Fjord Oceanography Monitoring Handbook: Glacier Bay, Alaska

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PREFACE

This handbook is a documentation of the protocol designed and implemented at Glacier Bay National Park & Preserve, Alaska, for the fjord oceanographic sampling and monitoring program (1993 to present). Contained in this manual is a description of the methods, techniques and equipment used to collect, process, and analyze oceanographic profiling data at survey stations in Glacier Bay. The handbook also discusses the integration of oceanographic data into a Geographic Information System (GIS) environment using the Field-Station-developed Oceanographic Analyst Extension (Hooge and Hooge 2000) to ESRI's ArcView GIS.

Much of this protocol could be transferred to other high-latitude fjord estuarine systems. In addition, the processing and integration of the oceanographic data within a GIS system are applicable to many oceanographic programs that wish to more tightly couple oceanographic data to other georeferenced data.

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INTRODUCTION

Glacier Bay

The study of oceanography describes the most fundamental physical aspects of a marine ecosystem. In Glacier Bay National Park almost all of the resource and research issues are, at least in part, related to the marine ecosystem. In addition, Glacier Bay exhibits a highly complex oceanographic regime within a small area (Hooge and Hooge, 2002). Therefore, an understanding of many of the resource and research issues in Glacier Bay is not possible without studying the underlying oceanographic processes causing large spatial and annual variation.

The Bay is a recently (300 years ago) deglaciated fjord located within Glacier Bay National Park in Southeast Alaska. Glacier Bay is a fjord estuarine system that has multiple sills. These sills are often associated with contractions and are backed by very deep basins with tidewater glaciers and many streams. Glacier Bay experiences a large amount of runoff, high sedimentation, and large tidal variations. Melting occurs year-round, which is thought to fuel the estuarine circulation even through the winter. This runoff and the presence of the tidewater glaciers make the bay extremely cold. In addition, there are many small- and large-scale mixing and upwelling zones at sills, glacial faces, and streams. The complex topography and strong currents lead to highly variable salinity, temperature, sediment, productivity, light penetration, and current patterns within a small area. This complexity defies simple characterization or modeling based on other areas in Southeast Alaska. While several oceanographic studies have been conducted in Glacier Bay, the conclusions of some of these studies are contradictory, many were of short duration and limited coverage, and they generally missed much of the spatial, seasonal, and annual variation. In addition, some assumptions based on past studies have been contradicted by recent results (Hooge and Hooge, 2002). The constantly changing nature of the Bay may contribute to contradictions among past studies and between recent and historical results.

Because of the importance of oceanography to understanding critical resource and research problems, the complexity of the Bay's oceanographic system, as well as the limited and contradictory prior work, it is imperative that a sustained, rigorous, and complete monitoring program be developed and implemented.

Oceanographic Sampling

The Glacier Bay oceanographic project was designed for the acquisition, analysis, and modeling of fjord-estuarine oceanographic data in Glacier Bay, Alaska. Twenty-four stations (Figure 1) located along the glacial chronosequence in the Bay are profiled multiple times each year in order to acquire measurements of:

- Temperature (as T068),
- Salinity (as SAL),
- Productivity (phytoplankton biomass indexed by chlorophyll-*a*, as WetStar),
- Sediment load (as OBS), and
- Light penetration (irradiance as PAR)

throughout the water column at 1-meter depth intervals from the surface to near the sea floor. Sigma-t (density) is calculated using the temperature and salinity measurements. Duplicate samples are taken at slack and peak current flow in those areas where water column characteristics are strongly affected by tidal stage. Each survey data set is integrated into a Geographic Information System (GIS) environment utilizing the Oceanographic Analyst Extension (OAE), which allows viewing and manipulation of 3- and 4-D oceanographic datasets within ESRI's ArcView GIS.

SURVEY PROTOCOL

Oceanographic surveys of 23 stations in Glacier Bay (Figure 1) are conducted over three to four days in: March, April, May, June, August, October, and January. While exact timing can vary, the attempt is to get several samples during the highly changing late winter to early summer period, a sample during the heavy early runoff in late summer and a late fall and a winter sample. The first station is in Icy Strait, offshore the mouth of Glacier Bay; thereafter, stations are spaced approximately every five nautical miles to the head of Tarr Inlet in the West Arm, the head of Geikie Inlet, and the head of Muir Inlet in the East Arm. The stations in the Lower Bay (Stations 00, 01, 02, 03, and 04) are sampled during both slack and peak current flow because of the

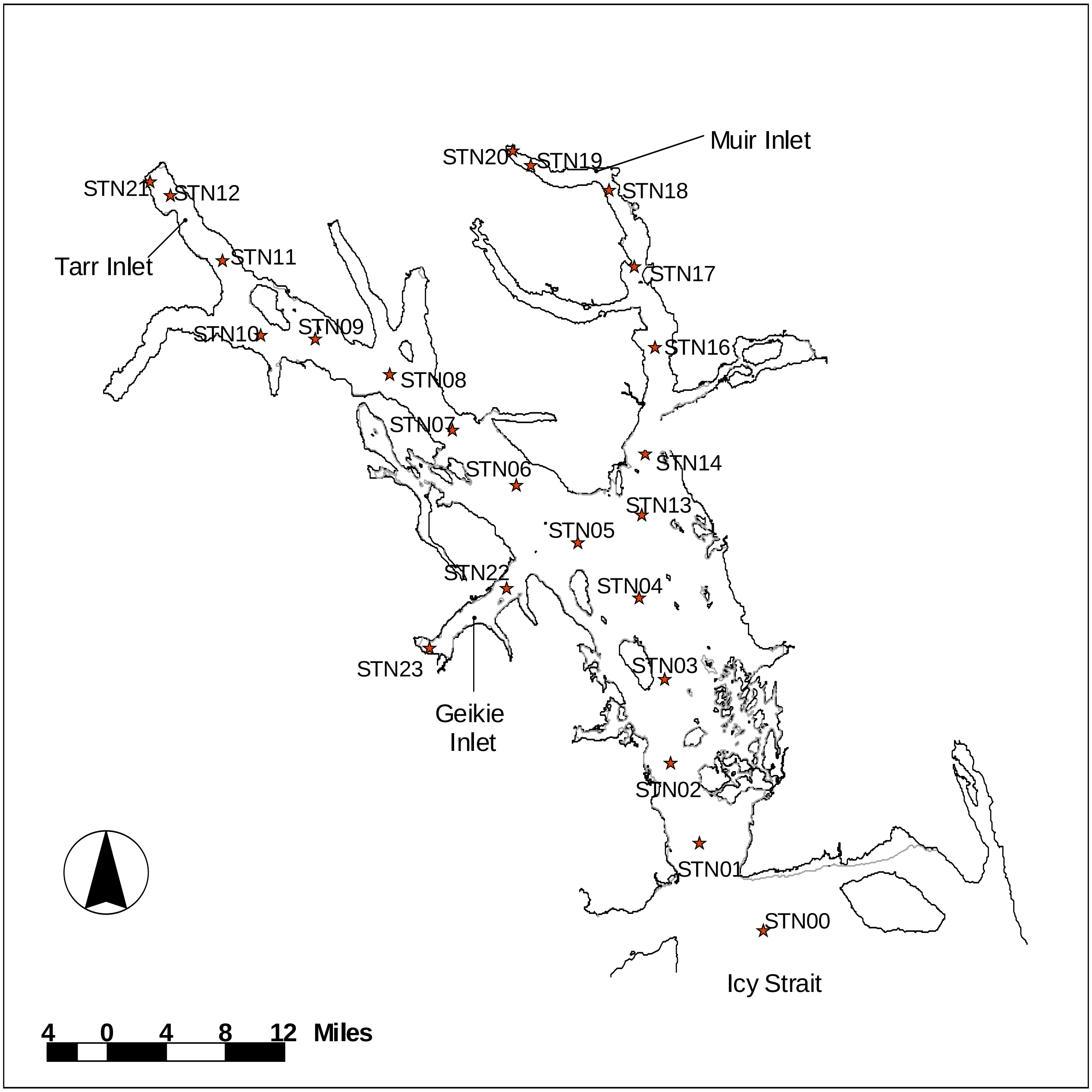


Figure 1. Oceanographic survey stations in Glacier Bay National Park, Alaska.

highly variable conditions in this area, trying to be sampling at station 02 once at slack high and once at peak flood. Throughout the project, the number of stations and number of surveys per year have varied from a low of 2 surveys and 21 stations to the current target of trying to do 5 surveys of 23 stations per year. For example, station 15, West of Muir Point was dropped in March 2002 because of the similarities between it and station 14. Appendix A contains a table listing station numbers with respective geographic coordinates, average depth and general location descriptions. The positions of the stations should be entered as waypoints into the research vessel chart plotter, GPS receiver (Rockwell PLGR+ Fed96) and/or the vessel's on-board GIS system (PC interfaced directly with the GPS). Instructions on how to enter station locations in to the PLGR can be found in: *K:\eco_data\data\glba\Ocean\PROTOCOL\Information\PLGR*

CTD Instrument Configurations

Oceanographic data are collected using one of two Sea-Bird SBE-19 Seacat profiling CTD's (by Sea-Bird Electronics). Instrument #193353 - 436 (designated as CTD #1) and instrument #194652 - 0775 (designated CTD #2) are both configured exactly the same, as of December 2000. Each has an SBE submersible pump (#2 has an SBE model 5-01 pump, #1 has the more recent model SBE 5T), an irradiance meter (PAR sensor, LI-COR model LI-192SA), a WetLabs WETstar fluorometer, and a D&A Instruments OBS-3 optical backscatterance (turbidity) sensor, in addition to the standard temperature probe, conductivity cell, and pressure port. Prior to August 1999, CTD#2 did not have an OBS sensor and had a Sea-Tech fluorometer rather than a WETstar.

Instrument Maintenance

Instrument Calibration

Annually, send the entire instrument to Sea-Bird Electronics for calibration of the temperature, salinity, and pressure sensors. The OBS sensor, the PAR (irradiance) sensor and the fluorometer (or WetStar) should be re-calibrated every second calibration. The calibration records can be found in *K:\eco_data\data\glaba\OCEAN\DATA\processed\CTDdata_index.xls*.

SeaBird shipping information:
(Be sure to get an RBE number from SeaBird before shipping the CTD to them)

SEA-BIRD ELECTRONICS, INC.
1808-136th Place NE
Bellevue, WA 98005, USA
Phone: (425) 643-9866
Fax: (425) 643-9554
E-mail: Seabird@seabird.com
Contacts: Dave Armstrong, Andy Heard
Sea-Bird's website also has return information at:
www.seabird.com

After Instrument Calibration

Before processing begins, a current configuration file (.con file) must exist in order to properly process each data (hex) file with updated calibration information. If the .con file has not been supplied with the instrument after calibration, a new one must be created using the SeaSave software module (as of January, 1999, **SEASAVE for WIN 95/NT V 1.07** is the current program). Run this program to enter the new calibration coefficients for the various sensors, which are printed on SeaBird's service report and included with the CTD upon return. Each time a new calibration file is received from SeaBird, the new OBS settings should be entered as 0 – 50 NTUs/V (See *K:\eco_data\data\glba\Ocean\PROTOCOL\Information\OBS\OBS-3_calcs.htm* for how to enter calibration coefficients).

Refer to the SeaSave manual (*K:\eco_data\data\glba\ocean\protocol\information**seasave_win32_V1_00Word97.doc***) for a full description of how to enter coefficients using the supplied calibration data sheets.

After running the SeaSave software module, save the resulting .con file. This file will be used while processing raw data from the CTD using SeaTerm software modules. Name the file using the CTD number (436 for CTD #1 and 775 for CTD #2) and the date of the calibration (noted as YYMM). For example, **775_9908.con** would have been the .con file for CTD #2 after August 1999, but before the next calibration was done. This file should be saved in: *K:\eco_data\data\glba\Ocean\DATA\processed\CTD_Calibration* and in *K:\eco_data\data\glba\Ocean\DATA\Raw_CTD\CTD**X**_RAW* (where ***X*** is the CTD number, e.g., CTD2_RAW for CTD #2).

NOTE: since Seasoft software is, in part, DOS-based, be sure to limit the name of the .con file to eight characters.

Field Operations

Before deployment of the CTD in the field, check the "status" of the instrument using the Seasoft software module SeaTerm (found in *N:\apps\DOS\CTD\Sea4.246\SEATERM\seaterm.exe*).

Before Each Cruise

1. Check battery status before each cruise with a multimeter or by connecting the CTD to SeaBird software via a computer using SeaTerm; if the Vmain is less than **10V**, replace the 9 D-cell batteries with fresh ones:

- Loosen the top of the battery housing by unscrewing the plastic end cover off. Using a wrench of some sort for leverage is suggested.
- Remove the Phillips head screws (3 of them) and lift out the retainer plate from inside.
- Positive terminals align against the flat battery contacts, and negative terminals against the spring contacts.
- Insert the batteries, reinstall the plate, and completely tighten the screws.
- Replace the top of the battery housing tightly.

2. Connect CTD to computer with SeaTerm (see *Connecting Hardware* section) and make sure the CTD memory is empty (info was cleared after the last cruise) In the SeaTerm window, press **F3** or click on the **Connect** button. The display should read >10V Vmain for the 9 alkaline D-Cell batteries and cleared memory (nsamples = 0, memory = 0).

3. Next, check to see that the time and date are current. If not, type **ST** in SeaTerm. The program will prompt you to type in the correct date, then the correct time. Synchronize your watch with CTD time.

Field Preparation

Appendix C outlines equipment needed to complete oceanographic surveys. Use the CTD's wooden box for transportation, particularly on unpaved roads in a car. Vibrations due to transportation have broken a connection on the CTD, causing sensor corrosion and failure. Please treat the instrument carefully (it is very expensive!). After the instrument is loaded onto the vessel, be sure to secure the end of the ground line to the CTD using 2 metal carabiners and the other end to the vessel.

Data Collection

1. The boat operator navigates to the waypoint of the station using the either the vessel's chart plotter, PLGR+ Fed96 GPS (Rockwell) with external antenna mounted to the top of the vessel, and/or PLGR GPS interfaced with the on-board computer navigation system (Pentium PC with ESRI ArcView 3.2 and Tracking Analyst loaded). Be sure the datum is being collected in decimal degrees NAD 83 (WGS_84). Note the datum used on the top of CTD Data Sheet (see *Appendix D* for a sample data sheet).

2. At the beginning of the CTD cast, record in the field notebook the latitude and longitude of the cast location, using decimal degrees in WGS 84 Alaska datum (called NAS-D on the PLGR GPS), or you can also mark a waypoint on the GPS and record the waypoint number in the logbook. Be sure to also record: the cast number (where the 1st two digits refer to the CTD number – C1 for CTD #1 and C2 for CTD #2, the second four digits are the dump number, and the last two digits are the cast number within this dump, starting with "00"); date; time the waypoint was marked; and the station number and location.

3. Upon arriving at a station, turn on the boat hydraulics. Hang the CTD from the block and slide the magnetic switch to the "ON" position. Record the time "on" in the field notebook. Next, lower the CTD into the water until just submerged to equilibrate for approximately **one minute**. This equilibration time will allow 45 seconds for the pump to turn on (45 sec is the set delay interval for CTD #1 and #2) and will provide time for the instrument to adjust to ambient temperature and for the conductivity cell to flush.

NOTE: Timing the sampling of the Lower Bay and Sitakaday Narrows stations is very important for measuring the variance of the conditions. The first five stations (Stations 00, 01, 02, 03, and 04) are sampled twice, both during slack high and peak flood current flow, as calculated by using the Tides & Currents Pro v. 2.5b program's tide charts (see Appendix F for tide station locations). When planning the cruise, **the goal is to be at Station 02, Sitakaday Narrows, as close to peak flood (about 180 minutes after low) and slack high as possible**. Ideally, the lower bay stations would be done in order each time (starting at 00 and ending at 04 for both parts of the tide cycle so that the progression of the tide into the Bay can be followed) but on a slower moving vessel, this isn't always feasible because the travel time back to station 00 from up-Bay. For example, to follow the peak flood tide current in the *R/V Alaskan Gyre*, this would mean sampling at Station 00, Icy Strait, about 60 minutes after low tide, Station 01, Mouth of Glacier Bay, about 120 minutes after low tide and Station 03, SE of Willoughby Island, about 240 minutes after low tide. For *R/V Sigma-t*, this would mean sampling Station 00 about 120 minutes after low tide, Station 01 about 150 minutes after low tide, and Station 03 about 210 minutes after low tide.
Another thing to consider in projecting estimated arrivals at sampling stations is whether or not Whale Water Restrictions in Glacier Bay are in effect. This will limit the vessel speed to 10 knots in various areas of the Bay. The park will post the dates and areas that whale waters are in effect.
Lastly, it is important to remember that the tide tables are for planning purposes only, so even if the stations are sampled right at the target time, the tide may be in a different part of the cycle still. However, there is usually only a small error in the actual times of the tides.

4. Check the water depth on the vessel's depth meter and record it on the data sheet (make sure to record depth in meters, as opposed to feet or fathoms). After equilibration, drop the CTD at a speed of **one m/sec** (meter per second) using a leaded ground line marked at 10-meter intervals (timed as 10 meters per 10 seconds). The instrument should be dropped no more than 90% of the depth at the station and never more than the **maximum depth of 335m** (both CTD1 and CTD2). The CTD is usually dropped to no more than 300 meters as a safety precaution.

5. Retrieve the CTD with a power block/davit or a long-line drum. Note that data are collected by the CTD on both the down- and up-casts; however, the up-cast data are not used for analysis (down-cast data are more accurate because the sensors are receiving and measuring a nearly-undisturbed water column on the way down) — so there is no need to go slowly on the way up. Be careful, however, as the instrument nears the surface, and be sure to control the power block so the CTD is not jerked up out of the water, or against the side of the boat.

After Each Cast

1. Turn the instrument off with magnetic switch.

2. Detach the conductivity cell and rinse entire instrument with distilled water using a squeeze bottle.

3. Replace hoses on the conductivity cell with tygon tubing and fill with distilled water. If cell is allowed to dry out between usages, salt crystals may form on and in the platinized electrode surfaces.

4. Rinse the irradiance meter with distilled water, and replace the cover.

5. The fluorometer should be flushed with fresh water.

6. **In freezing conditions, bring the CTD into the cabin between stations and during storage.**

7. Record any irregularities about the cast on the data sheet. Include comments about such events as, e.g., the magnetic switch arriving at the surface in the "off" position, forcing a duplication of that station's cast. Enter tide data (times of and heights of nearest high and low tides – see *SeaTerm Setup Parameters* section for details) onto the data sheet during the run between casts. If you marked a GPS waypoint for the cast's location, enter the coordinates onto the data sheet now to prevent loss of the waypoint when others use the GPS later. Then convert the location data into decimal degrees. The PLGR and the GPS receivers only provide positions in degrees and decimal minutes. (See *Appendix B* for conversions of degrees to decimal degrees.)

Storage of the CTD (After Each Cruise)

1. Rinse the entire instrument with fresh water.

2. For the WetLabs WETStar mini fluorometer, rinse thoroughly and air-dry the instrument after each experiment (the flow tube must be rinsed after each cast).

3. Rinse the conductivity cell with distilled water both the tubing and the cell itself, inside and out.

4. Flush the conductivity cell with a pre-mixed 1% solution of Triton X-100, fill the tubing with the solution and let soak for 30 minutes. (Note…Triton X is a non-ionic biogenic detergent; be careful not to get the solution on your skin). Drain the cell and tubing. Soapy water can be used to remove oil and grease but Triton-X should be sufficient.

5. If it looks clogged or dirty, use a Q-tip to clean the flow tube on the conductivity cell (use care, as the quartz tube is easily broken or scratched).

6. Rinse the conductivity cell with warm (not hot, room temperature is fine) fresh water.

7. Store the instrument with the tygon tubing submerging the conductivity cell in distilled water. If tubing is unavailable for whatever reason, let the Triton-X solution dry in the conductivity cell and do not rinse until the beginning of a cruise

8. **In freezing conditions, bring the CTD into the cabin between stations and during storage**, especially at night.

9. Connect CTD to computer with SeaBird software and upload data (See *Processing Raw Data* section).

10. Check battery status after uploading data with a multimeter or by connecting the CTD to SeaBird software via a computer. (See *Before Each Cruise* section)

11. Batteries left in place should be changed yearly (see dump log for dates of last battery change: *K:\eco_data\data\glba\ocean\data\processed\CTD_Dump_Log.xls*, also *Appendix E*) As a default, batteries are usually changed before the January sampling trip.

12. Enter CTD battery voltage, number of casts, and any comments in the Dump Log if data has been uploaded and cleared

Uploading & Processing Raw Data

Various Seasoft software modules are required in order to successfully acquire, retrieve (upload), process, and display CTD data in the appropriate format. The primary programs include: SEA TERM (previous version was called TERM19), _SEA.BAT, and SEASAVE (all from Sea-Bird Electronics). As of January 1999, the new Windows module called SEASAVE for WIN 95/NT became available, which incorporated functions from the DOS versions of SEACON and SEASAVE. Instructions and additional information about this software, as well as various components of the CTD, can be found in *K:\eco_data\data\glba\Ocean\PROTOCOL\Information*

Raw Data Upload

Upon completion of each survey, (or during the cruise, depending upon the status of the remaining memory on the CTD), download the instrument to a personal computer using the procedures described below. In Glacier Bay, this is usually done at the end of the East and West Arms, Geikie Inlet and the end of the cruise. The data is then checked for completeness, so that if it has to be resampled, it can be done on the way back down the Bay.

Connecting Hardware

1. Check that the white magnetic switch at the bottom of the CTD is in the off position before starting.

2. Remove the black bulkhead connector cover by unscrewing the cap and pulling the connector straight off, from the black pigtail on CTD #1 or at the base of the pump on CTD#2. **Do not twist the connector when taking it off; this can bend the pins.** Inspect the pins for any signs of corrosion (green/black areas). If minor corrosion appears, it can be removed with rubbing alcohol and a Q-tip.

3. With a lint-free cloth, clean in and around the connector AND inside the cable, making sure no dirt, dust, excess silicone grease, etc. remains. Be careful not to touch the pins

4. After connector and cable are cleaned, put a small (<pea sized) dab of 100% silicon grease on your finger and apply around the black base of the connector (avoid getting grease onto the pins).

5. Connect the 4-pin port of the instrument to COM port 1 or 2 of a PC with >580 MB of low memory with the connector cable by

aligning the cable end with the pins, and push into place (Do not twist). There are small knobs on both the connector and the cable that should be lined up when they are correctly connected Next, (this is important!) run your hand down the length of the cable connector to squeeze out any trapped air. You should hear a "pop" when it is on correctly. Screw the black cap back on to the connector.

Hardware Configuration Settings

The software module SeaTerm is used to establish communications between the instrument and a personal computer. Information about the hardware configuration settings (communication, etc.) of the CTD and individual computer is stored in the TERM19.CFG file (found in the folder *N:\apps\DOS\CTD\Sea4.246\SS-DOS*).

After the CTD has been properly connected to the computer, open the SeaSoft directory located in *N:\apps\dos\ctd* on the Bartlett Cove network, select *Sea2.246* (for both CTD1 and CTD2, as of June 2002) and double-click on *Sea4.246\SEATERM\SeaTerm.exe*. From the field laptop or onboard computer, navigate to *C:\Apps\data\CTD\Sea4.246* and select Seaterm.exe. Initiate session by clicking on the *Connect* button. The screen should read, "Communications established" when the computer detects the instrument; it may take two tries to establish a connection. If communication is not detected automatically, press **F6** (wake up) and communications should establish. If communication is still not detected, check the computer and CTD connections; you may have put the computer connection in the wrong port, or there may be another connection problem, such as the cable not being connected properly. To check the COM port setting in the software, open SeaTerm.exe and click on Configure → SBE19… (See *SEATERM Setup Parameters* section)

Before uploading a session (series of casts), the setup parameters must be checked using the SEATERM program (this file may need to be edited when switching between computers). Click on Configure → SBE19… to view or edit the setup parameters stored in the SEATERM.exe file as described below.

SEATERM Setup Parameters

(Open *Configure →SBE19…* in SeaTerm.exe)

- **SBE 19 Firmware version** = Less than 3.0
- **Communication set up**:
  Serial Port = COM1 or COM2
  Baud Rate = 9600
  Data Upload Baud Rate = 9600
  Data Bits = 7 Data Bits
  Parity = Even Parity
- **Data upload setup parameters**:
  Upload = Upload All Data Separated by Casts
  Echo = Echo Data During Upload
  Disk Drive to Write Uploaded HEX to [A-Z] = A on laptop, N on network (be sure disk is in A: for laptops)
  Upload File Name Choice = C1#### for CTD1, C2#### for CTD2 (The #### is the dump number on the logbook datasheet; the cast number will be added to the end during uploading).
  Default Upload File Name = Use Default File Name
  Upload Session Number = dump# (which should be determined by looking at archived CTD data and choosing the next sequential number depending upon which instrument is being used).
- **Header** = Prompt for Header Information
- **Header Form** = Check "Header" format and update the following cruise information. NOTE: **NEVER (ever!) change these established header names or their order (e.g. if your data is in UTMs instead of Lat/Long). New headers

can be added at the end but the GIS processing won't work if the old headers' names are changed! If you must use different headers, see *"Processing Converted (.cnv) Files: Creating .dbf Files"* to ensure that your data will be processed by the GIS program. To correct headers, click on Configure → Headers.

Ship: (e.g., R/V Alaskan Gyre)
Cruise: (e.g., Glacier Bay Oceanography Survey, June 2000)
Station #, Location: (number, station name)
Lat: (at Glacier Bay use decimal degrees, WGS 84/NAD 83)
Long: (at Glacier Bay use decimal degrees, WGS 84/NAD 83)
Bottom depth: <no units! Always meters!>
CTD dropped to: <no units! Always meters!>
Time Since/to Low: < no units! Always minutes! "-" is OK, but do not use "+" >
Time Since/to Hi: < no units! Always minutes! "-" is OK, but do not use "+" >
HiHight: < no units! Always meters! "-" is OK, but do not use "+" >
LowHight: < no units! Always meters! "-" is OK, but do not use "+" >
Comments: (for information such as PLGR+ accuracy, visible surface features, line angle, rate of drop, data/datum form and any type of irregularity that occurred during the cast)

NOTE: To calculate the time, in minutes, since/to the low and high tides, the *Tides and Currents* program can be used. Pick the high and low tide at the closest tide station for the time closest to each cast (see Appendix A for a list of oceanographic and tide station locations), and calculate the number of minutes to or from the cast to the high and low tides. For example, if the cast is before the low tide, the number of minutes to low tide should be a negative number (~counting down to a tide). Conversely, if the cast is after the low tide, the number of minutes after low tide should be positive. Because the elapsed times are written in hours and minutes, it is easiest to convert the elapsed hours to minutes by multiplying by 60 and adding that to the elapsed minutes (See *Appendix B* for more conversions). ONLY a minus sign "-" can be included when entering these data during data upload from the CTD -- do not use the plus sign "+". Calculating these numbers and entering them onto the data sheet between casts during the cruise is much easier and will save much time during data upload. Click on the Config button to check that the Tides and Currents program is reading tidal heights in meters and that the time (daylight savings or standard) is correct.

Once the setup parameters are checked, the next step is to display and check the instrument status by selecting **F3** or clicking on the **Status** button. Instrument status provides information such as software version, instrument serial number, time/date, battery voltage remaining, number of stored and free samples in memory, etc. Check the following settings:

- **Time and date** should be current. Use either daylight savings or standard time as applicable. (See the *Field Operations* section for how to change time on the CTD using Seasoft)
- **Sample rate** = 1 scan every 0.5 seconds (about every 5m)
- **Ncasts** = should match the number of data sheet entries (number of actual casts done, cast numbers start at 00)
- **Samples** = Note that the instrument's memory capacity is 256K, or 43336 (free) samples.
- **Vmain** = main battery level should be > 10 volts; if not, batteries must be replaced (see *Instrument Maintenance* section for instructions on changing the batteries).

Uploading CTD Data (aka "dumping" the CTD)

1. Navigate to SeaTerm if you have not already done so. In SeaTerm.exe, select **F9** to begin uploading data or click **Upload** on the tool bar.

2. The program will open a window with the headers information. For each cast, check the top of the screen to make sure that time and cast # on the computer correspond to time and cast #

on the data sheet, then enter data sheet information into headers prompted for each cast. Save files by C#>>>><<.hex, where # is the CTD number, >>>> is the four digit dump number and << is the two digit cast number. The program will automatically name and save each cast after asking you to designate a name and save location for the first cast it processes.

3. After all the header information has been entered, press the **escape** key or OK.

4. Either a series of dots (…………) will appear or the data will appear indicating that the cast is uploading to the computer.

5. Repeat for each cast #, making sure for each one that time and cast # on the data sheet correspond to time and cast # on the instrument

6. Exit SeaTerm by pressing **F10**

7. Check that all the .hex files are in the directory *n:\apps\dos\ctd\sea4.246* (or in designated drive letter) and that they contain data. They can be viewed in a text editor (e.g., Textpad) and should display header info and rows of hexidecimal digits. Be sure to check the headers for the correct information, delete the file path leaving just the file name, delete the extra zeros from the file name, check the number of spaces between header and information, check that longitude is a negative number, etc. Correct any mistakes in the headers and resave the .hex file. After resaving it, be sure to check for the correct name in the file directory (delete the extra zeros).

8. Files that do not contain data will interrupt batch processing of data files. Looking at file size can indicate if any files do not contain data. Files can be viewed for raw data as ASCII characters below the header. If they do not contain any ASCII characters, create a "Bad Cast" folder in the project's raw data folder (see below for the location of the raw data folder) and move that file into the folder. Create a _README.txt to annotate the file's location.

9. Make a copy of all new files to disk if working from a field computer, or to the Network (*K:\eco_data\data\glba\Ocean\DATA*). See the later section *Data Management: Raw Data* for the appropriate directories in which to store the raw .hex data files.

10. When ready to initialize the machine for data logging, run SeaTerm again and select **F8** (or click on **Init Log**). This will permanently clear the CTD memory. The memory must be cleared before the next cruise; however, it can be done either right after data upload or (if you're concerned about the raw data) immediately before the next cruise. BE SURE TO DOUBLE CHECK THE RAW DATA BEFORE DELETING THE CASTS OFF OF THE CTD.

11. When finished, log the CTD data upload in the "dump" logbook on the network (*K:\eco_data\data\glba\Ocean\DATA\processed\CTD_Dump_Log.xls*) and note the battery status, etc. (see Appendix D for a sample page from this file) If you do not have a network computer available, then log the cast dump into the CTD notebook and transfer this information to the network later.

Processing Raw Data

SeaSoft software versions

Various SeaSoft software versions (and corresponding manuals) have been supplied on floppy disk and/or CD-ROM with the CTD upon return from calibration at SeaBird. The following software versions have been used for processing data files from .hex to .cnv format: SeaSoft version 4.032; SeaSoft version 4.203; and SeaSoft version 4.236. As of June 2002, **SeaSoft version 4.246** is being utilized to process all CTD .hex files.

Processing hex files with SeaSoft software

This section describes the procedure for processing .hex files from the CTDs using SeaSoft version 4.246 software.

Copy (**not** move) the most recent .CON file (see the *Instrument Calibration* section) from the correct CTD file in the directory *K:\eco_data\data\glba\Ocean\data\processed\CTD_Calibration* or *K:\eco_data\data\glba\Ocean\DATA\Raw_CTD\CTDX_RAW* (where ***X*** is the number of the CTD that was used) to the directory *n:\apps\dos\ctd\sea4.246\SS-DOS*.

Copy (**not** move) the .hex files from the folder K*:\eco_data\data\glba\Ocean\data\RAW_CTD\CTD***x***_RAW\ctd***x_YYYY\YYYYMM*oceanography,* (where **x** is the number of the CTD (1 or 2), YYYY is the year and MM is the month.) to the directory *N:\apps\dos\ctd\sea4.246\SS-DOS*

Note: the data files must (temporarily) reside and be written to the Sea4.246 root directory only! SeaSoft does not recognize (read/write) to any other directory. Raw data files and the calibration file should be copied (not moved) into this folder (the Sea4.246 root directory) for processing, and then the converted (.cnv) files can be moved out of this folder to another directory after processing is complete. Delete the copied .hex and .con files from this directory once processing is finished, and, after they have been copied to their final locations, delete the converted (.cnv) files from this directory. Leave the original raw data (.hex) and calibration (.con) files in the raw data folders to ensure that original raw data are never lost!

Double click on the batch file _sea.bat. This file has been set up to properly process all files in the directory at one time. The batch file called _sea.bat is currently set up to process an entire group of files in the directory through the set of modules listed below, rather than having to process one file at a time. The batch file contains 6 DOS statements. The "-a" argument instructs each module to process **a**ll the files in the current directory:

- datcnv -a
- filter -a
- alignctd -a
- loopedit -a
- derive -a
- binavg -a

There are six software modules in the batch processing that perform various different processing functions sequentially on the data; all of these modules should be correctly set up for data processing. In case they are not correct, the setup screens for each of the software modules should be checked before standard data processing; exceptions to the standard data processing are noted later in the *Data Processing Troubleshooting* Section.

Press **F10** to begin batch processing of data files and to check the setup screen variables. **F10** is pressed to move through each module; **Esc** can be pressed to leave each module early, but will give an error message and cause the .cnv to be incomplete.

DATCNV

This first module uses instrument calibration coefficients and configuration to convert raw data (.hex or .dat files) to engineering units (ASCII or binary format with .cnv extension). Ensure that the settings are as follows:

- **Raw Data File:** c#<<<<>>.hex (this should be the name of the first cast where # is the number of the CTD used, <<<< is the dump number and >> is the cast number)
- **Configuration File [.CON]**: (e.g. 775_9908.con or most recent *.con file; see section *After*

Instrument Calibration. These *.con files can be found in the correct CTD (1 or 2) folders in the directory *K:\eco_data\data\glba\Ocean\DATA\processed\CTD_Calibration* or in the CTD's raw data folder *K:\eco_data\data\glba\Ocean\DATA\Raw_CTD\CTDx_RAW*, where ***x*** is the CTD number) Be sure to copy the .con file to *N:\apps\DOS\CTD\Sea4.246\SS-DOS* before running _sea.bat

- **Input File [.CON, .DAT, .HEX] Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Output Data File Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **DATCNV Format** = ASCII
- **DATCNV Variables** (by column). To alter or check these variables, use the ↑↓ arrows to select this field, then press <Enter>. Once in the next window, again use the ↑↓ arrows to select a variable and press <Enter> to modify it:
  - **Conversion units**: Metric
  - **Column # 0:** Scan Number
  - **Column # 1:** Pressure [db]
  - **Column # 2:**Temperature IPTS-68 [deg C]
  - **Column # 3:** Conductivity [S/m]
  - **Column # 4:** Irradiance (PAR)
  - **Column # 5:** WETlabs, WETStar chlorophyll concentration [μg/l]
  - **Column # 6:** Backscatterance
  - **Column # 7:** Time [Seconds - s]
- **Output Cast Select** = Down Cast Only
- **Number of Scans to Skip Over** = 0
- **Output Water Bottle Data**: No
- **Water Bottle Data Set Up**: Do not bother modifying these parameters because we do not do water bottle sampling.

Press **F10** to move on to the next module.

FILTER

This step forces conductivity to have the same response as temperature. Make sure the settings are as follows:

- **Input Data File**: should automatically show the first .cnv data file that you will be filtering. Only the first file is shown here, but all of the files in the root directory will be processed.
- **Input File [.CNV] Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Output Data File Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Low Pass Filter A, Time Constant [sec]**: 0.5
- **Low Pass Filter B, Time Constant [sec]**: 2.0
- **Variables to Filter** – To alter or check these variables, use the ↑↓ arrow to select this row, then press <Enter>. Once in the next window, use the ↑↓ arrows to select a variable if it needs to be modified:
  - **Filter, scan number =** None
  - **Filter, pressure [db] =** Low Pass Filter B
  - **Filter, temperature, IPTS-68 [deg C] =** None
  - **Filter, conductivity [S/m] =** Low Pass Filter A
  - **All other filter variables should be:** None

Press **F10** to move on to the next module.

ALIGNCTD

This step aligns temperature, conductivity and oxygen measurements in time relative to pressure, ensuring that calculations are made from the same parcel of water. When measurements are properly aligned, salinity spiking errors are minimized, and plots agree between down and up profiles. Check the following settings:

- **Input Data File**: should automatically show the first .cnv data file that you will be aligning. Only the first file is shown here, but all of the files in the root directory will be processed.
- **Input File [.CNV] Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Output Data File Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Advance Primary Sensors Relative to Pressure (seconds)**
  - **Advance Primary Conductivity**: 0.620000 (This value was obtained by adding the seconds to advance temperature - 0.5 - to the seconds to advance pressure - 0.12)
  - **Advance Primary Temperature**: 0.500000
  - **Advance Primary Oxygen**: 0.000000

- **Advance Secondary Sensors Relative to Pressure (seconds)**
  - **Advance Secondary Conductivity**: 0.000000
  - **Advance Secondary Temperature**: 0.000000
  - **Advanced Secondary Oxygen:** 0.000000
- **Advance Fluorometer Relative to Pressure (seconds):** 0.000000

Do not enter anything (defaults to 0.0) for secondary conductivity and secondary temperature. Also do not enter anything for oxygen because we do not have an O_2 sensor.

Press **F10** to move on to the next module.

LOOPEDIT

This software module marks scans with "badflag" if the scan fails pressure reversal, slowdowns or minimum velocity tests. Check the flowing settings:

- **Input Data File**: should automatically show the first .cnv data file that you will be loopediting. Only the first file is shown here, but all of the files in the root directory will be processed.
- **Input File [.CNV] Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Output Data File Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Minimum Velocity Selection**: Fixed Minimum Velocity
- **Minimum CTD velocity (m/s)**: 0.25
- **Exclude scans Marked Bad in LOOP EDIT**: YES

Press **F10** to move on to the next module.

DERIVE

Derive reads in .cnv files and calculates derived variables (including salinity, density, depth, and sound velocity). Check the following settings:

- **Input Data File**: should automatically show the first .cnv data file that you will be deriving. Only the first file is shown here, but all of the files in the root directory will be processed.
- **Configuration File [.CON] for Oxygen Coeffs:** should automatically show the .con file being used
- **Input File [. CNV, .CON] Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Output Data File Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Input Variables**: While batching files, this module should automatically pick up the list of variables initially entered into the DATCNV module, as follows. To alter or check these parameters, use the ↑↓ arrows to select this row, then press <Enter>. Once in the next window, use the ↑↓ arrows to select a parameter if it needs to be modified:
  - **Variable # 0:** scan Number
  - **Variable # 1:** pressure [decibars]
  - **Variable # 2:** temperature IPTS-68 [deg. C]
  - **Variable # 3:** conductivity [S/m]
  - **Variable # 4:** irradiance (PAR)
  - **Variable # 5:**WET Labs, WETStar chlorophyll concentration (µg/l)
  - **Variable # 6:** backscatterance
  - **Variable # 7:** time [elapsed seconds]

- **Variables to be Derived** – To alter or check these variables, use the ↑↓ arrows to select this row, then press <Enter>. Once in the next window, use the ↑↓ arrows to select a variable if it needs to be modified:
  - **Variable # 0:** depth, salt water [m] – Latitude is requested when you press <Enter>; it should be 58.4 as an average for Glacier Bay.
  - **Variable # 1:** salinity, PSS-78 [PSU]
  - **Variable # 2:** density, sigma-t [kg/m^3]
  - **Variable # 3:** sound velocity, chen millero [m/s] (methods to be determined, but chen millero selected in the interim)
  - **Variable # 4:** average sound velocity, chen millero [m/s] (methods and parameters to be determined, but chen millero and the below parameters selected in the interim:
    - **Minimum pressure** (decibars): 0
    - **Minimum salinity** (psu): 0
    - **Pressure window size** (decibars): 1
    - **Time window size** (seconds): 300.00
  - **All other Variables:** none
- **Variable Coefficients** – these do not need to be set for our current configuration, because we do not have an oxygen meter and we are binaveraging by depth, not using descent rate
  - **Time window size for doc/dt**: 0.0. We believe "doc/dt" refers to the rate of change of dissolved oxygen content, which we do not measure.

- Time Window size for descent rate: 0.0. We use depth bins for averaging, so descent rate is not important. (or, if this time window size is used in the doc/dt calculation, again we don't measure oxygen so this parameter does not apply to our calculations).

Press **F10** to move on to the next module.

BINAVG

BINAVG averages data in converted data (.cnv) files into pressure or depth bins. Input data file: should automatically show the first .cnv data file that you will be bin averaging. Only the first file is shown here, but all of the files in the root directory will be processed. Check that the settings are as follows:

- **Input Data File:** this should automatically select the first .cnv being created
- **Input File [.CNV] Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Output Data File Path**: *N:\apps\DOS\CTD\Sea4.246\SS-DOS*
- **Bin Type**: Depth Bins
- **Bin Size**: 1.0
- **Include Number of Scans Per Bin**: YES
- **Exclude Scans Marked Bad in BINAVG**: YES
- **Number of Scans to Skip Over**: 0
- **Surface bin setup parameters** – To alter or check these parameters, use the ↑↓ arrows to select this row, then press <Enter>. Once in the next window, use the ↑↓ arrows to select a parameter if it needs to be modified:
  - **Include surface bin**: Yes
  - **Surface bin minimum value**: 0.2
  - **Surface bin maximum value**: 0.5
  - **Value for surface bin**: 0.00

F10 must be pressed a total of 6 times, to continue running through each of the different modules: DATCNV, FILTER, ALIGNCTD, LOOPEDIT, DERIVE, and BINAVG.

Once files are processed, move all .cnv (converted) files to the following folder: *k:\eco_data\data\glba\ocean\data\processed*\YYYY \YYYYMM*oceanography* (note that YYYY and YYYYMM are examples of the year and month of the cruise – create an appropriate folder if one does not already exist). The raw data (.hex) and the configuration (.con) files should be deleted from the program folder after conversion. The original raw data and configuration files should still be in the oceanography project file, where they initially were stored and where they should remain.Immediately after converting the .hex files to .cnv files, open at least one of the .cnv files with a text editor. Make sure there is the correct number of .cnv files. Examine the dates, header information and briefly check the data. It is very important to correct any header name, spelling and prefix problems prior to doing any GIS processing. If the headers differ in *any* way from the headers listed in the *SEATERM Setup Parameters* section, ArcView will be unable to locate them during GIS processing. Be ***sure*** to check for the correct date in the "start_time" field! This field can be found in the .cvn files in the second grouping of data (which begins with #), after the name, span, and interval headers, and before the bad_flag and sensor headers. As of December 2000, the SeaSoft software v. 4.236 appears to have a bug causing year in the "start_date" field to be "0100" in the .cnv files even though the year is correctly entered on the CTD itself and appears correct in the .hex files. It is important that the date is correct in this field since it will be used by Oceanographic Analyst Extension during GIS processing to obtain the date of the cast. However, v. 4.246 has had the bug corrected. Finally, quickly scan the data to ensure that they are as expected; make sure there are no missing values, or no zero values or that all the values are not the same.

After all files have been processed, open the CTD_Process_Log.xls (located on the network: *k:\eco_data\data\glba\ocean\data\processed*) and record files processing.

Plotting

(This section is not usually done for Glacier Bay Oceanography) After processing the raw CTD data we move the data into ArcView to complete the GIS processing. If, however, you need to create and print a classic cast profile, the seaplot.exe software should be used and this is the procedure to follow:

1. From DOS or Windows (*C:\ProgramFiles\Sea-Bird\SS-DOS* or *N:\apps\DOS\CTD\Sea4.246\SS-DOS*), run SeaPlot.exe
2. For each profile, the maximum depth (50, 100, 150 or 200m) should be specified and Station#, description, and date entered.
3. No other settings should need changing but check to be sure. The correct setup screen follows:
    - Input file path: *K:\eco_data\data\glba\ocean\CTD*
    - Plot parameters file: seaplot.plt
    - Plot format: Overlaid X-Y plots
    - Variables to plot: Depth (minimum = 0, maximum = the nearest multiple of 50 to profile maximum)
    - Temperature (minimum = 0, maximum = 12, major units = 3, minor units = 4)
    - Salinity (minimum = 10, maximum = 35, major units = 5, minor units = 5)
    - Irradiance (minimum = .001, maximum = 1000, major units = 6, minor units = 10)
    - Fluorescence (minimum = .1, maximum = 10, major units = 2, minor units = 10)
    - Plot label: Type in the Station #, location, and date of profile from CTD data sheets
4. Press **F10** to display the profile
5. Press **Ctrl F9** to print the profile
6. Printed profiles are archived in the USGS data archive files

GIS Data Processing

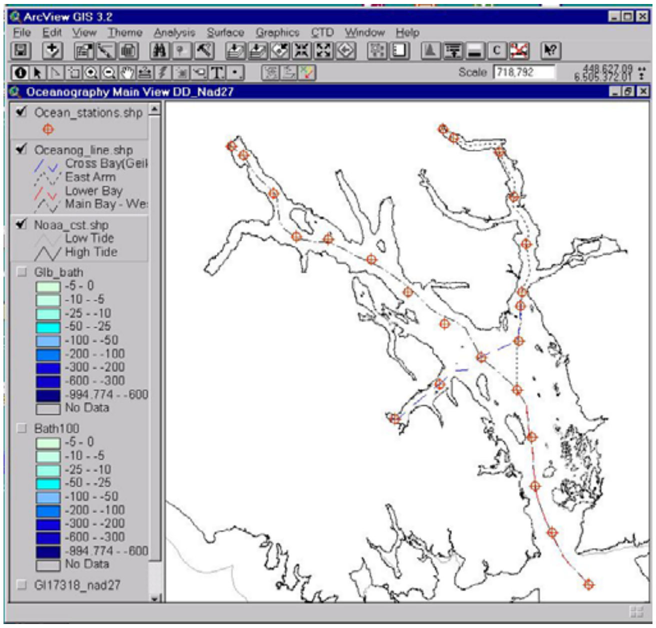
Once the raw data have been initially processed with the standard protocols by the SeaSoft software, which converts the raw .hex data files into converted (.cnv) files, the next step is to convert the .cnv files into a database format and plot the data in ArcView.

The ArcView extension called Oceanographic Analyst Extension (Hooge and Hooge, 2000) is used in order to automate the conversion of the .cnv files to .dbf tables and to bring the oceanography data into the geo-referenced GIS environment. This extension will also be used to create three-dimensional views and contour plots of the cast data.

Set Up

To begin, go to the following pathway: *Science (K:)\eco_data\data\glba\ocean\GIS*
and open: **ocean_template.apr**. This template has been created as a basic outline for GIS processed oceanographic data. If the template were to be lost, the configuration of this particular template file is as follows.

The ocean_template project has three extensions loaded: Spatial Analyst, 3D Analyst, and Oceanographic Analyst. To check or load extensions, go to the **File Menu** and select **Extensions…** Be sure to check the boxes on the left rather than merely clicking on the extensions' names.



There are three views in the ocean_template.apr. The first view is the *Oceanography Main View DD_NAD27*, which should be used when processing and projecting location data collected in decimal degrees (NAD 27). This view is projected in UTM (Zone 8) and the following themes should be present:

- Ocean_stations.shp
- Oceanog_line.shp
- Noaa_cst.shp
- Glb_bath
- Bath100
- Gl17318_nad27

The second view is *Oceanography Main View UTM_NAD27 (not projected)* and should be used when processing and projecting location data collected in UTM (NAD 27). The following themes should be present in this view:

- Ocean_stations_utm.shp
- Oceanog_line_utm.shp
- Noaa_cst_utm.shp
- Glb_bath
- Bath100
- Gl17318_nad27

The third view is called *Oceanography Main View DD_Nad83* and should be used when processing and projecting data collected in decimal degrees (NAD83). As of March 2003, all of the processed oceanography data are in UTM Nad27. This view is projected in UTM (Zone 8) (because geographic (decimal degree) projection distorts the map), and the following themes should be present:

- Ocean_stations_wgs84.shp
- Oceanog_line_nad83.shp
- Noaa_cst_nad83.shp
- Glb_bath83
- 17318_nad83

All the themes for the three views can be found either in Science (*K:)\eco_data\data\glba\OCEAN\GIS* or in: *ocean\gis* depending on which system you are working on (Bartlett Cove computer network or CD-ROM).

There are also three 3-D scenes in the project. If these are not present, you can created them by double-clicking on the 3-D icon in the project window. A 3-D window should come up, and you can change the name of the window by going to the **3D Scene Menu → Properties**, or by selecting **Rename 3-D Scene** under the **Project Menu**, from the Project Window.

The first 3-D scene is called *Oceanography 3D DD_nad27*. This 3D view has a 2D projection in UTM (Zone 8) and should include the following themes:

- Ocean_stations.shp
- Noaa_cst.shp

The second 3-D view is called *Oceanography 3D DD_nad83.* This 3D view has a 2D projection in UTM (Zone 8) and should include the following themes:

- Noaa_cst_nad83.shp
- Ocean_stations_wgs84.shp

The third 3-D view is called *Oceanography 3D UTM_Nad27 (Not Projected).* This 3D view should include the following themes:

- Ocean_stations_utm.shp
- Noaa_cst_utm.shp

To update the Oceanographic Analyst, navigate to: *K:\eco_data\data\glba\OCEAN\GIS\ OceanographicAnalyst_extension*, then copy and paste the ocean.avx document into the following pathway: *C:\ESRI\AV_GIS30\Arcview\EXT32* (or wherever your ArcView EXT32 folder is located). Also make sure, especially in ArcView versions prior to v3.2, that in the *C:\ESRI\AV_GIS30\Arcview\EXT32* folder there is an avdlog.dll document (avdlog.dll is a dynamic link library document).

Once the template is set up, select the file menu and **Save As** (be sure to ***Save As***, since this will create a new project using the template as the base without overwriting the template, so that the template can be used again to create other projects). Name the new project with the following format: <*yearmonth*>ocean.apr (e.g., 200001ocean.apr) and save it in the following location: *Science(K:)\eco_data\data\glba\ocean\DATA\Processed\YYYY\YYYYMMoceanography\YYYYMMocean.apr* (create folders for the year and month if necessary). When renaming the *.apr file, be sure not to call the file YYYYMMocean*ography*; long names have cause ArcView to crash in the past.

The final step before beginning the GIS data processing steps is to set the newly created project's working directory. With a View Window selected, go to the **File Menu**. Select **Set Working Directory**. Set the working directory as: *K:\eco_data\data\glba\ocean\DATA\processed\YYYY\YYYYMMoceanography*. If you do not set the working directory, you will have to navigate to the directory every time you save a new file. Also, be sure to type in the correct file path, otherwise ArcView will not recognize it

Processing Converted (.cnv) Files

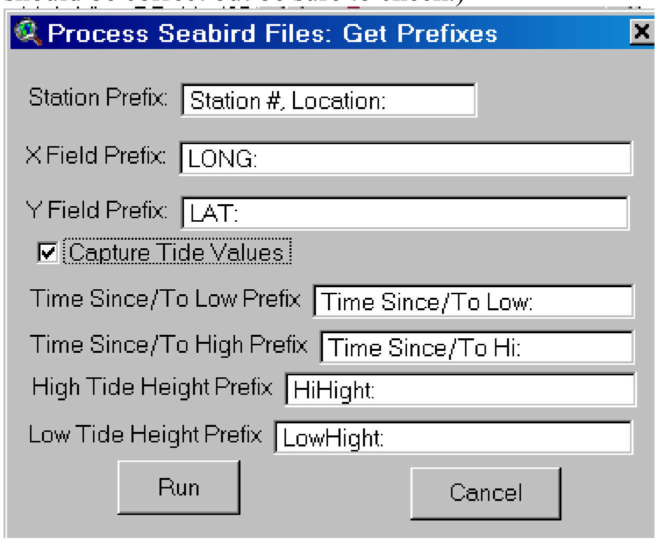
Creating .dbf Files

1. In the new project: Highlight/activate the project window (YYYYMMocean.apr) Be sure the name is not too long, otherwise it may cause ArcView to crash.

2. Click on **CTD Menu**, then select **Process CTD files**.

3. A dialog box will appear labeled: Process Seabird Files: Get Prefixes. This part of the program identifies the header information in the particular .cnv files you are processing. If you have changed these headers in any way or if your headers differ at all from those listed in the Header Form in the "SeaTerm.cfg Set Up Parameters" section, this is where you must incorporate those changes into the processing program. The first field is Station Prefix, and the default is **Station #,Location** (no space). The next two fields are X field prefix and Y field prefix, with defaults of **Long:** and **Lat:** respectively.

In the dialog box, there is an option to select a check-box labeled: Capture Tide Values. If tidal information has been entered into the .cnv header information, check this box and confirm or alter the four header prefixes. Note that it is alright to select this box even if the data do not exist in the .cnv files; fields will be created in the resulting .dbf table, with bad data flags ("-99999") as the values. (NOTE: The template is inconsistent with the SeaBird programs as to the spelling of the Time Since/To High prefix. As of September 2003, this is spelled the same way for all the SeaBird programs but has not been *permanently* corrected in ArcView. To correct this, the Time Since/To High prefix needs to be changed to **Time Since/To Hi**. All other headers should be correct but be sure to check.)



4. Click on **Run**.

5. If you have set the working directory, you will be directed to the folder where you moved the .cnv files after converting them from .hex files. Select all of the ".cnv" data files you wish to process (double check the whole list to make sure none are missing), then click **OK**.

You will now make a CTDMaster file and a ProfileMaster file. The CTDMaster holds information about the physical locations of the casts and cast summaries and the ProfileMaster holds all the data sets collected during each cast.

6. The prompt will then ask <u>What is the CTD master file?</u> Press **Cancel** – unless CTDmaster existed previously… This choice is available to allow the user to append single files onto an already-created CTDmaster file (for instance, if a file was initially overlooked), or to permit the creation of large combined CTDmaster files.

7. A prompt will ask for The <u>New CTD master file.</u> Make sure that the pathway is correct: (…/ocean/data/processed/YYYY/YYYYMM), then name the new file: **ctdmasterYYYYMM** (where YYYY is the year, and MM is the month of the desired data that you are processing).

8. A prompt will ask: <u>What is the Profile master file</u>? Press **Cancel** – unless Profilemaster existed previously… This choice is available to allow the user to append single files onto an already-created Profilemaster file (for instance, if a file was initially overlooked), or to permit the creation of large combined Profilemaster files.

9. The next dialog box will then ask for <u>The New Profile Master file</u> Check for the same pathway given in step #7 for the CTD master, and name the new file: **profilemasterYYYYMM**.

10. Processing should now occur and you should see many .dbf files appearing in the project window while processing is under way. After processing, all the new individual files will be automatically deleted from the project window and the new ctdmaster and profilemaster files will be in the project window. The individual processed files do still exist in the "processed" file on the network, where you can later access them if desired at the previously specified pathway.

11. **Save** project.

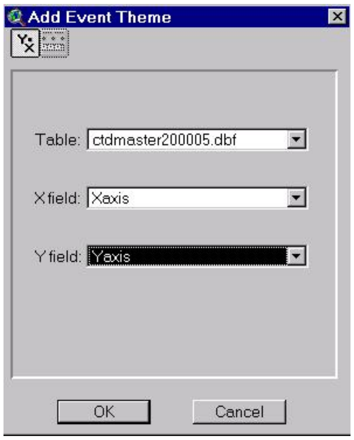
<u>Georeferencing the dbf Files</u>

1. Activate the *Oceanography Main View DD_NAD83* (or whichever view you are using to process and project your data, depending on the projection and datum of your coordinates).

2. Go to the **View** menu, then select **Add Event Theme**

3. The <u>Add Event Theme</u> dialog box will appear; make sure that the following is entered in the appropriate boxes:
   - <u>Table</u>: **ctdmasterYYYYMM.dbf** (once again, YYYYMM is just an *example* of a year and month, make sure you input the correct name of the CTD master file that you are processing)

- **<u>Xfield</u>**: Xaxis
- **<u>Yfield</u>**: Yaxis



4. Click **OK**. The ctdmaster will now be added (as a point event theme) to the list of themes at the left side of the view window

5. Go to the ctdmaster point event theme that you just created and click on the check box so that the theme is displayed.

6. Visually check that the points are in the correct location on the bay (i.e. that the coordinates in the file are correct). One good way to double check this is to highlight/activate this theme, then click on the **Zoom to Active Theme** button in the toolbar. If any points are "off in space" you will now see them. Also, count up the points you see on-screen and compare that with the number of casts you processed. Investigate any discrepancies. If the points seem to be consistently off or do not show up at all, check to see if they may have been measured in a different datum; this can be done by trying to georeference the ctdmaster in one of the other views (e.g. *Oceanography Main View DD_NAD27.)* If they have been measured in the wrong datum, see *ReprojectingLocations.doc*, found in *K:\eco_data\data\glba\Ocean\PROTOCOL\Information*.

7. Repeat the same steps again, except you will next add the Profilemaster as an event theme. Go to the **View** menu, select **Add Event Theme**

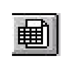
8. Make sure that the following are correct:
   - **Table**: profilemasterYYYYMM.dbf
   - **X**: X-axis
   - **Y**: Y-axis

9. Click on **OK**. The Profilemaster will now be added (as a point event theme) to the list of themes at the left side of the View Window.

10. Go to the Profilemaster point event theme that you just created and click on the check box so that the theme is displayed.

11. Again, visually check that the points are in the correct location on the bay, and that the number of points equals the number of CTD casts taken. Investigate any discrepancies. One way to check for discrepancies is to click on .dbf file in the list of themes on the left side of the window to highlight it, and then click on the Zoom to Active Theme button. If any of the points are outside of the bay, there is an error in the location data. Again, if the points seem to be consistently off or do not show up at all, check to see if they may have been measured in a different datum; this can be done by trying to georeference the ctdmaster in one of the other views (e.g. *Oceanography Main View DD_NAD27.)* If they have been measured in the wrong datum, see *ReprojectingLocations.doc*, found in *K:\eco_data\data\glba\Ocean\PROTOCOL\Information*.

12. Open both the CTDmaster and ProfileMaster dbf attribute tables. To do this, either, go to **Theme Menu → Table** or click on the attribute table icon:

    In the tables, examine the headers and all the data, both the cast information and the sensor values, to find gross errors or problems. A common missing header is *DateTime* and common empty fields are the *Station #, Location*, but be sure to check **all** of the information.

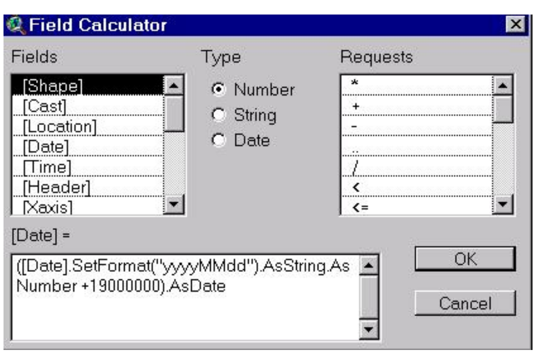
13. **Save** the project.

NOTE: If, despite all precautions, an error is discovered in the headers or data values of the CTDmaster and/or ProfileMaster, now is <u>definitely</u> the time to fix the problem – before shape files are created from these tables and further analysis proceeds. One can either fix the raw .hex and converted .cnv files and then re-create the CTDmaster and ProfileMaster tables, or one can simply edit the two .dbf tables. However, the policy at Glacier Bay is to fix both the .hex and .cnv files and then reprocess them, in order to avoid future problems if the .cnv files were ever reprocessed at a later date.

How to Edit dbf tables

It is often easier to correct the error in the .cnv and .hex files, then remake the CTDmaster and Profilemaster files. But, if an error was not caught at the .cnv stage (for example: because of a bug in the SeaSoft v4.236 software, as described in section on *Processing .hex files with SeaSoft software*, the year is not correct), the following is the procedure to correct year problems in the .dbf tables:

1. Select the dbf theme and go to the attribute table
2. Go to **Table Menu → Start editing**
3. In the table, select (click on) the header of the *Date* field
4. Go to **Field Menu → Calculate**
5. The Field Calculator dialog box will appear saying: [Date] =
   Type:
   ([Date].SetFormat("yyyyMMdd").AsString.AsNumber + 19000000).AsDate
6. Click **OK**
7. Go to **Table menu → Stop editing**.
8. Save edits? **Yes**



Creating 3-D Shapefiles

At this point, the CTD casts have been brought into ArcView and exist as point event themes made from .dbf tables; now these tables need to be converted to 3-D shapefiles (also called Point-Z files).

1. Go to the profilemaster .dbf file that you created (which was added to the list of themes on the left side of the view window) and "activate the theme" by clicking on it – it should appear highlighted or embossed.

2. Go to the **Theme** menu, select **Convert to 3D shape file**

3. It will ask you about Getting Z values: select **Attribute** in the dialog box. Click **OK**.

4. A dialog box will appear that says: Convert profilemasterYYYYMM.dbf and asks you to Choose the field that will provide the Z-values. Make sure you select ***Deps*** (which is the depth field). Click **OK**.

5. The next dialog box is called: Output Shape file name. Check that the file is being saved in the following directory: *\eco_data\data\glba\ocean\data\processed\YYYY\...* Name the file **YYYYMMocean.shp** Note once again that the YYYY represents the desired year, and MM the month that you are currently processing, and is only used here as an example. (Note in the past some of these files have been named <200001>oceanography.shp These long names can cause ArcView to crash)

6. Then add theme to view, and click **OK**. You should now see the **YYYYMMocean.shp** theme in the View Window.

7. Click on **profilemasterYYYYMM.dbf** and delete that theme from the view window by selecting the desired theme and going to the **Edit Menu** and selecting **Delete Theme**. Do not delete the profilemasterYYYYMM.dbf file from the list of Tables; simply delete it from the View. The CTDmaster can stay in the view.

8. **Save** project.

Summarizing Cast Data

During the next series of steps you will be performing some recalculations and summaries of the 3-dimensional cast data. These summaries will then be added into the CTDmaster file.

OBS Recalculation

The raw OBS sensor data values are reported as NTU's (nephelmetric turbidity units). These raw data need to be converted first from NTU's to volts, and then from volts to sediment densities. The following procedure describes this process.

Check OBS calibration parameters

Go to the attribute table of the Ocean_stations file you will be using. Check that all stations have the three correct numbers (in three separate fields) that constitute the variables in the 2^{nd}-order polynomial for OBS calibration. These variables are:

1. **Obs_VO3**: the coefficient of the 3^{rd} order term
2. **Obs_VO2**: the coefficient of the 2^{nd} order term (determines the "curviness" of the hyperbola)
3. **Obs_VO**: the coefficient of the 1^{st} order term (which can be thought of as the slope of the main regression line)
4. **Obs_Con**: a constant (the Y-intercept of the curve)

The particular values for each variable at each station can be found on the OBS sensor calibration sheets (*K:\eco_data\data\glba\Ocean\PROTOCOL\Information\OBS\OBSCalibrationSheet.doc)*. Calibration is performed by the D&A Instrument Company (the OBS sensor manufacturer), and measures the response of our particular sensor to sediments from the different locations that we sample.

Join Point-Z File to Ocean Stations

Next, join the tables for the Ocean_stations and the newly created Point-Z files through a Spatial Join:

1. Load the GeoProcessing Wizard extension, if it is not already loaded (**File Menu → Extensions**).

2. With your View active, start the GeoProcessing Wizard (**View Menu → GeoProcessing Wizard**).

3. Select **Assign Data by Location (Spatial Join) → Next**

4. In the dialog box:
   - <u>Select the theme to assign data to</u>: this is your Point-Z file YYYYMM**ocean.shp**
   - <u>Select the theme to assign data from</u>: this is the **Ocean_stations** shape file, the one that is in your View and that you checked for the OBS calibration variables. Be sure you aren't selecting an Ocean_stations file with the wrong projection or datum (i.e., UTM vs. Lat/Long, NAD27 vs. NAD83).

5. Press **Finish**. The Spatial Join will now assign data based on nearest (nearest is the only option because both themes are point themes).

6. Check that the spatial join was done correctly. A quick way to do so is to query one point per cast. For example: Query the Point-Z file (**Table Menu → Query**) where: [Deps] = -20 then click **New Set**. Now, label the theme in the View (**Theme Menu → Auto Label**) by the <u>Label Field:</u> **Stn**, which is one of the newly joined fields. Check if each cast is properly labeled with the number of the intended station. Delete all graphics when done.

The Point-Z table now displays the four OBS variable fields (at the end of the table), but the join is temporary. The next step is to perform the final OBS recalculation:

7. Unload the GeoProcessing Wizard

8. **Save** the Project

9. Now, query the Point-Z table (go to the Attribute table, then **Table Menu → Query)**

and select the fields where **[Obs] > 0**. This query removes from consideration spurious OBS sensor readings, indicated by negative numbers or 0.0. The records selected are those on which the recalculation will be performed; other records (in this case those with bad data) will have no value at all (a blank) in the recalculated field. Click **New Set**, then **Close** the query window.

10. Start editing the Point-Z table (**Table Menu → Start Editing**)

11. Add a new field (**Edit Menu → Add Field**)
    - Name: **Obs_Volts** --to convert the Obs data values from NTU's to Volts.
    - Type: **Number**
    - Width: **6** digits
    - Decimal Places: **4**

12. Add another new field (**Edit Menu → Add Field**)
    - Name: **OBS_mg** --for sediment in mg/liter
    - Type: **Number**
    - Width: **10** digits
    - Decimal Places: **4**

13. Select (click on) the new Obs_Volts field.

14. Go to the **Field Menu → Calculate** and calculate [Obs_Volts] = **[Obs] / 50**. (Here 50 is the gain setting where NTU / 50 = Volts)

15. Select (click on) the new OBS_mg field.

16. Go to the **Field Menu → Calculate** and enter the calibration formula. This formula is found on the OBS sensor calibration sheets and is also saved in a text file at *…ocean/gis/ArcView_CalculateFormulas/obs_mg_formula.txt*. The formula can be copied and pasted from this text file if entering the formula is confusing. The calibration formula is a second-order polynomial that utilizes the raw OBS sensor values plus the three numeric variables indicated by the appropriate calibration for each cast, which previously have been entered in the Ocean_Stations file. The formula is as follows:

    For CTD #1:

[1_Obs_Con] + ([1_Obs_VO] * [Obs_Volts]) + ([1_Obs_VO2] * [Obs_Volts] * [Obs_Volts]) + ([1_Obs_VO3] * [Obs_Volts] * [Obs_Volts] * [Obs_Volts])

    For CTD #2:

[2_Obs_Con] + ([2_Obs_VO]* [Obs_Volts]) + ([2_Obs_VO2] * [Obs_Volts] * [Obs_Volts]) + ([2_Obs_VO3] * [Obs_Volts] * [Obs_Volts] * [Obs_Volts])

    Click **OK.**

17. Stop editing and save the edits (**Table Menu → Stop Editing → Yes, save edits**)

18. Remove all joins (**Table Menu → Remove All Joins**)

19. Unselect records.

20. **Save** the Project.

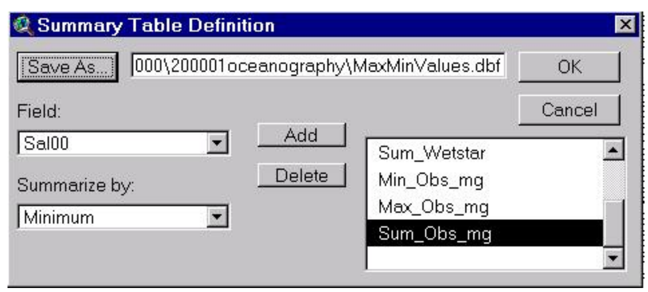
Obtaining Min/Max Values by Cast (3-D to 2-D)

Summarizing Data by Casts

1. Open the Point-Z attribute table for YYYYMMocean.shp (**Theme Menu → Table**)

2. Select (click on) the **Cast** field (this is the aggregating field).

3. Go to: **Field Menu → Summarize**.



The Summary Table Definition dialog box will appear. Click on Save As and check that the file path is correct, then name the new table: **MaxMinValues.dbf** (You may also click on the default name and remane it there, but be sure not to alter the file path, or ArcView will not be able to find the file after the project has been closed)

4. Back in the Summary Table Definition dialog box, **Add** all of the following field summarizations:
   - **Deps** (depth) by both **Min** and **Max** (first choose Summarized by Min, click Add, then do the same for Summarized by Max).
   - **PAR** (light penetration)by **Max** only
   - **T068** (temperature)by both **Min** and **Max**
   - **Wetstar** (**Fls** prior to August, 1999) (fluorescence)by **Min, Max**, and **Sum**
   - **OBS_mg** (optical backscatteance) by **Min**, **Max**, and **Sum** (use **OBS** until instrument is recalibrated)
   - **Sal00** by both **Min** and **Max**
   - **Sigma_t00** by both **Min** and **Max**

There should be 15 total.

5. Click **OK**

The new table is now created and opened (appears on-screen). The fields of this new table are named automatically and refer to the contributing fields and to how each was summarized (Max, Min, or Sum).

Joining Min/Max Results to CTDmaster

This step will perform a "one-to-one" Join of the table of results to your CTDmaster file (OR, if your naming scheme is different, to your "parent" file that contains only a single record per CTD cast).

1. Open the **attribute tables** for both **CTDmaster** and **MaxMinValues.dbf**.

2. Select (click on) the **Cast** field of the MaxMinValues.dbf table.

3. Bring forward (click on) the CTDmaster table and select (click on) the **Cast** field.

4. Go to: **Table Menu → Join**

At this point, the MaxMinValues.dbf table disappears (closes) and your CTDmaster table should now have the results, which are, however, only *temporarily* joined.

Making the Join Permanent

1. Go to: **CTD Menu → Permanent Table Join**

2. Select the fields to join: select the field **Count** plus all of the summarized variables (15 of them = 16 total) you created in the MaxMinValues.dbf table.

3. Choose Auto join all selected fields as the Method of Join. This will rename the fields by adding an underscore _ to the end (and possibly by shortening the name if it is over 10 characters).

4. Press **OK**

5. **Save the edits**. The temporary join is removed and the table is closed to editing.

6. **Save** the project.

Photic Zone Calculation

This step will perform an initial "one-to-many" join in order to calculate the depths to which usable light penetrates the water column. This calculation will then be moved back to the CTDmaster (or "parent") file.

Calculating PAR as a Proportion of the Surface Value

1. Open the attribute tables for both CTDmaster.dbf and the Point-Z table (YYYYMMocean.shp)

2. Select **Cast** field in both tables

3. Bring Point-Z (YYYYMMocean.shp) table forward.

4. Go to: **Table Menu → Join** This is a *temporary* Join only! This brings the data from the CTDmaster into the Point-Z table.

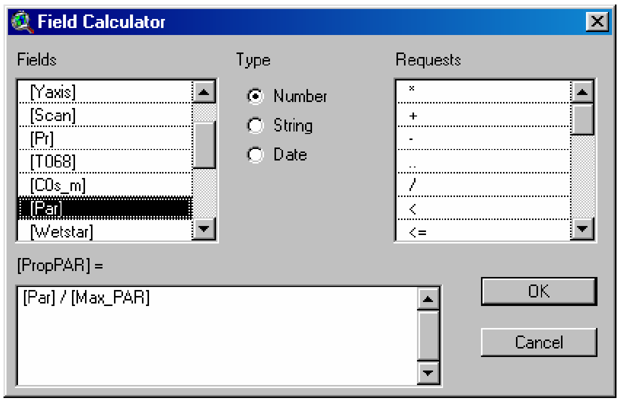
5. Start editing the Point-Z table (**Table Menu → Start editing**)

6. Add a new field to the table (**Edit Menu → Add field**)
   - Field Name: **Prop_PAR**
   - Type: **Number**

- Width: **5** digits overall
- Decimal Places: **3** decimal places

7. Add another new field
   - Field Name: **MaxDepth**
   - Type: **Number**
   - Width: **6** digits overall
   - Decimal Places: **0** decimal places

8. Select (click on) the **Prop_PAR** field header, then calculate it (**Field Menu → Calculate**) as: [Prop_PAR] = **[PAR] / [_Max_PAR]**



9. Click **OK**

10. Select the **MaxDepth** field, and calculate it as: [MaxDepth] = **[_Min_Deps]**

    NOTE: depths are negative from the 0 surface level, so the maximum depth is the minimum value of Deps

11. Click **OK**

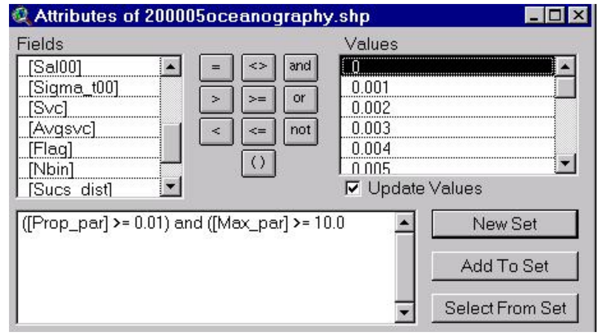
12. Stop editing the table and save it (**Table Menu → Stop editing → Yes, save edits**). Do not yet remove Joins.

13. **Save** the Project.

Transferring 1% Photic Zone Depth to the 2-D File

1. In the Point-Z table (YYYYMMocean.shp), Query the table (**Table Menu → Query**) for the depths at which light reaches 1% of its surface value (the 1% photic zone). Type: **([Prop_PAR >= 0.01) and ([Max_PAR] >= 10.0)**

   Then click on **New Set** and close the window.



NOTE: The second part of this query removes any casts that were taken at night or under very dim ambient light conditions (as sometimes happens during winter surveys). Proportional PAR (Prop_PAR) is not meaningful at night, and very dim light appears to result in an artificially shallow depth for the 1% light level. This lower limit of 10.0 micro-Einsteins per second per m^2 is somewhat arbitrary; it is based on an initial examination of the casts made during March of 2000, which included a wide variety of surface light levels.

2. Select (click on) the **Cast** field. Then go to: **Field Menu → Summarize**. The Summary Table Definition dialog box will appear. Click on Save As and check that the path of the file is correct, then name the new table: **PhoticDepth.dbf**

3. Back in the Summary Table Definition dialog box, **Add** the following field summarization:
   - **Deps**, summarized by: **Minimum**

4. Click **OK** and the new table PhoticDepth.dbf is created and opened.

5. Remove all Joins from the Point-Z table (**Table Menu → Remove All Joins**)

6. Unselect all the records in the Point-Z table (YYYYMMocean.shp) and close the table.

7. Select (click on) the **Cast** field in the PhoticDepth.dbf table

8. Open the CTDmaster attribute table (or your "parent" one-record-per-cast file), select the **Cast** field and leave this table forward

9. Join the two tables (**Table Menu → Join**). This is a *temporary* Join only! You will see blank values in the CTDmaster for any casts for which Max_PAR was less than 10.0. The PhoticDepth.dbf table disappeared (was closed by the Join).

10. Now make the Join permanent: **CTD Menu → Permanent Table Join**

11. Select only one field to join: Select the field **Min_Deps**

12. Choose **Enter New Field Name for Each** as the Method of Join

13. Press **OK**, then name the new field **PhoticDep1** (for depth of the 1% photic zone)

14. Press **OK**, and **Save the edits**. The temporary join is removed and the table is closed to editing

15. **Save** Project

Calculating Depth-Integrated Chlorophyll-a

Now we can calculate the standing crop of chlorophyll-*a* over depth increments, such as within the 1% photic zone, or within designated depths such as the surface 10m or 35m.

1. In the CTDmaster attribute table, click on (select) the **Cast** field.

2. Open the Point-Z attribute table (YYYYMMocean.shp), select the **Cast** field, and leave this table forward.

3. Join the two tables (**Table Menu → Join**). This is a *temporary* Join only! The CTDmaster table will be closed.

4. Query the Point-Z table for depths at and above the 1% photic zone depth (**Table Menu → Query**). Type: **[Deps] >= [PhoticDep1] and [Wetstar] > 0.05** (or: **[Fls] > 0.05** prior to August of 1999)

NOTE: The second part of this query removes from the analysis any casts with spurious fluorescence values, as evidenced by negative numbers or extremely small positive numbers.

5. Click **New Set** and close the window.

6. Select (click on) the **Cast** field and Summarize it: **Field Menu → Summarize**. The Summary Table Definition dialog box will appear. Click on Save As, check the file path and name the file: **DIC_Photic1.dbf** (for depth-integrated chlorophyll over the 1% photic zone).

7. Back in the Summary Table Definition dialog box, **Add** the following field summarization:
   - **Wetstar** (or **Fls** prior to August, 1999) summarized by: **Sum**

8. Click **OK**

9. The new dbf table is created and opened.

We now will repeat these steps twice more to calculate depth-integrated chlorophyll for the surface 15m and 35m:

10. Return to the Point-Z table, unselect all records, and **Query** the table for: **[Deps] >= -15 and [Wetstar] > 0.05** (or: **[Fls] > 0.05** prior to August of 1999) as a **New Set**

11. Select (click on) the **Cast** field and go to: **Field Menu → Summarize**. The Summary Table Definition dialog box will appear. Click on Save As, check the path and name the file: **DIC_15m.dbf** (for depth-integrated chlorophyll over the surface 15m).

12. Then, **Add** the following field summarization:
    - **Wetstar** (or Fls prior to August, 1999) summarized by: **Sum**

13. Click **OK** (second new dbf table opens up).

14. Return to the Point-Z table, unselect all records, and **Query** the table for**: [Deps] >= -35 and [Wetstar] > 0.05** (or: [Fls] > 0.05 prior to August of 1999) as a **New Set**.

15. Select (click on) the **Cast** field and go to: **Field Menu → Summarize**. Click on Save As, check the path and then name the file: **DIC_35m.dbf** (for depth-integrated chlorophyll over the surface 35m)

16. Next, **Add** the following field summarization:
    - **Wetstar** (or **Fls** prior to August, 1999) summarized by: **Sum**

17. Click **OK** (third new dbf table opens up)

18. Return to the Point-Z table, remove all Joins (**Table Menu → Remove All Joins**), unselect all records, and close the table.

19. In **DIC_Photic1.dbf**, select (click on) the **Cast** field.

20. Open the CTDmaster table, select the Cast field, and then Join these two tables (**Table Menu → Join**). The DIC_Photic1.dbf table is closed after this temporary Join.

21. Perform a Permanent Table Join (**CTD Menu → Permanent Table Join)** for only the Sum_Wetstar field (or **Sum_Fls** field prior to August, 1999). Choose **Enter New Field Name for Each** as the Method of Join. Name the new field **DIC_Photic1** (for depth-integrated chlorophyll over the 1% photic depth). (For Permanent Table Join instructions, see page 28.)

22. Repeat steps 19-21 for both of the other depth-integrated-chlorophyll tables (DIC_15m.dbf and DIC_35m.dbf), naming the permanently joined fields **DIC_15m** and **DIC_35m**, respectively.

23. **Save** Project.

Calculating Depth-Integrated Sediment

Repeat all the steps in the previous section (steps 1-23), this time summing **OBS_mg** rather than Wetstar, to obtain depth-integrated sediment values for the 1% photic zone and for the top 15m and 35m of the water column.

1. In the CTDmaster attribute table, click on (select) the **Cast** field.

2. Open the Point-Z attribute table (YYYYMMocean.shp), select the **Cast** field, and leave this table forward.

3. Join the two tables (**Table Menu → Join**). This is a *temporary* Join only! The CTDmaster table will be closed.

4. Query the Point-Z table for depths at and above the 1% photic zone depth (**Table Menu → Query**). Type: **[Deps] >= [PhoticDep1] and [OBS_mg] > 0.05**

5. Click **New Set** and close the window.

6. Select (click on) the **Cast** field and Summarize it: **Field Menu → Summarize**. The Summary Table Definition dialog box will appear. Click on Save As, check the file path and name the file: **DI_Obs_Pho.dbf**.

7. Back in the Summary Table Definition dialog box, **Add** the following field summarization:
   - **OBS_mg** summarized by: **Sum**

8. Click **OK**

9. The new dbf table is created and opened.

We now will repeat these steps twice more to calculate depth-integrated sediment for the surface 15m and 35m:

10. Return to the Point-Z table, unselect all records, and **Query** the table for: **[Deps] >= -15 and [OBS_mg] > 0.05** as a **New Set**

11. Select (click on) the **Cast** field and go to: **Field Menu → Summarize**. The Summary Table Definition dialog box will appear. Click on Save As, check the path and name the file: **DI_Obs_15m.dbf** (for depth-integrated sediment over the surface 15m).

12. Then, **Add** the following field summarization:
    - **OBS_mg** summarized by: **Sum**

13. Click **OK** (second new dbf table opens up).

14. Return to the Point-Z table, unselect all records, and **Query** the table for**: [Deps] >= -35 and [OBS_mg] > 0.05** as a **New Set**.

15. Select (click on) the **Cast** field and go to: **Field Menu → Summarize**. Click on Save As, check the path and then name the file: **DI_Obs_35m.dbf** (for depth-integrated sediment over the surface 35m)

16. Next, **Add** the following field summarization:

- **OBS_mg** (or **Fls** prior to August, 1999) summarized by: **Sum**

17. Click **OK** (third new dbf table opens up)

18. Return to the Point-Z table, remove all Joins (**Table Menu → Remove All Joins**), unselect all records, and close the table.

19. In **DI_Obs_Pho.dbf**, select (click on) the **Cast** field.

20. Open the CTDmaster table, select the Cast field, and then Join these two tables (**Table Menu → Join**). The DI_Obs_Pho.dbf table is closed after this temporary Join.

21. Perform a Permanent Table Join (**CTD Menu → Permanent Table Join)** for only the Sum_OBS_mg field. Choose **Enter New Field Name for Each** as the Method of Join. Name the new field **DI_Obs_Pho** (for depth-integrated chlorophyll over the 1% photic depth). (For Permanent Table Join instructions, see page 28.)

22. Repeat steps 19-21 for both of the other depth-integrated-chlorophyll tables (DIC_15m.dbf and DIC_35m.dbf), naming the permanently joined fields **DI_Obs_15m** and **DI_Obs_35m**, respectively.

23. **Save** Project.

Now the initial summarization of an oceanographic survey's data is complete (congratulations!) These data, summarized by cast, can now be manipulated in ArcView to create both contour slices (or plots) and 3-D scenes of the data, where features will appear vertically as if through the water column.

The cast summaries can also be exported to Excel and printed:

Exporting Cast Summaries for Printing

For examination and to file in the notebooks of oceanographic print-outs:

1. In the CTDmaster (or "parent") table, select all records.

2. From the **CTD Menu**, choose **Export Selected Record to Excel.**

3. The first time this function is run on a computer, it will ask for the location of Microsoft Excel on that computer. Navigate to the executable file for Excel and select it (double-click it or **OK**).

4. The Excel program will be opened, a new Excel worksheet will be created, and a dialog box will ask which fields to export.

5. Select all of the fields, and click **OK.**

6. The values are exported, and the active window returns to ArcView. Excel remains in the background.

7. Print the Excel worksheet. Saving the table is probably not necessary, because it is very quick to re-create, and may change if more values are summarized for that survey.

3-D Scene Creation

Next you will create 3-dimensional scenes of your data in order to visualize the CTD casts down through the water column in Glacier Bay:

1. Unlike a normal View Window, a 3-D Scene has 2 separate windows. One window is the list of themes and the other window is the 3-D map. When open, the 3-D map window ALWAYS floats on top of all other windows. Although you can select other windows or items in other windows, the 3-D map window will still be on top. To fully see the windows beneath, you must close the 3-D Scene. To close a 3-D Scene you need to close the 3-D Scene's theme list window (click once on the "x" in the upper right corner); both of the 3-D Scene windows will then close.

2. Copy the Point-Z shape file (YYYYMMocean.shp) from the View Window to the 3-D Scene. To do this, activate the Main Oceanography view and highlight the

YYYYMMocean.shp 3-D file that was created from the profile master previously. Go to the **Edit Menu** and select **Copy Theme**.

3. Scroll down to the 3-D scenes file at the bottom of the projects menu Open the 3-D Scene that is appropriate for your data (e.g., decimal degrees, NAD83). The 3-D Scene is empty except for the two themes ocean_stations and Noaa_coast. To open a 3-D Scene, in the Project Window: click ONCE (if you double-click then a new 3D Scene is created) on "3D Scenes" from the vertical icon list on the left (the bottom icon), then double-click on the file which now shows up in the Project Window.
   Then activate the 3-D view: go to the **Edit Menu** and select **Paste**. This should place the 3-D shape file in the 3-D scene.

4. For this 3-D scene, you need to alter the Theme Properties of the YYYYMMocean.shp so that features will be displayed 3-dimensionally on the map (i.e. the features will appear vertically as if through the water column). To do this, activate (click once) on YYYYMMocean.shp and go to the **Theme Menu → 3D Properties**.

5. In the dialog box that opens up, the first portion of the box, <u>Assign base heights by</u>, should be set to "**Existing 3D Shapes**" (select this option if it is not already selected).

6. The **Z factor** should be set to **100.0** (type **100** in the box).

7. In the next part of the dialog box, called <u>Offset heights by value or expression</u>, do not enter anything (the default in the box should be **0**).

8. In the third portion of the dialog box regarding the extrusion of features, <u>Extrude features by value or expression</u> should be set to **100** (type **100** in the box). <u>Extrude by</u> should be set to **Adding to base height** (select this option from the pull-down list).

9. Do not alter any of the "Advanced…" settings.

10. At the bottom, click **Apply**, and then once it has processed that action click **OK**, which will close the dialog box.

11. Now make 5 more copies of this 3-D theme in the 3-D Scene, so there will be a total of 6 identical 3-D themes (or, one for each type of CTD data). To do this, activate the theme that you wish to copy and go to the **Edit Menu** select **Copy Theme** and then **Paste**. You can now continue to paste until you get 6 total 3-D themes. The 5 new 3-D themes should now (already) have their 3D Theme Properties set in the exact same way as the first one (that is why we set the 3D Theme Properties before copying and pasting the themes).

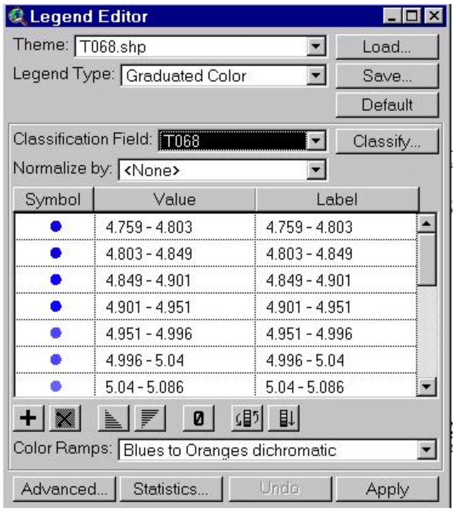
12. Rename all 6 of the 3-D themes so that each one reflects one parameter measured by the CTD (i.e. temperature, salinity, density anomaly, photosynthetically active radiation, fluorescence, and turbidity). The correct 3-D theme names should be, respectively:
    - T068_YYYYMM (T068 is temperature)
    - SAL_YYYYMM (SAL is salinity)
    - SigmaT_YYYYMM (Sigma-t is density of the water)
    - Prop_PAR_YYYYMM (PAR is light penetration)
    - WetStar_YYYYMM (FLS in projects before August 1999) (WetStar is fluorescence)
    - OBS_mg_YYYYMM (or use OBS until instrument is recalibrated) (OBS is optical backscatterance)

    To rename a 3-D theme select the theme that you wish to rename, go to **Theme Menu → Properties** (*not* 3-D properties). In the properties dialog box, the first box is the **Theme Name--** this is where you can change the name. Recall that in the above example, T068_YYYYMM - YYYY represents the year, while MM represents the month of the project that you are creating.

For each 3-D theme the values of the features now need to be displayed on the map. To do this, the legend for each theme will need to be set to display the values for the appropriate parameter in graduated colors.

13. Activate one 3-D theme, go to the **Theme Menu → Edit Legend** (or you can double click the desired 3-D theme, and the Legend will come up).

14. The Legend Editor dialog box opens:



15. For **Legend Type** choose **Graduated Color**.

16. The **Classification Field** should be the parameter that this theme has been named (e.g. select T068 from the drop-down box if this is the 3-D theme named T068_200001).

17. Then click on the **Classify** button, and in the dialog box that appears select **Natural Breaks** as the **type**, and enter 24 for the **number of classes**. Click **OK**.

18. For **Color Ramps** select the following colors for the various parameters so that all the projects are visually similar:
    - **T068: Blues to Oranges Dichromatic**
    - **Sal00: Blues to Oranges Dichromatic**
    - **SigmaT: Blues to Oranges Dichromatic**

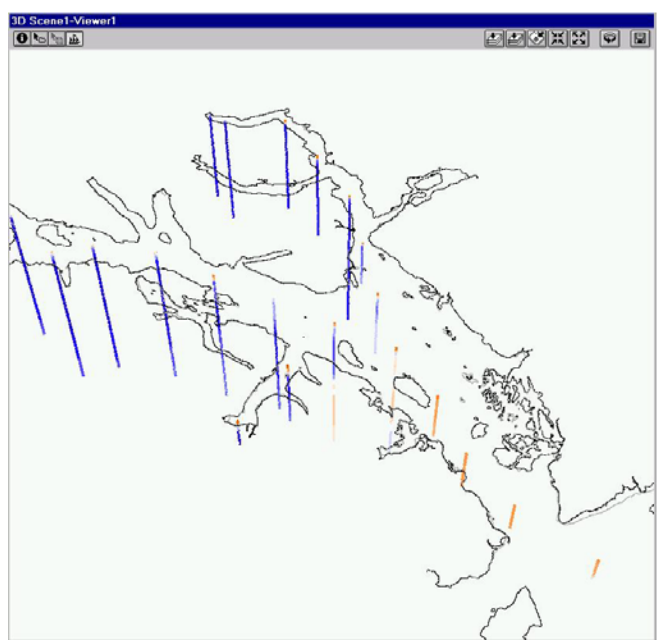
    ALL THREE of these should be ramped so that Blue represents low numerical values and Orange represents high numerical values (i.e. Blue would be low salinity, low temperature, and low density anomaly).

    - **Prop_PAR: Yellow to Green to Dark Blue** (Blue should represent low and Yellow high)
    - **Wetstar** (or **Fls** before August,1999)**: Purples to Greens Dichromatic** (Purple should represent low and green high)
    - **OBS_mg: Gray Monochromatic** (Pale Gray should represent low numerical values and dark gray high)

    To reverse the direction of the color ramping (i.e. to alter whether one end of the color scale represents high or low numerical values), click the button in the row of buttons beneath the legend values that has a figure of two arrows pointing in opposite directions around a graduated bar. Clicking this button once will reverse the color ramping. Clicking again returns the ramp to the original setting. For example, reversing the direction of the color ramping must be done when setting the Prop_PAR parameters.

19. Click **Apply** and close the Legend Editor Window.

20. Unselect all the themes, selecting only one at a time so only that one displays. For each parameter, look at the map and move it around and make sure that the values being displayed seem to make sense (i.e., for temperature, blue ought to generally be on the bottom, except at the surface near the tidewater glaciers or on the surface during winter. For Prop_PAR the yellow ought to be at the surface, and for density anomaly (SigmaT) orange should ALWAYS be at the bottom, etc.).



Three-dimensional view of temperature data.

21. To hide or show the legend, click on the appropriate theme to highlight it. Then, go to **Theme → Hide/Show Legend**.

22. Click on the "ship" tool (the fourth button on the upper left side of the 3D scene View) Right clicking on the map of the Bay zooms the view, left clicking rotates the view and clicking left and right together pans the view

23. Visually check for consistency with expected (or normal) data patterns for that time of year for all six parameters. This step is where we found 1998's odd temperature inversion, with warm temps (oranges) at the bottom of the basins. This step is also where we should catch some obvious errors. Be sure to note these errors so they can be investigated for abnormal patterns or equipment failure.

24. When done with 3-D Scene creation, save and close the 3-D Scene so that it is not floating on top of all the other windows any more.

25. **Save** the project.

Contouring Profile Slices (i.e., "Plotting")

Here, several profiles are going to be created using the three-dimensional data created. There are 5 different sections of the bay that are contoured (also see Appendix G for contour locations):

- Main Bay-West Arm (using the Lower Bay stations 00 to 04 sampled at slack high and stations 05 – 12 and station 21)
- East Arm (using stations 04 at slack high and stations 13-20)
- Cross Bay (Geike-Muir Sill) (using stations 23, 22, 05,13, and 14)
- Lower Bay – Slack High (using stations 00 – 04 sampled at slack high)
- Lower Bay – Peak Flood (using stations 00-04 sampled at peak flood)

Each contour will then be used to profile the CTD-measured parameters (T086, Sal00, SigmaT, Prop_PAR, WetStar (Fls before August 1999), and OBS_mg (OBS, if instrument not calibrated))

1. In the Oceanography Main View window (whichever one you are using for your data - Main View DD Nad 83 for Glacier Bay data), open the attribute table for the Oceanog_line theme. (To do this: click once on the Oceanog_line theme, then **Theme Menu → Table**).

2. Make sure none of the polylines are selected, and then select only the Main Bay-West Arm polyline, which should become highlighted in yellow both in the attribute table and on the map in the View window.

You can select the polyline on the map in the View window, but having the attribute table open makes it clear and obvious that only one polyline is selected, and which one it is. We will now contour profile slices for all six CTD-measured parameters along this one particular polyline before selecting another polyline to contour. You cannot contour along multiple polylines at once.

3. Now select the 3-D shape file YYYYMMocean.shp

4. On the map in the View window, select ONLY THOSE POINTS of this theme that should be profiled along the already-selected polyline.

To do this, click on the Select Feature Tool, which is in the upper left hand corner on the screen; it is a button on the bottom tool bar, left side, with an open square icon. After selecting this tool, you can select the points that you want with the mouse. To select multiple points, hold down the shift key while you are selecting. These points will now appear highlighted in yellow on the map in the View window. In the first instance, for the Main Bay-West Arm polyline, you should select only the 14 stations that lie along this polyline (stations 00 through 12 plus station 21). There are a few stations at the mouth of the bay that are duplicated at different stages of the tide cycle. If you include both casts for each of the duplicated stations, the contouring will be confused and inaccurate. For the Main Bay contour, select those casts that were taken at the **slack high portion of the tide**. These casts, along with the others needed for this contour, can be selected using a Query. Selection via Query should also be done when selecting the stations for the two Lower Bay contours. One Lower Bay contour should be made with the casts taken during the slack high tide, and another with the casts taken during the peak flood current portion of the tide.

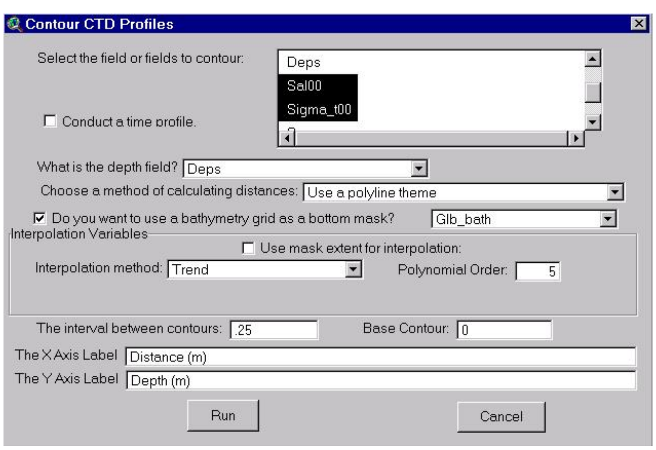
With the survey polyline and the 3-D shape (Point Z) files properly set up, the processing can now begin.

5. With the 3-D shape file YYYYMMocean.shp still selected in the View window, go to the **CTD Menu → Create a profile graph…**.

6. The Contour CTD Profiles dialog box will appear. First, select the parameters (= the fields) to be contoured. You can contour either one field or multiple fields at a time, but it saves time to process more than one field at once. The fields T068, Sal00, and SigmaT can be contoured together because they all can be processed with the same contour interval. However, Prop_PAR, Wetstar (Fls before August, 1999), and OBS_mg (or OBS) should each be processed individually. The first time through, select **TO68**, **Sal00**, and **SigmaT** (to select multiple fields press the Shift button while clicking on the fields in the drop-down box).

7. Next, select the **Depth Field**, which is normally **deps**, but if your data structure is different than our standard one you can select a different field from the drop-down box.

8. Select a method of calculating distance, which is the distance plotted along the x-axis in the final contour graph. Because we are using a polyline from the polyline theme Oceanog_line, select **Use a polyline theme** from the drop-down box.



NOTE: Although not done for the standard Glacier Bay oceanography project, there are two other alternatives possible here. You could have drawn a graphic (line) onto the map in the View window and selected it prior to initiating this contouring process; in this case you would select **Use a selected line graphic** and the final contour graph would run along that line graphic. The other alternative is to allow the program to **Use actual distance**, in which a straight line is drawn between each cast or data point. Intervening bathymetric features such as islands or trenches/mounts are reasons not to choose this option; we do not use this option in the standard oceanographic project because we are creating a longitudinal profile down Glacier Bay and its arms, which is not necessarily represented by straight lines drawn directly between the survey stations.

9. Put a check mark in the box next to: Do want to use a bathymetric grid as a bottom mask?

10. Select **Glb_bath83** as the mask from the drop-down box.

11. Do **NOT** select "Use mask extent for interpolation," so that the interpolation does not extend beyond the edges of the sampled regions.

12. For the **interpolation method**, select **Trend** from the drop-down box.

13. The **Polynomial Order** should be **5**.

NOTE: This method of interpolation has been selected for the standard oceanographic projects based not on theoretical considerations but based on numerous empirical trials in which the 5th order polynomial trend produced the smoothest, most accurate, and most consistent trend surface Grids between casts.

14. The interval between contours should be:
    - **0.25** for **T068**, **Sal00**, and **SigmaT**. This is why these three parameters can be processed together.
    - For **Prop_PAR** use a contour interval of **0.1**
    - For **Wetstar** (**Fls** prior to August, 1999), the interval should be **5** for surveys during March through October and **0.5** during the winter (contour intervals may need to be increased if the contour lines are too close together).
    - For **OBS_mg** (or **OBS**) use a contour interval of **5** or **10**.

These intervals have been selected based on the appearance of the resulting contour graphs, so that enough information is presented but not so much that the graph is unreadable. The contour intervals may be adjusted (i.e. a parameter may need to be re-contoured with a different interval) by the user once the final graph is produced and examined.

15. The **base contour** should be **0**.

16. The labels of the x and y-axis can be changed, but the defaults are fine as: **Distance (m)** and **Depth (m)**.

17. Click on **Run** to initiate the processing.

18. A dialog box will prompt you for which line theme to use for the distance calculation. Select **Oceanog_line_nad83.shp** from the drop-down box and then click **OK**.

19. If this is the second time (or later) you have contoured profiles from the 3-D shape file (YYYYMMoceanography.shp) you will next see a dialog box asking <u>Field Sucs_Dist already exists. Overwrite existing values?</u> This is fine, so click **Yes**. You will not encounter this question the first time you contour the shape file. If a second dialog box with a similar question appears immediately afterwards, click **Yes** again to completely overwrite the existing fields. …Some processing will now occur...

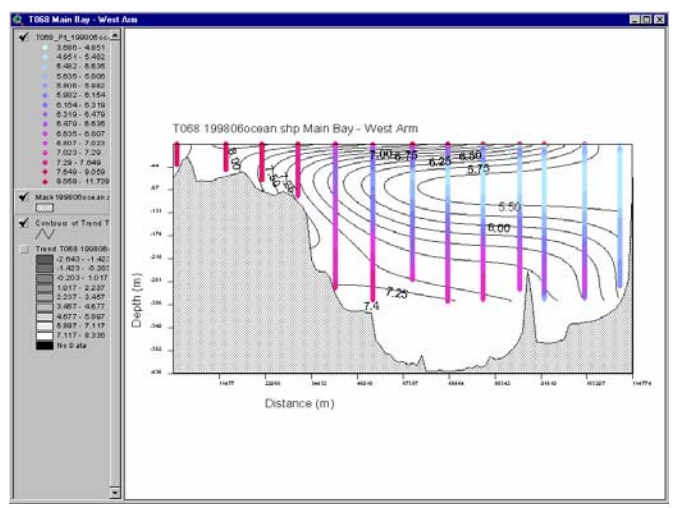
20. The next dialog box asks for the name of the <u>Output Bathymetry Mask</u>. Renaming the masks is time-consuming and isn't really necessary, so permit the automatic numbering scheme to name the mask. Usually the first mask run is named Mask<###>.shp and successive masks will iterate the number so that the second mask will be Mask<###+1>.shp, etc.

    MAKE SURE that this file will be written to the correct folder (in the processed data folder, in the month you are working on). If it is ***not* pointed to the right location, click on **Cancel** now and change the project's working directory; this is done by setting the working directory, which is explained above in the *GIS Data Processing* section. Click on **OK** if the file name and destination are correct.

21. The next dialog box asks for the name and destination of the output transposed point theme. Again, permit the automatic numbering scheme to name this file; the name will include the name of the parameter being contoured (such as t068), an underscore, then maybe a "p" to indicate this is a <u>p</u>oint theme (there will be no "p" for parameters with longer names, such as sal00 and sigmaT), then a number, which is incremented up when later contours of this same parameter are created. Again check that the destination folder is correct. Click on **OK**. …Some more processing will occur…

22. The next dialog box will ask you for output grid specifications. Make the output grid the same extent as the main oceanography 3-D shape file by choosing the output grid extent from the drop-down box to be: **Same as t068_Pt_YYYYMMocean.shp** (the parameter shown will change depending on which field is currently being contoured). Do not bother with the other input options in this dialog box (Output grid cell size, Number of Rows, Number of Columns). Click **OK**. …More processing will occur...

23. The next dialog box asks for the name and destination of the output contour file. Once again permit the automatic numbering scheme to name this file, which will be named similarly to the output transposed point theme except it will have a "c" instead of a "p" to indicate that it is a <u>c</u>ontour file (except, again, the parameters with longer names will not have a "c" in the file name).



Example contour view, showing June, 1998's intrusion of hot saline water into the deep basin of Glacier Bay.

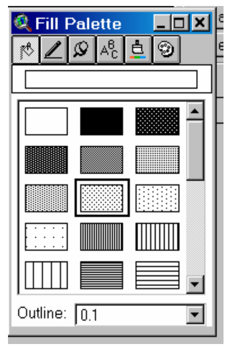
24. If you are contouring multiple parameters at once, you will see a dialog box requesting the file name and destination of the next parameter's output transposed point theme, then its grid specifications, and finally its contour file name and destination. Only a single mask will be used by all the parameters that are contoured in one batch.

25. When all parameters have been contoured (i.e., when processing is complete), a new View Window will open up for each parameter .To aid viewing and printing, change the bathymetry mask's default black color to an opaque stippled pattern (e.g., in the fill palette window, choose 3rd row, middle column pattern), and place it on top of the contour lines.

Editing of Contour Files

Some contour profiles are very large when they are created, with numerous extraneous contours that are unrelated to the actual data. The usual cause is that the procedure mathematically extrapolates into areas with no data. Each contour profile created should be checked for extra contour lines. These extraneous contour lines should be edited out, so that the project size, and the time it takes it to load it, are kept to a minimum.

1. Uncheck the Mask theme by clicking on the checkmark to the left of the theme name.
2. To begin editing, the contour file that you want to edit must be selected (highlighted or "embossed" in the View Window).
3. Then go to **Theme Menu**, and select **Start Editing**. Use the select feature tool (button) on the tool bar to select and visualize what to delete. Delete any extra contour lines, spurious "cells" (circles) of contours, etc.
4. For the Glacier Bay East Arm contours, the bathymetric mask needs to be edited since the glacier has receded. Highlight the mask file, click on the vertex-edit button and select all mask points. Pull the points on the right side over to the right border to correct the mask.
5. When done editing, return to **Theme Menu**, select **Stop Editing**, and **Save Edits**. Delete all contour labels (numbers) corresponding to the deleted contours and delete contour labels that appear in the mask.
6. Activate the mask theme, go to the **Theme Menu → Edit Legend** (or you can double click the theme, and the Legend will come up).
7. Double click on the Legend symbol to edit it.
8. The Fill Palette window opens. Click on the stippled square, second column over, third row down.



9. Close the Fill Palette window and click the **Apply** button at the bottom right corner of the Legend Editor window.
10. Close the Legend Editor Window.
11. For the Lower bay stations, the names of the views need to be changed to differentiate between the tidal cycles. This needs to be done in two places:

    a. In the contour view window, use the arrow button and double click on the name. This will open up a Text Properties window. In that window, add either Peak Flood or Slack High to the title.

b. Now, go to **View → Properties** and added either Peak Flood or Slack High to the name in the view properties window. Close the window

12. **Close** the contour window and **save** the project.

The project is now finished.

After all files have been processed, open the **CTD_Process_Log.xls** (located on the network: *k:\eco_data\data\glba\ocean\data\processed*) and update the status of processing for each of the cast files. Additionally, note each day's progress in the **ProjectLog.doc** (located on the network: *k:\eco_data\data\glba\ocean*) so that different changes or data quirks can be recorded. These data quirks should also be noted in _README.txt documents included in the processed data folders.

Joining all Oceanographic Data

The "master" ArcView oceanography databases, named All_CTDmaster, All_Profilemasters and All_Oceanmerge, in the Processed Data Folder, with the following path: *Science(K:)\eco_data\data\glba\ocean\data\processed\AllMaster\all_masters.apr*

These "master" files contain ALL of the CTD casts ever uploaded by the Glacier Bay Field Station, from any CTD for the oceanographic monitoring survey. Because these are the "master" files adn are very large, correcting then is difficult and time consuming, and subjects the files to further potential errors. Therefore, do not add a new batch of CTD profiles to the all_masters project until these new profiles have been checked by careful examination of the depth profiles and the projects themselves. New files should be added annually after they have been looked over for the annual report to the Glacier Bay National Park.

To confirm that data files are "good" and therefore are ready for inclusion in these two "master" files, they must be run through the ArcView processing and contouring steps described in this protocol and saved to a database file specific to the particular cruise, or project. Only good data should be added to the Master database file, some make sure you have done good error checking during the GIS processing steps.

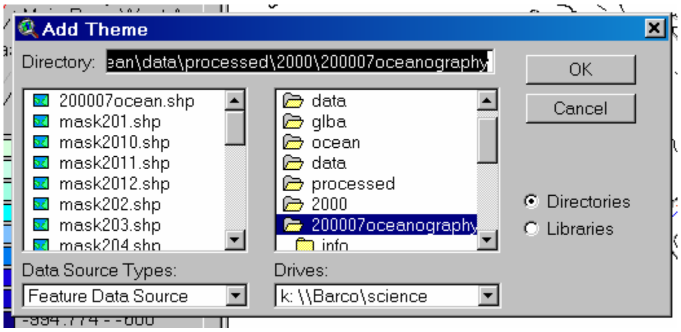
Data are added to the All_Ocean, All_CTDmasters and All_ProfileMasters tables by utilizing the **Merge** Command in the **CTD Menu**, accessed from the View Window. Select the themes you wish to merge from the pull-down list. The first theme in the selected list determines the fields that are used in the merge. Due to variation between surveys (in the instruments used and in other variable fields), care must be taken to insure that fields are labeled exactly the same or that a blank field with the alternative field name exists in the first file.

NOTE: Because merging the files can be time consuming and has a high risk of introducing errors, files should only be merged on an annual basis, after the projects have been checked for errors. Files should be merged in groups to make this process more efficient.

To join the point-z files:

1. Open the all_merge.apr (*K:\eco_data\data\glba\Ocean\DATA\processed\AllMaster)*

2. With the Oceanography Main View DDNAD 83 window highlighted, click on **View → Add Theme**.
3. Navigate to the project folder that contains the point-z file, YYYYMMocean.shp needing to be added to the master files.
4. Highlight the file and click **OK.**



5. The new theme should appear on the top of the list of theme's in the main view window.
6. Once all the point-z themes you wish to add have been added, be sure to double check the master theme that has the correct column headers in it's .dbf table is at the top of the list of themes. To add new columns to the master file:
   a. Open the attribute table for the master file: **Theme** menu **→ Table**
   b. Open the table for editing: **Table** menu **→ Start Editing**
   c. **Edit** menu **→ Add Field**
   d. When adding new fields be sure to add the correct number of decimal places and digits, and most importantly, the correct spelling of the name of the field header.
   e. When finished adding new fields to the master files, **Table** menu **→ Stop Editing**. Save Edits **→ Yes.**
7. Be sure the Main View Window is selected. Click on **CTD** menu **→ Merge Themes**
8. Highlight the themes you want to merge together and click **OK.**
9. A window will open up asking to have a name designated for the merged file. Check to make sure the file path is correct. Click **OK**. Note: with some of the bigger files, it take up to 30 minutes to merge the files.
10. A window will open, inquring about adding the newly merge .shp file to the view. Click **Yes**.
11. A second window will open up and ask you to designate the view you want to have the .shp file. Click on Oceanography Main View DD NAD 83 (or the view you have been using). Click **OK**.
12. Open the attribute table for the newly created merge to check to make sure the data and data fields are correct and included in the table. Close the table when done checking.
13. Delete the unmerged themes and the original All_Oceanmerge.shp. **Save** the project.
14. Open the Source Manager, **File** menu **→ Manage Data Sources**. Check that the file path is correct.
15. Rename the newly created merge .shp to All_Oceanmerge. Then close the Source Manager Window.
16. **Save** the project.

To Join CTDmaster.dbf and Profilemaster.dbf files to the All_CTDMaster file

1. Open the all_merge.apr (*K:\eco_data\data\glba\Ocean\DATA\processed\AllMaster*)
2. Highlight the project window and select the **Tables** icon.
3. Click on the **Add** button.

4. The Add Table window will open up. Navigate to the project folder that contains the CTDmaster and Profilemaster that is to be merged to the master file. Click on the files; holding down the Shift key allows for more than one file to be chosen. Click **OK.**
5. Once all the files have been created as .dbf. table, they should be opened as Event Themes. Activate the *Oceanography Main View DD_NAD83* (or whichever view you are using to process and project your data, depending on the projection and datum of your coordinates).
6. Go to the **View** menu, then select **Add Event Theme**
7. The Add Event Theme dialog box will appear; make sure that the following is entered in the appropriate boxes:
   - Table: **ctdmasterYYYYMM.dbf** (once again, YYYYMM is just an *example* of a year and month, make sure you input the correct name of one of the CTD master file that you are merging)
   - **Xfield**: Xaxis
   - **Yfield**: Yaxis
8. Click **OK**. The ctdmaster will now be added (as a point event theme) to the list of themes at the left side of the view window
9. Repeat the same steps again, except you will next add the Profilemaster as an event theme. Go to the **View** menu, select **Add Event Theme**
10. Make sure that the following are correct:
    - **Table**: profilemasterYYYYMM.dbf
    - **X**: X-axis
    - **Y**: Y-axis
11. Click on **OK**. The Profilemaster will now be added (as a point event theme) to the list of themes at the left side of the View Window.
12. Continue in this manner until all the CTDmaster and Profilemaster files that you wish to merge have been added to the view.
13. Once all the themes you wish to add have been added, be sure to double check the master theme that has the correct column headers in it's .dbf table is at the top of the list of themes. To add new columns to the master file:
    a. Open the attribute table for the master file: **Theme** menu → **Table**
    b. Open the table for editing: **Table** menu → **Start Editing**
    c. **Edit** menu → **Add Field**
    d. When adding new fields be sure to add the correct number of decimal places and digits, and most importantly, the correct spelling of the name of the field header.
    e. When finished adding new fields to the master files, **Table** menu → **Stop Editing**. Save Edits → **Yes.**
14. Be sure the Main View Window is selected. Click on **CTD** menu → **Merge Themes**
15. Highlight the themes you want to merge together and click **OK.**
16. A window will open up asking to have a name designated for the merged file. Check to make sure the file path is correct. Click **OK**. Note: with some of the bigger files, it take up to 30 minutes to merge the files. You will have to do this twice, once for the CTDmaster and once for the Profilemaster.
17. A window will open, inquring about adding the newly merge .shp file to the view. Click **Yes**.
18. A second window will open up and ask you to designate the view you want to have the .shp

file. Click on Oceanography Main View DD NAD 83 (or the view you have been using). Click **OK**.

19. Open the attribute table for the newly created merge to check to make sure the data and data fields are correct and included in the table. Close the table when done checking.
20. Delete the unmerged themes and the original All_Oceanmerge.shp. **Save** the project.
21. Open the Source Manager, **File** menu → **Manage Data Sources**. Check that the file path is correct.
22. Rename the newly created merge .shp to All_Oceanmerge. Then close the Source Manager Window.
23. **Save** the project.

A _README.txt file of the last data merge can be found in the folder: K:\eco_data\data\glba\Ocean\DATA\processed\All Master. Any other updates to the all_merge.apr should be noted here.

DATA MANAGEMENT

This section is an overview of where various types of oceanography-related files and data are stored.

A directory called Ocean, located on the Glacier Bay National Park computer network (*K:\eco_data\data\glba\ocean*) contains all oceanographic data and information files related to the oceanographic project, including raw/converted data, logistics, protocol, datasheets, base GIS layers, and analyses.

Raw Data

Raw CTD data are acquired in the field, initially uploaded to a portable computer while on board the field vessel, and/or uploaded directly to the Glacier Bay National Park computer network in a .hex (ASCII) file format.
One file is made and uploaded for every cast, and is labeled with the CTD number, dump number, and individual sequential cast number (See the *Raw Data Upload* section). Raw data in .hex format should be stored in the following raw data directories, which are organized first by CTD #, then by year, and finally by cruise date (or project name):

<u>For CTD 1</u>
E.g.,
Science (K:)\eco_data\data\glba\ocean\DATA\Raw_CTD\CTD1_RAW\<1998>\<199810>oceanography\c1003302.hex

<u>For CTD 2</u>
E.g.,
Science (K:)\eco_data\data\glba\ocean\DATA\Raw_CTD\CTD2_RAW\<1998>\<199810>oceanography\c2003706.hex

See the ***Field Operations*** section for an explanation of naming casts, .hex files and .cnv files. Once raw .hex files are stored in these directories, they should <u>never</u> be moved! These are the permanent raw data files. Any data processing should be performed on **copies** of these files if moving the files is required.

Additionally, the .CON files made after each CTD recalibration are stored in both the main raw data folder for each CTD (e.g. Science (K:)\eco_data\data\glba\ocean\DATA\Raw_CTD\CTD2_

RAW\) ***and*** each project folder (e.g. Science (K:)\eco_data\data\glba\ocean\DATA\Raw_CTD\CTD2_RAW\<1998>\<199810>oceanography\)

Processed Data

Once the raw data have been initially processed by the SeaSoft software, the resulting files have the ".cnv" extension. These converted files from both CTD 1 and CTD 2 should be stored in processed data directories, which are organized first by year (not by CTD number) and then by cruise date (month) and project name. An example is: Science(K:)\eco_data\data\glba\ocean\data\processed\<1998>\<199810>oceanography\c2003706.cnv

Analyzed Data

Data analyzed using GIS Arcview applications should also be stored in the processed data files. During processing, you can set the working directory to automatically deposit these files in the correct processed file according to year and month. For both CTD1 and CTD2, the processed dbf files, and the apr project with all corresponding files should be stored in the same folder. An example is:

Science (K:)\eco_data\data\glba\ocean\data\processed\<1998>\<199810>oceanography\ <199810>ocean.apr

Documentation & Protocols

This manual (Microsoft Word 2000 file) resides in: Science\eco_data\data\glba\ocean\protocol**oceanography_handbook.doc**

In addition, an Adobe Acrobat (.pdf) version of this handbook resides in the same directory, and is available over the Internet at: http://www.absc.usgs.gov/glba/index.htm

When the protocol is updated, the old version of the protocol should be saved in *K:\eco_data\data\glba\Ocean\PROTOCOL\Old Protocol Versions* and the updates should be noted in the *ReadMe*protocol_updating.txt located in *K:\eco_data\data\glba\Ocean\PROTOCOL*.

Archiving Written Data

All original data sheets from the oceanography survey project are stored in several notebooks in the data cabinet in the USGS office, where all Glacier Bay Field Station research project data are stored.

Archiving Digital Data

Save the raw data (.hex files) onto floppy disks and place them in the USGS data cabinet. Copy the entire **Ocean** folder (contains all raw and processed data, protocols, etc.) to CD-ROM's and archive them off-site at least once per year.

REFERENCE LIST

Hooge, P.N. and E.R. Hooge. 2000. The Oceanographic Analyst Extension to ArcView GIS. USGS Alaska Biological Science Center. http://www.absc.usgs.gov/glba/gistools/

Hooge, P.N. and E.R. Hooge. 2002. Fjord Oceanographic Processes in Glacier Bay, Alaska. Report to the National Park Service. USGS Alaska Science Center, 142 pages.

APPENDICES

Appendix A: Oceanographic Station Locations (NAD 83)

Location and average depths of oceanographic stations in Glacier Bay National Park, Alaska

Station Number	Latitude (Nad83)	Longitude (Nad83)	Description	Average Depth (m)
STN00	58.326735	-135.875108	Icy Strait	53
STN01	58.412562	-135.99511	Mouth of Glacier Bay	62
STN02	58.490056	-136.05178	Sitakaday Narrows	93
STN03	58.571715	-136.065116	SE of Willoughby Island	112
STN04	58.650872	-136.115113	N of Drake I and N of Marble I.	288
STN05	58.704199	-136.233473	Between N Drake and SW Tlingit PT	366
STN06	58.759193	-136.341762	E of Hugh Miller Inlet	288
STN07	58.8111687	-136.474331	N of Blue Mouse, W of Tidal Inlet	435
STN08	58.865018	-136.593433	S of Rendu Inlet	426
STN09	58.897515	-136.736769	SE of Russell Island	377
STN10	58.899179	-136.840103	N of Reid Inlet	361
STN11	58.972079	-136.916778	Tarr Inlet	338
STN12	59.033341	-137.018446	Head of Tarr Inlet	288
STN13	58.73253	-136.113453	SE of Tlingit PT, NW of Sturgess	146
STN14	58.79169	-136.108456	Muir Sill	81
STN15	58.815021	-136.105123	**NOT A STATION ANYMORE (**W of Muir PT)	116
STN16	58.895845	-136.093461	E of Hunter Cove	313
STN17	58.975001	-136.136797	E of Westdahl Pt	212
STN18	59.0500003	-136.18513	S of Riggs, NW of McBride	214
STN19	59.07168	-136.336789	Muir Inlet	225
STN20	59.086017	-136.370953	Head of Muir Inlet	179
STN21	59.047695	-137.057739	Marjorie/Grand Pacific	195
STN22	58.657692	-136.36543	Entrance to Geikie	155
STN23	58.598125	-136.506455	Head of Geikie	66

Appendix B: Oceanography Conversions

General Conversions

1 fathom → 2 yards → 6 feet → 1.83 meters
1 meter → 3.28 feet 1 foot → 0.305 meter

1 kilometer → 0.62 miles → 0.539 nautical mile
1 nautical mile → 6067.115 feet → 1852 meters → 1.15 miles
1 statute mile → 5280 feet → 880 fathoms
1 knot → 1 nautical mile/hour → 6067 feet/hour

1 nautical mile → 1/60th degree latitude → 1 minute latitude
1 degree → 60 minutes → 3600 seconds

Lat/Long Calculations

Lat/Long → Decimal Degrees (make sure GPS is measuring in the correct waypoint datum [NAD 83 or NAD 27])
Multiply minutes by 60, which equals seconds.
Next add to the number of seconds to above the number to obtain total seconds.
Divide total seconds by 3600
Add to degrees
e.g. 45°33'22" → 33' x 60 = 1980 → 1980 + 22" = 2002 → 2002/3600 = 0.55 → 45.55°

<u>Tide Time Calculations</u>

Time to Tide Time from Tide
"-" Slack "+"
← ← ← ← ← ← Tide→ → → → → →
If the cast is taken before the nearest slack high or slack low tide, then the time **to** the tide is negative (counting down to the slack tide). If the cast is taken after the nearest high or low tide, then the time **from** the tide is positive (counting up to the slack tide)

The time to or from the tide is documented in minutes only, not hours and minutes, so the hours will need to be converted to minutes by multiplying by 60. The remaining minutes can then be added to equal the time difference between the time of the cast and the time of the tide.

Appendix C: Oceanographic Survey Equipment List

Equipment Needed for Oceanographic Surveys

RESEARCH VESSELS & SUPPORT EQUIPMENT

- RV *Alaskan Gyre*, 50feet; 60,000lbs or RV *Sigma-t*, 26 feet; 4,000lbs
- Power Block/Davit (on boat)
- Hydraulics (on boat)

CTD SAMPLING EQUIPMENT

- SEACAT SBE 19-03 Conductivity, Temperature, Depth Recorder (Sea-Bird Electronics)
- Ground line (marked every 10m) and plastic tub
- 2 locking stainless steel locking carabineers (on CTD)
- CTD equipment box (also located in *K:\eco_data\data\glba\Ocean\PROTOCOL\Information\CTD Equipment Boxes.doc*)
  - Distilled water squirt bottle
  - Triton –X* detergent and squirt bottle with diluted solution
  - Silicone Grease (Dow Corning 4 Electrical Insulating Compound)
  - Rubbing Alcohol and Q-Tips (for cleaning conductivity cell and data cable pins)
  - Lint-free cloth and lint-free papers
  - Data Cable, including RS232 to DB9 connector, and spare computer disks
  - Copy of protocol, PLGR manual, SeaTerm Manual, Triton-X MSDS
  - Spare pens and pencils
  - Paper towels
  - Spare Batteries
    - 9 D-cell batteries (per CTD)
    - 12 AA-cell batteries (4 per GPS, 8 per PLGR)
- Distilled Water (1gallon)
- Portable Computer (if not working from the Gyre)
- Office Box (containing general office equipment)
- 2 PLGR+ Fed 96 GPS units (Rockwell) (Be sure to download station locations into PLGR before use. Instructions on how to do this are in the Summary Operator's Manual for the PLGR, located in *K:\eco_data\data\glba\Ocean\PROTOCOL\Information\PLGR*)
- Extra power/antenna cables and external antennas

* Triton X-100 is non-ionic detergent, which is used as a 1% percent solution in distilled water. One source is VWR Scientific Products in Seattle, WA at 800-932-5000, or http://www.vwrsp.com.

MANUALS & DOCUMENTATION

- Seacat SBE 19-03 and Seasoft 4.246 operating manuals
- PLGR+Fed 96 operating manual
- Last CTD dump number (recorded in CTD dump log, located *K:\eco_data\data\glba\Ocean\DATA\processed\CTD_Dump_Log.xls*)
- Waterproof field notebook with blank Rite-in-the-rain or Duracopy paper
- Oceanography notebook (contains protocol, station locations, maintenance info, etc.)
- CTD datasheets Xeroxed on waterproof paper (approx.10 sheets, 3 stations per page)

GENERAL FIELD GEAR

- Rite-in-the-Rain waterproof or DuraCopy plastic paper
- Several black Ultra Fine Point Sharpie pens and/or pencils.
- Personal Flotation Devices (one per person on board)
- Immersion (survival) suits (one per person on board)
- Handheld (waterproof) radio with ParkNet frequencies and extra radio batteries

- Groceries – order beforehand (see *K:\USGS-BRD\Old_Joint\ADMINIST\EQUIPMEN\Alaskan Gyre\Food for Oceanography.doc* for food purchasing suggestions. Also talk to Jim de about what is already on the *Gyre* when using it for oceanography)
- Rain gear
- Waterproof gloves (insulated ideal)
- Waterproof boots
- Binoculars
- Personal gear
- Topographical map and nautical charts of Glacier Bay
- Digital camera

CTD DATA ACQUISITION SOFTWARE

- SEASOFT Version 4.246 version 1.0.0.9
  02 December 2000
  Sea-Bird Electronics, Inc.
  Intended for use on an IBM-PC 386/386 or higher compatible computer
- Software includes 3 modules: SEATERM, SS-DOS (contains TERM19 and _Sea.bat) and SS-WIN32 (contains Seasave.exe) (See *K:\eco_data\data\glba\Ocean\PROTOCOL\Information\seabird_info.doc* for an explanation of these programs)

GENERAL COMPUTER EQUIPMENT & SOFTWARE

- On-board Pentium PC with Windows NT
- ESRI ArcView 3.2
- ESRI Tracking Analyst (with TCP/IP enabled on system, com port configured)
- MPS (Mission Planning Software)
- TextPad, NotePad, or other Text Editor Software

** Waypoint Datum:

OCEANOGRAPHY SURVEY

Glacier Bay National Park & Preserve, Alaska

Name:_____________________ Logbook Page: _____________

Cast Name: C
CTD id Dump # Cast #

Date:
Y Y Y Y M M D D

Time CTD on: :
AKST or AKDT

Lat: (decimal degrees) .

Lon: (decimal degrees) .

Time GPS position: :

Depth: (m)

CTD dropped to (m):

Station# **WP#**

Comments:

Location:

Tide High Height: **Low height:** **Time since high:** **Time since low:**

Sampling: Oceanography Sonic Bottom Dive Other : Tide Station:

Cast Name: C
CTD id Dump # Cast #

Date:
Y Y Y Y M M D D

Time CTD on: :
AKST or AKDT

Lat: (decimal degrees) .

Lon: (decimal degrees) .

Time GPS position: :

Depth: (m)

CTD dropped to (m):

Station# **WP#**

Comments:

Location:

Tide High Height: **Low height:** **Time since high:** **Time since low:**

Sampling: Oceanography Sonic Bottom Dive Other : Tide Station:

Cast Name: C
CTD id Dump # Cast #

Date:
Y Y Y Y M M D D

Time CTD on: :
AKST or AKDT

Lat: (decimal degrees) .

Lon: (decimal degrees) .

Time GPS position: :

Depth: (m)

CTD dropped to (m):

Station# **WP#**

Comments:

Location:

Tide High Height: **Low height:** **Time since high:** **Time since low:**

Sampling: Oceanography Sonic Bottom Dive Other : Tide Station:

Appendix E: CTD “Dump” Log

(Found in K:\eco_data\data\glba\Ocean\DATA\processed\CTD_Dump_Log.xls)

DATE	BATTERY STAT. (v)	DUMP#	#CASTS	INITIALS	COMMENTS

Appendix F: Tide Information and Contour Locations

Tide Locations

A. Bartlett Cove: Stations 00, 01, 02

B. Willoughby Island: Stations 03, 04, 05, 13, 22, 23

C. Composite Island: Stations 06, 07, 08, 09, 10, 11, 12, 21

D. Muir Inlet: Stations 14, 16, 17, 18, 19, 20

Contour Locations

A. Main Bay – West Arm: Stations 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 21 – should be contoured using the Lower Bay slack high tide values

B. East Arm: Stations 04, 13, 14, 16, 17, 18, 19, 20

C. Cross Bay (Geike-Muir Sill): Stations 23, 22, 05, 13, 14, 15

D. Lower Bay: Stations 00, 01, 02, 03, 04 – should be contoured for BOTH slack high tide and peak flood tide

Appendix G: FGDC Metadata

For ProfileMaster and CTDMaster ArcView shape files (including database field definitions)

A. ProfileMaster File

IDENTIFICATION_INFORMATION

Citation:
  Citation_Information:
    Originator: Philip N. Hooge
    Originator: Elizabeth Ross Hooge
    Publication_Date: 20001201
    Title: Oceanographic CTD 3d Profiles from Seabird Instruments
    Edition: 1
    Geospatial_Data_Presentation_Form: Map
    Publication_Information:
      Publication_Place: Glacierr Bay National Park, Gustavus, Alaska
      Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
    Other_Citation_Details:
    Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
    Larger_Work_Citation:
      Citation_Information:
        Originator: P. Hooge
        Publication_Date: 20001201
        Title: Fjord Oceanography of Glacier Bay
        Publication_Information:
          Publication_Place: Glacier Bay National Park, Gustavus, Alaska
          Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
        Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
Description:
  Abstract:
    The Bay is a recently (300 years ago) deglaciated fjord located within Glacier Bay National Park in Southeast Alaska. Glacier Bay is a fjord estuarine system that has multiple sills. These sills are often associated with contractions and are backed by very deep basins with tidewater glaciers and many streams. Glacier Bay experiences a large amount of runoff, high sedimentation, and large tidal variations. Melting occurs year-round, which fuels the estuarine circulation even through the winter. This runoff, and the presence of the tidewater glaciers makes the bay extremely cold. There are many small- and large-scale mixing and upwelling zones at sills, glacial faces, and streams. The complex topography and strong currents lead to highly variable salinity, temperature, sediment, productivity, light penetration, and current patterns within a small area. This complexity defies simple characterization or modeling based on other areas in Southeast Alaska. While several oceanographic studies have been conducted in Glacier Bay, these studies are contradictory and were of short duration and limited coverage, missing much of the spatial, seasonal and annual variation. In addition, some assumptions based on past studies have been contradicted by recent results (Hooge, et al. 2000) . The constantly changing nature of the Bay may contribute to contradictions among past studies and between recent and historical results.

Purpose:
The Glacier Bay oceanographic project was designed for the acquisition, analysis, and modeling of fjord-estuarine oceanographic data in Glacier Bay, Alaska. Located along the glacial chronosequence in the Bay, 24 stations are profiled multiple times each year in order to acquire measurements of temperature, salinity, productivity (phytoplankton biomass through chlorophyll-a), sediment load, and light penetration throughout the water column at 1-meter depth intervals from the surface to near the sea floor. Duplicate samples are taken at slack and peak current flow in those areas where water column characteristics are strongly affected by tidal stage. Each survey data set is integrated into a Geographic Information System environment utilizing the Oceanographic Analyst Extension (OAE), which allows viewing and manipulation of 3- and 4-D oceanographic datasets within ESRI's ArcView GIS.
Supplemental_Information:
Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 1993
Ending_Date: Present
Currentness_Reference: Current
Status:
Progress: Complete
Maintenance_and_Update_Frequency: Annually
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -137.0492
East_Bounding_Coordinate: -135.8733
North_Bounding_Coordinate: 59.0591
South_Bounding_Coordinate: 58.3144
Keywords:
Theme:
Theme_Keyword_Thesaurus: None
Theme_Keyword: Oceanography
Theme_Keyword: CTD
Theme_Keyword: Glacier Bay
Theme_Keyword: Fjord
Theme_Keyword: Estuarine
Theme_Keyword: Estuary
Theme_Keyword: Tidewater Glacier
Theme_Keyword: Sill
Theme_Keyword: Contraction
Theme_Keyword: Hydraulic Control
Theme_Keyword: Marine Ecosystem
Theme_Keyword: Temperature
Theme_Keyword: Salinity
Theme_Keyword: Density
Theme_Keyword: Sigma-T
Theme_Keyword: OBS
Theme_Keyword: PAR
Theme_Keyword: Chlorophyll-a
Theme_Keyword: Photosynthetically Active Radiation
Theme_Keyword: Backscatterance
Theme_Keyword: Sedimentation
Theme_Keyword: Flocculation

Theme_Keyword: Primary Productivity
Theme_Keyword: Primary Production
Theme_Keyword: Photic Depth
Theme_Keyword: Photic Zone
Theme_Keyword: Halocline
Theme_Keyword: Thermocline
Theme_Keyword: Pycnocline
Theme_Keyword: Mixed Layer
Place:
Place_Keyword_Thesaurus: None
Place_Keyword: Glacier Bay
Place_Keyword: Alaska
Place_Keyword: Gustavus
Place_Keyword: Southeast Alaska
Place_Keyword: Norther Lattitude
Place_Keyword: High Lattitude
Place_Keyword: Sub-Arctic
Place_Keyword: Cross Sound
Place_Keyword: Icy Strait
Place_Keyword: Inside Passage
Place_Keyword: Gulf of Alaska
Place_Keyword: North Pacific
Access_Constraints:
Use_Constraints:
Please contact before publication use
Point_of_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: USGS Alaska Biological Science Center
Contact_Person: Philip N. Hooge
Contact_Position: Research Population Ecologist
Contact_Address:
Address_Type: mailing and physical address
Address: P.O. Box 292, Glacier Bay National Park
City: Gustavus
State_or_Province: AK
Postal_Code: 99826
Country: USA
Contact_Voice_Telephone: 907-697-2637
Contact_Facsimile_Telephone: 907-697-2654
Contact_Electronic_Mail_Address: philip_hooge@usgs.gov
Hours_of_Service: 10:00-18:00 Alaska Time
Native_Data_Set_Environment:
ArcView version 3.2 shapefile format
k:\eco_data\data\glba\ocean\data\processed\2000\200003oceanography\200003oceanography.shp

DATA_QUALITY_INFORMATION

Attribute_Accuracy:
Attribute_Accuracy_Report:
Accuracy varies with the different oceanographic variables
locations, and years. However the insturments were
calibrated each year, values checked for errors, and all
observationally deviant data removed. See the oceanographic
protocol manual and report at
www.absc.usgs.gov/glba/oceanography/index.htm for details
on the way values were recorded and accuracy issues.
Logical_Consistency_Report:
Completeness_Report:
This data is updated after each survey which occurs

approximately five times a year.
Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report:
4 meters absolute accuracy using military crypto code receivers. Approximately 100 meter aquisition of repeated station position.
Vertical_Positional_Accuracy:
Vertical_Positional_Accuracy_Report:
None
Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator: Philip N. Hooge
Publication_Date: Varies
Title: Seabird Instruments CNV files which are Georeferenced
Edition: Varies with software and insturment
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place: Glacierr Bay National Park, Gustavus, Alaska
Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
Other_Citation_Details:
Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
Larger_Work_Citation:
Citation_Information:
Originator: P. Hooge
Publication_Date: Varies
Title: Fjord Oceanography of Glacier Bay
Publication_Information:
Publication_Place: Glacier Bay National Park, Gustavus, Alaska
Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
Source_Scale_Denominator:
Type_of_Source_Media: Digital
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 1993
Ending_Date: Present
Source_Currentness_Reference: Current
Source_Citation_Abbreviation:
Source_Contribution:
The Seabird Instrument files are the primary part of the georeferenced CTD profiles. Locational and tide information is added as well as some locationally dependent calibration coeficients.
Process_Step:
Process_Description:
Processing steps of this data are highly detailed and involved. These processing steps involve both detailed manipulation of the instrument derived variables as well as extensive parsing, databasing, georeferencing, creation of 2, 3 and 4-D spatial datasets, and then spatial and database joining and aggregation. These processes are described in detail in the Fjord Oceanographic Monitoring Handbook available in pdf form at www.absc.usgs.gov/glba/oceanography/index.htm
Source_Used_Citation_Abbreviation:
Process_Date: 1993 to current: each survey processed as obtained

Source_Produced_Citation_Abbreviation:
Process_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Organization: USGS Alaska Biological Science Center
Contact_Person: Philip N. Hooge
Contact_Position: Research Population Ecologist
Contact_Address:
Address_Type: mailing and physical address
Address: P.O. Box 292, Glacier Bay National Park
City: Gustavus
State_or_Province: AK
Postal_Code: 99826
Country: USA
Contact_Voice_Telephone: 907-697-2637
Contact_Facsimile_Telephone: 907-697-2654
Contact_Electronic_Mail_Address: philip_hooge@usgs.gov
Hours_of_Service: 10:00-18:00 Alaska Time

SPATIAL_DATA_ORGANIZATION_INFORMATION

Direct_Spatial_Reference_Method: Vector
Point_and_Vector_Object_Information:
SDTS_Terms_Description:
SDTS_Point_and_Vector_Object_Type:
Point_and_Vector_Object_Count: 4378

SPATIAL_REFERENCE_INFORMATION

Horizontal_Coordinate_System_Definition:
Planar:
Map_Projection:
Map_Projection_Name: Transverse Mercator
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: 0.999600
Longitude_of_Central_Meridian: -135.000000
Latitude_of_Projection_Origin: 0.000000
False_Easting: 500000.000000
False_Northing: 0.000000
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: Coordinate pair
Coordinate_Representation:
Abscissa_Resolution:
Ordinate_Resolution:
Planar_Distance_Units: Meters
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1927
Ellipsoid_Name: Clarke 1866
Semi-major_Axis: 6378206.4000000
Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

Detailed_Description:
Entity_Type:
Entity_Type_Label: 200003oceanography.dbf
Entity_Type_Definition: Shapefile Attribute Table
Entity_Type_Definition_Source: None
Attribute:
Attribute_Label: Cast

Attribute_Definition: The Oceanographic Instrument Cast Number
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Character Field
Attribute:
Attribute_Label: Date
Attribute_Definition: The Date of the Cast
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Date Field
Attribute:
Attribute_Label: Time
Attribute_Definition: The time the cast was made
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Character Field
Attribute:
Attribute_Label: Utmx
Attribute_Definition: The X coordinate Nad 27 Zone 8
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: Utmy
Attribute_Definition: The Y coordinate Nad 27 Zone 8
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: Scan
Attribute_Definition: Instrument Scan Number
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: Pr
Attribute_Definition: Pressure
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: T068
Attribute_Definition: Temperature Celsius
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: C0s_m
Attribute_Definition: Conductivity
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: Par
Attribute_Definition: Photosynthetically Active Radiation
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field

Attribute:
  Attribute_Label: Wetstar
  Attribute_Definition: Chlorophyl-a concentration mg/m3
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Obs
  Attribute_Definition: Optical Backscatter in mv
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Times
  Attribute_Definition: Time of the instrument reading
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Deps
  Attribute_Definition: Depth in seawater -derived from pressure
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Sal00
  Attribute_Definition: Salinity ppt, derived from conductivity
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Sigma_t00
  Attribute_Definition: Density, derived from conductivity and temperature
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Svc
  Attribute_Definition: Sound Velocity derived from density
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Avgsvc
  Attribute_Definition: Average Sound Velocity
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Unrepresentable_Domain: Numeric Field
Attribute:
  Attribute_Label: Flag
  Attribute_Definition: Bad Value Flag
  Attribute_Definition_Source:
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: 0.000
      Enumerated_Domain_Value_Definition: Good Value
      Enumerated_Domain_Value_Definition_Source:
Attribute:
  Attribute_Label: Nbin
  Attribute_Definition: Number of measurments average in a depth bin

Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: Sucs_Dist
Attribute_Definition: Distance between casts, a recalculated value dependent on chosen contouring profiles
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Attribute:
Attribute_Label: Prop_par
Attribute_Definition: Proportional Par of highest value in cast
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 1
Attribute:
Attribute_Label: Maxdepth
Attribute_Definition: The maximum depth of the cast
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Numeric Field
Overview_Description:
Entity_and_Attribute_Overview:
Entity_and_Attribute_Detail_Citation:

DISTRIBUTION_INFORMATION

Distributor:
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Hours_of_Service: 10:00-18:00 Alaska Time
Resource_Description:
Profile Master Data For Glacier Bay, Alaska
Distribution_Liability:
None
Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name:ArcView Shape Files PointZ
Digital_Transfer_Option:
Offline_Option:
Offline_Media: CD Rom

Recording_Format: Juliet
Compatibility_Information:
Can be used with any vector GIS capable system able to use or import ArcView Shape Files. The information can also be accessed from the dbf files containing the attribute information since the XY coordinates are in the table.
Fees: None
Ordering_Instructions:
Contact Philip N. Hooge Ph.D. at philip_hooge@usgs.gov see www.absc.usgs.gov/glba/oceanography/index.htm for current ordering or downloading methods.

METADATA_REFERENCE_INFORMATION

Metadata_Date: 11/22/2000
Metadata_Review_Date: 11/22/2000
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: USGS Alaska Biological Science Center
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Metadata_Standard_Name: FGDC CSDGM
Metadata_Standard_Version: FGDC-STD-001-1998

A. CTDMaster File

IDENTIFICATION_INFORMATION

Citation:
Citation_Information:
Originator: Philip N. Hooge
Originator: Elizabeth Ross Hooge
Publication_Date: 20001201
Title: Oceanographic CTD 2d Profiles from Seabird Instruments
Edition: 1
Geospatial_Data_Presentation_Form: Map
Publication_Information:
Publication_Place: Glacier Bay National Park, Gustavus, Alaska
Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
Other_Citation_Details:
Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
Larger_Work_Citation:
Citation_Information:
Originator: P. Hooge

Publication_Date: 20001201
Title: Fjord Oceanography of Glacier Bay
Publication_Information:
Publication_Place: Glacier Bay National Park, Gustavus, Alaska
Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
Description:
Abstract:
Oceanography describes one of the most fundamental physical aspects of a marine ecosystem. Most of the resource and research issues in Glacier Bay are marine in whole or part. Glacier Bay exhibits a highly complex oceanographic regime within a small area. An understanding of many of the resource and research issues in Glacier Bay will not be possible without an understanding of the underlying oceanographic processes causing the large spatial and annual variation.

The Bay is a recently (300 years ago) deglaciated fjord located within Glacier Bay National Park in Southeast Alaska. Glacier Bay is a fjord estuarine system that has multiple sills. These sills are often associated with contractions and are backed by very deep basins with tidewater glaciers and many streams. Glacier Bay experiences a large amount of runoff, high sedimentation, and large tidal variations. Melting occurs year-round, which fuels the estuarine circulation even through the winter. This runoff, and the presence of the tidewater glaciers makes the bay extremely cold. There are many small- and large-scale mixing and upwelling zones at sills, glacial faces, and streams. The complex topography and strong currents lead to highly variable salinity, temperature, sediment, productivity, light penetration, and current patterns within a small area. This complexity defies simple characterization or modeling based on other areas in Southeast Alaska. While several oceanographic studies have been conducted in Glacier Bay, these studies are contradictory and were of short duration and limited coverage, missing much of the spatial, seasonal and annual variation. In addition, some assumptions based on past studies have been contradicted by recent results (Hooge, et al. 2000) . The constantly changing nature of the Bay may contribute to contradictions among past studies and between recent and historical results.

Because of the importance of oceanography to understanding critical resource and research problems, the complexity of the Bay's oceanographic system, as well as the limited and contradictory prior work, it is imperative that a sustained, rigorous, and complete monitoring program be developed and implemented.
Purpose:
The Glacier Bay oceanographic project was designed for the acquisition, analysis, and modeling of fjord-estuarine oceanographic data in Glacier Bay, Alaska. Located along the glacial chronosequence in the Bay, 24 stations are profiled multiple times each year in order to acquire measurements of temperature, salinity, productivity (phytoplankton biomass through chlorophyll-a), sediment load, and light penetration throughout the water column at

1-meter depth intervals from the surface to near the sea floor. Duplicate samples are taken at slack and peak current flow in those areas where water column characteristics are strongly affected by tidal stage. Each survey data set is integrated into a Geographic Information System environment utilizing the Oceanographic Analyst Extension (OAE), which allows viewing and manipulation of 3- and 4-D oceanographic datasets within ESRI's ArcView GIS.
Supplemental_Information:
This database supplments the 3-D ProfileMaster shapefile and provides 2-D summary information in order to integrate the cast profile data with other 2-D data sets.
Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 1992
Ending_Date: present
Currentness_Reference: Current
Status:
Progress: Complete
Maintenance_and_Update_Frequency: Annually
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -136.9230
East_Bounding_Coordinate: -135.8750
North_Bounding_Coordinate: 59.0920
South_Bounding_Coordinate: 58.3177
Keywords:
Theme:
Theme_Keyword_Thesaurus: None
Theme_Keyword: Backscatterance
Theme_Keyword: Chlorophyll-a
Theme_Keyword: Contraction
Theme_Keyword: CTD
Theme_Keyword: Density
Theme_Keyword: Estuarine
Theme_Keyword: Estuary
Theme_Keyword: Fjord
Theme_Keyword: Flocculation
Theme_Keyword: Glacier Bay
Theme_Keyword: Halocline
Theme_Keyword: Hydraulic Control
Theme_Keyword: Marine Ecosystem
Theme_Keyword: Mixed Layer
Theme_Keyword: OBS
Theme_Keyword: Oceanography
Theme_Keyword: PAR
Theme_Keyword: Photic Depth
Theme_Keyword: Photic Zone
Theme_Keyword: Photosynthetically Active Radiation
Theme_Keyword: Primary Production
Theme_Keyword: Primary Productivity
Theme_Keyword: Pycnocline
Theme_Keyword: Salinity
Theme_Keyword: Sedimentation
Theme_Keyword: Sigma-T
Theme_Keyword: Sill
Theme_Keyword: Temperature
Theme_Keyword: Thermocline
Theme_Keyword: Tidewater Glacier

Place:
Place_Keyword_Thesaurus: None
Place_Keyword: Alaska
Place_Keyword: Cross Sound
Place_Keyword: Glacier Bay
Place_Keyword: Gulf of Alaska
Place_Keyword: Gustavus
Place_Keyword: High Lattitude
Place_Keyword: Icy Strait
Place_Keyword: Inside Passage
Place_Keyword: North Pacific
Place_Keyword: Norther Lattitude
Place_Keyword: Southeast Alaska
Place_Keyword: Sub-Arctic
Access_Constraints:
Use_Constraints:
Please contact before publication and cite P.N. Hooge and
E.R. Hooge. 2000. Glacier Bay Fjord Oceanography Dataset.
USGS, Alaska Biological Science Center.
Point_of_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: USGS Alaska Biological Science Center
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Contact_Position: Research Population Ecologist
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City: Gustavus
State_or_Province: AK
Postal_Code: 99826
Country: USA
Contact_Voice_Telephone: 907-697-2637
Contact_Facsimile_Telephone: 907-697-2654
Contact_Electronic_Mail_Address: philip_hooge@usgs.gov
Hours_of_Service: 10:00-18:00 Alaska Time
Native_Data_Set_Environment:
ArcView version 3.2 shapefile format
k:\eco_data\data\glba\ocean\data\processed\2000\200005oceanography\ctdmaster.shp

DATA_QUALITY_INFORMATION

Attribute_Accuracy:
Attribute_Accuracy_Report:
Accuracy varies with the different oceanographic variables
locations, and years. However the insturments were calibrated each year, values checked for errors, and all observationally deviant data removed. See the oceanographic protocol manual and report at www.absc.usgs.gov/glba/oceanography/index.htm for details on the way values were recorded and accuracy issues.
Logical_Consistency_Report:
This data is logically consistent.
Completeness_Report:
These data are updated after each survey which is occurs
appromately five times of a year.
Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report:
4 meters absolute accuracy using military crypto code
receivers. Approximately 100 meter aquisition of repeated

station position.
Vertical_Positional_Accuracy:
Vertical_Positional_Accuracy_Report:
All positions are at sea level and these data do not have a
vertical component.
Lineage:
Source_Information:
Source_Citation:
Citation_Information:
Originator: Philip N. Hooge
Publication_Date: Varies
Title: Seabird Instruments CNV files which are Georeferenced
Edition: Varies with software and insturment
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place: Glacier Bay National Park, Gustavus, Alaska
Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
Other_Citation_Details:
Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
Larger_Work_Citation:
Citation_Information:
Originator: P. Hooge
Publication_Date: Varies
Title: Fjord Oceanography of Glacier Bay
Publication_Information:
Publication_Place: Glacier Bay National Park, Gustavus, Alaska
Publisher: USGS Alaska Biological Science Center, Glacier Bay National Park
Online_Linkage: www.absc.usgs.gov/glba/oceanography/index.htm
Source_Scale_Denominator:
Type_of_Source_Media: Digital
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 1992
Ending_Date: present
Source_Currentness_Reference: Current
Source_Citation_Abbreviation:
Source_Contribution:
The Seabird Instrument files are the primary part of the georeferenced CTD profiles. Locational and tide information is added as well as some locationally dependent calibration coeficients.
Process_Step:
Process_Description:
Processing steps of this data are highly detailed and involved. These processing steps involve both detailed manipulation of the instrument derived variables as well as
extensive parsing, databasing, georeferencing, creation of 2, 3 and 4-D spatial datasets, and then spatial and database joining and aggregation. These processes are described in detail in the Fjord Oceanographic Monitoring Handbook available in pdf form at wwww.absc.usgs.gov/glba/oceanography/index.htm
Source_Used_Citation_Abbreviation:
Process_Date: 1992 to current; each survey processed as obtained
Source_Produced_Citation_Abbreviation:
Process_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Organization: USGS Alaska Biological Science Center
Contact_Person: Philip N. Hooge
Contact_Position: Research Population Ecologist
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City: Gustavus

State_or_Province: AK
Postal_Code: 99826
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Hours_of_Service: 10:00-18:00 Alaska Time

SPATIAL_DATA_ORGANIZATION_INFORMATION

Direct_Spatial_Reference_Method: Point
Point_and_Vector_Object_Information:
SDTS_Terms_Description:
SDTS_Point_and_Vector_Object_Type: Point
Point_and_Vector_Object_Count: 25

SPATIAL_REFERENCE_INFORMATION

Horizontal_Coordinate_System_Definition:
Planar:
Grid_Coordinate_System:
Grid_Coordinate_System_Name: Universal Transverse Mercator
Universal_Transverse_Mercator:
UTM_Zone_Number: 8
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: 0.999600
Longitude_of_Central_Meridian: -135.000000
Latitude_of_Projection_Origin: 0.000000
False_Easting: 500000.000000
False_Northing: 0.000000
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: Coordinate pair
Coordinate_Representation:
Abscissa_Resolution: 1 meter
Ordinate_Resolution: 1 meter
Planar_Distance_Units: Meters
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1927
Ellipsoid_Name: Clarke 1866
Semi-major_Axis: 6378206.4000000
Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

Detailed_Description:
Entity_Type:
Entity_Type_Label: ctdmaster.dbf
Entity_Type_Definition: Shapefile Attribute Table
Entity_Type_Definition_Source: None
Attribute:
Attribute_Label: Cast
Attribute_Definition: Cast Name as a composite of instrument id, dump number and cast number
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Character Field
Attribute:
Attribute_Label: Location
Attribute_Definition: Oceanographic Station

Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Character Field
Attribute:
Attribute_Label: Date
Attribute_Definition: The day the cast was taken
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Date Field
Attribute:
Attribute_Label: Time
Attribute_Definition: The specific time the instument was lowered
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Character Field
Attribute:
Attribute_Label: Header
Attribute_Definition: All the Seabird header information as a comment
Attribute_Definition_Source:
Attribute_Domain_Values:
Unrepresentable_Domain: Character Field
Attribute:
Attribute_Label: Xaxis
Attribute_Definition: The X coordinate in Nad27
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 389783
Range_Domain_Maximum: 448751
Attribute:
Attribute_Label: Yaxis
Attribute_Definition: The Y coodinate in Nad27
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 6.46541e+006
Range_Domain_Maximum: 6.55043e+006
Attribute:
Attribute_Label: Timetolow
Attribute_Definition: Time to low tide (in minutes)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -99999
Range_Domain_Maximum: 400
Attribute:
Attribute_Label: Timetohi
Attribute_Definition: The number of minutes to high tide (as a positive or negative number)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -99999
Range_Domain_Maximum: 4000
Attribute:
Attribute_Label: Hiheight
Attribute_Definition: The height of the high tide (in meters)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -99999

Range_Domain_Maximum: 8
Attribute:
Attribute_Label: Lowheight
Attribute_Definition: The height of the nearest low tide (in meters)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -99999
Range_Domain_Maximum: 0.2
Attribute:
Attribute_Label: Count_
Attribute_Definition: Number of depth bins used in statistics
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 47
Range_Domain_Maximum: 303
Attribute:
Attribute_Label: Min_Deps_
Attribute_Definition: Minimum Depth of the cast
Attribute_Definition_Source: The deepest depth reach on a cast
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -302
Range_Domain_Maximum: -47
Attribute:
Attribute_Label: Max_Deps_
Attribute_Definition: The shallowest depth bin used in summary statistics
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -3
Range_Domain_Maximum: 0
Attribute:
Attribute_Label: Max_Par_
Attribute_Definition: The Maximum values of photosenthetically active radiation
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 2000
Attribute:
Attribute_Label: Min_T068_
Attribute_Definition: The minimum temperature found on a cast
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 15
Attribute:
Attribute_Label: Max_T068_
Attribute_Definition: The maximum temperature found on a cast
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 15
Attribute:

Attribute_Label: Min_Wetsta
Attribute_Definition: The minimum values of chlorophyll-a in ug/l
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 100
Attribute:
Attribute_Label: Max_Wetsta
Attribute_Definition: THe maximum value of chlorophyll-a found on a cast (in ug/l)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 100
Attribute:
Attribute_Label: Min_OBS_mg
Attribute_Definition: Minimum value of sediment found on a cast (in mg/l)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 1000
Attribute:
Attribute_Label: Max_OBS_mg
Attribute_Definition: The maximum value of sediment found on a cast (in mg/l)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 1000
Attribute:
Attribute_Label: Sum_OBS_mg
Attribute_Definition: The integrated amount of sediment found throughout the cast (in g/meter2)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 100000
Attribute:
Attribute_Label: Min_Sal00_
Attribute_Definition: The minimum value of salinity found in the cast (in ppt)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 35
Attribute:
Attribute_Label: Max_Sal00_
Attribute_Definition: The maximum value of salinity found in the cast (in ppt)
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 35
Attribute:
Attribute_Label: Min_Sigma_
Attribute_Definition: Minumim density values found in the cast (in sigma-t values)
Attribute_Definition_Source:
Attribute_Domain_Values:

Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 30
Attribute:
Attribute_Label: Max_Sigma_
Attribute_Definition: The maximum sigma-t values found in the cast
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: 0
Range_Domain_Maximum: 30
Attribute:
Attribute_Label: Photicdep1
Attribute_Definition: The depth to which only 1 percent of the surface of light penetrates
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -100
Range_Domain_Maximum: 0
Attribute:
Attribute_Label: Zsum_wetst
Attribute_Definition: The integrated amount of chlorophyll-a throughout the cast in mg/meter2
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -9999
Range_Domain_Maximum: 5000
Attribute:
Attribute_Label: Dic_photic
Attribute_Definition: The integrated amount of chlorophyll-a throughout the photic depth portion of the cast in mg/meter2
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -9999
Range_Domain_Maximum: 5000
Attribute:
Attribute_Label: Dic_15m
Attribute_Definition: The integrated amount of chlorophyll-a throughout the photic the upper 15 m portion of the cast in mg/meter2
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -9999
Range_Domain_Maximum: 5000
Attribute:
Attribute_Label: Dic_35m
Attribute_Definition: The integrated amount of chlorophyll-a throughout the upper 35 meter portion of the cast in mg/meter2
Attribute_Definition_Source:
Attribute_Domain_Values:
Range_Domain:
Range_Domain_Minimum: -9999
Range_Domain_Maximum: 5000

DISTRIBUTION_INFORMATION

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Contact_Electronic_Mail_Address: philip_hooge@usgs.gov
Hours_of_Service: 10:00-18:00 Alaska Time
Resource_Description:
CTDMaster Data for Glacier Bay, Alaska
Distribution_Liability:
User must assume to determine the appropriate use of these data.
Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name:ArcView Point Shape File
Digital_Transfer_Option:
Offline_Option:
Offline_Media: CD ROM in Juliet format
Recording_Format:
Compatibility_Information:
Can be used in any vector GIS capable system able to use or import ArcView Shape Files. The information can also be accesed from dbf files containing the attribute information since the XY coordiates are in the table
Fees: None
Ordering_Instructions:
Contact: Philip N. Hooge PhD at philip_hooge@usgs.gov or
see www.absc.usgs.gov/glba/oceanography/index.htm for current ordering or downloading methods.

METADATA_REFERENCE_INFORMATION

Metadata_Date: 12/6/2000
Metadata_Review_Date: 12/7/2000
Metadata_Contact:
Contact_Information:
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Contact_Organization: USGS Alaska Biological Science Center
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City: Gustavus
State_or_Province: AK
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Country: USA
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Contact_Facsimile_Telephone: 907-697-2654
Contact_Electronic_Mail_Address: philip_hooge@usgs.gov
Hours_of_Service: 10:00-18:00 Alaska Time
Metadata_Standard_Name: FGDC CSDGM
Metadata_Standard_Version: FGDC-STD-001-1998

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