER FOR WAVE FORECASTING', NEW YORK
  UNIVERSITY, DEPARTMENT OF METEOROLOGY AND OCEANOGRAPHY
.....
SUBROUTINE PROPAR(UW,ZM,TD,ZTM,VST,ZO,SLN)
DATA A/7.3627E-04/B/1.3045E-03/C/-1.4534E-03/C=/54.3478/
VST=.04*UW
IE(ARS(TD).GT.1.) GO TO 2000
VSTN=(.4*UW)/(LOG(ZM/(A/VST+9*VST**2+C)))
IE(ARS(VSTN-VST).LT..05) GO TO 1400
VST=VSTN
1000
1200

```



```

C
C
C      FOR NEUTRAL CONDITIONS 'SLN' RETURNS 0
1400  SLN=0.
      GO TO 12
2000  SLG=VST**2*(LOG(ZTM/(A/VST+B*VST**2+C)))/TD
      1  VSTN=(.4*UM)/(LOG(ZM/(A/VST+P*VST**2+C)))-PSI(ZM/SLG))
      2  IF (ABS(VSTN-VST).LT..05) GO TO 4
      3  VST=VSTN
      4  GO TO 1
      5  SL=SLG
      6  SLN=CE*VSTN**2*(LOG(ZTM/(A/VSTN+P*VSTN**2+C)))-PSI(ZTM/SL))/TD
      7  IF (ABS(SLN-SL).LT.1.) GO TO 8
      8  SL=SLN
      9  GO TO 5
     10  IF (ABS(SLN-SLG).LT.1.) GO TO 12
     11  SLG=SLN
     12  GO TO 1
      12  ZC=A/VST+B*VST**2+C
      RETURN
      END

```

```

PRPR0470
PRPR0480
PRPR0490
PRPR0500
PRPR0510
PRPR0520
PRPR0530
PRPR0540
PRPR0550
PRPR0560
PRPR0570
PRPR0580
PRPR0590
PRPR0600
PRPR0610
PRPR0620
PRPR0630
PRPR0640
PRPR0650
PRPR0660
PRPR0670

```


FORTRAN IV SUBPROGRAM ITRATE FOR IBM 360/OS

```

.....
SUBROUTINE ITRATE
PURPOSE
  TO COMPUTE THE FRICTION VELOCITY, THE INFLOW ANGLE, THE
  ROUGHNESS PARAMETER AND THE STABILITY LENGTH FROM THE LARGE
  SCALE SYNOPTIC PARAMETERS
USAGE
  CALL ITRATE(G,F,TD,TH,ETAH,VST,PHI,ZC,PARAM)
DESCRIPTION OF PARAMETERS
  G      -INPUT VALUE CONTAINING THE GEOSTROPHIC WIND SPEED (FT/
          /SEC)
  F      -INPUT VALUE CONTAINING THE CORIOLIS PARAMETER (1/SEC)
  TD     -INPUT VALUE CONTAINING THE AIR-SEA TEMPERATURE
          DIFFERENCE (CELSIUS)
  TH     -INPUT VALUE CONTAINING THE DIMENSIONLESS THERMAL WIND
          MAGNITUDE
  ETAH   -INPUT VALUE CONTAINING THE ANGLE BETWEEN THE
          GEOSTROPHIC WIND AND THE THERMAL WIND
  VST    -OUTPUT VALUE CONTAINING THE FRICTION VELOCITY (FT/SEC)
  PHI    -OUTPUT VALUE CONTAINING THE INFLOW ANGLE (RADIAN)
  ZC     -OUTPUT VALUE CONTAINING THE ROUGHNESS PARAMETER (FT)
  PARAM  -OUTPUT VALUE CONTAINING THE STABILITY LENGTH (FT)
REMARKS
  TO NOTICE THE UNITS OF THE PARAMETERS
SUBROUTINES AND FUNCTIONS REQUIRED
PSI(P)
SHR(PS)
ABS (IBM SCIENTIFIC LIBRARY)
LOG (IBM SCIENTIFIC LIBRARY)
SORT (IBM SCIENTIFIC LIBRARY)
ASIN (IBM SCIENTIFIC LIBRARY)
ATAN (IBM SCIENTIFIC LIBRARY)
SIN (IBM SCIENTIFIC LIBRARY)
COS (IBM SCIENTIFIC LIBRARY)
METHOD AND SOURCE
  CARPONE, V.J., 1969, 'SPECIFICATION OF THE WIND DISTRIBUTION IN
  THE MARINE BOUNDARY LAYER FOR WAVE FORECASTING', NEW YORK
  UNIVERSITY, DEPARTMENT OF METEOROLOGY AND OCEANOGRAPHY
.....

```



```

SUBROUTINE ITRATE(G,F,TD,TH,ETAH,VST,PHI,ZO,PARAM)
DATA C1/7.3627E-04/C2/1.3045E-03/C3/-1.4534E-03/B/3.E-04/TA/280./
VST=.0245*G
T=0.
ETA=0.
INDEX=1
IF(CABS(TD).GT.1.) GO TO 4
ZONL=0.
PARAM=C.
FI=0.
S=1.
GO TO 1110
PARAM=TA*VST**2/(.16*32.2*.1*TD)
ZONL=((B*G)/F)/PARAM
FI=PSI(ZONL)
S=SHR(ZONL)
1110 CPA=(G/(F*S))*(LOG(B*G/(F*(C1/VST+C2*VST**2+C3)))-FI)
RFT=SOFT(S*F**2/(2*VST*.4*B*G))
P=SOFT(1.+2.*CPA**2*BT**2+2.*CPA*3*BT)
F=SOFT(1.+(F**2**2*CPA**2)/G**2-(2.*F*T*CPA*COS(ETA))/G)
ALPHA=ASIN(CPA*BT/P)
ARGUM=(F*T*CPA*BT*SI(ETA)/(R*G))
GAMMA=ASIN(ARGUM)
PHI=ATAN(SIN(ALPHA+GAMMA)/(P/R-COS(ALPHA+GAMMA)))
1114 VSTN=((.4*G*F*SI(ALPHA+GAMMA))/(P*SI(PHI)))/(LOG(B*G/F*(C1/VST+
* C2*VST**2+C3)))-FI)
IF(TEST-.05)1130,1130,1120
VST=VSTN
GO TO 1110
IF(ZONL-G.)1140,1150,1140
F=VST(33./PARAM)
PARAMNU=(VST**2*TA*(LOG(33./(C1/VST+C2*VST**2+C3))-FE))/(5.15*TD)
1142 IF(CABS(PARAMNU-PARAM).LT.5) GO TO 1150
PARAM=PARAMNU
GO TO 6
1150 IF(INDEX-2)1152,1155,1152
1152 T=TH
ETA=ETAH
INDEX=2
GO TO 1110
ZC=C1/VST+C2*VST**2+C3
1155 RETURN
END

```



```

.....
FUNCTION PSI(P)
.....
PSI 0020
PSI 0030
PSI 0040
PSI 0050
PSI 0060
PSI 0070

```

```

.....
FUNCTION PSI(P)
IF(P.GT.0.) GO TO 40
5 S=SHR(P)
PSI=1.-S-3.*LOG(S)+2.*LOG((1.+S)/2)+2.*ATAN(S)-1.5708+
*LOG((1.+S**2)/2.)
GO TO 50
40 PSI=-7.*P
50 RETURN
END

```

```

CCCCCCC

```

```

.....
FUNCTION SHR(PS)
.....
SHR 0080
SHR 0090
SHR 0100
SHR 0110
SHR 0120
SHR 0130
SHR 0140
SHR 0150
SHR 0160
SHR 0170
SHR 0180
SHR 0190

```

```

.....
FUNCTION SHR(PS)
IF(PS.GT.0.) GO TO 40
5 RI=PS
10 RINEW=PS*(1.-18.*RI)**(1./4.)
20 IF(ABS(RINEW-RI).LT..001) GO TO 30
RI=RINEW
GO TO 10
30 SHR=1./((1.-18.*RINEW)**(1./4.))
GO TO 50
40 SHR=1.+7.*PS
50 RETURN
END

```

```

SHR 0080
SHR 0090
SHR 0100
SHR 0110
SHR 0120
SHR 0130
SHR 0140
SHR 0150
SHR 0160
SHR 0170
SHR 0180
SHR 0190

```


APPENDIX J

FORTRAN IV SUBPROGRAM DRAW FOR IBM 360/OS

```

.....
SUBROUTINE DRAW
.....
PURPOSE
  TO NEUTRALIZE THE 'IBM SUBROUTINE DRAW'
.....
USAGE
  CALL DRAW(I,A,B,J,K,LABEL,ITITLE,D,E,K1,K2,L1,L2,L3,L4,L5,
    LAST)
.....
REMARKS
  (1) IF THIS SUBROUTINE IS INCLUDED IN A GIVEN PROGRAM, THIS
  WON'T HAVE OUTPUT PLOTS
  (2) IF THIS SUBROUTINE IS INCLUDED IN A GIVEN PROGRAM, THE
  OUTPUT VALUE OF 'LAST' WILL BE 9
.....
SUBROUTINE DRAW(I,A,B,J,K,LABEL,ITITLE,D,E,K1,K2,L1,L2,L3,L4,L5,
  *LAST)
  LAST=9
  RETURN
  END
.....
DRAW0010
DRAW0020
DRAW0030
DRAW0040
DRAW0050
DRAW0060
DRAW0070
DRAW0080
DRAW0090
DRAW0100
DRAW0110
DRAW0120
DRAW0130
DRAW0140
DRAW0150
DRAW0160
DRAW0170
DRAW0180
DRAW0190
DRAW0200

DRAW0210
DRAW0220
DRAW0230
DRAW0240
DRAW0250

```

CCCCCCCCCCCCCCCCCCCCCCCCCCCC

MODIFICATION TO THE FORTRAN IV BASIC
COMPUTER PROGRAM (APPENDIX F) TO INCLUDE
THE SUBPROGRAM PROPAR (APPENDIX I)

MAIN0010
MAIN0020
MAIN0030
MAIN0040
MAIN0050
MAIN0060
MAIN0070

MAIN4681
MAIN4682
MAIN4683
MAIN4684
MAIN4685
MAIN4686
MAIN4687
MAIN4688

MAIN5680
MAIN5690
MAIN5700
MAIN5710
MAIN5720
MAIN5730
MAIN5740
MAIN5750
MAIN5760
MAIN5770
MAIN5775
MAIN5780
MAIN5790
MAIN5791
MAIN5792
MAIN5793
MAIN5794
MAIN5795
MAIN5800
MAIN5810
MAIN5811
MAIN5812
MAIN5813
MAIN5814
MAIN5815
MAIN5820
MAIN5830
MAIN5831

MAIN PROGRAM

```
COMMON/WORKH/W00(20,12),W01(20,12),W02(20,12),W03(20,12),
*W05(20,12),W10(20,12),ZM00(20,12),ZM01(20,12),ZM02(20,12),
*ZM03(20,12),ZM05(20,12),ZM10(20,12),TD00(20,12),TD01(20,12),
*TD02(20,12),TD03(20,12),TD05(20,12),TD10(20,12),ZTM00(20,12),
*ZTM01(20,12),ZTM02(20,12),ZTM03(20,12),ZTM05(20,12),ZTM10(20,12),
*ZQ00(20,12),ZQ01(20,12),ZQ02(20,12),ZQ03(20,12),ZQ05(20,12),
*ZQ10(20,12),SLN00(20,12),SLN01(20,12),SLN02(20,12),SLN03(20,12),
*SLN05(20,12),SLN10(20,12)
```

PROCESSING THE WIND FIELD

```
310 READ(5,310) XGRID,YGRID,KKK,KAMMA1,KKK
    FORMAT(2F10.0,2I3)
    PFAD(5,312) W00(NORDER,ISTA),KANG00(NORDER,ISTA),
    *ZM00(NORDER,ISTA),TD00(NORDER,ISTA),ZTM00(NORDER,ISTA)
312 FOPMAT(F10.0,I3,3F10.0)
    CALL PROPAR(W00(NORDER,ISTA),ZM00(NORDER,ISTA),TD00(NORDER,ISTA),
    *ZTM00(NORDER,ISTA),R00(NORDER,ISTA),Z000(NORDER,ISTA),
    *SLN00(NORDER,ISTA))
    CALL WIND00(NORDER,ISTA,XGRID,YGRID,KKK,N10,LABEL,ITITL4,KAMMA1,
    *N10)
    PFAD(5,312) W01(NORDER,ISTA),KANG01(NORDER,ISTA),
    *ZM01(NORDER,ISTA),TD01(NORDER,ISTA),ZTM01(NORDER,ISTA),
    *CALL PROPAR(W01(NORDER,ISTA),ZM01(NORDER,ISTA),TD01(NORDER,ISTA),
    *ZTM01(NORDER,ISTA),R01(NORDER,ISTA),Z001(NORDER,ISTA),
    *SLN01(NORDER,ISTA))
    CALL WIND01(NORDER,ISTA,XGRID,YGRID,KKK,N10,LABEL,ITITL4,KAMMA1,
    *N10)
    PFAD(5,312) W02(NORDER,ISTA),KANG02(NORDER,ISTA),
    *ZM02(NORDER,ISTA),TD02(NORDER,ISTA),ZTM02(NORDER,ISTA),
    *CALL PROPAR(W02(NORDER,ISTA),ZM02(NORDER,ISTA),TD02(NORDER,ISTA),
    *ZTM02(NORDER,ISTA),R02(NORDER,ISTA),Z002(NORDER,ISTA),
    *SLN02(NORDER,ISTA))
    CALL WIND02(NORDER,ISTA,XGRID,YGRID,KKK,N10,LABEL,ITITL4,KAMMA1,
    *N10)
    PFAD(5,312) W03(NORDER,ISTA),KANG03(NORDER,ISTA),
```


MAIN5832
MAIN5833
MAIN5834
MAIN5835
MAIN5840
MAIN5850
MAIN5851
MAIN5852
MAIN5853
MAIN5854
MAIN5855
MAIN5860
MAIN5870
MAIN5871
MAIN5872
MAIN5873
MAIN5874
MAIN5875
MAIN5880
MAIN5890
MAIN5900

```
* ZM03(NORDER, ISTA), TD03(NORDER, ISTA), ZTM03(NORDER, ISTA)
* CALL PRCPAR(W03(NORDER, ISTA), ZM03(NORDER, ISTA), TD03(NORDER, ISTA),
* ZTM03(NORDER, ISTA), R03(NORDER, ISTA), Z003(NORDER, ISTA),
* SLN03(NORDER, ISTA))
* CALL WIND03(NORDER, ISTA, XGRID, YGRID, KKK, N10, LABEL, ITITL4, KAMMAL,
* N10)
* READ(5, 312) W05(NORDER, ISTA), KANG05(NORDER, ISTA),
* ZM05(NORDER, ISTA), TD05(NORDER, ISTA), ZTM05(NORDER, ISTA),
* CALL PRCPAR(W05(NORDER, ISTA), ZM05(NORDER, ISTA), TD05(NORDER, ISTA),
* ZTM05(NORDER, ISTA), R05(NORDER, ISTA), Z005(NORDER, ISTA),
* SLN05(NORDER, ISTA))
* CALL WIND05(NORDER, ISTA, XGRID, YGRID, KKK, N10, LABEL, ITITL4, KAMMAL,
* N10)
* READ(5, 312) W10(NORDER, ISTA), KANG10(NORDER, ISTA),
* ZM10(NORDER, ISTA), TD10(NORDER, ISTA), ZTM10(NORDER, ISTA),
* CALL PRCPAR(W10(NORDER, ISTA), ZM10(NORDER, ISTA), TD10(NORDER, ISTA),
* ZTM10(NORDER, ISTA), R10(NORDER, ISTA), Z010(NORDER, ISTA),
* SLN10(NORDER, ISTA))
* CALL WIND10(NORDER, ISTA, XGRID, YGRID, KKK, N10, LABEL, ITITL4, KAMMAL,
* N10)
450 CONTINUE
```

.....

CCC

MODIFICATION TO THE FORTRAN IV BASIC
COMPUTER PROGRAM (APPENDIX F) TO INCLUDE
THE SUBPROGRAM ITRATE (APPENDIX J)

MAIN0010
MAIN0020
MAIN0030
MAIN0040
MAIN0050
MAIN0060
MAIN0070

MAIN4681
MAIN4682
MAIN4683
MAIN4684
MAIN4685
MAIN4686
MAIN4687
MAIN4688
MAIN4689

MAIN5680
MAIN5690
MAIN5700
MAIN5710
MAIN5720
MAIN5730
MAIN5740
MAIN5750
MAIN5760
MAIN5770
MAIN5775
MAIN5780
MAIN5790
MAIN5791
MAIN5792
MAIN5793
MAIN5794
MAIN5795
MAIN5800
MAIN5810
MAIN5811
MAIN5812
MAIN5813
MAIN5814
MAIN5815
MAIN5820
MAIN5830

MAIN PROGRAM

```
COMMON/WORKG/W00(20,12),W01(20,12),W02(20,12),W03(20,12),W04(20,12),
*W05(20,12),W10(20,12),TD00(20,12),TD01(20,12),TD02(20,12),
*TD03(20,12),TD05(20,12),TD10(20,12),TH00(20,12),TH01(20,12),
*TH02(20,12),TH03(20,12),TH05(20,12),TH10(20,12),ETAH00(20,12),
*ETAH01(20,12),ETAH02(20,12),ETAH03(20,12),ETAH05(20,12),PHI03(20,12),
*ETAH10(20,12),PHI01(20,12),PHI02(20,12),Z002(20,12),
*PHI05(20,12),PHI10(20,12),Z000(20,12),Z001(20,12),PARM01(20,12),
*Z003(20,12),Z005(20,12),Z010(20,12),PARM00(20,12),PARM10(20,12),F(12),
*PARM02(20,12),PARM03(20,12),PARM05(20,12),PARM10(20,12),F(12)
```

PROCESSING THE WIND FIELD

```
310 READ(5,310) XGRID,YGRID,KKK,KAMMAL,KKK,F(ISTA)
      FORMAT(2F10.0,2I3,F10.0)
      *TD00(NORDER,ISTA),TH00(NORDER,ISTA),KAN00(NORDER,ISTA),
312 *CALL ITRATE(W00(NORDER,ISTA),3F10.0)
      *TH00(NORDER,ISTA),ETAH00(NORDER,ISTA),F(ISTA),TD00(NORDER,ISTA),
      *PHI00(NORDER,ISTA),Z000(NORDER,ISTA),PARM00(NORDER,ISTA),
      *CALL WIND00(NORDER,ISTA,XGRID,YGRID,KKK,N10,LABEL,ITITL4,KAMMAL,
      *N10)
      *READ(5,312) W01(NORDER,ISTA),KAN01(NORDER,ISTA),
      *TD01(NORDER,ISTA),TH01(NORDER,ISTA),ETAH01(NORDER,ISTA),
      *CALL ITRATE(W01(NORDER,ISTA),F(ISTA),TD01(NORDER,ISTA),
      *TH01(NORDER,ISTA),ETAH01(NORDER,ISTA),F01(NORDER,ISTA),
      *PHI01(NORDER,ISTA),Z001(NORDER,ISTA),PARM01(NORDER,ISTA),
      *CALL WIND01(NORDER,ISTA,XGRID,YGRID,KKK,N10,LABEL,ITITL4,KAMMAL,
      *N10)
      *READ(5,312) W02(NORDER,ISTA),KAN02(NORDER,ISTA),
      *TD02(NORDER,ISTA),TH02(NORDER,ISTA),ETAH02(NORDER,ISTA),
      *CALL ITRATE(W02(NORDER,ISTA),F(ISTA),TD02(NORDER,ISTA),
      *TH02(NORDER,ISTA),ETAH02(NORDER,ISTA),F02(NORDER,ISTA),
      *PHI02(NORDER,ISTA),Z002(NORDER,ISTA),PARM02(NORDER,ISTA),
      *CALL WIND02(NORDER,ISTA,XGRID,YGRID,KKK,N10,LABEL,ITITL4,KAMMAL,
      *N10)
```



```

READ(5,312) W03(NORDER,ISTA),KANG03(NORDER,ISTA),
*TD03(NORDER,ISTA),TH03(NORDER,ISTA),ETAH03(NORDER,ISTA),
CALL ITRATE(W03(NORDER,ISTA),F(ISTA),TD03(NORDER,ISTA),
**TH03(NORDER,ISTA),ETAH03(NORDER,ISTA),F03(NORDER,ISTA),
**PHI03(NORDER,ISTA),Z003(NORDER,ISTA),PAPM03(NORDER,ISTA))
CALL WIND03(NORDER,ISTA,XGRID,YGRID,KKK,NIO,LABEL,ITITL4,KAMMAL,
*NIO)
READ(5,312) W05(NORDER,ISTA),KANG05(NORDER,ISTA),
*TD05(NORDER,ISTA),TH05(NORDER,ISTA),ETAH05(NORDER,ISTA),
CALL ITRATE(W05(NORDER,ISTA),F(ISTA),TD05(NORDER,ISTA),
**TH05(NORDER,ISTA),ETAH05(NORDER,ISTA),F05(NORDER,ISTA),
**PHI05(NORDER,ISTA),Z005(NORDER,ISTA),PARM05(NORDER,ISTA),
CALL WIND05(NORDER,ISTA,XGRID,YGRID,KKK,NIO,LABEL,ITITL4,KAMMAL,
*NIO)
READ(5,312) W10(NORDER,ISTA),KANG10(NORDER,ISTA),
*TD10(NORDER,ISTA),TH10(NORDER,ISTA),ETAH10(NORDER,ISTA),
CALL ITRATE(W10(NORDER,ISTA),F(ISTA),TD10(NORDER,ISTA),
**TH10(NORDER,ISTA),ETAH10(NORDER,ISTA),F10(NORDER,ISTA),
**PHI10(NORDER,ISTA),Z010(NORDER,ISTA),PARM10(NORDER,ISTA),
CALL WIND10(NORDER,ISTA,XGRID,YGRID,KKK,NIO,LABEL,ITITL4,KAMMAL,
*NIO)
CONTINUE

```

UUU

APPENDIX M

MODIFICATION TO THE FORTRAN IV BASIC COMPUTER PROGRAM (APPENDIX F) TO INCLUDE THE SUBPROGRAM TREND (APPENDIX G)

```

.....
MAIN PROGRAM
.....
COMMON/MODKRF/SEXT(50),VEXT(50),STOP(50),SPDT(50),VISC(50),V1(50),
*SMAX(50),VMAX(50),SMIN(50),VMIN(50)
.....
WRITE(6,43)(I40,IG(I40),I40,ZG(I40),I40=1,NDP)
CALL TREND(NDP)
CALL LINTPS(NDP,NTW,M60)
.....

```

CCCCCCCCCC
 CCCCC
 CCCCC

MAIN0010
 MAIN0020
 MAIN0030
 MAIN0040
 MAIN0050
 MAIN0060
 MAIN0070

 MAIN4684
 MAIN4686

 MAIN5470
 MAIN5475
 MAIN5480

APPENDIX N

JOB CONTROL LANGUAGE (JCL) FOR
THE HEAD PART OF THE FORTRAN IV
BASIC COMPUTER PROGRAM (APPENDIX F)

```
a //SAL10079 JOB (0C79,0581ET,CPO2),SALDANHA,TIME=(5,)
b //      EXEC FORTCLGP,REGION,FORT=150K,REGION.GO=30CK,TIME.GO=(5,)
c //FRT.SYSPRINT DD SYSOUT=A,SPACE=(CYL,(3,1))
d //FRT.SYSIN DD DSN=SSD3(MISR),DISP=SHR
e //
```


APPENDIX O

JOB CONTROL LANGUAGE (JCL) FOR THE
LAST PART OF THE FORTRAN IV BASIC
COMPUTER PROGRAM (APPENDIX F)

```

a //GC.FTC6F001 DD SPACE=(CYL,(20,3))
b //GC.FTC9F001 DD DSN=SO079.DATA,UNIT=2314,VOL=SER=QUEFY,
c //          DI SP=(OLD,KEEP),DCB=(RECFM=VBS,BLKSIZE=3500),
d //          SPACE=(CYL,1),LABEL=EXPT=71274
e //GC.SYSIN DD *
```


APPENDIX P

JOB CONTROL LANGUAGE (JCL) FOR THE
LAST PART OF THE FORTRAN IV BASIC
COMPUTER PROGRAM (APPENDIX F)

```
a //GO.FT06F001 DD DUMMY
b //GO.FT06F001 DD DSN=S0079.DAT,UNIT=2314,VOL=SER=DUEFY,
c // DISP=(OLD,KEEP),DCB=(RECFM=VBS,BLKSIZE=3500),
d // SPACE=(CYL,J),LABEL=EXPT=71274
e //GO.SYSIN DD *
```


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ABSTRACT <p>Oceanographic and meteorologic data, namely expendable or mechanical bathythermograph traces and wind reports have been systematically collected for years and every day more observations are made.</p> <p>To handle such a large amount of information, it is advantageous to set up a computerized model which is: (1) automatic, (2) performs an objective analysis of XBT/BT traces to identify the most significant thermal features, such as thermoclines and inversions, (3) restricts the human participation to an initial stage dealing with organization of data available and selection of proper values for the parameters of the model, and (4) preserves the initial information.</p> <p>A FORTRAN IV program takes into consideration the above requirements to: (1) perform objective analyses of XBT/BT digital traces, (2) process wind information, (3) study the statistical characteristics of the original and processed data, and (4) plot the generated fields.</p> <p>The digital model was tested and its application may be extended to the study of any environmental variable continuously distributed along a vertical or horizontal axis.</p>			

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