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CTD Measurements During 1997 and 1998 as Part of the Global Ocean-Atmosphere-Land System (GOALS)/Pan American Climate Studies (PACS)

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Abstract. During 1997 and 1998, 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 meridians 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 bulk of 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. 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 track-line 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.

CTD measurements are used to verify ATLAS temperature sensor data, calculate dynamic height, and at many sites, are the only observations of the equatorial Pacific salinity field. These CTD data are quickly processed, calibrated, and distributed internationally to a wide variety of users: biological, chemical, and physical oceanographers at universities and government laboratories including NOAA/NCEP for improvement of ENSO predictions.

Summaries of CTD measurements and hydrographic data collected on fifteen cruises during 1997 and 1998 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 (97 or 98), and zz is the ship code (KA for the NOAA ship *Ka'imimoana*, RB for the NOAA ship *Ronald H. Brown*). 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 conducitivity (see section 6).

2. Sea-Bird 911plus CTD System

The Sea-Bird Electronics, Inc. (SBE) 911plus CTD system is a real-time data system with the CTD data from the SBE 9plus underwater unit 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).

2.1 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:

$$C(\mathrm{S/m}) = (g + hf^2 + if^3 + jf^4)/[10(1 + \mathit{ctcor}\ t + \mathit{cpcor}\ p)]$$

where g, h, i, j, *ctcor*, and *cpcor* 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.

2.2 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-90) is computed according to

$$T(^\circ\mathrm{C}) = 1/\{g + h[\ln(f0/f)] + i[\ln^2(f0/f)] + j[\ln^3(f0/f)]\} - 273.15$$

where g, h, i, j, and $f0$ are calibration coefficients, and f is the instrument frequency (kHz). SEASOFT automatically implements this equation, and converts between ITS-90 and IPTS-68 temperature scales when selected.

2.3 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

$$
\begin{aligned}
c &= c1 + c2 * U + c3 * U^2 \\
d &= d1 + d2 * U \\
t0 &= t1 + t2 * U + t3 * U^2 + t4 * U^3 + t5 * U^4
\end{aligned}
$$

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 (μs). 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 $\frac{1}{4}$" QIC-80 cartridge tapes or Zip disks.

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 are acquired from the instruments and stored unmodified. 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-s 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 s and on conductivity with a time constant of 0.03 s. 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 plus or minus half the bin size.

6. Post-Cruise 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 linear or 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. CALCOPn additionally returns a linear pressure term (modified beta) that is multiplied by CTD pressure and added to conductivity. The order of the polynomial was chosen to keep the standard deviation of each grouping to a minimum. Table 3 lists the conductivity calibration coefficients determined for each station grouping.

For *Ka'imimoana* cruises beginning with GP398, adjustments were made to the bias of the thermistors using a linear fit of the sensor drift history from calibration data projected to the midpoint of each cruise. Also, a uniform correction was applied for heating of the thermistor owing to viscous effects. Thermistors are biased high by this effect and were adjusted down by 0.6e–03°C. This results in errors of no more than ±0.15e–03°C from this effect for the full range of oceanographic temperature and salinity. Table 2 lists the drift and viscous heating corrections applied to temperature for these cruises.

PMEL Fortran program CALMSTR applies post-cruise calibrations to temperature and conductivity, and computes final salinity values. Final pressure calibrations were pre-cruise. CTD-bottle conductivity differences (Figs. 2a–h) are used to verify the success of the fit parameters.

Due to power outages during GP898 salinity analyses for stations 13–17, bad bottle salinities for stations 14–17 and some of station 13 were omitted from the calibration data.

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 amended 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 plots which follow were produced using Plot Plus Scientific Graphics System (Denbo, 1992). Figures 3–47 are potential temperature, salinity, and sigma-theta sections for each meridian. Figures 48–62 are composite potential temperature-salinity diagrams for each meridian. Tables 4–8 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

The assistance of the officers, crew, and scientific parties of the NOAA ships *Ka'imimoana* and *Ronald H. Brown* are gratefully acknowledged. Salinity analyses were successfully completed by each ship's Survey Department personnel: Jim Davis, Dennis Sweeney, and Jonathan Shannahoff. Linda Mangum supervised CTD operations on some cruises and completed preliminary calibrations and processing at sea. This research was supported by NOAA's Office of Global Programs.

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FIGURES AND TABLES

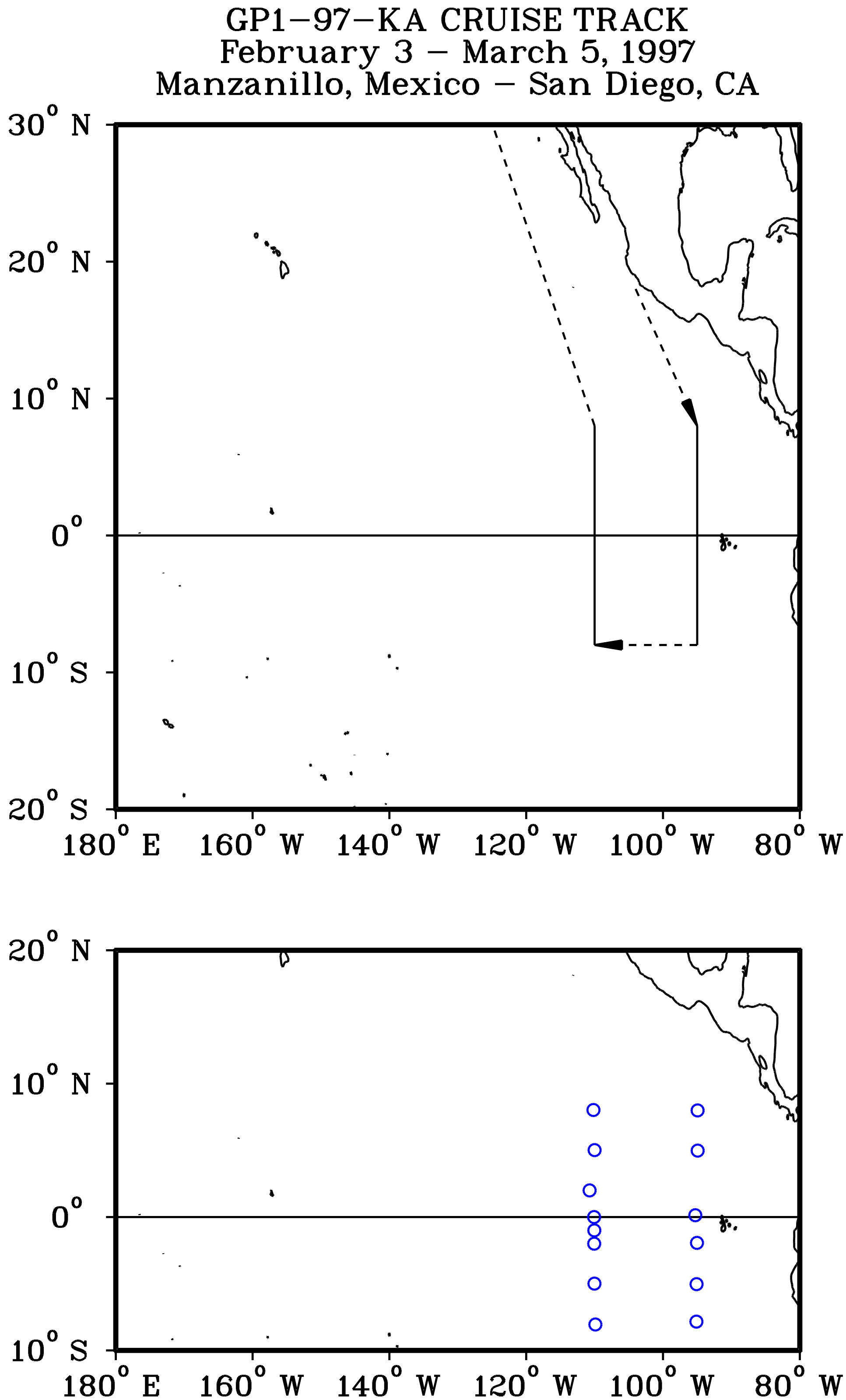


Figure 1a: GP1-97-KA cruise track and station locations.

Table 1a: GP1-97-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	7° 59.6′N	94° 56.6′W	8 Feb 97	36	67	9	3712	1001
21	4° 58.8′N	94° 56.0′W	8 Feb 97	2353	37	5	3770	1002
31	0° 8.1′N	95° 16.7′W	12 Feb 97	1118	163	11	3330	3004
41	1° 56.3′S	95° 1.9′W	13 Feb 97	1809	135	10	3390	1006
51	5° 2.0′S	95° 5.6′W	14 Feb 97	2126	145	8	3834	1001
61	7° 50.5′S	95° 6.9′W	15 Feb 97	2122	136	14	3982	1001
71	8° 3.4′S	109° 53.2′W	19 Feb 97	1317	115	14	3500	3003
81	4° 59.6′S	110° 1.3′W	20 Feb 97	1520	145	12	3409	501
91	1° 59.9′S	110° 3.6′W	21 Feb 97	1039	106	18	9999	1004
101	1° 0.1′S	110° 2.4′W	21 Feb 97	1851	86	9	3921	501
111	0° 0.1′S	110° 4.3′W	22 Feb 97	928	107	10	3750	3503
121	1° 59.8′N	110° 43.8′W	24 Feb 97	1815	135	13	3750	1002
131	5° 1.1′N	110° 0.0′W	25 Feb 97	2251	48	15	3901	1000
141	8° 1.5′N	110° 10.2′W	26 Feb 97	1844	44	14	4266	1000

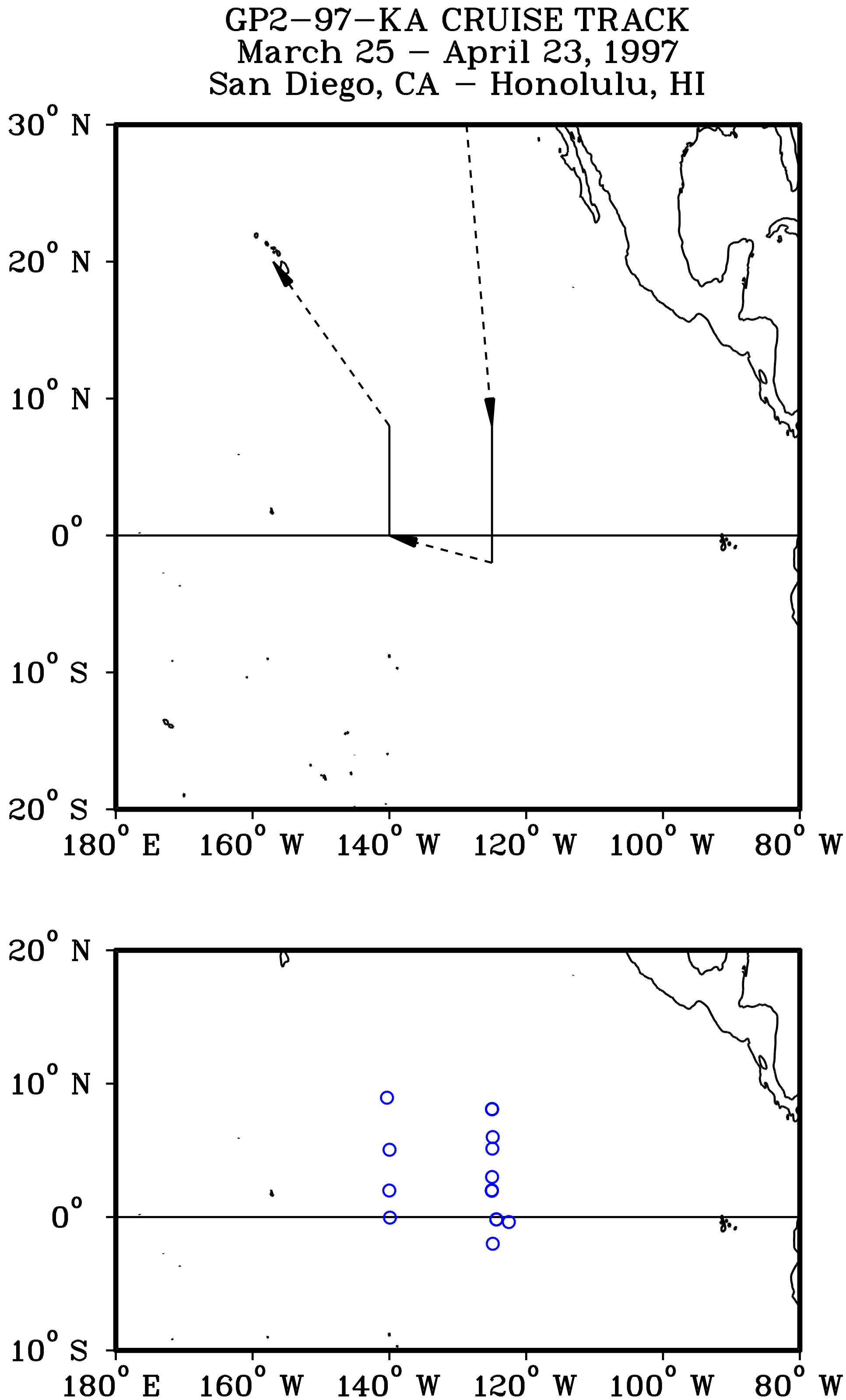
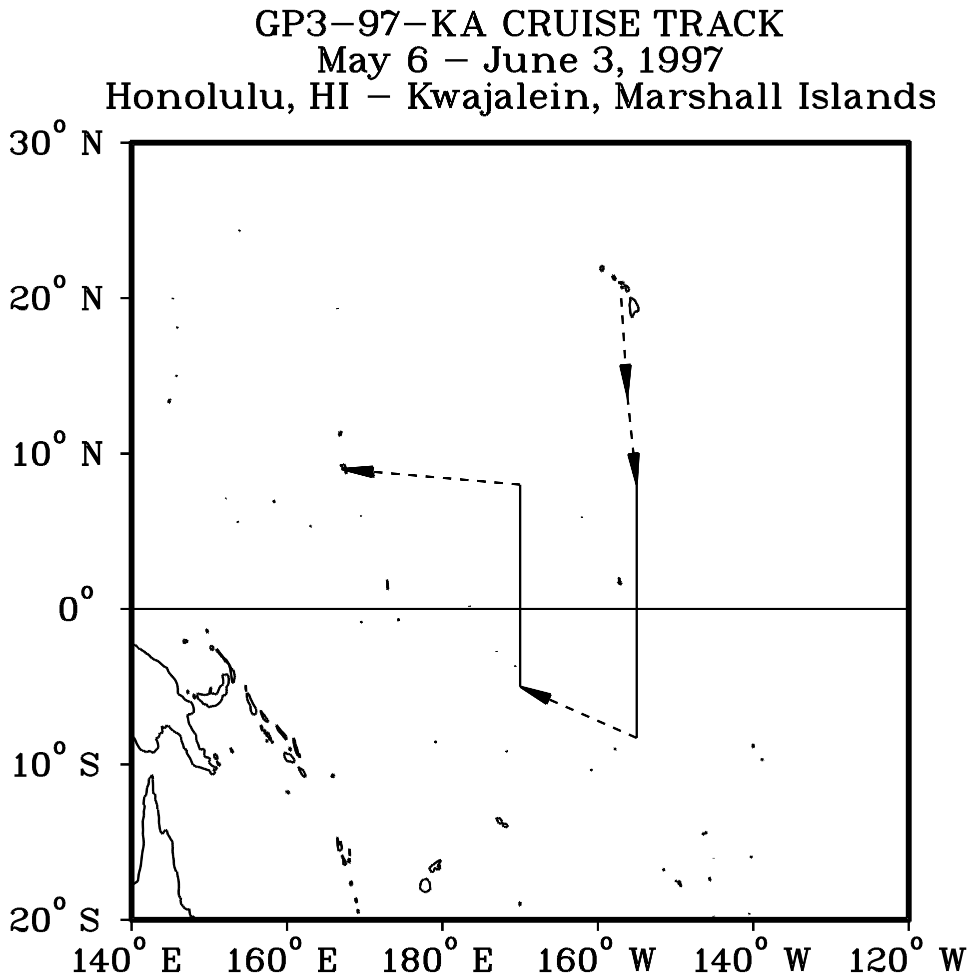


Figure 1b: GP2-97-KA cruise track and station locations.

Table 1b: GP2-97-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	8° 6.0′N	124° 59.7′W	2 APR 97	20	123	14	4507	1007
12	8° 4.7′N	124° 59.6′W	2 APR 97	422	80	4	3775	502
21	5° 59.8′N	124° 53.7′W	2 APR 97	1834	175	9	4997	1004
31	5° 7.7′N	124° 57.0′W	3 APR 97	631	170	7	5010	1003
41	3° 0.2′N	124° 59.5′W	3 APR 97	2013	172	5	5089	1002
51	2° 0.5′N	125° 1.5′W	4 APR 97	916	259	1	4669	4002
61	1° 57.9′N	125° 1.5′W	4 APR 97	2204	124	7	4608	501
71	0° 22.5′S	122° 32.3′W	6 APR 97	2119	53	9	5040	502
81	0° 10.6′S	124° 21.9′W	7 APR 97	1119	64	9	4730	4001
82	0° 10.7′S	124° 21.4′W	8 APR 97	2241	81	9	5220	1002
91	2° 0.2′S	124° 53.2′W	9 APR 97	1445	81	10	4730	1004
101	0° 2.7′S	139° 55.4′W	14 APR 97	758	80	13	4330	3505
111	1° 59.3′N	140° 1.1′W	16 APR 97	429	84	13	4372	1002
121	5° 2.7′N	139° 58.9′W	17 APR 97	323	71	11	4315	502
131	8° 56.8′N	140° 21.2′W	18 APR 97	1251	223	14	5002	1002



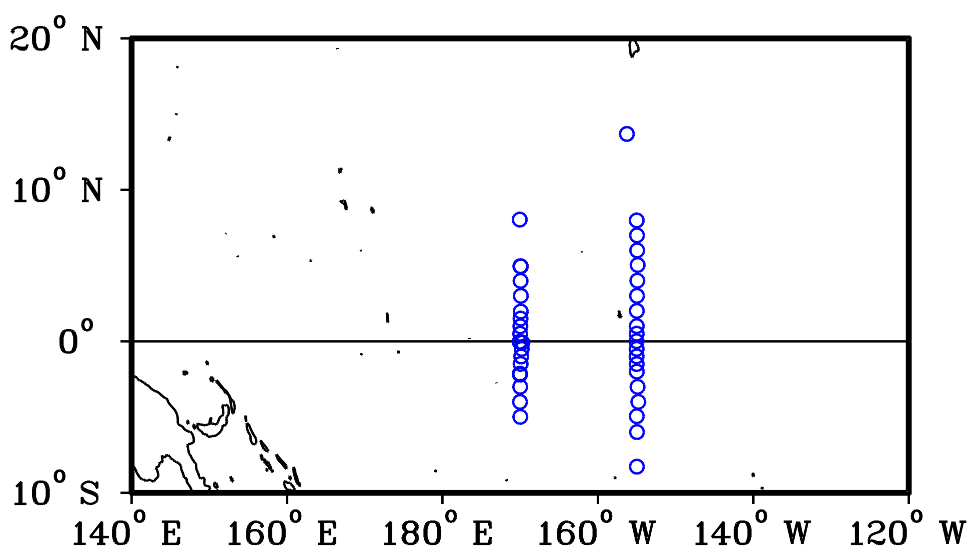


Figure 1c: GP3-97-KA cruise track and station locations.

Table 1c: GP3-97-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	13° 41.6′N	156° 16.2′W	9 MAY 97	46	55	7	5534	201
21	7° 58.9′N	155° 0.3′W	10 MAY 97	1335	75	17	0	1005
31	6° 59.9′N	154° 58.0′W	10 MAY 97	2047	102	18	5690	1009
41	6° 0.1′N	154° 56.6′W	11 MAY 97	405	88	10	5484	1005
51	5° 2.4′N	154° 53.0′W	11 MAY 97	1312	65	11	4632	3703
61	4° 0.3′N	154° 55.5′W	12 MAY 97	846	20	9	5310	1006
71	3° 0.3′N	154° 58.0′W	12 MAY 97	1545	88	10	4755	1004
81	2° 0.6′N	154° 59.6′W	12 MAY 97	2257	105	12	4698	1002
91	1° 0.2′N	154° 59.9′W	13 MAY 97	1241	115	13	4761	1004
101	0° 30.3′N	155° 0.2′W	13 MAY 97	1648	115	17	4693	1002
111	0° 0.5′N	155° 1.6′W	14 MAY 97	117	129	3	4693	1004
121	0° 29.7′S	155° 0.7′W	14 MAY 97	541	128	9	4909	1006
131	0° 59.4′S	155° 1.0′W	14 MAY 97	943	127	11	4755	1009
141	1° 30.0′S	155° 0.3′W	14 MAY 97	1355	120	14	4884	1007
151	1° 59.9′S	154° 59.8′W	15 MAY 97	404	96	11	4983	1005
161	3° 0.2′S	154° 53.8′W	15 MAY 97	1115	98	15	4909	1003
171	3° 59.7′S	154° 47.8′W	15 MAY 97	1753	21	6	3605	1005
181	4° 56.6′S	154° 59.9′W	16 MAY 97	40	111	9	4632	1006
191	5° 59.4′S	154° 58.3′W	16 MAY 97	818	98	10	5001	1005
201	8° 16.4′S	154° 58.9′W	17 MAY 97	802	102	8	5336	1008
211	4° 59.0′S	169° 59.0′W	21 MAY 97	738	241	4	5351	1004
221	3° 59.8′S	170° 1.2′W	21 MAY 97	1445	194	4	5695	1006
231	3° 0.0′S	169° 59.7′W	21 MAY 97	2110	149	4	5279	1005
241	2° 12.0′S	170° 1.6′W	22 MAY 97	643	174	6	4724	503
251	2° 8.2′S	170° 1.7′W	22 MAY 97	1543	3	6	4886	4006
261	2° 9.3′S	170° 1.6′W	22 MAY 97	2147	68	12	4909	302
271	1° 29.4′S	169° 56.5′W	23 MAY 97	219	183	3	5047	1010
281	1° 0.0′S	169° 52.1′W	23 MAY 97	546	147	2	0	1002
291	0° 30.1′S	169° 47.8′W	23 MAY 97	933	147	2	0	1102
301	0° 5.0′S	169° 42.9′W	23 MAY 97	1540	84	6	5279	3004
311	0° 1.6′S	170° 3.4′W	24 MAY 97	825	20	8	0	1454
321	0° 2.4′S	170° 3.3′W	25 MAY 97	132	136	7	5599	1505
331	0° 30.1′N	170° 0.0′W	25 MAY 97	610	60	14	5449	1003
341	0° 59.6′N	169° 58.5′W	25 MAY 97	1010	56	12	5413	1005
351	1° 30.2′N	169° 57.1′W	25 MAY 97	1406	50	10	5569	1004
361	1° 58.0′N	169° 55.5′W	25 MAY 97	1746	80	8	5355	1001
371	3° 0.3′N	169° 54.9′W	26 MAY 97	249	156	7	5496	1003
381	3° 59.5′N	169° 56.8′W	26 MAY 97	930	33	5	5713	1005
391	4° 56.8′N	169° 55.0′W	26 MAY 97	1556	116	8	5800	1004
401	4° 57.6′N	169° 58.7′W	27 MAY 97	250	103	4	5776	503
411	8° 2.3′N	170° 3.3′W	27 MAY 97	2340	60	12	5493	4003

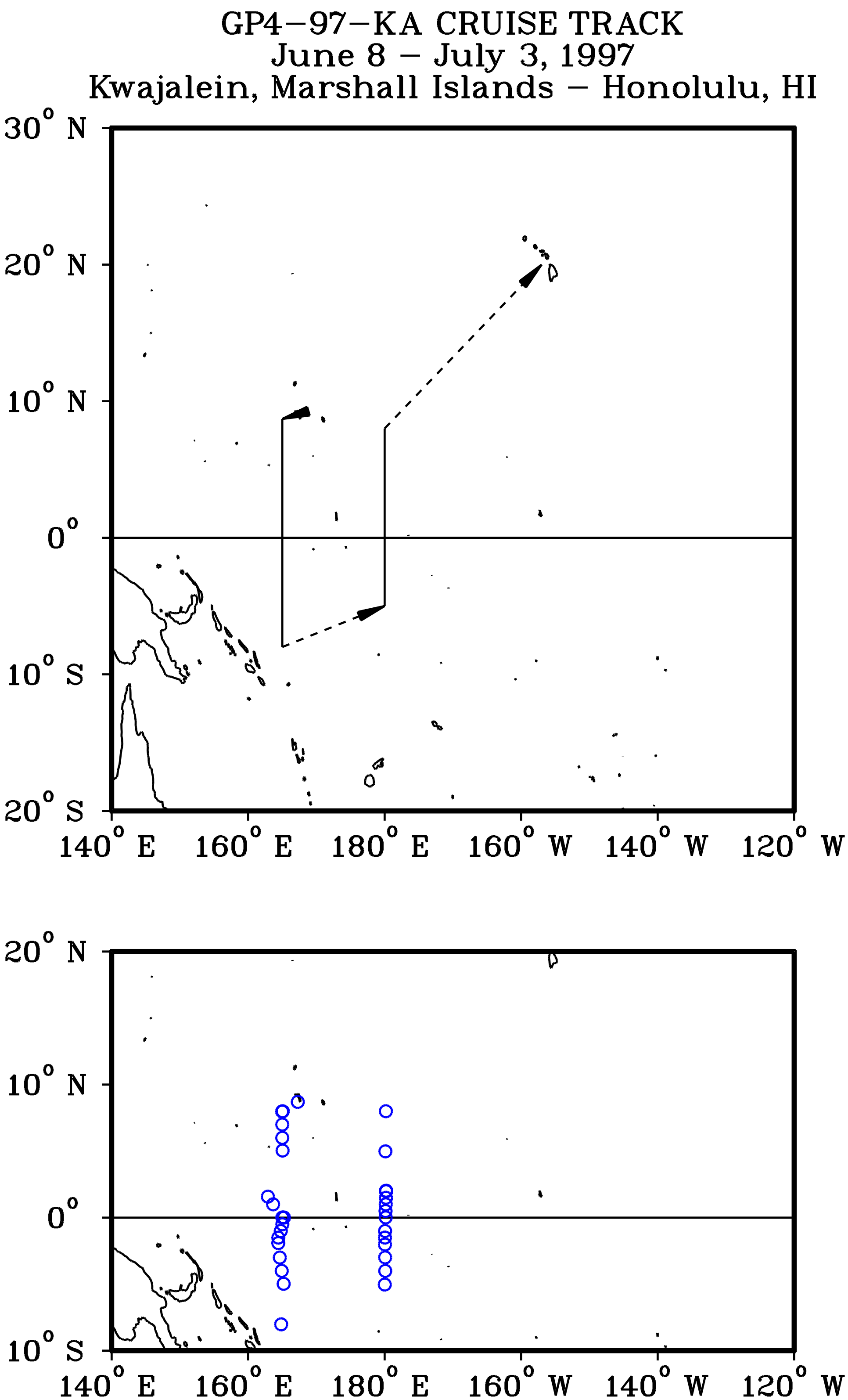


Figure 1d: GP4-97-KA cruise track and station locations.

Table 1d: GP4-97-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	8° 42.0′N	167° 16.3′E	8 JUN 97	1328	23	8	0	4004
21	7° 58.3′N	164° 58.6′E	9 JUN 97	1014	70	1	5183	3005
22	7° 59.6′N	165° 4.3′E	9 JUN 97	2342	50	6	5210	1006
31	6° 59.9′N	165° 0.2′E	10 JUN 97	525	61	3	5121	1003
41	6° 0.0′N	165° 0.0′E	10 JUN 97	1153	29	3	4998	1001
51	5° 2.5′N	165° 2.5′E	11 JUN 97	401	131	3	4786	1005
61	1° 34.7′N	162° 53.6′E	12 JUN 97	852	290	10	4254	1002
71	0° 59.9′N	163° 39.3′E	12 JUN 97	1458	294	11	4295	1006
81	0° 0.3′N	165° 15.3′E	13 JUN 97	1008	292	16	4387	3004
91	0° 0.6′N	165° 0.5′E	14 JUN 97	122	191	9	4387	1003
101	0° 30.2′S	165° 0.6′E	14 JUN 97	540	168	6	4417	1008
111	1° 0.3′S	164° 46.6′E	14 JUN 97	1016	174	7	4387	1003
121	1° 30.2′S	164° 25.2′E	14 JUN 97	205	168	9	4306	1002
131	1° 54.9′S	164° 25.0′E	15 JUN 97	402	172	17	4437	1005
141	3° 0.0′S	164° 38.2′E	15 JUN 97	1144	169	12	4203	1001
151	4° 0.0′S	164° 55.1′E	15 JUN 97	1902	190	6	3807	1004
161	4° 58.5′S	165° 12.0′E	16 JUN 97	230	165	8	2539	1004
171	8° 1.3′S	164° 50.2′E	17 JUN 97	348	114	4	3899	1004
181	5° 1.9′S	179° 59.0′W	22 JUN 97	506	263	3	5973	1005
191	4° 0.1′S	179° 54.9′W	22 JUN 97	1242	255	13	5744	1001
201	2° 59.6′S	179° 55.6′W	22 JUN 97	1943	258	12	5063	1003
211	2° 1.3′S	179° 57.3′W	23 JUN 97	225	189	4	0	1004
221	1° 30.0′S	179° 57.3′W	23 JUN 97	651	242	7	5238	1006
231	1° 0.3′S	179° 56.2′W	23 JUN 97	1045	226	5	0	1003
242	0° 0.9′N	179° 50.8′W	23 JUN 97	2347	196	4	5403	1005
251	0° 29.7′N	179° 52.2′W	24 JUN 97	350	253	17	5682	1003
261	0° 59.8′N	179° 50.4′W	24 JUN 97	752	253	17	5734	1004
271	1° 29.5′N	179° 48.5′W	24 JUN 97	1150	130	2	5558	1002
281	2° 1.2′N	179° 47.6′W	24 JUN 97	1622	200	6	5484	1334
282	1° 59.2′N	179° 47.4′W	24 JUN 97	1730	206	9	5434	1003
283	2° 0.2′N	179° 46.9′W	25 JUN 97	328	143	3	5486	502
291	4° 58.8′N	179° 53.4′W	26 JUN 97	1005	95	1	5514	1003
301	7° 59.8′N	179° 49.0′W	27 JUN 97	629	191	2	5918	460

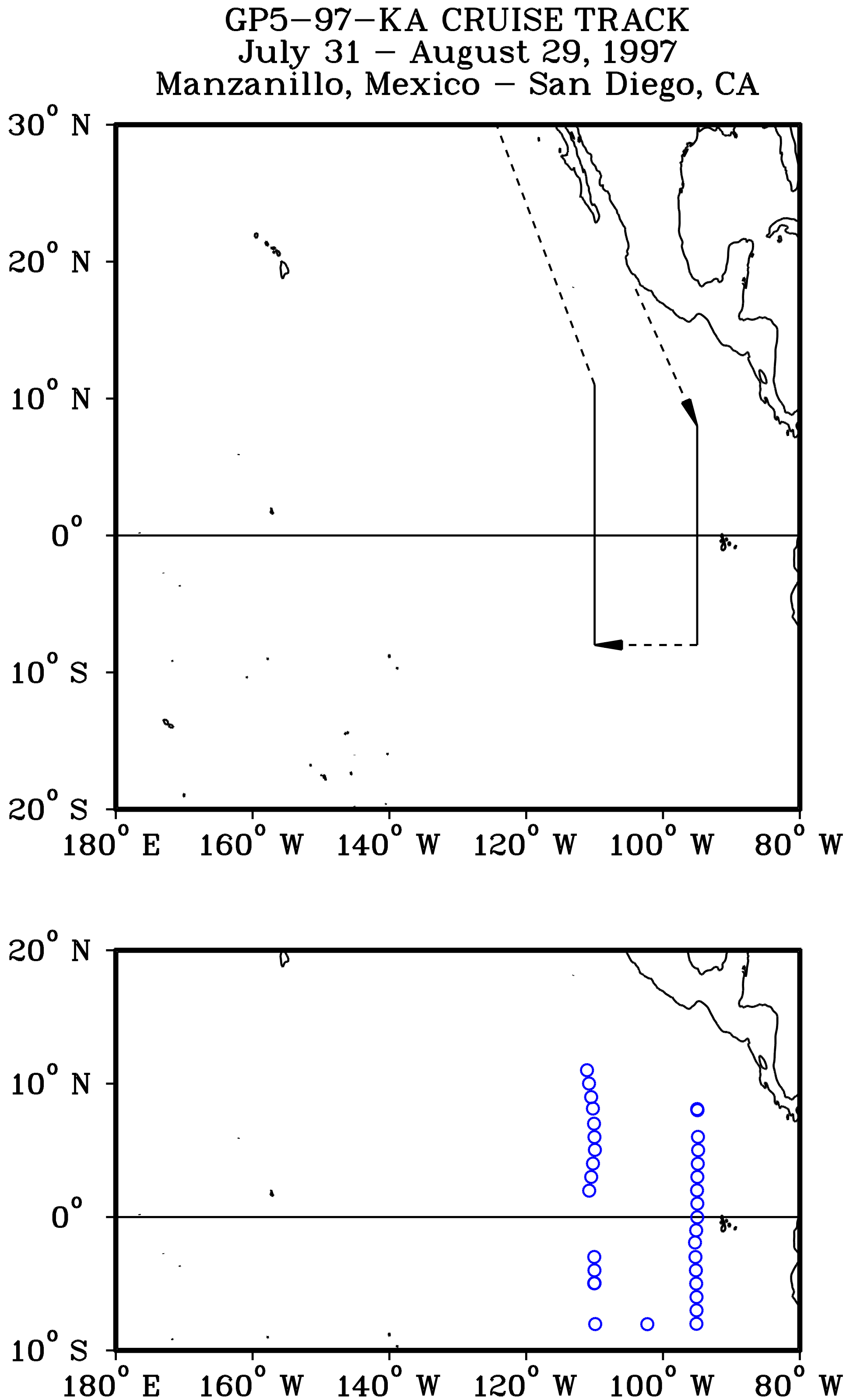


Figure 1e: GP5-97-KA cruise track and station locations.

Table 1e: GP5-97-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	8° 5.7′N	95° 0.4′W	5 AUG 97	316	98	4	3642	3338
12	8° 0.6′N	94° 57.8′W	5 AUG 97	2245	75	12	3682	1397
21	6° 0.6′N	94° 53.5′W	6 AUG 97	1228	270	4	3007	1103
31	5° 0.7′N	94° 51.9′W	6 AUG 97	2057	159	5	3530	1501
41	3° 59.7′N	94° 54.9′W	7 AUG 97	408	187	3	3198	1302
51	3° 0.3′N	94° 58.8′W	7 AUG 97	1122	150	9	2691	1003
61	2° 0.0′N	95° 1.3′W	7 AUG 97	2317	183	16	2867	1503
71	1° 0.3′N	94° 58.9′W	8 AUG 97	724	174	10	3117	1010
81	0° 1.2′S	94° 59.8′W	9 AUG 97	201	184	9	3337	1003
91	0° 59.8′S	95° 9.0′W	9 AUG 97	915	145	12	3319	916
101	1° 54.6′S	95° 19.3′W	9 AUG 97	1711	173	8	3397	1004
111	2° 59.9′S	95° 15.3′W	10 AUG 97	134	142	8	3652	1003
121	3° 59.8′S	95° 11.5′W	10 AUG 97	835	161	12	3047	1002
131	4° 59.5′S	95° 9.0′W	10 AUG 97	1600	100	6	3815	1004
141	6° 0.0′S	95° 6.1′W	10 AUG 97	2300	115	8	3888	1004
151	6° 59.8′S	95° 6.1′W	11 AUG 97	554	168	10	3846	1003
161	8° 0.3′S	95° 7.1′W	12 AUG 97	400	144	12	3943	1004
171	8° 2.0′S	102° 17.7′W	13 AUG 97	2019	127	13	4138	502
181	8° 1.5′S	109° 54.9′W	16 AUG 97	358	103	17	3500	168
191	4° 58.0′S	110° 3.8′W	17 AUG 97	342	111	18	3458	338
202	4° 57.4′S	110° 0.3′W	17 AUG 97	1829	92	14	3470	1004
211	3° 59.8′S	110° 1.3′W	18 AUG 97	201	122	17	3667	502
221	2° 59.7′S	110° 3.1′W	18 AUG 97	952	135	17	3758	1005
231	1° 58.7′N	110° 47.5′W	20 AUG 97	1838	149	12	3743	1003
241	3° 0.3′N	110° 29.9′W	21 AUG 97	338	162	10	3910	1004
251	4° 0.6′N	110° 14.4′W	21 AUG 97	1017	174	12	3931	1005
261	5° 2.1′N	109° 57.4′W	21 AUG 97	1738	130	4	4016	1004
271	5° 59.7′N	110° 1.4′W	22 AUG 97	12	144	5	3682	1003
281	6° 59.8′N	110° 5.1′W	22 AUG 97	701	86	1	3530	1003
291	8° 8.1′N	110° 14.9′W	23 AUG 97	349	108	4	4022	1004
301	8° 59.6′N	110° 30.3′W	23 AUG 97	1124	118	6	3743	1002
311	10° 0.6′N	110° 49.0′W	23 AUG 97	1810	92	12	3591	1003
321	11° 0.4′N	111° 6.7′W	24 AUG 97	39	84	13	3349	1002

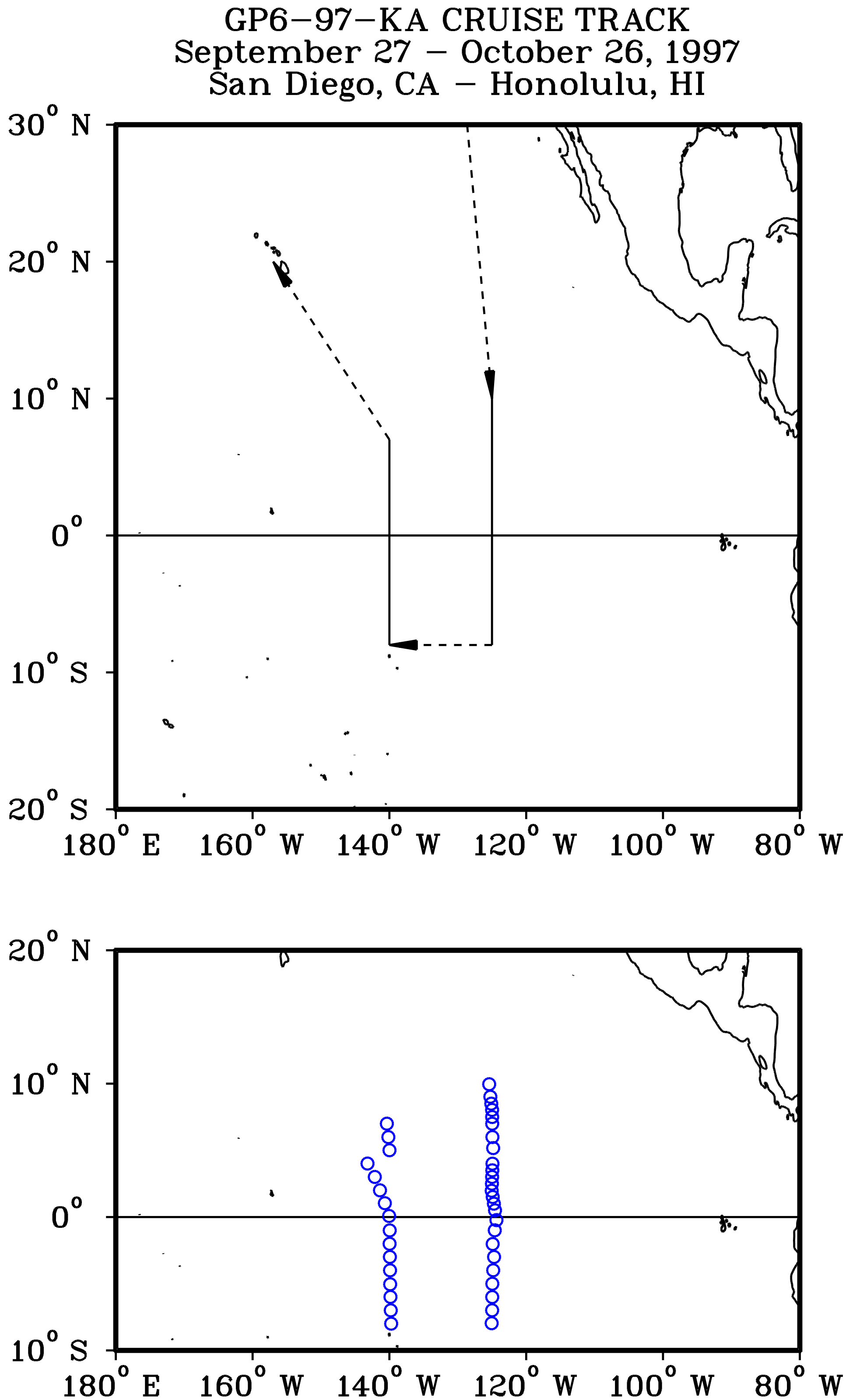


Figure 1f: GP6-97-KA cruise track and station locations.

Table 1f: GP6-97-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
21	9° 57.4′N	125° 24.7′W	4 OCT 97	104	13	17	4628	1004
31	9° 1.1′N	125° 14.5′W	4 OCT 97	935	17	10	4574	503
41	8° 30.0′N	125° 6.4′W	4 OCT 97	1337	4	11	4512	502
51	8° 1.9′N	124° 59.2′W	5 OCT 97	104	359	1	4634	1002
61	7° 30.0′N	124° 58.7′W	5 OCT 97	515	310	3	4567	1002
71	6° 59.9′N	124° 58.2′W	5 OCT 97	1017	323	4	4628	1005
81	5° 59.9′N	124° 56.6′W	5 OCT 97	1632	315	6	4610	1010
91	5° 10.1′N	124° 50.0′W	6 OCT 97	455	203	6	4126	1012
101	4° 0.0′N	124° 55.9′W	7 OCT 97	439	270	4	4506	1003
111	3° 30.1′N	124° 57.3′W	7 OCT 97	840	267	2	4536	1003
121	3° 0.4′N	124° 59.0′W	7 OCT 97	1248	149	17	4444	1005
131	2° 29.9′N	125° 0.5′W	7 OCT 97	1651	144	14	4536	1003
141	1° 58.2′N	125° 2.5′W	7 OCT 97	2141	142	14	4690	1004
151	1° 30.1′N	124° 53.6′W	8 OCT 97	205	135	10	4751	1003
161	1° 0.1′N	124° 43.6′W	8 OCT 97	618	105	11	4567	1003
171	0° 30.2′N	124° 33.6′W	8 OCT 97	1029	95	11	4618	1005
181	0° 13.8′S	124° 21.0′W	8 OCT 97	1640	82	13	4653	3003
191	0° 59.7′S	124° 35.7′W	9 OCT 97	546	106	13	4634	1004
201	2° 1.3′S	124° 54.2′W	9 OCT 97	1333	104	11	4721	1005
211	2° 59.7′S	124° 41.9′W	10 OCT 97	647	112	18	4573	501
221	3° 59.6′S	124° 49.5′W	10 OCT 97	1335	103	16	4475	505
231	5° 0.1′S	124° 57.2′W	11 OCT 97	519	104	12	4532	1002
241	6° 0.0′S	124° 58.1′W	11 OCT 97	1235	128	15	4536	503
251	6° 59.5′S	124° 59.0′W	11 OCT 97	1933	134	12	4591	503
261	7° 57.7′S	125° 2.8′W	12 OCT 97	619	92	13	4493	1004
271	7° 59.7′S	139° 44.5′W	17 OCT 97	1040	154	12	2840	1005
281	6° 59.8′S	139° 48.0′W	17 OCT 97	1733	79	14	3929	1004
291	5° 59.4′S	139° 50.7′W	18 OCT 97	42	108	11	3639	1003
301	5° 2.5′S	139° 53.3′W	18 OCT 97	804	112	10	4322	3006
311	3° 59.8′S	139° 54.5′W	19 OCT 97	734	122	21	4506	1004
321	2° 59.5′S	139° 55.8′W	19 OCT 97	1509	101	12	4291	1001
331	2° 0.4′S	139° 58.3′W	20 OCT 97	555	116	18	4318	502
341	1° 0.2′S	139° 57.2′W	20 OCT 97	1319	116	15	4242	502
351	0° 4.6′N	140° 2.5′W	21 OCT 97	829	135	13	4315	3008
361	1° 2.3′N	140° 40.0′W	22 OCT 97	747	110	14	4444	503
371	2° 0.1′N	141° 22.6′W	22 OCT 97	1542	131	13	4524	501
381	3° 0.3′N	142° 8.1′W	23 OCT 97	37	137	4	4475	502
391	4° 0.6′N	143° 12.1′W	23 OCT 97	1128	81	3	4506	1000
401	5° 0.5′N	139° 59.3′W	24 OCT 97	1203	216	3	4444	3003
411	5° 59.5′N	140° 9.2′W	25 OCT 97	542	163	8	4506	503
421	7° 0.0′N	140° 22.2′W	25 OCT 97	1328	141	8	5617	510

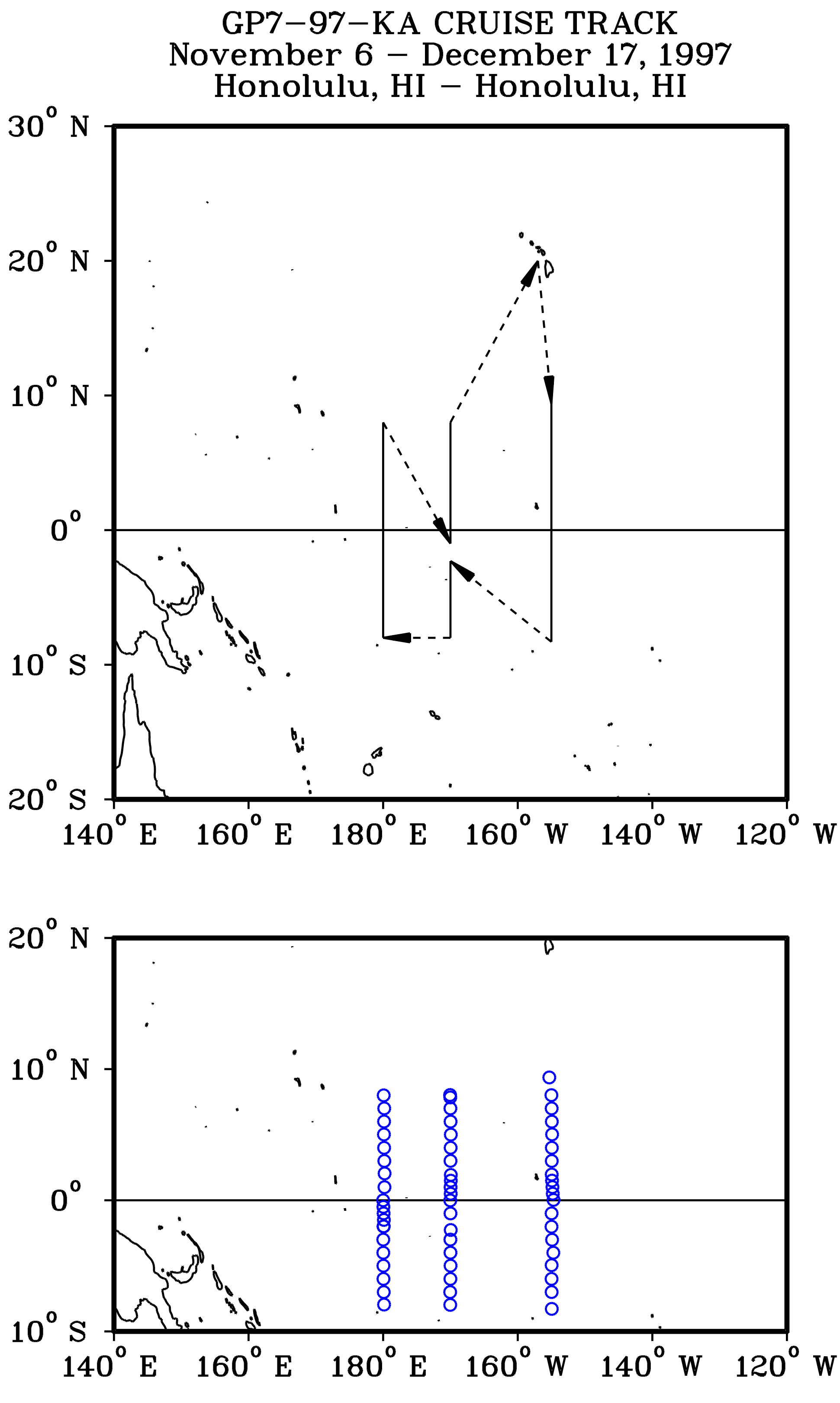


Figure 1g: GP7-97-KA cruise track and station locations.

Table 1g: GP7-97-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	9° 22.0′N	155° 18.7′W	10 NOV 97	51	347	7	5412	505
21	8° 1.0′N	155° 0.0′W	10 NOV 97	1106	349	7	5152	3003
31	7° 0.3′N	154° 57.7′W	11 NOV 97	1006	31	8	4942	1003
41	5° 59.9′N	154° 56.3′W	11 NOV 97	1701	50	7	4837	1002
51	5° 1.4′N	154° 53.9′W	12 NOV 97	12	64	1	4693	1004
61	4° 0.1′N	154° 56.1′W	12 NOV 97	728	90	0	4699	1004
71	2° 59.9′N	154° 56.8′W	12 NOV 97	1415	301	2	4796	1003
81	1° 57.8′N	154° 57.2′W	12 NOV 97	2122	259	2	4663	1004
91	1° 30.0′N	154° 54.6′W	13 NOV 97	114	226	1	4509	1004
101	1° 0.2′N	154° 50.5′W	13 NOV 97	500	82	2	4717	1003
111	0° 30.1′N	154° 47.8′W	13 NOV 97	858	155	2	4642	1004
121	0° 1.8′N	154° 41.1′W	13 NOV 97	1329	153	2	4755	3002
131	0° 59.9′S	154° 58.3′W	14 NOV 97	1151	66	6	0	1003
141	2° 0.9′S	154° 59.0′W	14 NOV 97	1910	237	6	4878	1003
151	3° 0.7′S	154° 53.9′W	15 NOV 97	244	147	1	4878	1004
161	3° 59.9′S	154° 42.8′W	15 NOV 97	1008	137	1	4454	1004
171	4° 57.0′S	154° 58.0′W	15 NOV 97	1655	89	7	5063	1002
181	5° 59.8′S	154° 58.6′W	16 NOV 97	1010	111	7	4945	1005
191	6° 59.9′S	154° 58.0′W	16 NOV 97	1716	91	13	5217	1003
201	8° 16.9′S	154° 56.7′W	17 NOV 97	706	102	9	5347	1005
211	2° 16.0′S	169° 57.5′W	21 NOV 97	1451	254	11	4387	3002
221	2° 59.9′S	170° 0.4′W	22 NOV 97	1215	357	7	5094	1002
231	3° 59.7′S	169° 59.9′W	22 NOV 97	1917	33	3	5626	1005
241	4° 59.2′S	169° 59.1′W	23 NOV 97	251	350	2	5434	1005
251	5° 59.9′S	170° 0.4′W	23 NOV 97	955	170	3	4810	1004
261	7° 0.0′S	170° 2.4′W	23 NOV 97	1647	205	4	5186	1002
271	7° 58.6′S	170° 1.9′W	24 NOV 97	935	133	6	5372	1004
281	7° 57.2′S	179° 52.0′W	27 NOV 97	738	104	7	4730	1004
291	7° 0.1′S	179° 54.7′W	27 NOV 97	1459	230	2	4632	1003
301	5° 59.8′S	179° 57.2′W	27 NOV 97	2203	292	1	4683	1003
311	4° 59.5′S	179° 57.8′W	28 NOV 97	540	237	7	5521	1004
321	4° 0.1′S	179° 58.6′W	28 NOV 97	1240	134	5	5496	1000
331	3° 0.0′S	179° 59.0′W	28 NOV 97	1946	303	8	4816	1005
341	1° 59.4′S	179° 55.8′W	29 NOV 97	725	244	13	5434	1005
342	1° 59.6′S	179° 55.7′W	29 NOV 97	1001	241	11	5403	5010
351	1° 29.9′S	179° 53.7′W	30 NOV 97	227	271	15	5236	1005
361	1° 0.1′S	179° 55.9′W	30 NOV 97	633	274	13	5341	1006
371	0° 30.2′S	179° 57.8′W	30 NOV 97	1046	314	15	5397	1003
381	0° 0.1′S	179° 59.9′W	30 NOV 97	1537	193	7	5248	3004
391	0° 59.9′N	179° 48.1′W	1 DEC 97	1046	315	7	5869	1004
401	2° 2.8′N	179° 47.2′W	1 DEC 97	1939	329	8	5465	3006
411	2° 59.9′N	179° 49.5′W	2 DEC 97	522	27	7	5651	1006
421	3° 59.9′N	179° 51.5′W	2 DEC 97	1322	346	9	5682	1005
431	5° 1.1′N	179° 53.1′W	2 DEC 97	2143	35	7	5589	1004
441	6° 0.4′N	179° 51.9′W	3 DEC 97	452	16	13	5555	1006
451	7° 0.4′N	179° 50.4′W	3 DEC 97	1150	55	12	5804	1003
461	8° 0.0′N	179° 55.3′W	4 DEC 97	455	41	11	5959	1009
471	1° 0.2′S	169° 59.8′W	7 DEC 97	1146	325	10	5248	1003
481	0° 0.7′S	170° 1.5′W	7 DEC 97	2039	17	8	5589	1006
491	0° 29.9′N	169° 57.7′W	8 DEC 97	128	29	8	5434	1005
501	0° 59.7′N	169° 59.0′W	8 DEC 97	553	355	8	5453	1003
511	1° 29.7′N	169° 56.9′W	8 DEC 97	1017	25	10	5533	1004
521	1° 55.8′N	169° 56.8′W	8 DEC 97	1444	28	12	5372	3005
531	3° 0.3′N	169° 59.5′W	9 DEC 97	1520	43	6	5465	1004
541	4° 0.2′N	169° 58.3′W	9 DEC 97	2224	100	10	5682	502
551	5° 0.4′N	169° 56.8′W	10 DEC 97	552	56	17	5744	1003
561	6° 0.1′N	169° 59.0′W	10 DEC 97	1517	54	16	5434	502
571	7° 0.3′N	170° 0.3′W	10 DEC 97	2301	70	16	5928	501
581	7° 50.5′N	170° 1.6′W	11 DEC 97	634	61	18	5549	5041
591	8° 1.6′N	170° 3.2′W	12 DEC 97	406	45	18	5477	501

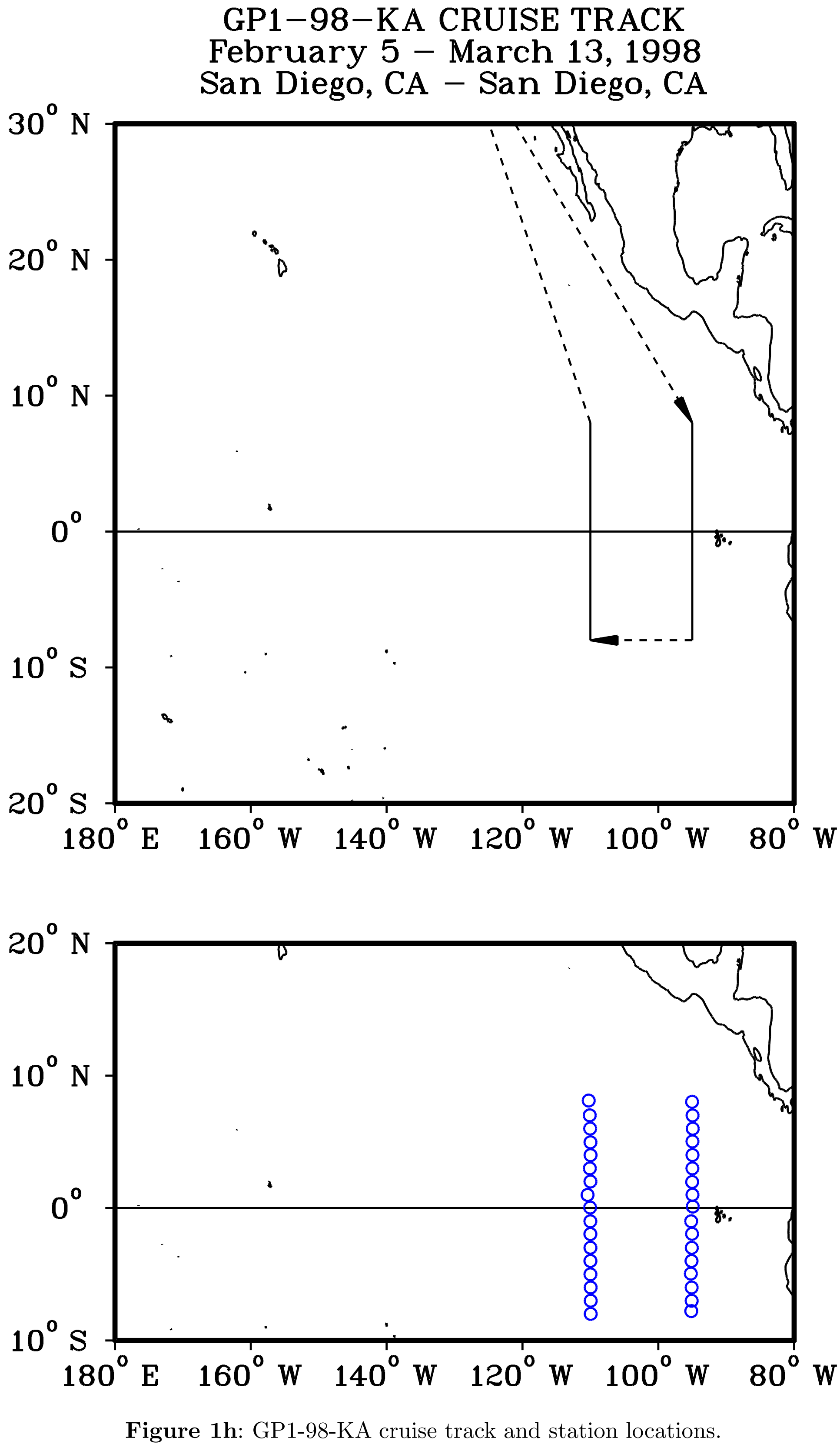


Figure 1h: GP1-98-KA cruise track and station locations.

Table 1h: GP1-98-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	8° 1.7′N	95° 1.7′W	14 FEB 98	1327	308	5	3727	3505
21	6° 59.8′N	94° 57.5′W	15 FEB 98	441	51	11	3712	1006
31	5° 59.9′N	94° 55.7′W	15 FEB 98	1202	44	8	3228	1002
41	5° 1.9′N	94° 58.3′W	16 FEB 98	225	17	10	3591	1003
51	4° 0.4′N	94° 58.1′W	16 FEB 98	1025	23	9	3349	846
61	2° 59.8′N	94° 58.9′W	16 FEB 98	1824	64	8	2626	1008
71	1° 58.4′N	95° 1.0′W	17 FEB 98	249	102	10	3077	1006
81	1° 0.5′N	94° 58.1′W	17 FEB 98	1059	126	5	3500	1005
91	0° 6.7′N	94° 55.7′W	17 FEB 98	1817	129	4	3319	1003
101	0° 59.9′S	95° 9.7′W	18 FEB 98	1107	286	1	3288	1006
111	1° 56.7′S	95° 1.8′W	19 FEB 98	203	224	2	3414	1002
121	3° 0.0′S	95° 4.1′W	19 FEB 98	1256	99	3	3470	1004
131	3° 59.7′S	95° 6.4′W	19 FEB 98	2113	178	5	3561	1006
141	4° 57.0′S	95° 12.7′W	20 FEB 98	642	7	5	3773	3512
151	6° 0.0′S	95° 5.5′W	21 FEB 98	858	297	4	3895	1002
161	7° 0.1′S	95° 5.3′W	21 FEB 98	1639	147	13	3895	1001
171	7° 46.9′S	95° 8.9′W	22 FEB 98	410	162	13	3834	1008
181	7° 59.5′S	109° 57.2′W	26 FEB 98	807	109	13	3409	1004
191	6° 59.8′S	109° 57.3′W	26 FEB 98	1637	108	13	3440	502
201	5° 59.9′S	109° 57.8′W	27 FEB 98	8	161	8	3512	1004
211	5° 0.3′S	109° 59.7′W	27 FEB 98	735	102	6	3603	1006
221	3° 59.6′S	109° 59.6′W	27 FEB 98	1512	130	8	3609	1006
231	2° 59.7′S	109° 59.5′W	27 FEB 98	2211	134	2	3773	1005
241	1° 57.7′S	110° 0.0′W	28 FEB 98	543	215	7	3925	1005
251	1° 0.0′S	110° 0.3′W	28 FEB 98	1239	93	3	3955	1003
261	0° 2.4′N	110° 2.3′W	1 MAR 98	705	93	6	3724	3511
271	0° 59.7′N	110° 24.9′W	2 MAR 98	1415	169	2	3761	1004
281	2° 0.4′N	109° 59.6′W	3 MAR 98	905	327	6	3712	3512
291	2° 59.8′N	110° 5.0′W	4 MAR 98	339	40	10	3925	1005
301	3° 59.8′N	109° 58.6′W	4 MAR 98	1204	340	6	3864	1004
311	4° 58.0′N	109° 59.3′W	5 MAR 98	132	13	13	3906	1006
321	6° 0.3′N	110° 2.1′W	5 MAR 98	953	10	12	3500	1004
331	7° 0.3′N	110° 5.8′W	5 MAR 98	1726	8	15	3712	1004
341	8° 7.3′N	110° 15.0′W	6 MAR 98	812	10	17	4077	1007

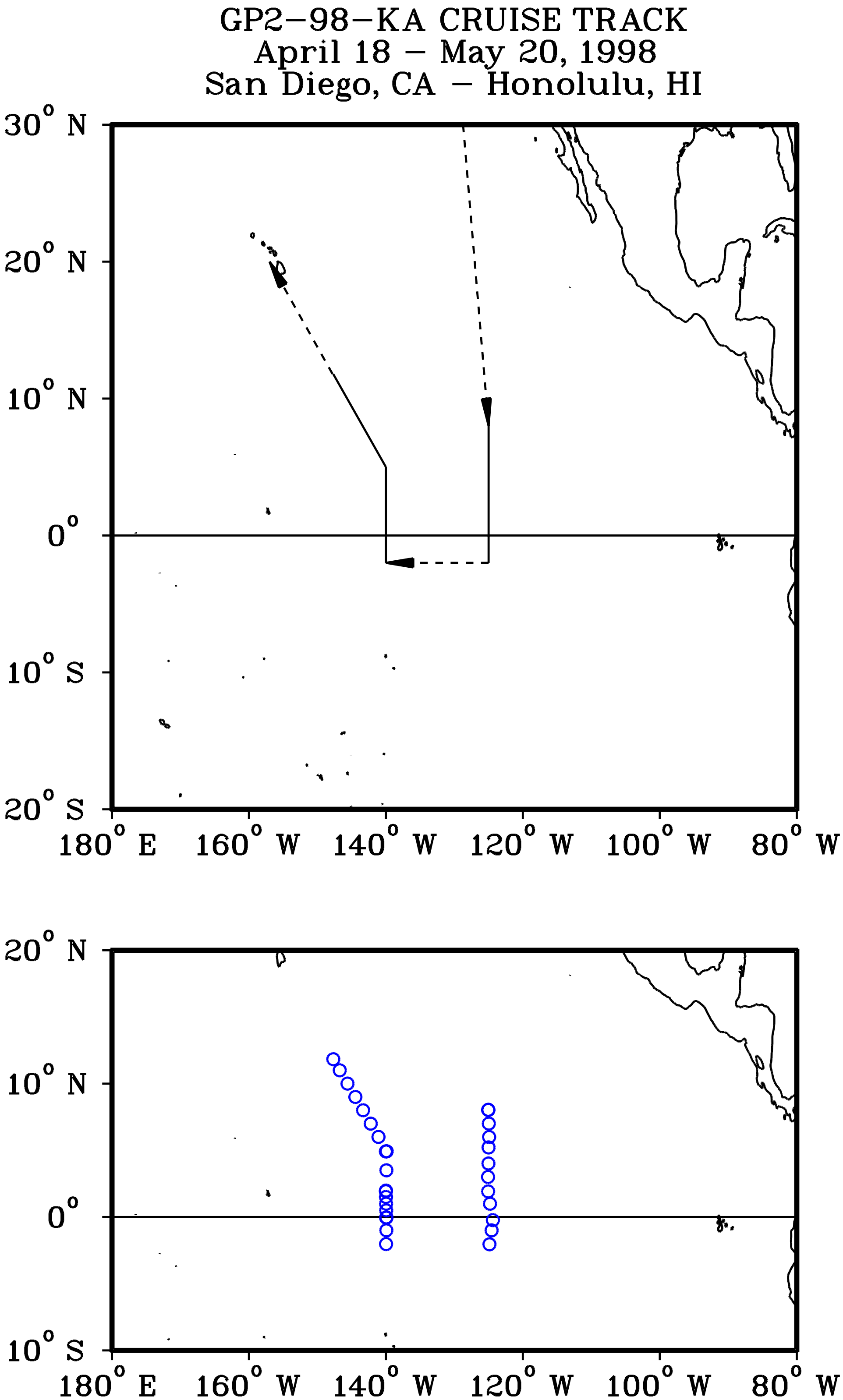


Figure 1i: GP2-98-KA cruise track and station locations.

Table 1i: GP2-98-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	8° 2.0′N	125° 3.7′W	25 APR 98	452	31	18	4567	4011
12	8° 2.0′N	125° 2.1′W	25 APR 98	821	25	13	4639	504
21	7° 0.5′N	124° 58.3′W	26 APR 98	154	19	13	4644	1002
31	6° 0.0′N	124° 55.5′W	26 APR 98	900	26	7	4387	1002
41	5° 13.0′N	125° 0.5′W	26 APR 98	2133	12	11	4416	1005
51	4° 0.8′N	125° 1.7′W	27 APR 98	542	15	13	4413	1005
61	3° 0.3′N	125° 4.8′W	27 APR 98	1304	358	15	4499	1005
71	1° 55.2′N	125° 4.0′W	28 APR 98	533	323	10	4690	1003
81	0° 59.9′N	124° 47.7′W	28 APR 98	1242	304	8	4662	1004
91	0° 13.9′S	124° 22.4′W	29 APR 98	728	323	12	4733	1003
101	1° 0.1′S	124° 33.9′W	29 APR 98	1407	332	10	4731	1004
111	2° 2.7′S	124° 52.6′W	29 APR 98	2352	312	11	4694	1006
121	2° 1.7′S	139° 58.3′W	9 MAY 98	526	87	4	4321	1003
131	0° 59.9′S	139° 56.1′W	9 MAY 98	1311	4	12	4213	1004
141	0° 1.9′S	139° 54.7′W	10 MAY 98	424	7	10	4339	4007
151	0° 2.7′S	139° 57.5′W	10 MAY 98	2114	43	14	4301	502
161	0° 29.9′N	139° 57.2′W	11 MAY 98	201	63	15	4353	1002
171	1° 0.0′N	139° 58.0′W	11 MAY 98	626	59	19	4315	1003
181	1° 30.3′N	139° 59.2′W	11 MAY 98	1047	46	11	4501	1003
191	1° 55.9′N	140° 0.2′W	11 MAY 98	1429	77	21	4380	1005
192	1° 59.0′N	139° 59.2′W	12 MAY 98	245	43	18	4369	202
201	3° 30.1′N	139° 55.7′W	12 MAY 98	1500	50	23	4373	1003
211	4° 55.1′N	140° 0.4′W	13 MAY 98	713	47	21	4412	4007
212	4° 55.7′N	139° 53.0′W	13 MAY 98	1855	31	20	4491	508
221	6° 0.5′N	141° 5.1′W	14 MAY 98	1030	47	16	4948	1002
231	7° 0.1′N	142° 13.0′W	14 MAY 98	2006	24	16	5030	1005
241	8° 0.3′N	143° 20.0′W	15 MAY 98	559	60	20	4885	1004
251	9° 0.2′N	144° 27.5′W	15 MAY 98	1631	35	16	5140	1004
261	10° 0.3′N	145° 36.5′W	16 MAY 98	249	30	19	5122	1005
271	11° 0.0′N	146° 44.3′W	16 MAY 98	1314	61	17	5169	1004
281	11° 49.7′N	147° 41.0′W	16 MAY 98	2246	58	12	5427	4105

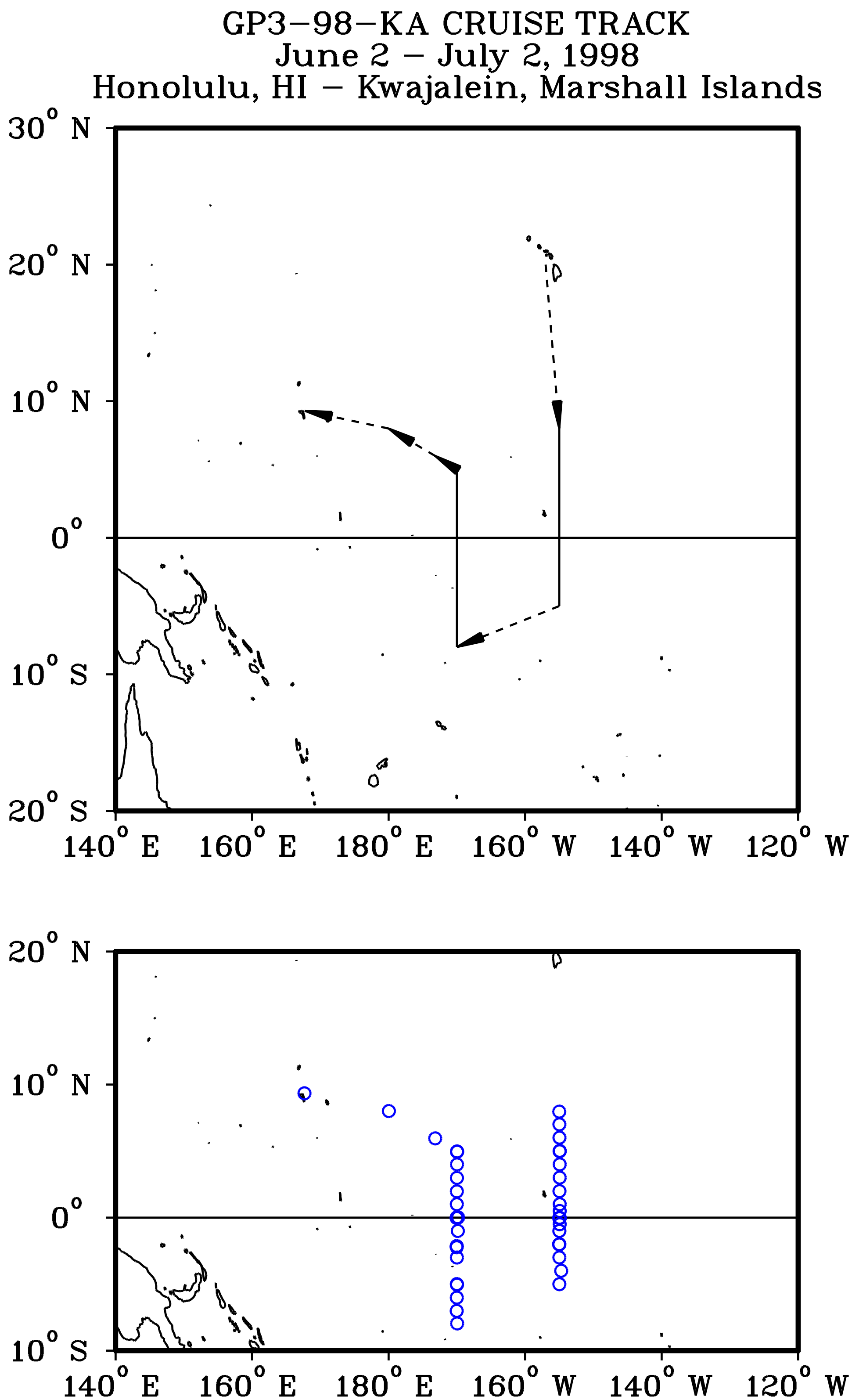


Figure 1j: GP3-98-KA cruise track and station locations.

Table 1j: GP3-98-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	7° 58.1′N	155° 0.1′W	6 JUN 98	648	53	19	5212	1006
21	7° 0.5′N	154° 58.8′W	6 JUN 98	1351	64	18	4968	1005
31	6° 0.8′N	154° 58.2′W	6 JUN 98	2145	69	17	4838	4016
41	5° 1.0′N	154° 55.9′W	7 JUN 98	919	75	16	4595	4007
42	4° 59.1′N	154° 57.1′W	8 JUN 98	339	40	11	4583	202
51	4° 0.1′N	154° 56.5′W	8 JUN 98	1031	25	17	4708	1004
61	3° 0.4′N	154° 56.6′W	8 JUN 98	1722	90	11	4808	1011
71	1° 59.4′N	154° 58.3′W	9 JUN 98	1001	90	12	4658	1005
81	1° 0.3′N	154° 56.3′W	9 JUN 98	1723	113	22	4745	1005
91	0° 29.9′N	154° 56.3′W	9 JUN 98	2143	111	15	4734	1004
101	0° 2.1′S	154° 56.7′W	10 JUN 98	520	105	10	4636	1006
111	0° 29.8′S	154° 56.5′W	10 JUN 98	926	102	12	4880	1006
121	0° 1.0′S	154° 56.3′W	13 JUN 98	539	60	5	4641	4005
122	0° 1.8′S	155° 0.7′W	13 JUN 98	2351	52	7	4687	202
131	1° 0.0′S	154° 59.1′W	14 JUN 98	655	98	2	4750	1006
141	2° 0.6′S	155° 1.5′W	14 JUN 98	1448	5	8	4815	4004
142	2° 0.1′S	154° 58.9′W	15 JUN 98	440	135	9	4993	202
151	2° 59.7′S	154° 59.2′W	15 JUN 98	1146	142	6	4920	1003
161	3° 59.7′S	154° 43.0′W	15 JUN 98	1921	111	7	4630	1003
171	5° 0.3′S	154° 59.2′W	16 JUN 98	326	60	7	5005	1006
181	7° 57.3′S	169° 57.7′W	19 JUN 98	1646	90	11	5358	1004
191	7° 0.5′S	170° 1.6′W	20 JUN 98	214	90	11	4622	1006
201	6° 0.8′S	170° 0.7′W	20 JUN 98	929	82	15	4777	1004
211	5° 2.5′S	169° 59.2′W	20 JUN 98	1624	101	14	5395	1004
212	4° 59.9′S	170° 0.2′W	21 JUN 98	344	92	15	5421	201
221	3° 0.0′S	169° 59.9′W	21 JUN 98	1706	90	10	5088	1003
231	2° 8.3′S	170° 1.6′W	22 JUN 98	11	76	11	4942	1008
232	2° 13.7′S	170° 1.9′W	22 JUN 98	1023	40	18	4944	201
241	1° 0.0′S	169° 51.7′W	22 JUN 98	1119	30	10	5788	1006
251	0° 0.7′N	169° 49.0′W	23 JUN 98	1109	94	13	5269	4007
261	0° 0.9′N	170° 0.8′W	23 JUN 98	1707	77	16	5279	202
262	0° 1.3′S	170° 2.4′W	24 JUN 98	549	103	10	5605	204
271	1° 0.3′N	170° 0.5′W	24 JUN 98	1313	78	11	5463	1004
281	1° 58.3′N	170° 0.3′W	24 JUN 98	2014	79	9	5407	1007
291	2° 59.3′N	169° 59.5′W	25 JUN 98	340	86	12	5469	1008
301	4° 0.0′N	169° 58.7′W	25 JUN 98	1031	75	10	5676	1006
311	4° 57.0′N	169° 58.1′W	25 JUN 98	1711	50	10	5799	1006
312	4° 58.4′N	169° 58.6′W	26 JUN 98	325	66	15	5765	203
321	5° 57.3′N	173° 10.6′W	26 JUN 98	2306	63	19	5854	504
331	8° 0.6′N	179° 57.7′W	28 JUN 98	1736	61	19	5951	4014
341	9° 20.5′N	167° 40.1′E	2 JUL 98	207	0	0	3746	3659

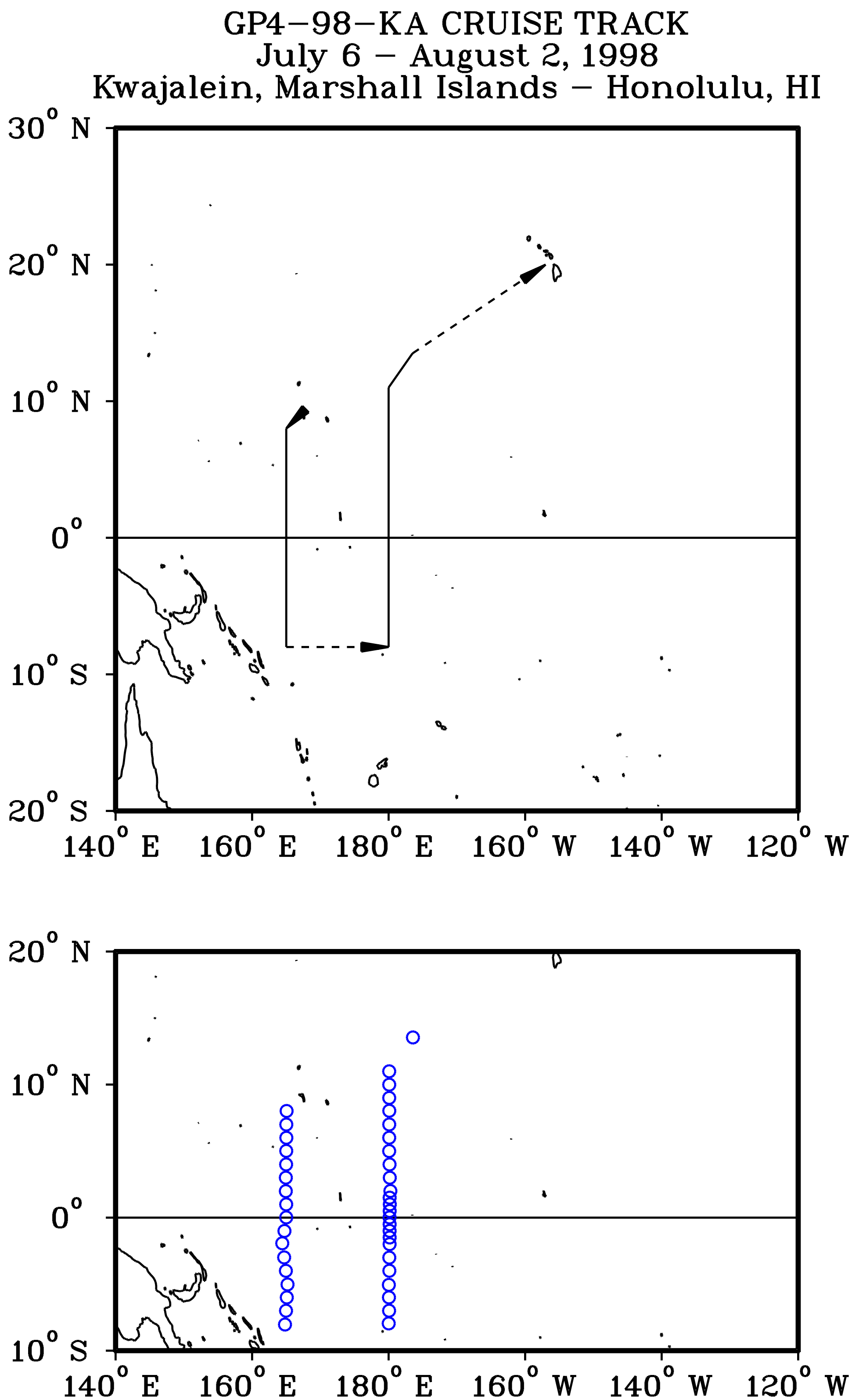


Figure 1k: GP4-98-KA cruise track and station locations.

Table 1k: GP4-98-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	8° 0.9′N	165° 3.2′E	8 JUL 98	428	82	3	5215	1008
21	6° 59.9′N	165° 0.6′E	8 JUL 98	1210	19	1	5157	1006
31	6° 0.1′N	165° 0.9′E	8 JUL 98	1858	67	3	5005	1004
41	5° 0.9′N	165° 0.0′E	9 JUL 98	906	30	15	4780	1012
51	3° 59.9′N	164° 58.9′E	9 JUL 98	1622	125	8	4498	1004
61	3° 0.3′N	164° 56.4′E	9 JUL 98	2317	49	5	4198	1006
71	1° 59.4′N	164° 56.3′E	10 JUL 98	616	83	5	4189	1008
81	0° 59.7′N	164° 59.6′E	10 JUL 98	1348	155	11	4335	1004
91	0° 0.9′N	164° 59.9′E	11 JUL 98	750	105	9	4415	1010
101	1° 0.3′S	164° 44.2′E	11 JUL 98	1504	103	3	4428	1005
111	1° 55.8′S	164° 25.0′E	11 JUL 98	2202	186	3	4432	1010
121	2° 59.5′S	164° 41.7′E	12 JUL 98	1705	35	11	3635	1017
131	3° 59.9′S	164° 56.9′E	13 JUL 98	56	63	18	3249	1004
141	5° 1.5′S	165° 11.3′E	13 JUL 98	920	65	13	2479	1004
151	6° 0.0′S	165° 5.0′E	13 JUL 98	1555	88	10	3609	1003
161	6° 59.9′S	164° 58.0′E	13 JUL 98	2235	89	11	3727	1004
171	8° 2.2′S	164° 49.1′E	14 JUL 98	1050	119	19	3901	1003
181	7° 57.1′S	179° 59.3′W	18 JUL 98	1705	100	20	5382	1002
191	6° 59.8′S	179° 55.9′W	19 JUL 98	246	41	4	4610	1003
201	5° 59.8′S	179° 57.2′W	19 JUL 98	937	58	8	4648	1005
211	5° 3.3′S	179° 58.0′W	19 JUL 98	1625	46	15	5755	1003
221	3° 59.7′S	179° 53.6′W	20 JUL 98	1127	40	10	5873	1008
231	3° 0.3′S	179° 54.2′W	20 JUL 98	1822	20	8	5289	1008
241	1° 59.6′S	179° 51.4′W	21 JUL 98	138	79	13	5346	1005
251	1° 29.5′S	179° 50.9′W	21 JUL 98	533	76	11	5242	1006
261	0° 59.8′S	179° 51.3′W	21 JUL 98	915	67	14	5392	1007
271	0° 30.0′S	179° 51.1′W	21 JUL 98	1308	85	12	4693	1003
281	0° 0.8′N	179° 51.9′W	21 JUL 98	1710	87	15	5403	1003
291	0° 30.0′N	179° 50.7′W	21 JUL 98	2200	97	14	5574	1005
301	1° 0.0′N	179° 49.6′W	22 JUL 98	206	90	12	5796	1005
311	1° 30.0′N	179° 51.0′W	22 JUL 98	629	106	9	5589	1006
321	2° 0.2′N	179° 44.6′W	22 JUL 98	1738	119	16	5620	1003
331	3° 0.0′N	179° 49.8′W	23 JUL 98	925	123	15	5662	1006
341	3° 59.9′N	179° 51.9′W	23 JUL 98	1635	172	7	5672	1003
351	5° 0.1′N	179° 55.3′W	24 JUL 98	1010	122	13	5678	1006
361	6° 0.5′N	179° 54.9′W	24 JUL 98	1745	90	23	5610	1002
371	7° 0.1′N	179° 54.6′W	25 JUL 98	27	120	16	5697	1005
381	8° 1.8′N	179° 54.3′W	25 JUL 98	719	100	12	5975	1008
391	8° 59.9′N	179° 54.9′W	25 JUL 98	1417	100	12	5870	1003
401	9° 59.6′N	179° 54.8′W	25 JUL 98	2132	70	9	6243	1011
411	10° 59.8′N	179° 55.0′W	26 JUL 98	450	65	12	5752	1006
431	13° 32.6′N	176° 26.4′W	27 JUL 98	1926	68	14	5212	4006

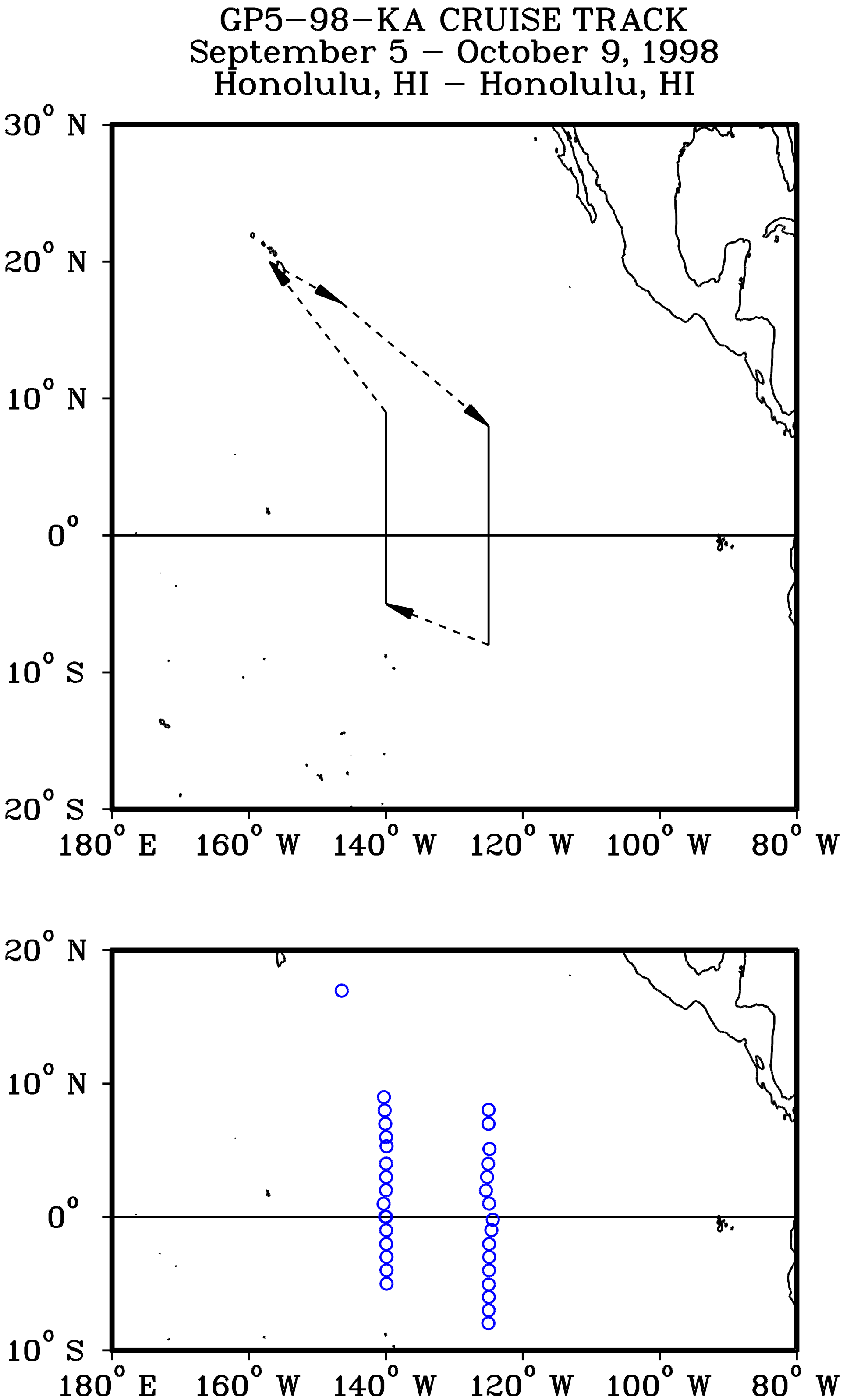
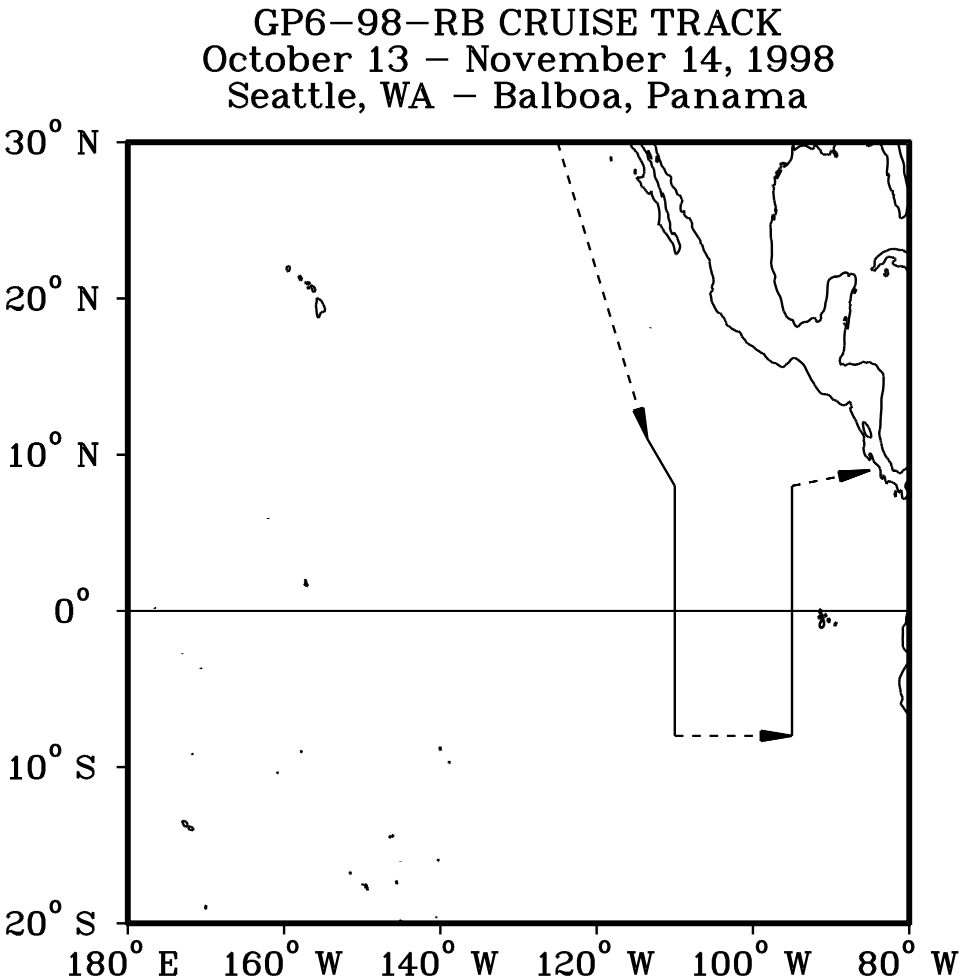


Figure 11: GP5-98-KA cruise track and station locations.

Table 1l: GP5-98-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
1	16° 58.2′N	146° 26.8′W	8 SEP 98	2330	52	10	5205	1010
11	8° 2.4′N	125° 0.4′W	15 SEP 98	530	196	8	4576	1005
21	6° 59.6′N	125° 0.8′W	15 SEP 98	1311	203	10	4719	1005
31	5° 6.3′N	124° 52.5′W	16 SEP 98	529	227	8	4378	1004
41	3° 59.8′N	125° 3.5′W	16 SEP 98	1436	161	15	4403	1007
51	3° 0.1′N	125° 12.9′W	16 SEP 98	2156	155	17	4563	1005
61	1° 59.1′N	125° 23.8′W	17 SEP 98	600	125	17	4565	1004
71	1° 0.6′N	124° 55.4′W	17 SEP 98	1558	132	15	4688	1004
81	0° 11.7′S	124° 23.4′W	18 SEP 98	847	115	5	4780	1004
91	0° 59.3′S	124° 35.5′W	18 SEP 98	1527	60	4	4649	1006
101	2° 1.5′S	124° 55.4′W	19 SEP 98	744	55	14	4649	1005
111	2° 59.5′S	124° 54.9′W	19 SEP 98	1445	120	11	4647	1004
121	3° 59.7′S	124° 56.1′W	19 SEP 98	2126	108	12	4513	1004
131	5° 3.3′S	124° 58.7′W	20 SEP 98	522	136	12	4476	3005
141	5° 59.8′S	124° 58.1′W	20 SEP 98	2240	100	23	4678	1004
151	6° 59.7′S	124° 59.5′W	21 SEP 98	640	108	22	4761	1006
161	7° 57.9′S	125° 1.8′W	22 SEP 98	303	113	14	4470	1005
171	4° 59.8′S	139° 54.3′W	26 SEP 98	132	88	17	4363	1005
181	3° 59.6′S	139° 54.7′W	26 SEP 98	906	88	11	4517	1005
191	2° 59.3′S	139° 55.0′W	26 SEP 98	1626	114	14	4285	1004
201	2° 1.3′S	139° 57.3′W	27 SEP 98	719	9	4	4337	138
211	0° 59.7′S	139° 57.1′W	27 SEP 98	1715	122	9	4245	1006
221	0° 2.1′N	140° 6.3′W	28 SEP 98	928	94	14	4330	4006
222	0° 0.6′N	139° 58.5′W	29 SEP 98	729	105	18	4358	1005
231	1° 0.1′N	140° 20.2′W	29 SEP 98	1455	105	18	3725	1006
241	2° 0.4′N	139° 59.3′W	30 SEP 98	1924	133	17	4381	1005
251	2° 59.9′N	139° 58.2′W	1 OCT 98	312	118	13	4297	1004
261	4° 0.4′N	139° 58.5′W	1 OCT 98	1020	126	14	4331	1010
271	5° 18.0′N	139° 54.4′W	2 OCT 98	210	127	15	4532	1005
281	5° 59.4′N	139° 58.4′W	2 OCT 98	847	127	15	4832	1004
291	6° 59.5′N	140° 4.9′W	2 OCT 98	1808	141	11	4942	1005
301	7° 59.8′N	140° 10.8′W	3 OCT 98	251	156	15	5137	1007
311	8° 59.0′N	140° 17.3′W	3 OCT 98	2333	148	5	4871	1004



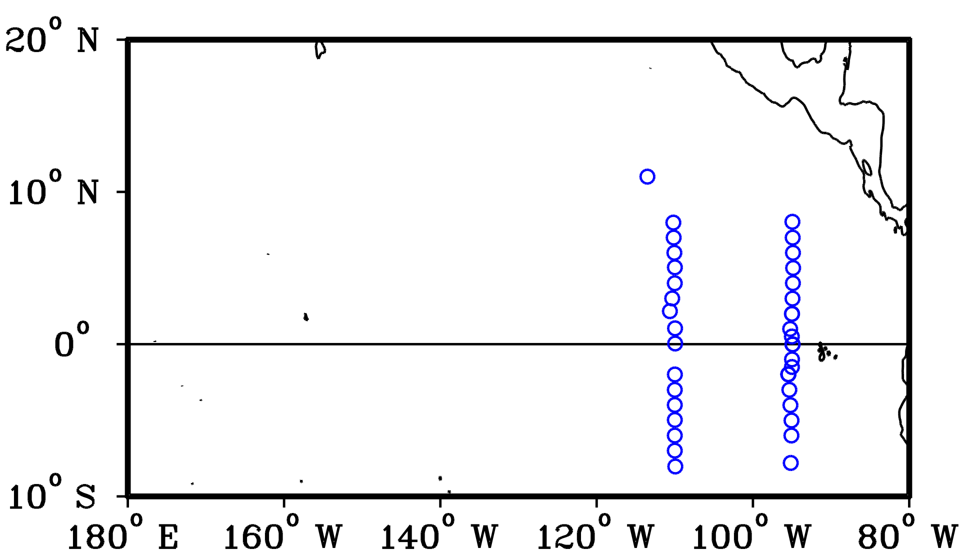


Figure 1m: GP6-98-RB cruise track and station locations.

Table 1m: GP6-98-RB CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	11° 0.2′N	113° 30.3′W	21 OCT 98	2132	10	5	4024	1001
21	7° 59.1′N	110° 11.2′W	22 OCT 98	2355	225	12	4154	1001
31	7° 0.0′N	110° 8.7′W	24 OCT 98	5	220	12	3633	1002
41	6° 0.2′N	110° 3.2′W	24 OCT 98	556	180	17	3562	1001
51	5° 2.7′N	109° 59.4′W	24 OCT 98	1221	170	21	3941	1014
61	4° 0.1′N	110° 0.1′W	24 OCT 98	2148	165	22	3873	1002
71	3° 0.3′N	110° 19.9′W	25 OCT 98	403	150	18	3783	1009
81	2° 10.0′N	110° 37.7′W	25 OCT 98	1324	140	15	3757	1005
91	1° 2.4′N	109° 57.9′W	26 OCT 98	1115	115	11	3768	1001
101	0° 2.6′N	109° 57.4′W	27 OCT 98	41	95	9	3806	1002
111	1° 59.5′S	109° 59.4′W	28 OCT 98	205	110	8	3941	1001
121	3° 0.0′S	110° 0.0′W	28 OCT 98	814	105	10	3748	1001
131	3° 59.6′S	110° 0.0′W	28 OCT 98	1349	120	14	3668	1001
141	4° 58.6′S	109° 59.8′W	29 OCT 98	107	125	15	3583	1001
151	6° 0.0′S	110° 0.0′W	29 OCT 98	730	120	18	3731	1002
161	6° 59.7′S	110° 0.0′W	29 OCT 98	1315	105	11	3598	1001
171	8° 2.1′S	109° 56.1′W	30 OCT 98	409	115	13	3397	1002
181	7° 48.2′S	95° 9.6′W	3 NOV 98	147	122	15	3924	1002
191	6° 0.0′S	95° 4.6′W	4 NOV 98	925	105	10	3898	1002
201	5° 0.8′S	95° 3.8′W	4 NOV 98	1714	100	10	3817	1003
211	4° 0.5′S	95° 12.3′W	4 NOV 98	2249	135	12	3705	1004
221	3° 0.0′S	95° 20.4′W	5 NOV 98	437	90	4	3545	1001
231	1° 58.8′S	95° 28.2′W	5 NOV 98	1123	80	2	3352	3003
232	1° 58.8′S	95° 28.2′W	5 NOV 98	1326	180	4	3352	201
241	1° 30.0′S	95° 0.5′W	5 NOV 98	2358	0	0	3336	1001
251	1° 0.0′S	95° 0.0′W	6 NOV 98	343	130	7	3322	1002
261	0° 1.0′S	94° 55.8′W	6 NOV 98	1300	170	7	3369	3003
262	0° 1.0′S	94° 55.8′W	6 NOV 98	1445	140	7	3369	201
271	0° 30.0′N	95° 1.3′W	7 NOV 98	502	175	14	3281	1001
281	1° 0.0′N	95° 14.3′W	7 NOV 98	836	185	14	3500	1000
291	1° 59.2′N	95° 0.0′W	8 NOV 98	230	177	20	3111	3002
292	1° 59.7′N	95° 0.5′W	8 NOV 98	416	162	17	3126	203
301	2° 59.6′N	94° 56.2′W	8 NOV 98	2324	150	16	3262	1001
311	4° 0.5′N	94° 53.1′W	9 NOV 98	504	175	15	3285	1002
321	5° 0.2′N	94° 51.5′W	9 NOV 98	1539	167	12	3441	1002
331	6° 0.1′N	94° 52.7′W	9 NOV 98	2105	180	10	3767	1002
341	6° 59.9′N	94° 54.8′W	10 NOV 98	235	190	9	3735	1002
351	8° 2.3′N	94° 57.0′W	10 NOV 98	1218	200	3	3670	1002

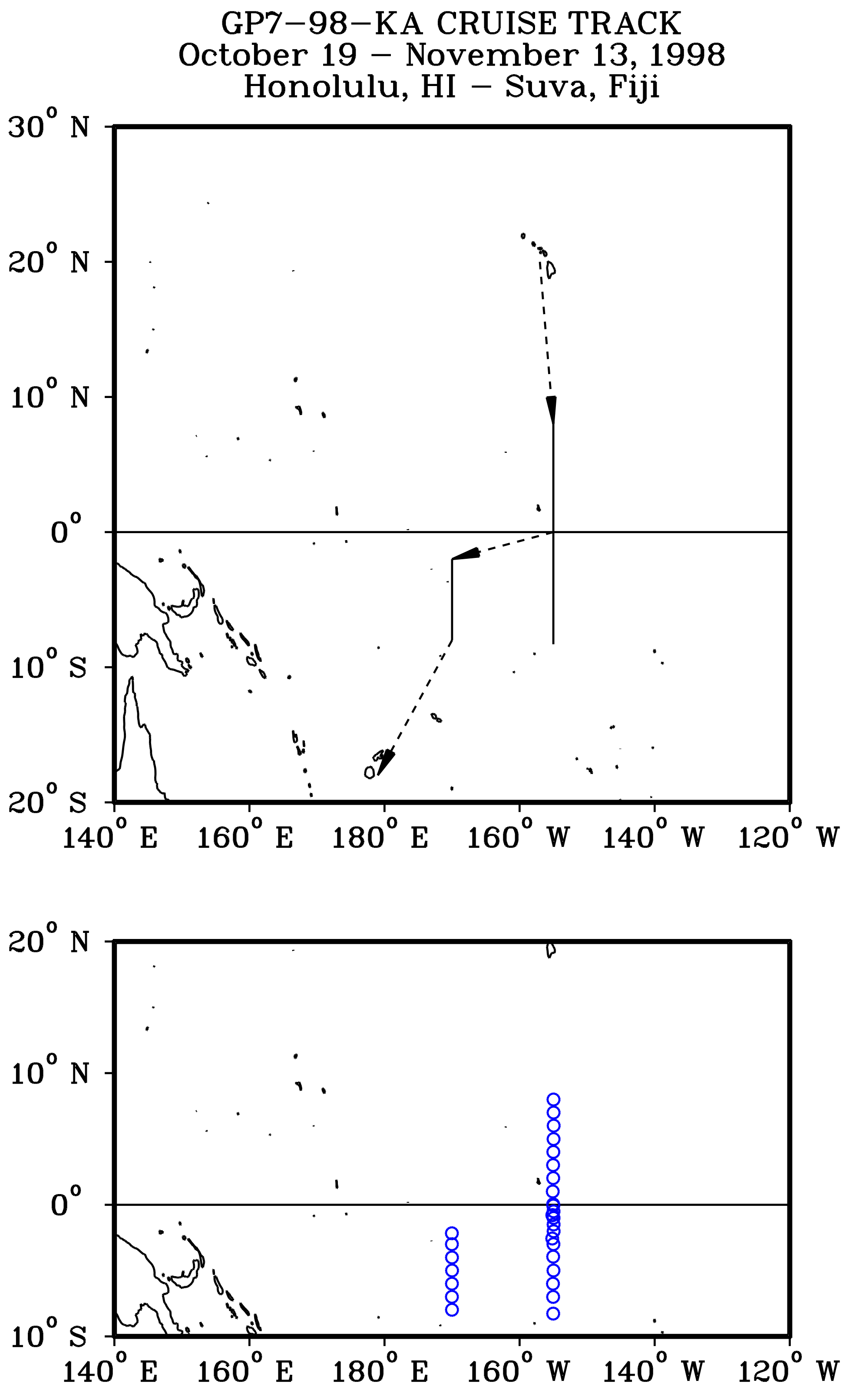
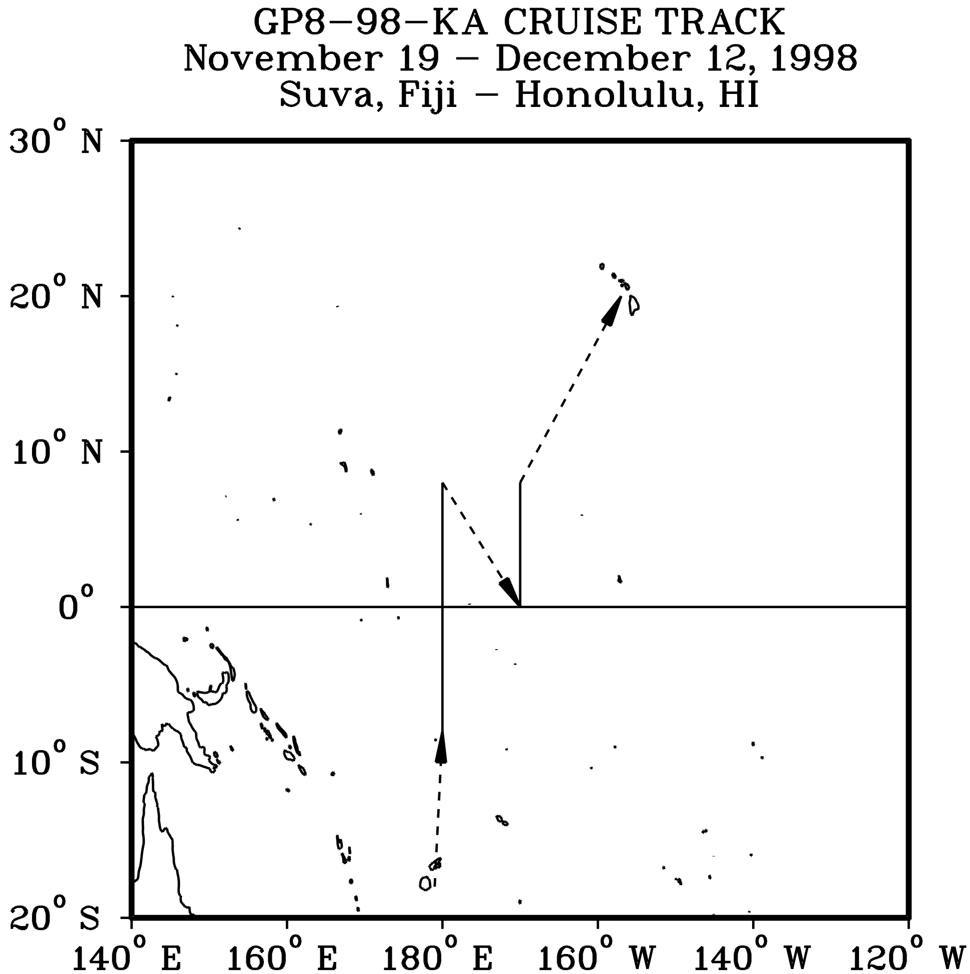


Figure 1n: GP7-98-KA cruise track and station locations.

Table 1n: GP7-98-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	7° 59.7′N	154° 58.8′W	24 OCT 98	423	155	14	5222	1003
21	7° 0.3′N	154° 58.2′W	24 OCT 98	1302	105	17	4965	1004
31	6° 0.6′N	154° 57.3′W	24 OCT 98	2116	83	8	4834	1003
41	4° 59.4′N	154° 58.2′W	25 OCT 98	743	51	4	4571	1005
51	4° 0.8′N	155° 0.3′W	25 OCT 98	1738	190	1	4679	1003
61	3° 0.8′N	155° 2.5′W	26 OCT 98	535	124	13	4771	1005
71	2° 1.7′N	155° 1.4′W	26 OCT 98	2256	147	18	4773	1004
81	1° 0.6′N	155° 5.5′W	27 OCT 98	1355	130	17	4736	1007
91	0° 3.6′S	155° 0.6′W	28 OCT 98	340	93	9	4697	1006
101	0° 30.0′S	154° 58.4′W	28 OCT 98	757	72	12	4890	1005
111	1° 0.0′S	154° 58.5′W	28 OCT 98	1136	70	10	4755	1005
121	1° 29.9′S	154° 58.0′W	28 OCT 98	1516	70	10	4886	1003
131	2° 0.7′S	154° 57.7′W	28 OCT 98	1923	66	15	4995	1004
141	2° 59.6′S	154° 59.4′W	29 OCT 98	209	50	18	4930	1004
151	3° 56.5′S	155° 1.8′W	29 OCT 98	829	60	13	2075	1004
161	4° 59.6′S	154° 58.9′W	30 OCT 98	302	32	11	5027	1006
171	8° 16.1′S	155° 1.6′W	31 OCT 98	746	357	7	5341	1006
181	7° 0.0′S	155° 2.2′W	31 OCT 98	1637	40	10	5224	1008
191	5° 59.8′S	155° 3.6′W	1 NOV 98	2	41	6	5258	1004
201	2° 33.9′S	155° 10.0′W	1 NOV 98	2315	43	9	4904	200
211	0° 47.4′S	155° 7.9′W	2 NOV 98	1326	68	10	3227	200
212	0° 47.2′S	155° 8.9′W	2 NOV 98	1441	70	15	3319	3004
221	0° 2.3′N	155° 1.9′W	3 NOV 98	900	82	16	4681	1005
231	2° 9.9′S	170° 1.6′W	7 NOV 98	615	71	14	4963	1005
241	2° 59.7′S	170° 1.4′W	7 NOV 98	1248	60	11	5066	1003
251	4° 0.1′S	170° 0.8′W	7 NOV 98	1924	74	17	5732	1005
261	4° 59.6′S	170° 0.2′W	8 NOV 98	301	74	17	5421	1005
271	5° 59.7′S	170° 1.1′W	8 NOV 98	1026	92	16	4708	1006
281	6° 59.6′S	170° 1.3′W	8 NOV 98	1814	65	16	4778	1007
291	7° 58.7′S	170° 0.7′W	9 NOV 98	919	54	14	5376	1005



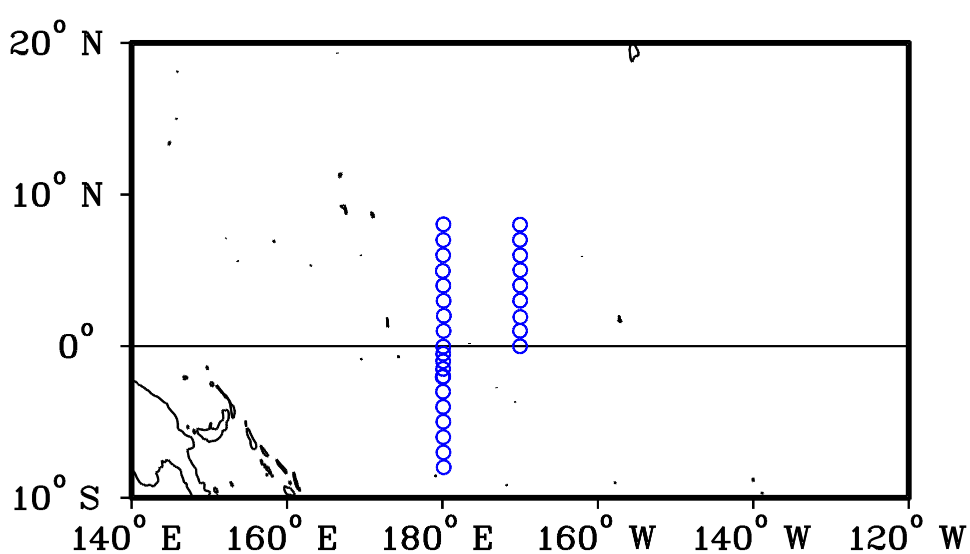


Figure 1o: GP8-98-KA cruise track and station locations.

Table 1o: GP8-98-KA CTD Cast Summary.

Cast #	Latitude	Longitude	Date	Time	W/D T	W/S (kts)	Depth (m)	Cast (db)
11	7° 59.1′S	179° 50.5′W	22 NOV 98	734	49	5	5538	1005
21	7° 0.4′S	179° 52.3′W	22 NOV 98	1456	180	4	5257	1006
31	5° 59.9′S	179° 53.6′W	22 NOV 98	2215	263	9	4899	1004
41	4° 59.1′S	179° 53.0′W	23 NOV 98	600	74	2	5629	1004
51	4° 0.4′S	179° 54.9′W	23 NOV 98	1332	21	15	6003	1006
61	3° 0.1′S	179° 55.3′W	23 NOV 98	2128	35	7	5401	1004
71	2° 2.1′S	179° 58.6′E	24 NOV 98	949	39	15	5393	4005
81	1° 59.8′S	179° 54.0′W	24 NOV 98	2146	74	9	5314	1006
91	0° 59.8′S	179° 54.4′W	25 NOV 98	623	62	11	5356	1006
101	0° 30.0′S	179° 54.1′W	25 NOV 98	1049	59	12	4653	1006
111	0° 1.8′N	179° 53.9′W	25 NOV 98	1722	78	14	5402	1004
121	1° 0.2′N	179° 51.3′W	26 NOV 98	1122	66	12	5842	1004
131	2° 0.3′N	179° 49.5′W	26 NOV 98	1935	121	11	5471	1011
141	2° 59.5′N	179° 51.2′W	27 NOV 98	309	119	20	5663	1006
151	3° 59.8′N	179° 53.3′W	27 NOV 98	1031	142	14	5703	1004
161	4° 57.6′N	179° 57.0′W	27 NOV 98	1746	149	21	5380	1005
171	6° 0.0′N	179° 54.4′W	28 NOV 98	224	147	20	5498	1003
181	7° 0.0′N	179° 53.4′W	28 NOV 98	932	144	14	5827	1003
191	8° 2.1′N	179° 52.6′W	28 NOV 98	1754	152	14	5910	1002
201	0° 0.3′S	170° 0.8′W	2 DEC 98	2332	98	37	5550	1002
211	1° 0.7′N	170° 1.2′W	3 DEC 98	732	157	4	5463	1002
221	1° 55.2′N	169° 58.7′W	3 DEC 98	1630	73	3	5397	1004
231	3° 0.0′N	170° 0.1′W	4 DEC 98	256	236	47	5487	1008
241	4° 0.4′N	169° 59.7′W	4 DEC 98	1024	28	8	5673	1003
251	5° 0.8′N	169° 59.2′W	4 DEC 98	1737	72	14	5804	1005
261	6° 0.1′N	169° 59.9′W	5 DEC 98	133	76	15	5425	1003
271	7° 0.4′N	170° 1.3′W	5 DEC 98	915	75	26	5989	1002
281	8° 0.6′N	170° 1.0′W	6 DEC 98	226	70	20	5521	1002

Table 2: Drift and viscous heating corrections for CTD temperature calibrations.

Cruise	Temp. Sensor S/N	Drift Correction °C	Viscous Heat Correction °C
GP398	2026	0.000109	–0.0006
GP498	2026	0.000206	–0.0006
GP598	2026	0.000432	–0.0006
GP798	2026	0.000578	–0.0006
GP898	2026	0.000675	–0.0006

Table 3: Station groupings for CTD conductivity calibrations.

Cruise	Stations	Sensor S/N	Standard Seawater	Fitting Routine	Points Used	Total Points	Percent Points Used	Fit Standard Deviation (mS/cm)	Conductivity Fit Bias (mS/cm)	Pressure Correction Beta	Minimum Fit Slope	Maximum Fit Slope
GP197	1–6	1467	P127	Calcos1	39	40	97.50	0.002087	–0.025678563		1.0009262	1.0009638
	7–14	1467	P127	Calcos2	56	59	94.92	0.001931	–0.023852768		1.0009401	1.0010155
GP297	1–8	1467	P127	Calcos1	64	70	91.43	0.002766	–0.026944072		1.0010991	1.0012349
	9–13	1469	P127	Calcos1	33	35	94.29	0.002120	0.008019998		0.9999984	1.0000441
	2, 8		P127	Calcos1	11	11	100.00	0.002663	–0.009929637		1.0002716	1.0003796
GP397	1–27	1469	P130	Calcos3	146	160	91.25	0.002293	–0.003114562		1.0005042	1.0007716
	29–40	1536	P130	Calcos3	51	61	83.61	0.000837	–0.005480338		1.0002551	1.0003776
	25,28,30,31,41	1537	P130	Calcos3	34	39	87.18	0.000748	–0.021174820		1.0007864	1.0011089
GP497	1–17	1536	P130	Calcop3	101	122	82.79	0.000813	–0.008783065	4.1647099e-007	1.0004982	1.0005514
	18–29	1536	P130	Calcop3	64	75	85.33	0.000762	–0.012301793	2.2680421e-006	1.0006075	1.0007091
GP597	1–5	1536/1467	P130	Calcos2	28	33	84.85	0.002317	–0.031347916		1.0012617	1.0015644
	6–32	1467/1469	P130	Calcos3	125	143	87.41	0.001983	–0.004869412		0.9998995	0.9999970
GP697	2–26	1536	P130	Calcop2	130	146	89.04	0.000969	–0.012709966	6.9759176e-007	1.0002533	1.0002871
	28–42	1536	P130	Calcop2	72	82	87.80	0.001191	–0.017907535	1.1967037e-006	1.0004481	1.0005116
GP797	1–20	1536	P130	Calcop1	128	149	85.91	0.001408	–0.014960263	5.1027392e-007	1.0004086	1.0004406
	21–59	1536	P130	Calcop1	335	462	72.51	0.001493	–0.016891421	5.5873249e-007	1.0004968	1.0005381
GP198	1–34	1536	P127	Calcop2	260	376	69.15	0.001494	–0.021680330	9.0721519e-007	1.0007042	1.0007459
GP298	1–11	1536	P127	Calcop2	105	135	77.78	0.001309	–0.012401920	8.8076851e-007	1.0002304	1.0002474
	12–19	1536	P127	Calcop1	68	82	82.93	0.002497	–0.006284314	9.7291910e-007	0.9999921	1.0000273
	20–28	1536	P127	Calcop2	86	106	81.13	0.001049	–0.012169303	6.8877508e-007	1.0002114	1.0002223
GP398	1–34	1536	P127	Calcop4	290	378	76.72	0.001015	–0.009440483	4.7234494e-007	1.0000625	1.0001405
GP498	1–43	1536	P127	Calcop4	365	488	74.80	0.001165	–0.009564218	3.2069263e-007	1.0000968	1.0001483
GP598	0	1536	P127	Calcop0	11	11	100.00	0.000240	–0.591093850	–6.2301439e-005	1.0197296	1.0197296
	1–17	1536	P127	Calcop1	165	203	81.28	0.001435	–0.009925754	1.7198771e-007	1.0000914	1.0001003
	18–26	1536	P127	Calcop1	80	106	75.47	0.001407	–0.008593210	3.3902804e-007	0.9999743	1.0001110
	27–31	1536	P127	Calcop0	46	58	79.31	0.002025	–0.015873065	2.8028602e-006	1.0001948	1.0001948
GP698	1–18	1473	P133	Calcop3	120	138	79.47	0.001270	–0.014603804	3.7086808e-006	1.0001870	1.0002701
	19–35	1473/1921	P133	Calcop2	138	181	76.24	0.001378	–0.011277530	9.4984781e-007	1.0002516	1.0003121
GP798	1–29	1536	P127	Calcop3	260	310	83.87	0.001676	–0.007654385	–1.8101290e-008	1.0000010	1.0000467
GP898	1–28	1536	P127	Calcop4	184	240	76.67	0.001435	–0.009748257	6.9818194e-007	1.0000375	1.0000898

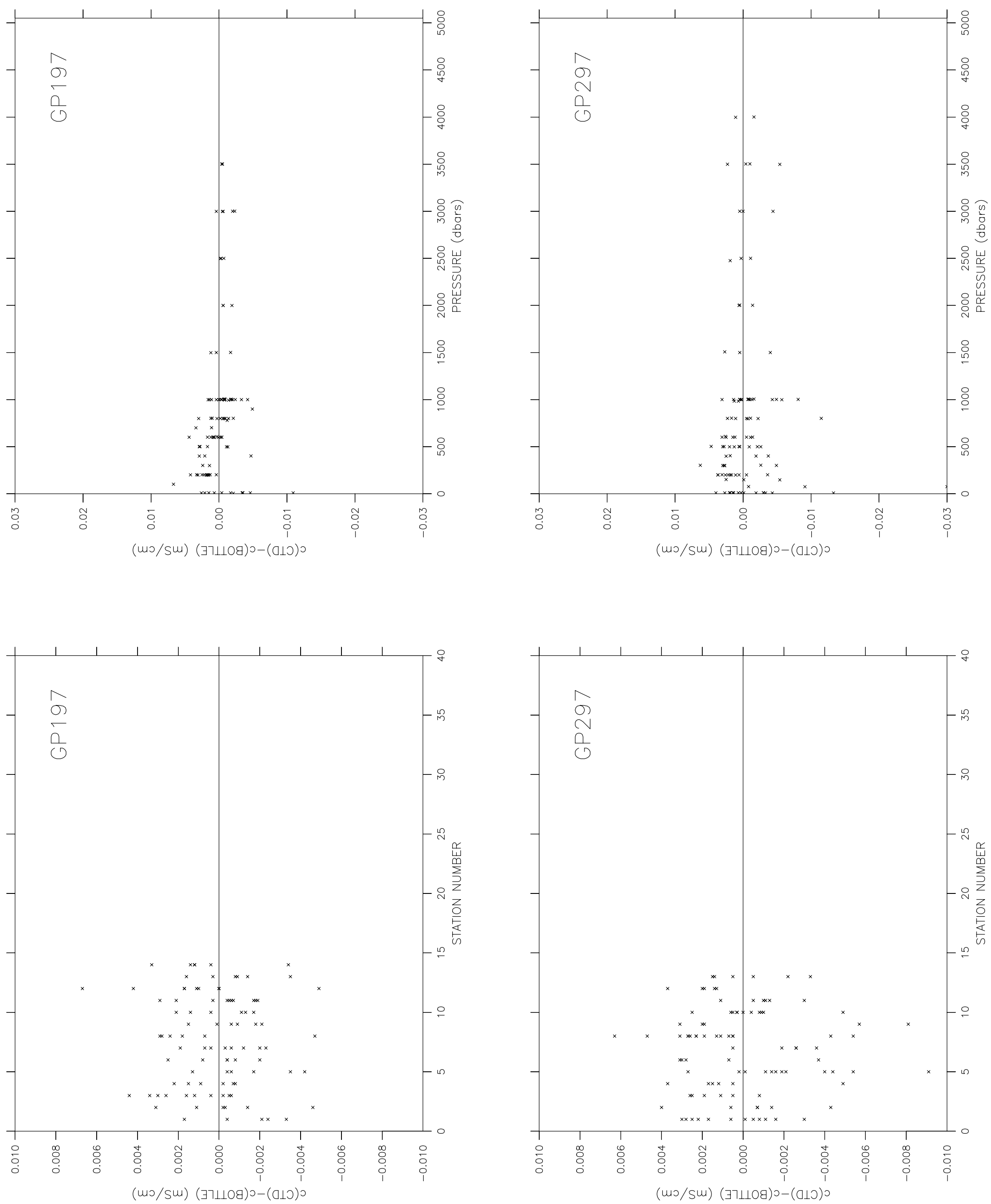


Figure 2a: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP197 (upper panels) and GP297 (lower panels).

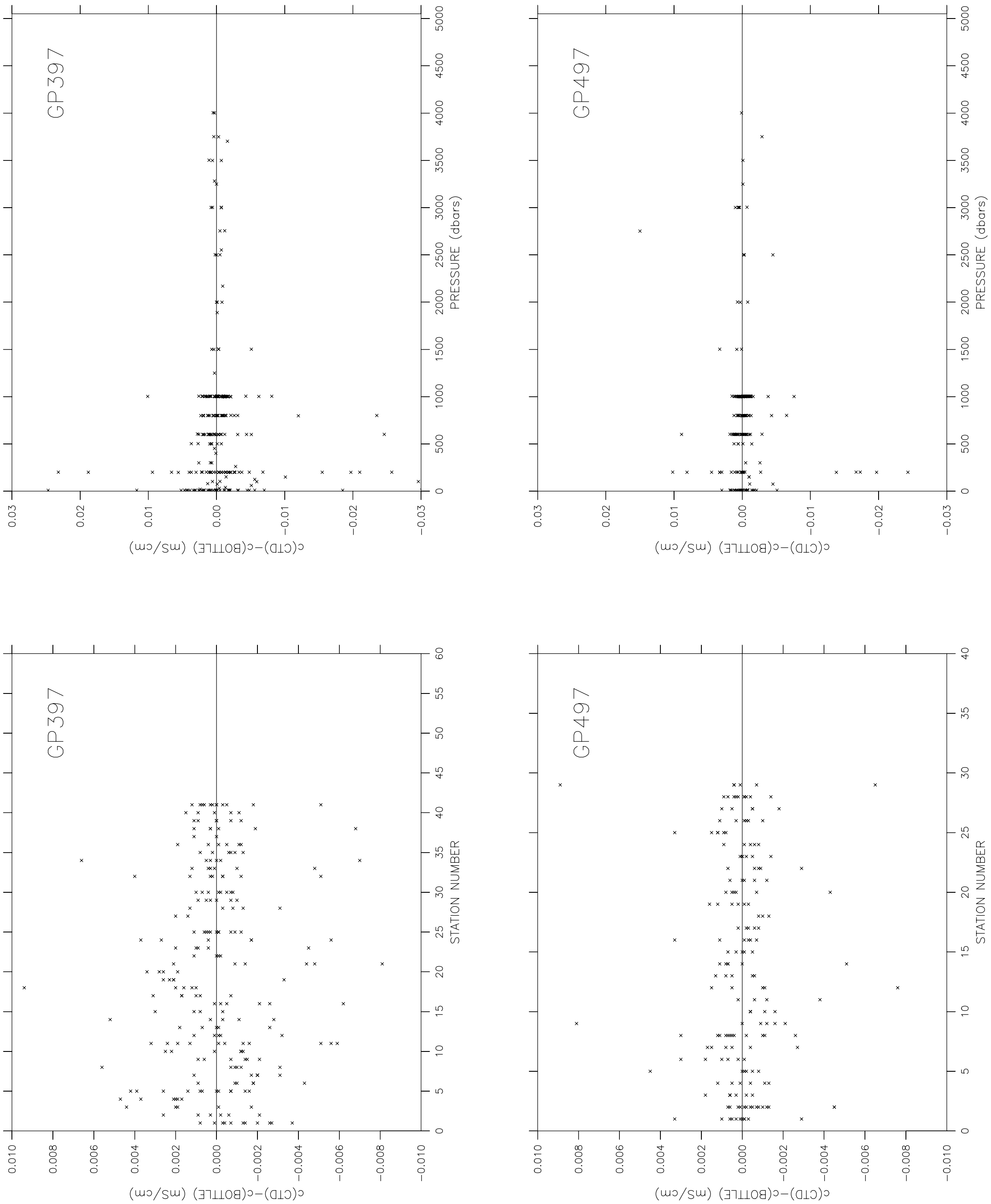


Figure 2b: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP397 (upper panels) and GP497 (lower panels).

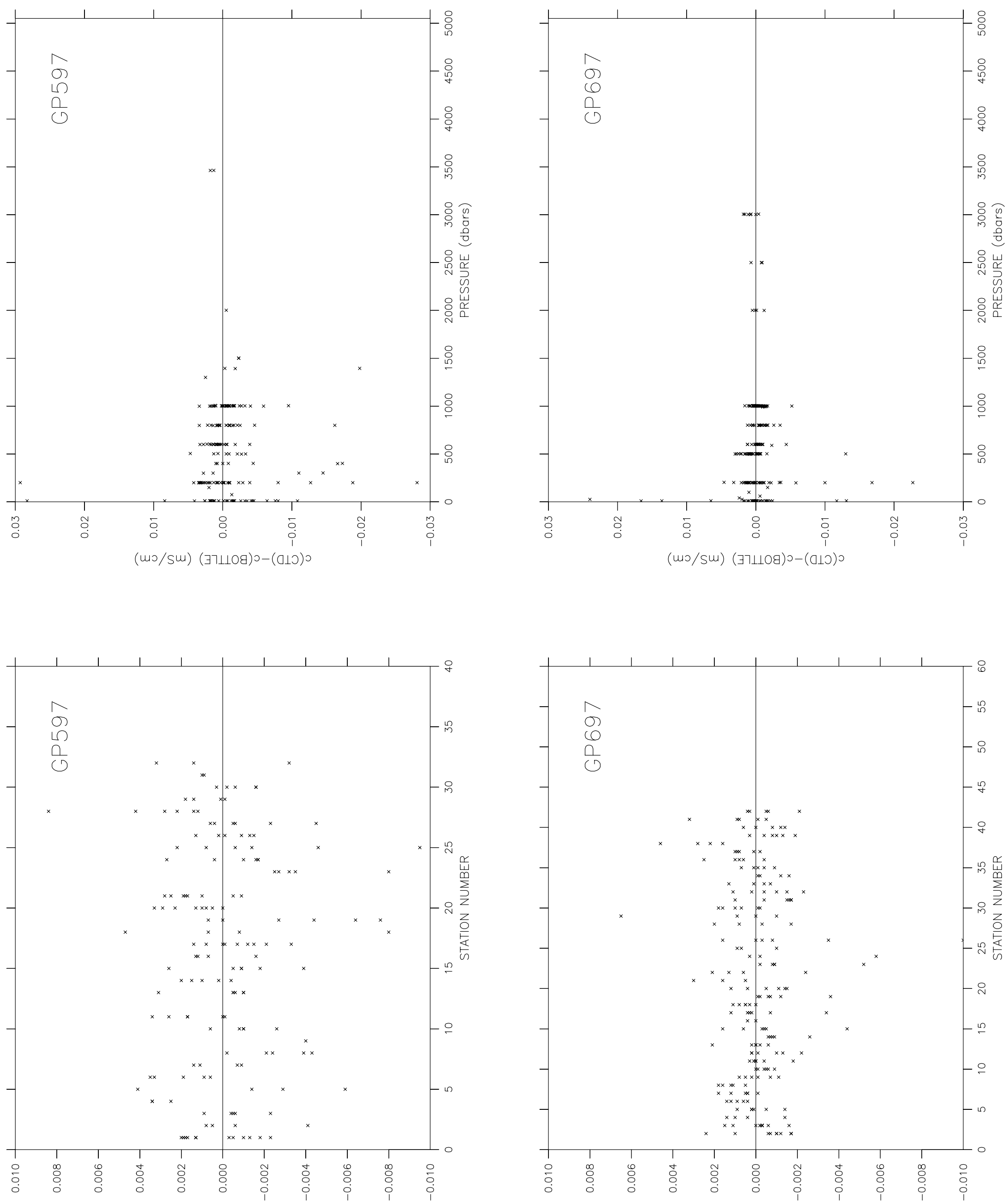


Figure 2c: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP597 (upper panels) and GP697 (lower panels).

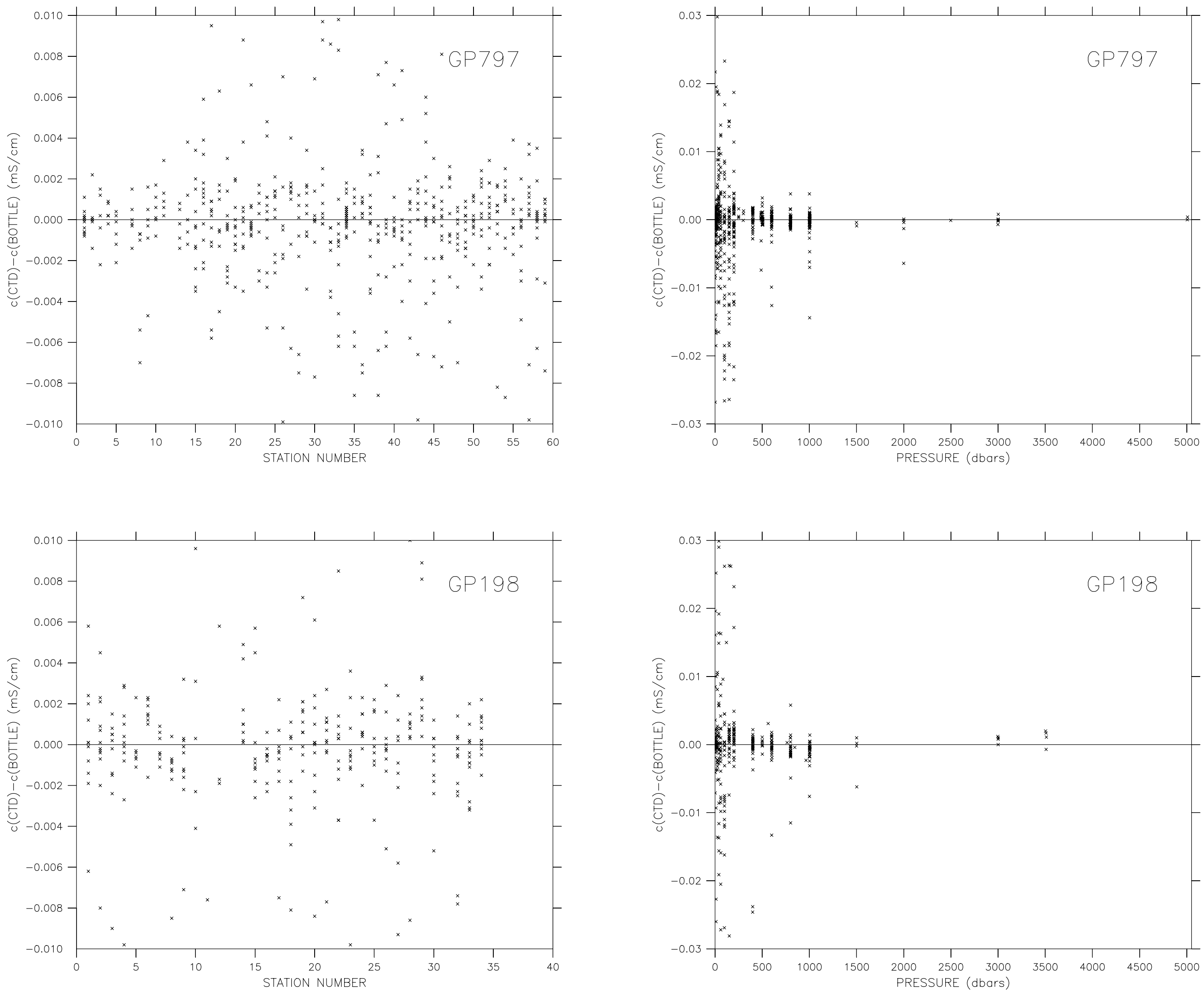


Figure 2d: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP797 (upper panels) and GP198 (lower panels).

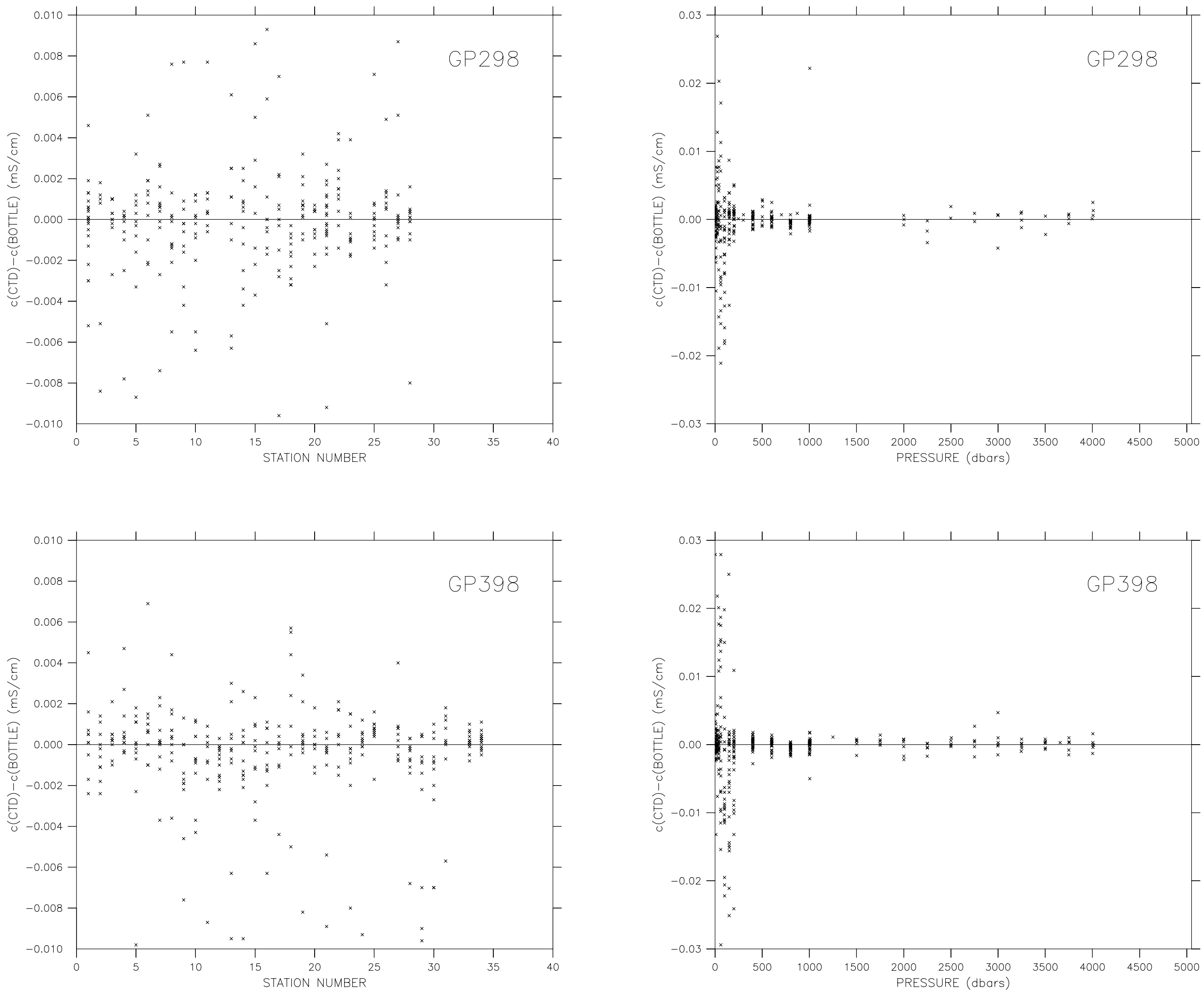


Figure 2e: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP298 (upper panels) and GP398 (lower panels).

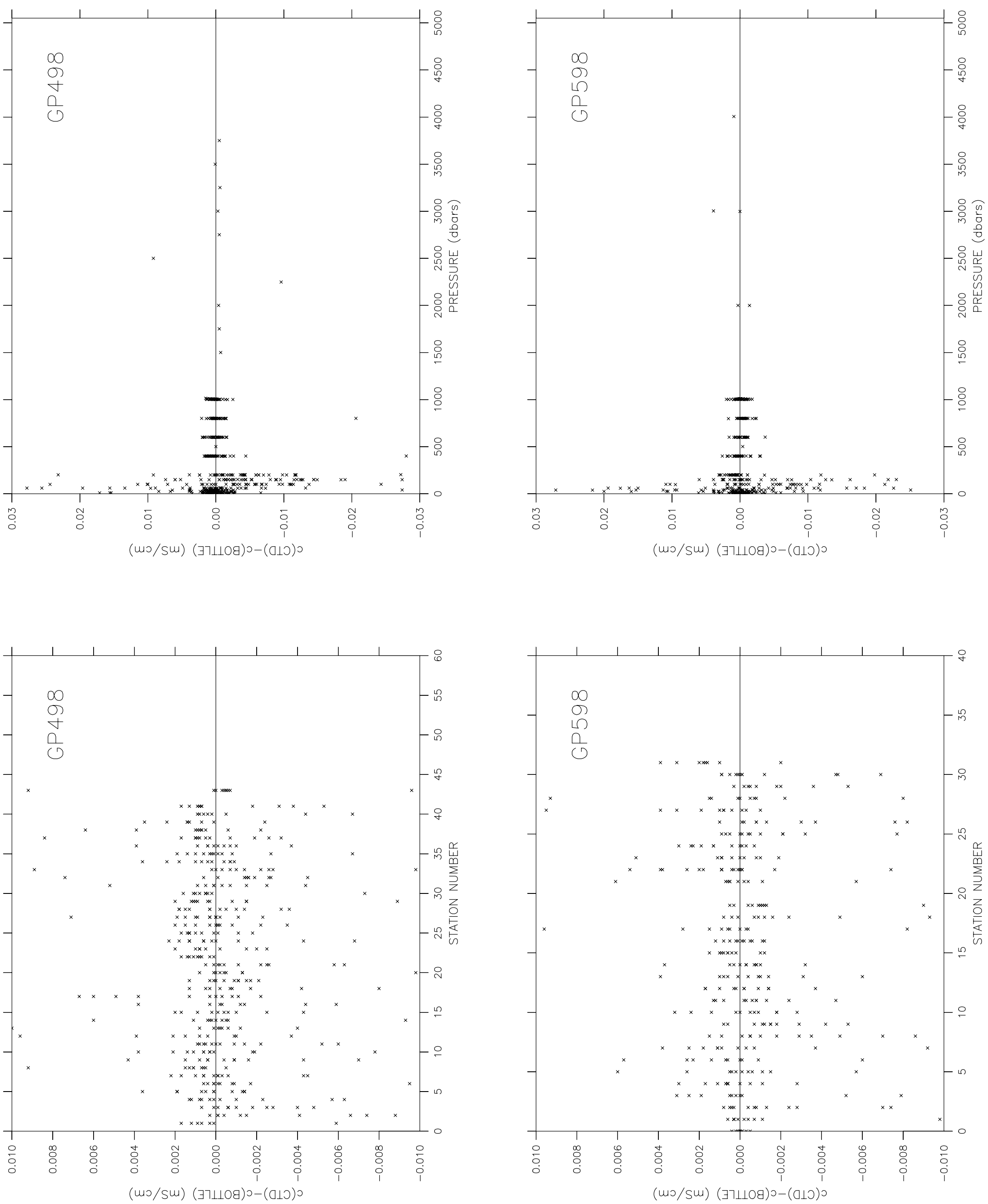


Figure 2f: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP498 (upper panels) and GP598 (lower panels).

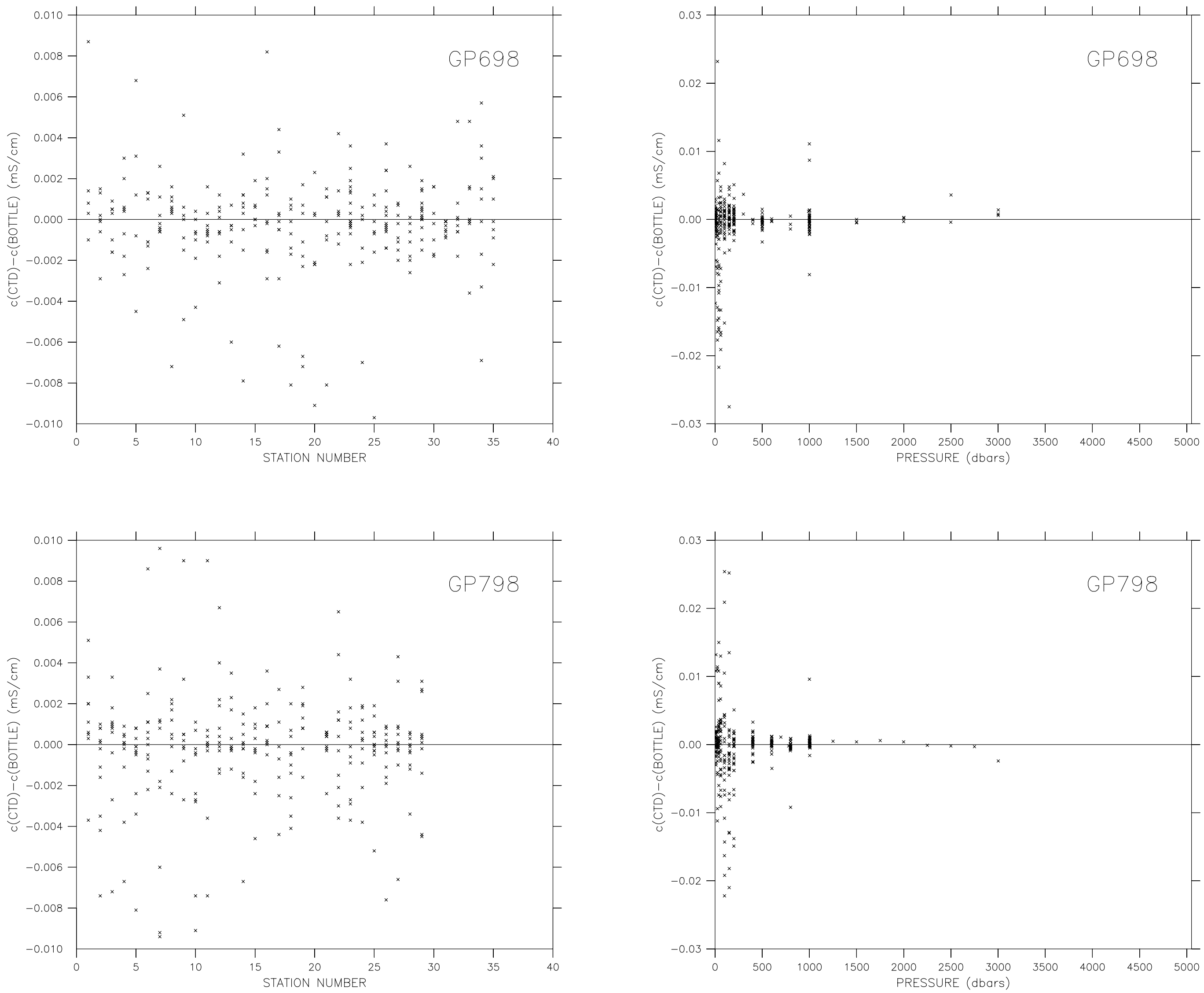


Figure 2g: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP698 (upper panels) and GP798 (lower panels).

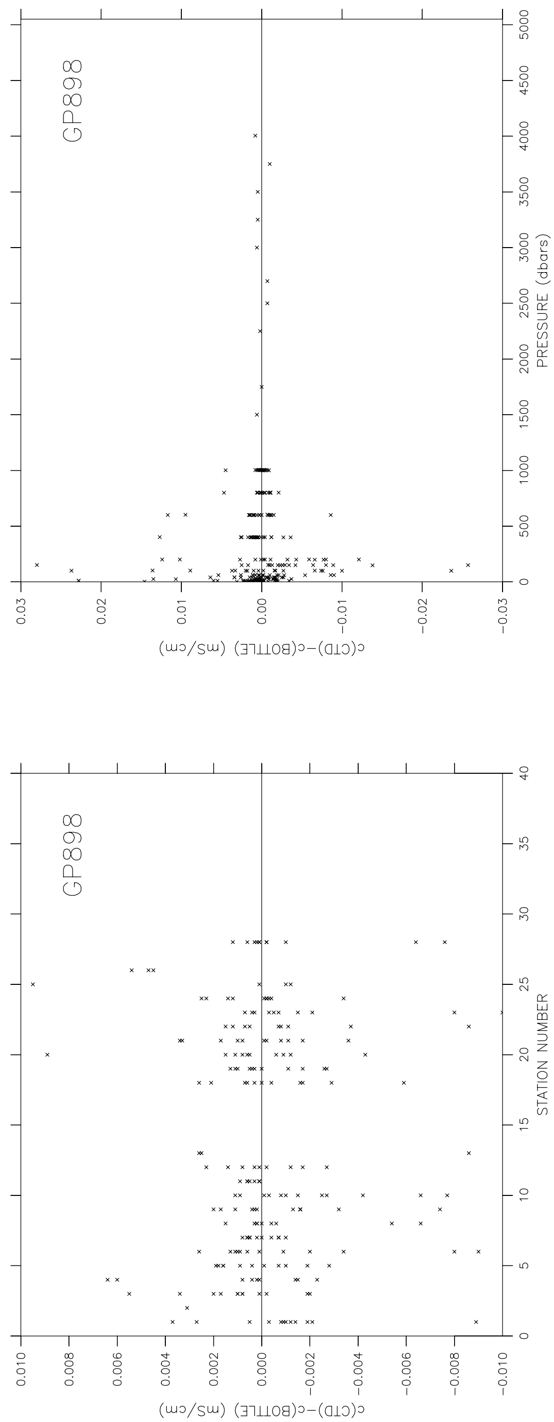


Figure 2h: Calibrated CTD-bottle conductivity differences plotted against station number and pressure for cruises GP898.

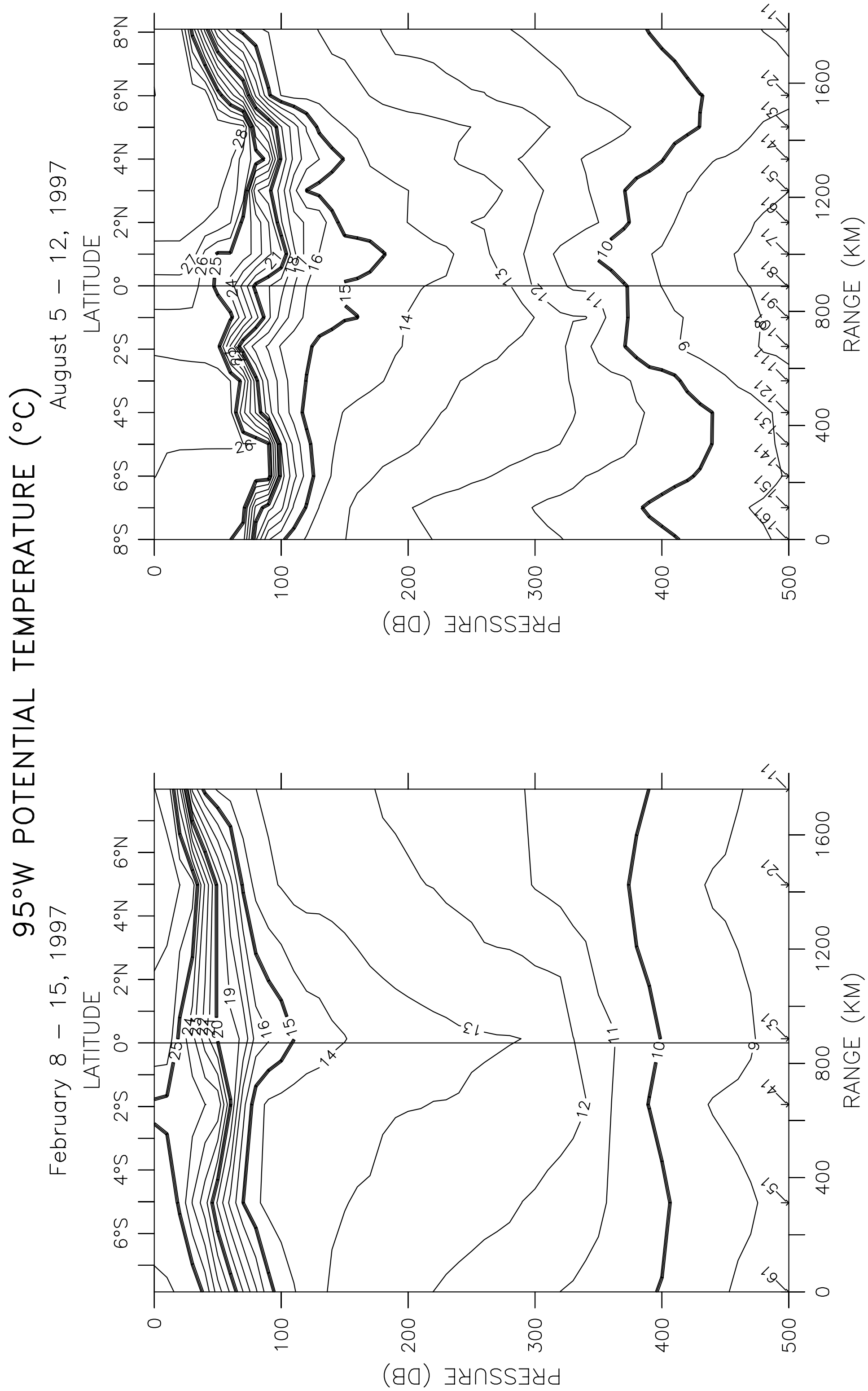


Figure 3: GP1-97-KA winter and GP5-97-KA summer potential temperature (°C) sections along 95°W. Contour intervals are 1°C.

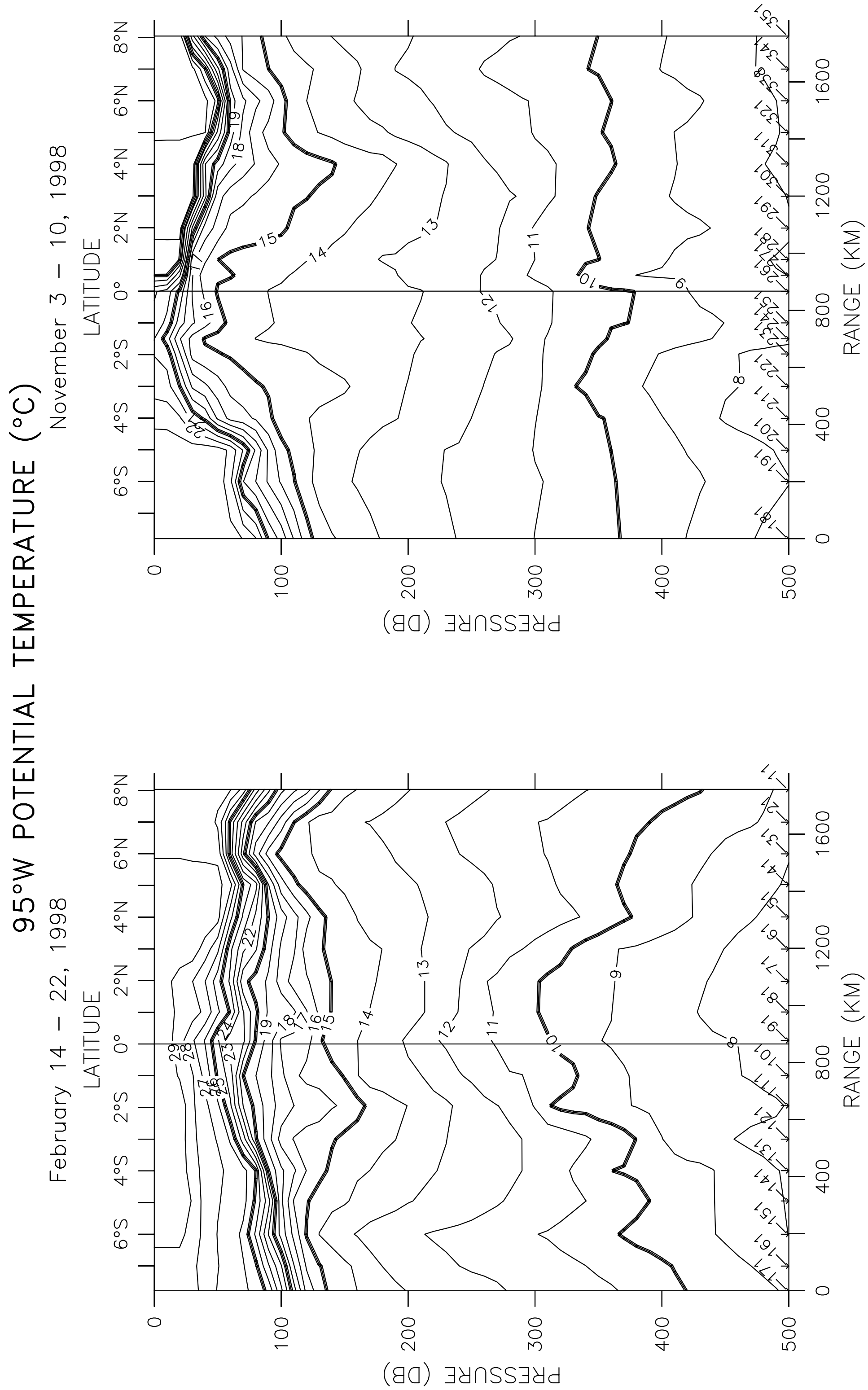


Figure 4: GP1-98-KA winter and GP6-98-RB fall potential temperature (°C) sections along 95°W. Contour intervals are 1°C.

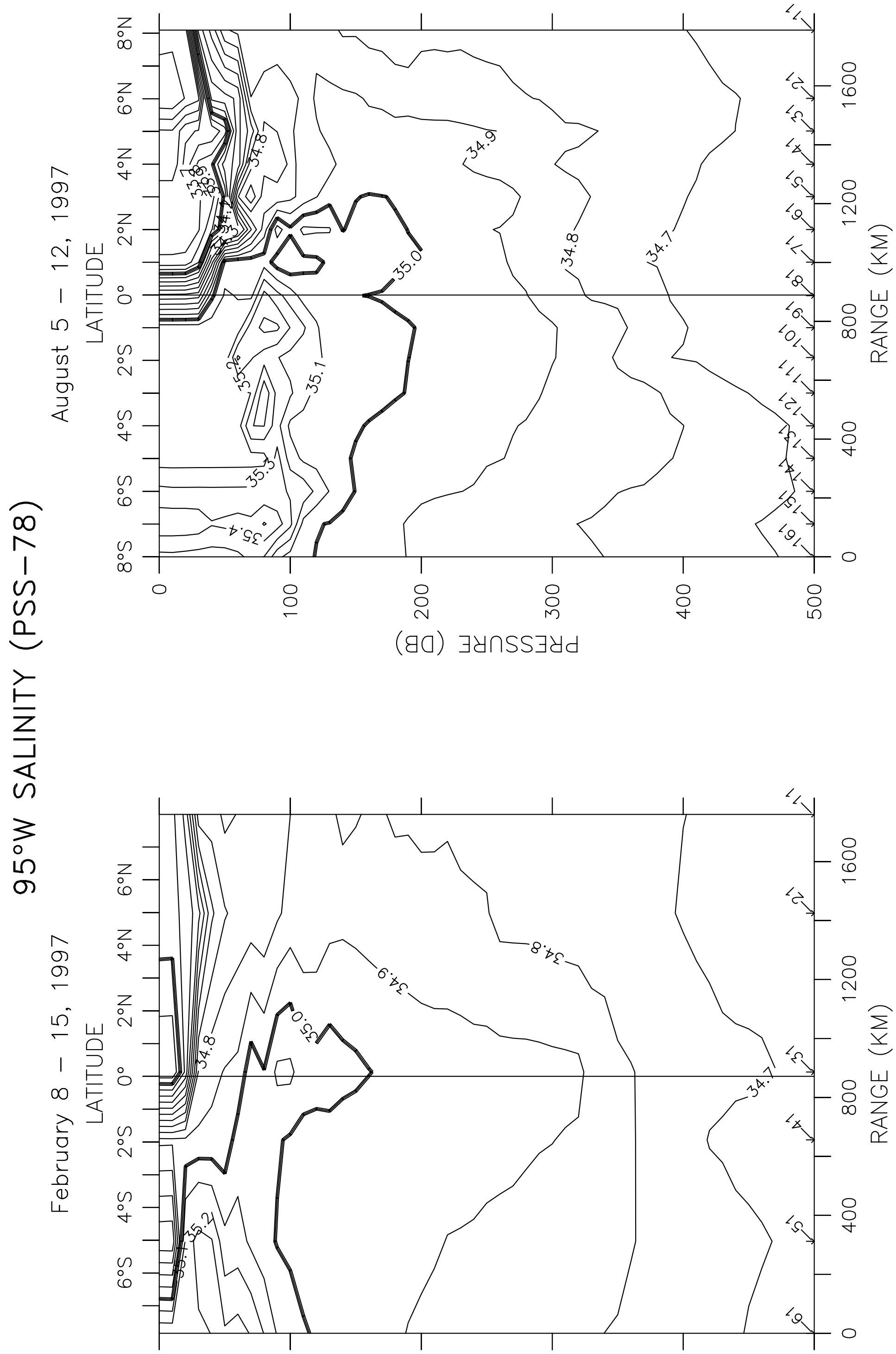


Figure 5: GP1-97-KA winter and GP5-97-KA summer salinity (PSS-78) sections along 95°W. Contour intervals are 0.1 PSS.

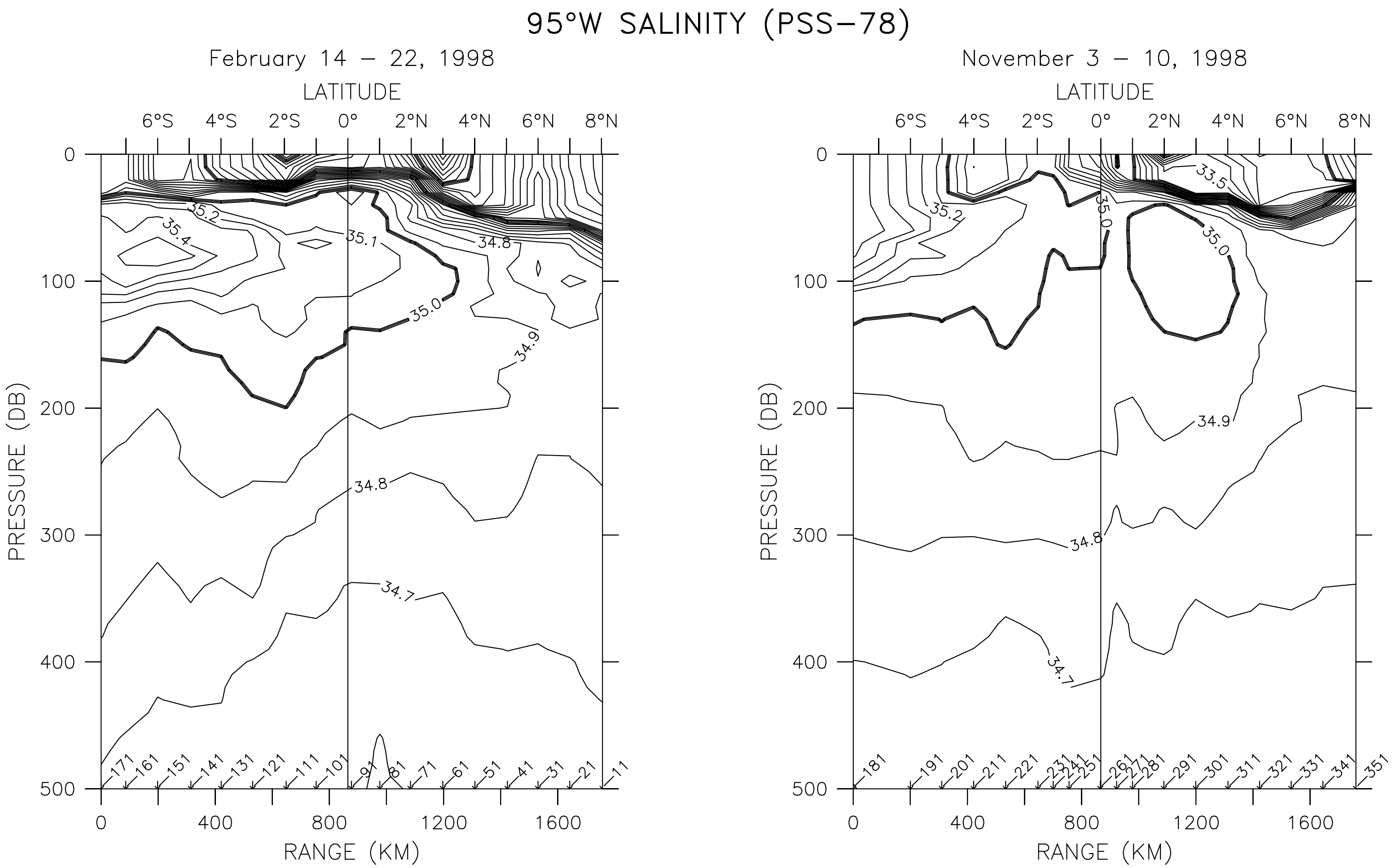


Figure 6: GP1-98-KA winter and GP6-98-RB fall salinity (PSS-78) sections along 95°W. Contour intervals are 0.1 PSS.

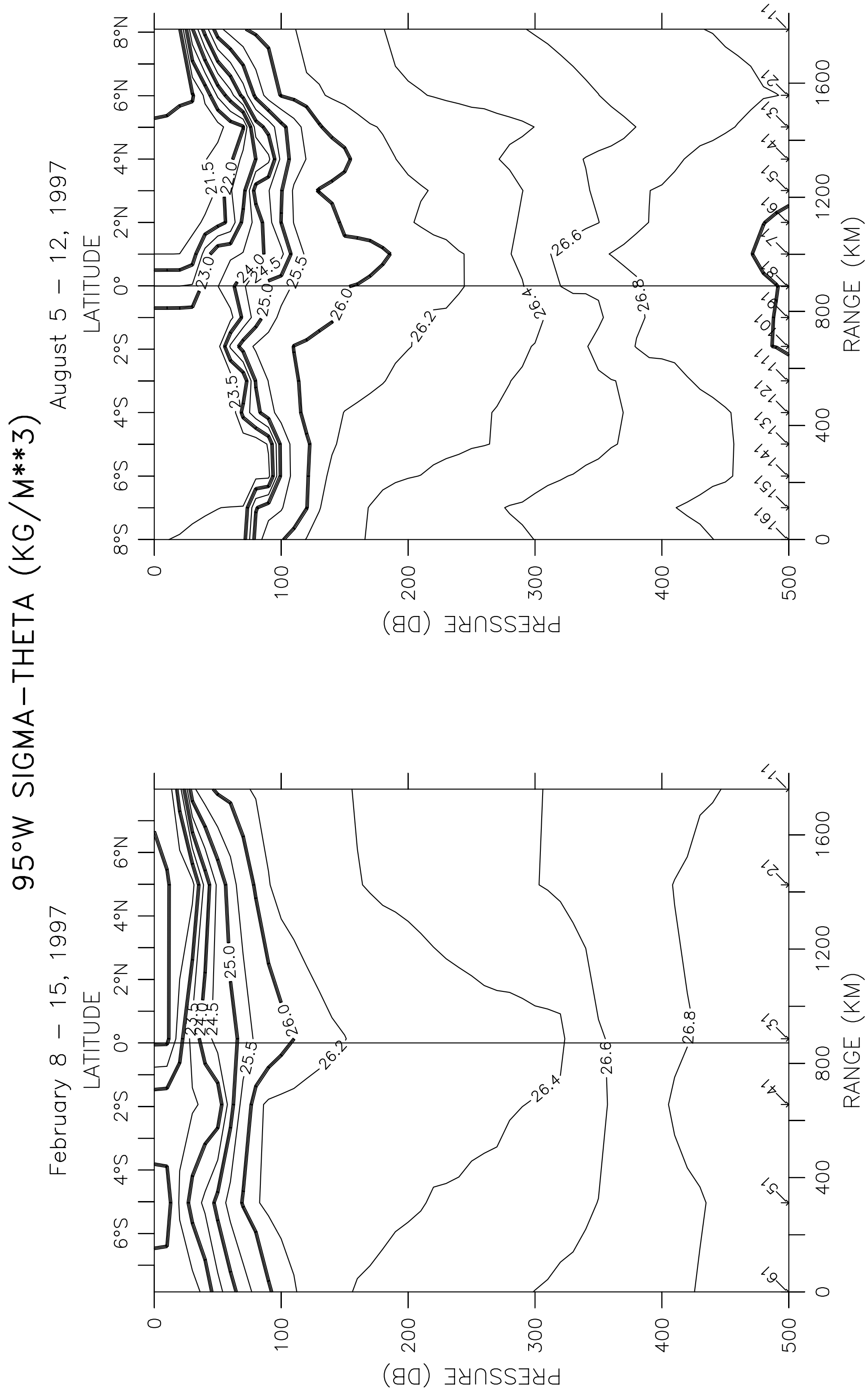


Figure 7: GP1-97-KA winter and GP5-97-KA summer potential density (kg/m^3) sections along 95°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

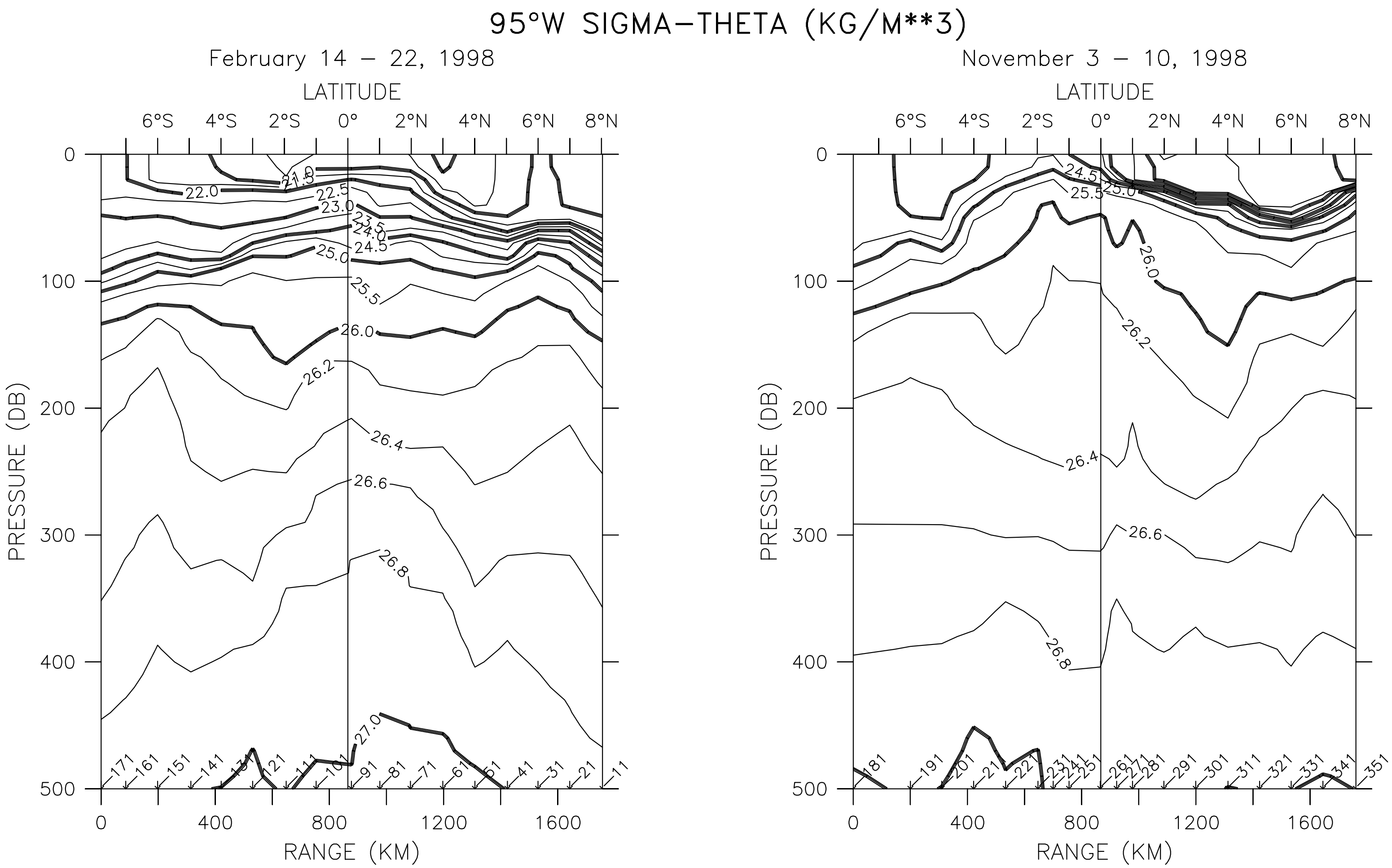


Figure 8: GP1-98-KA winter and GP6-98-RB fall potential density (kg/m^3) sections along 95°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

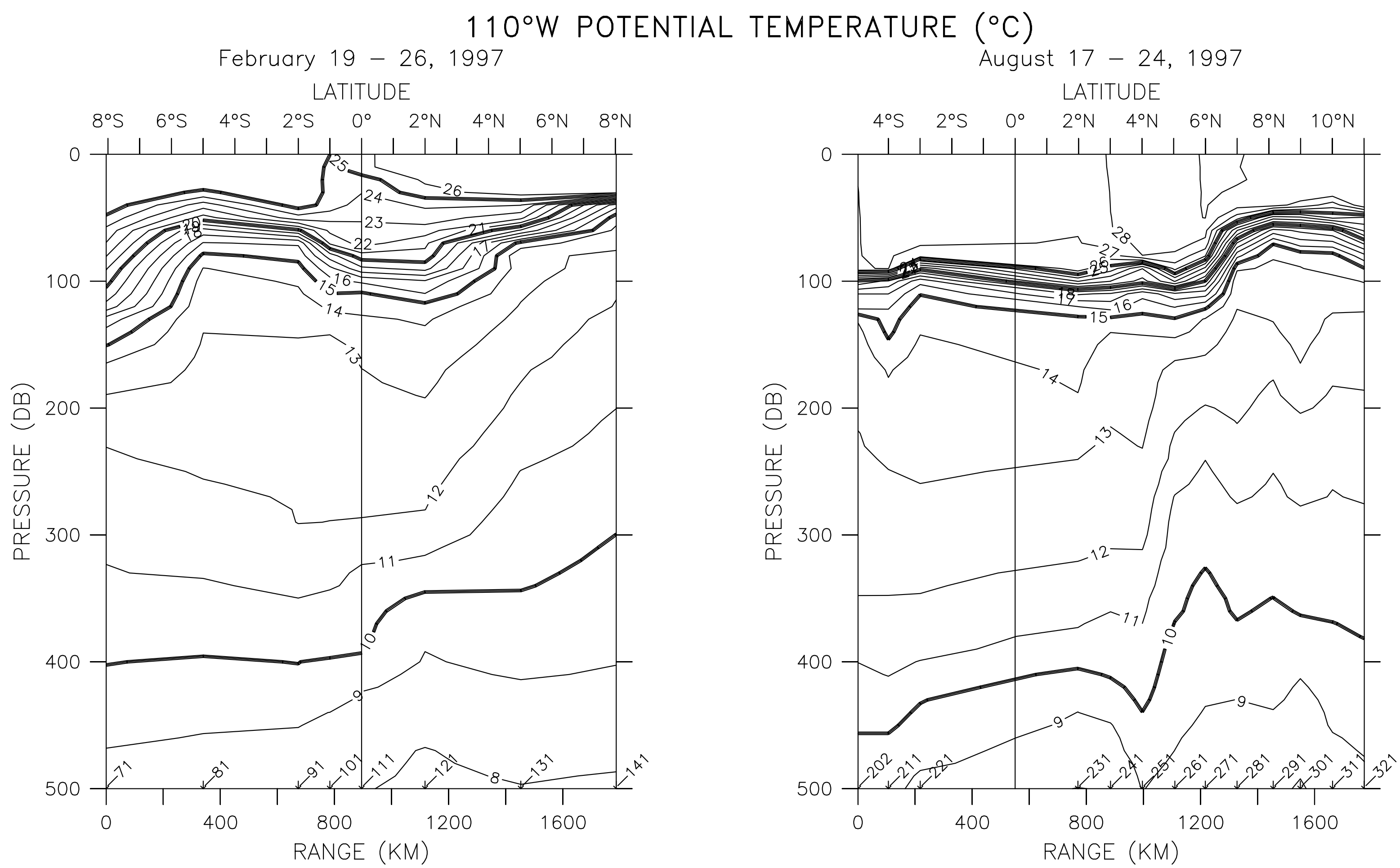


Figure 9: GP1-97-KA winter and GP5-97-KA summer potential temperature (°C) sections along 110°W. Contour intervals are 1°C.

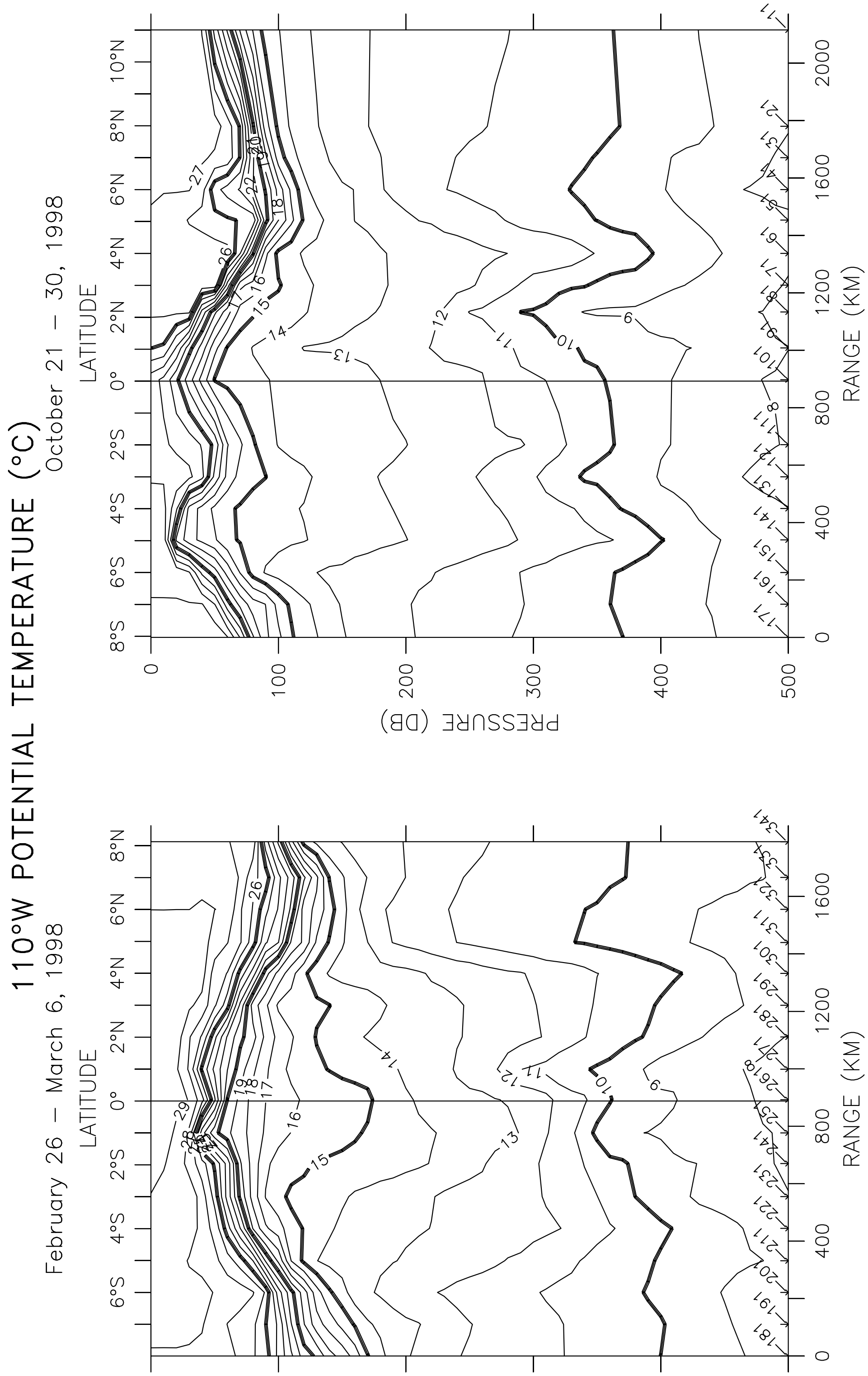


Figure 10: GP1-98-KA winter and GP6-98-RB fall potential temperature (°C) sections along 110°W. Contour intervals are 1°C.

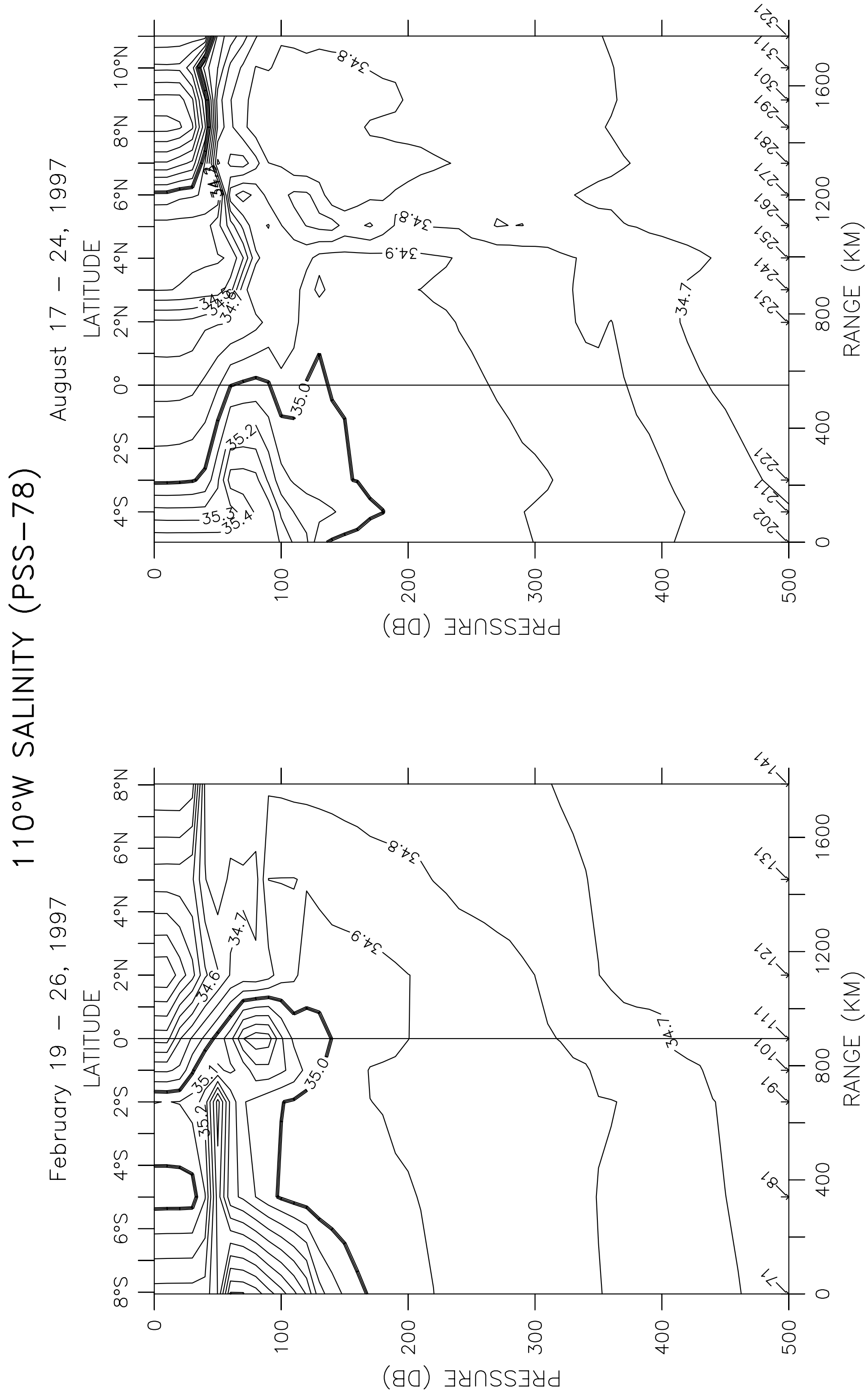


Figure 11: GP1-97-KA winter and GP5-97-KA summer salinity (PSS-78) sections along 110°W. Contour intervals are 0.1 PSS.

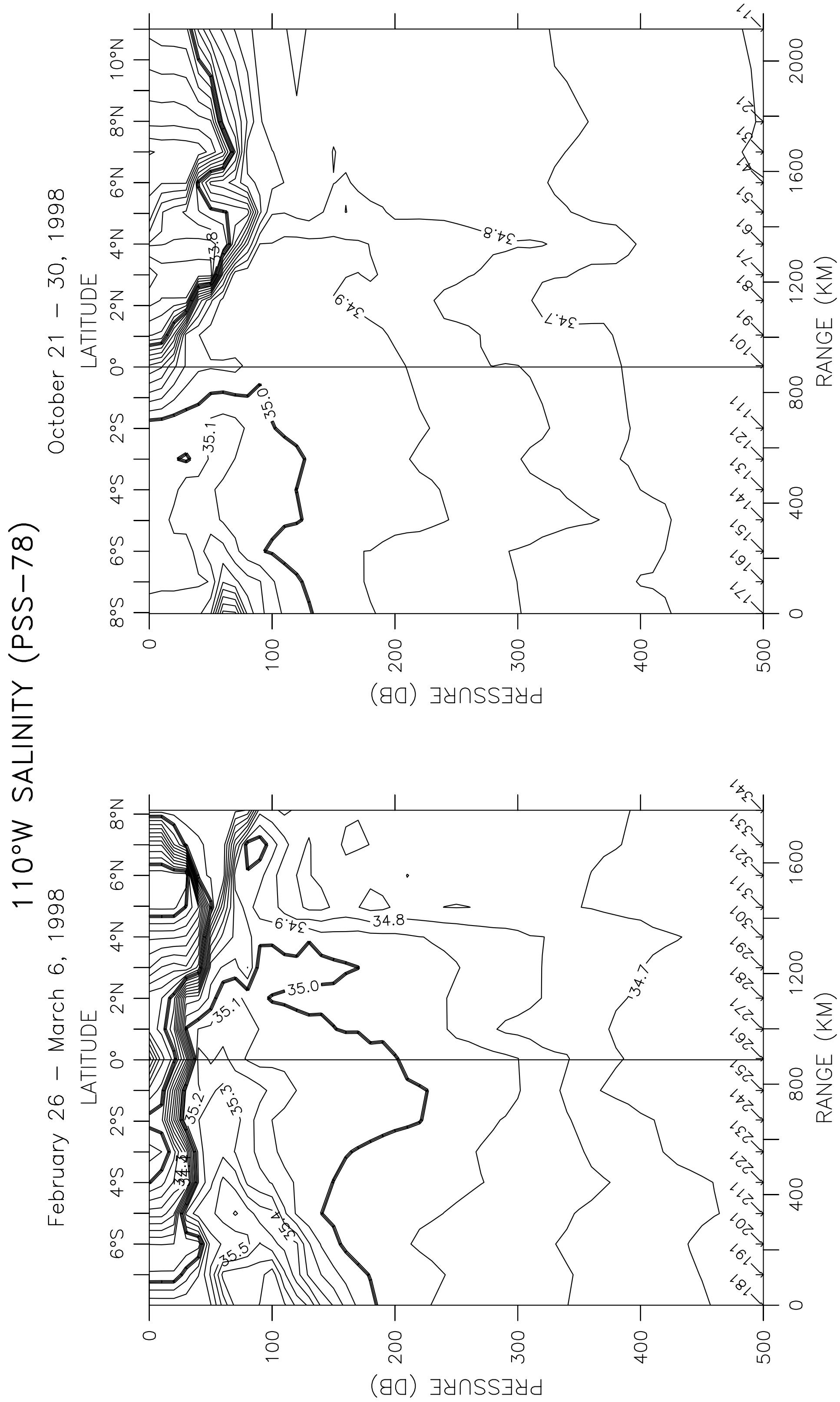


Figure 12: GP1-98-KA winter and GP6-98-RB fall salinity (PSS-78) sections along 110°W. Contour intervals are 0.1 PSS.

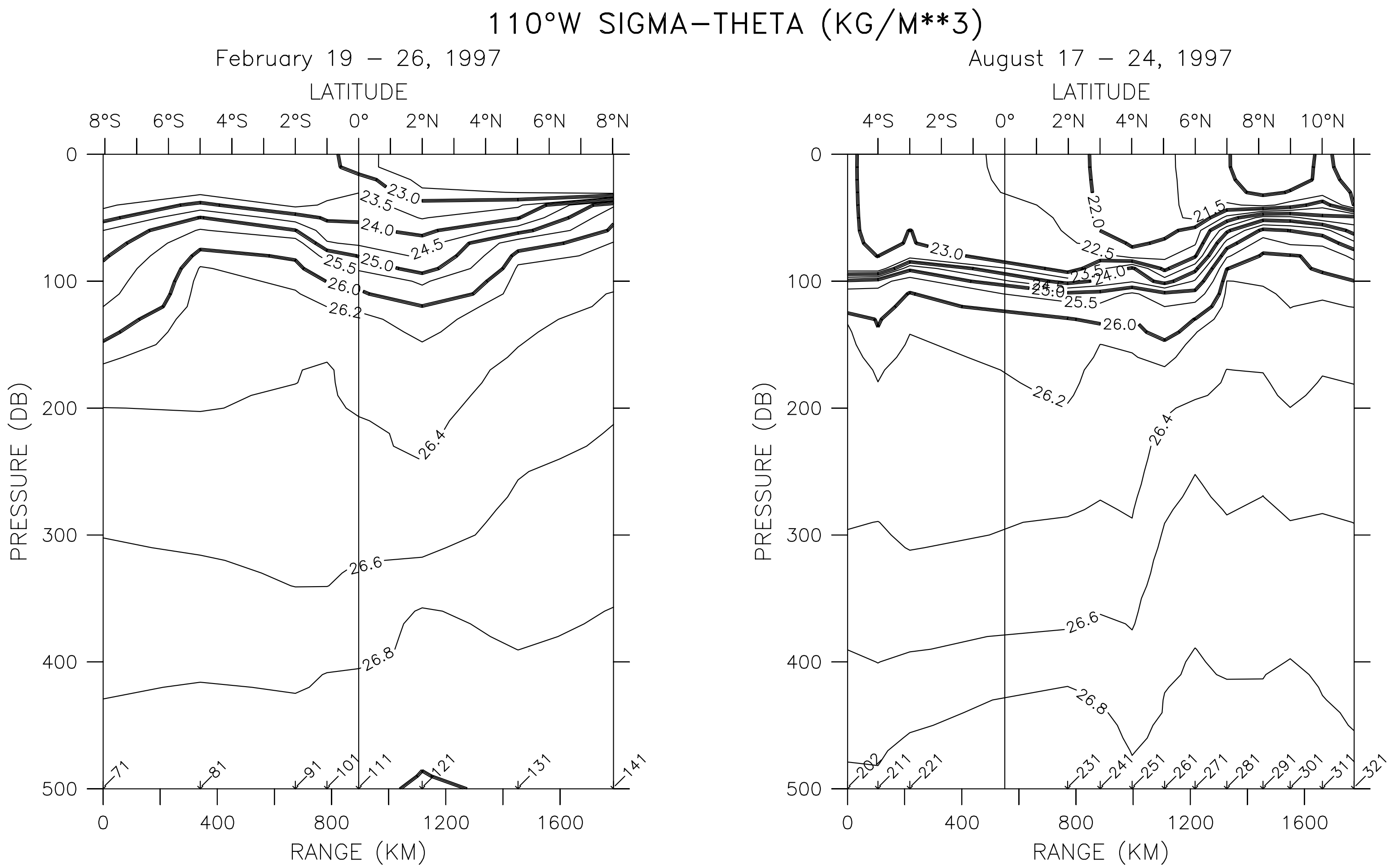


Figure 13: GP1-97-KA winter and GP5-97-KA summer potential density (kg/m^3) sections along 110°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

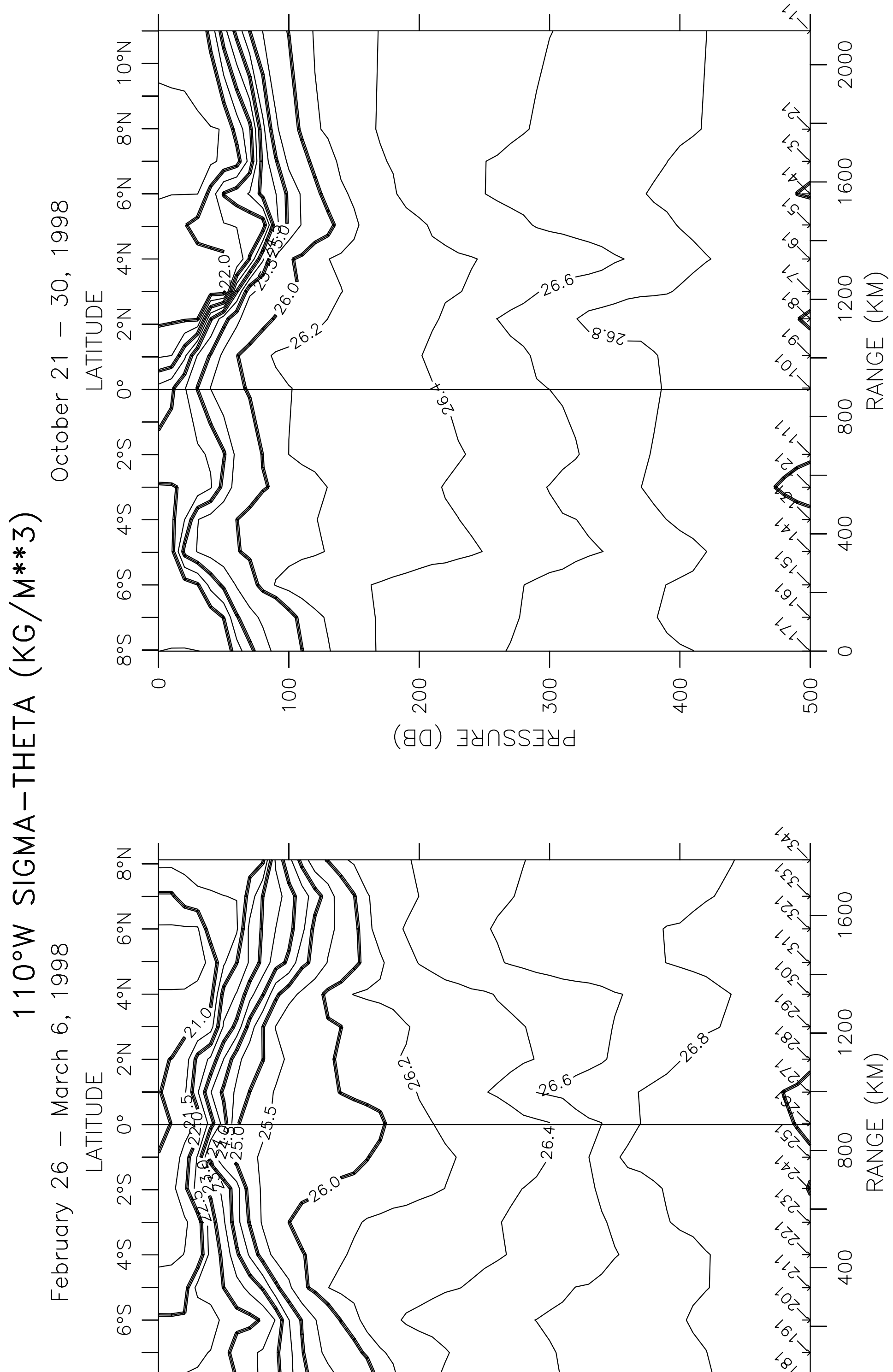


Figure 14: GP1-98-KA winter and GP6-98-RB fall potential density (kg/m^3) sections along 110°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

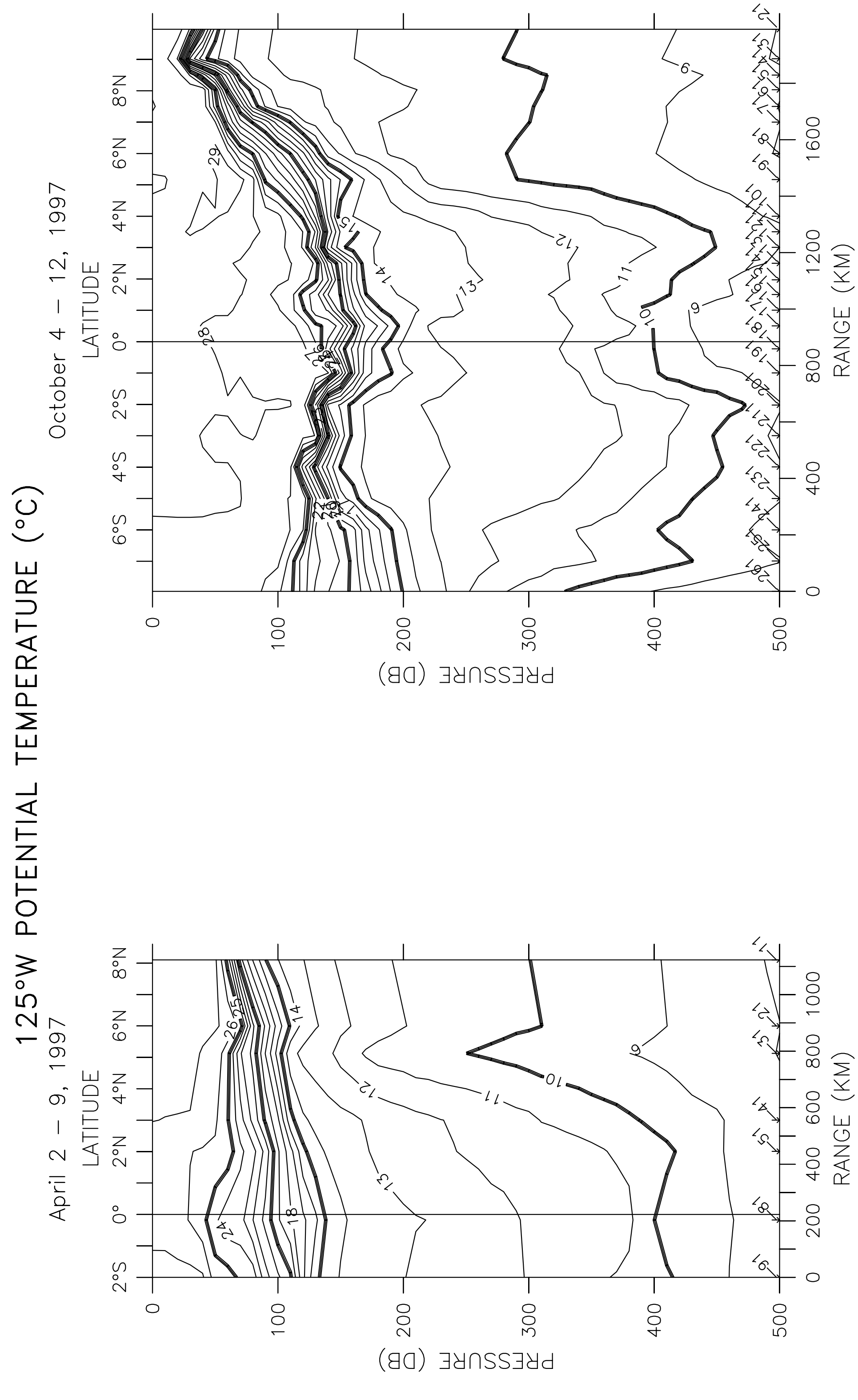


Figure 15: GP2-97-KA spring and GP6-97-KA fall potential temperature (°C) sections along 125°W. Contour intervals are 1°C.

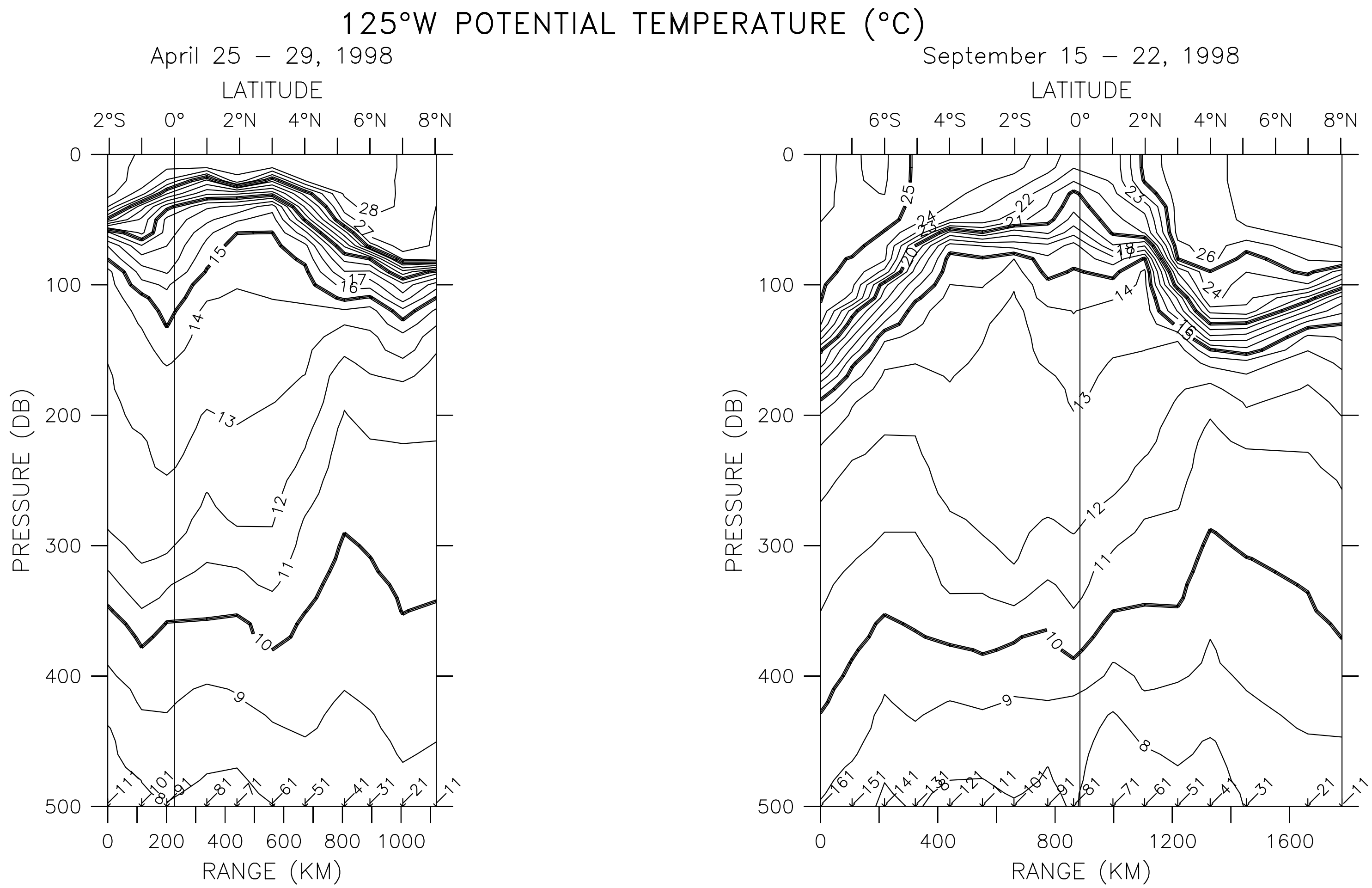


Figure 16: GP2-98-KA spring and GP5-98-KA summer potential temperature (°C) sections along 125°W. Contour intervals are 1°C.

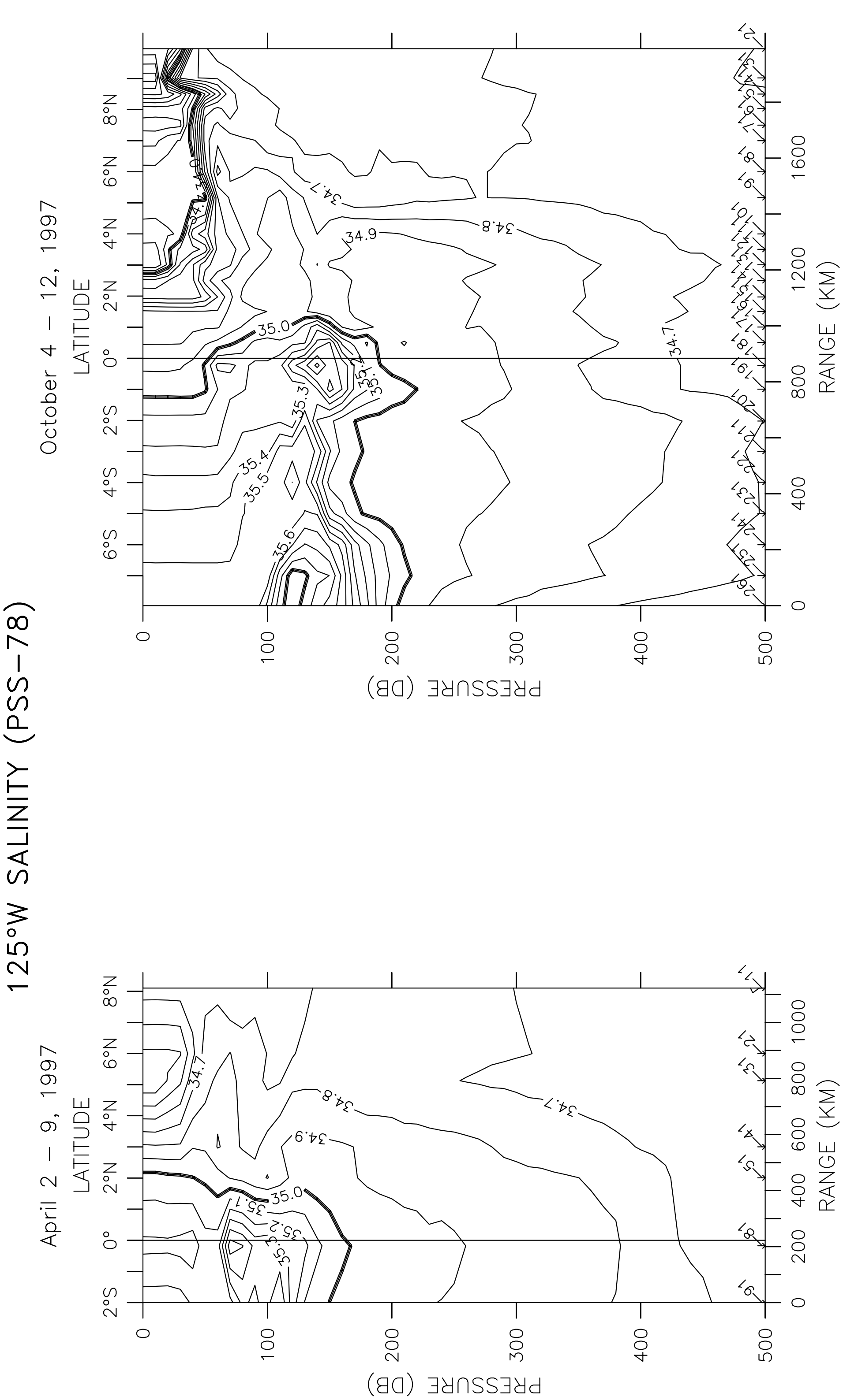


Figure 17: GP2-97-KA spring and GP6-97-KA fall salinity (PSS-78) sections along 125°W. Contour intervals are 0.1 PSS.

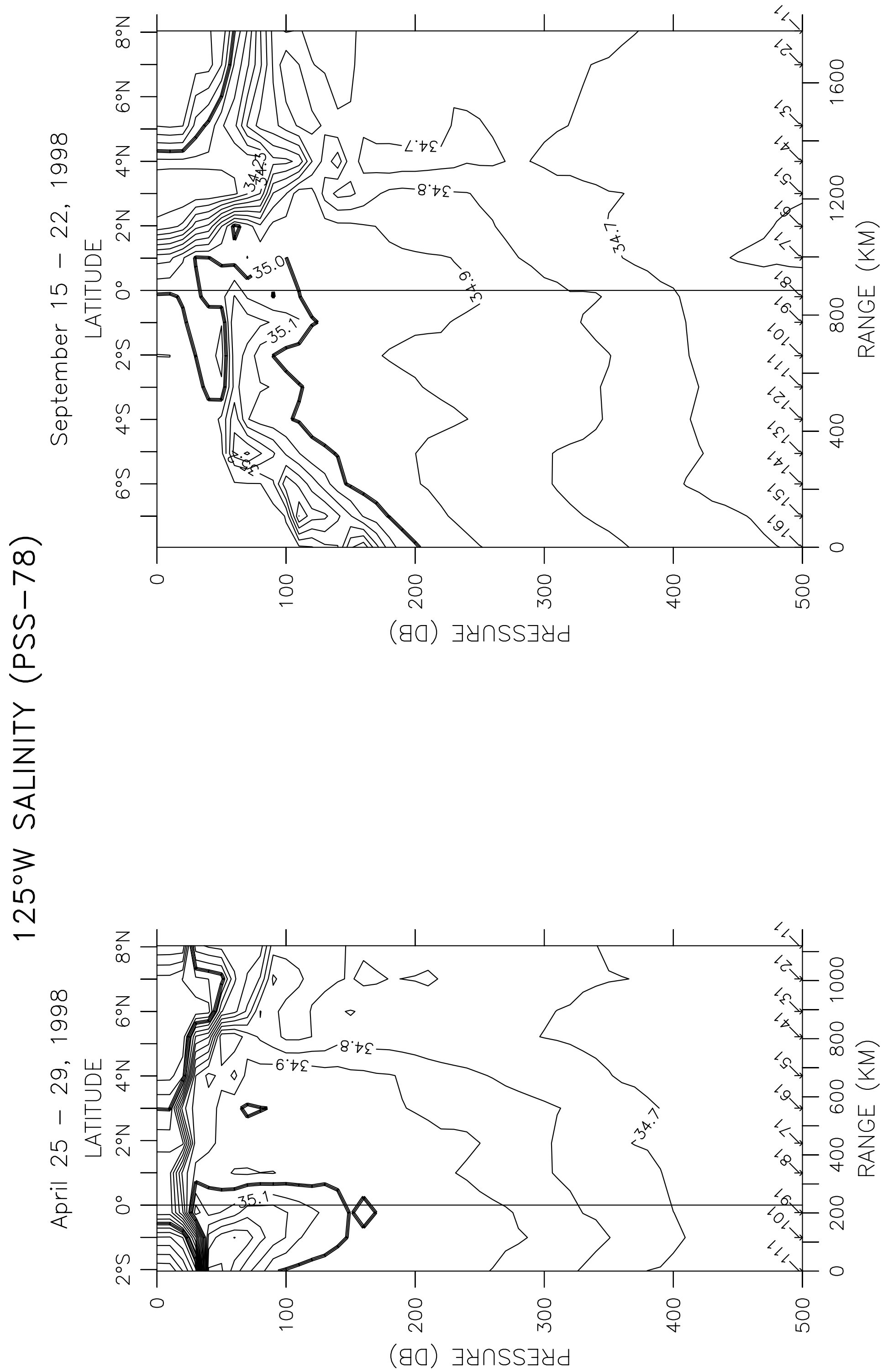


Figure 18: GP2-98-KA spring and GP5-98-KA summer salinity (PSS-78) sections along 125°W. Contour intervals are 0.1 PSS.

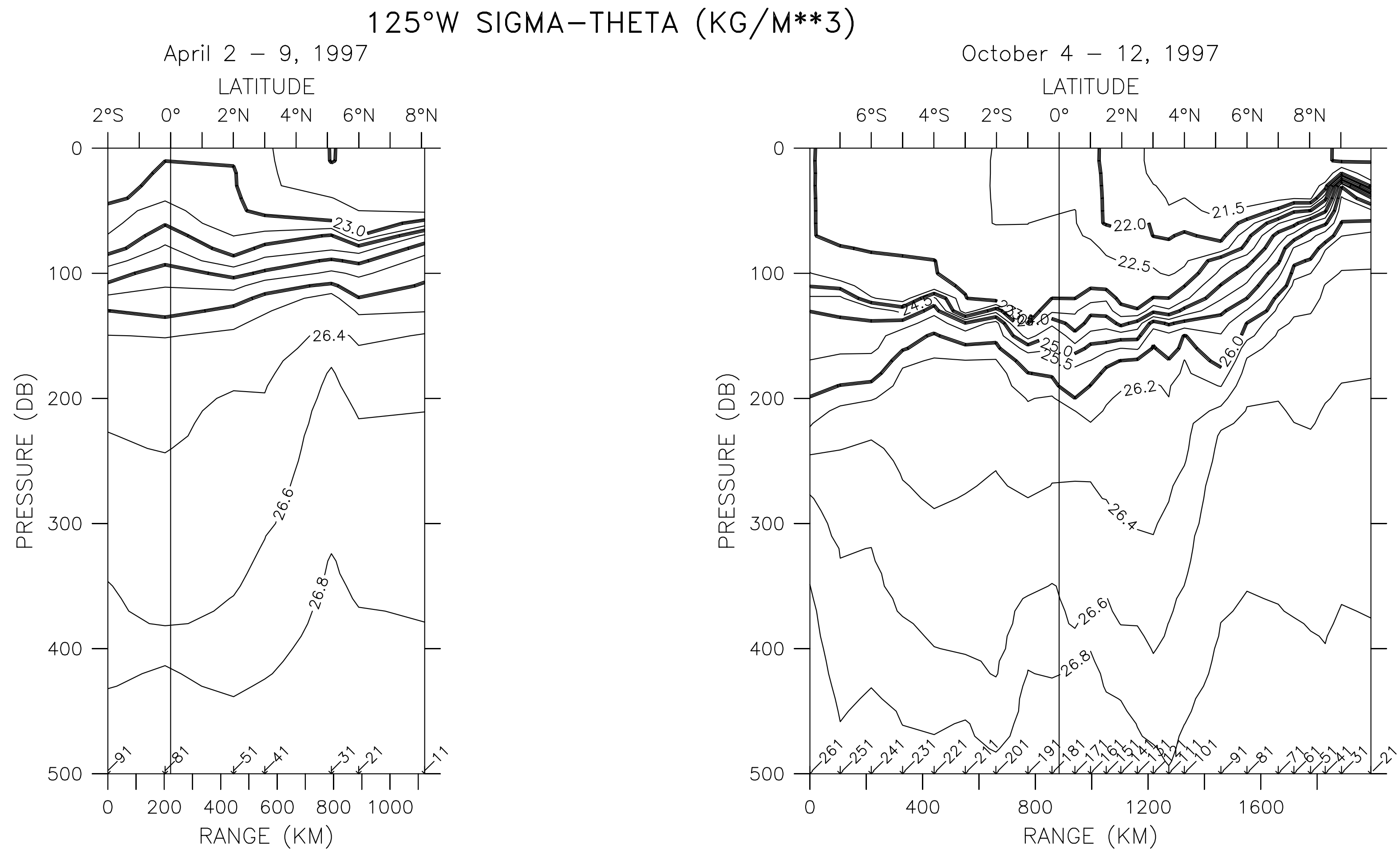


Figure 19: GP2-97-KA spring and GP6-97-KA fall potential density (kg/m^3) sections along 125°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

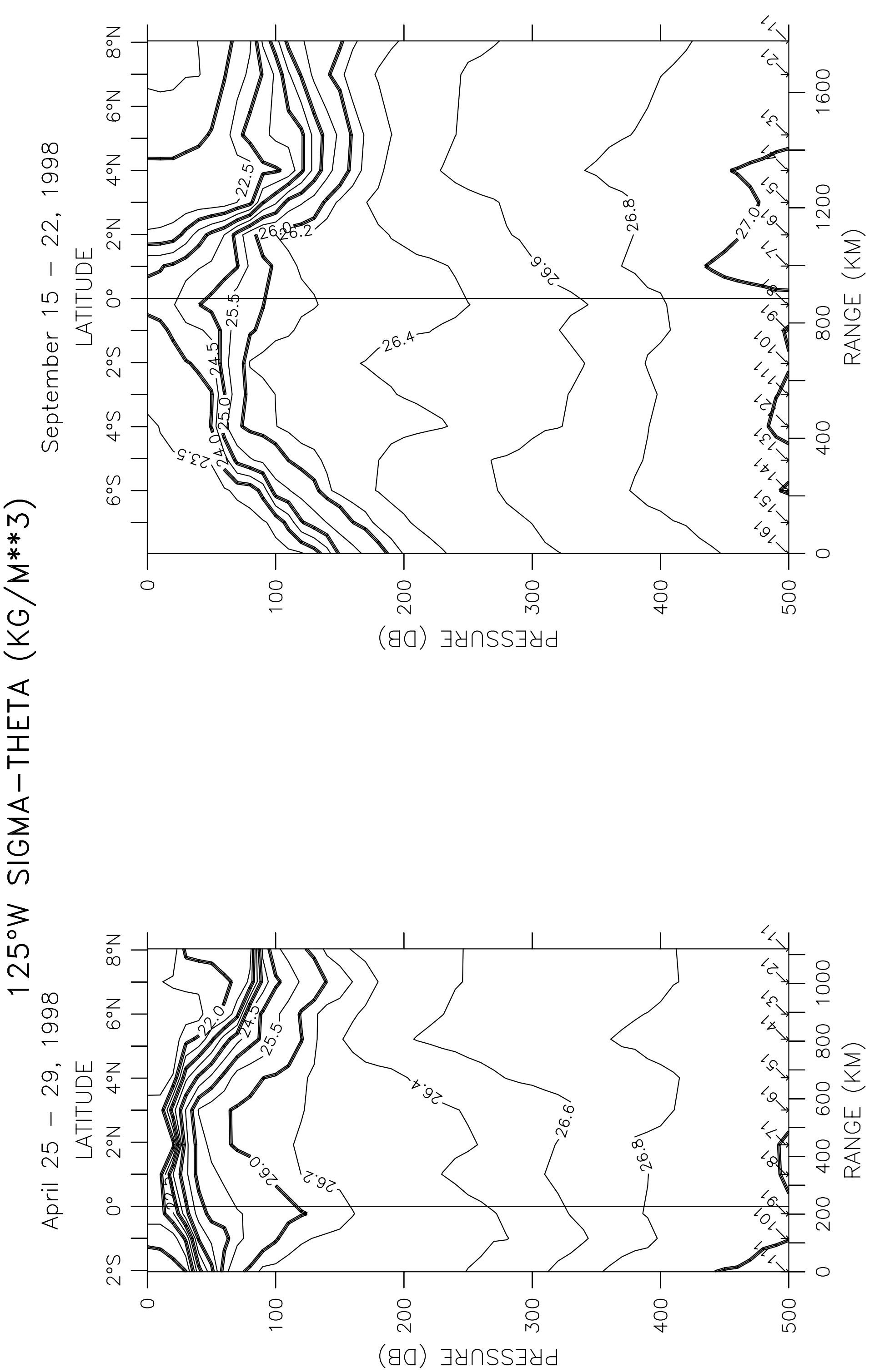


Figure 20: GP2-98-KA spring and GP5-98-KA summer potential density (kg/m^3) sections along 125°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

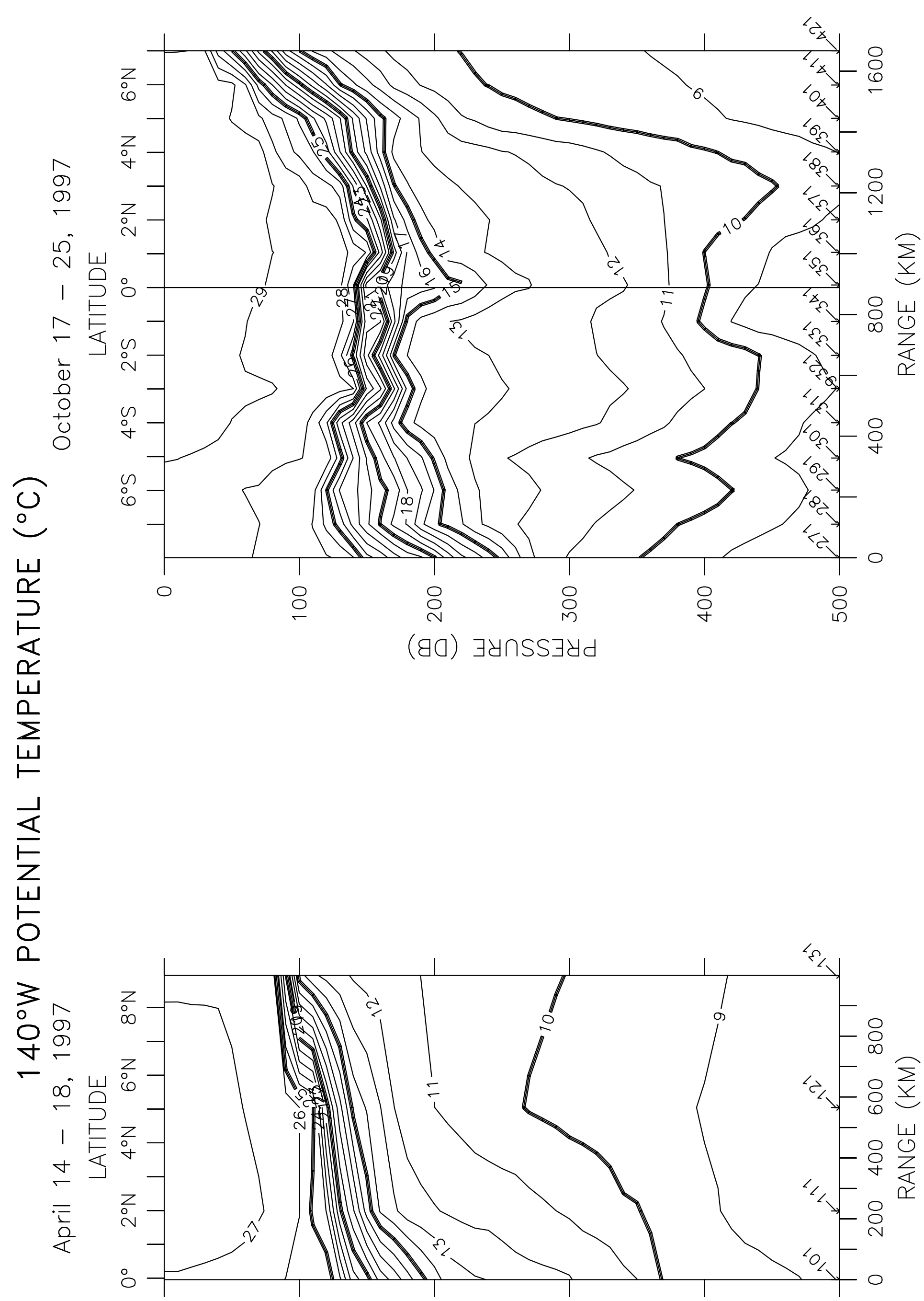


Figure 21: GP2-97-KA spring and GP6-97-KA fall potential temperature (°C) sections along 140°W. Contour intervals are 1°C.

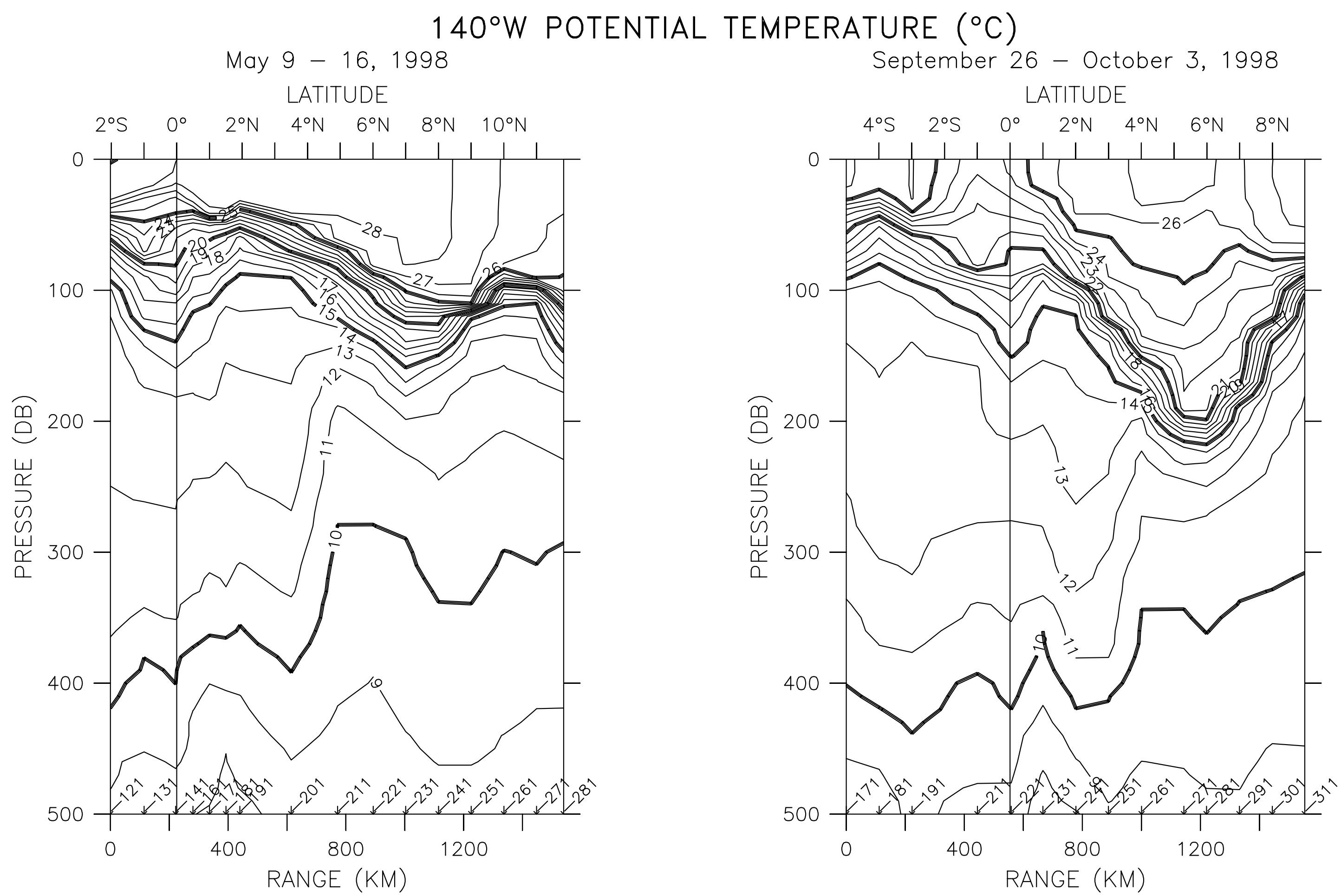


Figure 22: GP2-98-KA spring and GP5-98-KA summer potential temperature (°C) sections along 140°W. Contour intervals are 1°C.

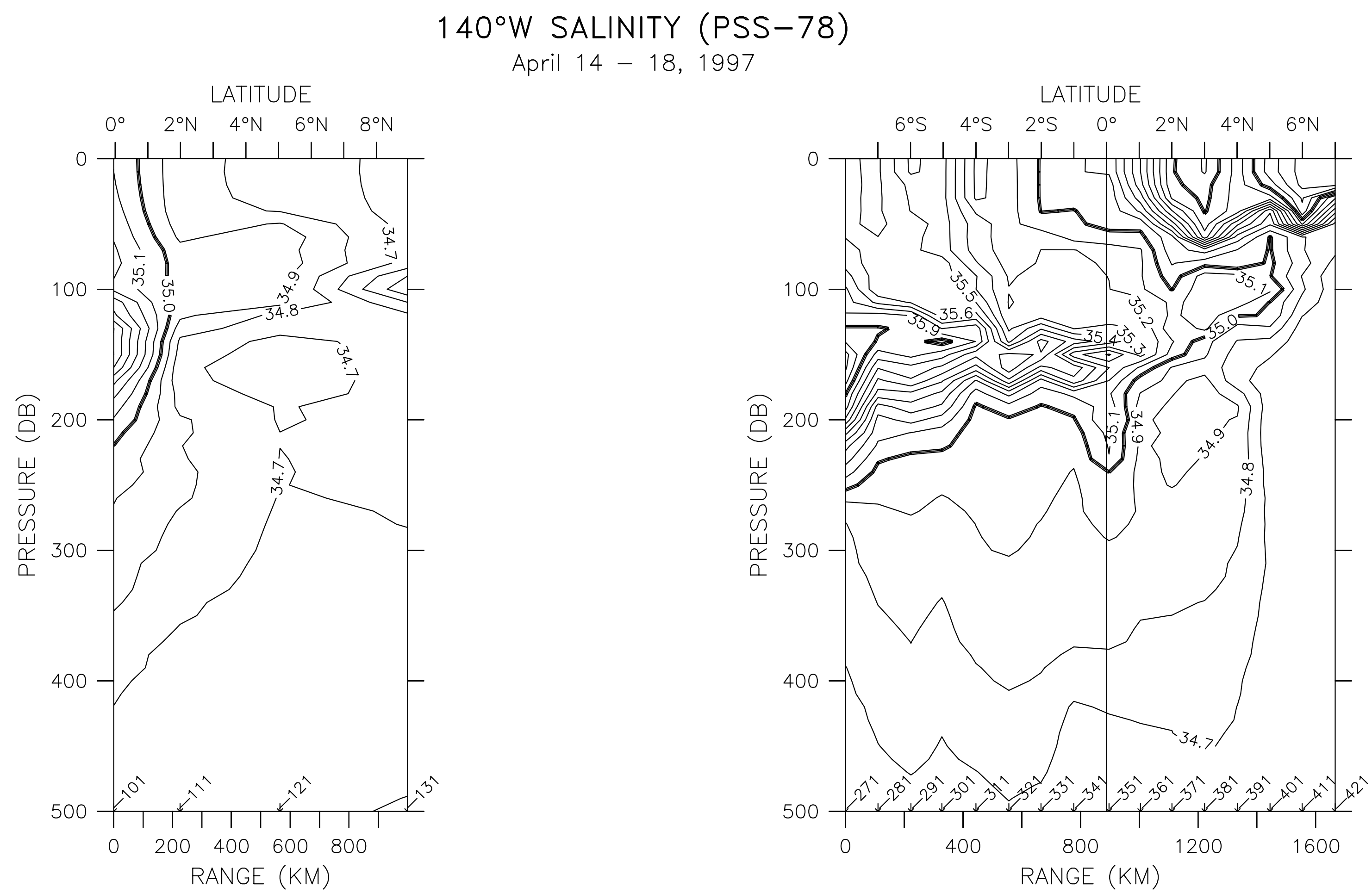


Figure 23: GP2-97-KA spring and GP6-97-KA fall salinity (PSS-78) sections along 140°W. Contour intervals are 0.1 PSS.

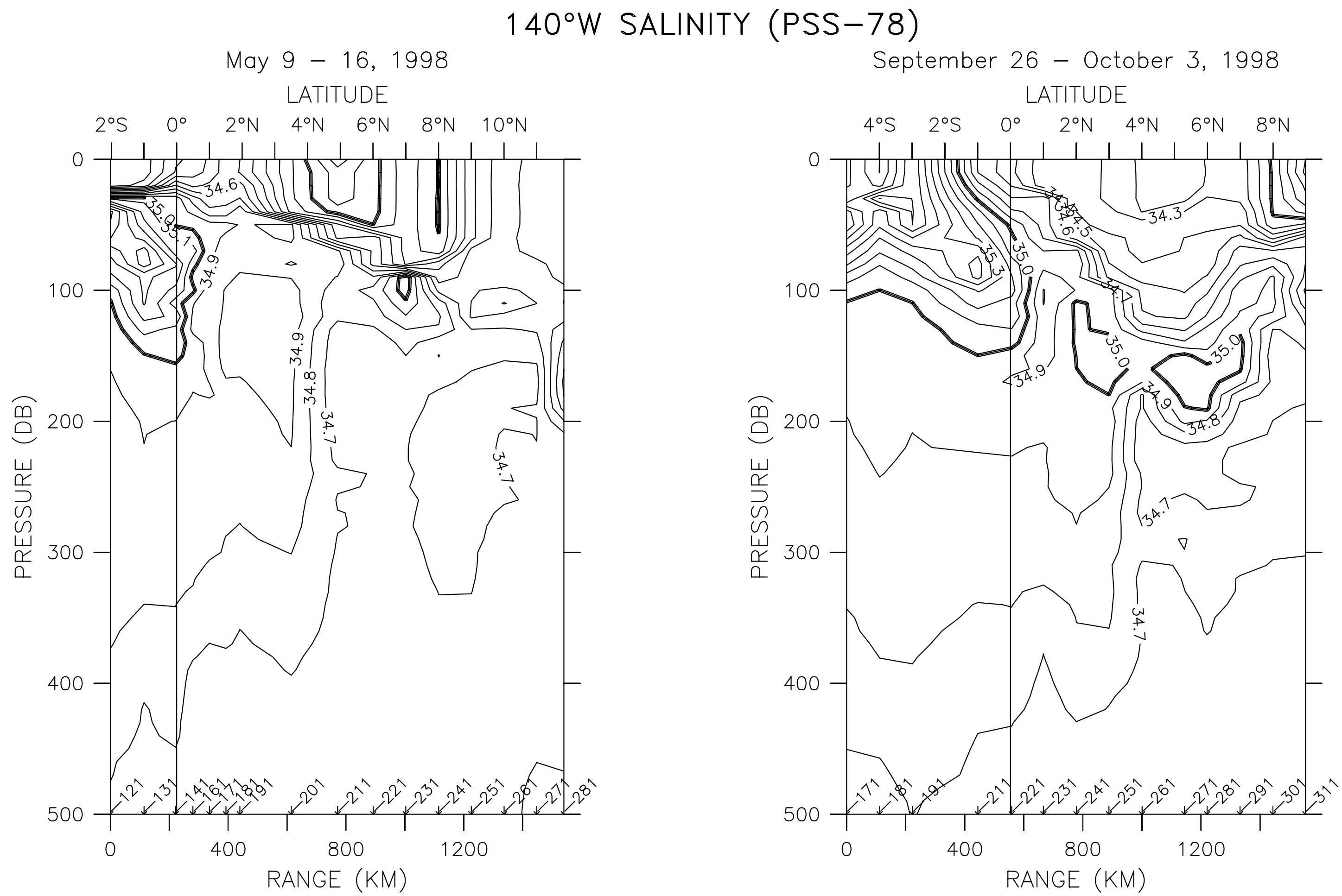


Figure 24: GP2-98-KA spring and GP5-98-KA summer salinity (PSS-78) sections along 140°W. Contour intervals are 0.1 PSS.

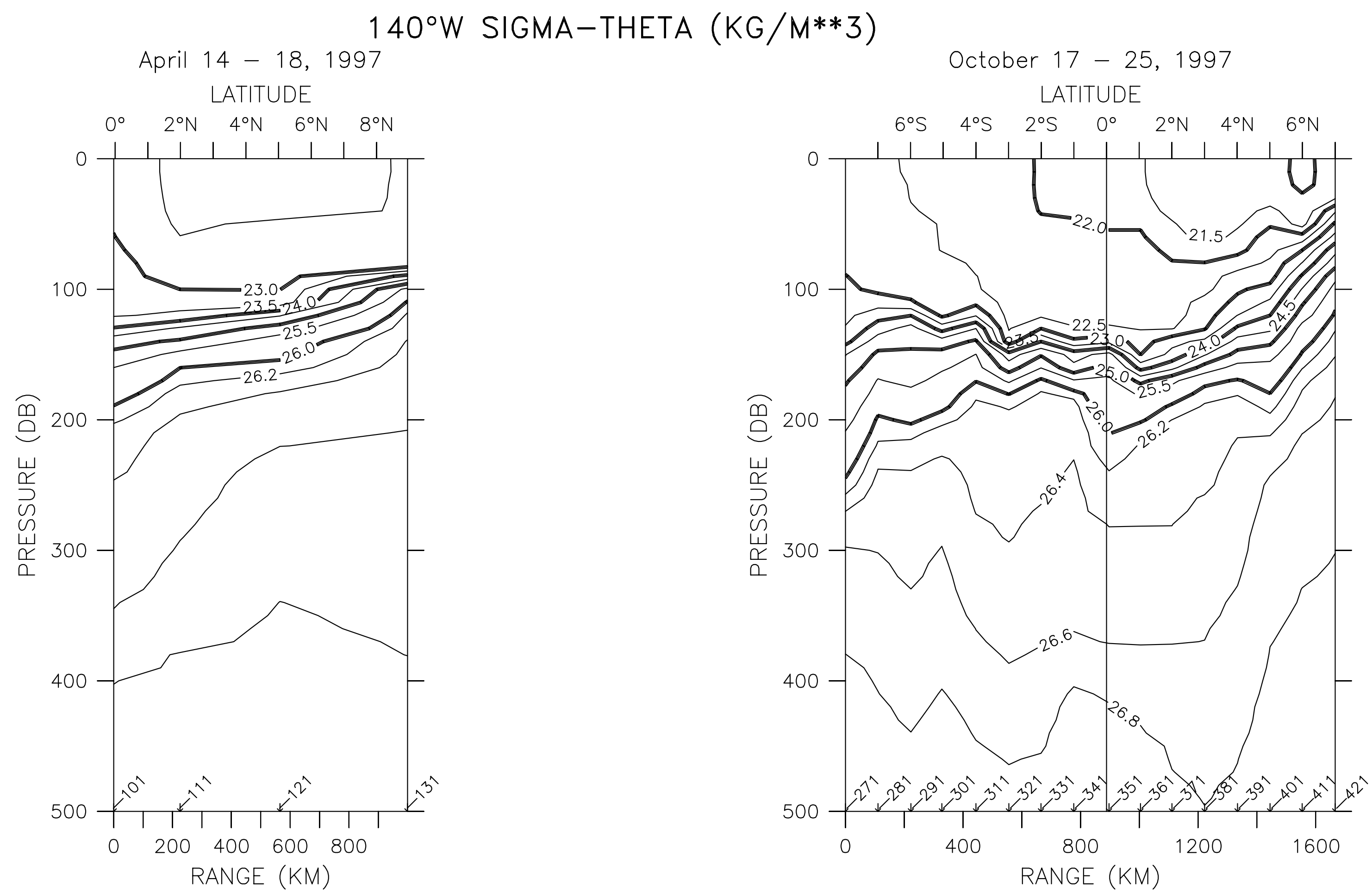


Figure 25: GP2-97-KA spring and GP6-97-KA fall potential density (kg/m^3) sections along 140°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

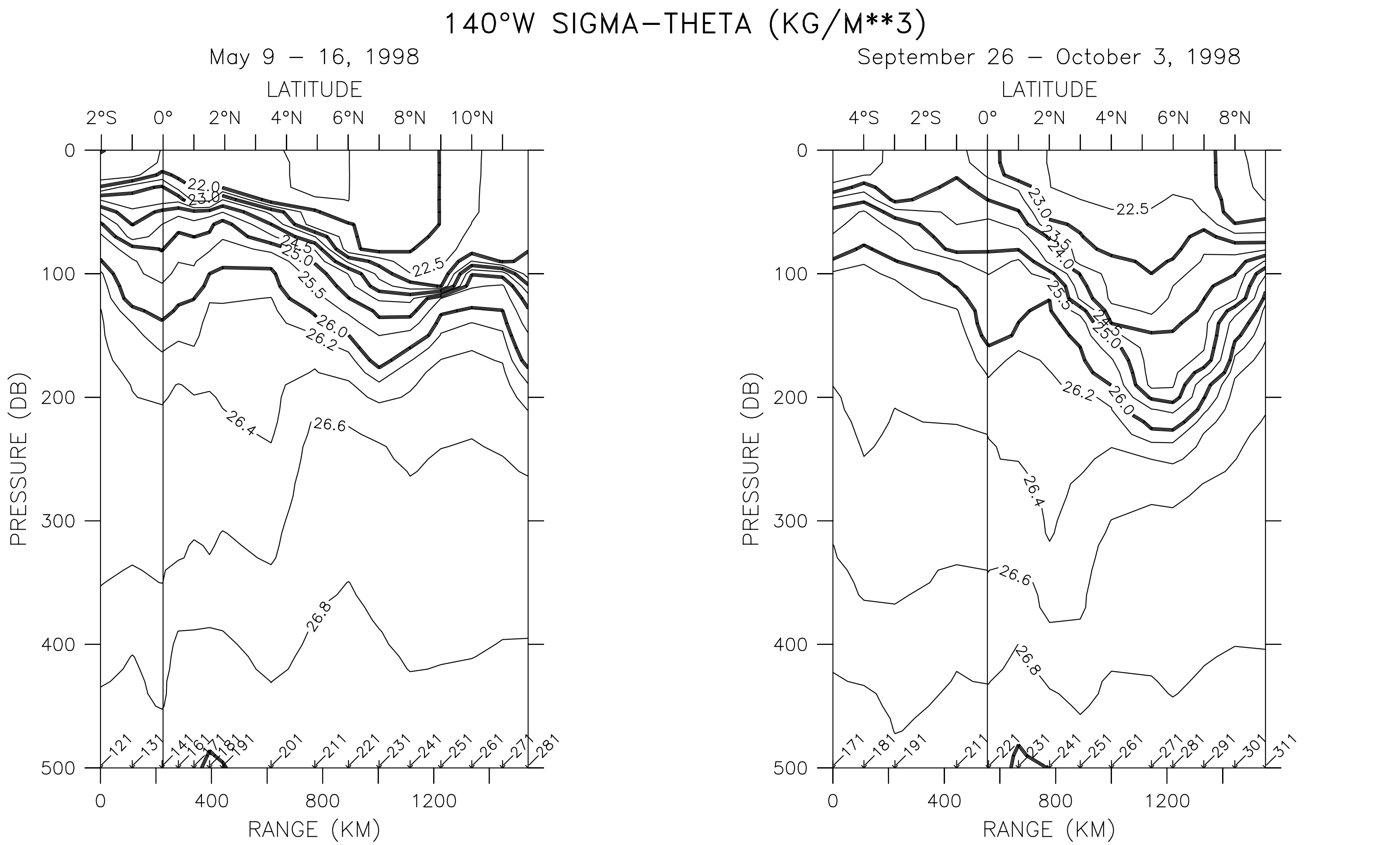


Figure 26: GP2-98-KA spring and GP5-98-KA summer potential density (kg/m^3) sections along 140°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

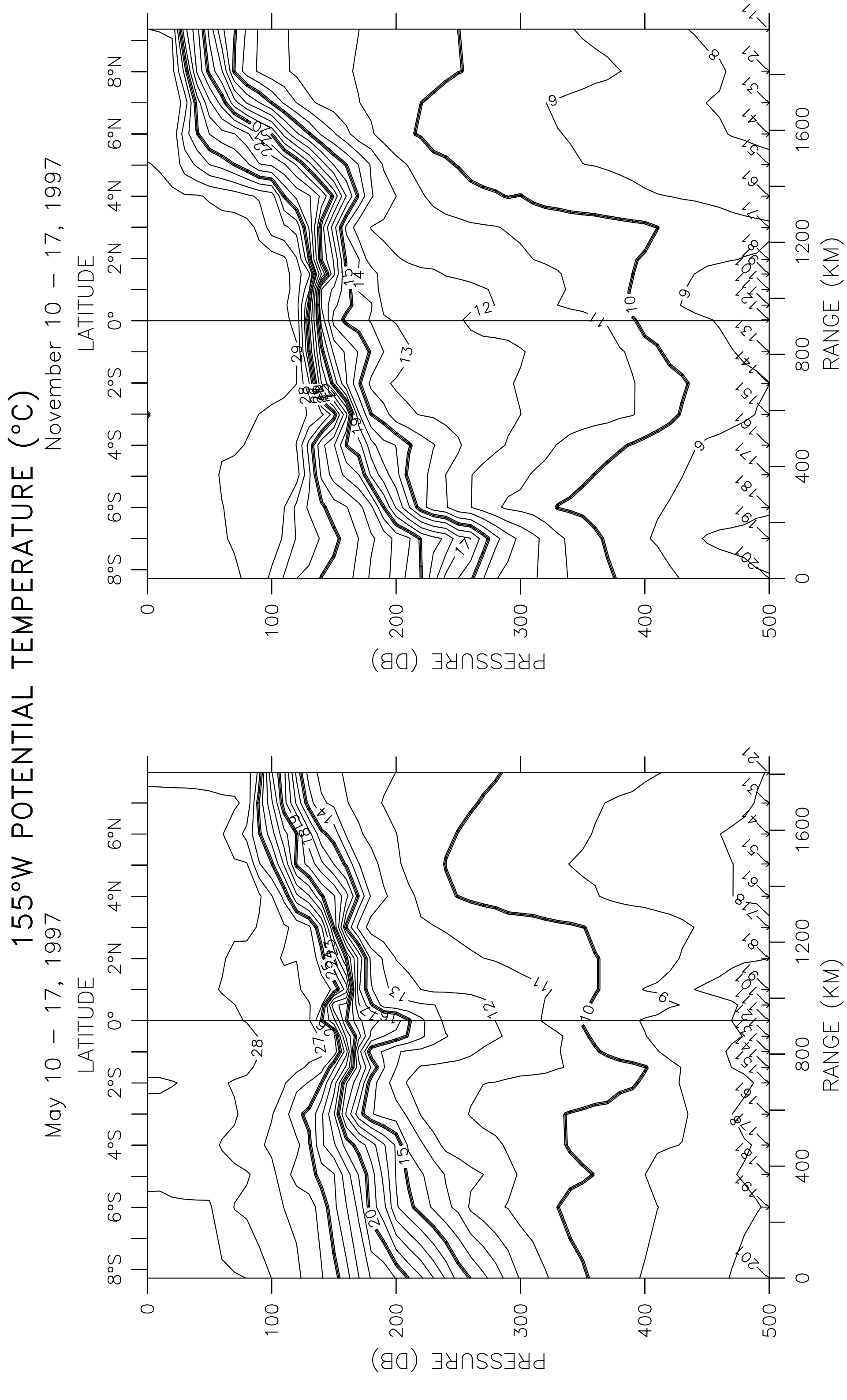


Figure 27: GP3-97-KA spring and GP7-97-KA fall potential temperature (°C) sections along 155°W. Contour intervals are 1°C.

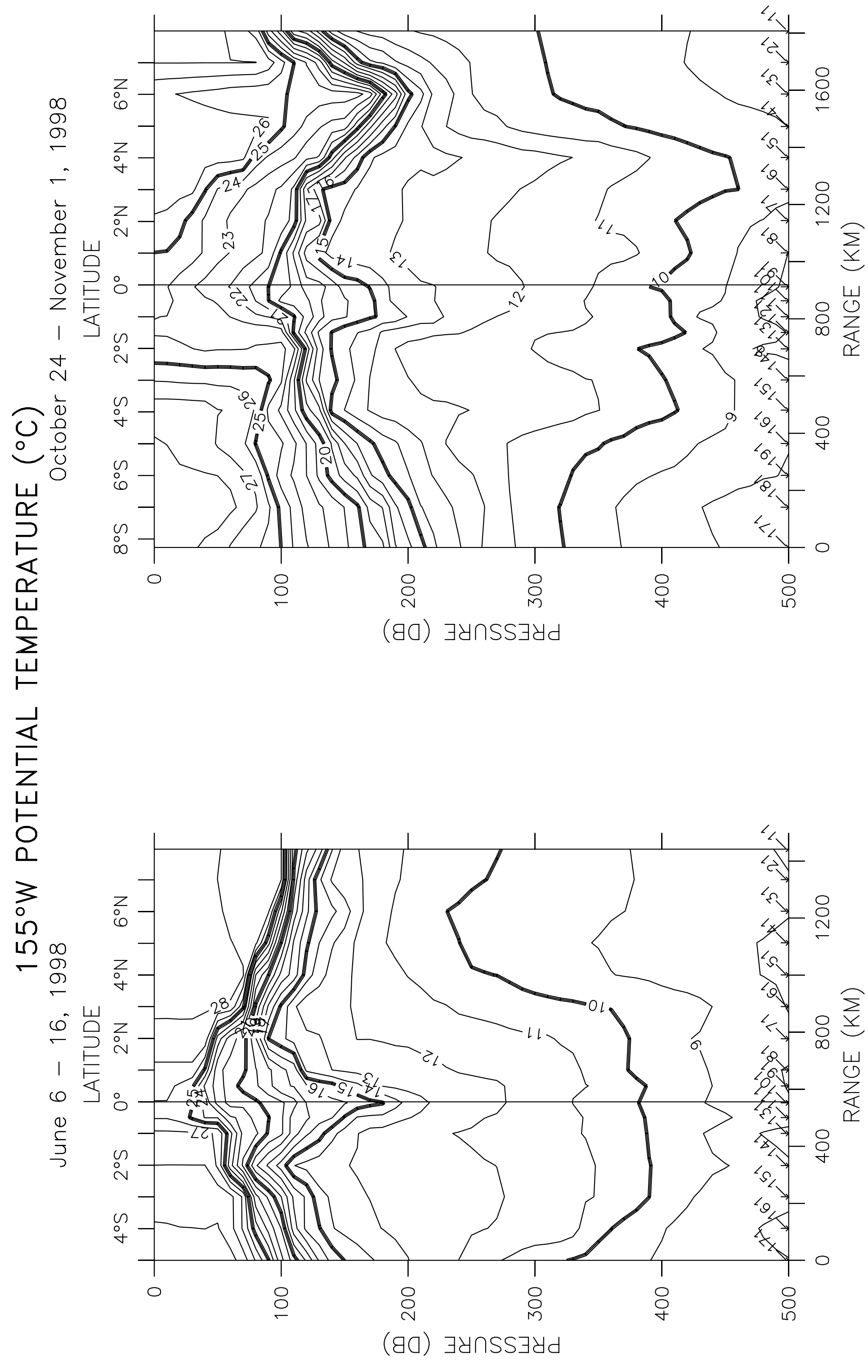


Figure 28: GP3-98-KA spring and GP7-98-KA fall potential temperature (°C) sections along 155°W. Contour intervals are 1°C.

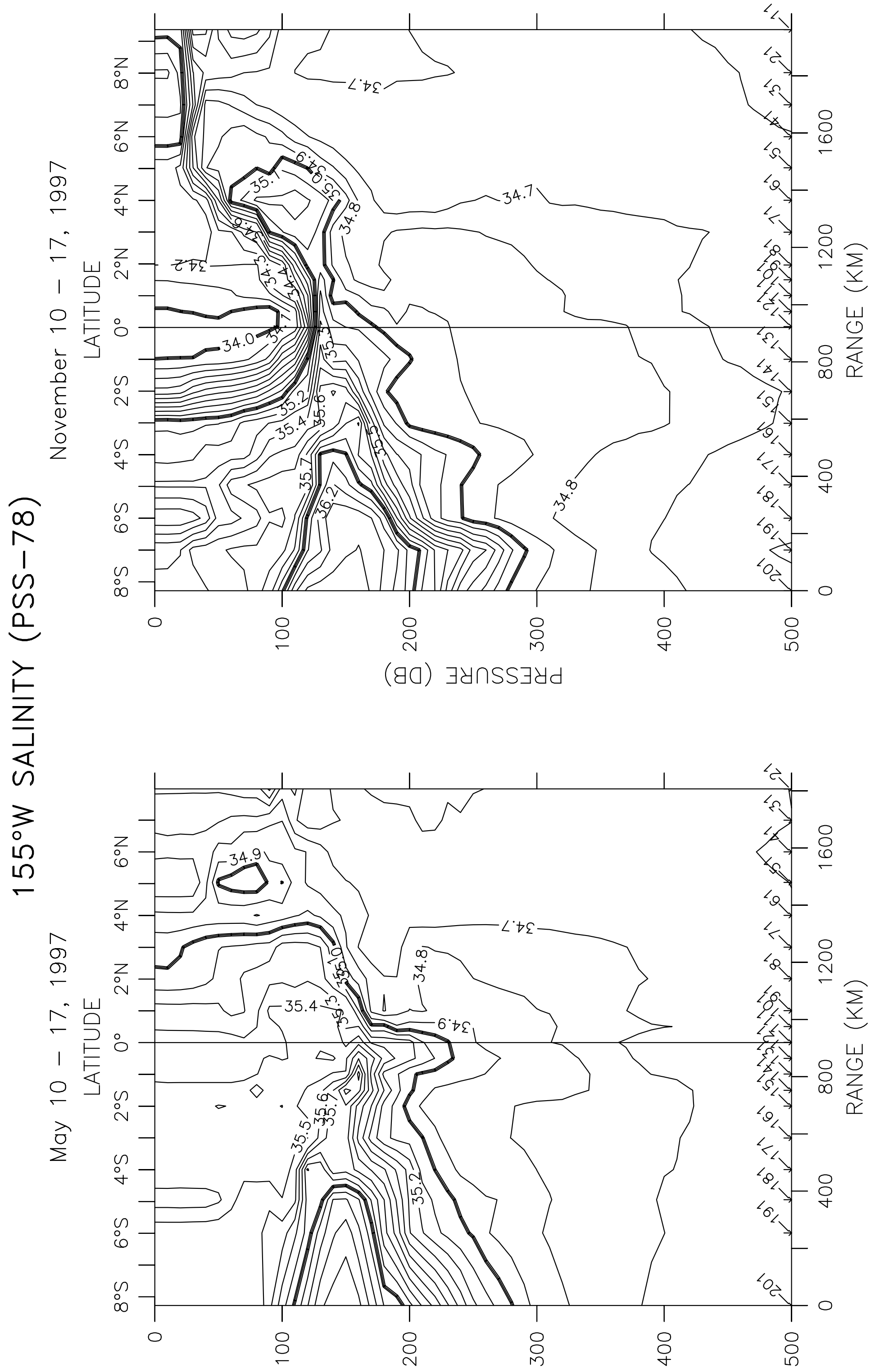


Figure 29: GP3-97-KA spring and GP7-97-KA fall salinity (PSS-78) sections along 155°W. Contour intervals are 0.1 PSS.

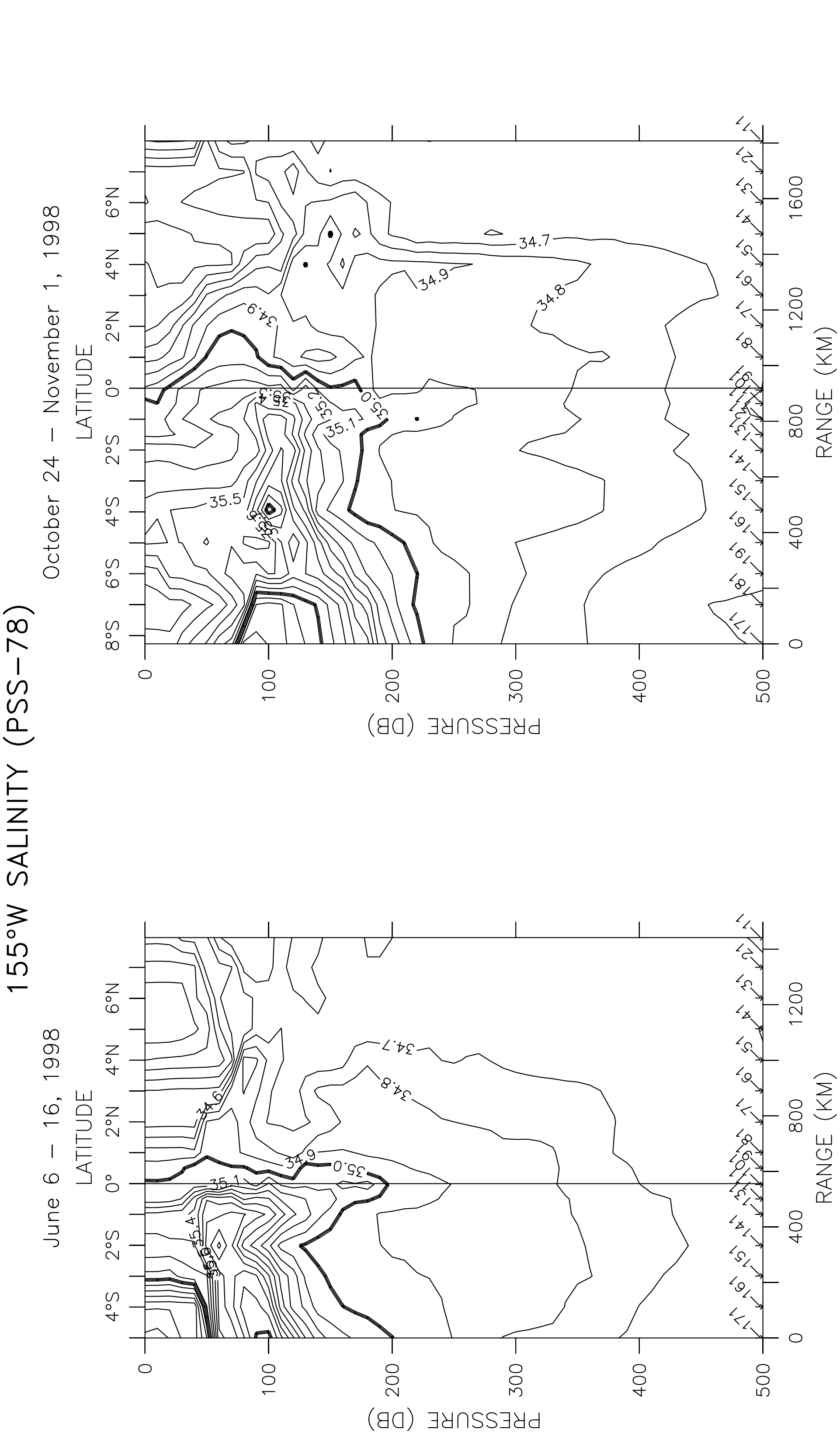


Figure 30: GP3-98-KA spring and GP7-98-KA fall salinity (PSS-78) sections along 155°W. Contour intervals are 0.1 PSS.

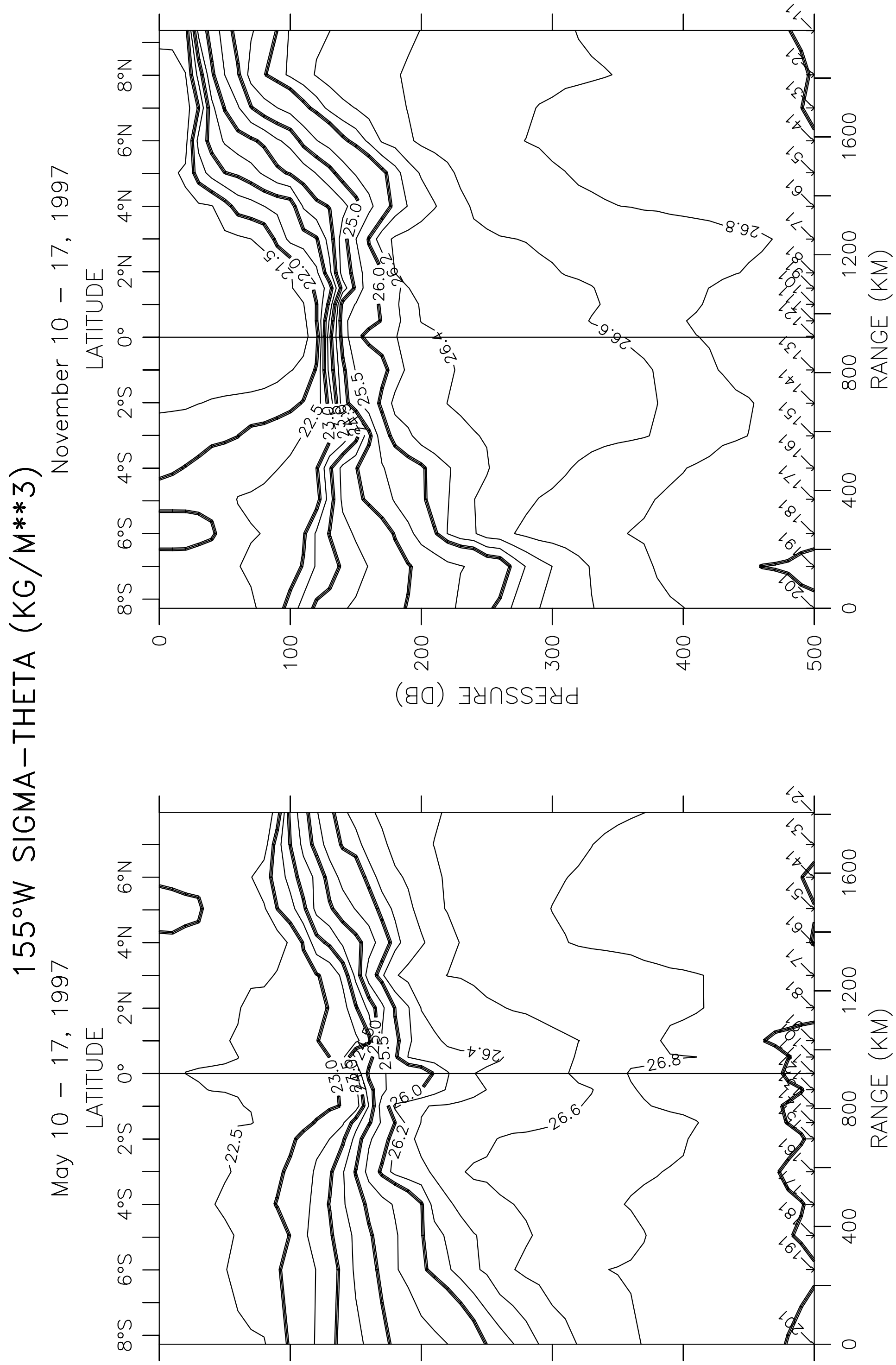


Figure 31: GP3-97-KA spring and GP7-97-KA fall potential density (kg/m^3) sections along 155°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

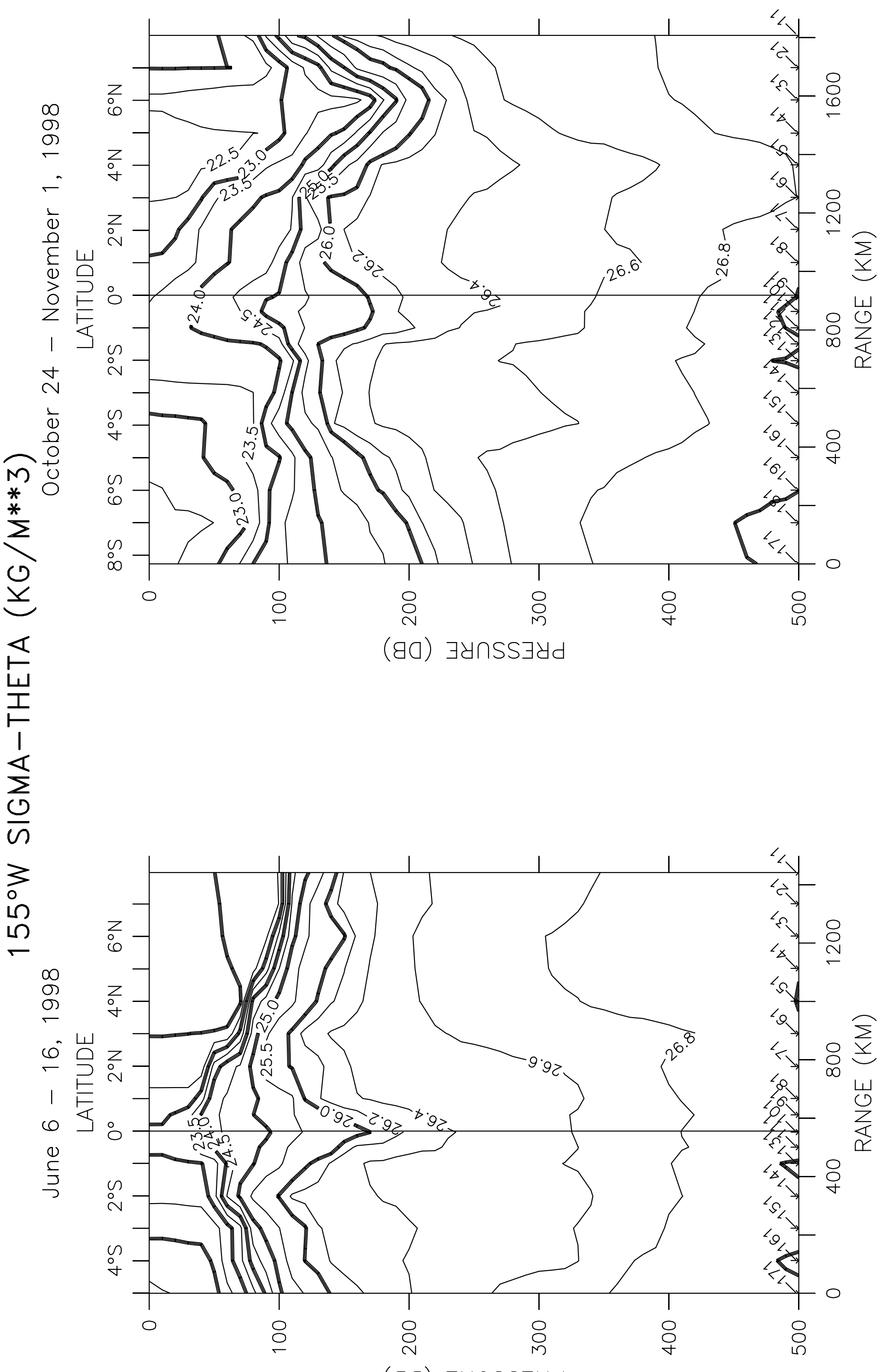


Figure 32: GP3-98-KA spring and GP7-98-KA fall potential density (kg/m^3) sections along 155°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

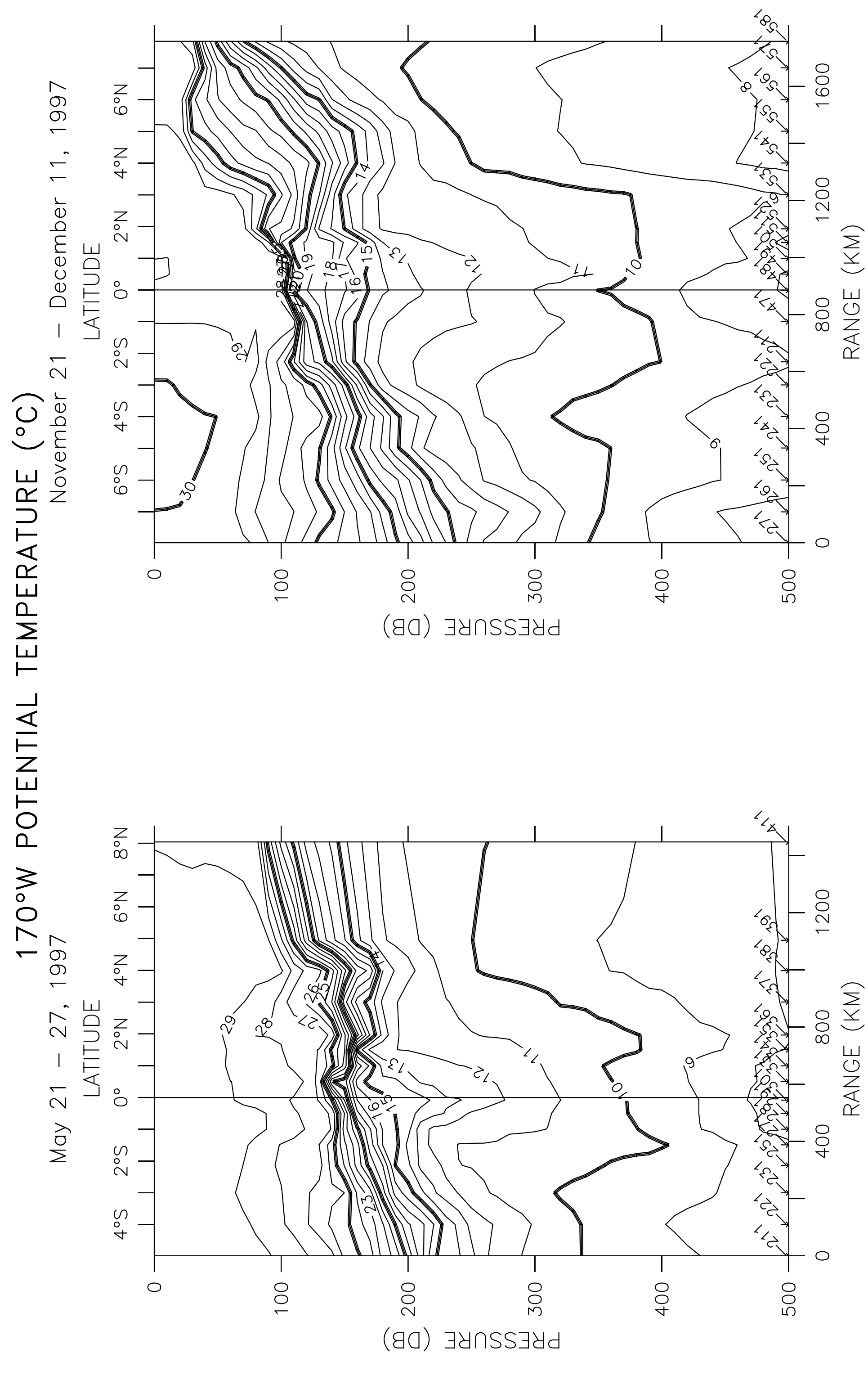


Figure 33: GP3-97-KA spring and GP7-97-KA fall potential temperature (°C) sections along 170°W. Contour intervals are 1°C.

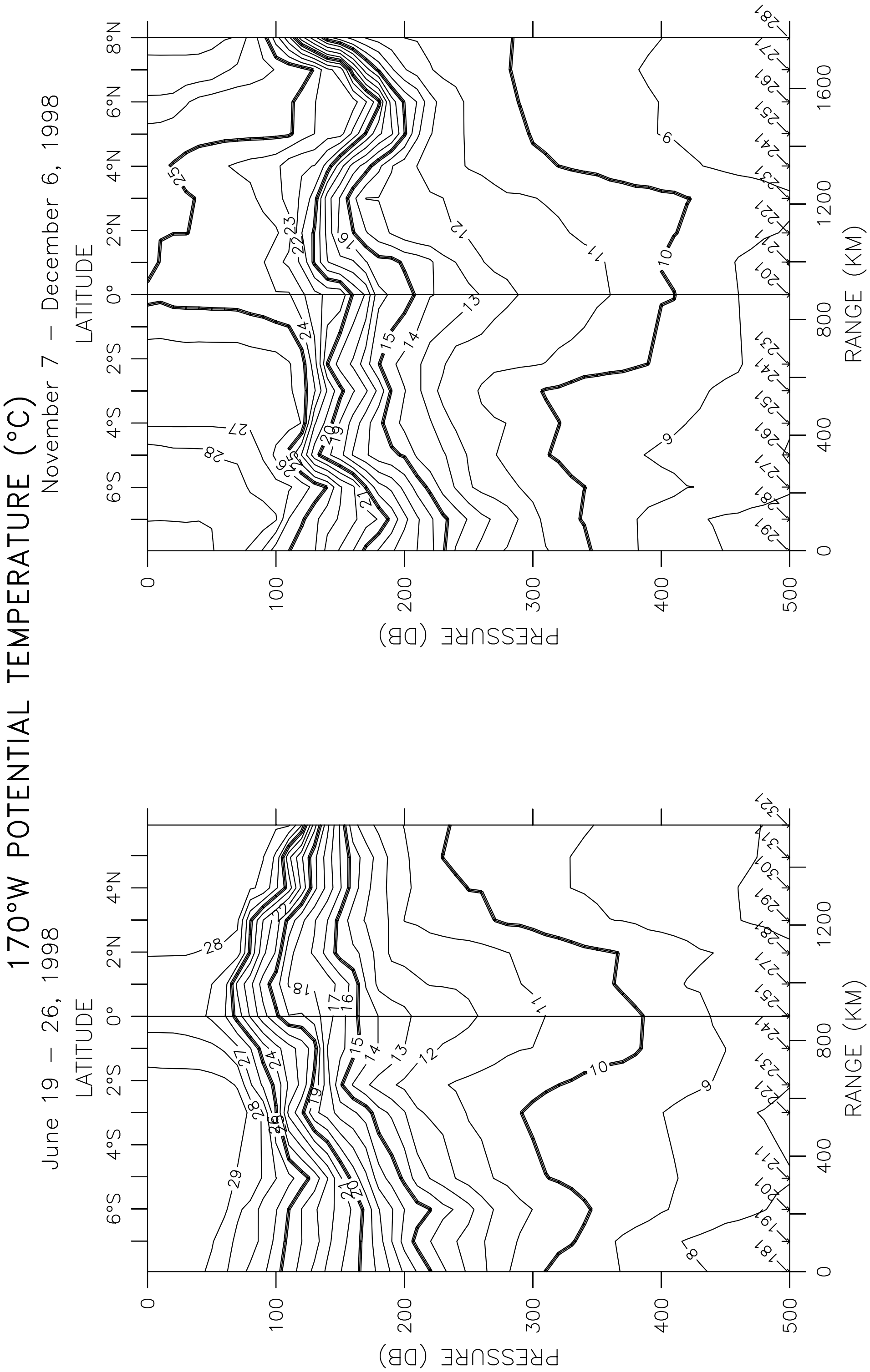


Figure 34: GP3-98-KA spring and GP7/8-98-KA fall potential temperature (°C) sections along 170°W. Contour intervals are 1°C.

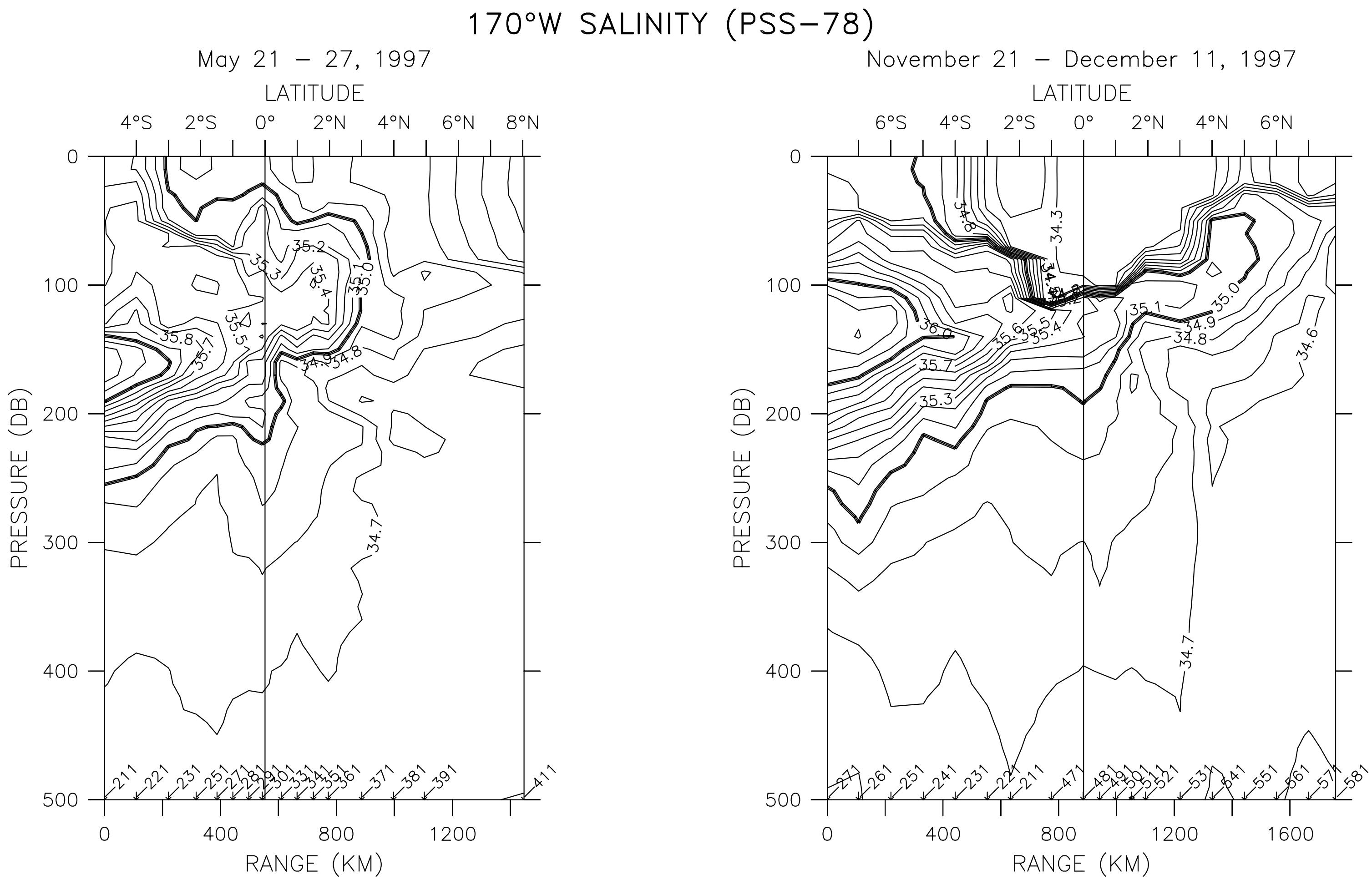


Figure 35: GP3-97-KA spring and GP7-97-KA fall salinity (PSS-78) sections along 170°W. Contour intervals are 0.1 PSS.

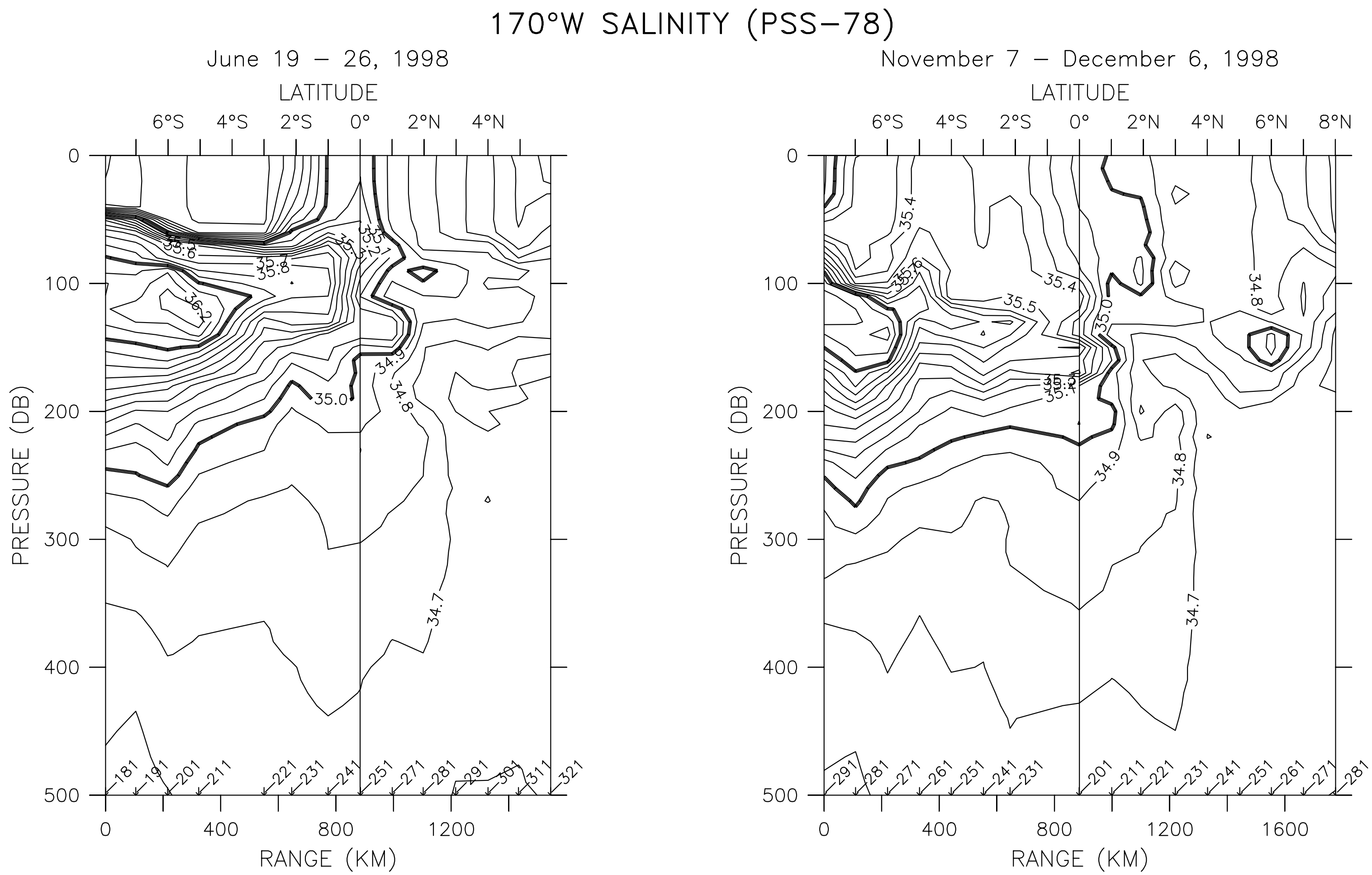


Figure 36: GP3-98-KA spring and GP7/8-98-KA fall salinity (PSS-78) sections along 170°W. Contour intervals are 0.1 PSS.

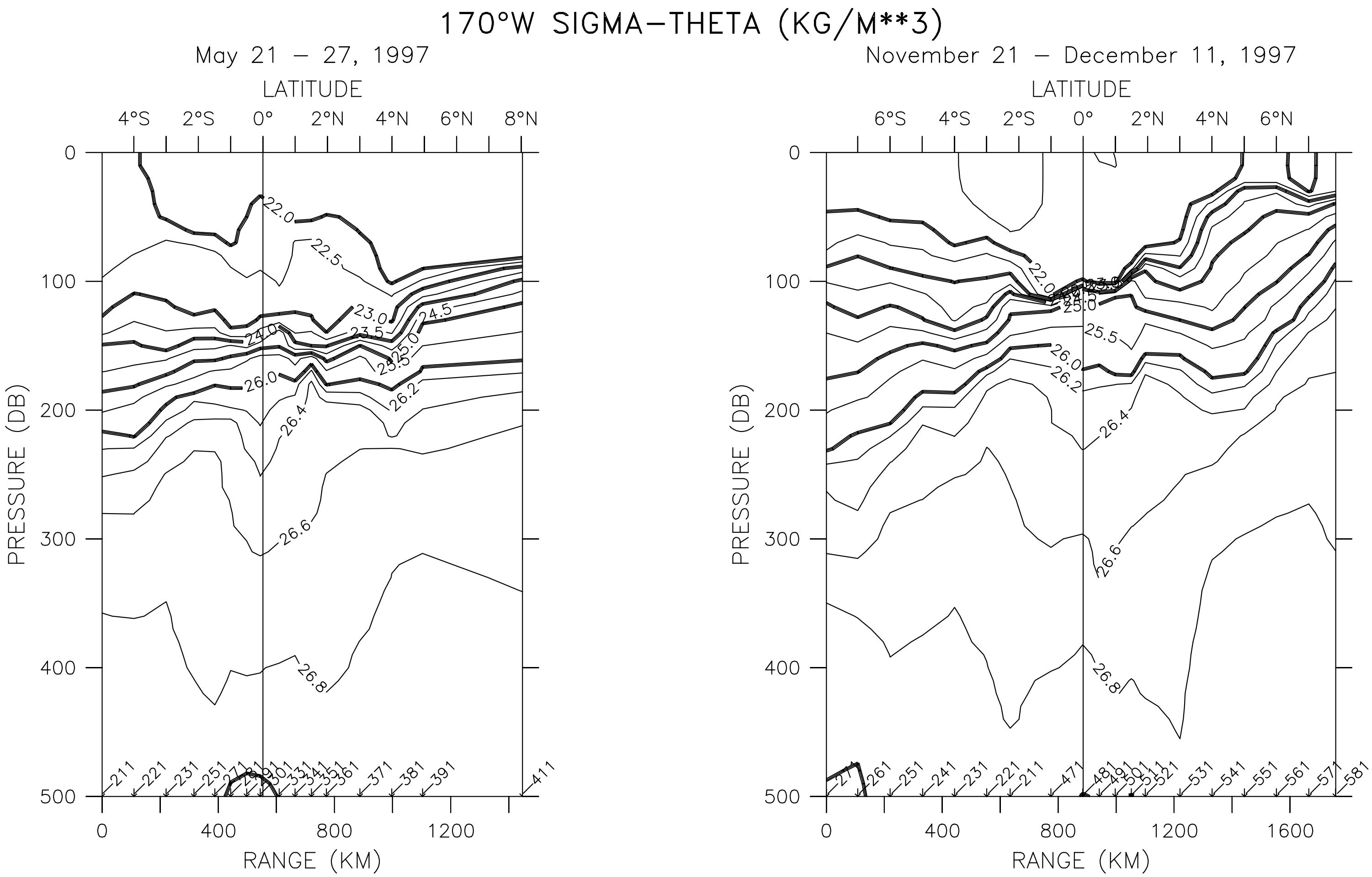


Figure 37: GP3-97-KA spring and GP7-97-KA fall potential density (kg/m^3) sections along 170°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

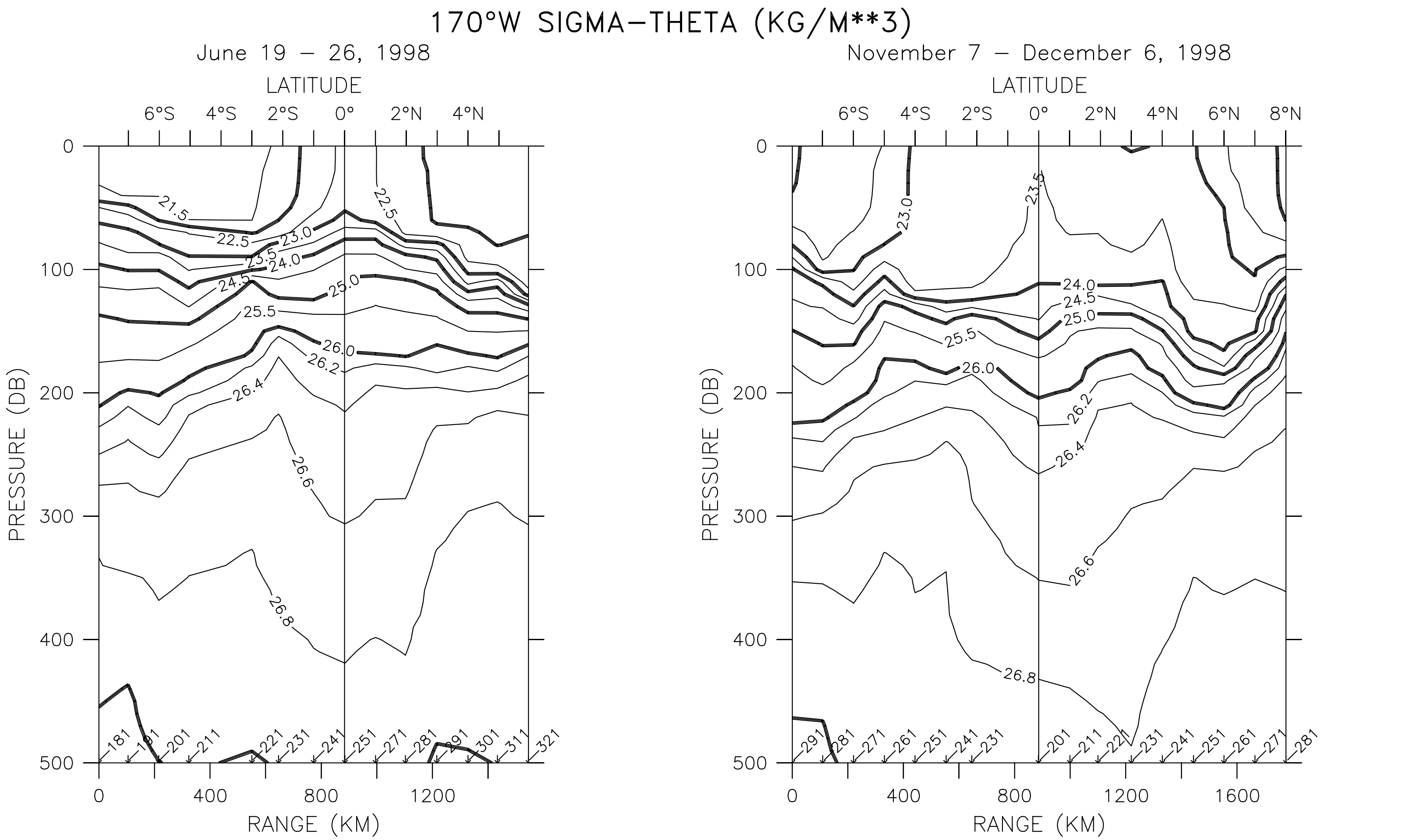


Figure 38: GP3-98-KA spring and GP7/8-98-KA fall potential density (kg/m^3) sections along 170°W. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

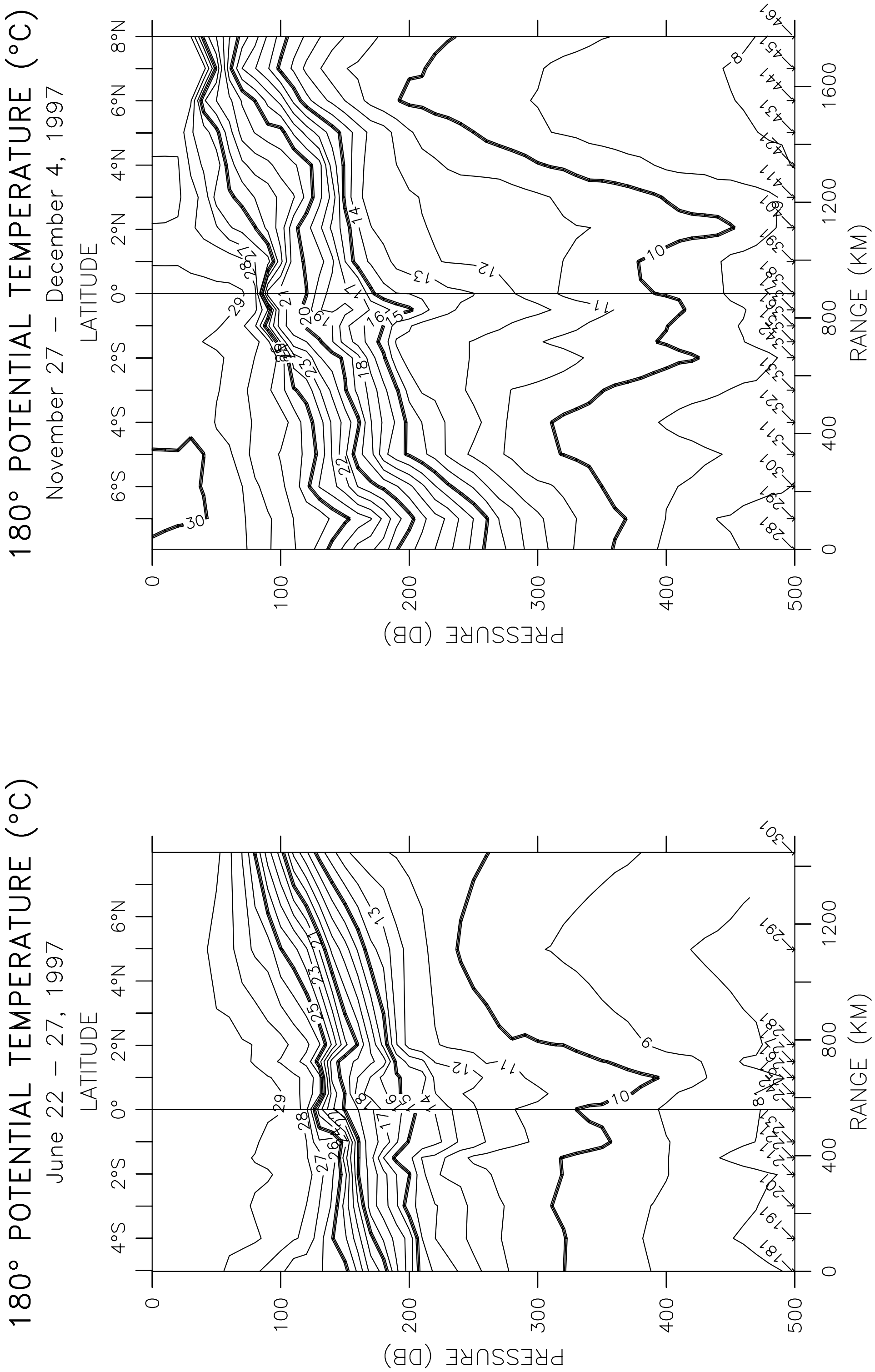


Figure 39: GP4-97-KA spring and GP7-97-KA fall potential temperature (°C) sections along 180°. Contour intervals are 1°C.

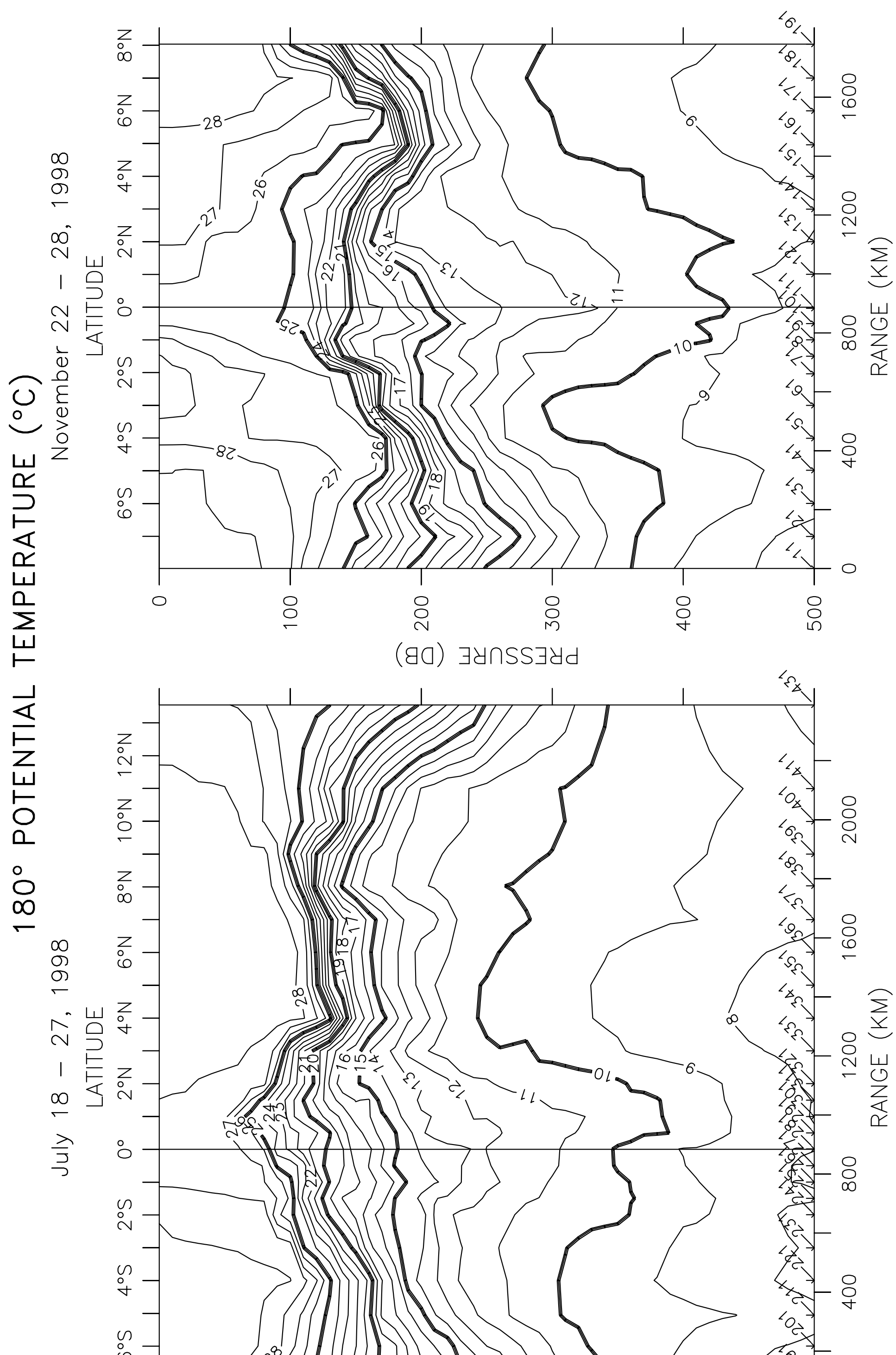


Figure 40: GP4-98-KA summer and GP8-98-KA fall potential temperature (°C) sections along 180°. Contour intervals are 1°C.

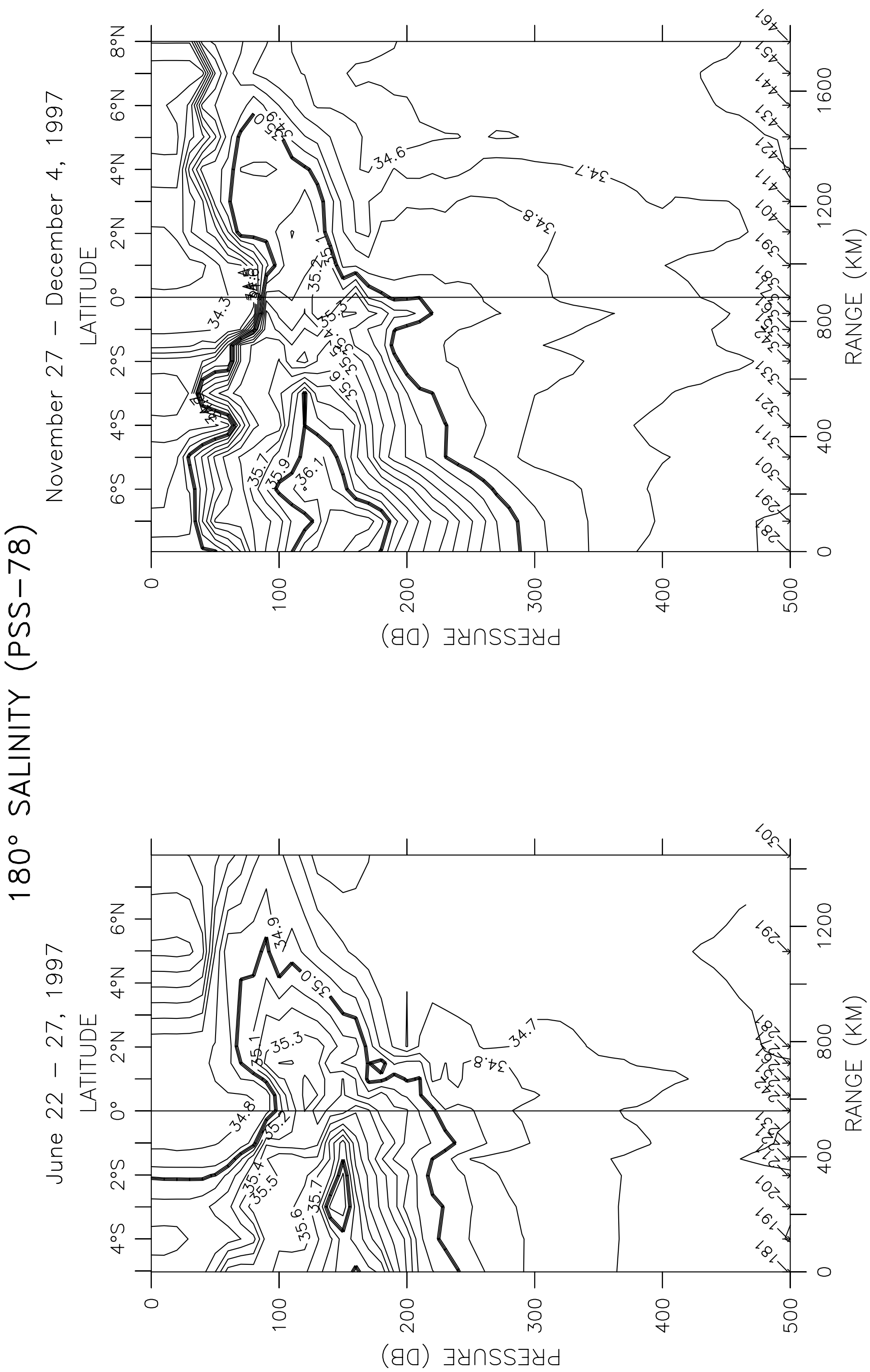


Figure 41: GP4-97-KA spring and GP7-97-KA fall salinity (PSS-78) sections along 180°. Contour intervals are 0.1 PSS.

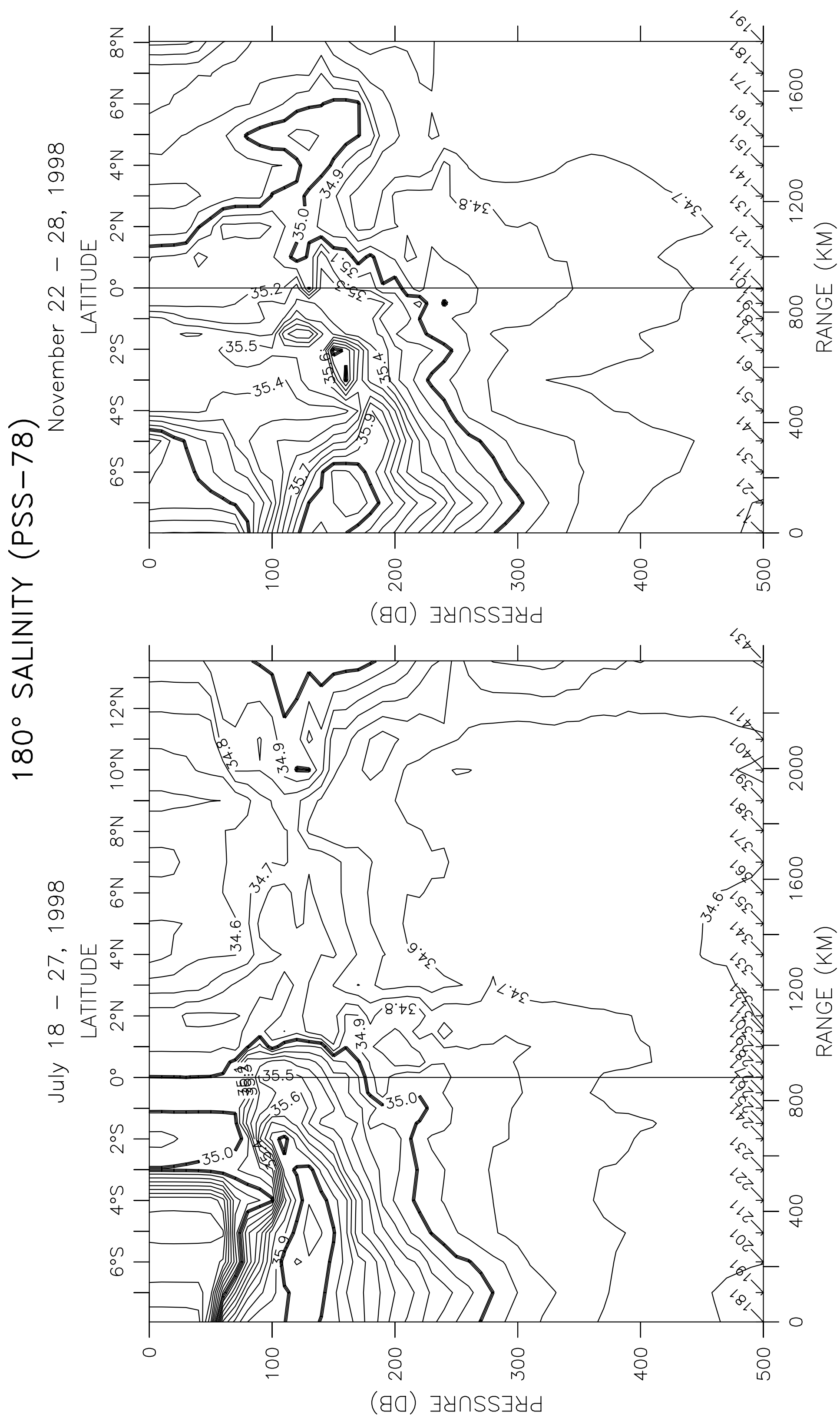


Figure 42: GP4-98-KA summer and GP8-98-KA fall salinity (PSS-78) sections along 180°. Contour intervals are 0.1 PSS.

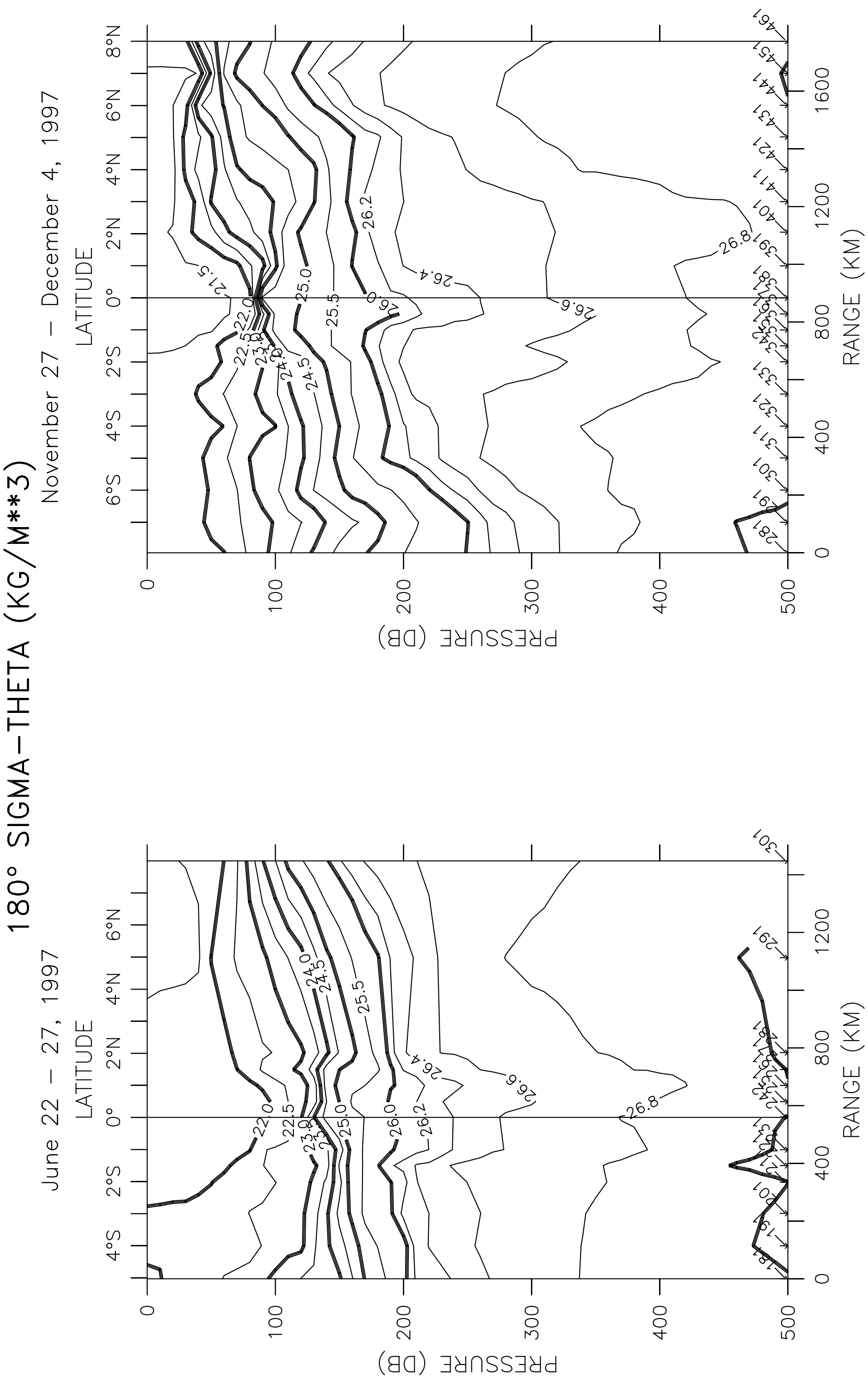


Figure 43: GP4-97-KA spring and GP7-97-KA fall potential density (kg/m^3) sections along 180°. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

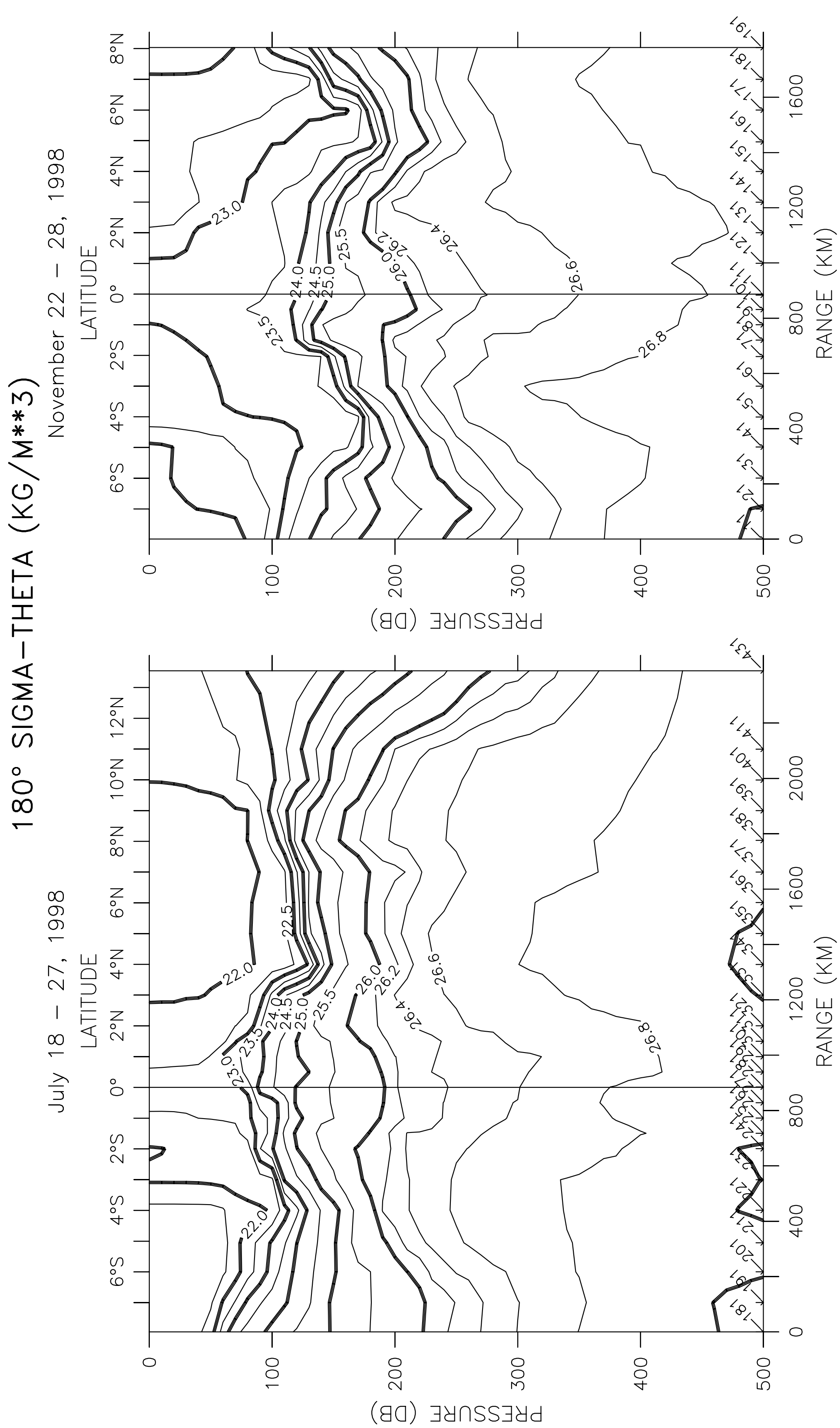


Figure 44: GP4-98-KA summer and GP8-98-KA fall potential density (kg/m^3) sections along 180°. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

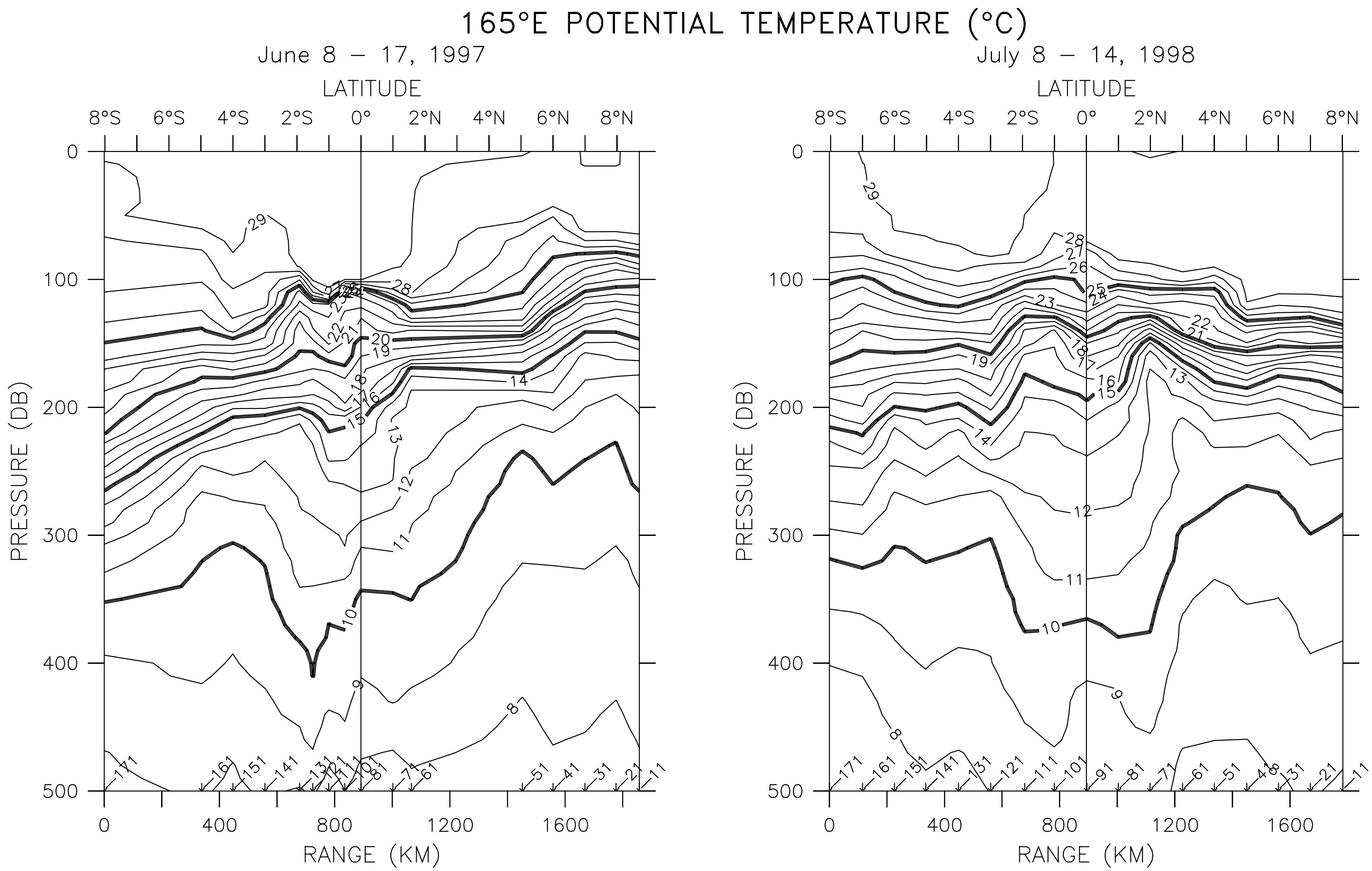


Figure 45: GP4-97-KA spring and GP4-98-KA summer potential temperature (°C) sections along 165°E. Contour intervals are 1°C.

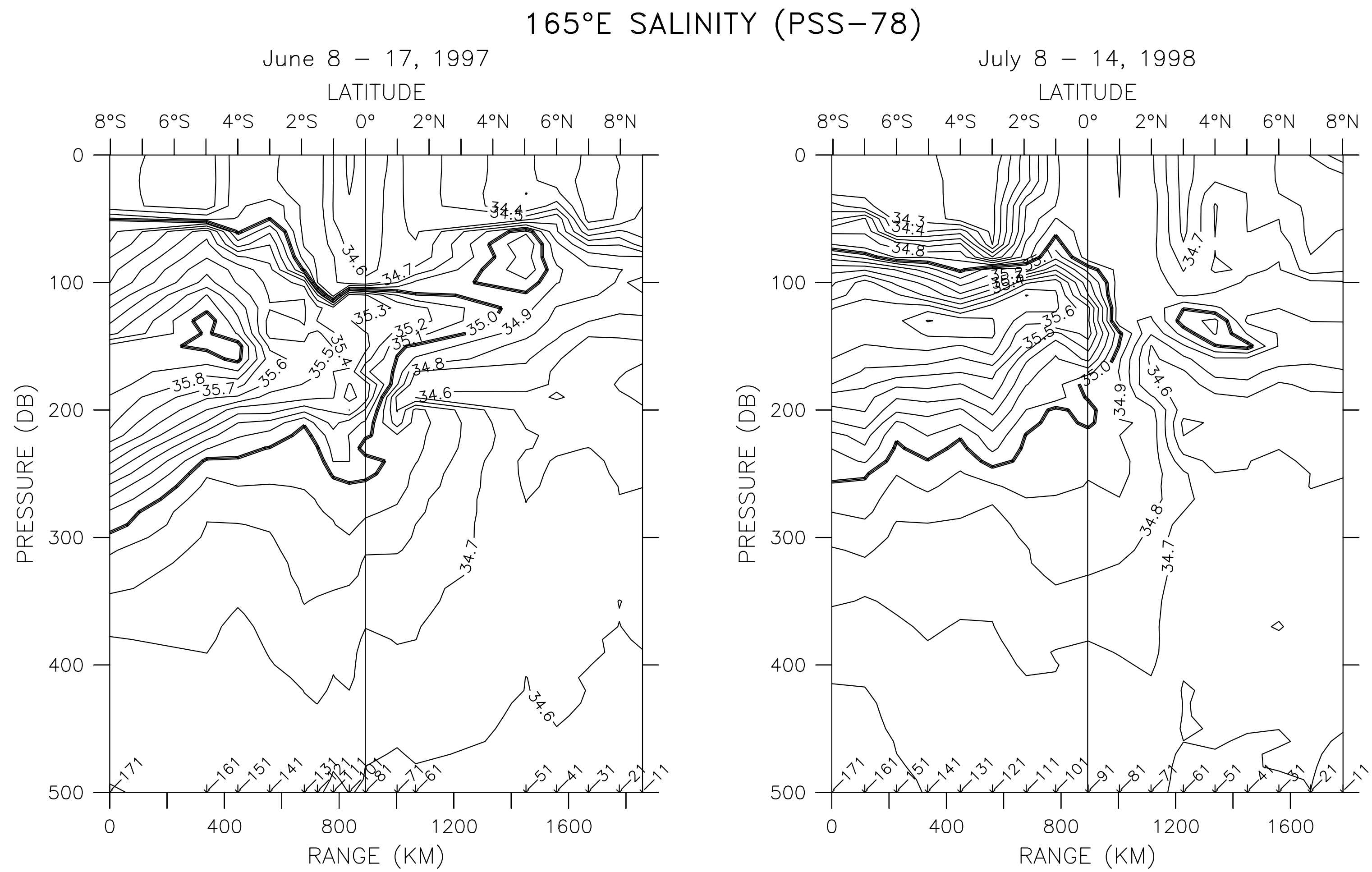


Figure 46: GP4-97-KA spring and GP4-98-KA summer salinity (PSS-78) sections along 165°E. Contour intervals are 0.1 PSS.

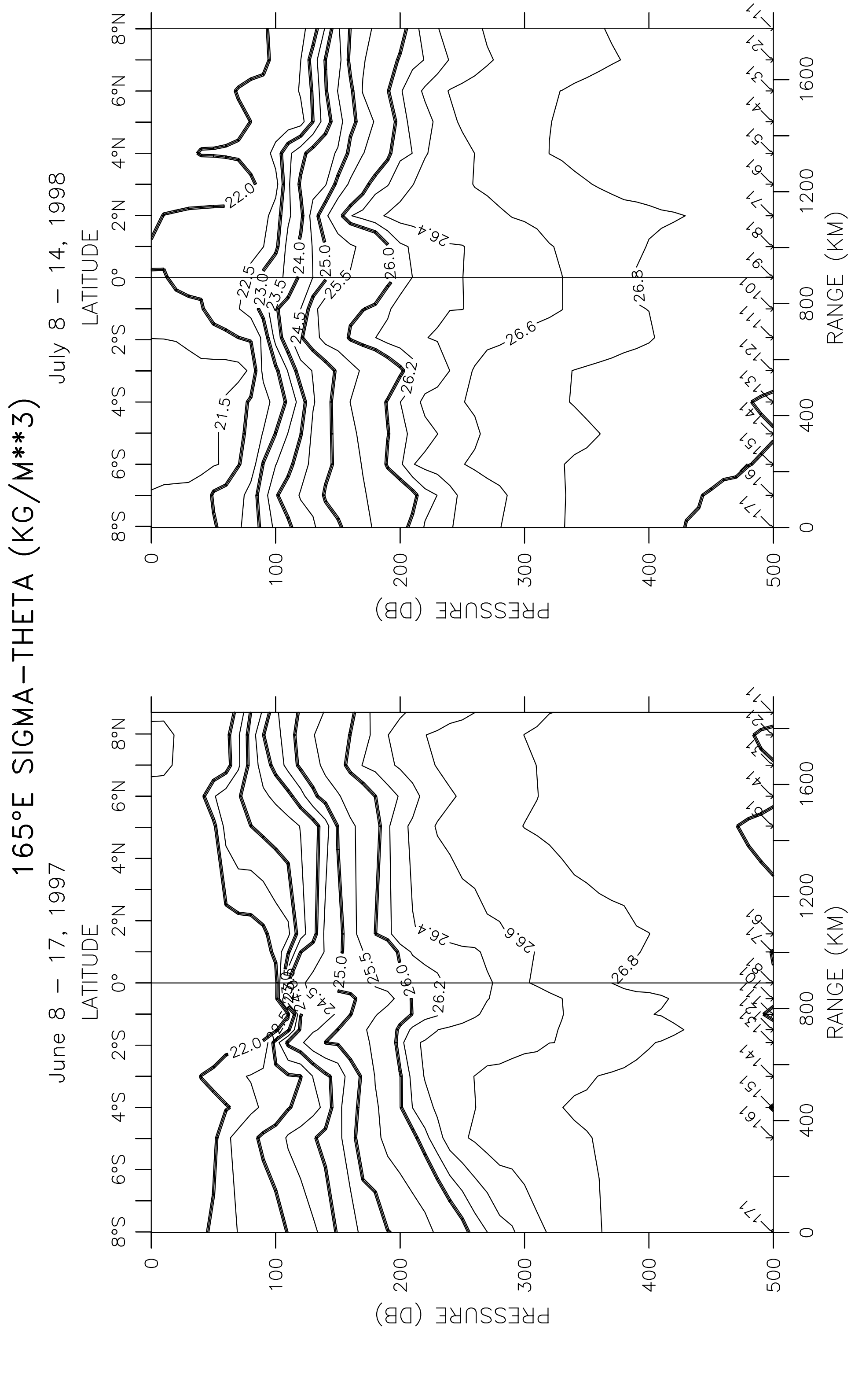


Figure 47: GP4-97-KA spring and GP4-98-KA summer potential density (kg/m^3) sections along 165°E. Contour intervals are 0.5 less than 26.0 and 0.2 greater than 26.0.

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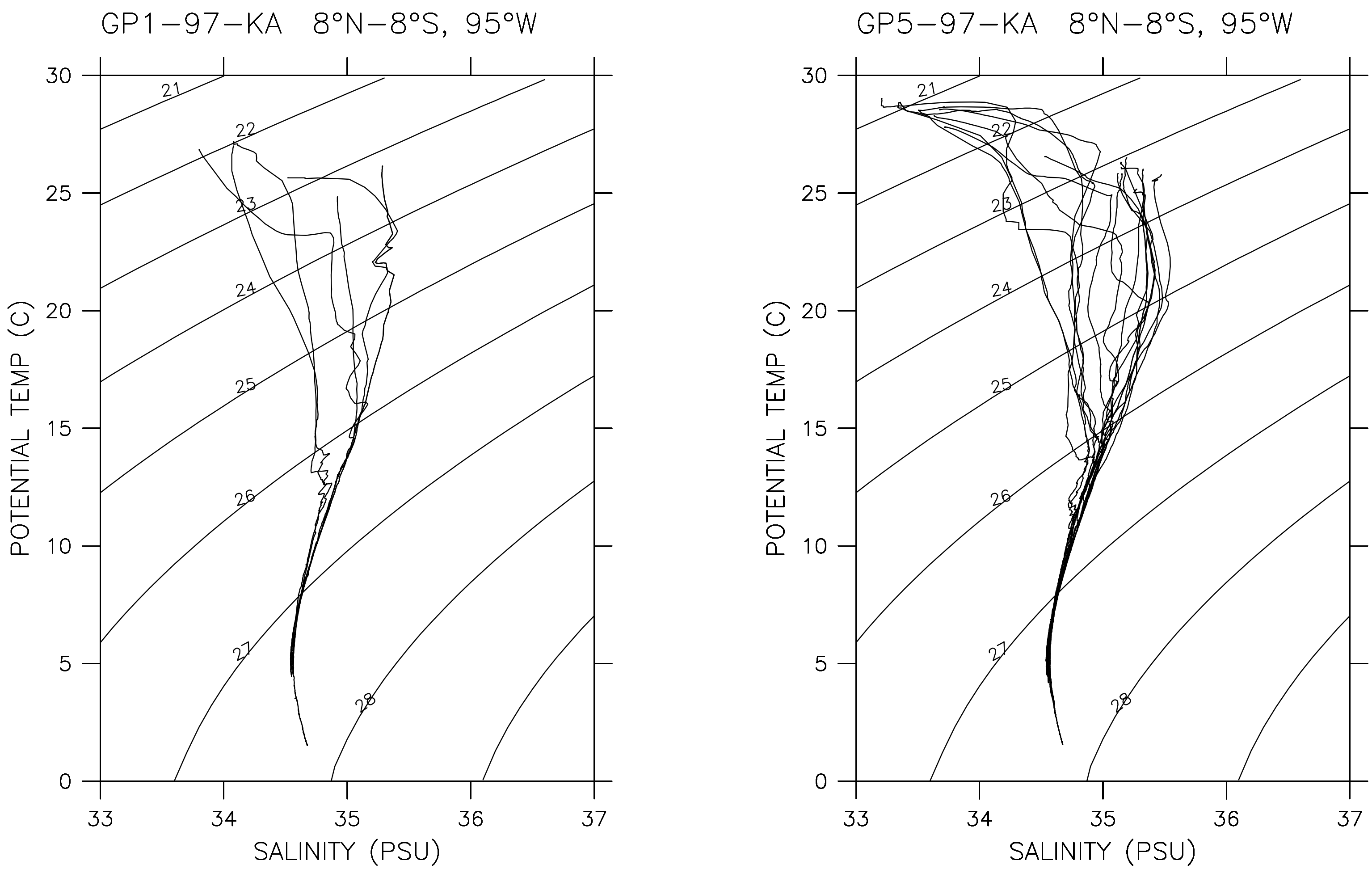

Figure 48: GP1-97-KA winter and GP5-97-KA summer composite TS diagrams along 95°W.

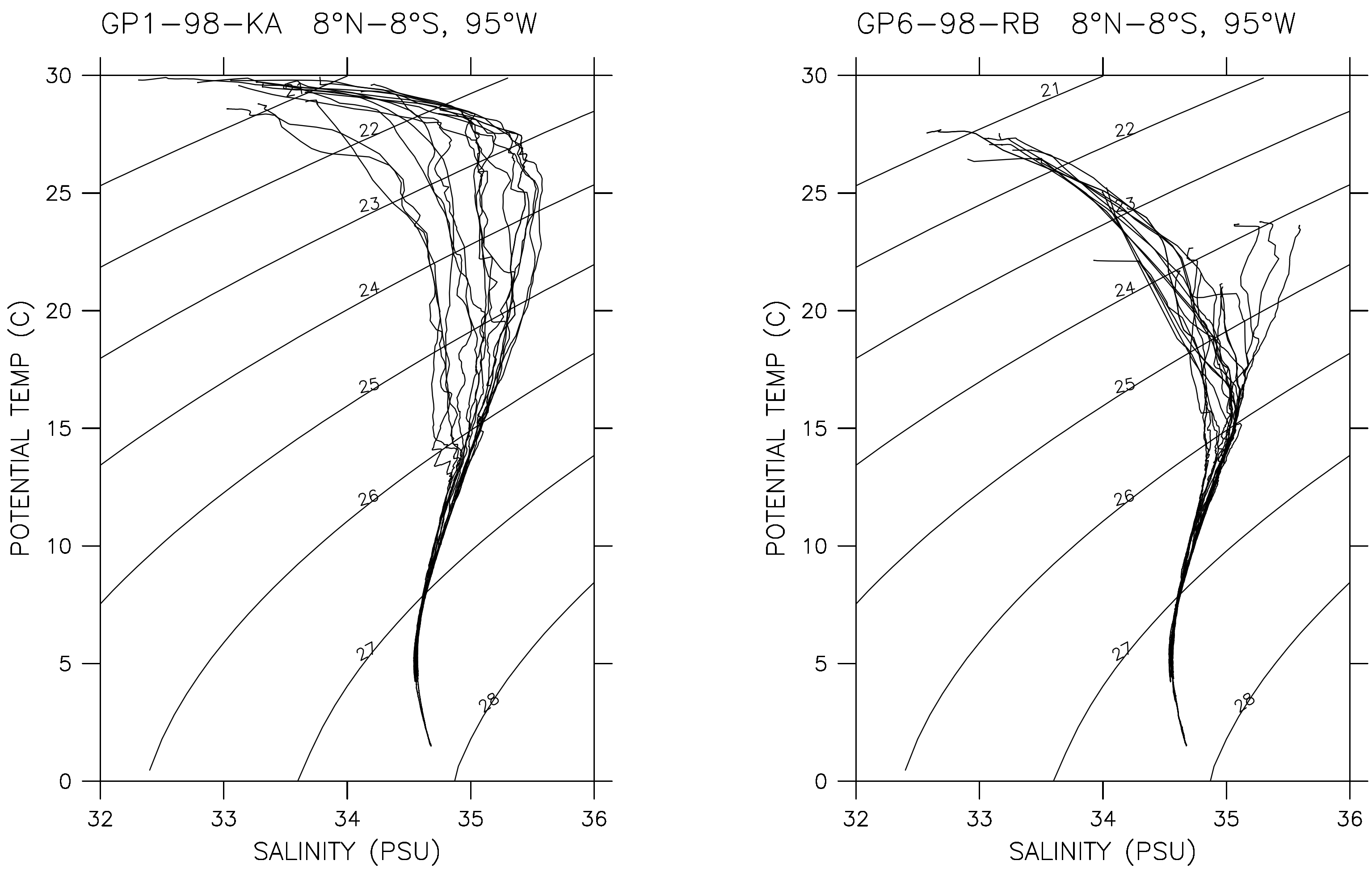

Figure 49: GP1-98-KA winter and GP6-98-RB fall composite TS diagrams along 95°W.

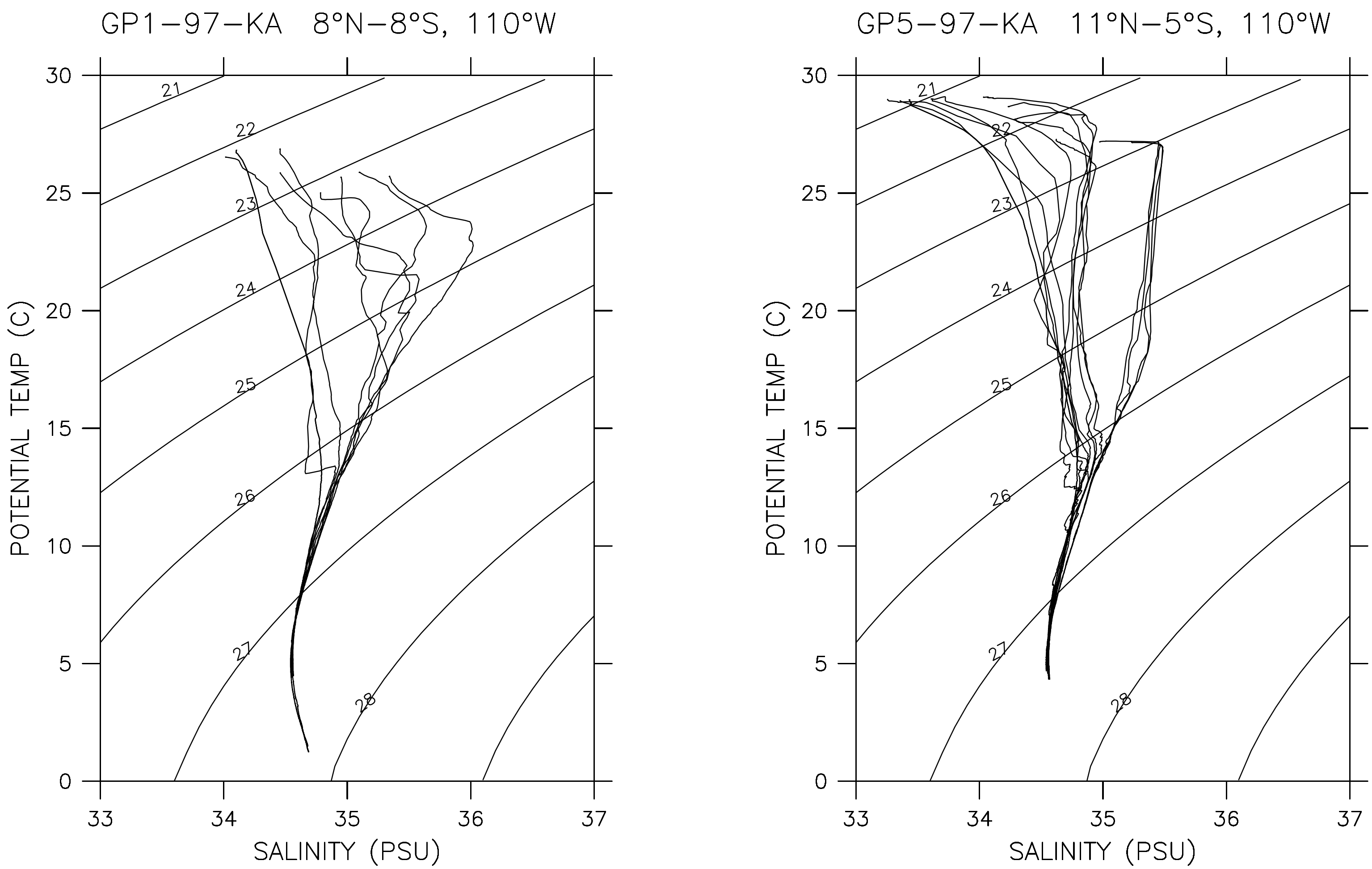

Figure 50: GP1-97-KA winter and GP5-97-KA summer composite TS diagrams along 110°W.

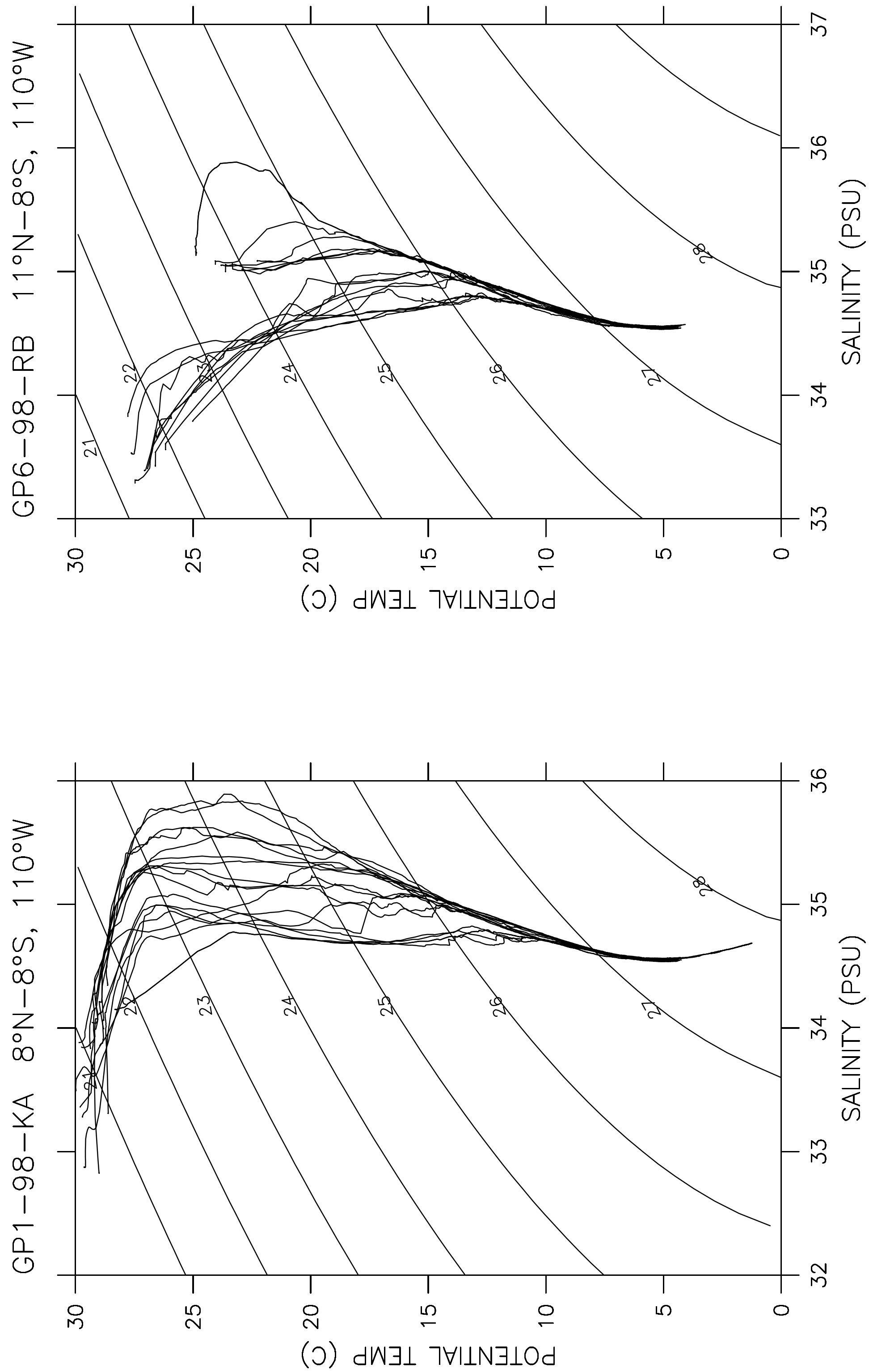

Figure 51: GP1-98-KA winter and GP6-98-RB fall composite TS diagrams along 110°W.

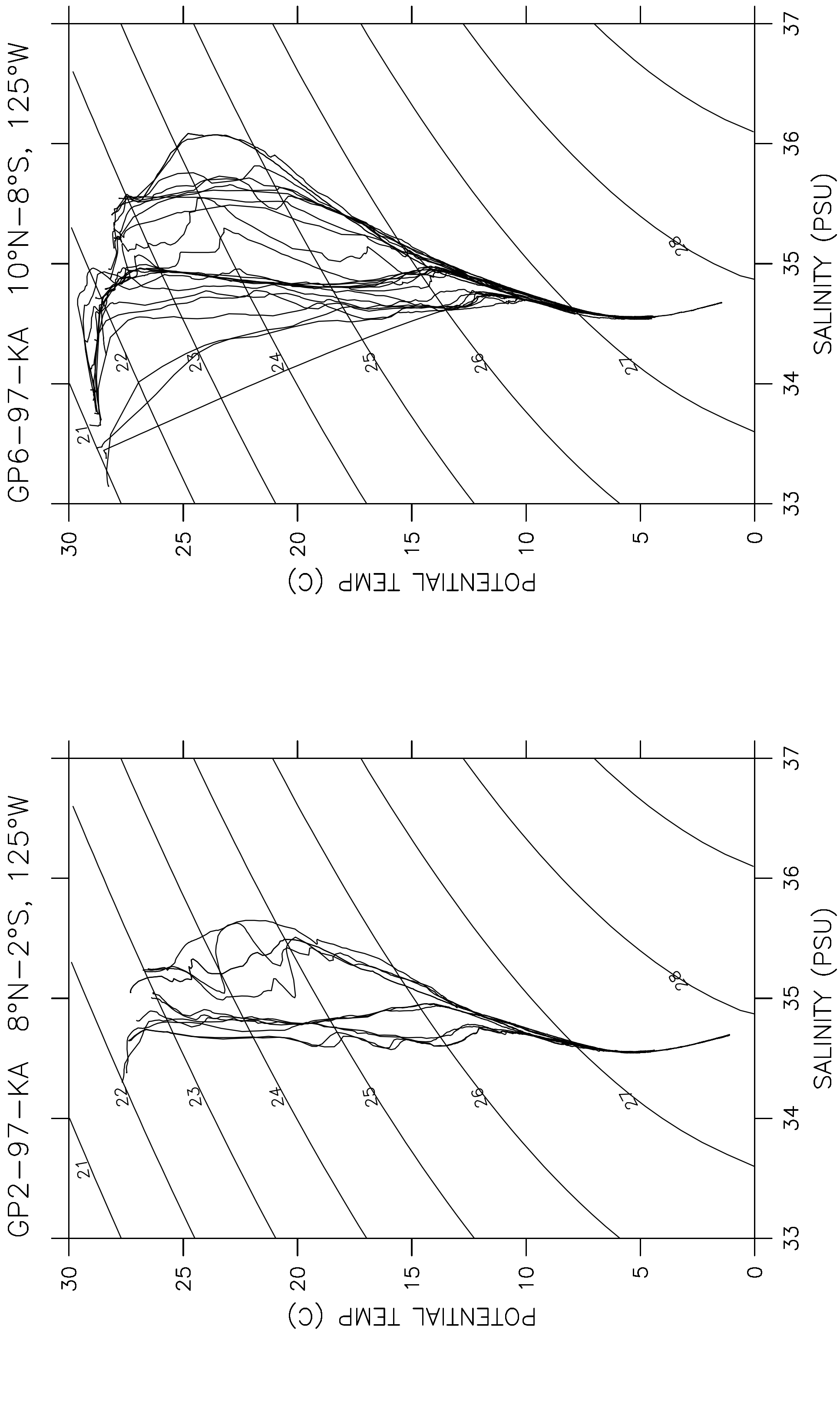

Figure 52: GP2-97-KA spring and GP6-97-KA fall composite TS diagrams along 125°W.

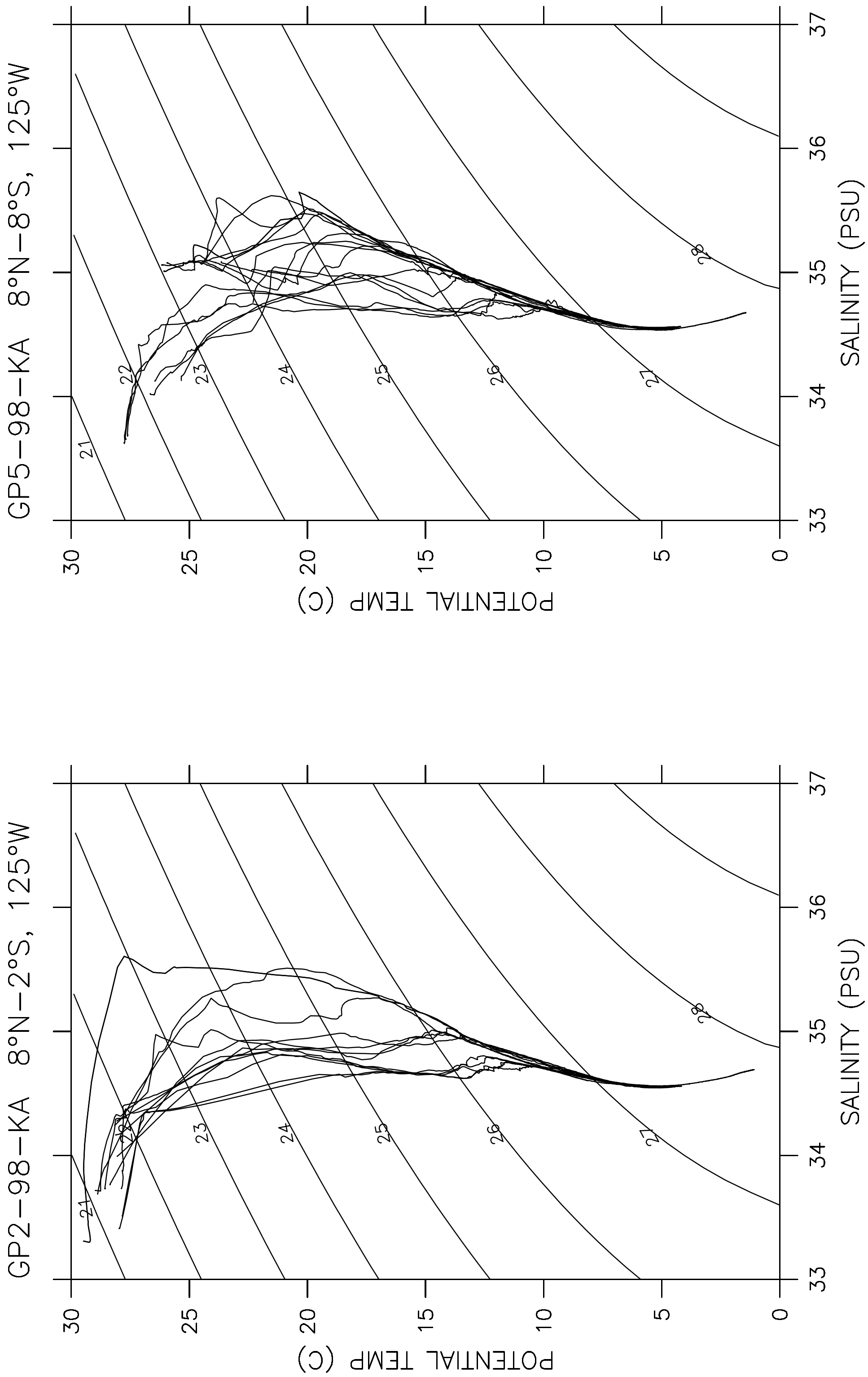

Figure 53: GP2-98-KA spring and GP5-98-KA summer composite TS diagrams along 125°W.

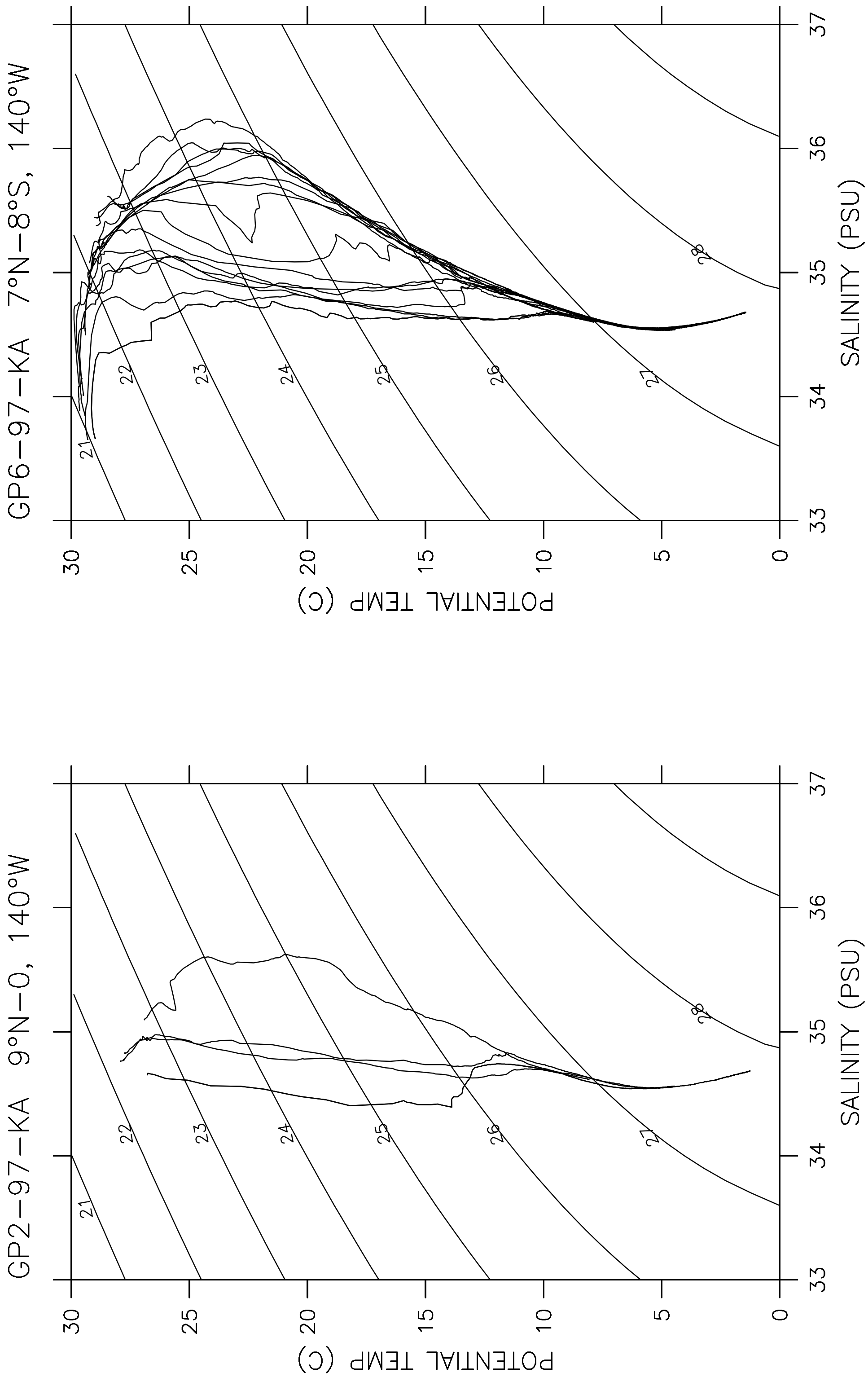

Figure 54: GP2-97-KA spring and GP6-97-KA fall composite TS diagrams along 140°W.

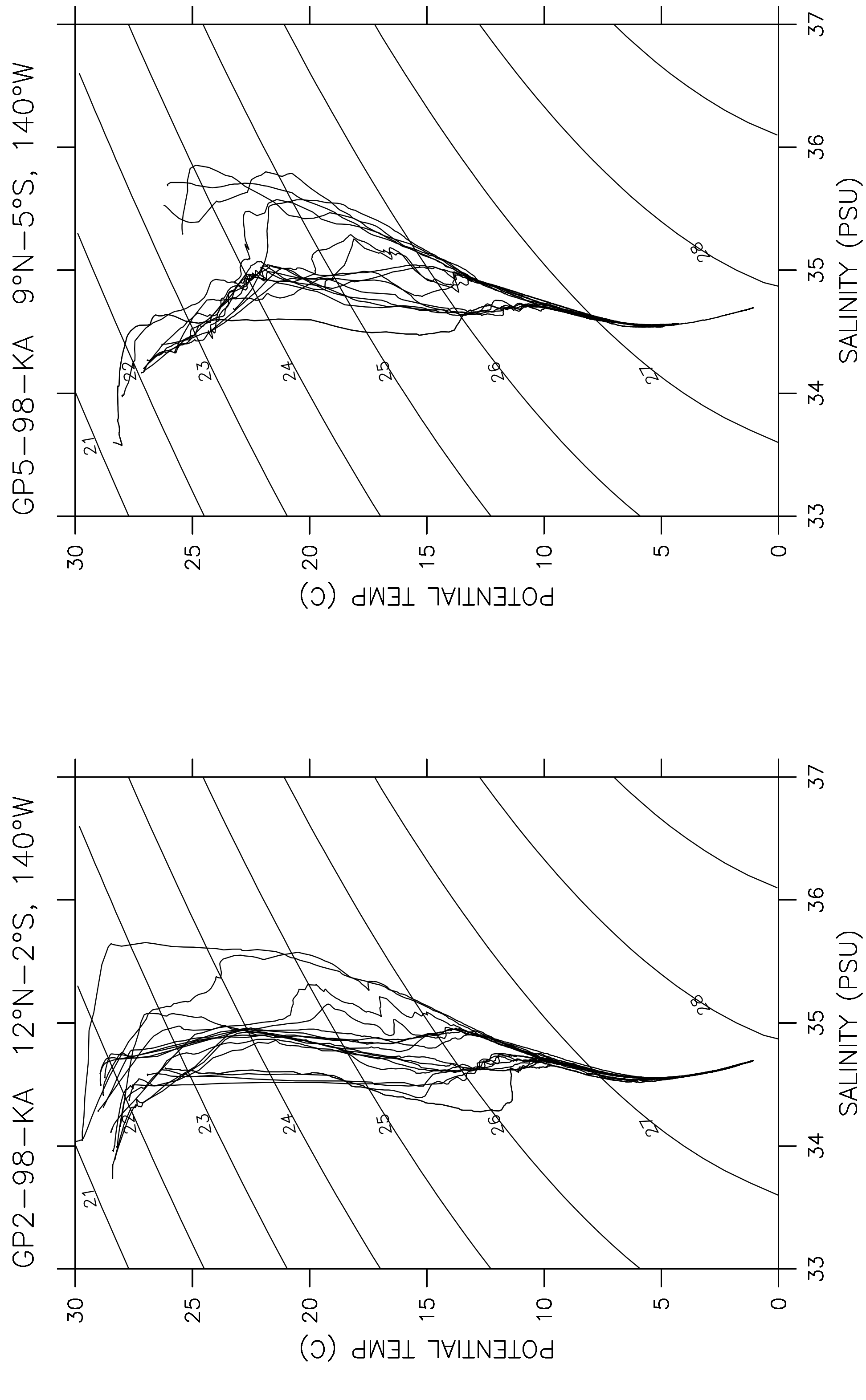

Figure 55: GP2-98-KA spring and GP5-98-KA summer composite TS diagrams along 140°W.

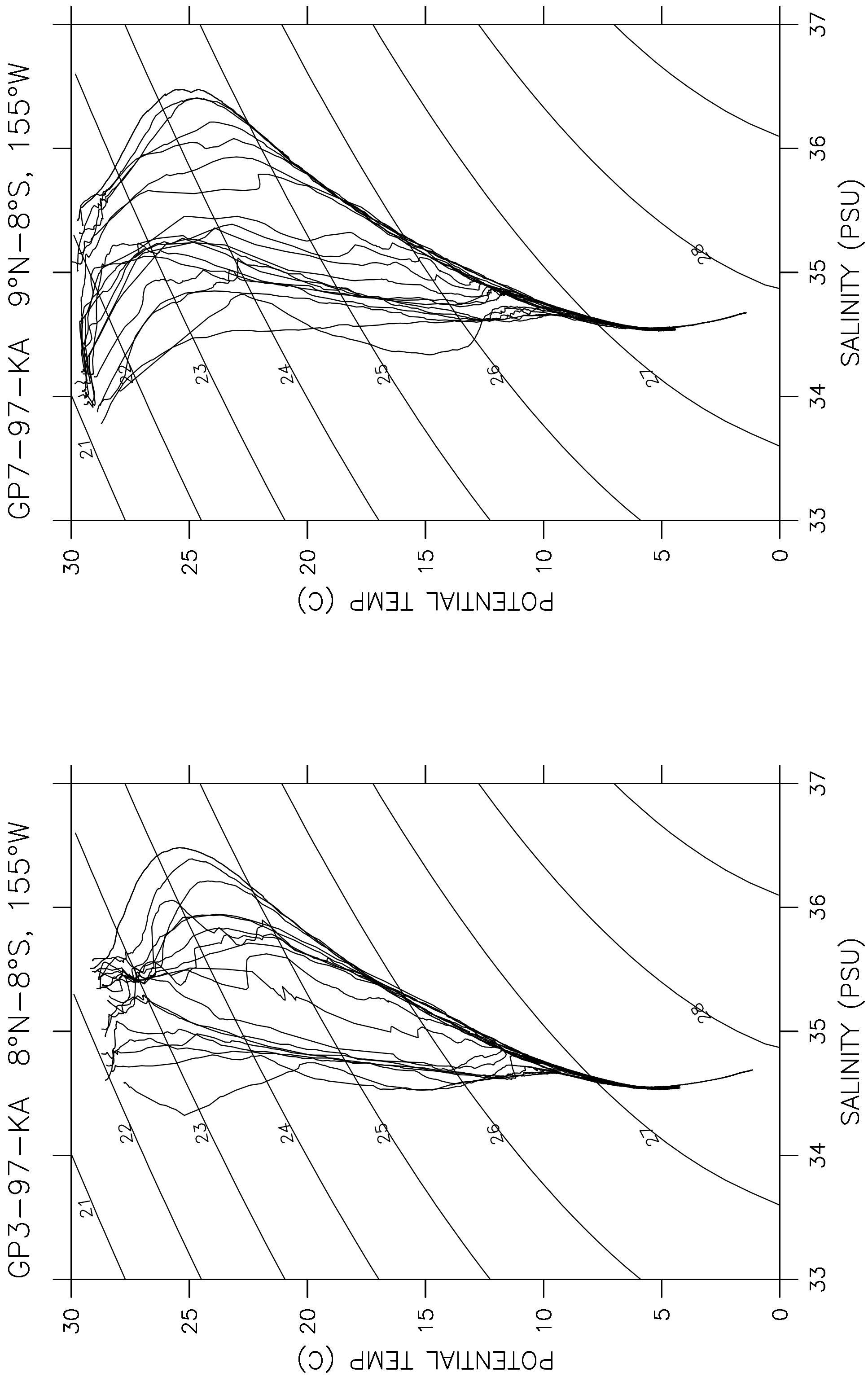

Figure 56: GP3-97-KA spring and GP7-97-KA fall composite TS diagrams along 155°W.

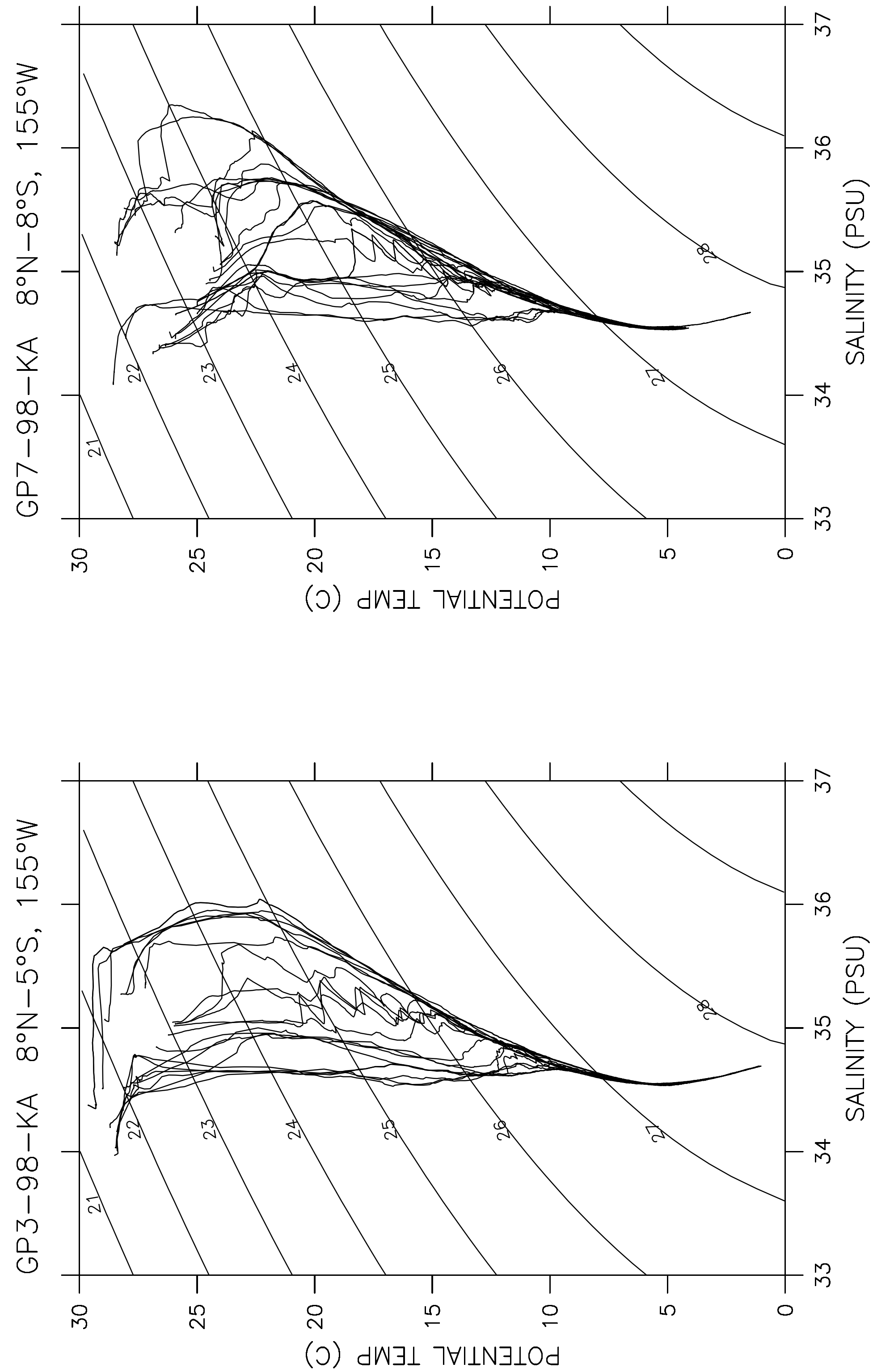

Figure 57: GP3-98-KA spring and GP7-98-KA fall composite TS diagrams along 155°W.

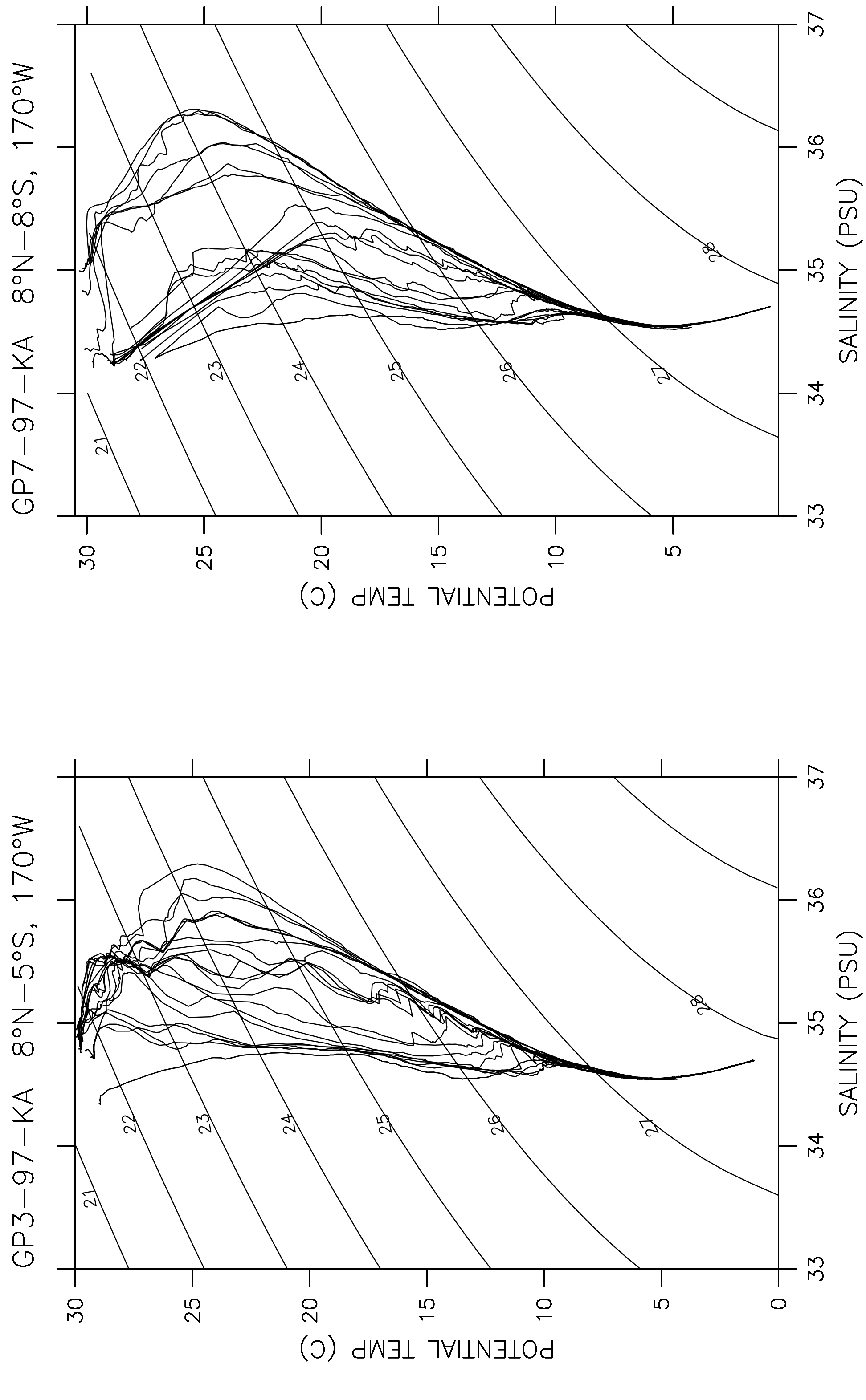

Figure 58: GP3-97-KA spring and GP7-97-KA fall composite TS diagrams along 170°W.

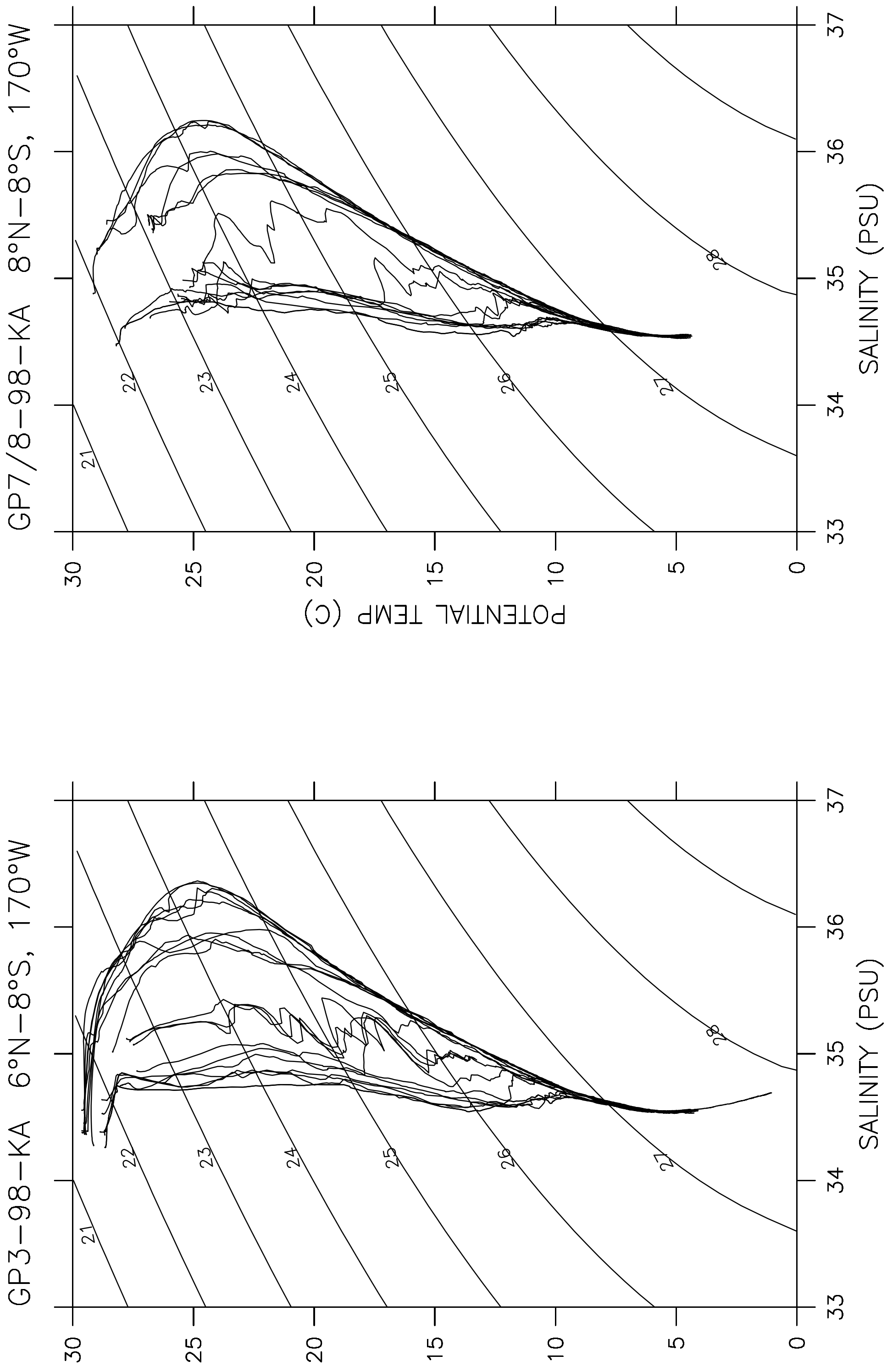

Figure 59: GP3-98-KA spring and GP7/8-98-KA fall composite TS diagrams along 170°W.

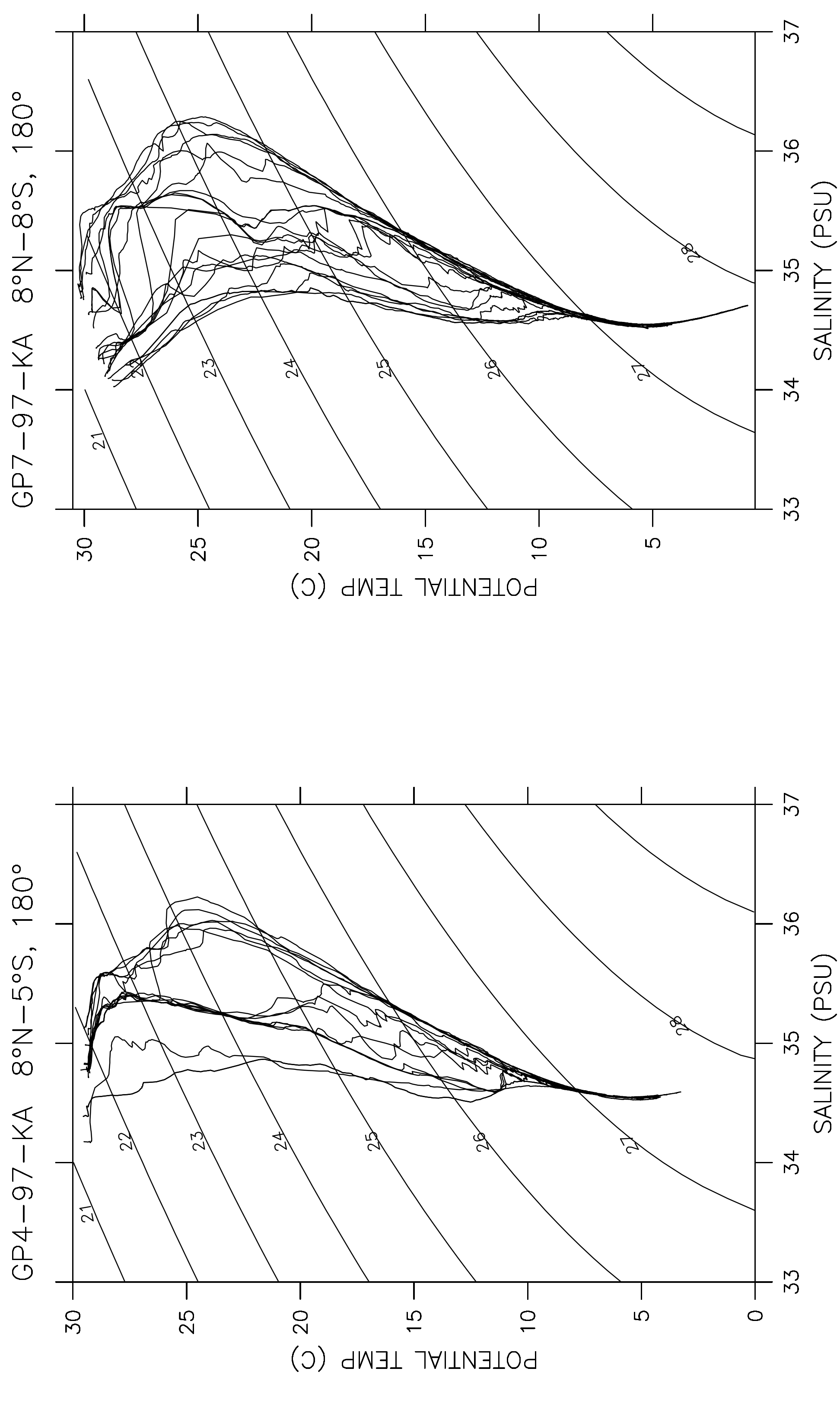

Figure 60: GP4-97-KA spring and GP7-97-KA fall composite TS diagrams along 180°.

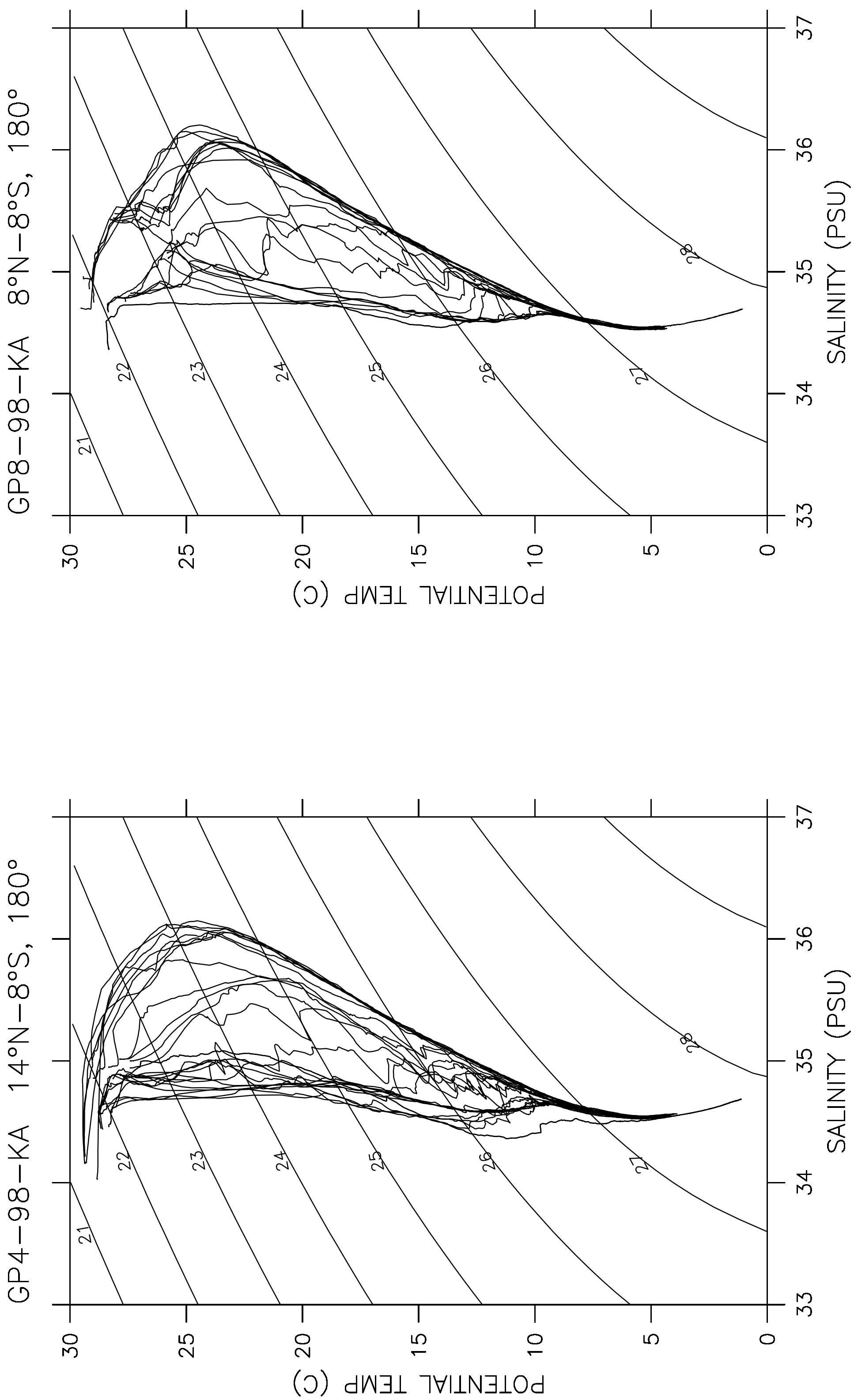

Figure 61: GP4-98-KA summer and GP8-98-KA fall composite TS diagrams along 180°.

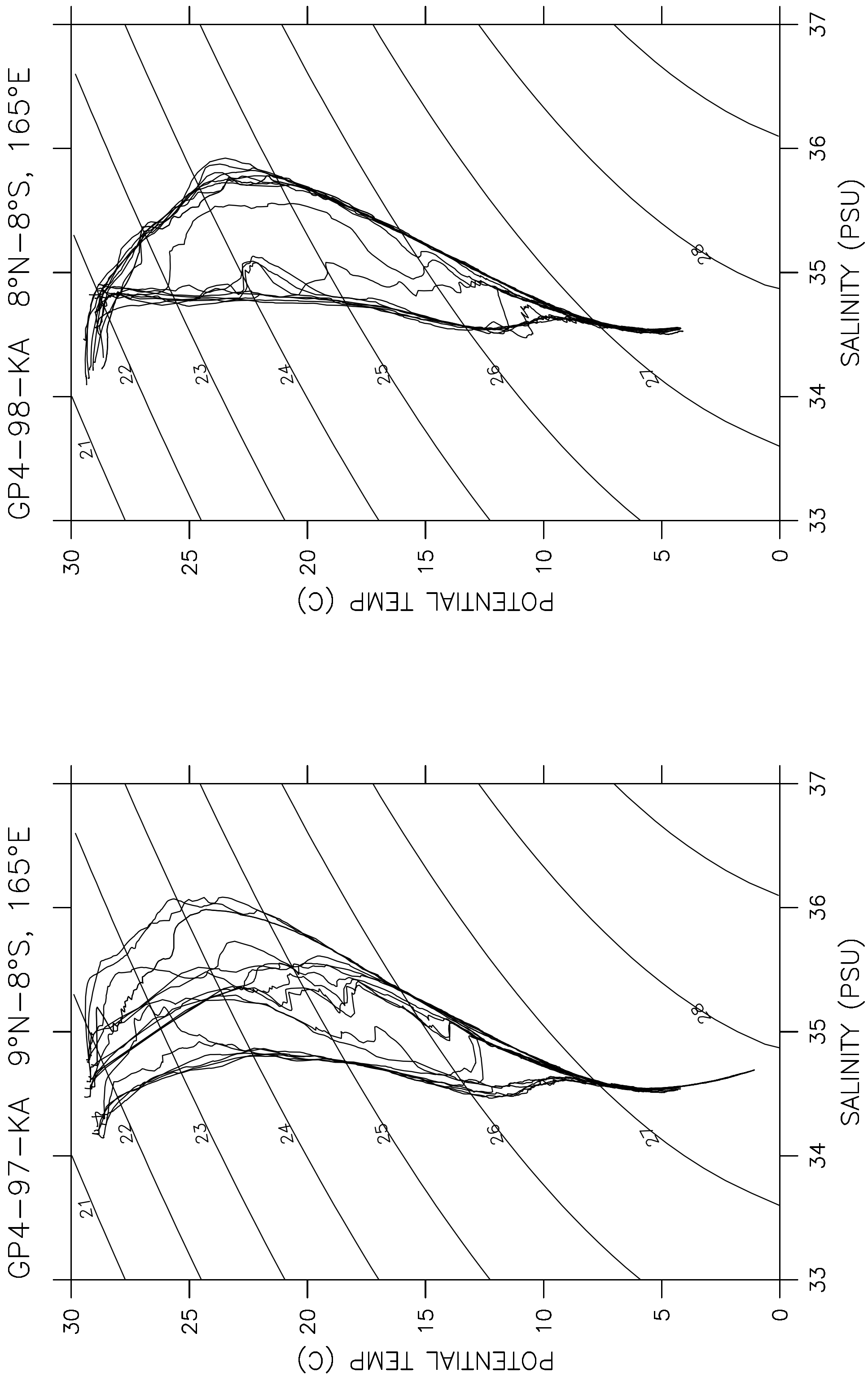

Figure 62: GP4-97-KA spring and GP4-98-KA summer composite TS diagrams along 165°E.

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