

GP9-01-KA  
NOAA Ship Ka'imimoana  
Kwajalein, Marshall Islands - Honolulu, HI  
October 30 - November 25, 2001

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CTD Personnel: AST Amy Frank (CST Sweeney in Honolulu post-cruise)  
Final Processing: K. McTaggart

#### ACQUISITION:

Fifty-three CTD profiles were collected on this cruise. Twenty-three profiles were collected from 8N to 8S along 165E. Twenty-four profiles were collected from 8S to 8N along 180. And six profiles were collected along the ship's trackline to Hawaii. 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 sensors (s/n 2027, 2026), and the ship's conductivity sensors (s/n 1537, 1536) were used for all casts (last calibrated in March, 2001).

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 8mm tape and CD-ROM and returned to PMEL for post-cruise processing.

Profile data for cast 0381 was not found on any backup. Neither were there bottle salinities for cast 0361.

CST Sweeney continues to be on medical leave. Augmenting AST, Amy Franks was responsible for running salinities as well as doing CTDs. Problems continue with the quality of CTD data during this cruise. Casts 0061-0241 were especially bad. The only troubleshooting done at sea was replacing all the interconnect cables by ET Jeff Hill. CTD salinity values were unrecoverable for stations 0071 0-238 db, 0081 0-149 db, 0091 0-284db, 0101 0-362 db, all of 0151, all of 0181, all of 0191, all of 0201, and 0221 0-200 db.

#### SALINITIES:

12 samples were taken each cast as usual. No duplicate samples were taken this cruise. Salinity analysis was performed using Guildline Autosol 8400B salinometer s/n 61.383 and 61.667 (no ACI2000 interface). IAPSO standard seawater batch #P136 and #P139 were both used. Laboratory operating temperature ranged between 22-25 degrees Celsius. There was no sample data for cast 0361.

Salinity analysis was poor. Bottle salinities tended to be salty of the CTD for the entire cruise.

#### POST-CRUISE CONDUCTIVITY CALIBRATIONS:

GP901S.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 amended where needed. Primary sensors s/n 1537 and 1467 were noisier than the secondary sensors 1536 and 2026. GP901S.CAL was edited to remove records where CTD data were bad or bottle salts were hugely bad ( $\Delta S > .05$ ). This reduced the number of records in the .CAL file by 27%.

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

Conductivity fit coefficients were determined using Matlab program CALCOS0. CALCOP programs were not chosen because there were only a few deep bottles and the overall poor quality of sample salinity data. In order not to fit the negative scatter in the residuals owing to salty sample readings, the standard deviation allowable in the fit was 2.3 instead of 2.8.

number of points used	264
total number of points	386
% of points used in fit	68.39
fit standard deviation	0.005005
fit bias	-0.016862524
min fit slope	1.0004561
max fit slope	1.0004561

Slope and bias correction values were applied to CTD data and converted directly into netCDF format using CNV\_\_SHIFT\_EPS\*; and to bottle file data using CALMSTR and CLB\_SHIFT\_EPS\*.

#### 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.

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 (excluding those flagged as bad).

NOTE: When the 4 deep profiles were compared to historical profiles, it was apparent that the CTD data were too salty. The offsets were averaged and 0.0032 were subtracted from CTD salinities using CNV\_SHIFT\_EPS and CLB\_SHIFT\_EPS (in order to compute corrected densities for the files).

Over 27% of burst data were omitted before calibrations, owing to either bad CTD burst data or hugely bad bottle salts ( $\text{delta} > .05$ ). After calibrations, 31 acceptable bottle salts were returned to the .CLB file where the problem was only poor CTD data. Also, seven additional bottle salts from deeper depths were flagged as bad and not included in the database files. Eight bottle salts were flagged as questionable. No sample data were provided for cast 0361.

Final CTD and bottle files were moved to DISK\$EPIC1:[HAYES.DATA.GP901.CTD] and included in the MySQL data management tables on January 14, 2002. Note that CTD data files for stations 0071, 0081, 0091, 0101, and 0221 contain missing values for salinity where each was truncated. Note that CTD data files for stations 0151, 0181, 0191, and 0201 contain missing values for all salinities in the profile. These 9 files contain good temperature values however and are archived on disk HAYES, but they are not available to the public through EPIC data selection routines.