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CTD MEASUREMENTS DURING 1995 AND 1996 AS PART OF THE GLOBAL OCEAN-ATMOSPHERE-LAND SYSTEM (GOALS)/PAN AMERICAN CLIMATE STUDIES (PACS)

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ABSTRACT. During 1995 and 1996, CTD data were collected in the equatorial Pacific Ocean as part of the Global Ocean-Atmosphere-Land System (GOALS)/Pan American Climate Studies (PACS), follow-up programs to the Tropical Ocean-Global Atmosphere (TOGA) and Equatorial Pacific Ocean Climate Studies (EPOCS). Summaries of Sea-Bird CTD measurements and hydrographic data acquired on fifteen cruises are presented. Composite potential temperature-salinity diagrams and section plots of oceanographic variables along 95°W, 110°W, 125°W, 140°W, 155°W, 170°W, 180°, and 165°E meridionals are given. Profiles including station location, meteorological conditions, and abbreviated CTD data listings are shown for each cast. Hydrographic data are listed for each cruise.

1. Introduction

The Global Ocean-Atmosphere-Land System (GOALS)/Pan American Climate Studies (PACS) Program began in 1995 with scientific objectives to understand and more realistically model (1) the seasonally varying mean climate of the Americas and adjacent ocean regions; (2) the role of boundary processes in forcing season-to-interannual climate variability over the Americas; (3) the coupling between the oceanic mixed layer in the tropical Atlantic and eastern Pacific; and (4) the processes that determine the structure and evolution of the tropical sea-surface temperature field (Piotrowicz, 1995). CTD data are collected in the equatorial Pacific Ocean in conjunction with the maintenance of the Tropical Atmosphere-Ocean (TAO) array.

The TAO array is made up of ATLAS wind and thermistor chain moorings and current meter moorings that record and report data in real time using the ARGOS satellite data telemetry system. A major objective of the TAO array is to facilitate understanding, modeling, and prediction of the global interannual climate fluctuations associated with the El Niño-Southern Oscillation phenomena in the tropical Pacific Ocean. To this end, an ocean observing array has been implemented to initialize, force, and verify ocean prediction models in real time. The TAO array consists of approximately 70 ATLAS moorings and current meter moorings within 8 degrees of the equator spanning the Pacific Basin from 95°W to 137°E. The array is being maintained by the Pacific Marine Environmental Laboratory (PMEL) TAO Project Office as part of the NOAA Ocean Climate Observing System for the Climate and Global Change Program.

The primary objective of TAO cruises is the deployment and recovery of moorings. At a minimum, CTD casts supporting the GOALS/PACS program are conducted at each mooring site to a depth of 1000 m. CTD measurements are used to verify ATLAS temperature sensor data, calculate

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dynamic height, and, at many sites, is the only observation of the equatorial Pacific salinity field. As time allows, additional CTD work is prioritized as follows: (1) 1000-m casts at 1 degree intervals between 8°N and 8°S along each meridional transect, (2) deep casts at mooring sites to a depth within 200 m of the bottom, (3) 1000-m casts every one-half degree of latitude between 3°N and 3°S, and (4) 1000-m casts every degree between 8°N and 11°N along the ship's trackline to/from port. Physical underway operations include Acoustic Doppler Current Profiler (ADCP) measurements, sea surface temperature (SST) and salinity (SSS) measurements, routine weather observations, and upper air soundings.

Summaries of CTD measurements and hydrographic data collected on fifteen cruises during 1995 and 1996 are presented here. Data include meridional sections across the equator along 95°W, 110°W, 125°W, 140°W, 155°W, 170°W, 180°, and 165°E. Figures 1a–o show the cruise track and CTD station locations for each cruise. Tables 1a–o summarize CTD station information for each cruise. Cruise name notation is GPx-yy-zz, where x is the sequential GOALS/PACS cruise number during each year, yy is the year (95 or 96), and zz is the ship code (MB for the NOAA ship *Malcolm Baldrige*, DI for the NOAA ship *Discoverer*, or KA for the NOAA ship *Ka'imimoana*). Sea-Bird 911plus systems are used to acquire CTD data on all cruises. Pressure, temperature, and conductivity are sampled at a rate of 24 Hz. Water samples are collected on the upcast using an electronically fired rosette sampler and analyzed for salinity using an autosalinometer (see section 4). Water sample salinity is used to calibrate CTD conductivity (see section 6).

2. Sea-Bird 911plus CTD System

The Sea-Bird Electronics, Inc. (SBE) 911plus CTD system is designed to be a real-time data system with the CTD data from the SBE 9plus underwater unit being transmitted via a conducting cable to the SBE 11plus deck unit. The serial data from the underwater unit is sent to the deck unit in RS-232 NRZ format. The deck unit decodes the serial data and sends it to a personal computer for display and storage using Sea-Bird SEASOFT software program SEASAVE. The SBE 911plus CTD system transmits data from its primary and auxiliary sensors in the form of binary number equivalents of the frequency or voltage outputs from those sensors. This is referred to as the raw data. The calculations required to convert raw data to engineering units are performed in the software, either in real time, or after the data has been stored in a disk file (Seasoft, 1994).

a. Conductivity

The flow-through conductivity sensing element is a glass tube (cell) with three platinum electrodes. The resistance measured between the center electrode and end electrode pair is determined by the cell geometry and the specific conductance of the fluid within the cell, and controls the output frequency of a Wien Bridge circuit. The sensor has a frequency output of approximately 3 to 12 kHz corresponding to conductivity from 0 to 7 Siemens/meter (0 to 70 mmho/

cm). The SBE conductivity sensor has a typical accuracy/stability of ±0.0003 S/m/month, and resolution of 0.00004 S/m at 24 Hz.

Pre-cruise sensor calibrations are performed at Sea-Bird Electronics, Inc. in Bellevue, Washington. Conductivity calibration certificates show an equation containing the appropriate pressure-dependent correction term to account for the effect of hydrostatic loading (pressure) on the conductivity cell:

$$C(\mathrm{S/m}) = (af^{m} + bf^{2} + c + dt) \,/\, [10\ (1–9.57\mathrm{e}\text{-}08\ p)]$$

where a, b, c, d, and m are calibration coefficients, f is the instrument frequency (kHz), t is the water temperature (°C), and p is the water pressure (db). SEASOFT automatically implements this equation.

b. *Temperature*

The temperature sensing element is a glass-coated thermistor bead, pressure-protected by a stainless steel tube. The sensor output frequency ranges from approximately 5 to 13 kHz corresponding to temperature from –5 to 35 degrees Celsius. The output frequency is inversely proportional to the square root of the thermistor resistance which controls the output of a patented Wien Bridge circuit. The thermistor resistance is exponentially related to temperature. The SBE thermometer has a typical accuracy/stability of ±0.004°C per year; and resolution of 0.0003°C at 24 Hz. The SBE thermometer has a fast response time of 0.070 seconds.

Pre-cruise sensor calibrations are performed at Sea-Bird Electronics, Inc. Temperature (IPTS-68) is computed according to

$$T\ (^{\circ}\mathrm{C}) = 1/\{a + b[\ln(f0/f)] + c[\ln^{2}(f0/f)] + d[\ln^{3}(f0/f)]\} - 273.15$$

where a, b, c, d, and $f0$ are calibration coefficients and f is the instrument frequency (kHz). SEASOFT automatically implements this equation.

c. *Pressure*

The Paroscientific series 4000 Digiquartz high pressure transducer uses a quartz crystal resonator whose frequency of oscillation varies with pressure-induced stress measuring changes in pressure as small as 0.01 parts per million with an absolute range of 0 to 10,000 psia (0 to 6885 decibars). Also, a quartz crystal temperature signal is used to compensate for a wide range of temperature changes. Repeatability, hysteresis, and pressure conformance are 0.005% FS. The nominal pressure frequency (0 to full scale) is 34 to 38 kHz. The nominal temperature frequency is 172 kHz + 50 ppm/°C.

Periodic sensor calibrations are performed at Sea-Bird Electronics, Inc. Pressure coefficients are first formulated into

$$c = c1 + c2*U + c3*U^2$$
$$d = d1 + d2*U$$
$$t0 = t1 + t2*U + t3*U^2 + t4*U^3 + t5*U^4$$

where U is temperature in degrees Celsius. Then pressure is computed according to

$$P \text{ (psia)} = c * [1 - (t0^2/t^2)] * \{1 - d[1 - (t0^2/t^2)]\}$$

where t is pressure period (μsec). SEASOFT automatically implements this equation.

3. Data Acquisition

The package enters the water and is held beneath the surface for 60 seconds in order to prime the system. Under ideal conditions the package should be lowered at a rate of 30 m/min to 50 m, 45 m/min to 200 m, and 60 m/min to depth. Ship heave may cause substantial variation about these mean lowering rates. Cable tension is monitored at the winch box display. The position of the package relative to the bottom during deep casts is monitored using the ship's Precision Depth Recorder (PDR). An estimated bottom depth is first obtained from bathymetric charts and then the PDR is run during the bottom 1000 m of the cast.

Water samples are collected during the upcast using an SBE rosette. Five- or 10-liter Niskin sample bottles are used, depending on the cruise. Bottle closures are performed through the SEASOFT software.

A backup of the analog data stream is made on video cassette tape. Digitized data on the PC are backed up onto 1/4" QIC-80 cartridge tapes.

4. Salinity Analysis

Bottle salinity analyses are performed in temperature-controlled environments using Guildline Model 8400B inductive autosalinometers standardized with IAPSO Standard Seawater. The autosalinometer is standardized before each run and either at the end of each run or after no more than 48 samples. The drift between standardizations is monitored and the individual samples are corrected for that drift by linear interpolation. Duplicate samples are taken from the deepest bottle on each cast and analyzed on a subsequent day. Bottle salinities are compared to preliminary CTD salinities at sea to aid in the identification of leaking bottles as well as to monitor the CTD conductivity cells' performance and drift. Their use in calibrating CTD conductivity on shore is detailed in section 6. The expected precision of the autosalinometer with an accomplished operator is 0.001 PSS, with an accuracy of 0.003.

5. PC Processing

SEASOFT consists of modular menu-driven routines for acquisition, display, processing, and archiving of oceanographic data acquired with Sea-Bird equipment and is designed to work with an IBM or compatible personal computer. Raw data is acquired from the instruments and is stored as unmodified data. The conversion module DATCNV uses instrument configuration and pre-cruise calibration files to create a converted engineering unit data file that is operated on by all SEASOFT post-processing modules. The following describes each processing module used and notes the specifications in the reduction of GOALS/PACS CTD data.

ROSSUM creates a summary of the bottle data. Pressure, temperature, and conductivity are averaged over a 2-second interval after the confirm bit in the upcast data stream. WILDEDIT marks extreme outliers in the data files. The first pass obtains an accurate estimate of the true standard deviation of the data. The data are read in blocks of 100 scans. Data greater than two standard deviations are flagged. The second pass computes a standard deviation over the same 100 scans excluding the flagged values. Values greater than 20 standard deviations are marked bad. All flagged data are excluded. CELLTM uses a recursive filter to remove conductivity cell thermal mass effects from the measured conductivity. Typical values are used for thermal anomaly amplitude (alpha = 0.03) and the time constant (1/beta = 9.0). FILTER performs a low pass filter on pressure with a time constant of 0.15 seconds and on conductivity with a time constant of 0.03 seconds. In order to produce zero phase (no time shift) the filter first runs forward through the file and then runs backwards through the file. LOOPEDIT excludes scans where the minimum velocity of the package is less than 0.25 m/s or the package has reversed its direction owing to ship heave. BINAVG averages the data into 1-db pressure bins starting at 1 db (no surface bin). The center value of the first bin is set equal to the bin size. The bin minimum and maximum values are the center value ± half the bin size.

6. Conductivity Calibrations

PMEL Fortran program SBECAL combines SEASOFT bottle files into one listing. PMEL Fortran program ADDSAL reads bottle salinity data received from Survey personnel and adds it to the combined listing. MATLAB functions CALCOSn are used to determine the best fit of CTD and bottle data, where n is the order of the station-dependent polynomial fit. CALCOSn recursively throws out data greater than 2.8 standard deviations. CALCOSn returns a single conductivity bias and a conductivity slope for each station. A station-dependent slope coefficient best models the gradual shift in the conductivity sensor within each station grouping with time. The order of the polynomial was chosen to keep the standard deviation of each grouping to a minimum. Table 2 lists the conductivity calibration coefficients determined for each station grouping. PMEL Fortran program CALMSTR applies the post-cruise calibration coefficients to conductivity and computes final salinity values. Final pressure and temperature calibrations were pre-cruise. CTD-bottle conductivity differences (Figs. 2a–e) are used to verify the success of the fit parameters.

For GP1-495 cruises, several Autosal runs jumped in conductivity by approximately 0.003 mS/cm owing to poor standardization and fluctuating ambient temperature of 3–6°C in the Autosal lab space. Sample salinities from a run during GP295 of stations 59–63 were thought to be bad and not included in the calibration file. During GP595, several Autosal runs jumped in conductivity by approximately 0.03 mS/cm, possibly owing to changing trim adjustment. Deep CTD traces overlayed well at these jumps. WOCE section P18 data also confirmed which Autosal runs were bad. As a result, stations 11–17 and 23–26 bottle data were not used in the fitting routines for conductivity.

7. VAX Processing

Following the SEASOFT processing modules, PMEL Fortran program EPSBE applies post-cruise calibrations to conductivity and converts the 1-db averaged CTD data to EPIC format (Soreide *et al.*, 1995). EPSBE creates a WOCE quality flag associated with each record of pressure, temperature, and CTD salinity. Quality flag definitions can be found in the WOCE Operations Manual (1994). EPSBE skips bad records near the surface and also any records flagged bad by SEASOFT. Measured data are copied back to 0 db and gaps are linearly interpolated such that a record exits every 1 db. WOCE flags are ammended to reflect these changes. EPSBE calculates ITS-90 temperature and salinity (PSS-78), as well as potential temperature (IPTS-68), sigma-t, and sigma-theta using the 1980 equation of state algorithms described by Fofonoff and Millard (1983). Dynamic height in dynamic meters is calculated by integrating down from the sea surface.

PMEL Fortran program EPICBOMSTR creates individual bottle files in EPIC format for each cast.

8. Data Presentation

The majority of the following plots were produced using Plot Plus Scientific Graphics System (Denbo, 1992). Figures 3–47 are potential temperature, salinity, and sigma-theta sections for each meridional. Figures 48–62 are composite potential temperature-salinity diagrams for each meridional. Tables 3–7 define the abbreviations and units used in the CTD data summary listings that are presented alongside 0–1000 m profiles of each cast for each cruise. Hydrographic bottle data at discrete depths are also given for each cruise.

9. Acknowledgments

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FIGURES AND TABLES

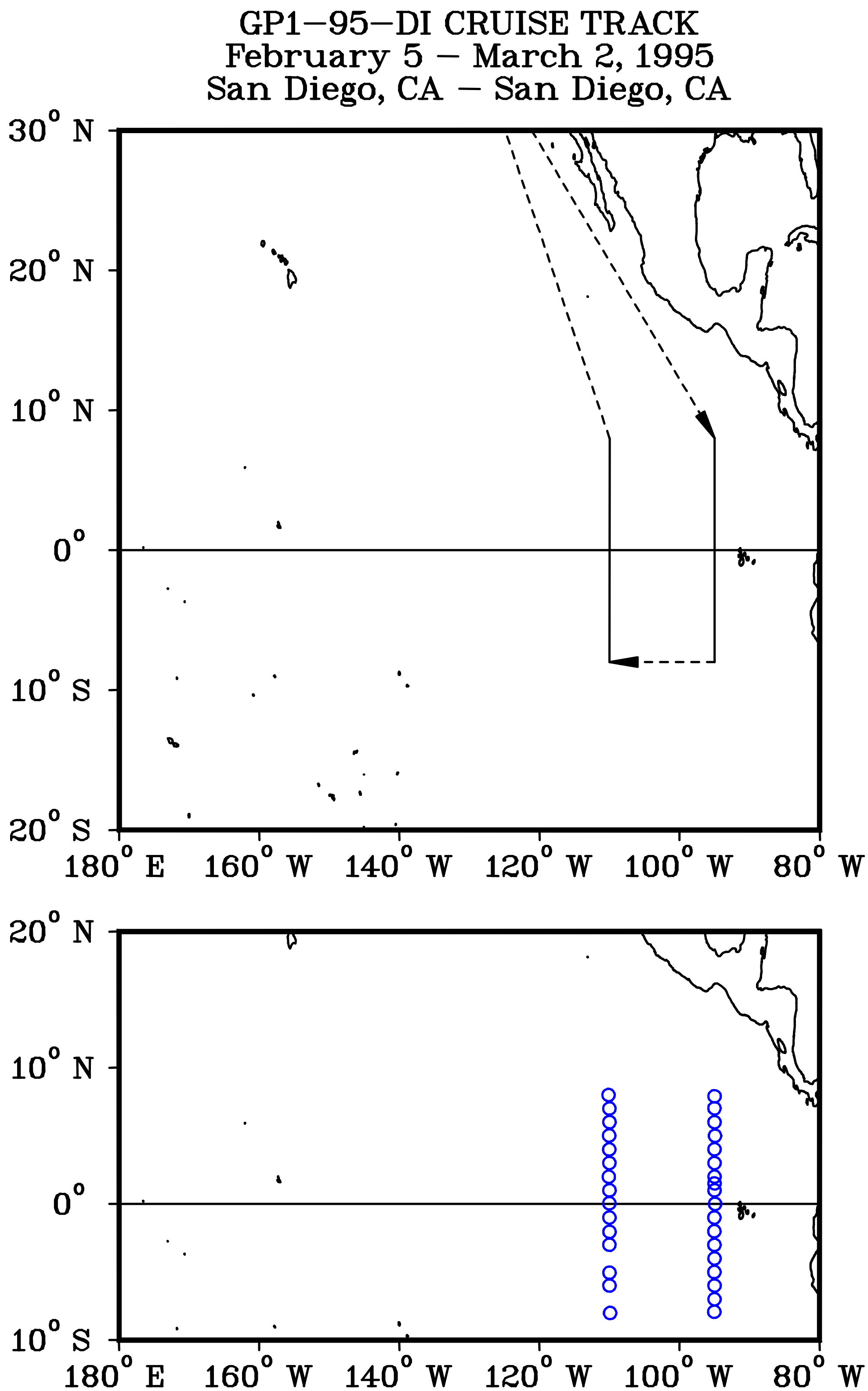

Figure 1a. GP1-95-DI cruise track and station locations.

Table 1a. GP1-95-DI CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
1	7 54.2N	94 59.9W	11 FEB 95	659	30	13	3786	808
2	7 1.1N	95 0.5W	11 FEB 95	1217	20	13	3680	1001
3	6 0.0N	95 0.0W	11 FEB 95	1755	30	14	3088	606
4	5 0.0N	94 55.1W	12 FEB 95	430	30	7	3646	3447
5	4 0.5N	95 0.4W	13 FEB 95	0	30	11	3512	1001
6	3 0.0N	95 0.3W	13 FEB 95	600	10	8	2781	1001
7	2 0.1N	95 0.1W	14 FEB 95	433	125	10	2978	2005
8	1 30.3N	95 0.2W	14 FEB 95	810	110	9	2770	1002
9	0 59.9N	95 0.0W	15 FEB 95	313	125	8	3525	1002
10	0 0.1N	94 54.7W	15 FEB 95	900	130	10	3390	3204
11	1 0.1S	95 0.9W	16 FEB 95	116	80	9	3370	1001
12	2 0.3S	95 1.0W	16 FEB 95	730	135	17	3348	3102
13	3 0.6S	95 0.6W	16 FEB 95	1337	135	15	3556	1015
14	4 0.5S	95 0.3W	16 FEB 95	1841	145	13	3662	1006
15	5 0.2S	95 0.9W	17 FEB 95	524	120	15	3941	3703
16	5 59.9S	94 59.9W	17 FEB 95	2323	120	15	3848	1001
17	6 59.9S	95 0.0W	18 FEB 95	421	90	13	4002	1003
18	7 55.4S	95 1.5W	18 FEB 95	946	100	13	3989	3807
19	8 0.5S	109 53.6W	21 FEB 95	708	100	12	3385	3205
20	5 59.9S	109 59.7W	22 FEB 95	746	120	14	3780	1001
21	5 3.0S	109 59.3W	22 FEB 95	1224	140	10	3499	1003
22	3 0.0S	110 0.0W	23 FEB 95	805	140	12	3776	1002
23	2 2.9S	109 59.5W	23 FEB 95	1241	45	4	3907	1005
24	1 0.2S	109 59.9W	23 FEB 95	1808	105	9	3950	1006
25	0 3.0N	110 0.5W	24 FEB 95	1107	180	7	3767	1024
26	0 59.9N	109 59.8W	24 FEB 95	1545	90	14	3814	1006
27	1 59.5N	110 5.4W	24 FEB 95	2030	90	11	3852	1000
28	3 0.1N	110 0.1W	25 FEB 95	145	90	16	3893	1001
29	3 59.8N	110 0.8W	25 FEB 95	631	85	11	3880	1004
30	5 1.2N	110 1.6W	25 FEB 95	1312	25	21	4015	1002
31	6 0.3N	109 59.6W	26 FEB 95	449	60	11	3718	1005
32	7 0.0N	110 0.1W	26 FEB 95	928	90	12	3760	1002
33	7 59.5N	110 7.5W	26 FEB 95	1453	60	15	4220	4004

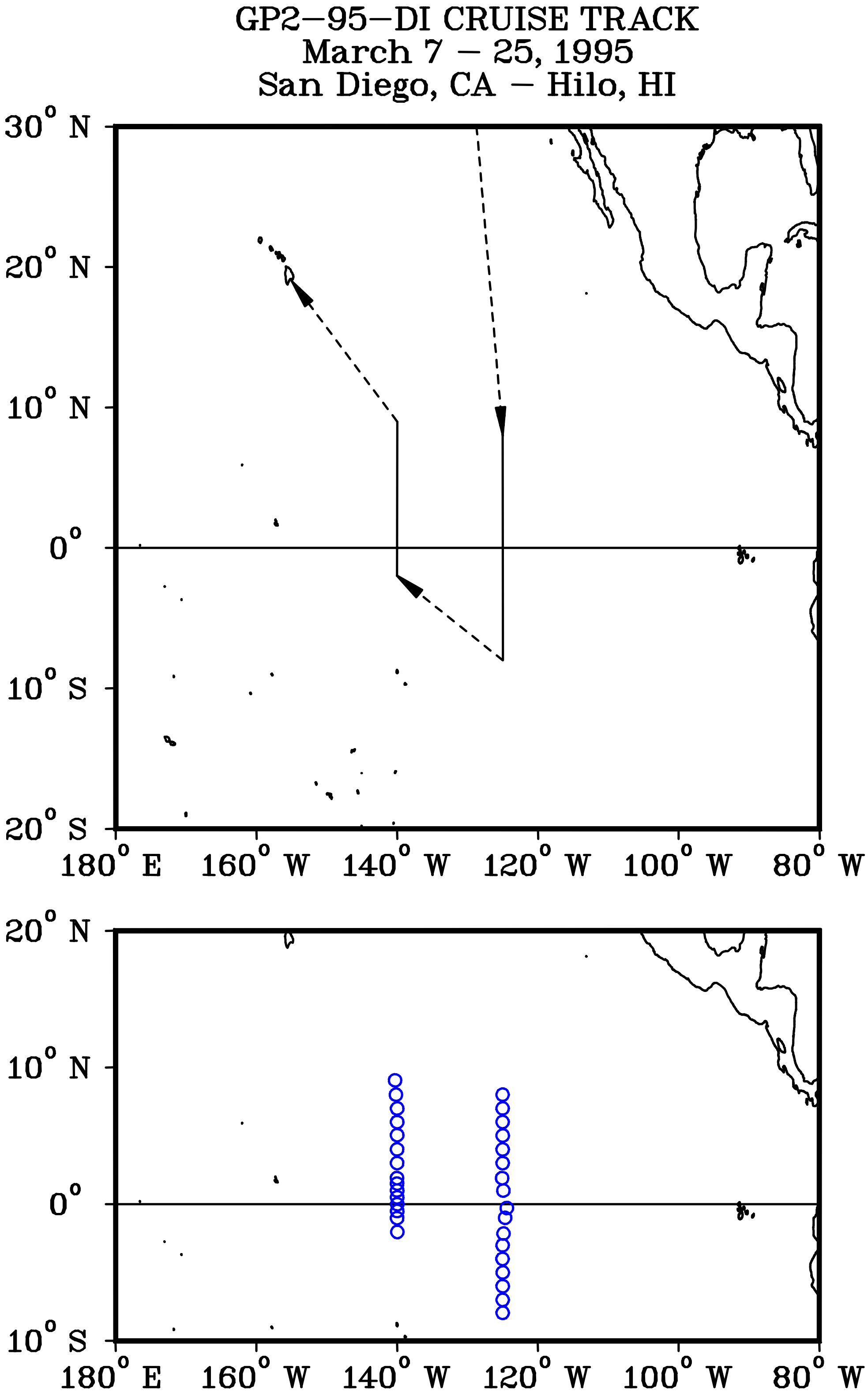

Figure 1b. GP2-95-DI cruise track and station locations.

Table 1b. GP2-95-DI CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
1	8 0.5N	125 0.6W	12 MAR 95	922	40	21	4591	3003
2	7 0.2N	125 0.1W	12 MAR 95	1457	100	16	4660	1003
3	6 0.6N	125 0.2W	12 MAR 95	2018	40	20	4455	1003
4	5 1.2N	124 59.4W	13 MAR 95	332	60	12	4312	1004
5	4 0.1N	124 59.9W	13 MAR 95	841	110	13	4500	1004
6	3 0.2N	124 59.9W	13 MAR 95	1341	100	17	4551	1008
7	1 54.2N	125 4.6W	14 MAR 95	832	70	12	4726	4423
8	0 59.7N	124 54.6W	14 MAR 95	1356	85	4	4558	1002
9	0 16.9S	124 24.7W	14 MAR 95	2242	85	4	4670	4305
10	0 59.8S	124 39.6W	15 MAR 95	334	110	5	4684	1006
11	2 8.9S	124 53.0W	15 MAR 95	1104	60	4	4678	1003
12	3 0.4S	125 0.5W	15 MAR 95	1520	90	10	4537	1000
13	4 0.1S	125 0.9W	15 MAR 95	2025	90	17	4490	1021
14	4 59.8S	124 59.2W	16 MAR 95	736	100	11	4397	4002
15	5 59.9S	124 59.7W	17 MAR 95	129	90	10	4805	1006
16	7 0.0S	124 59.9W	17 MAR 95	614	90	11	4739	1003
17	7 56.7S	124 59.8W	17 MAR 95	1151	65	12	4529	4303
18	2 1.9S	139 58.4W	20 MAR 95	1324	45	13	4274	1003
19	1 1.2S	140 0.2W	20 MAR 95	1931	60	17	4275	1032
20	0 30.2S	139 59.5W	20 MAR 95	2217	90	13	4290	1008
21	0 0.0N	139 59.0W	21 MAR 95	916	75	13	4322	4106
22	0 30.0N	140 0.0W	22 MAR 95	403	65	16	4349	1002
23	1 0.1N	140 0.0W	22 MAR 95	719	80	17	4312	1005
24	1 30.2N	140 0.2W	22 MAR 95	1031	85	17	4427	1002
25	1 54.5N	140 1.0W	22 MAR 95	1402	90	12	4404	4204
26	3 0.3N	140 0.4W	23 MAR 95	924	100	14	4305	1004
27	4 0.4N	140 0.2W	23 MAR 95	1401	70	10	4347	1002
28	5 2.8N	139 59.9W	23 MAR 95	1946	60	10	4446	2005
29	6 0.2N	139 59.8W	24 MAR 95	126	45	11	4824	1002
30	6 59.9N	139 59.8W	24 MAR 95	613	50	21	4974	1001
31	8 0.3N	140 10.2W	24 MAR 95	1109	30	18	5101	1002
32	9 3.4N	140 17.9W	25 MAR 95	722	60	22	4977	2004

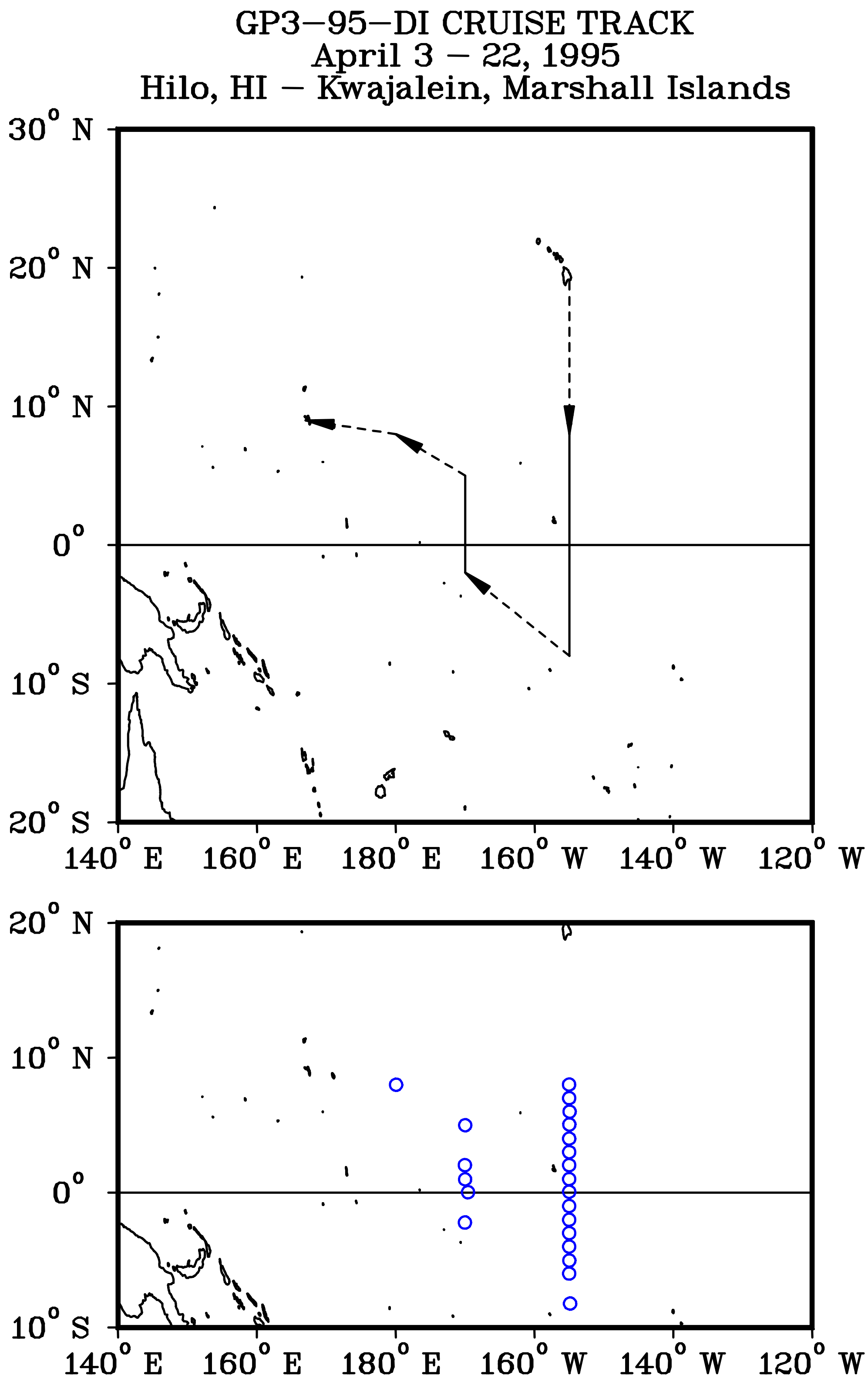

Figure 1c. GP3-95-DI cruise track and station locations.

Table 1c. GP3-95-DI CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
1	8 0.8N	155 1.3W	6 APR 95	1313	1	66	3309	4006
2	7 0.3N	155 0.0W	7 APR 95	1028	45	10	5391	1003
3	6 0.2N	154 56.6W	7 APR 95	1536	70	18	1010	1002
4	5 2.9N	154 58.5W	7 APR 95	2106	701	55	4692	3004
5	4 0.2N	154 59.9W	8 APR 95	327	90	15	1012	1007
6	3 0.2N	155 0.1W	8 APR 95	832	120	12	4829	1001
7	2 2.4N	155 0.0W	8 APR 95	1450	90	14	4438	4504
8	1 0.3N	155 0.2W	9 APR 95	846	60	18	4748	1004
9	0 4.1N	154 59.9W	9 APR 95	1405	35	15	3073	3002
10	0 59.5S	155 0.6W	9 APR 95	2048	40	14	4745	1007
11	2 0.5S	155 0.1W	10 APR 95	844	50	1	5080	1009
12	2 59.8S	155 0.1W	10 APR 95	1336	30	13	5110	1003
13	3 59.8S	155 0.5W	10 APR 95	1832	60	9	1945	1006
14	5 1.9S	154 58.2W	11 APR 95	23	80	13	5155	1005
15	6 0.0S	155 0.0W	11 APR 95	657	70	14	5214	1002
16	8 13.1S	154 52.0W	11 APR 95	1701	70	15	5224	1004
17	2 12.8S	170 1.5W	14 APR 95	0	40	16	0	1006
18	0 2.0N	169 34.8W	16 APR 95	1143	50	8	5339	1006
19	0 59.1N	170 0.0W	16 APR 95	1638	75	7	6643	1004
20	2 2.4N	170 1.8W	17 APR 95	922	110	10	5359	1005
21	4 59.8N	169 59.1W	18 APR 95	943	60	15	5783	1006
22	7 59.8N	179 56.2W	20 APR 95	1037	50	22	5885	4008

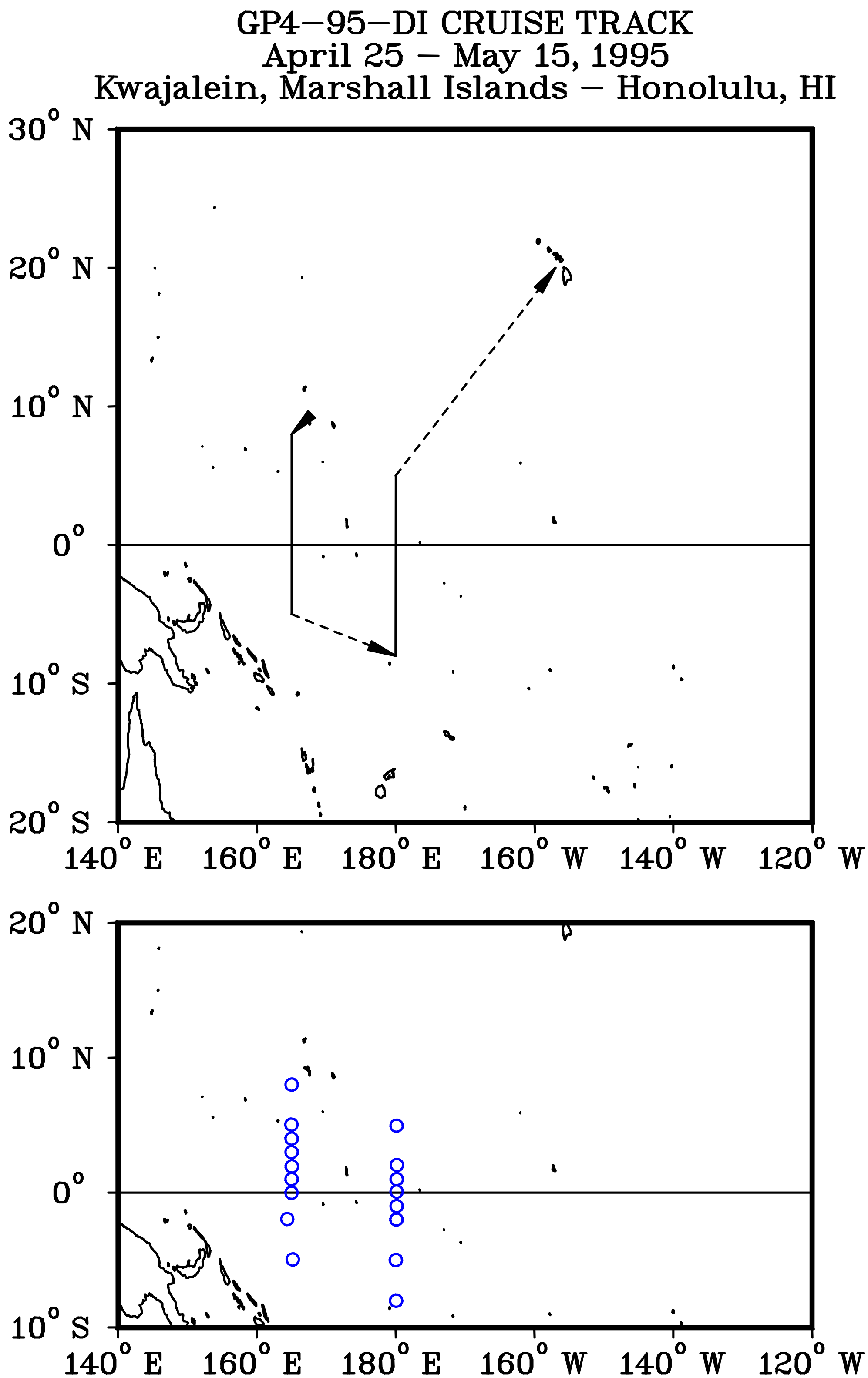

Figure 1d. GP4-95-DI cruise track and station locations.

Table 1d. GP4-95-DI CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
1	8 0.3N	165 0.8E	26 APR 95	558	60	20	5189	1002
2	5 2.5N	164 58.9E	27 APR 95	556	160	4	4776	1003
3	4 0.3N	165 0.1E	27 APR 95	1134	250	16	4489	1003
4	2 59.9N	165 0.0E	27 APR 95	1651	230	22	4263	1002
5	1 56.7N	165 2.7E	27 APR 95	2331	230	20	4183	1006
6	1 0.0N	164 59.9E	28 APR 95	443	230	28	4328	1003
7	0 0.5S	164 59.2E	1 MAY 95	1456	90	8	4380	1002
8	1 57.5S	164 22.5E	2 MAY 95	1300	70	12	4401	1003
9	4 57.2S	165 10.0E	3 MAY 95	942	80	10	2529	1002
10	8 0.4S	179 55.8W	6 MAY 95	818	100	6	5534	1004
11	4 59.7S	179 58.0W	7 MAY 95	610	85	11	5676	1004
12	1 59.6S	179 53.5W	8 MAY 95	415	110	10	5314	1002
13	1 0.1S	179 52.2W	8 MAY 95	946	120	12	5338	1003
14	0 4.7N	179 52.3W	8 MAY 95	1534	170	7	5391	1003
15	1 0.0N	179 50.7W	8 MAY 95	2017	120	5	5803	1004
16	2 2.7N	179 49.0W	9 MAY 95	1129	160	13	5436	5005
17	4 57.8N	179 52.7W	10 MAY 95	1701	75	8	5624	1002

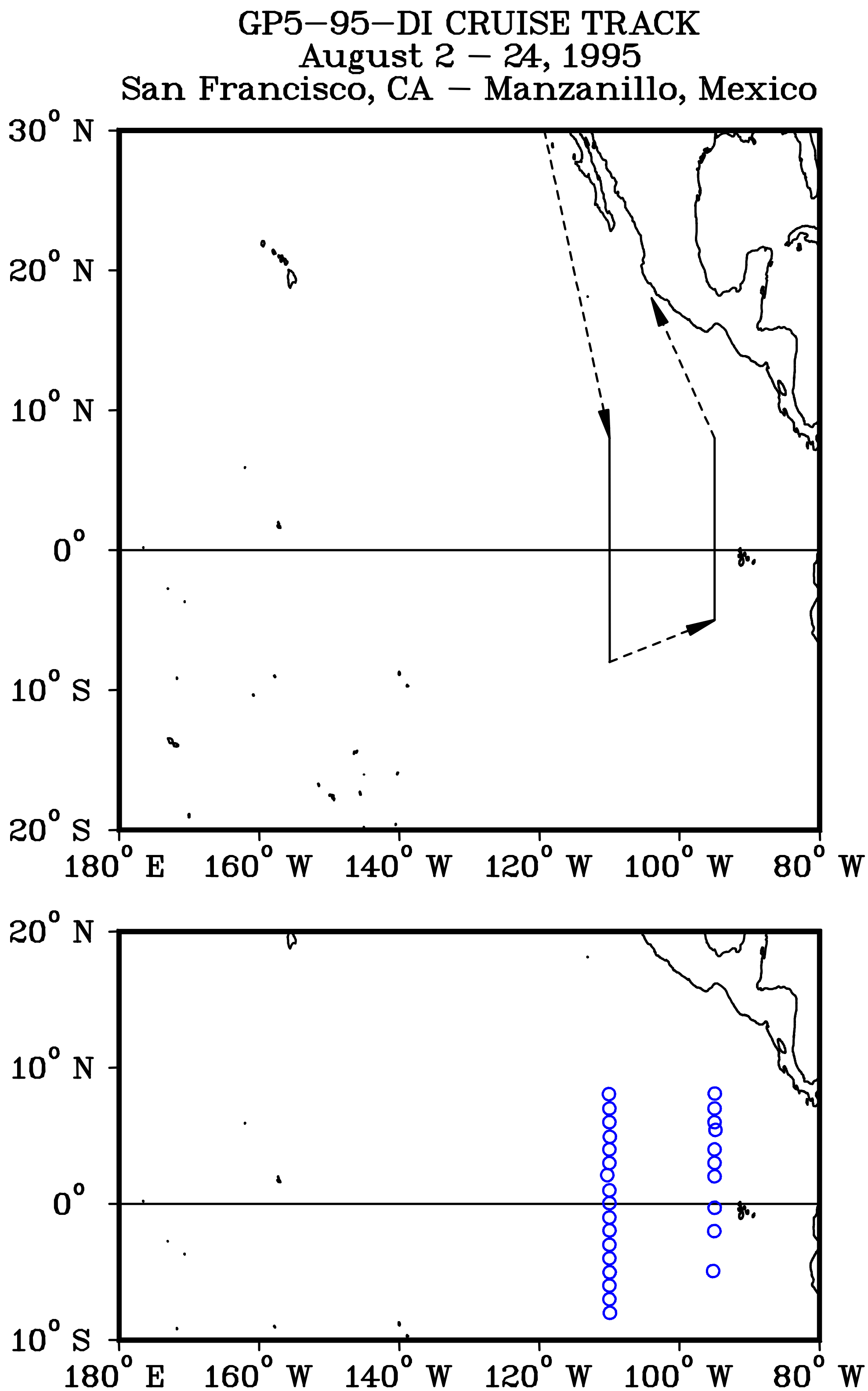

Figure 1e. GP5-95-DI cruise track and station locations.

Table 1e. GP5-95-DI CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
1	8 3.6N	110 3.7W	8 AUG 95	925	180	13	4059	3853
2	7 0.0N	110 0.1W	9 AUG 95	126	175	12	3751	1003
3	6 0.1N	110 0.1W	9 AUG 95	627	160	14	3702	1002
4	4 55.6N	109 56.7W	9 AUG 95	1756	155	12	4012	3804
5	3 59.9N	110 0.5W	9 AUG 95	2344	165	20	3859	1001
6	2 59.9N	110 0.3W	10 AUG 95	450	150	13	3890	1003
7	2 6.8N	110 18.1W	10 AUG 95	1028	145	14	3814	3606
8	0 59.6N	110 0.4W	11 AUG 95	1013	120	17	3822	1004
9	0 3.5N	109 59.6W	12 AUG 95	1024	125	15	3824	3604
10	1 0.0S	110 0.0W	13 AUG 95	339	110	9	994	1004
11	1 56.7S	109 59.3W	13 AUG 95	914	125	17	3920	3707
12	3 0.0S	110 0.0W	14 AUG 95	455	120	10	994	1003
13	3 59.9S	110 0.1W	14 AUG 95	1014	115	14	3782	1002
14	5 1.2S	109 58.8W	14 AUG 95	1734	100	15	3488	3306
15	5 59.9S	110 0.0W	14 AUG 95	2309	115	20	3729	1007
16	7 0.0S	110 0.0W	15 AUG 95	405	100	21	3469	1006
17	7 59.9S	109 55.8W	15 AUG 95	952	90	17	3398	3204
18	4 55.7S	95 11.4W	18 AUG 95	607	130	15	3852	1004
19	1 59.7S	95 1.7W	19 AUG 95	402	140	8	3362	1009
20	0 17.4S	94 58.3W	19 AUG 95	1250	190	13	3158	1003
21	2 1.4N	94 59.9W	20 AUG 95	818	150	8	3036	2802
22	3 0.5N	95 0.2W	20 AUG 95	1323	210	12	3093	1005
23	3 59.8N	94 59.9W	20 AUG 95	1814	170	7	3349	1002
24	5 25.8N	94 51.6W	21 AUG 95	221	210	10	3630	3405
25	5 59.9N	95 0.0W	21 AUG 95	621	210	8	3257	1005
26	7 0.1N	94 59.8W	21 AUG 95	1122	225	10	3686	1003
27	8 6.2N	94 57.3W	21 AUG 95	2356	210	7	3638	3407

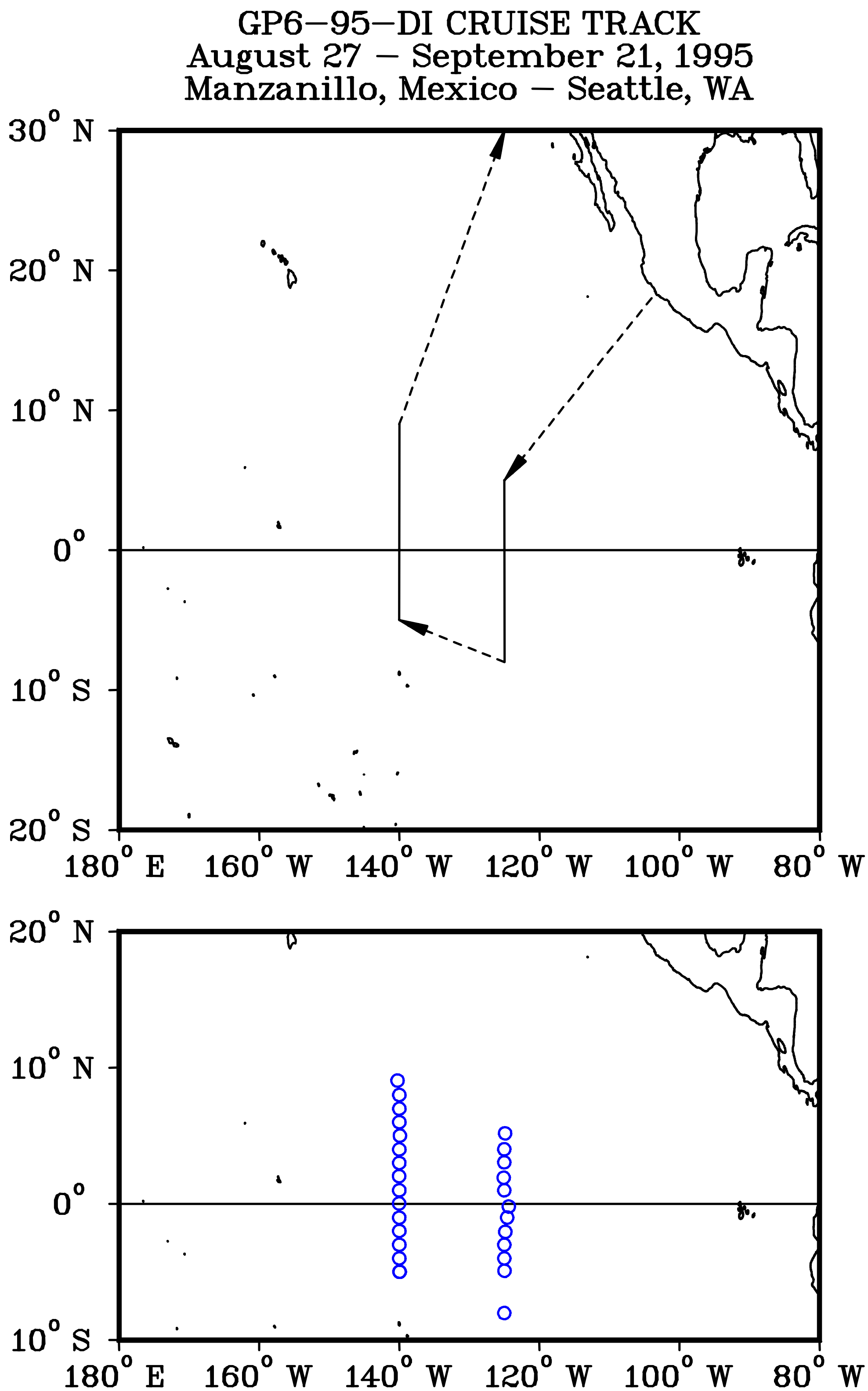

Figure 1f. GP6-95-DI cruise track and station locations.

Table 1f. GP6-95-DI CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
1	5 11.0N	124 53.8W	2 SEP 95	153	170	11	4416	1002
2	4 0.7N	125 0.4W	2 SEP 95	925	130	12	4469	1007
3	3 3.0N	125 0.3W	2 SEP 95	1517	135	17	4566	1001
4	1 55.3N	125 5.8W	2 SEP 95	2125	135	19	4676	1003
5	1 0.0N	125 0.2W	3 SEP 95	227	110	11	4562	1002
6	0 11.4S	124 22.1W	3 SEP 95	943	70	5	5534	4003
7	1 0.2S	124 35.6W	4 SEP 95	551	85	8	4657	1004
8	2 2.9S	124 51.3W	4 SEP 95	1130	90	5	4664	3002
9	3 0.1S	125 0.0W	5 SEP 95	420	100	14	4541	1003
10	4 0.0S	125 0.0W	5 SEP 95	916	100	13	4429	1005
11	4 54.6S	124 58.4W	5 SEP 95	1407	100	17	4476	1003
12	8 0.7S	125 0.4W	6 SEP 95	454	95	15	4626	1004
13	4 59.0S	139 57.9W	8 SEP 95	1240	130	11	4283	3007
14	4 58.9S	139 56.4W	8 SEP 95	1331	130	14	4284	503
15	4 0.0S	139 59.9W	9 SEP 95	534	95	13	4474	1001
16	3 0.0S	140 0.0W	9 SEP 95	1017	105	13	4416	1003
17	1 59.1S	140 0.0W	10 SEP 95	56	90	11	4187	3005
18	1 0.7S	140 0.4W	10 SEP 95	655	80	8	4270	1003
19	0 2.0N	140 2.0W	10 SEP 95	1300	95	17	4314	4074
20	0 59.9N	140 0.1W	11 SEP 95	1407	115	13	4311	1004
21	2 2.2N	140 2.0W	11 SEP 95	1944	120	15	4374	3004
22	3 0.2N	140 0.2W	12 SEP 95	49	120	14	4302	1009
23	4 0.0N	139 59.9W	12 SEP 95	520	130	15	4349	1007
24	5 0.6N	139 55.2W	12 SEP 95	1505	145	13	4469	1012
25	6 0.1N	140 0.0W	13 SEP 95	908	140	10	4818	1005
26	6 59.6N	139 59.7W	13 SEP 95	1415	160	7	4958	1006
27	7 59.9N	139 59.7W	13 SEP 95	1852	180	6	5134	1002
28	9 3.3N	140 15.0W	14 SEP 95	227	10	7	4869	3003

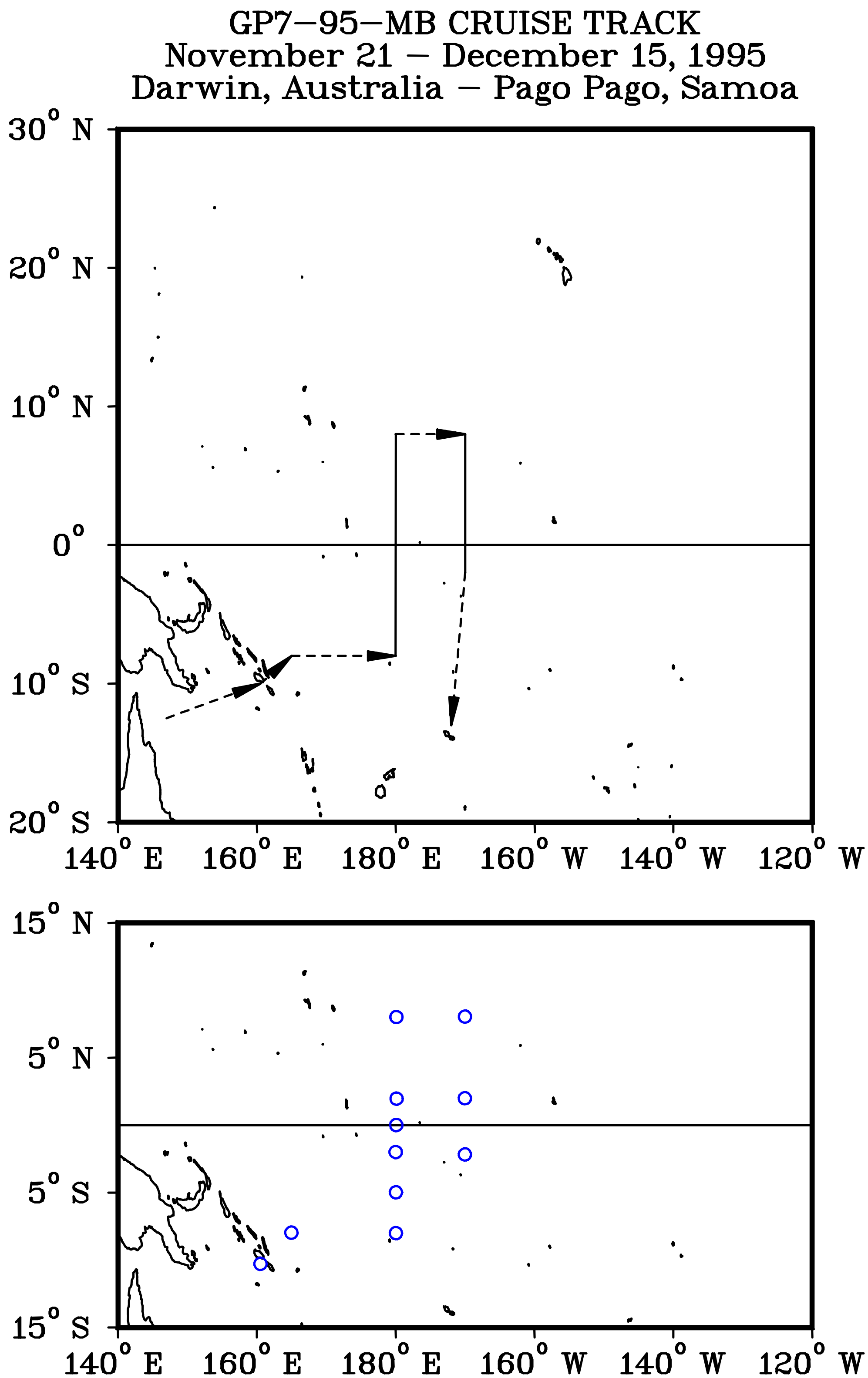

Figure 1g. GP7-95-MB cruise track and station locations.

Table 1g. GP7-95-MB CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
1	10 16.6S	160 31.1E	27 NOV 95	408	0	0	3683	500
2	7 57.9S	164 58.5E	28 NOV 95	1334	127	8	3892	1004
4	8 0.0S	179 57.8W	1 DEC 95	1541	283	6	5538	3010
5	4 58.4S	179 57.4W	2 DEC 95	1652	330	10	5615	1003
6	1 59.6S	180 0.0W	3 DEC 95	812	105	7	5308	1010
7	0 0.6N	179 55.2W	4 DEC 95	706	90	12	5357	1003
8	1 58.0N	179 52.7W	4 DEC 95	1735	92	14	5377	1020
9	8 0.9N	179 53.9W	7 DEC 95	1045	95	15	5923	3505
11	8 2.8N	170 1.4W	10 DEC 95	1044	108	14	5439	1004
12	1 59.7N	170 2.3W	12 DEC 95	806	160	7	5361	551
13	2 10.3S	170 2.0W	13 DEC 95	1408	75	12	4950	552

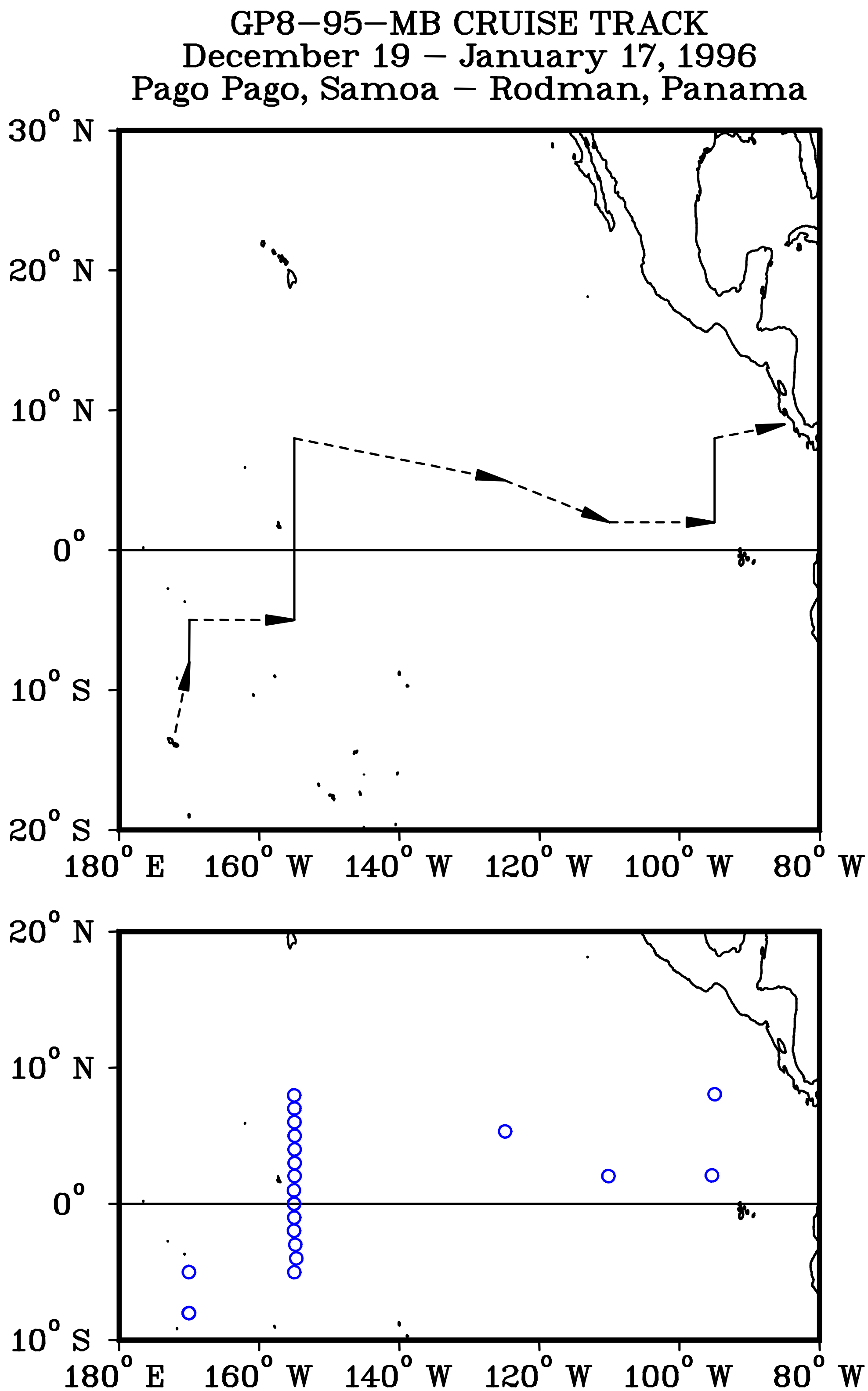

Figure 1h. GP8-95-MB cruise track and station locations.

Table 1h. GP8-95-MB CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
15	8 1.2S	170 0.6W	21 DEC 95	948	285	9	5340	3024
16	8 0.6S	170 3.0W	21 DEC 95	2349	350	12	5350	552
17	5 0.4S	170 1.5W	22 DEC 95	1510	40	9	5400	2511
18	5 0.9S	154 59.4W	26 DEC 95	627	8	14	4882	1013
19	4 0.0S	154 42.5W	26 DEC 95	1242	101	5	4644	1003
20	2 59.6S	154 51.2W	26 DEC 95	1824	95	22	4900	1015
21	1 58.1S	155 1.6W	27 DEC 95	140	80	16	4972	3043
22	1 0.3S	154 59.9W	27 DEC 95	1026	95	18	4733	1002
23	0 1.1N	155 1.2W	27 DEC 95	1616	85	12	4676	1003
25	0 0.5S	155 0.3W	28 DEC 95	404	90	15	4670	558
26	0 59.8N	155 1.9W	28 DEC 95	947	88	13	4742	1004
27	2 2.8N	154 57.0W	29 DEC 95	135	135	15	4700	1013
28	2 59.8N	154 55.4W	29 DEC 95	732	74	5	4742	1014
29	3 59.9N	154 56.2W	29 DEC 95	1326	140	18	4963	1001
30	5 0.0N	154 55.5W	30 DEC 95	539	83	8	4584	1029
31	6 0.3N	154 58.1W	30 DEC 95	1159	118	3	4826	1006
32	7 0.3N	154 58.8W	30 DEC 95	1737	16	15	4961	1006
33	7 58.2N	155 0.1W	31 DEC 95	622	136	18	5210	1015
34	5 19.5N	124 53.4W	6 JAN 96	244	0	0	4282	1013
35	2 2.6N	110 8.2W	10 JAN 96	457	34	11	3898	1024
36	2 5.6N	95 21.6W	13 JAN 96	1132	31	8	4389	1511
37	8 3.2N	94 58.6W	14 JAN 96	2030	70	12	3712	1004

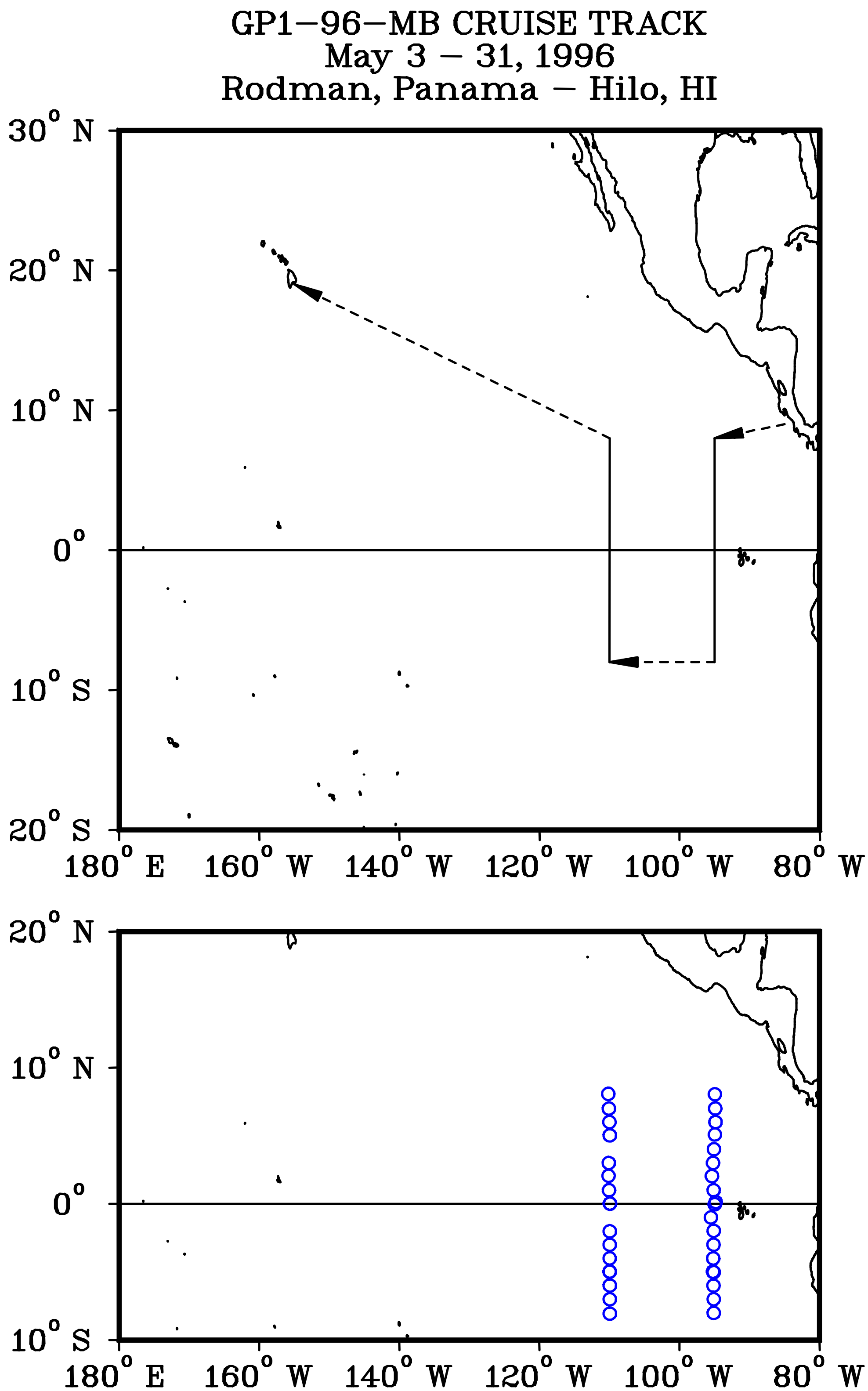

Figure 1i. GP1-96-MB cruise track and station locations.

Table 1i. GP1-96-MB CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
11	8 2.9N	94 56.6W	6 MAY 96	2125	0	0	3667	40
21	7 0.2N	94 53.5W	7 MAY 96	358	250	13	3773	1003
31	6 0.4N	94 51.4W	7 MAY 96	957	0	0	3733	1002
41	5 5.6N	94 56.0W	8 MAY 96	212	220	10	3587	1003
51	4 0.8N	95 3.9W	8 MAY 96	927	190	10	3474	1001
61	3 0.3N	95 11.7W	8 MAY 96	1631	173	11	2703	1002
71	2 2.5N	95 21.8W	8 MAY 96	2215	168	10	2664	1002
81	1 0.2N	95 7.7W	9 MAY 96	403	140	9	3454	1001
91	0 8.3N	94 49.8W	9 MAY 96	1053	0	0	3390	3001
101	0 1.6S	94 57.3W	9 MAY 96	2104	123	9	3375	1000
111	0 59.6S	95 30.6W	10 MAY 96	949	110	9	3340	1000
121	1 58.7S	95 6.4W	10 MAY 96	1530	117	11	3423	1005
131	2 59.7S	95 8.2W	10 MAY 96	2201	100	9	3600	1003
141	4 0.1S	95 10.3W	11 MAY 96	329	110	15	3653	1002
151	4 58.3S	95 13.4W	11 MAY 96	931	150	13	3810	3001
161	5 1.1S	95 5.7W	12 MAY 96	138	150	11	3812	1003
171	6 0.1S	95 8.6W	12 MAY 96	933	145	10	3896	1002
181	6 59.9S	95 6.4W	12 MAY 96	1257	125	5	3740	1003
191	8 0.3S	95 6.3W	13 MAY 96	532	120	15	3997	1001
201	8 3.5S	109 56.2W	16 MAY 96	644	50	8	3270	1001
211	7 0.0S	109 56.8W	16 MAY 96	1402	24	9	3488	1004
221	5 59.7S	109 57.0W	16 MAY 96	1929	39	8	3577	1002
231	4 58.9S	109 58.5W	17 MAY 96	513	90	6	3643	3002
241	4 57.8S	109 57.9W	17 MAY 96	1841	92	10	3727	1003
251	3 59.9S	109 58.3W	18 MAY 96	9	125	14	3853	1007
261	2 59.9S	109 57.9W	18 MAY 96	548	135	14	3810	1006
271	2 0.8S	109 56.8W	18 MAY 96	1158	140	9	3943	3002
281	0 1.0N	109 55.4W	19 MAY 96	913	60	6	3817	3001
291	0 1.7N	109 54.9W	20 MAY 96	330	90	12	3786	1002
301	1 0.3N	110 2.7W	21 MAY 96	1029	135	14	3815	1001
311	2 3.8N	110 7.4W	21 MAY 96	1638	148	15	3780	1003
321	3 0.1N	110 5.6W	21 MAY 96	2205	152	20	3924	1003
331	5 1.9N	109 56.9W	22 MAY 96	924	170	14	3815	1000
341	6 0.3N	109 59.9W	22 MAY 96	1433	175	20	3714	1007
351	6 59.9N	110 4.9W	22 MAY 96	1954	188	19	3451	1002
361	8 4.7N	110 9.3W	23 MAY 96	213	195	19	4232	1003

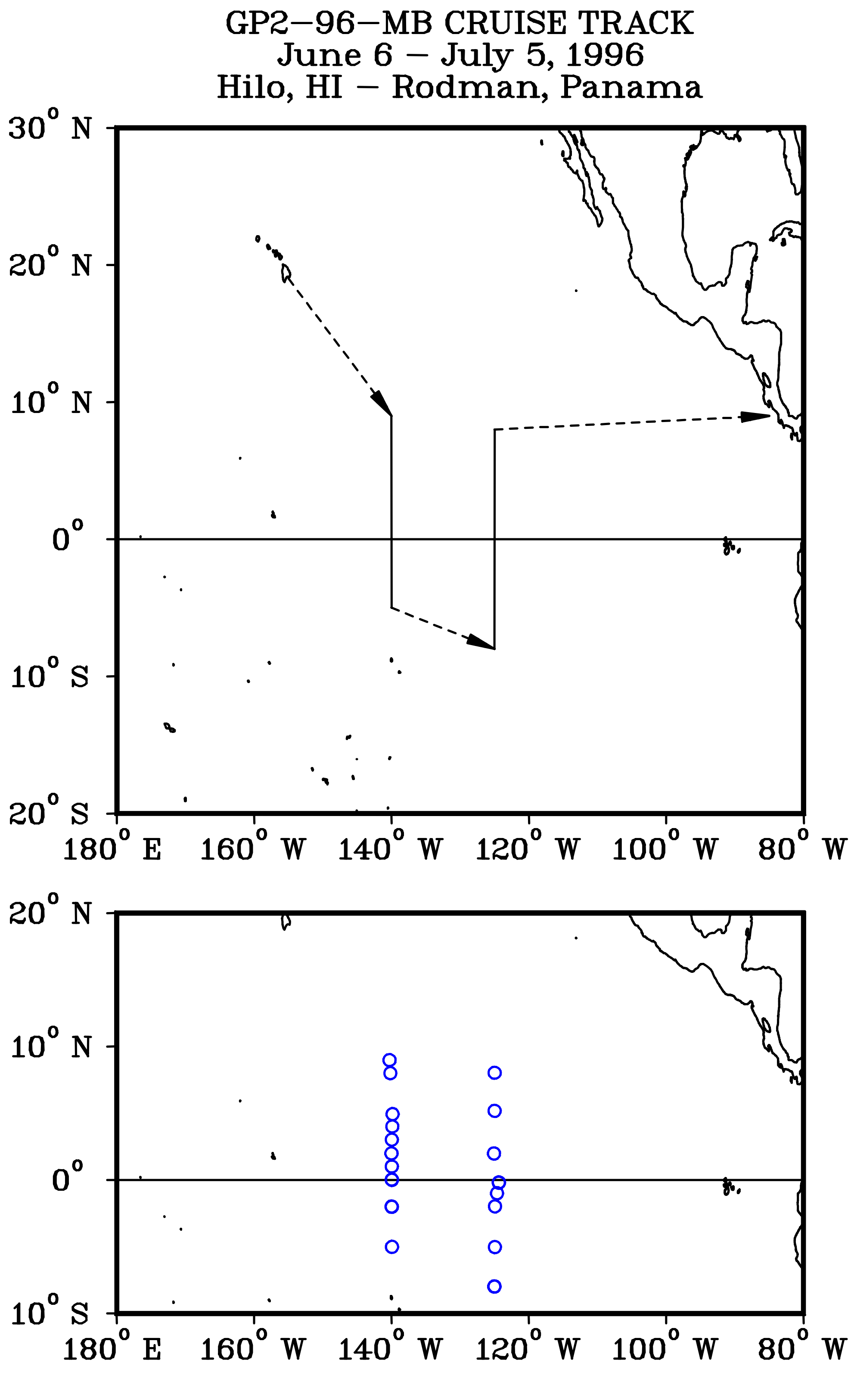

Figure 1j. GP2-96-MB cruise track and station locations.

Table 1j. GP2-96-MB CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
371	8 58.9N	140 17.2W	11 JUN 96	715	107	7	4848	1001
381	8 0.2N	140 10.0W	11 JUN 96	1357	50	6	5130	1013
391	4 56.1N	139 50.0W	12 JUN 96	802	97	10	4485	1000
401	4 0.5N	139 52.9W	12 JUN 96	1336	80	10	4393	1001
411	3 1.2N	139 56.9W	12 JUN 96	1943	45	9	4290	1012
421	1 59.7N	140 0.0W	13 JUN 96	1140	75	16	4371	1008
431	1 0.7N	139 57.0W	13 JUN 96	1747	90	16	4327	1002
441	0 0.8N	139 56.0W	14 JUN 96	711	84	17	4359	3002
451	0 2.1N	139 56.6W	14 JUN 96	2327	100	15	4360	1001
461	1 59.0S	139 58.5W	15 JUN 96	1224	110	15	4299	3003
471	2 0.5S	139 57.1W	16 JUN 96	301	131	19	4342	1002
481	5 0.5S	139 55.5W	16 JUN 96	2013	100	18	4307	1007
491	7 58.2S	124 59.3W	20 JUN 96	948	100	23	4547	3004
501	7 59.1S	125 1.1W	21 JUN 96	428	100	20	4520	1004
511	5 1.4S	124 56.8W	22 JUN 96	725	84	14	4543	1004
521	1 58.6S	124 55.8W	22 JUN 96	2250	110	10	4718	1003
531	0 59.5S	124 37.3W	23 JUN 96	545	115	7	4648	1004
541	0 10.9S	124 20.9W	23 JUN 96	1104	105	8	4654	3081
551	0 12.0S	124 22.2W	24 JUN 96	656	70	8	4721	1004
561	1 59.1N	125 4.5W	25 JUN 96	729	119	13	4631	1004
571	5 10.8N	124 58.6W	26 JUN 96	1106	165	17	4410	1002
581	8 1.8N	124 58.2W	27 JUN 96	207	194	21	4723	1004

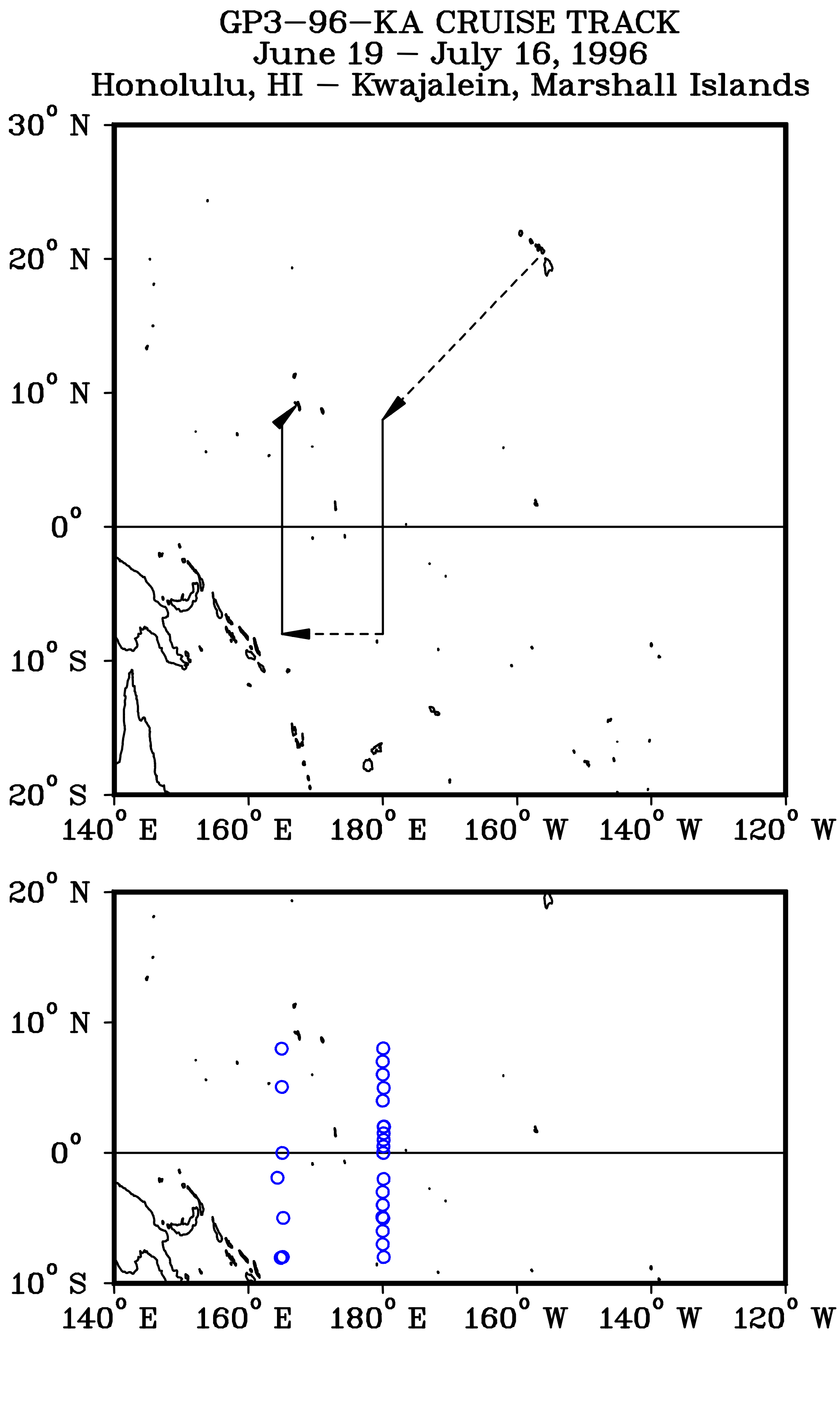

Figure 1k. GP3-96-KA cruise track and station locations.

Table 1k. GP3-96-KA CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
11	8 0.5N	179 56.0W	26 JUN 96	11	100	16	5800	1004
21	7 0.4N	179 59.9W	26 JUN 96	805	100	16		1034
31	6 0.3N	179 59.7W	26 JUN 96	1455	131	5	5400	1003
41	4 58.7N	179 51.4W	27 JUN 96	1010	202	11	5685	1004
51	4 0.1N	179 59.7W	27 JUN 96	1704	350	4	5700	1003
61	2 0.2N	179 53.1W	28 JUN 96	1238	90	5	5313	5102
62	2 0.9N	179 48.6W	29 JUN 96	149	350	0	5442	503
71	1 30.0N	179 52.1W	29 JUN 96	600	59	5	5545	1001
81	0 59.9N	179 52.6W	29 JUN 96	946	33	5	5760	1012
91	0 30.1N	179 53.6W	29 JUN 96	137	70	7	5673	1003
101	0 0.1S	179 55.3W	29 JUN 96	1800	90	15	5360	3006
111	2 0.1S	179 52.8W	30 JUN 96	801	100	11	4740	1006
121	2 59.8S	179 59.9E	30 JUN 96	1440	121	12	5625	1002
131	3 59.3S	179 59.6W	30 JUN 96	2131	110	6	4500	1004
141	4 55.5S	179 56.8E	1 JUL 96	1219	160	5	5520	5301
142	5 0.8S	179 55.5W	2 JUL 96	704	110	13	5662	506
151	5 59.8S	179 59.9E	2 JUL 96	1408	116	13	5250	1001
161	7 0.4S	179 59.6E	2 JUL 96	2038	74	12	3300	1005
171	7 59.2S	179 51.0W	3 JUL 96	449	90	17	4800	1002
181	7 58.8S	165 6.2E	6 JUL 96	1536	135	15	3900	1006
182	8 2.6S	164 48.7E	6 JUL 96	2350	110	12	3900	503
191	4 59.2S	165 11.5E	9 JUL 96	523	67	7	2580	1003
201	1 54.5S	164 19.2E	10 JUL 96	1021	100	16	4440	1005
211	0 0.3S	165 3.0E	11 JUL 96	1322	68	7	4371	4104
221	5 3.5N	164 58.5E	14 JUL 96	647	72	13	5376	1006
231	7 59.3N	164 57.2E	15 JUL 96	759	50	12	5190	4960

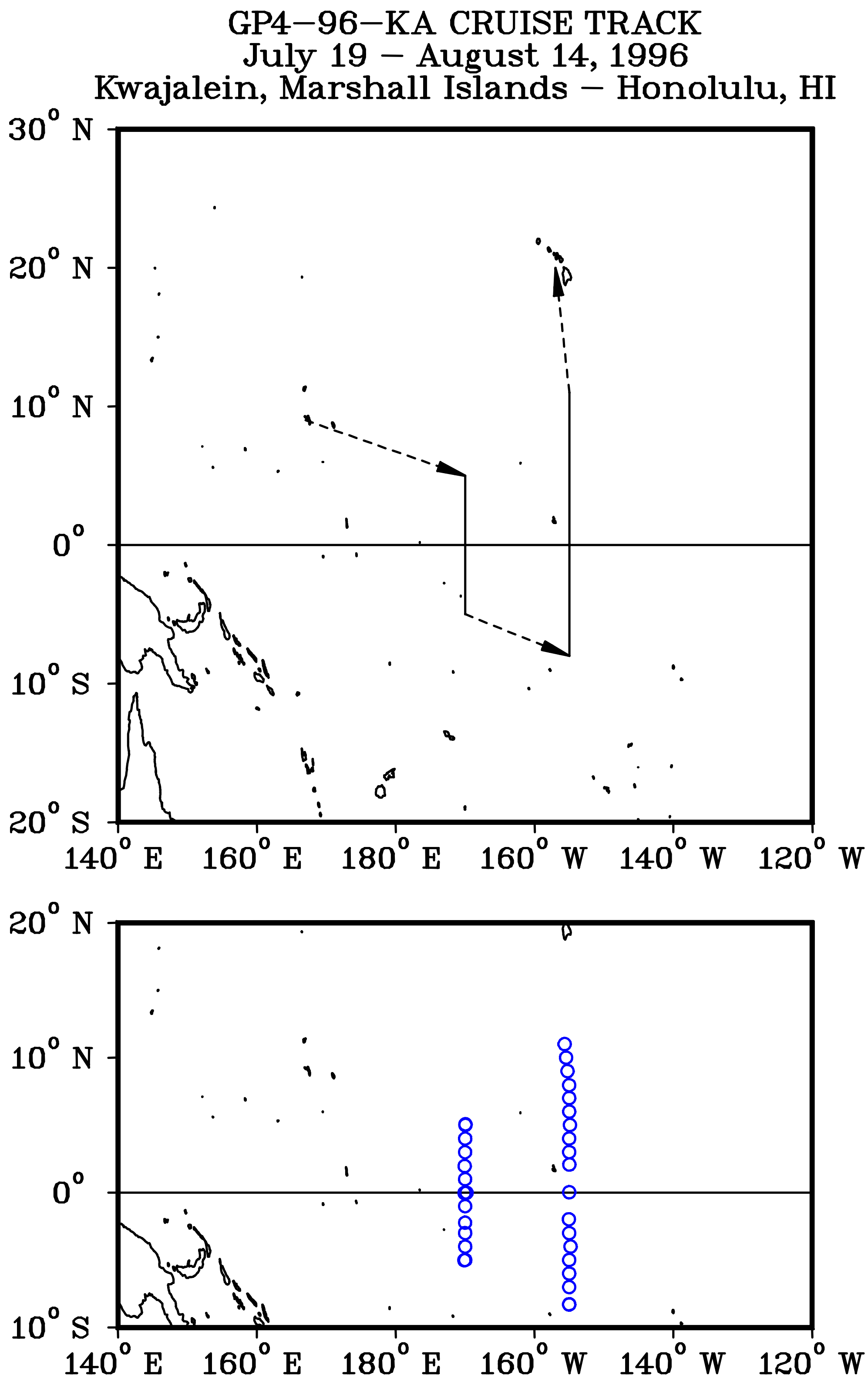

Figure 1l. GP4-96-KA cruise track and station locations.

Table 1l. GP4-96-KA CTD Cast Summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
11	5 4.1N	169 56.2W	25 JUL 96	1530	125	13	5640	4010
12	5 0.8N	169 56.8W	26 JUL 96	713	310	13	5640	502
21	4 0.3N	169 59.7W	26 JUL 96	1431	103	11	5610	1007
31	2 59.9N	170 0.2W	26 JUL 96	2136	101	11	5445	1005
41	1 58.1N	170 3.2W	27 JUL 96	517	90	15	5370	1003
51	0 59.9N	170 0.1W	27 JUL 96	1200	75	17	5430	1005
61	0 0.2S	169 47.5W	28 JUL 96	1009	65	17	5370	5002
62	0 1.2S	170 4.3W	29 JUL 96	751	83	15	5520	501
71	1 0.1S	169 59.9W	29 JUL 96	1450	70	13	5250	1003
81	2 13.6S	170 0.3W	30 JUL 96	709	84	22	4350	1004
91	2 59.7S	169 59.8W	30 JUL 96	1312	95	22	5070	1003
101	4 0.0S	169 59.7W	30 JUL 96	1956	108	24	5580	1003
111	5 0.6S	170 7.0W	31 JUL 96	907	100	20	5160	4002
112	4 59.8S	169 58.7W	1 AUG 96	150	80	16	6127	502
121	8 16.1S	154 59.9W	5 AUG 96	913	70	14	5325	3020
122	8 17.4S	154 59.8W	5 AUG 96	2228	5	15	5314	503
131	6 59.9S	155 0.1W	6 AUG 96	653	110	12	5100	1002
141	5 59.8S	154 59.5W	6 AUG 96	1316	109	11	4944	1003
151	4 59.5S	155 0.6W	6 AUG 96	2053	80	8	4620	1004
161	3 59.7S	154 48.5W	7 AUG 96	333	100	8	3360	1003
171	2 59.8S	155 0.1W	7 AUG 96	945	350	5	4820	1005
181	1 58.4S	155 2.9W	8 AUG 96	845	40	9	4815	1003
191	0 1.9N	154 58.8W	8 AUG 96	2128	100	8	5220	1002
201	2 5.0N	154 57.9W	9 AUG 96	1025	152	10	4734	1003
211	3 0.2N	155 0.0W	9 AUG 96	1614	135	15	5220	1002
221	4 0.6N	155 0.0W	9 AUG 96	2234	122	14	4680	1002
231	5 0.9N	154 53.8W	10 AUG 96	619	107	10	4590	4003
241	6 0.4N	154 59.3W	10 AUG 96	1323	107	12	4830	1004
251	7 0.6N	154 59.7W	10 AUG 96	1942	100	10	4920	1001
261	7 57.8N	155 0.5W	11 AUG 96	415	60	13	5160	4004
271	9 0.4N	155 14.1W	11 AUG 96	1231	70	16	5250	1004
281	10 0.4N	155 27.2W	11 AUG 96	1904	60	13	5160	1002
291	11 0.6N	155 39.5W	12 AUG 96	228	2	14	5190	4003

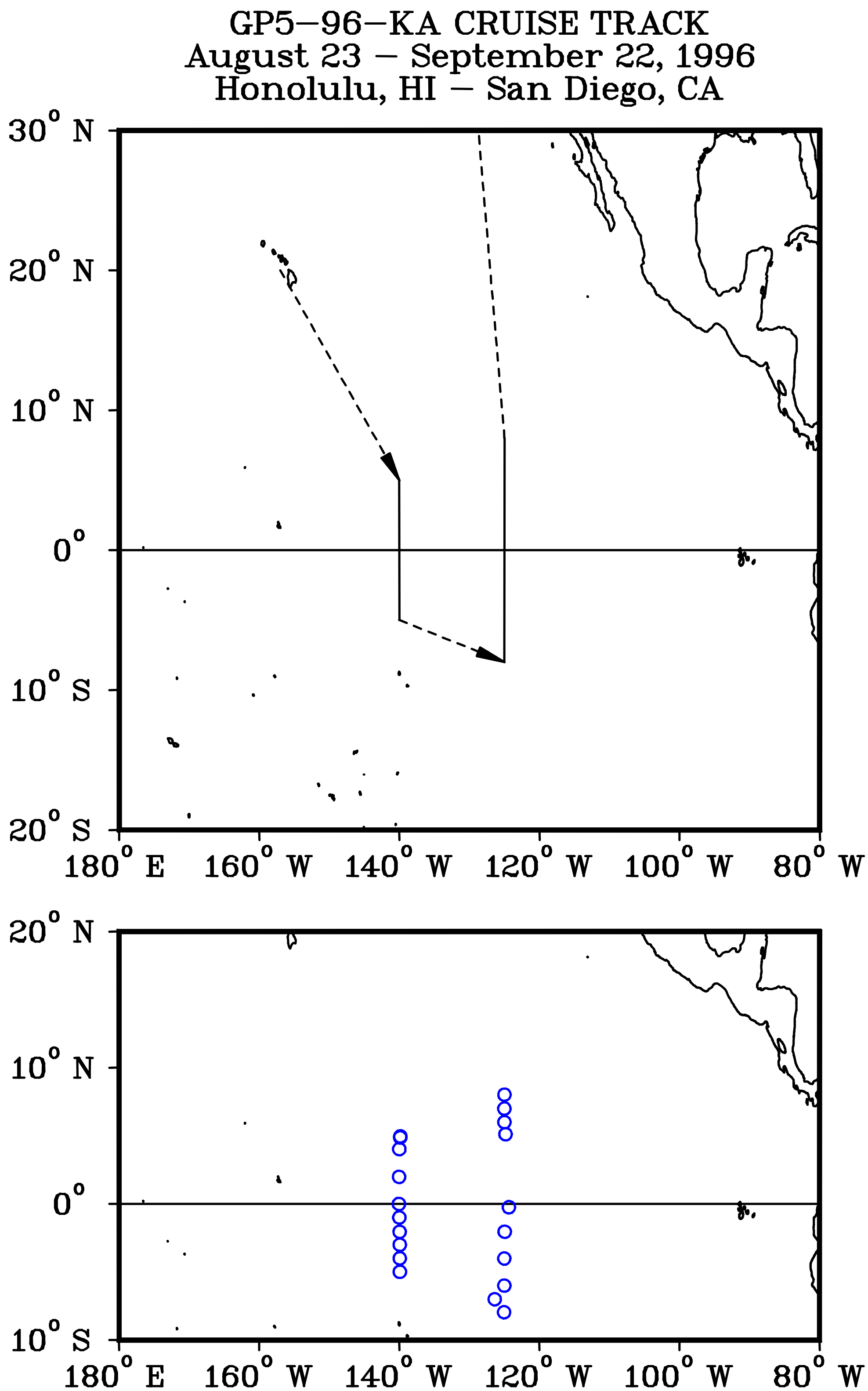

Figure 1m. GP5-96-KA cruise track and station locations.

Table 1m. GP5-96-KA CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
11	4 57.4N	139 51.1W	1 SEP 96	406	114	12	4500	3009
12	4 52.7N	139 52.7W	1 SEP 96	2104	127	12	4500	502
21	4 1.2N	140 0.1W	2 SEP 96	1055	70	11	4320	1002
31	1 59.0N	140 2.2W	3 SEP 96	233	100	16	4362	1003
41	0 0.2S	140 2.9W	4 SEP 96	2312	82	15	4300	1007
51	0 59.9S	139 59.7W	5 SEP 96	942	84	13	4200	1002
61	2 2.9S	139 57.0W	5 SEP 96	1638	73	17	4320	1003
71	2 59.8S	139 55.8W	5 SEP 96	2337	82	13	4305	4009
81	3 59.8S	139 55.8W	6 SEP 96	817	77	16	4500	1004
91	4 59.3S	139 55.3W	7 SEP 96	248	117	18	4320	1008
101	7 0.0S	126 23.1W	11 SEP 96	205	95	14	4380	1003
111	7 57.2S	125 2.0W	11 SEP 96	2110	82	20	4500	1008
121	6 0.0S	124 59.8W	12 SEP 96	1047	94	17	4410	1004
131	4 0.6S	125 0.2W	13 SEP 96	156	104	16	4500	1004
141	2 2.6S	124 57.0W	14 SEP 96	302	96	16	4695	530
151	0 14.7S	124 20.7W	14 SEP 96	1831	122	9	4650	1001
161	5 6.9N	124 49.8W	16 SEP 96	721	142	5	4387	3004
171	6 0.1N	124 59.1W	17 SEP 96	1	163	10	4380	1002
181	6 59.9N	124 59.6W	17 SEP 96	642	169	16	4560	1002
191	8 1.2N	124 58.8W	18 SEP 96	205	230	6	4702	1002

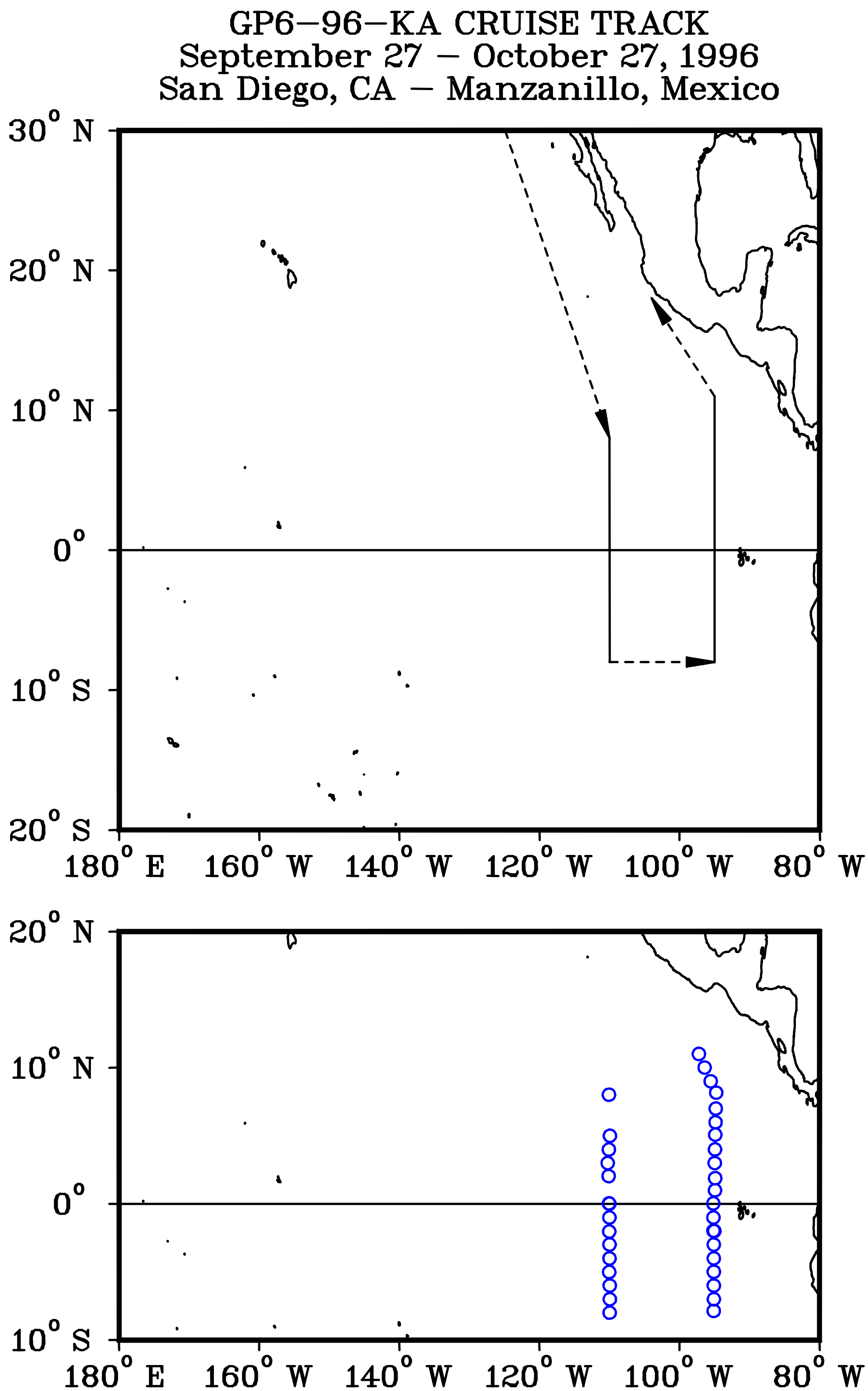

Figure 1n. GP6-96-KA cruise track and station locations.

Table 1n. GP6-96-KA CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
11	8 1.1N	110 3.3W	6 OCT 96	547	222	12	4200	3005
21	5 0.0N	109 55.5W	7 OCT 96	1947	161	18	3960	1004
31	3 59.6N	110 5.2W	8 OCT 96	358	147	9	3918	1002
41	2 59.9N	110 14.9W	8 OCT 96	1018	131	11	3738	1003
51	2 2.6N	110 6.7W	9 OCT 96	245	117	14	3673	1002
61	0 2.2N	110 3.4W	10 OCT 96	301	101	10	3750	3003
62	0 1.2N	110 0.1W	11 OCT 96	33	79	12	3775	504
71	0 59.8S	109 59.9W	11 OCT 96	803	98	12	3969	1003
81	2 1.6S	110 1.0W	11 OCT 96	2323	114	13	3922	1003
91	2 59.0S	109 59.0W	12 OCT 96	609	101	16	3900	1001
101	4 0.1S	109 59.4W	12 OCT 96	1303	106	12	3924	1003
111	5 0.1S	110 1.2W	12 OCT 96	2044	111	14	3397	1001
121	5 59.7S	109 57.3W	13 OCT 96	340	108	14	3480	1002
131	6 59.9S	109 56.7W	13 OCT 96	1027	92	13	3450	1002
141	7 59.3S	109 58.5W	13 OCT 96	2339	131	14	3360	3002
151	7 51.3S	95 6.6W	18 OCT 96	217	110	13	3750	1004
161	6 59.8S	95 4.6W	18 OCT 96	827	91	6	3900	1004
171	5 59.9S	95 5.1W	18 OCT 96	1447	103	8	3900	1002
181	4 58.9S	95 5.1W	18 OCT 96	2209	114	17	3787	1002
191	4 0.0S	95 5.6W	19 OCT 96	433	130	13	3673	1001
201	2 59.3S	95 6.1W	19 OCT 96	1106	120	11	3578	1002
211	1 58.2S	95 8.5W	19 OCT 96	1739	119	10	3420	1001
212	1 59.4S	95 1.3W	20 OCT 96	228	117	12	3352	503
221	0 59.9S	95 8.8W	20 OCT 96	850	127	9	3327	1002
231	0 2.2N	95 9.8W	20 OCT 96	1653	135	13	3300	3000
241	1 0.0N	94 55.2W	21 OCT 96	639	160	7	3517	1002
251	1 53.1N	94 53.9W	21 OCT 96	1316	166	9	2850	2503
261	2 59.8N	94 57.6W	22 OCT 96	146	211	9	2713	1001
271	4 0.0N	94 55.0W	22 OCT 96	814	216	10	3133	1001
281	5 4.8N	94 53.2W	22 OCT 96	1554	191	13	3570	3002
291	5 59.6N	94 50.7W	23 OCT 96	12	213	12	3720	1004
301	6 59.9N	94 49.0W	23 OCT 96	631	208	8	3792	1002
311	8 10.1N	94 45.4W	23 OCT 96	2200	318	6	3708	3002
321	9 0.2N	95 32.7W	25 OCT 96	248	67	7	3180	1000
331	10 0.8N	96 23.8W	25 OCT 96	1030	47	5	3954	1003
341	11 0.5N	97 13.7W	25 OCT 96	1827	80	4	4080	3022

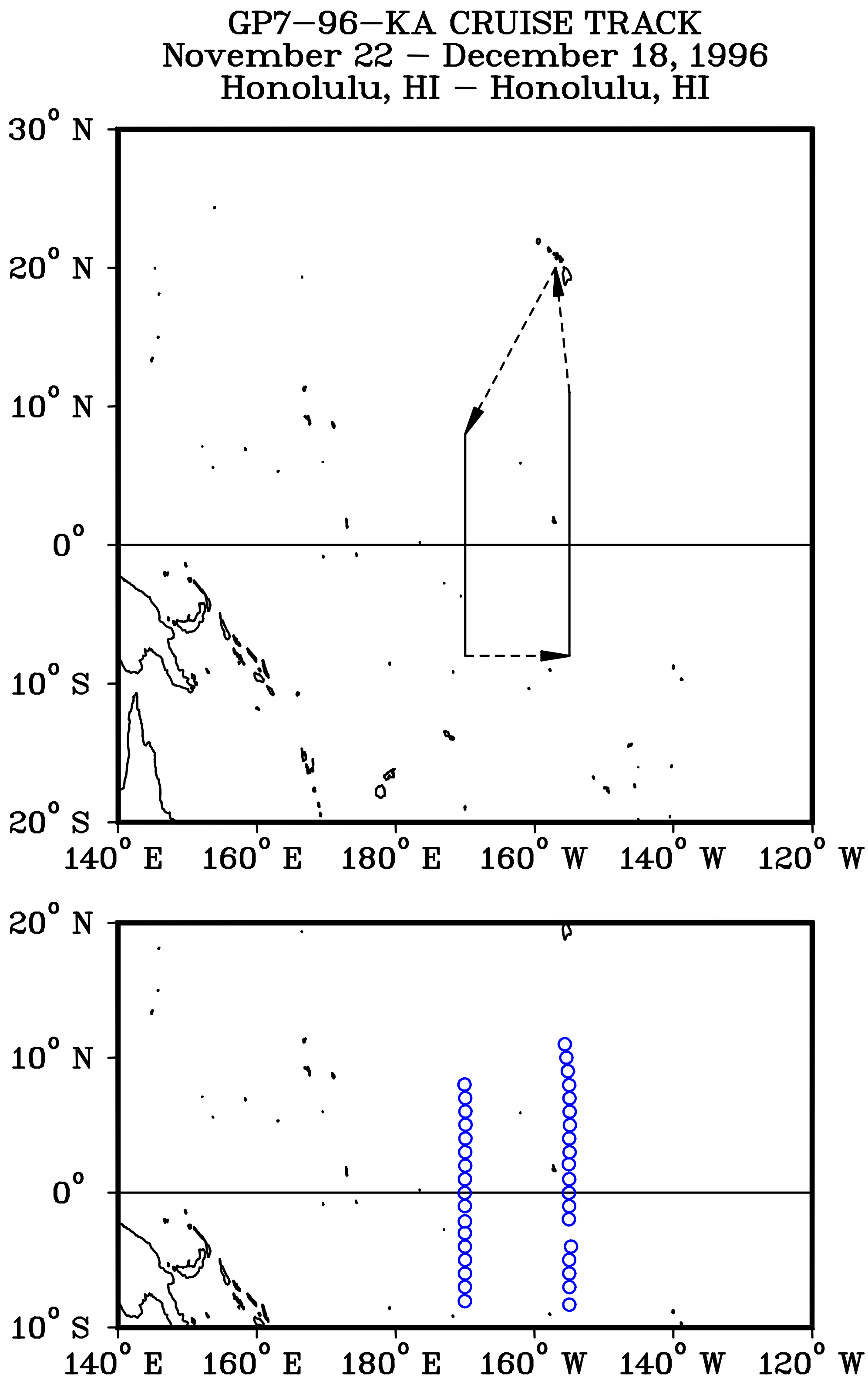

Figure 1o. GP7-96-KA cruise track and station locations.

Table 1o. GP7-96-KA CTD cast summary.

CAST #	LATITUDE	LONGITUDE	DATE	TIME	W/D T	W/S (kts)	DEPTH (m)	CAST (db)
11	8 0.6N	170 4.7W	27 NOV 96	846	67	19	5460	3002
21	7 0.6N	169 58.3W	28 NOV 96	630	62	16	5820	1005
31	6 1.1N	169 56.5W	28 NOV 96	1445	96	23	5400	1001
41	5 2.2N	169 56.0W	29 NOV 96	25	103	12	5580	1002
51	4 0.8N	169 56.9W	29 NOV 96	826	65	3	5480	1003
61	3 0.1N	169 59.0W	29 NOV 96	1637	51	5	5460	1002
71	1 59.9N	169 58.3W	30 NOV 96	1027	356	8	5350	1005
81	0 59.9N	170 1.3W	30 NOV 96	1747	352	4	5460	1001
91	0 1.5S	170 2.8W	1 DEC 96	123	106	1	5580	1001
101	0 59.7S	170 1.6W	1 DEC 96	756	62	3	5460	1001
111	2 7.8S	170 1.6W	1 DEC 96	1530	16	8	4680	1002
121	2 59.9S	170 2.3W	2 DEC 96	906	54	5	5175	1003
131	3 59.8S	170 1.0W	2 DEC 96	1531	38	5	5460	1001
141	4 59.4S	170 0.3W	2 DEC 96	2327	50	10	5400	1002
151	5 59.6S	170 0.8W	3 DEC 96	622	3	11	4800	1002
161	6 59.3S	170 1.4W	3 DEC 96	1309	11	11	4680	1002
171	8 2.3S	170 1.8W	4 DEC 96	404	3	8	5220	1002
181	8 18.0S	154 58.4W	8 DEC 96	9	71	11	5250	1001
191	6 59.8S	154 58.3W	8 DEC 96	906	71	14	5160	1007
201	5 59.4S	154 58.9W	8 DEC 96	1622	94	19	5220	1002
211	4 59.1S	155 0.0W	9 DEC 96	711	85	20	4860	1007
221	3 59.9S	154 44.4W	9 DEC 96	1501	102	19	9999	1005
231	1 58.1S	155 2.9W	10 DEC 96	605	67	18	4800	1003
241	1 0.2S	155 0.1W	10 DEC 96	1351	73	19	4740	1001
251	0 1.2S	155 2.6W	11 DEC 96	733	94	17	4680	3003
261	0 59.9N	154 59.9W	11 DEC 96	1554	119	16	9999	1004
271	2 6.3N	155 3.2W	12 DEC 96	353	115	21	4710	3003
281	2 59.7N	154 56.6W	13 DEC 96	513	86	19	4800	1004
291	4 0.6N	154 59.6W	13 DEC 96	1205	101	20	4690	1002
301	5 0.4N	154 54.8W	13 DEC 96	2042	90	12	4560	3002
311	5 59.9N	154 56.0W	14 DEC 96	511	108	15	4800	1004
321	6 59.7N	154 57.1W	14 DEC 96	1218	124	9	4800	1002
331	7 58.2N	154 59.7W	15 DEC 96	513	86	5	5160	3007
341	9 0.3N	155 11.9W	15 DEC 96	1339	149	1	5280	1003
351	10 0.2N	155 24.4W	15 DEC 96	2035	106	13	5880	1003
361	11 0.0N	155 37.7W	16 DEC 96	356	54	11	5760	3004

To view Figures 2–62, click the red circle next to the figure number.

Table 3. Weather condition code used to describe each set of CTD measurements.

Code	Weather Condition
0	Clear (no cloud)
1	Partly cloudy
2	Continuous layer(s) of cloud(s)
3	Sandstorm, dust storm, or blowing snow
4	Fog, thick dust or haze
5	Drizzle
6	Rain
7	Snow, or rain and snow mixed
8	Shower(s)
9	Thunderstorms

Table 4. Sea state code used to describe each set of CTD measurements.

Code	Height (meters)	Description
0	0	Calm-glassy
1	0–0.1	Calm-rippled
2	0.1–0.5	Smooth-wavelet
3	0.5–1.25	Slight
4	1.25–2.5	Moderate
5	2.5–4	Rough
6	4–6	Very rough
7	6–9	High
8	9–14	Very high
9	>14	Phenomenal

Table 5. Visibility code used to describe each set of CTD measurements.

Code	Visibility
0	<50 meters
1	50–200 meters
2	200–500 meters
3	500–1,000 meters
4	1–2 km
5	2–4 km
6	4–10 km
7	10–20 km
8	20–50 km
9	50 km or more

Table 6. Cloud type.

Code	Cloud Types
0	Cirrus
1	Cirrocumulus
2	Cirrostratus
3	Altocumulus
4	Altostratus
5	Nimbostratus
6	Stratocumulus
7	Stratus
8	Cumulus
9	Cumulonimbus
X	Clouds not visible

Table 7. Cloud amount.

Code	Cloud Amount
0	0
1	1/10 or less but not zero
2	2/10–3/10
3	4/10
4	5/10
5	6/10
6	7/10–8/10
7	9/10
8	10/10
9	Sky obscured or not determined

All CTD and Hydrographic Data can be obtained by contacting K.E. McTaggart at kem@pmel.noaa.gov.