

RECOMP II USERS' PROGRAM NO. 1125

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY PROGRAM

PROGRAM CLASSIFICATION: General

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PURPOSE: To compute specific volume
anomalies from oceanographic
station data.

DATE: June 4, 1962

Published by

RECOMP Users' Library

at

AUTONETICS INDUSTRIAL PRODUCTS

A DIVISION OF NORTH AMERICAN AVIATION, INC.

3400 East 70th Street, Long Beach 5, California

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1.0 INTRODUCTION

Given the temperature and salinity at depth, it is desired to describe the density field. In oceanography, the reciprocal of the density, called the specific volume, is generally used. For convenience in application, this is expressed as an anomaly, i.e. the difference between the actual specific volume and the specific volume of water of salinity 35‰ at 0 C.

2.0 METHOD

The techniques described in Processing Oceanographic Data by E. C. LaFond (1951, U.S. Hydrographic Office Publication #614) were used, corrected according to the original publication by Ekman in 1908 (Ref. in LaFond).

The specific volume, $\alpha_{s,t,p}$, is computed as follows:

(t is the temperature in °C

p is the pressure in decibars, equivalent to the depth (d) in meters

s is the salinity in ‰)

First, the following quantities are computed:

$$A_t = 10^{-3} t \quad [4.7867 - 0.098185t + 0.0010843t^2]$$

$$B_t = 10^{-6} t \quad [18.030 - 0.8164t + 0.01667t^2]$$

$$C_t = 28.33 - 0.551t + 0.004t^2$$

$$D_t = 105.5 + 9.50t - 0.158t^2$$

$$E_t = 147.3 - 2.72t + 0.04t^2$$

$$F_t = 32.4 - 0.87t + 0.02t^2$$

and $G = \frac{4886}{1 + 10^{-4} p(.183)} - 227$

Then $\sigma_o = -0.069 + 1.4708 \frac{(s - 0.030)}{1.805} - 0.00157 \frac{(s - 0.030)^2}{1.805} + 0.0000398 \frac{(s - 0.030)^3}{1.805}$ *1

$$\Sigma_t = - \frac{(t - 3.98)^2}{503.57} \left(\frac{t + 283}{t + 67.26} \right)$$

$$\sigma_{s,t,o} = \Sigma_t + (\sigma_o + 0.1324) \left[1 - A_t + B_t (\sigma_o - 0.1324) \right] \quad *2$$

and

$$\alpha_{s,t,o} = \frac{1}{1 + 10^{-3} \sigma_{s,t,o}}$$

The specific volume $\alpha_{s,t,p}$ is found:

$$10^5 \alpha_{s,t,p} = \alpha_{s,t,o} \left\{ 10^5 - 10^{-4} p \left[G - tC_t + 10^{-4} p (Dt - 10^{-4} p \times 1.5t) + \frac{(\sigma_o - 28)}{10} (-E_t + 10^{-4} p F_t) + \frac{(\sigma_o - 28)^2}{10} (4.5 - 0.1t - 10^{-4} p (1.8 - 0.06t)) \right] \right\}$$

$$\text{Then } 10^5 \alpha_{35,0,p} = \alpha_{35,0,0} \left\{ 10^5 - 10^{-4} p \left[G + 105.5 \times 10^{-4} p - (\sigma_{35,0,0} - 28) (14.73 - 3.24 \times 10^{-4} p) \right] \right\}$$

*1 The value of $\frac{s - 0.030}{1.8050}$ represents the CHLORINITY, defined according to the determinations of Knudsen in 1901 (Ref. in LaFond).

*2 $\sigma_{s,t,o}$ is more commonly known as σ_t . Printing out σ_t would involve only a small modification to the program.

where G is defined above and

$$\alpha_{35,0,0} = 0.972643; \quad \sigma_{35,0,0} = 28.126$$

Finally, the specific volume anomaly, $10^5 \delta$, is computed:

$$10^5 \delta = 10^5 \alpha_{s,t,p} - 10^5 \alpha_{35,0,p}$$

$10^5 \delta$ is printed and punched out.

3.0 RESTRICTIONS

- a) The typewriter is used for direct input of data and output of results. The punch is also used for output of results.
- b) The data for a station must be in order of increasing depth.
- c) The program uses subroutines AN-002 and AN-015.

4.0 USAGE

- a) The program occupies 0001 - 1227.
- b) Typewriter tabs should be set up for 4 columns of data (e.g. left margin at 10 and tabs at 25, 40, 55, and right margin greater than 70. Set toggle switch on typewriter to TAB.
- c) Operating Instructions
 - 1) Read in and verify program tape.
 - 2) Press START 1. A location counter setting of 1247 will be punched onto the tape. Typewriter will type STATION.
 - 3) Type in station number (must have 4 digits). Station number will be punched on tape, and headings D, T, S, DELTA will print out.
 - 4) Machine will wait for data input with location counter at 7775.1. Type in the depth, followed by a tab, and then type in the temperature, and the salinity, tabbing after each entry. After the salinity is entered, computing will start, and $10^5 \times$ specific volume anomaly will be punched out.

NOTE: If an error is made in typing data, press slash (/) key, and computer will be re-set to accept the corrected depth, temperature, and salinity.

Pressing START 3 will also set computer up for corrected data.

5) Repeat step 4 until the end of the station is reached. At the end of a station, press error reset and clear buttons. Then press START 2. An ending will be punched on tape.

6) For more stations, repeat procedure from step 2.

d) The punched tape output from this program may be used as input to the WHOI dynamic heights program. To suppress this punched output the following changes should be made to the program:

Locations 0355: -0000000 + 5703600, 0452: + 5704530 - 0000000 and
0454: + 5704621 + 7477600.

5.0 EXAMPLE

Sample problem:

see enclosed page with typewriter input and output shown for
Crawford 0421

6.0 CODING INFORMATION

a) Constants: The number of constants is large, so no list is made here. See the symbolic program listing for constants.

b) Subroutines

AN-002 0500 - 0637

AN-015 0650 - 1127

c) Temporary storage for input:

d (depth) in locations 0074 -75

t (temperature) in locations 0160 -0161

s (salinity) in locations 0076 -77

Temporary storage for output:

d (depth) in locations 0474 - 75

Delta (10^5 X specific volume) in locations 0130 - 31

d) Timing estimates:

The average timing for a typical set of station data is:

Printing of headings and entering of station number.....8 sec

Entering of one set of d,t,s.....7.4 sec

Computation of δ and print-out of δ 5.7 secPunch-out of d and δ 2.2 sec

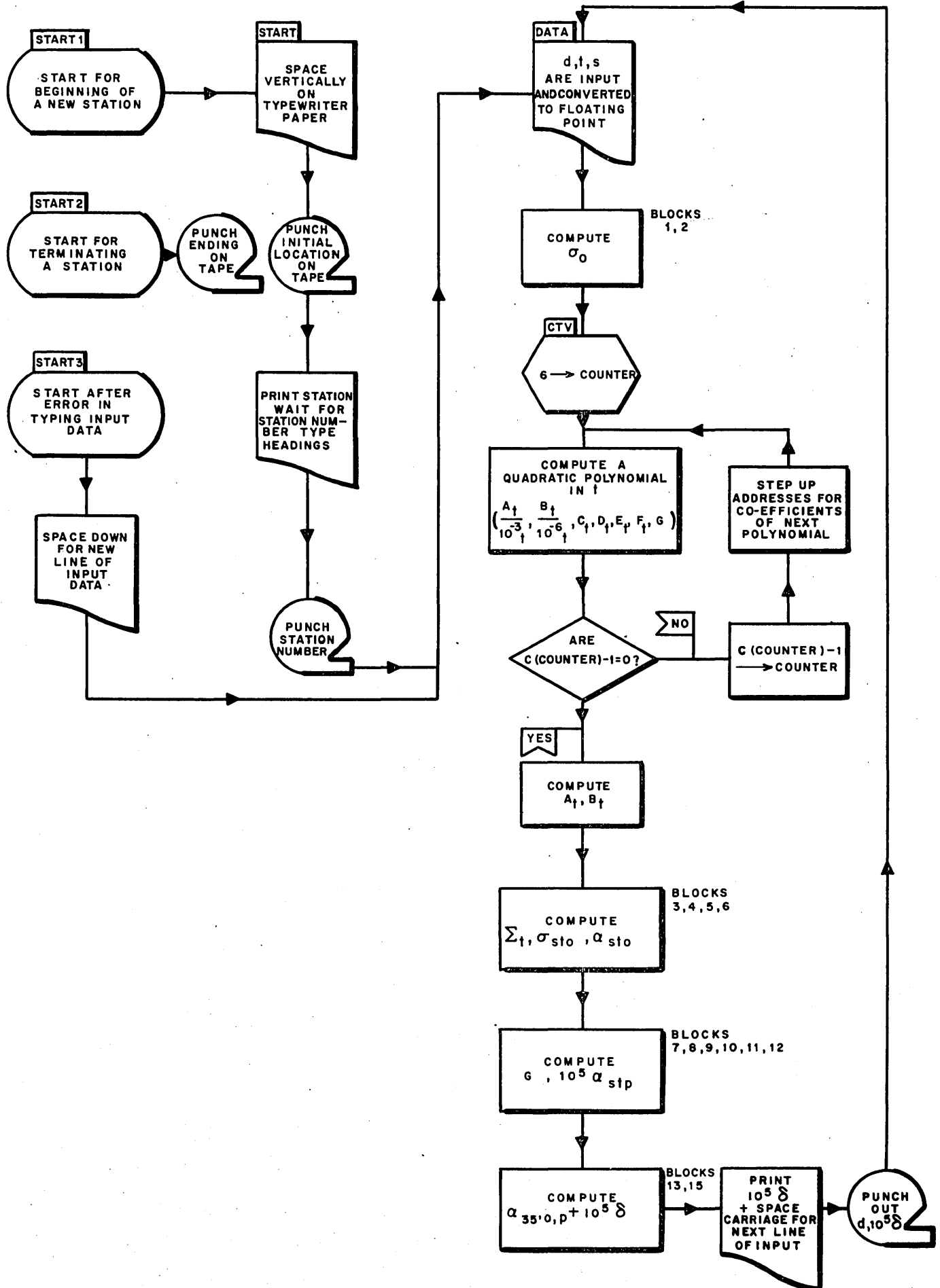
For one entry of d,t,s.....15.3 sec

Total time to run average station of 25 entries = 390.5 sec

= 6.5 min

STATION 0421

D	T	S	DELTA
0	22.21	36.664	254.7
50	22.10	36.679	252.6
100	21.82	36.651	249.1
200	17.39	35.899	196.2
295	14.42	35.421	168.3
395	12.64	35.177	153.1
495	10.03	34.824	133.6
595	07.82	34.584	117.4
695	06.05	34.428	105.0
795	04.84	34.364	95.2
895	04.06	34.358	87.1
995	03.47	34.403	77.7
1195	03.30	34.563	65.3
1395	03.51	34.742	56.2
1580	03.43	34.828	50.3
1780	03.33	34.891	45.9
1975	03.38	34.944	44.2
2175	03.24	34.946	43.5
2375	03.11	34.944	43.2
2570	02.99	34.940	43.1
2870	02.83	34.933	43.1
3170	02.67	34.921	43.2
3465	02.39	34.896	42.2
3765	01.48	34.804	35.7
4065	00.52	34.705	28.6



PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
00540				10P ⁵				10 ⁺⁵ = 100,000.0
1								
00550								
1								
00560								
1								
00570	+	00	00000	R1.0				
1	-	00	00010					
00600	-	26	00700	STATION				
1	-	33	03020					
00610	+	75	02040	HEAD				
1	-	47	32171					
00620	+	03	32171	+1				
1	-	27	32171					
00630	-	44	14500	+2				
1	-	15	02151					
00640	+	00	00000	LB IND				
1	-	00	00170					
00650	+	00	00000	LB INT				
1	-	00	00041					
00660	+	00	00000	LB INS				
1	-	00	00041					
00670	+	00	00000	R2.0				
1	-	00	00020					

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
01510								
1								
01520						DEC		-0.069
1								
01530								
1								
01540						DEC		Temp. Storage
1								
01550								
1								
01560								
1								
01570								
1								
01600				t				temperature
1								
01610								
1								
01620	+	30	77600			FCA	7760	
1	+	07	77700			FMP	7770	
01630	+	04	77720			FAD	7772	
1	+	07	77600			FMP	7760	
01640	+	04	77740			FAD	7774	
1	+	35	01020	POLY		FST	A _t	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
01650	+	00	77671			CLA	7767.1	
1	+	03	00570			SUB	R1.0	
01660	+	50	04171			TZE	ØUT	
1	+	57	04131			TRA	ST UP	
01670	+	00	00000	CTER 1		PZE	0	
1	-	00	00060			MZE	6	
01700	+	30	01600	BLØCK 3		FCA	t	
1	+	07	77700			FMP	7770	
01710	+	35	77760			FST	7776	
1	+	07	77700			FMP	7770	
01720	+	07	01040			FMP	B _t	
1	+	35	01040			FST	B _t	$B_t = t \times 10^{-6}$ (18.030 - 0.8164t + 0.1667t ²)
01730	+	30	77760			FCA	7776	
1	+	07	01020			FMP	A _t	
01740	+	35	01020			FST	A _t	$A_t = 10^{-3}t$ (4.7867 - 0.098185t + 0.0010843t ²)
1	+	30	01000			FCA	SIGMA 0	
01750	+	06	77720			FSB	7772	
1	+	35	77760			FST	7776	($\sigma_0 - 0.1324$)
01760	+	07	01040			FMP	B _t	
1	+	06	01020			FSB	A _t	
01770	+	04	77740			FAD	7774	1 - A _t + B _t ($\sigma_0 - 0.1324$)
1	+	57	04460			TRA	PATCH 2	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
02000				BLØCK 4		DEC		$10^{-3} = +0.001$
1								
02010								
1								
02020						DEC		+0.1324
1								
02030								
1								
02040						DEC		+1.0
1								
02050								
1								
02060								ERASABLE
1								
02070								
1								
02100	+	30	01600	BLØCK 5		FCA	t	
1	+	04	77700			FAD	7770	t + 67.26
02110	+	35	77700			FST	7770	
1	+	04	77720			FAD	7772	t + 283
02120	+	05	77700			FDV	7770	
1	+	35	77700			FST	7770	(t + 283) / (t + 67.26)
02130	+	30	01600			FCA	t	
1	+	06	77740			FSB	7774	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
02450								
1								
02460						DEC		+227.0
1								
02470								
1								
02500	+	34	01600	BLØCK 9		FCS	t	
1	+	07	01060			FMP	C _t	
02510	+	04	01160			FAD	G	
1	+	35	01220			FST	SUM	G - tC _t
02520	+	30	00740			FCA	p	
1	+	07	01600			FMP	t	
02530	+	07	77720			FMP	7772	-1.5t x 10 ⁻⁴ p
1	+	04	01100			FAD	D _t	
02540	+	07	00740			FMP	p	
1	+	04	01220			FAD	SUM	
02550	+	35	01220			FST	SUM	G - t C _t + 10 ⁻⁴ pD _t - 10 ⁻⁸ 1.5 p ² t
1	+	30	01000			FCA	SIGMA 0	
02560	+	06	77740			FSB	7774	
1	+	05	77760			FDV	7776	
02570	+	35	01240			FST	SIGMA Sq	
1	+	30	00740			FCA	p	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
02600	+	07	01140	BLØCK 10		FMP	F _t	
1	+	06	01120			FSB	E _t	
02610	+	07	01240			FMP	SIGMA Sq	
1	+	57	04260			TRA	MAIN 4	
02620						DEC		-1.5
1								
02630								
1								
02640						DEC		+28.0
1								
02650								
1								
02660						DEC		+10.0
1								
02670								
1								
02700	+	30	01600	BLØCK 11		FCA	t	
1	+	07	77700			FMP	7770	0.06t
02710	+	04	77720			FAD	7772	1.8 - 0.06t
1	+	07	00740			FMP	p	
02720	+	35	77660			FST	7766	10 ⁻⁴ _p (1.8 - 0.06t)
1	+	34	77740			FCS	7774	
02730	+	07	01600			FMP	t	-0.1t
1	+	04	77760			FAD	7776	+4.5

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
02740	+	06	77660			FSB	7766	$[4.5 - 0.1t - 10^{-4}p$ $(1.8 - 0.06t)]$
1	+	07	01240			FMP	SIGMA Sq	
02750	+	07	01240			FMP	SIGMA Sq	$(\frac{\sigma_0 - 28}{10})^2 []$
1	+	57	04301			TRA	MAIN 5	
02760								ERAS. STORAGE
1								
02770								
1								
03000				BLØCK 12		DEC		+0.06
1								
03010								
1								
03020						DEC		+1.8
1								
03030								
1								
03040						DEC		+0.1
1								
03050								
1								
03060						DEC		+4.5
1								
03070								
1								
03100	+	66	03200	BLØCK 13		CTV	BLØCK 14	
1	+	34	00740			FCS	p	
03110	+	07	77700			FMP	7770	
1	+	04	77720			FAD	7772	
03120	+	35	77660			FST	7766	$14.73 - 3.24 \times 10^{-4}p$
1	+	30	77740			FCA	7774	
03130	+	06	77760			FSB	7776	$(\sigma_{35,0,0} - 28)$
1	+	07	77660			FMP	7766	$(\sigma_{35,0,0} - 28) (14.73 - 0.000324p)$

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ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
03140	+	66	03400			CTV	BLØCK 16	
1	+	57	04351			TRA	MAIN 6	
03150								
1								
03160								ERASABLE STORAGE
1								
03170								
1								
03200				BLØCK 14		DEC		+3.24
1								
03210								
1								
03220						DEC		+14.730
1								
03230								
1								
03240						DEC		$\sigma_{35,0,0} = +28.126$
1								
03250								
1								
03260						DEC		+28.0
1								
03270								
1								
03300	+	35	77760	BLØCK 15		FST	7776	$+(\sigma_{35,0,0} - 28)$ $(14.73 - 3.24 \times 10^{-4}p)$
1	+	30	00740			FCA	p	
03310	+	07	77720			FMP	7772	0.01055p
1	+	06	77760			FSB	7776	
03320	+	04	01160			FAD	G	
1	+	57	04500			TRA	PATCH 3	
03330	+	04	77700			FAD	7770	
1	+	07	77740			FMP	7774	
03340	+	35	01320			FST	ALPHA 35p	$10^5 \sigma_{35,o,p}$
1	+	30	01260			FCA	ALPHA stp	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
03500								
1								
03510								
1								
03520	+	00	04700			CLA	MZE	
1	+	74	77600			PNC	7760	
03530	+	74	77600			PNC	7760	
1	+	57	03551			TRA	New ST	
03540	-	00	00000	LOCSET		MZE	0	
1	-	00	12470			MZE	1247	To set location counter for storage of station data from this tape for program II (dynamic heights)
03550	-	00	00000					
1	+	74	00160	NEW ST		PNC	C	
03560	+	14	03540			PNW	LOCSET	
1	+	74	00220			PNC	L	
03570	+	74	00100			PNC	CR	
1	+	74	00150			PNC	F	

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ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
03600	+	72	00370	START		TYC	LS	
1	+	72	00100			TYC	CR	
03610	+	72	00100			TYC	CR	
1	+	00	00600			CLA	STATION	PRINT OUT STATION
03620	+	72	77600			TYC	7760	
1	+	72	00330			TYC	FS	
03630	+	71	77640			RDY	7764	WAIT FOR 4 CHARACTERS
1	+	60	00730			STØ	STN. NO.	
03640	+	57	04520			TRA	PATCH 4	
1	+	72	77600			TYC	7760	
03650	+	00	00620			CLA	HEAD + 1	
1	+	72	77600			TYC	7760	
03660	+	00	00630			CLA	HEAD + 2	
1	+	72	77600			TYC	7760	
03670	+	00	00640	DATA		CLA	LBIND	} Input Depth Using } AN002
1	+	57	05000			TRA	INPUT	
03700	+	57	00030			TRA	0003	Error Return
1	+	43	00000			XAR		Convert to Fl. Pt.
03710	+	00	00640			CLA	LBIND	
1	+	43	00000			XAR		
03720	+	45	00000			FNM		
1	+	57	04720			TRA	PATCH 9	
03730	+	00	00650			CLA	LBINT	Input Temp.
1	+	57	05000			TRA	INPUT	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
03740	+	57	00030			TRA	0003	Error Return
1	+	43	00000			XAR		Convert to Fl. Pt.
03750	+	00	00650			CLA	LBINT	
1	+	43	00000			XAR		
03760	+	45	00000			FNM		
1	+	35	01600			FST	t	
03770	+	00	00660			CLA	LBINS	Input Salinity
1	+	57	05000			TRA	INPUT	
04000	+	57	00030			TRA	0003	
1	+	43	00000			XAR		
04010	+	00	00660			CLA	LBINS	Convert to Fl. Pt.
1	+	43	00000			XAR		
04020	+	45	00000			FNM		
1	+	35	00760			FST	s	Finished Input
04030	+	64	01400			CTL	BLOCK 1	} Read constants into L + V Loops
1	+	66	01500			CTV	BLOCK 2	
04040	+	06	77600			FSB	7760	s - 0.030
1	+	05	77620			FDV	7762	$S = \frac{s - 0.030}{1.805}$
04050	+	35	77740			FST	7774	Note s is salinity input, S is chlorinity .0000398S
1	+	07	77640			FMP	7764	
04060	+	06	77660			FSB	7766	
1	+	07	77740			FMP	7774	S (.0000398S - .00157)
04070	+	04	77700			FAD	7770	
1	+	07	77740			FMP	7774	$S (.0000398S^2 - .00157S + 1.4708)$

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
04100	+	04	77720			FAD	7762	
1	+	35	01000			FST	SIGMA0	$\sigma_0 = -0.069 + 1.4798S - 0.00157S^2 + .0000398S^3$
04110	+	00	00700			CLA	LCØN	Initialize addresses
1	+	42	04121			STA	CTV	
04120	+	64	01600			CTL	t	
1	+	66	00000	CTV		CTV	[]	
04130	+	57	77620			TRA	7762	
1	+	60	77670	STUP		STØ	7767	
04140	+	00	04121			CLA	CTV	
1	+	01	11470			ADD	CTER1	
04150	+	42	04121			STA	CTV	
1	+	00	77640			CLA	7764	
04160	+	01	00670			ADD	R2.0	
1	+	42	77641			STA	7764.1	
04170	+	57	04121			TRA	CTV	
1	+	64	01700	ØUT		CTL	BLØCK 3	
04200	+	66	02000			CTV	BLØCK 4	
1	+	57	77600			TRA	7760	
04210	+	07	77760	MAIN 1		FMP	7776	
1	+	35	00710			FST	ERAS	
04220	+	64	02100			CTL	BLØCK 5	
1	+	66	02200			CTV	BLØCK 6	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
04230	+	57	77600			TRA	7760	
1	+	64	02300	MAIN 2		CTL	BLØCK 7	
04240	+	57	77600			TRA	7760	
1	+	64	02500	MAIN 3		CTL	BLØCK 9	
04250	+	66	02600			CTV	BLØCK 10	
1	+	57	77600			TRA	7760	
04260	+	04	01220	MAIN 4		FAD	SUM	
1	+	35	01220			FST	SUM	$G - tC + t \cdot 10^{-4} pD_t - 10^{-8}$ $1.5p^2t + \frac{\sigma_0 - 28}{10} \left[- E_t + 10^{-4} \right]$
04270	+	64	02700			CTL	BLØCK 11	
1	+	66	03000			CTV	BLØCK 12	
04300	+	57	77600			TRA	7760	
1	+	04	01220	MAIN 5		FAD	SUM	
04310	+	35	01220			FST	SUM	
1	+	07	00740			FMP	p	
04320	+	35	01220			FST	SUM	{ }
1	+	30	00540			FCA	10p5	
04330	+	06	01220			FSB	SUM	$10^{-5} - 10^{-4}p$ { }
1	+	07	01200			FMP	ALPHASTØ	
04340	+	35	01260			FST	ALPHASTP	$10^5 \propto_{s,t,p}$
1	+	64	03100			CTL	BLØCK 13	
04350	+	57	77600			TRA	7760	
1	+	64	03300	MAIN 6		CTL	BLØCK 15	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
04360	+	57	77600			TRA	7760	
1	+	57	06500	MAIN 7		TRA	PRINT	$10^{-5} \delta$ in A reg.
04370	+	00	04010			PZE	04010	use AN-015 to output
1	+	77	04371			HTR		
04400	+	72	00370			TYC	LS	
1	+	72	00100			TYC	CR	Space down for next line of data
04410	+	72	00330			TYC	FS	
1	+	57	04540			TRA	PATCH 5	
04420	+	07	00100	PATCH 1		FMP	$10M^3$	
1	+	04	00120			FAD	FL 1	
04430	+	35	00710			FST	ERAS	
1	+	30	00120			FCA	FL 1	
04440	+	05	00710			FDV	ERAS	
1	+	35	01200			FST	ALPHASTØ	
04450	+	57	04231			TRA	MAIN 2	
1								
04460	+	35	77760	PATCH 2		FST	7776	$1-A_t + B_t (\sigma_0 - 0.1324)$
1	+	30	01000			FCA	SIGMA 0	
04470	+	04	77720			FAD	7772	$\sigma_0 + 0.1324$
1	+	57	04210			TRA	MAIN 1	
04500	+	35	77760	PATCH 3		FST	7776	
1	+	34	00740			FCS	p	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
04510	+	07	77760			FMP	7776	
1	+	57	77630			TRA	7763	
04520	+	74	77600	PATCH 4		PNC	7760	Punch Out
1	+	74	00100			PNC	C/R	STN NØ
04530	+	00	00610			CLA	HEAD	
1	+	57	03641			TRA	0364.1	
04540	+	00	04740	PATCH 5		CLA	PUNCH p	Punch out p
1	+	74	77600			PNC	7760	↓
04550	+	74	00100			PNC	C/R	↓
1	+	00	04750			CLA	PUNCH p+1 and its exponent	
04560	+	74	77600			PNC	7760	
1	+	74	00100			PNC	C/R	
04570	+	40	00000			NØP		
1	+	00	01300			CLA	DELTA	Punch out δ
04600	+	74	77600	PATCH 6		PNC	7760	↓
1	+	74	00100			PNC	C/R	↓
04610	+	00	01310			CLA	DELTA+1	and its exponent
1	+	74	77600			PNC	7760	
04620	+	74	00100			PNC	CR	
1	+	57	03670			TRA	DATA	
04630	+	72	00100	PATCH 7		TYC	CR	
1	+	72	00100			TYC	CR	
04640	+	57	03520			TRA	NEW ST	
1	+	00	04700	PATCH 8		CLA	MZE	

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
04650	+	74	77600			PNC	7760	
1	+	00	04710			CLA	ENDER	
04660	+	74	77600			PNC	7760	
1	+	74	00160			PNC	C	
04670	+	74	00240			PNC	H	
1	+	77	04671			HTR	0467.1	
04700	-	00	00000	MZE				
1	-	00	00000					
04710	-	72	25700	ENDER				
1	+	32	65440					
04720	+	35	04740	PATCH 9		FST	PUNCH p	
1	+	35	00740			FST	p	
04730	+	57	03730			TRA	0373.0	
1								
04740				PUNCH p				
1								
04750								
1								
0500-0647								
Input Subroutine				INPUT		DEF	0500	140 ₈ cells, (to 0640) AN002 spaced to 0650
0650-1146								
Output Subroutine				PRINT		DEF	0650	260 cells (to 1130) AN015 spaced to 1146

PROGRAM TITLE: SPECIFIC VOLUME ANOMALY

ABSOLUTE LOCATION	S	OPRN	ADDRESS	LOCATION SYMBOL	S	OPRN	ADDRESS	REMARKS
11770								
1								
12000						DEC	-0.158	}
1								
12010								
1								
12020						DEC	+9.50	}
1								
12030								
1								
12040						DEC	+105.5	}
1								
12050								
1								
12060								
1								
12070								
1								
12100						DEC	+0.04	}
1								
12110								}
1								
12120						DEC	-2.72	}
1								

