

GP4-01-KA  
NOAA Ship Ka'imimoana  
Kwajalein, Marshall Islands - Honolulu, HI  
July 2-30, 2001

Chief Scientist: Ms. Margie McCarty  
Survey Department: AST Amy Frank (CST Dennis Sweeney post-cruise inport)  
CTD Personnel: AST Amy Frank (CST Dennis Sweeney post-cruise inport)  
Final Processing: K. McTaggart

#### ACQUISITION:

Forty-nine CTD profiles were collected on this cruise. Twenty-three profiles were collected from 8N-8S, 165E, and twenty-six profiles were collected along 180 from 8S-8N and along the ship's trackline from 8N-12N. Four casts were deep (>3500 m) and the rest were to 1000 m.

PMEL's Sea-Bird 9plus CTD s/n 09P10881-0390 measuring pressure (s/n 58950), the ship's temperature (s/n 2027, 2026), and the ship's conductivity (s/n 1537, 1536) was used for 49 casts (PMC24.CON, sensors yearly calibrated prior to GP201).

The CTD was mounted in a custom 24-bottle frame with Sea-Bird rosette sampler s/n 88. The CTD data stream was passed through Sea-Bird 11plus deck unit s/n 376 with factory settings. An analog signal was recorded onto the audio portion of VCR tape as a backup. Digitized data were sent to a Dell 5133 personal computer equipped with Sea-Bird's SEASOFT acquisition software (version 4.216) where calibrated data were displayed in graphical form in real-time, as well as stored in raw form onto hard disk. Backups of the raw data were made on CD-ROM and returned to PMEL for post-cruise processing.

CST Sweeney was on medical leave this leg. Augmenter Amy Frank was responsible for running the stored salts from GP301, and doing CTDs and salinities for GP401.

#### SALINITIES:

For casts 5-12, seawater was collected at only 6 depths and salinity samples drawn while the augmeter caught up on GP301 salinities. For all other casts, 12 samples at 12 depths were taken as usual. Duplicate samples were analyzed on a subsequent day from the rest. Salinity analysis was performed using Guildline Autosol 8400B salinometer s/n 61.667 and ACI2000 interface. IAPSO standard seawater batch #P139, was used for all casts. Laboratory operating temperatures ranged from 22.7 to 26.0 degrees Celsius.

#### POST-CRUISE CONDUCTIVITY CALIBRATIONS:

GP401S.CAL of secondary sensor data (not including any duplicate salts) was created post-cruise at the lab. It's completeness and correctness were scrutinized and ammended where needed. Primary conductivity sensor s/n 1537 developed an up/down hysteresis between GP301 and GP401, and also

displayed a noisier signal. Therefore it was decided to calibrate and process the secondary sensor data (s/n 2026 and 1536).

Final pressure and temperature calibrations were pre-cruise. A viscous heating correction of  $-0.0006$  C and a historical drift correction of  $-0.00024$  was applied to temperature sensor s/n 2026.

Conductivity fit coefficients were determined using Matlab program CALCOS0. Although there were four deep stations to  $>3500$  m, there were no sample data collected deeper than 1000 m so CALCOP routines were not considered. Also, salinity analysis was poor and jumped around with each run owing to an inexperienced operator so station dependent and higher order fits were not considered. Also, a standard deviation criteria of 2.3 instead of 2.8 was used running CALCOS0.

number of points used	318
total number of points	484
% of points used in fit	65.7
fit standard deviation	0.004209
fit bias	-0.0066730881
fit slope	1.0001906

Slope and bias correction values were applied to CTD data and converted directly into netCDF format using CNV\_EPS; and to bottle file data using CALMSTR and CLB\_EPS. An additional offset of  $-0.006$  was applied to salinity values after calibration in order to align the deep profiles within their historical envelope.

#### FINAL PROCESSING:

The following are the standard SEASOFT processing modules used to reduce Sea-Bird CTD data:

DATCNV converts raw data to engineering units and creates a bottle file if a Sea-Bird rosette sampler was used. Both down and up casts are processed.

ROSSUM averages the bottle data specified in the DATCNV output and derives salinity, theta, sigma-t, and sigma-th. Bottle data are used to calibrate the CTD post-cruise.

WILDEDIT makes two passes through the data in 100 scan bins. The first pass flags points greater than 2 standard deviations; the second pass removes points greater than 20 standard deviations from the mean with the flagged points excluded.

CELLTM uses a recursive filter to remove conductivity cell thermal mass effects from the measured conductivity. In areas with steep temperature gradients the thermal mass correction is on the order of 0.005 psu. In other areas the correction is negligible. The value used for the thermal anomaly amplitude (alpha) is 0.03. The value used for the thermal anomaly time constant ( $1/\beta$ ) is 9.0.

FILTER applies a low pass filter to pressure with a time constant of 0.15 seconds, and to conductivity with a time constant of 0.03 seconds. In order to produce zero phase (no time shift) the filter is first run forward through the file and then run backwards through the file.

LOOPEDIT removes scans associated with pressure slowdowns and reversals. If the CTD velocity is less than 0.25 m/s or the pressure is not greater than the previous maximum scan, the scan is omitted.

BINAVG averages the data into 1 db bins. Each bin is centered around a whole pressure value, e.g. the 1 db bin averages scans where pressure is between 0.5 db and 1.5 db.

DERIVE uses 1 db averaged pressure, temperature, and conductivity to compute salinity, theta, sigma-t, sigma-th, and dynamic height.

TRANS converts the data file from binary to ASCII format.

Program CNV\_EPS applies post-cruise temperature corrections and conductivity calibration coefficients, recomputes the derived variables in DERIVE, and converts the ASCII data files to netCDF format. CNV\_EPS skips bad records near the surface (typically the top 3 m) as well as any records containing  $-9.990e-29$ , and copies back raw data to the surface (0 db) within 10 db. Because the SBE module LOOPEDIT does not handle package slowdowns and reversals well in the thermocline where gradients are large, CNV\_EPS removes raw data records where a sigma-theta inversion is greater than  $-0.01$  kg/m<sup>3</sup>. Data are linearly interpolated such that a record exists for every 1 db. When data are copied back to the surface, the WOCE quality word is '888'; when interpolated over greater than 2 db, the WOCE quality word is '666'. The WOCE quality word consists of a 1-digit flag for pressure, temperature (ITS-90), and salinity.

Station 0011 had to be recovered from VCR tape, and the downcast was not part of the archived data returned to the lab. Neither was there a .BTL file for station 0011. Sample data for station 0351 could not be found in the salinity data archive.

Program CALMSTR applies post-cruise temperature corrections and conductivity calibration coefficients and recomputes the derived variables in ROSSUM. CLB\_EPS converts the ASCII bottle data file into individual cast netCDF data files.

Final CTD and bottle files were moved to DISK\$EPIC1:[HAYES.DATA.GP401.CTD] and included in the MySQL data management tables on August 28, 2001.