CSDL Informal Technical Note No. 11

NOS ALASKA HISTORICAL CIRCULATION SURVEY DATA RESTORATION: COOK INLET (1973-1975), PRINCE WILLIAM SOUND (1976-1978), ICY BAY (1979), AND SOUTHEAST ALASKA (1984)

Silver Spring, Maryland
April 2012

noaa National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF COMMERCE
National Ocean Service
Coast Survey Development Laboratory

Office of Coast Survey
National Ocean Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

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ABSTRACT

The purpose of this report is to document the restoration of the National Ocean Service (NOS) historical circulation survey data in Cook Inlet (1973-1975), Prince William Sound (1976-1978), Icy Bay (1979), and Southeast Alaska (1984). Previous computer programs developed for Delaware River and Bay circulation survey data (2006) were used to analyze conductivity-temperature and current (CT/Current) data (Richardson and Schmalz, 2006). There were no CTD profile data available. Based on plots of salinity, temperature, current speed and direction at CT/Current moorings, temperature, salinity and current speed and direction data quality were assessed and indicated in the dataset tables. Meteorological data (sea level atmospheric pressure, air temperature, and wind speed and wind direction) were either not collected or not considered due to data issues. This report is meant to serve as a supplement to the Cook Inlet circulation survey report and to serve as the circulation survey report for Prince William Sound, Icy Bay, and Southeast Alaska.

While no formal quality control has been performed, the data processing algorithms, which may be used to accomplish this are described. Investigators may use these or other approaches for further quality control. Each estuary is next presented in a separate chapter, including description of data inventories of both raw and processed data files. Discussion of the CT/current data is followed by regional oceanographic considerations. Major data preservation and data use issues are then addressed. In conclusion, an overall summary is provided along with recommendations for additional data analysis tasks.

1. INTRODUCTION

From 1973 through 1984, the National Ocean Service (NOS) conducted circulation surveys in Cook Inlet (Patchen et al., 1981), Prince William Sound (Frey, 7/1983), Icy Bay (Frey, 3/1983), and Southeast Alaska. Due to corruption in computer system transfer and lost media, these datasets have been lost. To restore the available datasets, the remaining conductivity-temperature and current (CT/Current) collected during these surveys were obtained from the Center for Operational Oceanographic Products and Services (CO-OPS) and analyzed.

While no formal quality control of the data was performed, this report does review the data quality control and analysis programs previously used by Loeper (2006) and Richardson and Schmalz (2006) in Chapter 2. In Chapters 3-6, Cook Inlet, Prince William Sound, Icy Bay, and Southeast Alaska circulation survey data processing and analysis are considered, respectively. In each chapter, raw and processed data inventories of CT and current data are presented. Time series of salinity, water temperature, current speed and direction data at CT/Current moorings at representative estuarine stations are plotted. Water temperature, salinity, and current speed and direction spikes were minimal and were not edited out of the record. Some further filtering and editing may be required prior to model-data comparison. CTD vertical profiles and meteorological data were either not collected or not available. In Chapter 7, data preservation and data use issues are considered. In Chapter 8, conclusions and recommendations for future work are advanced.

2. DATA PROCESSING ALGORITHMS

An initial quality control of the current and CT data can be performed using the program currnt.f developed during the Delaware Bay circulation survey data restoration (Richardson and Schmalz, 2006). This program can be used to initially plot salinity, temperature, current speed, and current direction data. After these plots have been reviewed, one can determine which data sets require removal of bad data segments. This first step was performed during this study to analyze the datasets and inventory bad data as given in the station inventory tables. Subseqent steps which can be employed are as follows: 1) clipping of current direction data to remove spikes, 2) application of a box-car type filter to remove spikes in salinity, temperature, current speed and direction data. The use of the program is outlined in the following paragraphs.

The first variable read from the control file is initplot. With initplot set to 1, the program will plot the unfiltered, unedited data. For any changes, brought about either through filtering or through editing, to be observed in the plots, initplot must be set to 0. With initplot equal to 0, the program will automatically eliminate (filter) spikes in salinity, temperature, and current speed data using a box car type filter. However, the program will not automatically handle bad portions (multiple spikes or noise) of salinity, temperature, and current speed data. When multiple spikes occur, the nedit option must be used.

The nedit portion of the program substitutes a null value for bad data. Bad data segments are considered to be those in which there is clear evidence of instrument malfunction. With nedit equal to 0, no editing will occur. If there are n segments of data requiring editing, then nedit will be set to n. The parameters which are required in the control file for a segment of data to be edited include: the station name, the depth of the reading, and the year in which the data was recorded. Also required are the start and stop dates for the bad data segment, and the integer indicator for each data type. If the salinity data is good, iedt_s is set to 0. If the salinity data requires editing, iedt_s is set to 1. The indicator for temperature data is iedt_t, the indicator for current data is iedt_cur.

During this study, only those data segments of 15 days or longer are plotted with information printed to output file time.out2. The information printed to time.out2 is particularly useful when editing data plots. This information includes the station number, the depth of the reading, the year of the reading, and the start and stop dates (Julian days) for the data segment. Also printed to time.out2 is the plot number. The plot number is particularly useful when using display to observe the plots, and from there, to edit data. No editing of data was performed during this study.

A new version of Program currnt.f was developed to write the station files for each dataset in NOS skill assessment format as described by Zhang et al. (2009) for Cook Inlet, since this area will be included in the NOS operational nowcast/forecast system suite in 2013.

Due to lack of data availability, no CTD data were analyzed and the program sets previously described by Loeper (2006) and Richardson and Schmalz (2006) were not used.

3. COOK INLET

NOS performed an intensive 3-year survey from 1973 through 1975 to study the circulation in Cook Inlet. The study was performed during the late Spring and Summer months to avoid ice. Over the study period, 92 current meter locations and 214 locations of conductivity and temperature versus depth (CTD) were occupied (Patchen et al., 1981). The Aanderaa Model RCM-4 current meter recorded and measured current speed and direction and included temperature and conductivity and pressure sensors. Here, we summarize the recovered data and discuss related regional oceanographic characteristics.

Data Inventory and Summary

The datasets available from CO-OPS on compact disc are listed in Table 3.1 and constitute the recoverable data. It was necessary to carefully inventory these datasets and determine their data quality. Note no meteorological data (wind speed and direction, and sea level atmospheric pressure) were collected (Patchen et al., 1981). The 214 CTD profile datasets were lost.

Table 3.1. Cook Inlet Circulation Survey Raw Data Inventory.

Directory Name	Number of Files	Data Period	Data Description	Data Quality
COOK1	57	1973	Aanderaa Current Meter	OK
COOK2	68	1974-1975	Aanderaa Current Meter	OK
COOK3	19	1975	Aanderaa Current Meter	OK
COOK4	49	1974	Aanderaa Current Meter	OK

In Table 3.2, the raw, edited, and final quality controlled datasets are given along with their location in the CSDL/MMAP SAN. The general processing approach was to keep the same file structures as the original datasets. Each dataset was plotted and then written to output files in exactly the same format as the original data. It should be noted that since the focus was on data for model validation and harmonic analysis, only stations with record lengths of 15 days or greater were considered. In general, data quality was high and no editing was performed. However, some of the station time series exhibited high frequency spikes, which may need to be further filtered and edited prior to model-data comparison.

CT/Current Data

The salinity and temperature and current data were distributed amongst four directories: Cook1, Cook2, Cook3, and Cook4. The data files in these directories (FILE1 through FILEn) were concatenated to create cumulative data files; e.g., file_cook1, file_cook2, file_cook3, file_cook4. The data in each individual data file (FILE1 through FILEn) represent current and CT data at one specific station location, over a given time period.

The four datasets are inventoried in Tables 3.3 through Tables 3.5, respectively, in terms of station location, measurement and station depths and measurement dates and durations. Stations locations are shown in Figures 3.1 through Figures 3.3, respectively, for each of the four datasets. Datasets 3 and 4 have been combined. These tables and figures serve as a supplement to the Cook Inlet Circulation Survey Report (Patchen et al., 1981). It should be noted that current harmonic analysis results are available in this report.

Table 3.2. Cook Inlet Circulation Survey Processed Data File Inventory

Data Type	Location	Filename
CT/Current	~/cook1/, ~/cook2/, ~/cook3/, ~/cook4/,	file_cook1.ed, file_cook2.ed, file_cook3.ed, file_cook4.ed
CT/Current Qc	~/qc/	file_cook1.qc, file_cook2.qc, file_cook3.qc, file_cook4.qc

~ = /disks/NASUSER/philr/cook_inlet

Table 3.3. Cook Inlet Dataset 1.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (ft)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality S TAD
C-1	59.854	152.210	-22	58.800	7/17/73	8/16/73	30.07	x
C-1	59.854	152.210	50	58.800	7/17/73	8/16/73	30.09	x
C-1	59.862	152.200	-22	58.800	6/16/73	7/16/73	29.88	x
C-1	59.862	152.200	-75	58.800	6/16/73	7/16/73	29.90	x
C-1	59.862	152.200	50	58.800	6/16/73	7/16/73	29.92	x
J-1	59.878	152.175	-22	58.800	5/18/73	6/16/73	29.65	x
J-1	59.878	152.175	-75	58.800	5/18/73	6/16/73	29.66	x
J-1	59.878	152.175	50	58.800	5/18/73	6/16/73	29.63	x
C-2	59.568	152.267	50	69.800	5/14/73	6/15/73	31.20	x x
C-2	59.568	152.267	-22	69.800	5/14/73	6/ 2/73	18.86	x
C-2	59.568	152.267	-75	69.800	5/14/73	6/15/73	31.28	x
C-3	59.085	152.257	-22	118.900	6/23/73	7/25/73	31.94	x
C-3	59.085	152.257	-75	118.900	6/23/73	7/25/73	31.95	x
C-3	59.085	152.257	50	118.900	6/23/73	7/25/73	31.95	x
C-4	59.006	152.563	-22	148.100	7/21/73	8/21/73	30.26	x
C-4	59.006	152.563	-75	148.100	7/21/73	8/21/73	30.31	x
C-4	59.006	152.563	50	148.100	7/21/73	8/21/73	30.32	x
C-6	59.120	151.895	-22	86.300	7/21/73	8/21/73	31.54	
C-5	58.941	152.890	-22	170.100	7/10/73	8/ 6/73	27.93	x
C-5	58.941	152.890	50	170.100	7/10/73	8/ 6/73	27.93	x
C-7	59.067	151.957	50	202.400	8/22/73	9/ 7/73	16.03	x
C-8	58.973	151.987	-22	151.800	8/10/73	8/25/73	15.04	x
C-9	59.140	151.705	-22	27.400	6/22/73	7/ 9/73	16.79	x
C-12	59.428	151.922	50	42.100	8/25/73	9/11/73	16.53	x
C-14	59.555	151.797	-22	67.700	6/ 5/73	6/22/73	16.99	
C-14	59.555	151.797	50	67.700	6/ 5/73	6/22/73	17.01	x
C-18	59.853	152.008	-22	35.100	5/22/73	6/16/73	25.00	x
C-18	59.853	152.008	50	35.100	5/22/73	6/16/73	25.01	x
C-19	59.912	152.477	-22	36.600	5/21/73	6/21/73	30.92	x
C-19	59.912	152.477	50	36.600	5/21/73	6/21/73	30.92	x
C-20	59.567	152.817	50	41.500	5/18/73	6/ 4/73	16.18	x
C-22	59.408	153.620	-22	18.900	8/23/73	9/10/73	17.49	
C-25	58.889	153.188	-22	163.700	7/25/73	8/ 9/73	15.03	x xx
C-25	58.889	153.188	-75	163.700	7/25/73	8/ 9/73	15.07	x xx
C-26	59.297	152.912	-22	82.600	8/23/73	9/10/73	18.30	x xx
C-26	59.297	152.912	-75	82.600	8/23/73	9/10/73	18.31	x xx
C-27	59.253	152.272	-22	94.500	6/19/73	7/20/73	31.85	x
C-27	59.253	152.272	-75	94.500	6/19/73	7/21/73	31.97	x
C-27	59.253	152.272	50	94.500	6/19/73	7/21/73	31.97	x
C-6	59.120	151.895	50	86.300	7/21/73	8/21/73	31.53	
C-12	59.428	151.910	-22	42.100	8/25/73	9/11/73	16.49	x
C-7	59.067	151.957	-75	202.400	8/22/73	9/ 7/73	16.02	x

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth with respect to MLLW. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

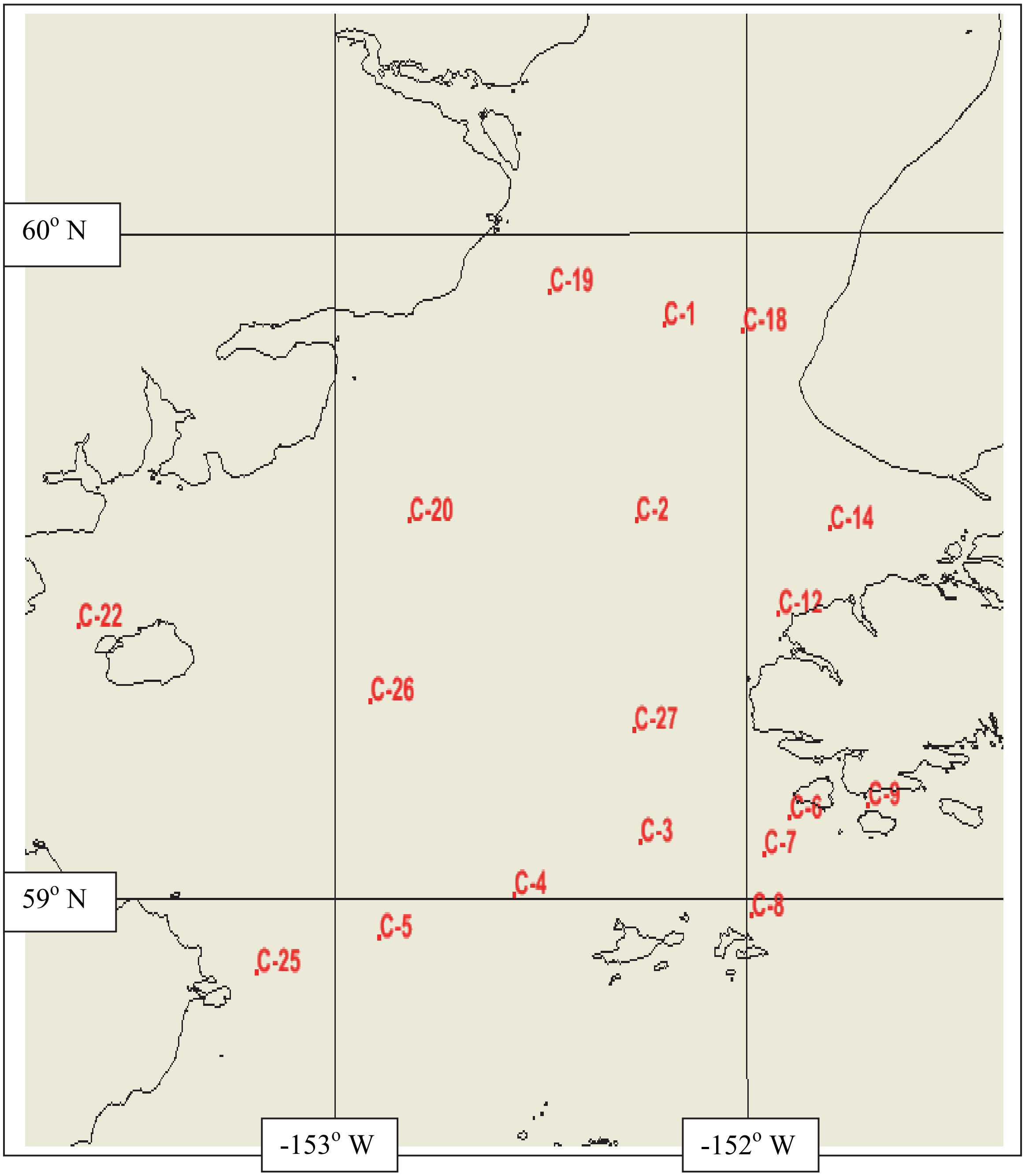


Figure 3.1. Station Locations for Cook Inlet Dataset 1.

Table 3.4. Cook Inlet Dataset 2.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (ft)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-33	59.967	151.951	-20	29.260	7/10/74	7/25/74	15.62	x
C-34	60.133	151.934	-20	40.230	6/25/74	7/11/74	15.19	x
C-34	60.133	151.934	50	40.230	6/25/74	7/11/74	15.21	x
C-36	60.374	152.166	-20	100.580	6/25/74	7/22/74	27.66	x
C-36	60.374	152.166	50	100.580	6/21/74	7/23/74	31.26	x
C-37	60.338	151.877	-20	36.580	6/25/74	7/11/74	15.42	
C-38	60.279	151.718	-20	25.600	7/ 9/74	8/ 9/74	30.88	x
C-38	60.279	151.718	50	25.600	7/ 9/74	8/ 9/74	30.89	x
C-50	60.729	151.553	-20	21.950	7/26/74	8/15/74	19.84	x
C-50	60.729	151.553	50	21.950	7/12/74	8/15/74	33.97	x
C-36	60.374	152.166	-75	100.580	6/21/74	7/22/74	31.23	x
C-67	61.088	150.472	-20	27.400	5/30/75	6/17/75	17.92	x
C-67	61.088	150.472	-50	27.400	5/30/75	6/17/75	17.92	x
C-68	61.050	150.462	-20	13.800	5/30/75	6/16/75	17.08	x
C-69	61.059	150.383	-20	40.700	5/28/75	6/16/75	19.06	x
C-77	61.180	150.229	-20	24.300	6/12/75	6/30/75	18.03	x
C-50	60.729	151.550	-20	30.100	6/26/75	7/11/75	15.81	x
C-50	60.729	151.550	-46	30.100	6/26/75	7/11/75	15.81	x
C-65	61.162	150.508	-50	26.700	6/18/75	7/ 7/75	18.94	x
C-69A	61.052	150.321	-50	56.300	6/16/75	7/ 6/75	19.40	x
C-81	61.222	150.072	-20	9.750	6/23/75	7/ 9/75	16.13	x x
C-82	61.207	150.061	-20	14.600	6/23/75	7/ 9/75	16.07	x
C-83	61.187	150.063	-20	11.200	6/25/75	7/10/75	15.22	x
C-84	61.214	150.003	-20	13.000	7/ 2/75	7/18/75	16.00	x
C-85	61.228	150.001	-20	28.900	6/23/75	7/10/75	16.94	x
C-85	61.228	150.001	-50	28.900	6/23/75	7/10/75	16.94	x
C-86	61.231	149.999	-26	20.600	7/ 1/75	7/17/75	16.02	x
C-93	61.267	149.893	-20	35.300	6/23/75	7/ 9/75	15.79	x
C-93	61.267	149.893	-50	35.300	6/23/75	7/ 9/75	15.81	x
C-53	60.804	151.287	-50	24.300	5/ 8/75	5/27/75	19.16	x
C-54	60.846	151.337	-20	42.800	5/ 8/75	5/27/75	18.94	x
C-54	60.846	151.337	-50	42.800	5/ 8/75	5/27/75	19.01	x
C-55-	60.905	151.460	-50	72.800	5/ 7/75	5/23/75	16.01	x
C-55-	60.905	151.460	50	72.800	5/ 7/75	5/23/75	16.05	x
C-37	60.338	151.877	50	36.580	6/25/74	7/11/74	15.41	x
C-51A	60.724	151.466	-20	10.970	7/24/74	8/ 8/74	15.00	x

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth with respect to MLLW. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

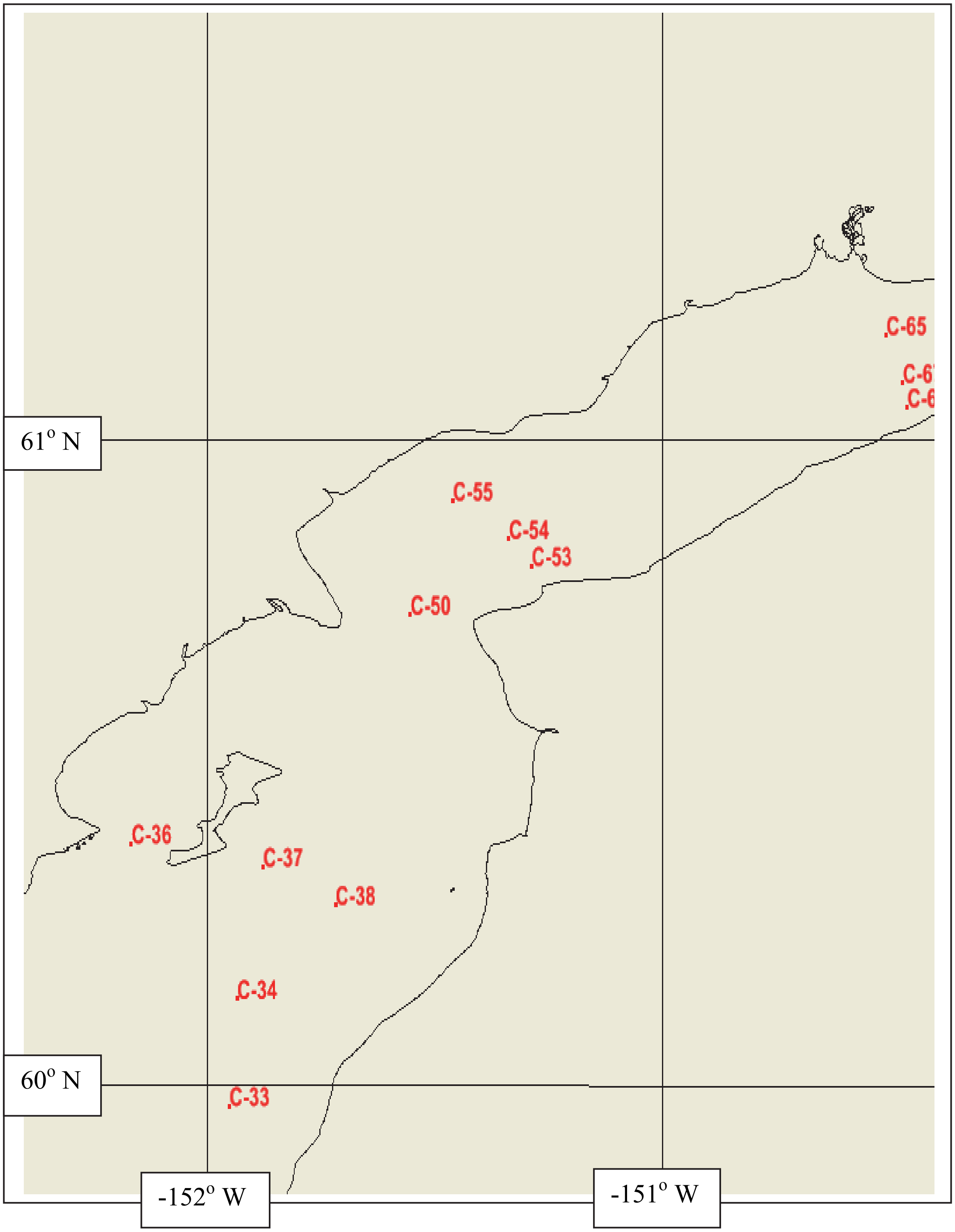


Figure 3.2. (a) Station Locations for Cook Inlet Dataset 2 Part One.

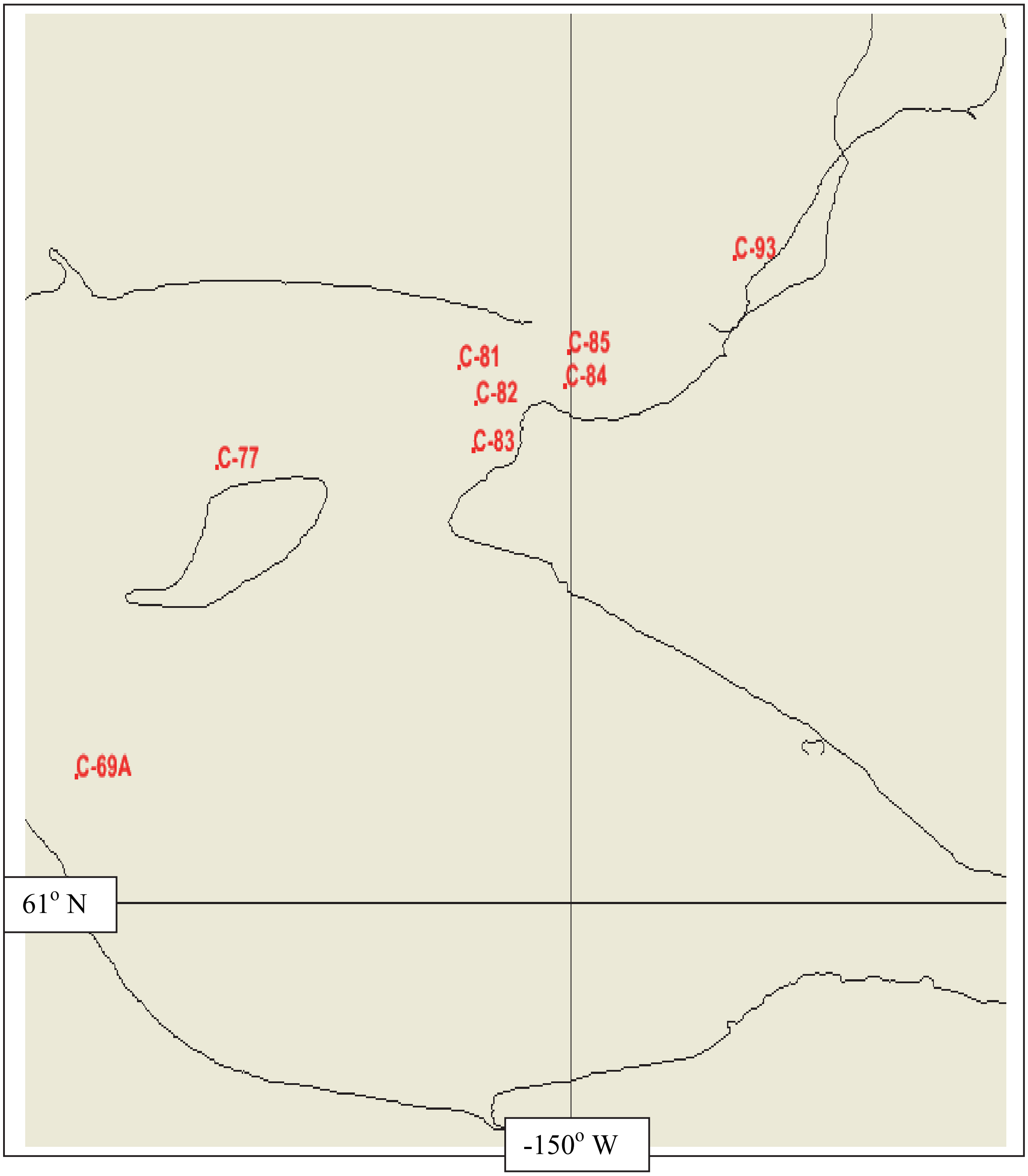


Figure 3.2. (b) Station Locations for Cook Inlet Dataset 2 Part Two.

Table 3.5. Cook Inlet Datasets 3 and 4.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (ft)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-87	61.228	149.948	-20	22.500	5/ 9/75	5/28/75	18.99	
C-87	61.228	149.947	-50	22.500	5/ 9/75	6/12/75	33.67	
C-65	61.162	150.512	-20	26.700	5/31/75	6/17/75	16.97	x
C-66	61.125	150.488	-20	22.500	5/30/75	6/18/75	18.84	x
C-88	61.246	149.923	-50	24.600	7/21/75	8/ 7/75	16.42	x
C-89	61.246	149.908	-20	19.500	7/18/75	8/ 4/75	16.90	x
C-90	61.241	149.897	-20	22.500	7/ 8/75	7/24/75	15.90	x
C-42	60.542	152.099	-75	67.670	6/ 7/74	6/24/74	17.01	x
C-29	60.097	152.574	-20	53.040	7/24/74	8/ 9/74	15.28	x
C-29	60.097	152.574	50	53.040	7/25/74	8/ 9/74	15.17	x
C-30	60.127	152.402	-20	36.580	7/23/74	8/ 8/74	16.78	x
C-30	60.127	152.402	50	36.580	7/23/74	8/ 9/74	16.83	x
C-31	60.077	152.279	-20	58.520	7/27/74	8/12/74	16.92	x
C-31	60.077	152.279	-75	58.520	7/27/74	8/12/74	16.93	x
C-50	60.721	151.560	-20	21.950	5/ 7/74	5/30/74	23.68	x
C-48	60.630	151.897	-20	18.290	5/ 7/74	5/22/74	15.09	x
C-52	60.679	151.430	-20	31.090	5/ 8/74	5/23/74	15.85	x
C-47	60.598	151.735	-20	16.460	5/ 8/74	5/23/74	15.49	
C-52	60.679	151.430	50	31.090	5/ 8/74	5/23/74	15.85	x
C-17	59.584	151.389	-20	87.780	5/10/74	5/29/74	19.02	x
C-15	59.654	151.790	-20	29.260	5/10/74	5/29/74	18.88	x
C-50	60.721	151.560	50	21.950	5/ 7/74	5/30/74	23.69	x
C-49	60.739	151.642	-20	18.290	5/ 6/74	6/ 5/74	29.99	x
C-45	60.412	151.533	-20	82.300	5/22/74	6/ 6/74	15.15	x
C-1	59.868	152.195	-75	60.350	5/30/74	6/14/74	15.01	x
C-1	59.868	152.195	50	60.350	5/30/74	6/14/74	15.02	x
C-41	60.460	152.180	-20	36.580	6/ 7/74	6/24/74	17.47	x
C-41	60.460	152.180	50	36.580	6/ 7/74	6/24/74	17.48	x
C-42	60.542	152.099	-20	67.670	6/ 7/74	6/24/74	17.01	x
C-17	59.584	151.389	-75	87.780	5/10/74	5/29/74	19.01	x
C-50	60.724	151.554	-20	21.950	5/31/74	7/ 9/74	39.02	x
C-50	60.724	151.554	50	21.950	5/31/74	7/ 9/74	39.02	x
C-37	60.338	151.877	50	36.580	6/25/74	7/11/74	15.41	
C-51A	60.724	151.466	-20	10.970	7/24/74	8/ 8/74	15.00	x
C-29	60.097	152.574	50	53.040	7/25/74	8/ 9/74	15.17	x
C-17	59.584	151.389	50	87.780	5/10/74	5/29/74	18.99	x

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth with respect to MLLW. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

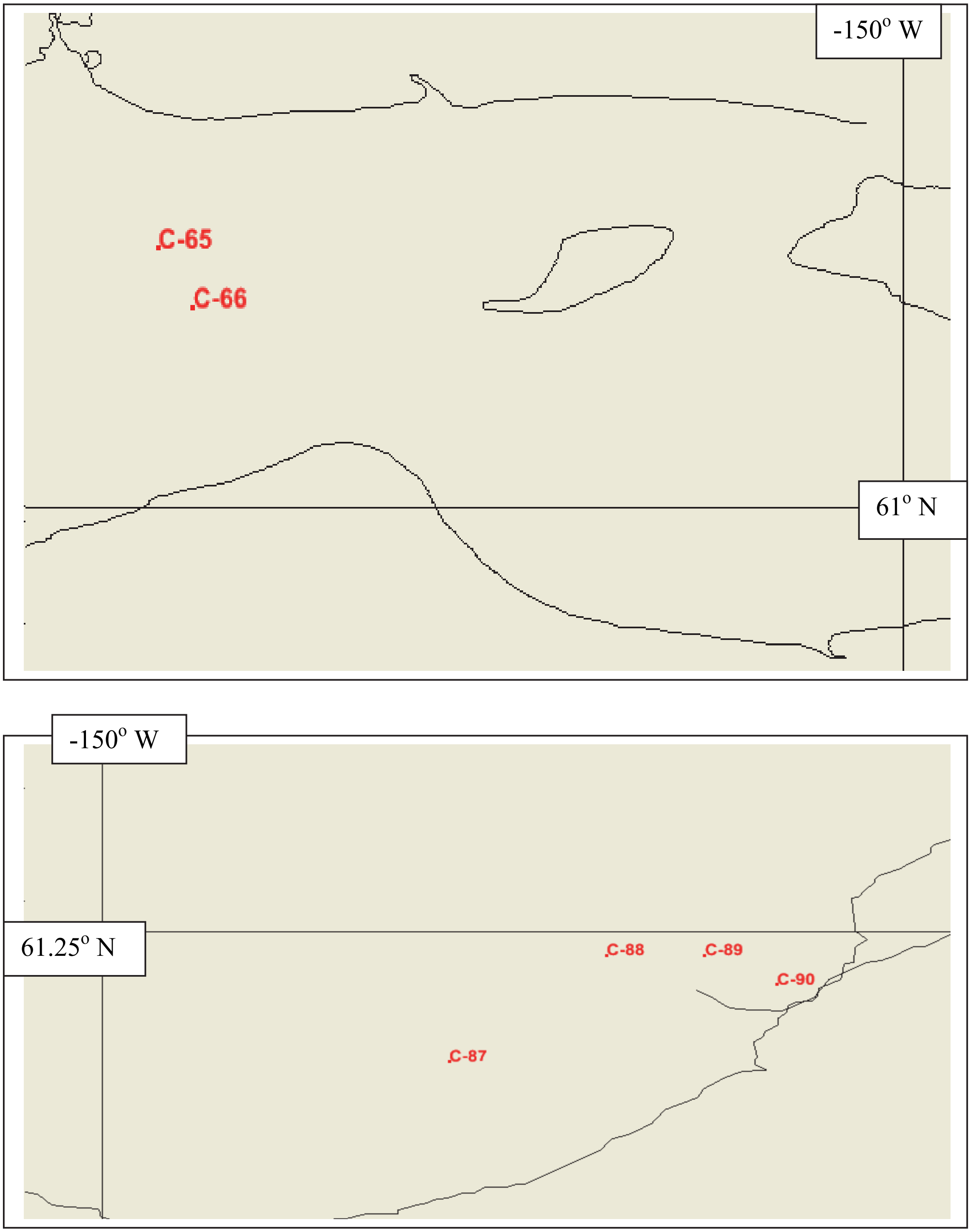


Figure 3.3. Station Locations for Cook Inlet Dataset 3.

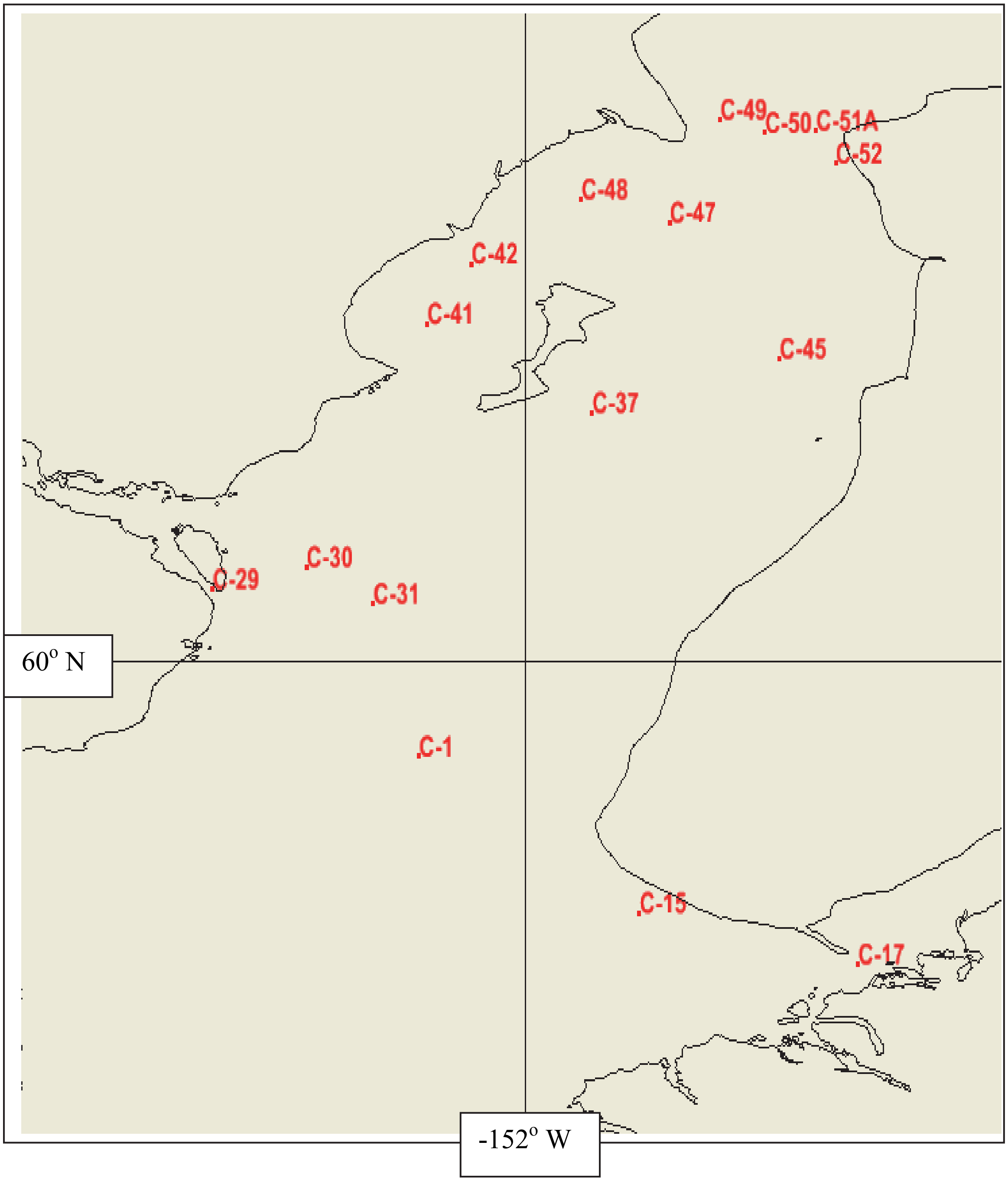


Figure 3.4. Station Locations for Cook Inlet Dataset 4.

Regional Oceanographic Characteristics

Schumacher (2005) described in detail the physical oceanography of the Cook Inlet System. The following paragraphs are from his edited Cook Inlet Physical Oceanography Workshop. The Cook Inlet marine ecosystem is a semi-enclosed tidal estuary, extending roughly 370 km. The inlet has marine connections with Shelikof Strait and the Gulf of Alaska, and has freshwater input from several large rivers and is influenced by the Aleutian Low pressure system and the Alaska Coastal Current.

Storms originating in the western Pacific move eastward along the Aleutian Islands into the northern Gulf of Alaska. Storms tend to be stopped in the Gulf of Alaska by the surrounding mountains. On the spatial scale of Cook Inlet, the mountainous terrain again plays an important role by causing local modifications to the larger scale atmospheric pressure and wind fields. Mountains are present on the east and west with only small breaks surrounding Cook Inlet and Shelikov Strait. On the western side of Cook Inlet are the Alaska and Aleutian mountain ranges. On the eastern side of the inlet are the Talkeetna, Chugach, and the Kenai mountain ranges.

The mountains not only block low-level airflow east and west but also form airflow channels for northern and southern winds. There are two main types of wind resulting from the terrain: gap winds and drainage winds. A gap wind is a wind flowing from areas of high-pressure systems to areas of low-pressure systems along the sea-level channel. Gap winds were observed over Cook Inlet in two wind channels that constrain low-level winds: the north-south channel formed by Cook Inlet, and the east-west channel formed by Kamishak Gap, Kamishak Bay, and Kennedy and Stevenson entrances. Mountain-gap wind speeds can reach more than 50 meters per second over the Barren Islands.

Small-scale features of the wind field such as drainage winds and wake flow also exist in the Cook Inlet region. Drainage winds occur along Cook Inlet's mountainous southeastern and western coasts draining from glaciated valleys. In winter, cold continental air drains from the mountainous regions surrounding northern Cook Inlet. Drainage wind peak velocities are on the order of the peak gap winds.

Wind generated by small-scale features can create conditions that do not appear on standard National Weather Service products, but can affect conditions which are important for marine operations and the distribution of oil spills. The paucity of direct wind observations in Cook Inlet makes quantification of small-scale phenomena unfeasible, though they directly impact mariners and aviators traversing the region.

The dominant currents within Cook Inlet are tidal, and forced externally. Two unequal high and low tides occur per day with the mean range increasing northward. The semidiurnal tidal wave enters lower Cook Inlet through both Kennedy and Stevenson Entrances and from the south end of Shelikov Strait. Tidal currents in lower Cook Inlet are of the mixed type with the semidiurnal components, M_2 and S_2 dominant, having speeds in excess of 150 cm/sec. Tidal speeds are generally stronger in the western than the eastern portions of lower Cook Inlet and increase northward. As a result, the strong tidal currents interact with the bottom and produce robust mixing.

External forcing is also provided by the Alaska Coastal Current (ACC), which is driven by both freshwater inflow and winds. Changes in basin scale climate influence the properties of the ACC. In general, there is agreement regarding the in-and-outflow of the ACC that provides a southern boundary to the ecosystem, and the existence of outflow along the western side of the inlet resulting from freshwater inflow.

Internal forcing for currents results from the regional winds and river discharge. The wind drift current depends upon the speed of the wind, its constancy, and the length of time it has blown. For extreme small scale wind features (50 m/sec), the surface current speeds would be ~150 cm/sec. For more typical winds (~25 knots), the wind drift current would be ~39 cm/sec. For many regions of Cook Inlet, the tidal currents are equal to or significantly greater than these values. At certain times and in particular regions of Cook Inlet, however, gap and other small-scale winds might be the dominant forcing factor for surface currents.

Freshwater inflow to the Cook Inlet ecosystem is dominated by an annual signal. The river flows entering the upper Cook Inlet include the Knik, Matanuska, Susitna, Talkeetna and Skwentna Rivers. Most freshwater input occurs during the spring and summer months (April – October) due to snowmelt and rainfall. In upper Cook Inlet, vigorous tidal stirring results in the fresh water being vertically well mixed with the marine waters.

Sea ice is a prominent feature in Cook Inlet with implications for hazardous material spills and ecosystem dynamics. There are four different types of ice which appear including pack ice, shorefast ice, stamukhi (layered ice-cakes), and estuarine river ice. The amount of sea ice varies annually. In general, sea ice forms in October and November, increases from October to February, and melts in March and April. The conditions governing ice formation, movement, and decay in Cook Inlet are complex and dynamic.

Here we examine CT and current time series during May, June and July at Stations C-4, C-1, C-37 and C-67, which proceed from the entrance up the estuary. During July 1973 at Station C-4 near the eastern entrance at 22 ft below the surface in Figure 3.4 we note peak current speeds of order 80 cm/s with rotary current characteristics. In Figure 3.5, for C-4 at 75 ft below the surface, current speeds are reduced to order 60 cm/s with directions unchanged from those at 22 ft below the surface. At Station C-1, further up the estuary, during July 1973 peak current speeds are near 200 cm/s with the flood direction near due North and the ebb direction near 180^o clockwise from North. At Station C-37 during June 1974, at 50 feet above the bottom, the salinity is near 31 PSU with the temperature slowly increasing from 9 ^oC, as shown in Figure 3.7. In Figure 3.8, the peak current speeds at C-37 are order 160 cm/s, with the ebb and flood directions order 24^o and 205^o clockwise from North. At Station C-67 in May 1975 at 20 feet below the surface, peak current speeds are near 200 cm/s with a distinct rectilinear flow with ebb and flood direction near 90^o and 270^o clockwise from North, respectively

Salinity time series are available at only a few stations, due to measurement issues. Current speeds are very large (~200 cm/s) and decrease with depth. Even at Station C-4, current speeds are 40 cm/s. Data are taken primarily during the Spring and Summer periods. No ice formation data are available.

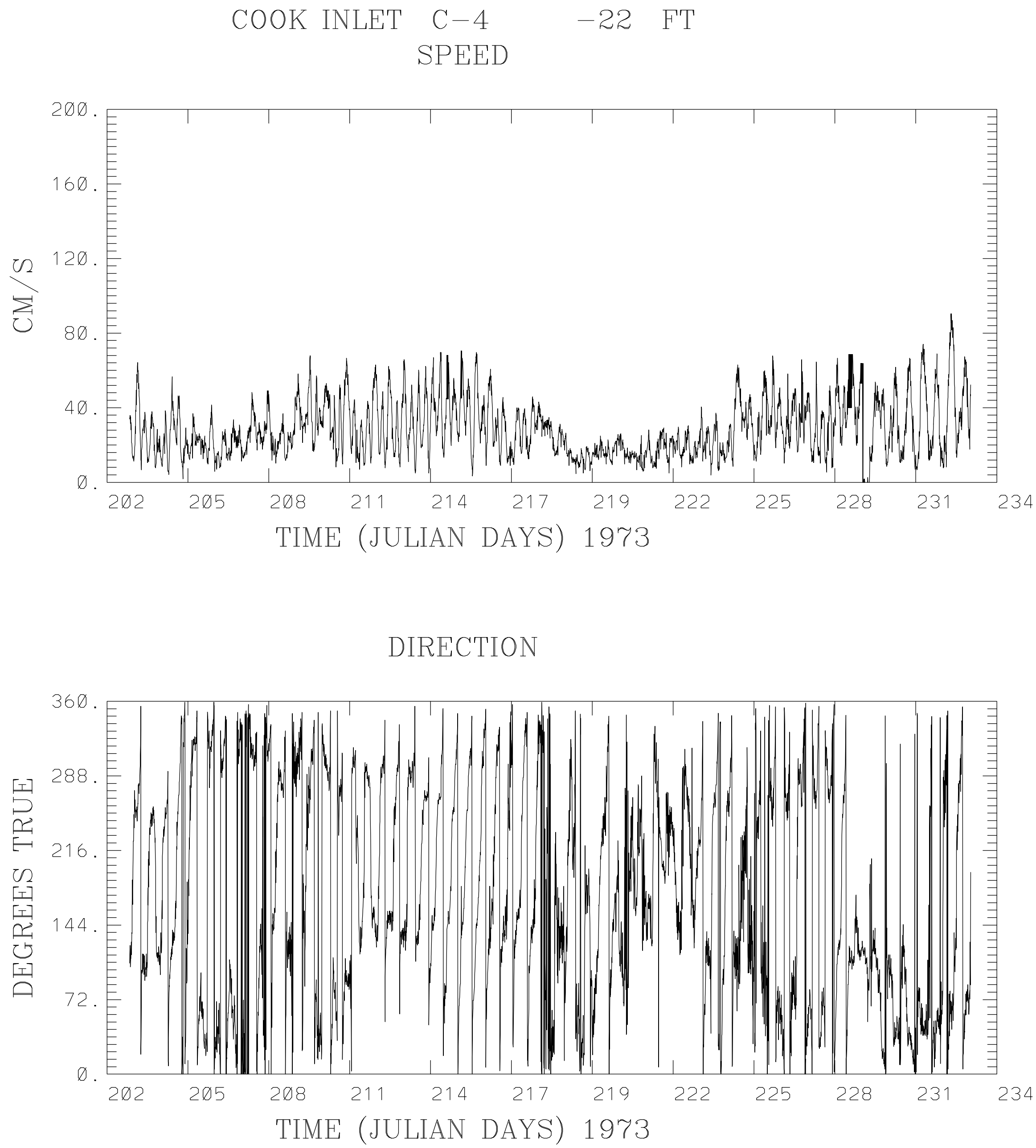


Figure 3.5. Station C-4 Cook Inlet Current Speed and direction at 22 ft below the surface in July 1973.

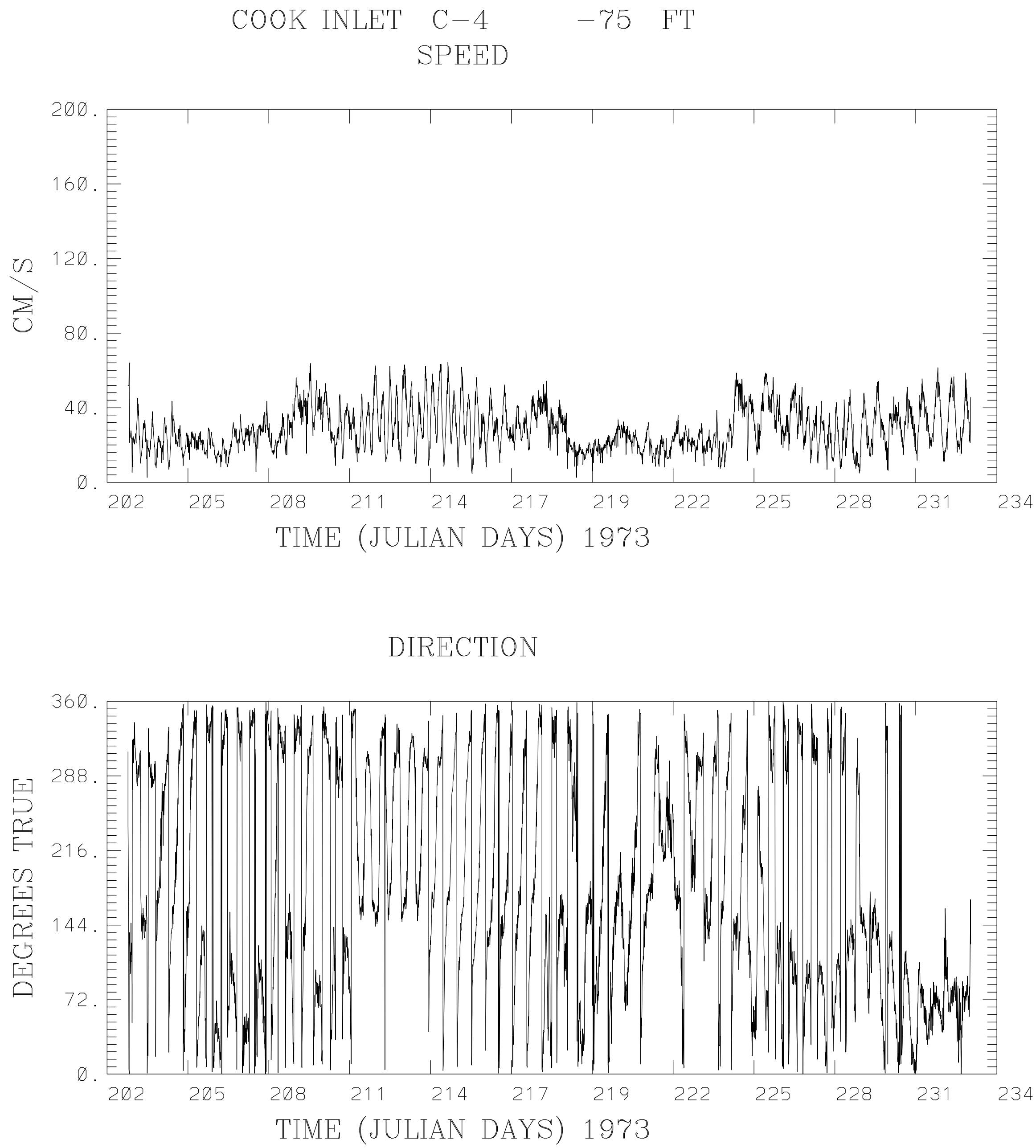


Figure 3.6. Station C-4 Cook Inlet Current Speed and Direction at 75 ft below the surface in July 1973.

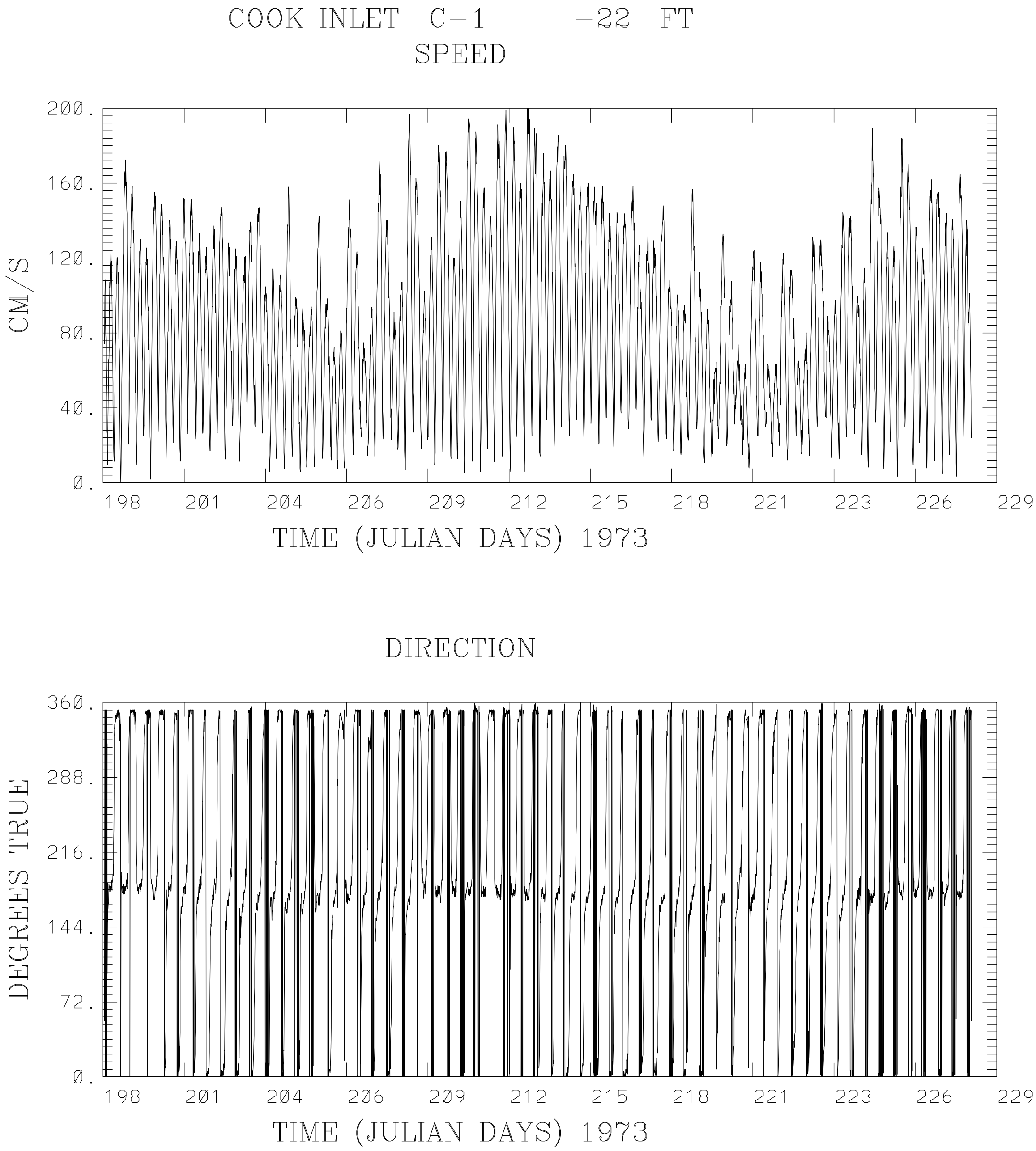


Figure 3.7. Station C-1 Cook Inlet Current Speed and Direction at 22 ft below the surface in July 1973.

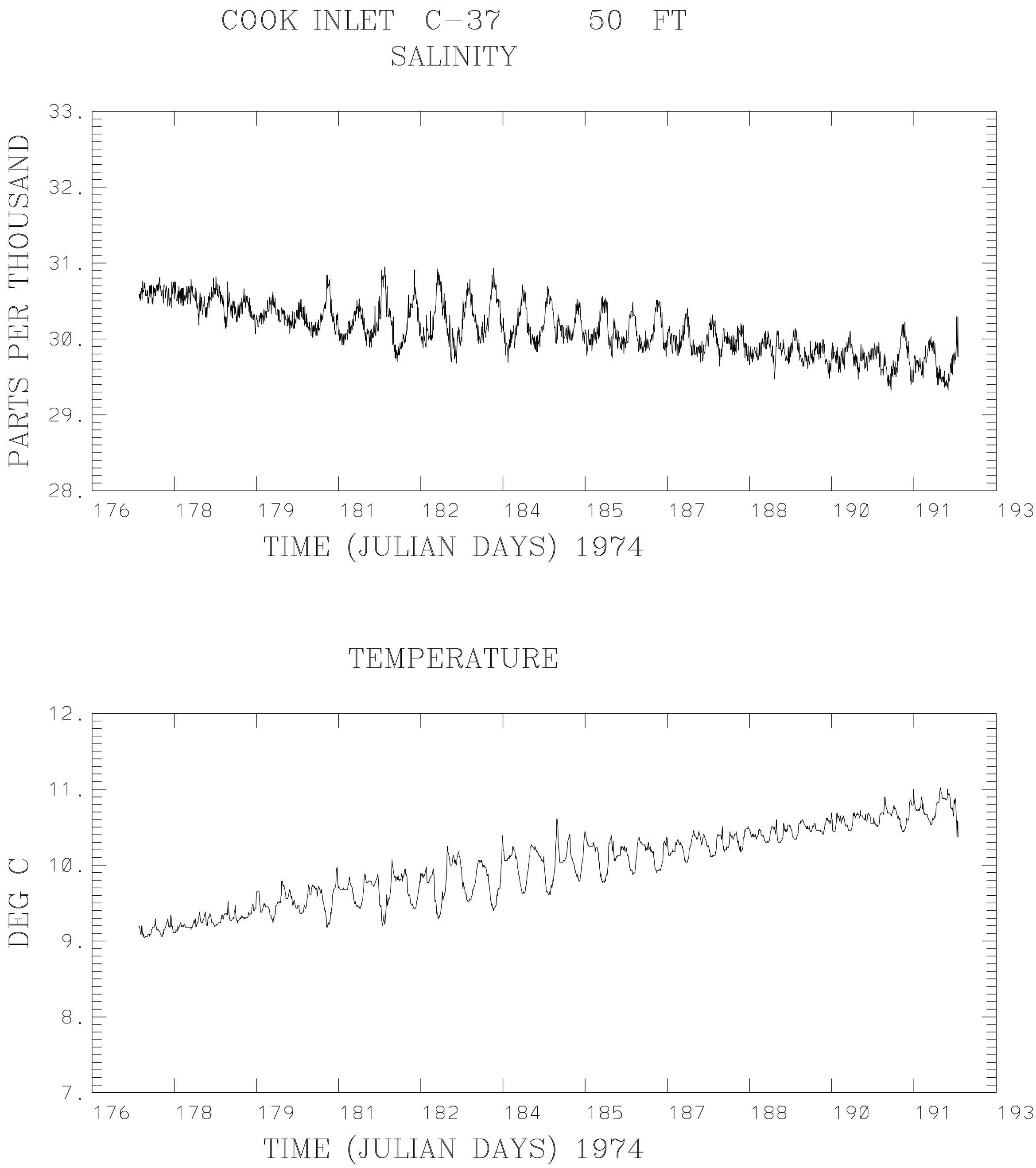


Figure 3.8. Station C-37 Cook Inlet Salinity and Temperature at 50 ft above the bottom in June 1974.

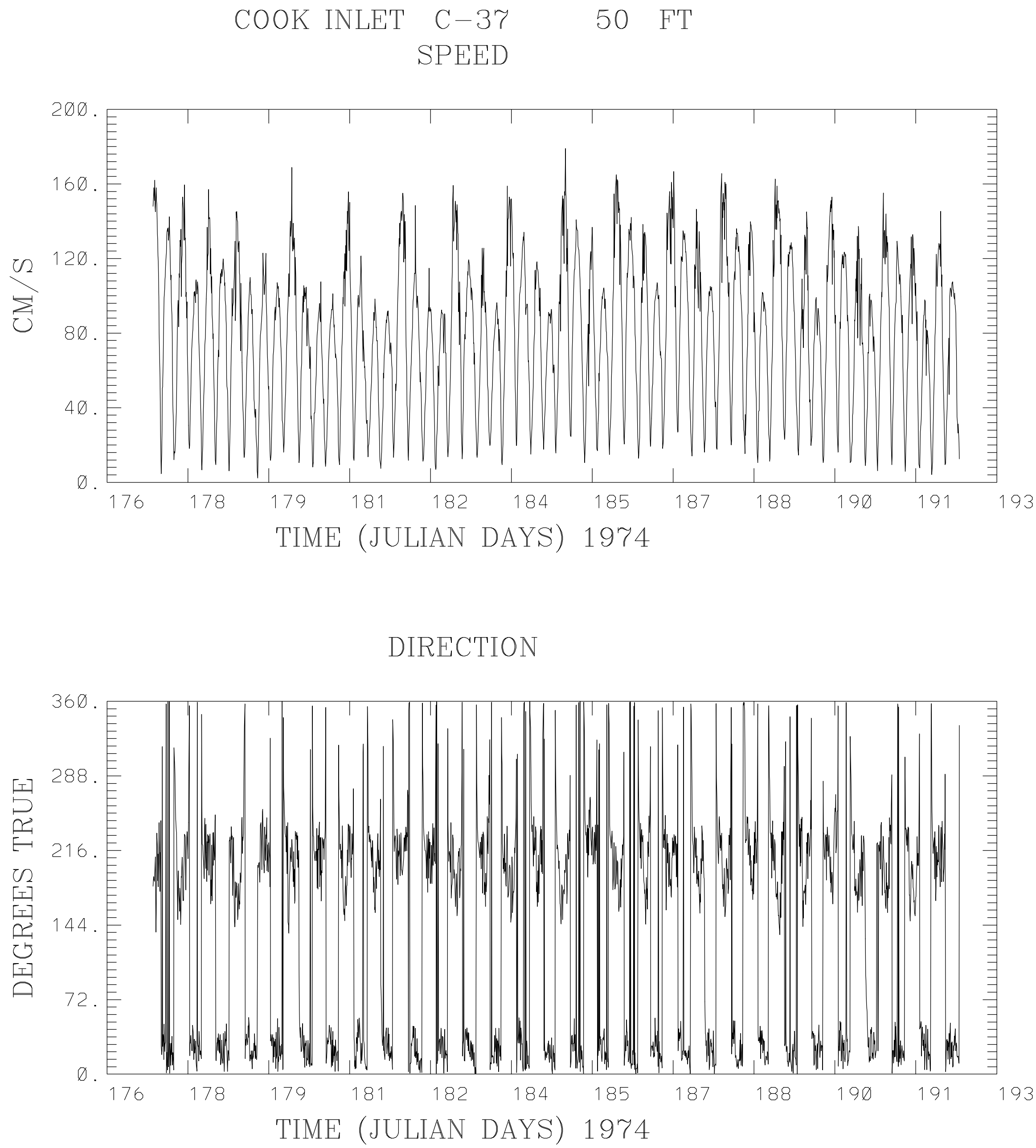


Figure 3.9. Station C-37 Cook Inlet Current Speed and Direction at 50 ft above the bottom in June 1974.

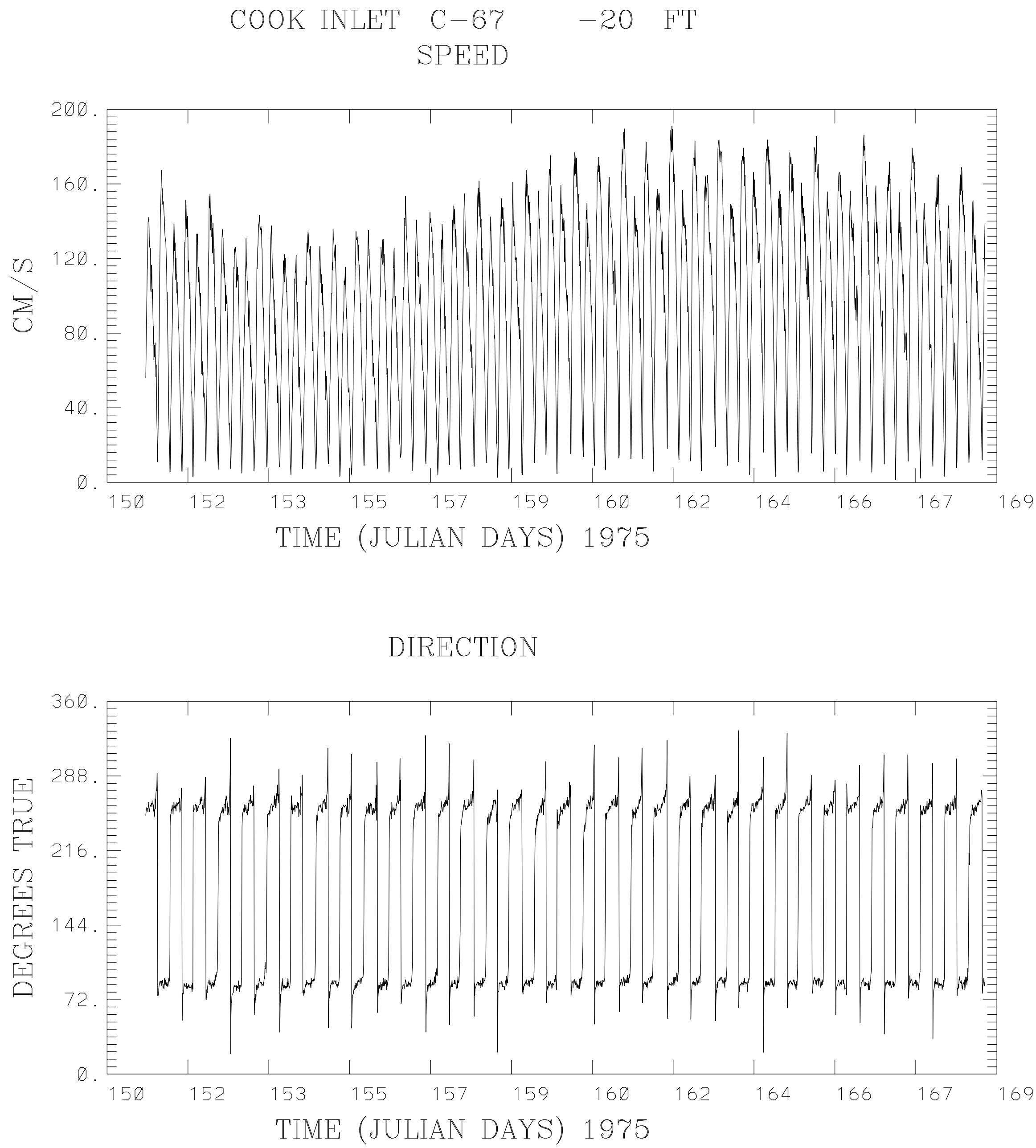


Figure 3.10. Station C-67 Cook Inlet Current Speed and Direction at 20 ft below the surface in May 1975.

4. PRINCE WILLIAM SOUND

NOS performed an intensive 3-year survey from May 1976 ending in August 1978 to study the circulation in Prince William Sound. The study was performed during the late Spring and Summer months to avoid ice. Over the study period, 86 current meter locations were occupied, with CTD data collected at all current meter stations. The Aanderaa Model RCM-4 current meter recorded and measured current speed and direction and included temperature and conductivity and pressure sensors. Here, we summarize the recovered data and discuss related regional oceanographic characteristics.

Data Inventory and Summary

The datasets obtained from CO-OPS on compact disc are listed in Table 4.1 and constitute the recoverable data. It was necessary to carefully inventory these datasets and determine their data quality. Note while meteorological data (wind speed and direction, and sea level atmospheric pressure) were collected in 5 files in 1976 and 1977, and in 1 file in 1978 (Frey, 7/1983), all data were lost. 336 and 228 CTD profiles were collected in 1977 and in 1978 (Frey, 7/1983), but all data were lost.

Table 4.1. Prince William Sound Circulation Survey Raw Data Inventory.

Directory Name	Number of Files	Data Period	Data Description	Data Quality
Prince1	38	1976	Aanderaa Current Meter	OK
Prince2	51	1977	Aanderaa Current Meter	OK
Prince3	46	1976	Aanderaa Current Meter	OK
Prince4	66	1978	Aanderaa Current Meter	OK

CT/Current Data

The salinity and temperature and current data inventoried in Table 4.2 were distributed amongst four directories: Prince1, Prince2, Prince3, and Prince4. The data files in these directories (FILE1 through FILEn) were concatenated to create cumulative data files: such as file_prince1, file_prince2, file_prince3, and file_prince4. The data in each individual data file (FILE1 through FILEn) represent current and CT data at one specific station location, over a given time period. It should be noted that since the focus was on data for model validation and harmonic analysis, only stations with record lengths of 15 days or greater were considered. In general, data quality was sufficient, such that no editing was performed.

Each of the four datasets are described in Tables 4.3 through Tables 4.6, respectively, in terms of station location, measurement and station depths and measurement dates and durations. Note in these tables the station depths with respect to MLLW were estimated using Edition 31 of Nautical Chart 16700, since no station depths were given in the memorandum of record (Frey, 7/1983). Stations locations are shown in Figures 4.1 through Figures 4.4, respectively, for each of the four datasets.

Table 4.2. Prince William Sound Circulation Survey Processed Data File Inventory.

Data Type	Location	Filename
CT/Current Raw	~/Prince1/ ~/Prince2/ ~/Prince3/ ~/Prince4/	FILE1 – FILE38, FILE1 – FILE51, FILE1 – FILE46, FILE1 – FILE66,
CT/Current Edited	~/prince1/ ~/prince2/ ~/prince3/ ~/prince4/	file_prince1 file_prince2 file_prince3 file_prince4
CT/Current Qc	~/qc/	file_prince1.qc file_prince2.qc file_prince3.qc file_prince4.qc

~ = /disks/NASUSER/philr/prince_william

Table 4.3. Prince William Sound Dataset 1.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (fathoms)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-01	61.113	146.358	22	100	5/11/76	6/ 2/76	22.16	x
C-01	61.113	146.358	72	100	5/11/76	6/ 2/76	22.17	x
C-02	61.095	146.351	69	101	5/11/76	5/26/76	15.01	x
C-03	61.116	146.555	-19	120	5/11/76	5/26/76	15.00	x
C-04	61.089	146.554	-20	100	5/11/76	5/26/76	15.03	x
C-04	61.089	146.554	-7	100	5/11/76	5/26/76	15.03	x
C-04	61.089	146.554	50	100	5/11/76	5/26/76	15.03	x
C-07	61.042	146.640	20	66	5/12/76	5/28/76	16.01	x
C-07	61.042	146.640	70	66	5/12/76	5/28/76	15.96	x
C-06	61.022	146.792	50	100	5/12/76	5/28/76	16.05	x
C-08	60.986	146.724	20	74	5/12/76	5/28/76	15.89	xx
C-08	60.986	146.724	70	74	5/12/76	5/28/76	15.88	x
C-08	60.986	146.724	50	74	5/12/76	5/28/76	15.88	xx
C-5	61.077	146.655	27	100	5/12/76	6/11/76	29.87	x
C-5	61.077	146.655	-50	100	5/14/76	6/11/76	28.06	
C-11	60.895	146.878	-15	120	6/ 2/76	6/17/76	15.06	x
C-11	60.895	146.878	-65	120	6/ 2/76	6/17/76	15.07	x
C-11	60.895	146.878	50	120	6/ 2/76	6/17/76	15.12	x
C-17	60.859	146.929	-19	20	6/ 2/76	6/18/76	16.00	x
C-10	60.913	146.770	50	15	6/ 1/76	6/17/76	15.09	xx
C-5	61.077	146.656	-52	100	6/11/76	7/ 2/76	21.10	xxx
C-5	61.077	146.656	-252	100	6/11/76	7/ 2/76	21.10	x
C-5	61.077	146.656	27	100	6/11/76	7/ 2/76	21.11	x x
C-16	60.921	147.218	-20	133	5/27/76	6/24/76	28.04	x
C-17	60.859	146.928	-70	20	6/18/76	7/ 6/76	18.10	x
C-18	60.792	146.857	-20	70	6/15/76	6/30/76	15.12	x x
C-19	60.768	146.747	-20	90	6/15/76	6/30/76	15.15	xx
C-19	60.768	146.747	-70	90	6/15/76	6/30/76	15.15	x
C-19	60.768	146.747	50	90	6/15/76	6/30/76	15.14	x x
C-20	60.789	146.620	-20	84	6/17/76	7/ 7/76	20.08	x x
C-20	60.794	146.620	50	84	6/17/76	7/ 7/76	20.10	xx
C-22	60.794	146.465	-20	110	6/17/76	7/ 6/76	19.23	xx
C-22	60.794	146.465	-70	110	6/17/76	7/ 6/76	19.22	xxx
C-22	60.794	146.465	50	110	6/17/76	7/ 6/76	19.22	xxx
C-23	60.827	146.264	-20	100	6/17/76	7/ 7/76	19.17	x
C-23	60.827	146.264	-70	100	6/17/76	7/ 7/76	19.18	xxx

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth in fathoms with respect to MLLW estimated from Edition 31 of Nautical Chart 16700. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

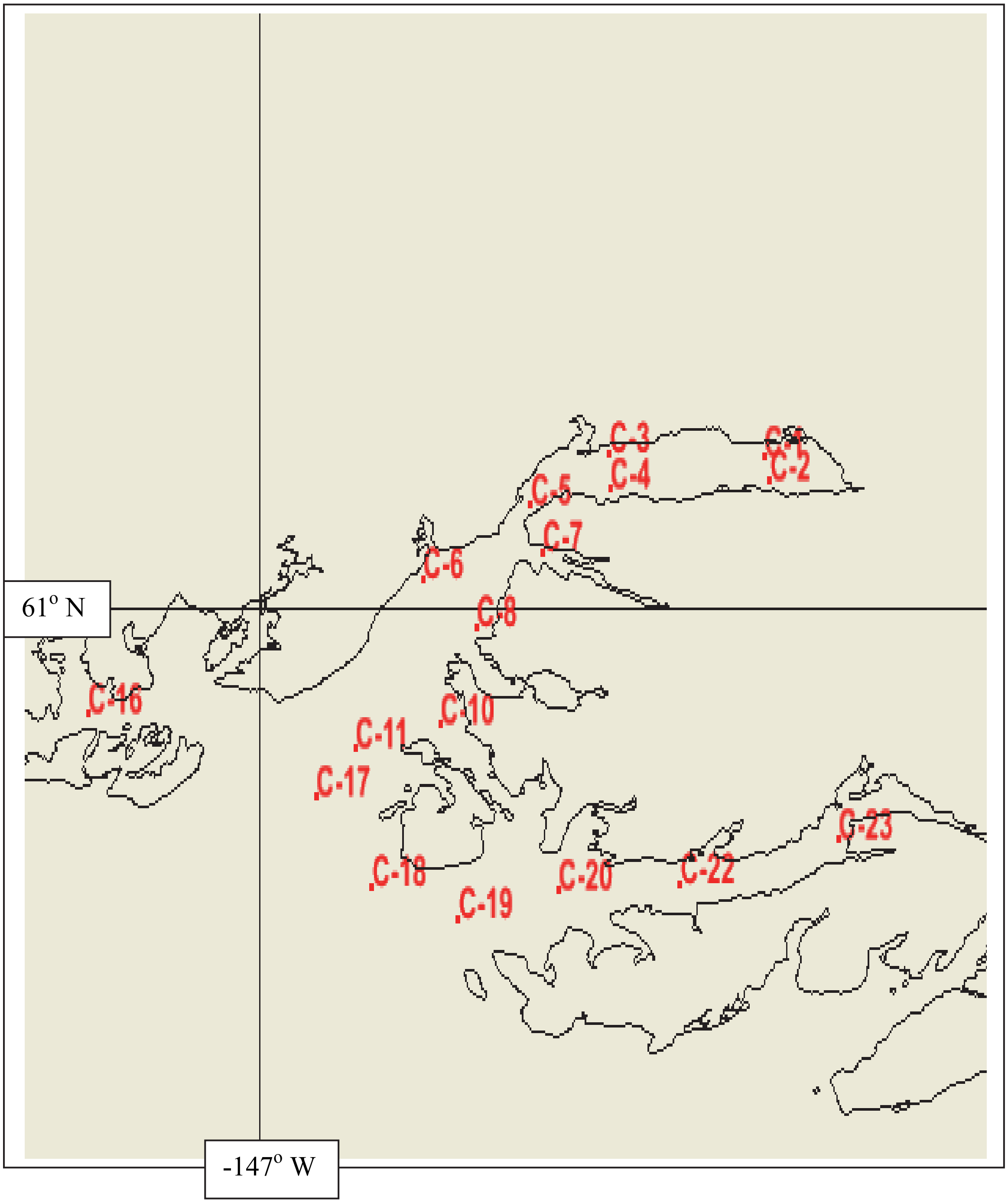


Figure 4.1. Station Locations for Prince William Sound Dataset 1.

Table 4.4. Prince William Sound Dataset 2.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (fathoms)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-55	60.312	146.813	-79	144	5/ 9/77	5/25/77	16.06	
C-59	60.528	147.182	100	90	5/10/77	6/13/77	34.91	x
C-56	60.417	146.779	-70	150	5/10/77	5/26/77	16.02	x
C-56	60.417	146.779	-400	150	5/10/77	6/ 9/77	30.06	x
C-57	60.411	146.968	-401	160	5/10/77	6/ 9/77	30.04	x
C-57	60.411	146.968	-71	160	5/10/77	5/26/77	15.87	x
C-29	60.557	146.600	100	70	5/11/77	6/10/77	30.72	x
C-64	60.693	147.038	-417	244	5/31/77	7/ 1/77	30.11	x
C-65	60.687	147.233	100	110	6/ 1/77	7/ 1/77	30.06	x
C-61	60.552	146.783	-401	150	6/ 1/77	7/ 6/77	34.19	xx
C-60	60.546	147.017	100	180	6/ 1/77	7/ 6/77	34.84	x
C-63	60.718	146.863	-402	230	6/ 2/77	7/ 5/77	33.10	x
C-63	60.718	146.863	100	230	6/ 2/77	7/ 5/77	33.13	xx
C-61	60.552	146.783	-71	150	6/16/77	7/ 6/77	19.14	x
C-55	60.313	146.816	-71	144	6/23/77	7/12/77	19.01	
C-5	61.074	146.656	-20	100	6/27/77	7/19/77	21.94	x
C-5	61.074	146.656	-70	100	6/27/77	7/19/77	21.94	x
C-5	61.074	146.656	100	100	6/27/77	7/19/77	21.98	x
C-69	60.961	146.821	-69	200	6/27/77	7/19/77	21.94	x
C-69	60.961	146.821	100	200	6/27/77	7/19/77	21.95	x
C-66	60.786	147.283	-400	220	6/28/77	7/28/77	30.02	x
C-68	60.924	147.045	-69	173	6/28/77	7/20/77	21.94	x
C-73	60.921	147.173	-21	132	6/29/77	7/20/77	21.98	x
C-73	60.921	147.173	-71	132	6/28/77	7/20/77	21.99	x
C-73	60.921	147.173	-401	132	6/28/77	7/20/77	21.95	
C-55	60.316	146.817	-75	144	7/12/77	8/12/77	30.78	xx
C-55	60.316	146.817	100	144	7/12/77	8/12/77	30.79	x
C-60	60.549	147.020	-69	180	7/13/77	8/12/77	30.04	x
C-60	60.549	147.020	100	180	7/13/77	8/12/77	30.04	x
C-5	61.074	146.657	-17	100	7/19/77	8/11/77	23.00	x
C-5	61.074	146.657	-67	100	7/19/77	8/11/77	22.96	x
C-69	60.960	146.817	-69	200	7/19/77	8/11/77	22.99	x
C-69	60.960	146.817	100	200	7/19/77	8/11/77	23.00	x
C-68	60.924	147.046	-20	173	7/20/77	8/13/77	23.05	x
C-68	60.924	147.046	-70	173	7/20/77	8/13/77	23.05	x
C-68	60.924	147.046	100	173	7/20/77	8/13/77	23.06	xx
C-73	60.921	147.178	-22	132	7/21/77	8/13/77	23.03	x
C-73	60.921	147.178	-72	132	7/21/77	8/13/77	23.03	x
C-73	60.921	147.178	-402	132	7/21/77	8/13/77	23.03	x
C-73	60.921	147.178	100	132	7/21/77	8/13/77	23.03	x
C-67	60.847	147.012	-18	200	7/21/77	8/20/77	30.00	x
C-67	60.847	147.012	-68	200	7/21/77	8/20/77	30.01	x
C-67	60.847	147.012	-398	200	7/21/77	8/20/77	30.01	x
C-67	60.847	147.012	100	200	7/21/77	8/20/77	30.01	x
C-76	60.689	147.800	-75	77	5/13/78	6/12/78	30.83	x
C-76	60.689	147.800	-205	77	5/13/78	6/12/78	30.83	x

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth in fathoms estimated from Edition 31 of Nautical Chart 16700. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

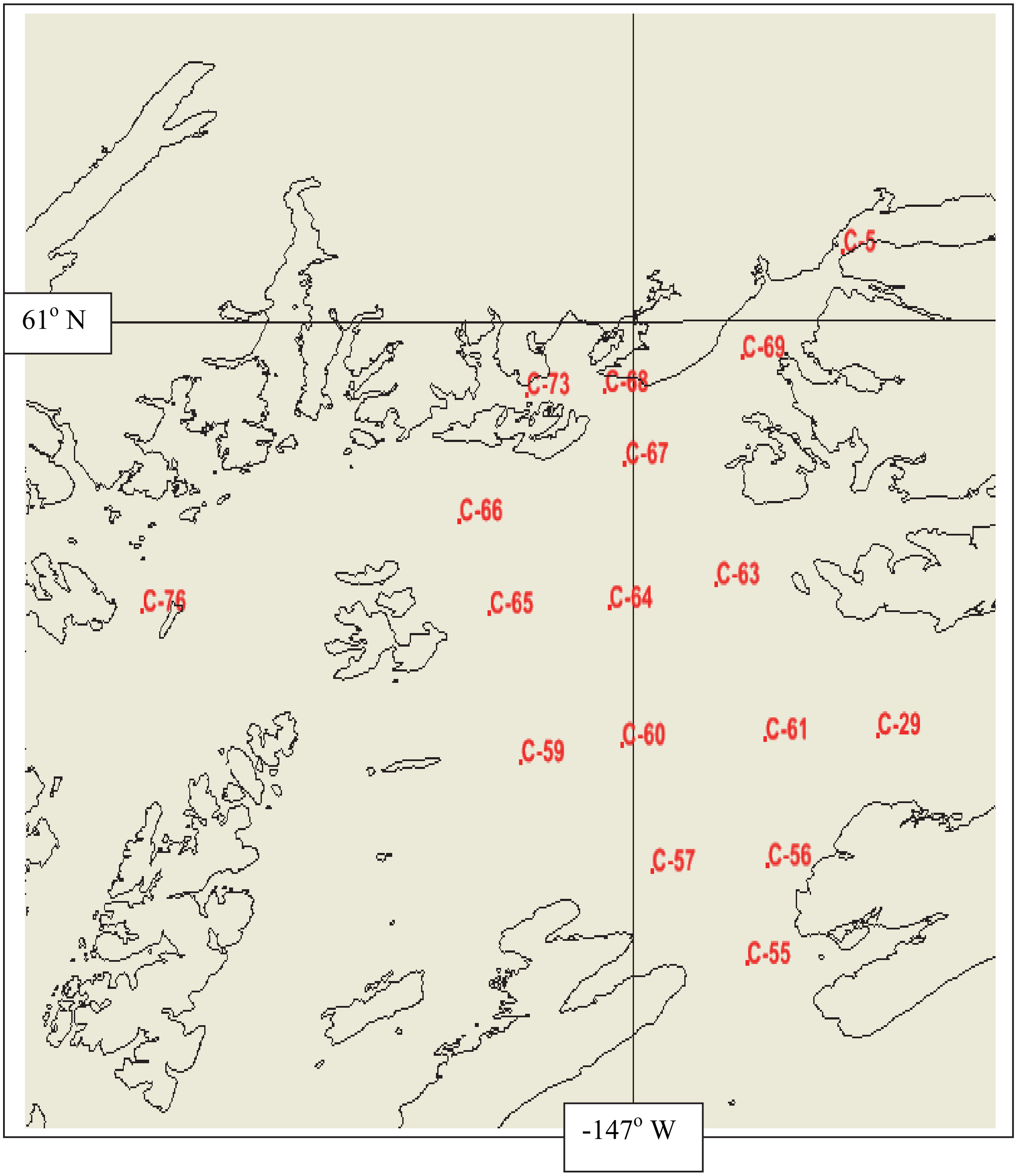


Figure 4.2. Station Locations for Prince William Sound Dataset 2.

Table 4.5. Prince William Sound Dataset 3.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (fathoms)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-30	60.505	146.590	-20	70	7/ 1/76	7/16/76	15.10	x
C-30	60.505	146.590	-70	70	7/ 1/76	7/16/76	15.10	x
C-30	60.505	146.590	50	70	7/ 1/76	7/16/76	15.09	x
C-29	60.554	146.597	-20	70	7/ 1/76	7/16/76	15.08	x
C-29	60.554	146.597	-70	70	7/ 1/76	7/16/76	15.08	x
C-29	60.554	146.597	50	70	7/ 1/76	7/16/76	15.08	x
C-28	60.728	146.593	-20	n/a	7/ 1/76	7/19/76	18.15	x
C-28	60.728	146.593	-70	n/a	7/ 1/76	7/19/76	18.16	xx
C-28	60.728	146.593	50	n/a	7/ 1/76	7/19/76	18.17	x
C-27	60.728	146.113	-70	50	7/ 7/76	7/23/76	15.17	x
C-25	60.658	146.606	-20	17	7/ 1/76	7/19/76	18.04	x
C-25	60.658	146.606	-70	17	7/ 1/76	7/19/76	18.06	x
C-13	60.916	147.084	-20	150	7/ 9/76	7/27/76	18.10	x
C-31	60.565	146.453	-20	67	7/12/76	7/28/76	15.15	x
C-31	60.565	146.453	-70	67	7/12/76	7/28/76	15.15	x
C-32	60.580	146.253	-20	75	7/12/76	7/28/76	15.19	xx
C 32	60.580	146.253	-70	75	7/12/76	7/28/76	15.19	x
C-32	60.580	146.253	50	75	7/12/76	7/28/76	15.19	x xx
C-03	61.116	146.557	-68	120	7/23/76	8/ 9/76	16.80	x
C-10	60.911	146.776	-22	40	7/23/76	8/ 9/76	17.13	x
C-10	60.911	146.776	-72	40	7/23/76	8/ 9/76	17.12	x
C-33	60.585	146.055	-20	47	7/13/76	8/ 3/76	20.18	x
C-33	60.585	146.055	-70	47	7/13/76	8/ 3/76	20.17	xxx
C-34	60.599	145.815	-20	50	7/13/76	8/ 3/76	20.97	x
C-34	60.599	145.815	-70	50	7/13/76	8/ 3/76	20.97	x
C-36	60.498	146.447	-20	45	7/20/76	8/ 4/76	15.00	x
C-36	60.498	146.447	-70	45	7/20/76	8/ 4/76	15.13	x
C-05	61.077	146.657	-50	100	7/23/76	8/11/76	18.88	x
C-05	61.077	146.657	-100	100	7/23/76	8/11/76	18.83	x
C-05	61.077	146.657	27	100	7/23/76	8/11/76	18.88	x
C-37	60.339	146.746	-20	150	7/28/76	8/12/76	15.03	x
C-37	60.339	146.746	-70	150	7/28/76	8/12/76	15.03	x
C-39	60.191	146.894	-18	148	7/29/76	8/13/76	15.01	x
C-39	60.191	146.894	-68	148	7/29/76	8/13/76	15.01	xx
C-39	60.191	146.894	50	148	7/29/76	8/13/76	15.05	x
C-40	60.187	146.748	-20	115	7/28/76	8/12/76	15.04	x
C-40	60.187	146.748	-70	115	7/28/76	8/12/76	15.04	x
C-40	60.187	146.748	50	115	7/28/76	8/12/76	15.05	x
C-41	60.224	146.663	-81	15	7/28/76	8/12/76	15.06	x
C-41	60.224	146.663	50	15	7/28/76	8/12/76	15.08	x

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth in fathoms with respect to MLLW estimated from Edition 31 of Nautical Chart 16700. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction. Note for Station C-28 no station depth could be determined since the station location was on land.

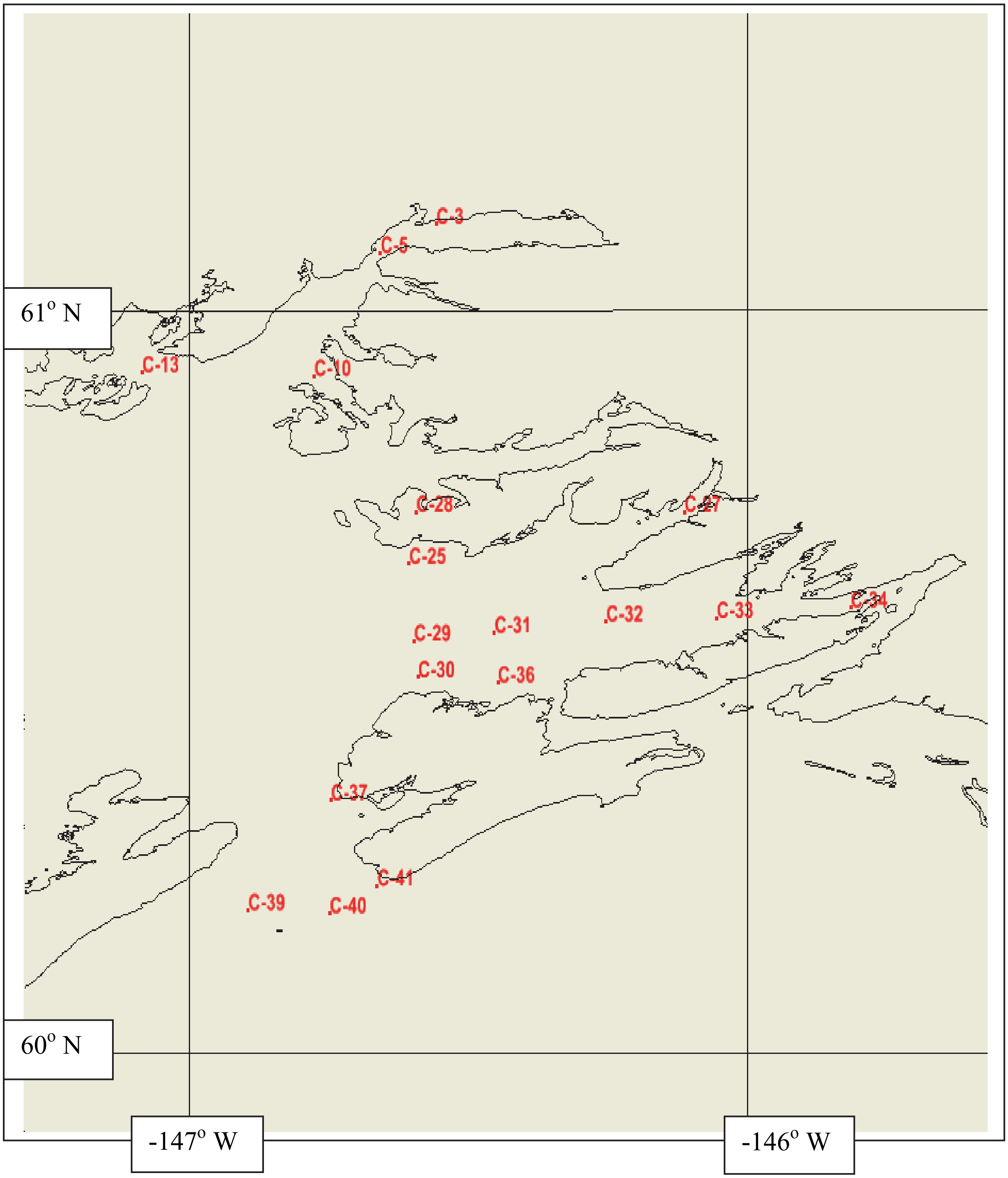


Figure 4.3. Station Locations for Prince William Sound Dataset 3.

Table 4.6. Prince William Sound Dataset 4.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (fathoms)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD			
								S	T	A	D
C-76	60.689	147.800	-75	75	5/13/78	6/12/78	30.83	x			
C-76	60.689	147.800	-205	75	5/13/78	6/12/78	30.83	x			
C-77	60.609	148.125	-68	214	5/14/78	6/13/78	30.97	x			
C-79	60.773	148.140	-72	232	5/11/78	6/12/78	31.90	x			
C-79	60.773	148.140	-402	232	5/11/78	6/12/78	31.90		x		
C-79	60.773	148.140	100	232	5/11/78	6/12/78	31.91	x			
C-48	59.948	147.861	-70	90	5/ 8/78	6/ 7/78	29.99				
C-48	59.948	147.861	-200	90	5/ 8/78	6/ 7/78	29.99				
C-48	59.948	147.861	100	90	5/ 8/78	6/ 7/78	29.99				
C-55	60.299	146.816	-69	150	5/ 8/78	6/ 6/78	28.78	x			
C-55	60.299	146.816	100	150	5/ 8/78	6/ 6/78	28.76				
C-65	60.691	147.236	-68	107	5/15/78	6/ 2/78	17.92	x			
C-65	60.691	147.236	-198	107	5/15/78	6/ 2/78	17.92				
C-65	60.691	147.236	100	107	5/15/78	6/ 2/78	17.92	x			
C-66	60.789	147.288	-69	195	5/10/78	6/ 9/78	30.74				
C-66	60.789	147.288	100	195	5/10/78	6/ 9/78	30.75	x			
C-68	60.924	147.050	-69	173	5/15/78	6/ 2/78	18.10				
C-68	60.924	147.050	100	173	5/15/78	6/ 2/78	18.13	x			
C-78	60.699	148.052	-81	235	5/11/78	5/26/78	15.02	x			
C-78	60.699	148.052	-411	235	5/11/78	5/26/78	15.02	x		x	
C-78	60.699	148.052	100	235	5/11/78	5/26/78	15.03	x			
C-80	60.797	147.942	-400	125	5/11/78	5/26/78	15.01	x			
C-81	60.882	147.531	-82	160	5/16/78	6/ 1/78	16.87	x			
C-81	60.882	147.531	-412	160	5/16/78	6/ 1/78	16.86				
C-81	60.882	147.531	100	160	5/16/78	6/ 1/78	16.86				
C-83	60.896	148.180	100	150	5/11/78	5/26/78	15.01	x			
C-83	60.896	148.180	-400	150	5/11/78	5/26/78	15.01				
C-83	60.896	148.180	-70	150	5/11/78	5/26/78	15.01	x			
C-84	60.791	148.393	100	185	5/12/78	5/27/78	15.05	x			
C-84	60.791	148.393	-402	185	5/12/78	5/27/78	15.05	x			
C-84	60.791	148.393	-72	185	5/12/78	5/27/78	15.05	x			
C-85	60.887	147.329	100	54	5/15/78	6/ 1/78	16.85	x			
C-85	60.887	147.329	-69	54	5/15/78	6/ 1/78	16.85	x			
C-86	60.166	147.697	-199	141	6/13/78	7/14/78	30.03	x	x		
C-86	60.166	147.697	100	141	6/14/78	7/14/78	30.02				
C-50	60.164	147.902	-71	150	6/15/78	7/14/78	29.94				
C-50	60.164	147.902	100	150	6/15/78	7/14/78	29.95	x			
C-53	60.288	147.971	-69	311	6/14/78	7/14/78	29.92				
C-53	60.288	147.971	100	311	6/14/78	7/14/78	29.93				
C-74	60.446	147.858	-75	215	6/14/78	7/14/78	29.99	x			x
C-74	60.446	147.858	-405	215	6/14/78	7/ 6/78	21.40	x	x		
C-74	60.446	147.858	100	215	6/14/78	7/14/78	30.00	x	x		
C-51	60.268	147.305	-70	32	6/16/78	7/18/78	31.26	x			
C-58	60.399	147.140	-68	75	6/16/78	7/18/78	31.24	x			
C-58	60.399	147.140	100	75	6/16/78	7/18/78	31.16	x	x		
C-48	59.950	147.860	-208	90	7/12/78	8/16/78	35.08				
C-48	59.950	147.860	100	90	7/12/78	8/16/78	35.06				
C-55	60.293	146.821	-69	150	7/13/78	8/17/78	35.06	x			
C-55	60.293	146.821	-399	150	7/13/78	8/17/78	35.05				

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth in fathoms with respect to MLLW estimated from Edition 31 of Nautical Chart 16700. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

Table 4.6. Prince William Sound Dataset 4 (Cont.).

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (ft)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-55	60.293	146.821	100	150	7/13/78	8/17/78	35.08	
C-45	60.047	148.128	100	37	7/17/78	8/16/78	30.00	
C-46	60.005	148.081	100	35	7/17/78	8/16/78	30.01	x
C-49	60.092	147.538	50	50	7/17/78	8/17/78	30.08	x
C-90	60.126	147.146	-207	116	7/18/78	8/ 2/78	15.03	x
C-90	60.126	147.146	100	116	7/18/78	8/ 2/78	15.03	x
C-89	59.867	147.287	-71	35	7/18/78	8/17/78	29.76	x
C-89	59.867	147.287	50	35	7/18/78	8/17/78	29.77	
C-88	59.724	147.897	-20	15	7/20/78	8/10/78	20.19	
C-88	59.724	147.897	20	15	7/20/78	8/10/78	20.19	
C-87	59.844	148.062	-200	75	7/20/78	8/10/78	20.22	x
C-87	59.844	148.062	100	75	7/20/78	8/10/78	20.22	x
C-44	60.127	148.204	-21	24	7/25/78	8/ 9/78	15.10	
C-44	60.127	148.204	20	24	7/25/78	8/ 9/78	15.11	x
C-43	59.954	148.324	-69	80	7/25/78	8/ 9/78	15.07	x
C-43	59.954	148.324	-199	80	7/25/78	8/ 9/78	15.07	
C-43	59.954	148.324	100	80	7/25/78	8/ 9/78	15.07	x

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth in fathoms with respect to MLLW estimated from Edition 31 of Nautical Chart 16700. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, S=current speed, and D=current direction.

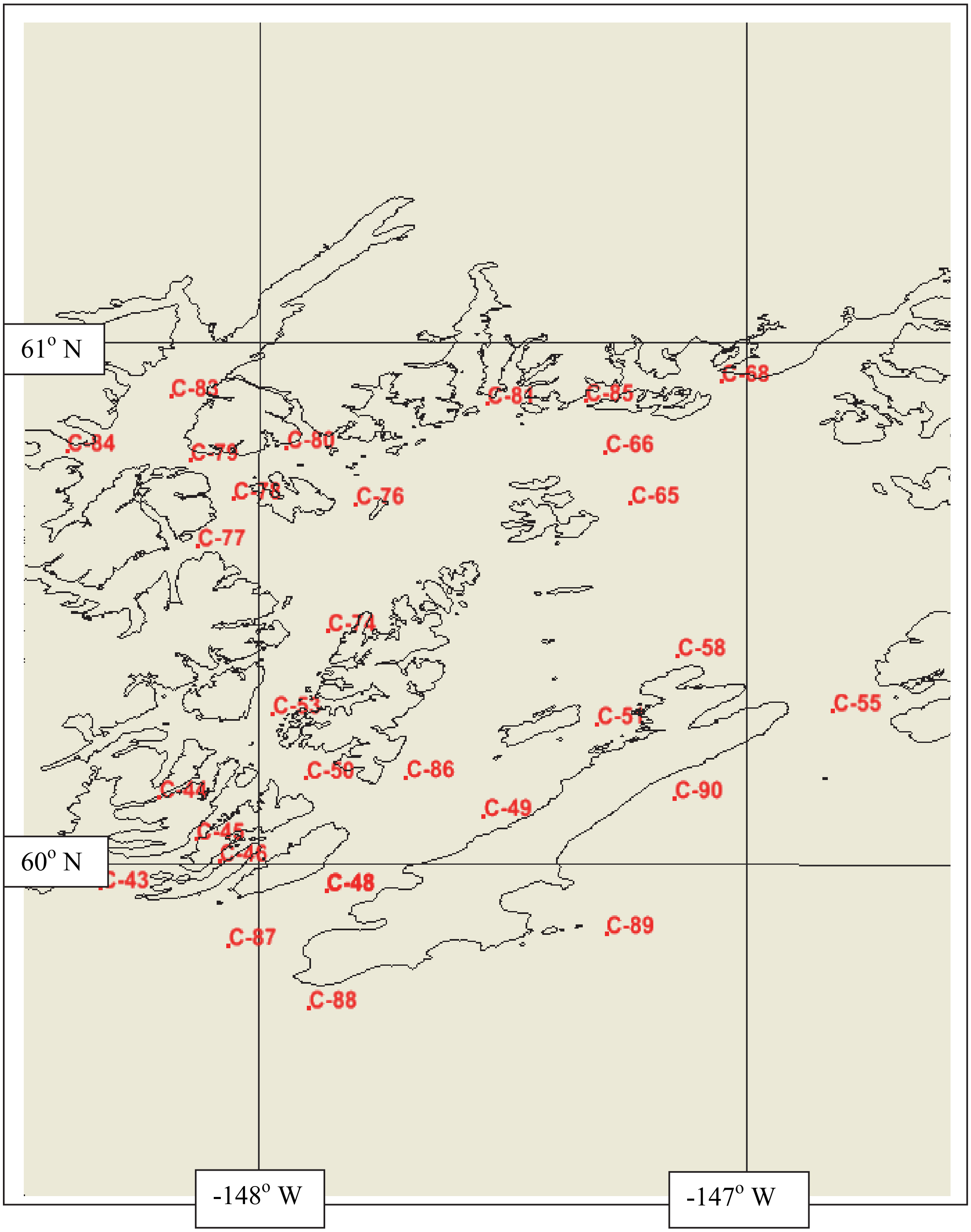


Figure 4.4. Station Locations for Prince William Sound Dataset 4.

Regional Oceanographic Characteristics

Gay and Vaughn (2001) described the seasonal hydrography and tidal circulation. The following paragraphs from their article provide the oceanographic setting.

Prince William Sound is located along the south-central coast of Alaska. It is comprised of deep basins and passes and is bounded to the south by the Gulf of Alaska and by large, mountainous islands. The shoreline to the north is complex due to the regions glacial and tectonic history. The fjords and bays of the region reflect geological diversity, and range from small, shallow basins to large fjords with depths exceeding 400m. The Chugach mountains form a border along the entire mainland. The elevations rise abruptly to heights of up to 4000 m within 60 km of the coast.

The regional climate of Prince William Sound is influenced by the Aleutian Low, which generates strong south-east winds over the northern Gulf Coast from autumn through spring. Local wind fields during these seasons are complicated by the coastal topography and the passage of storm systems. Geostrophic winds over the Gulf of Alaska generally force coastal downwelling. In the autumn and winter, this results in strong upper layer transport into Prince William Sound through Hinchinbrook Entrance and a corresponding outflow through Montague Strait. During the summer, as wind stress diminishes and downwelling ceases, the circulation at Hinchinbrook Entrance and Montague Strait is complicated by the effects of stratification and increased flow in the Alaska Coastal Current.

The seasonal cycle of fresh water discharge is characterized by minimum amounts of discharge occurring during winter when precipitation is stored as snow, and maximum amounts in the autumn when inputs are high due to precipitation and glacial runoff. These patterns tend to occur throughout Prince William Sound, though significant local variation in both stored and direct precipitation indicate that large subregional differences exist in seasonal freshwater input.

No CTD data were originally processed due to instrument failure and one must rely on the CT/Current data to provide the vertical structure. In addition, no reliable meteorological data could be recovered.

Here we examine CT/Current time series in July 1977 at Station C-55 at the Hinchinbrook Entrance at 75 ft below the surface. For salinity and temperature time series in Figure 4.5, there is some high frequency content, which may need filtering. In Figure 4.6 peak current speeds are order 100 cm/s with some breakdowns in the rectilinear current structure around Julian Days 205 and 217. In Figure 4.7 for C-55 at 100 ft above the bottom, the peak currents are reduced to order 80 cm/s. At Station C-29 to the east of the entrance within the lower Bay, current speeds and directions are shown during July 1976 at 20 ft and 70 ft below the surface and at 50 ft above the bottom in Figures 4.8-4.10, respectively. One notes the decrease in peak current speeds from 40 cm/s to 10 to 15 cm/s at the deeper depths. At Station C-86 to the west of the entrance in the lower Bay, salinity and temperature signals are essential constant at 34 PSU and and 5.4°C during June 1978 at 100 ft above the bottom as shown in Figure 4.11. In Figure 4.12, the current speed and directions are shown with the peak current strengths being 10-15 cm/s. At Station C-78 in the upper Bay, current time series are shown during May 1978 at 81 ft and 411 ft below the surface and at 100 ft above the bottom in Figures 4.13-4.15, respectively. Peak current speeds are weak at all depths, with more variability in current direction shown near the surface. Note limited salinity time series data are available primarily due to instrument malfunction.

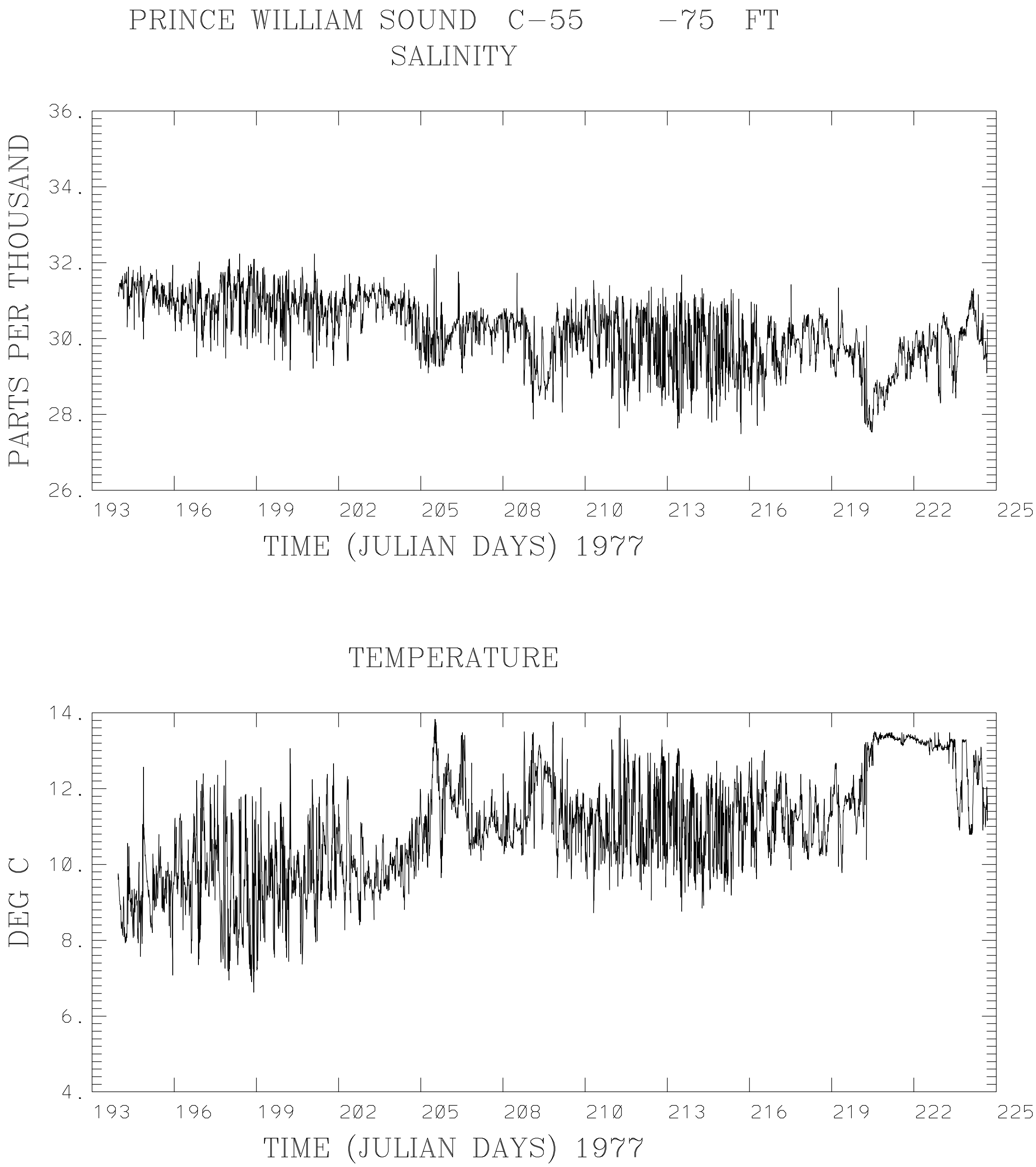


Figure 4.5. Station C-55 Prince William Sound Salinity and Temperature at 75 ft below the surface in July 1977.

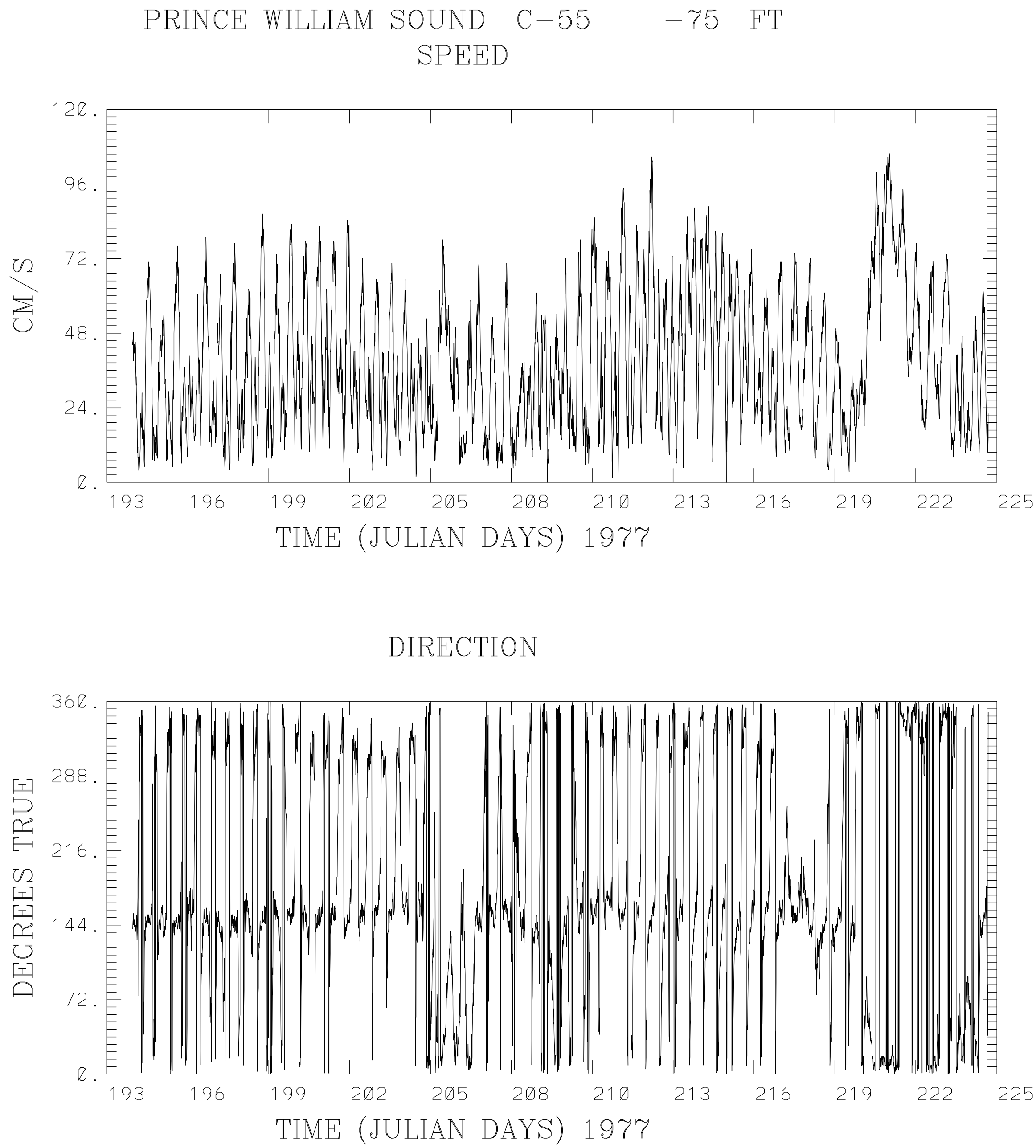


Figure 4.6. Station C-55 Prince William Sound Current Speed and Direction at 75 ft below the surface in July 1977.

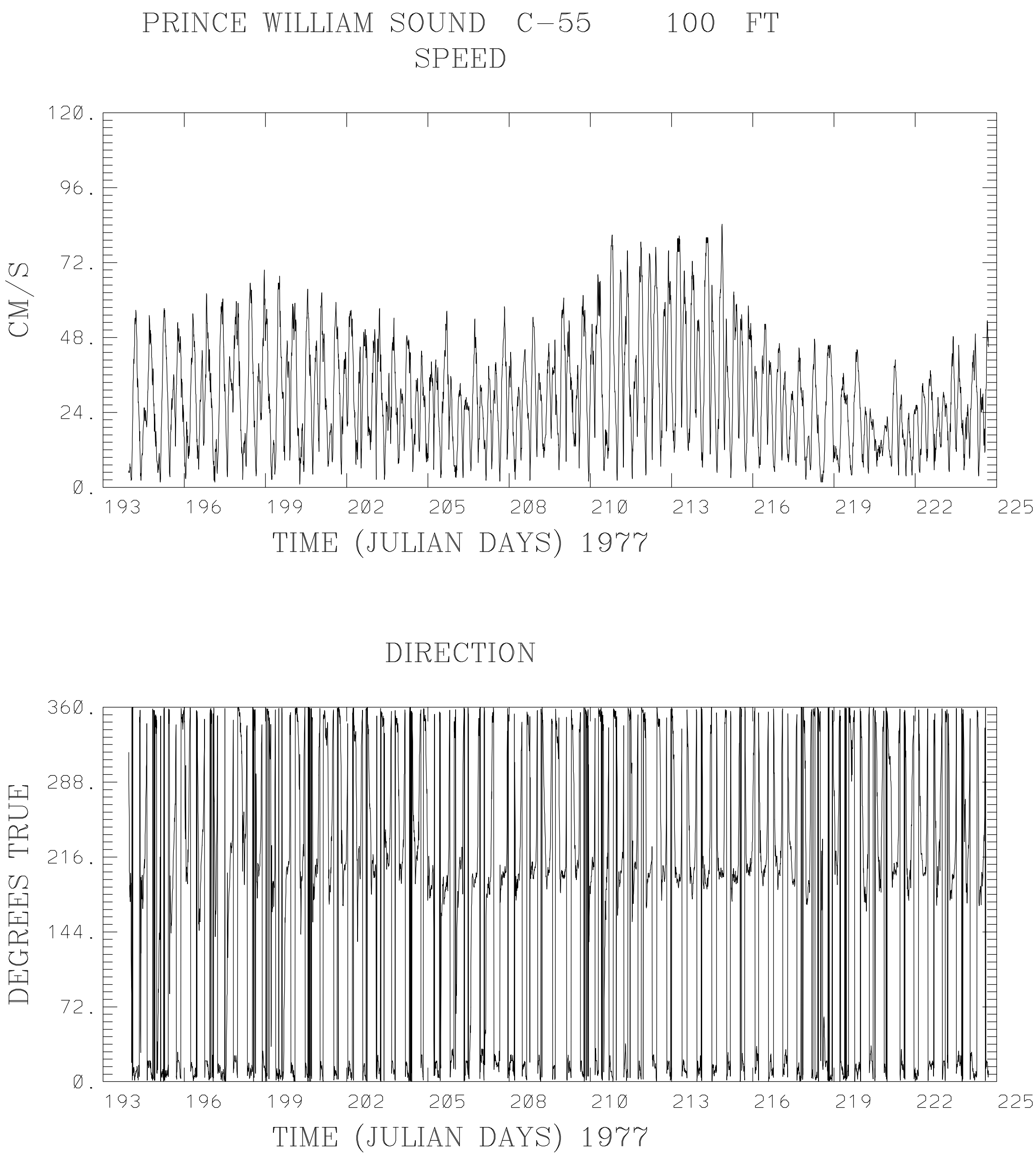


Figure 4.7. Station C-55 Prince William Sound Current Speed and Direction at 100 ft above the bottom in July 1977.

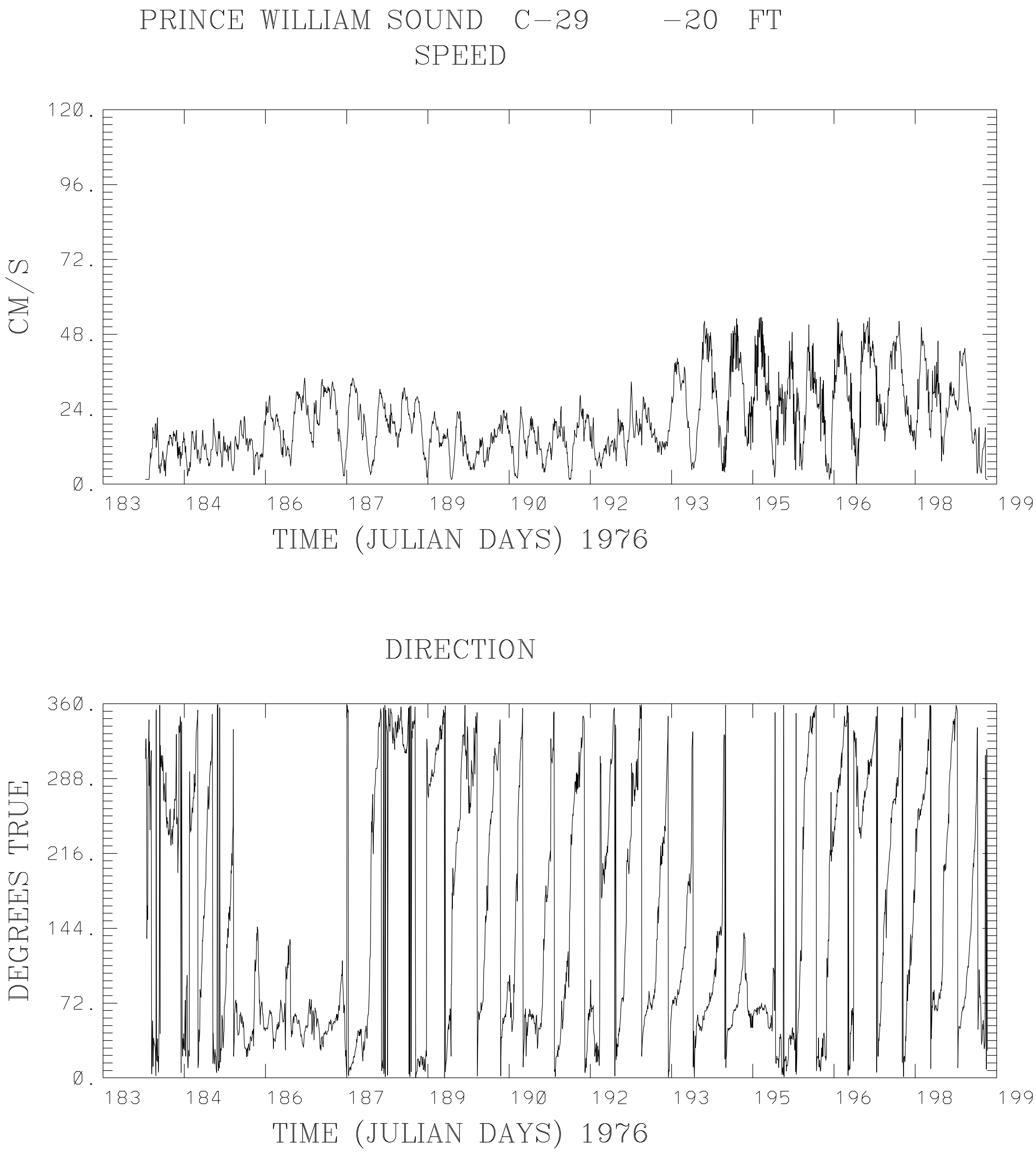


Figure 4.8. C-29 Prince William Sound Current Speed and Direction at 20 ft below the surface in July 1976.

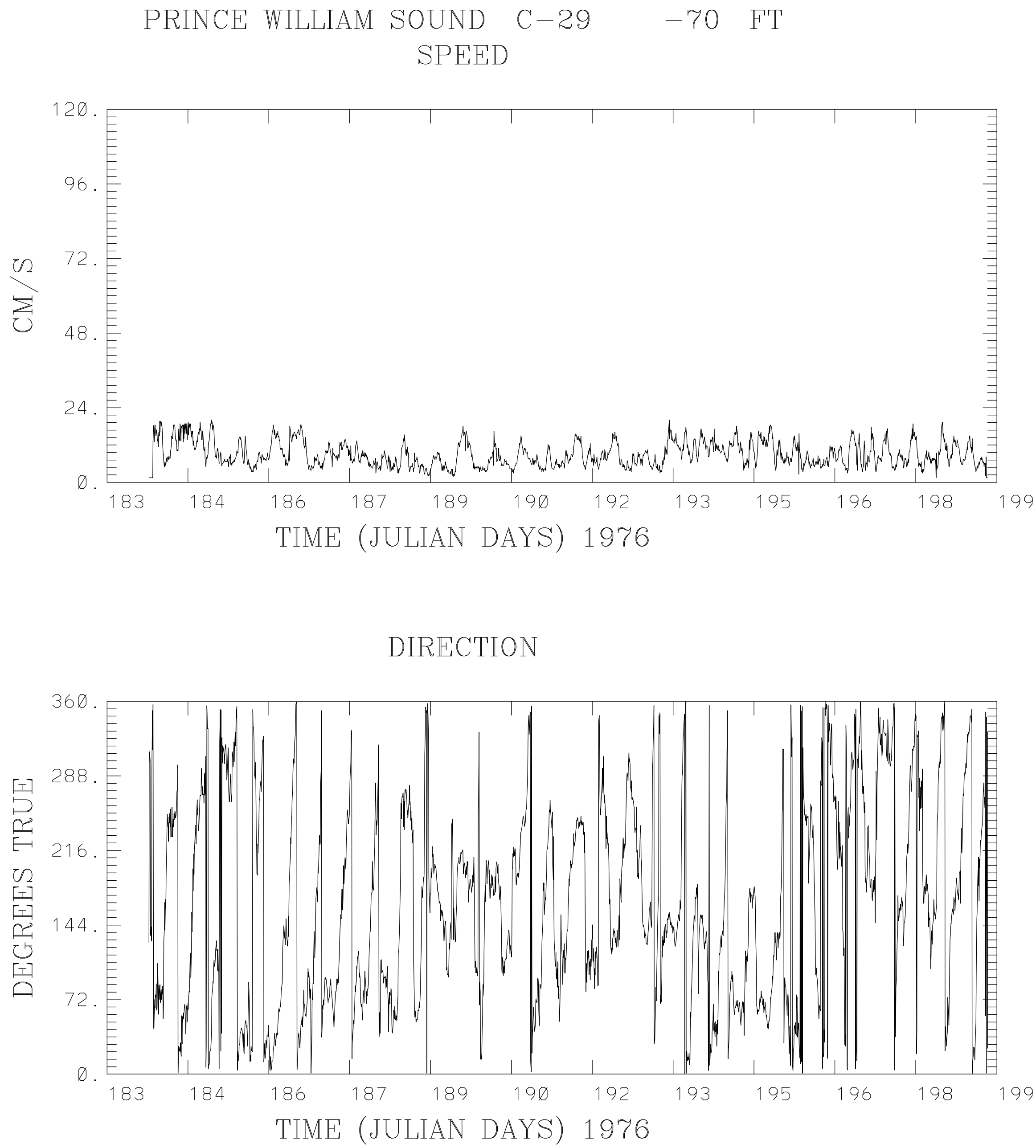


Figure 4.9. Station C-29 Prince William Sound Current Speed and Direction at 70 ft below the surface in July 1976.

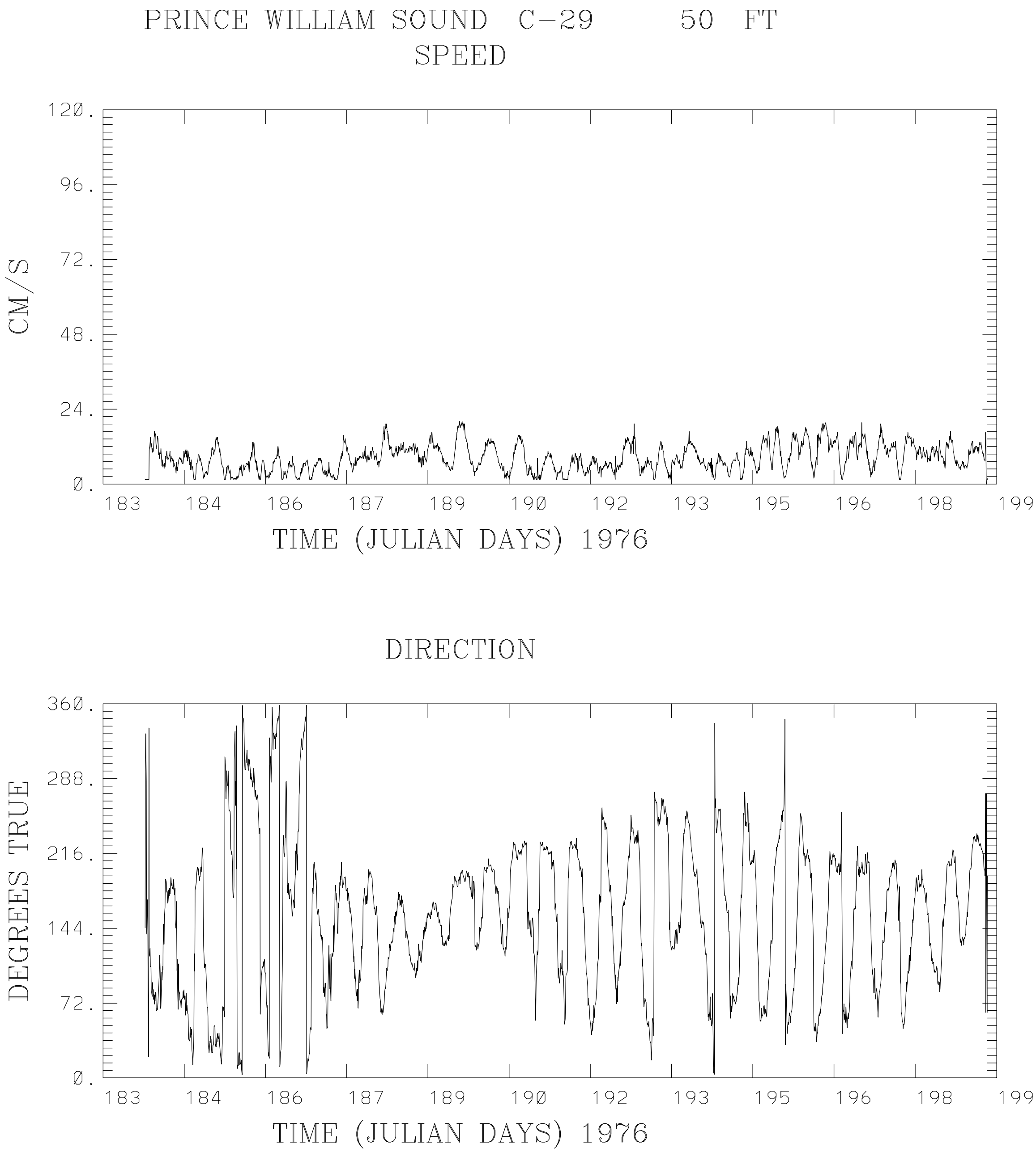


Figure 4.10. Station C-29 Prince William Sound Current Speed and Direction at 50 ft above the bottom in July 1976.

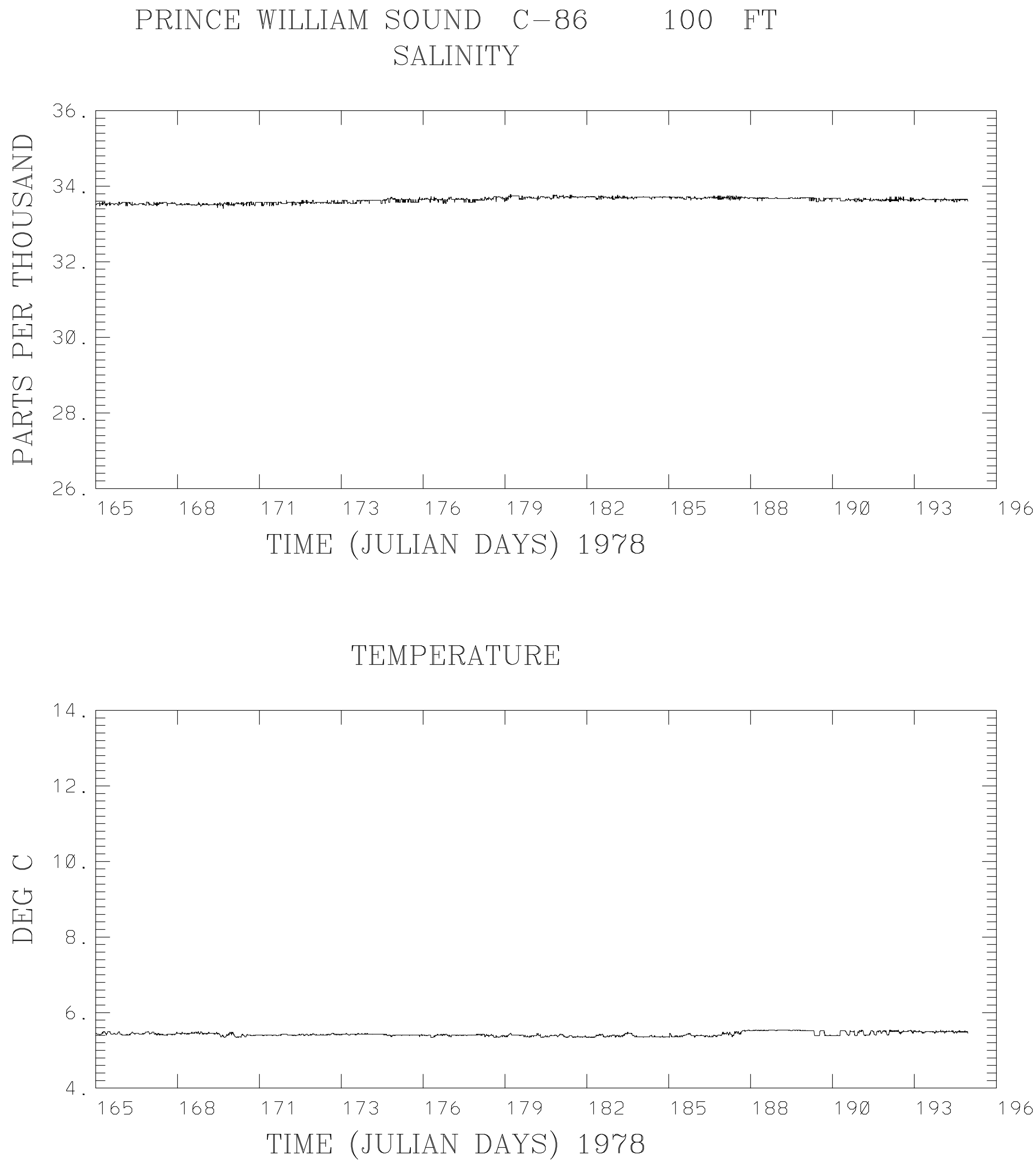


Figure 4.11. Station C-86 Prince William Sound Salinity and Temperature at 100 ft above the bottom in June 1978. Note salinity data are not available.

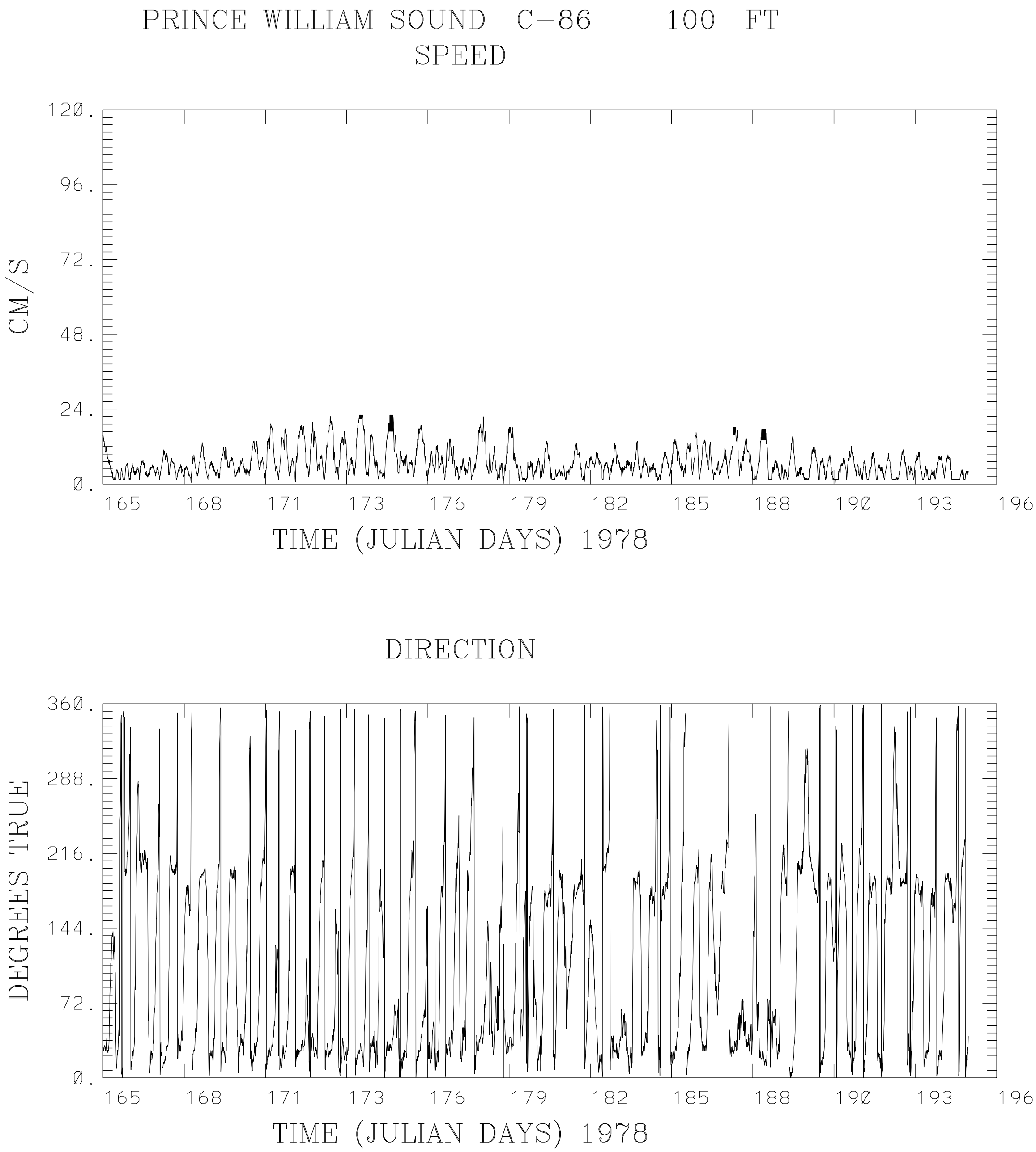


Figure 4.12. Station C-86 Prince William Sound Current Speed and Direction at 100 ft above the bottom in June 1978.

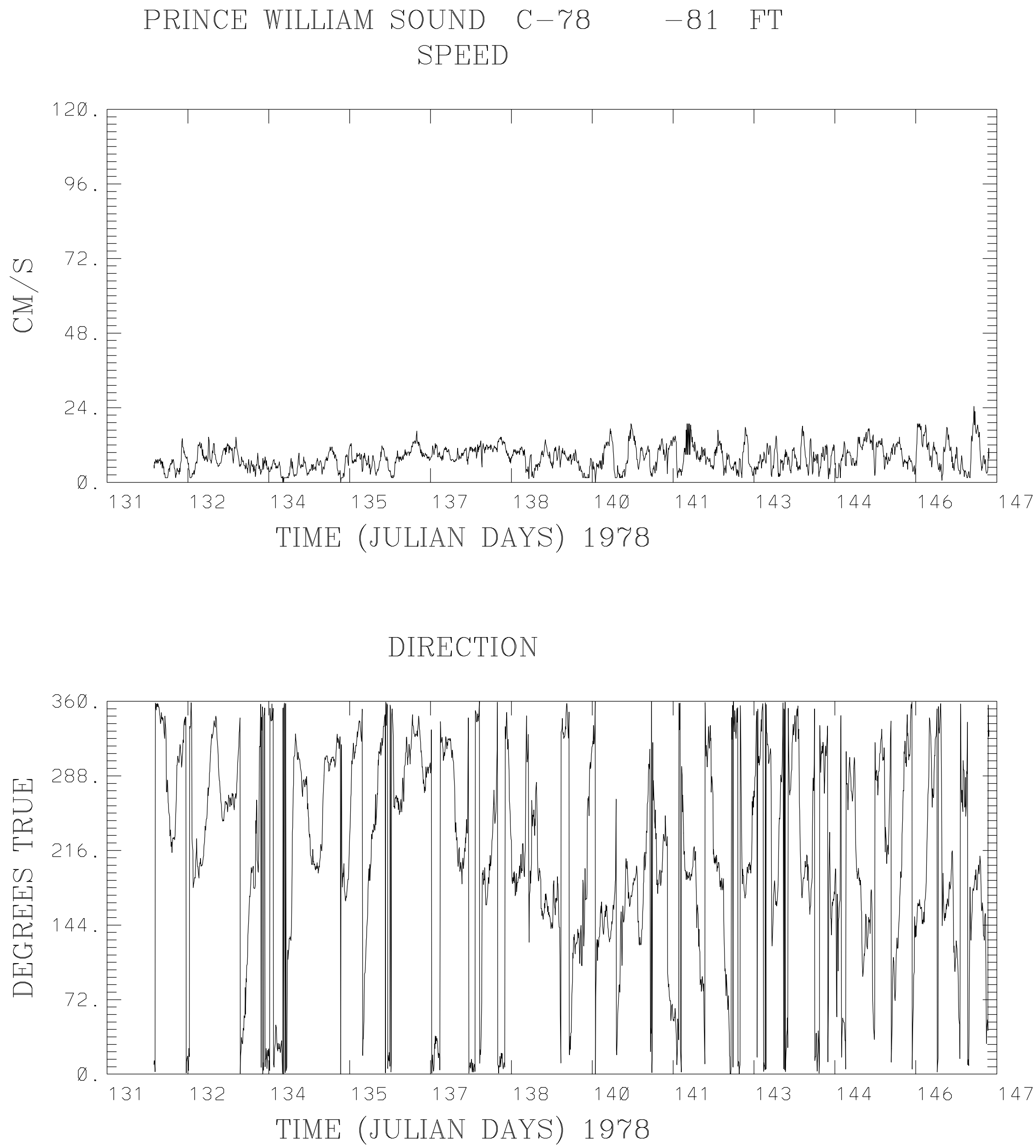


Figure 4.13. Station C-78 Prince William Sound Current Speed and Direction at 81 ft below the surface in May 1978.

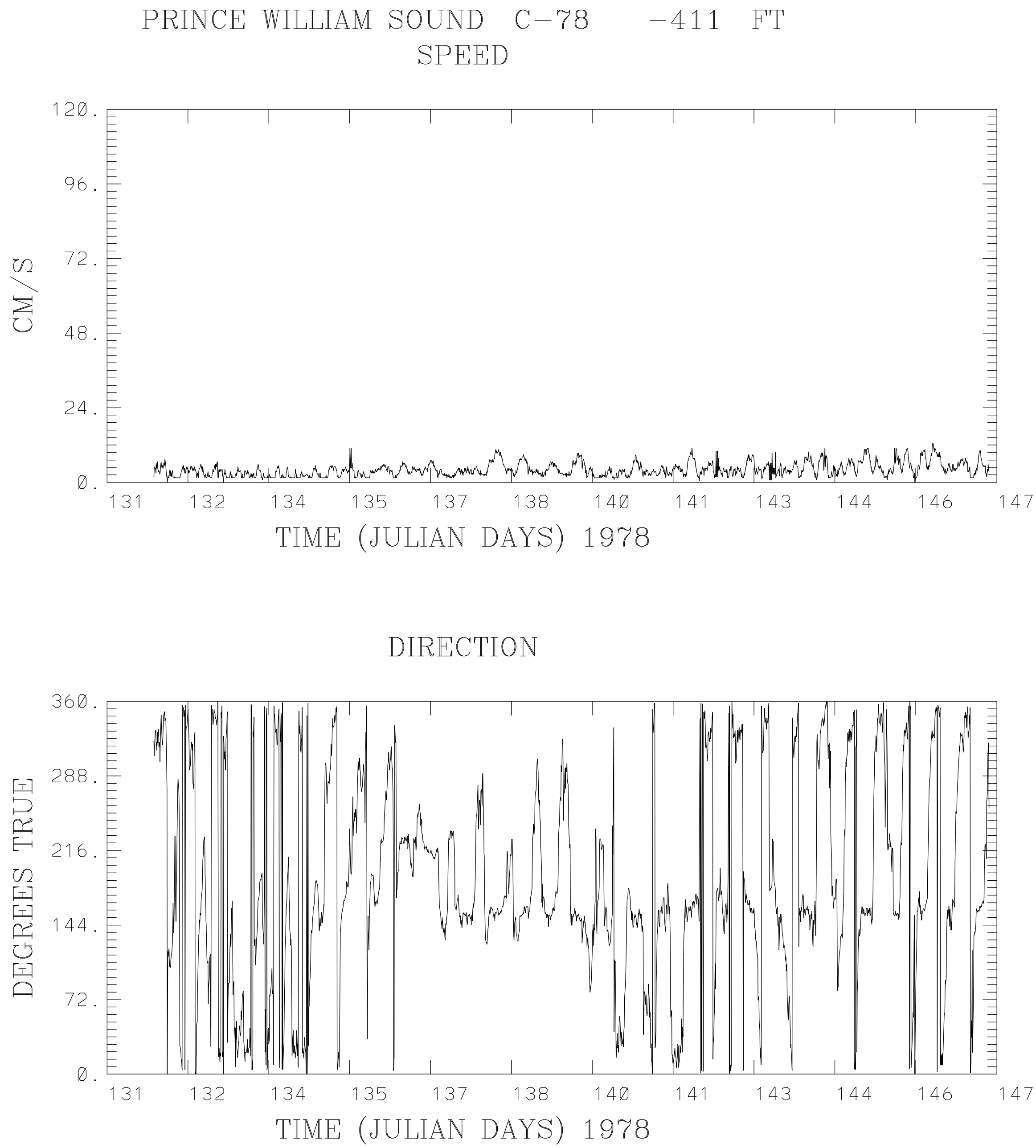


Figure 4.14. Station C-78 Prince William Sound Current Speed and Direction at 411 ft below the surface in May 1978.

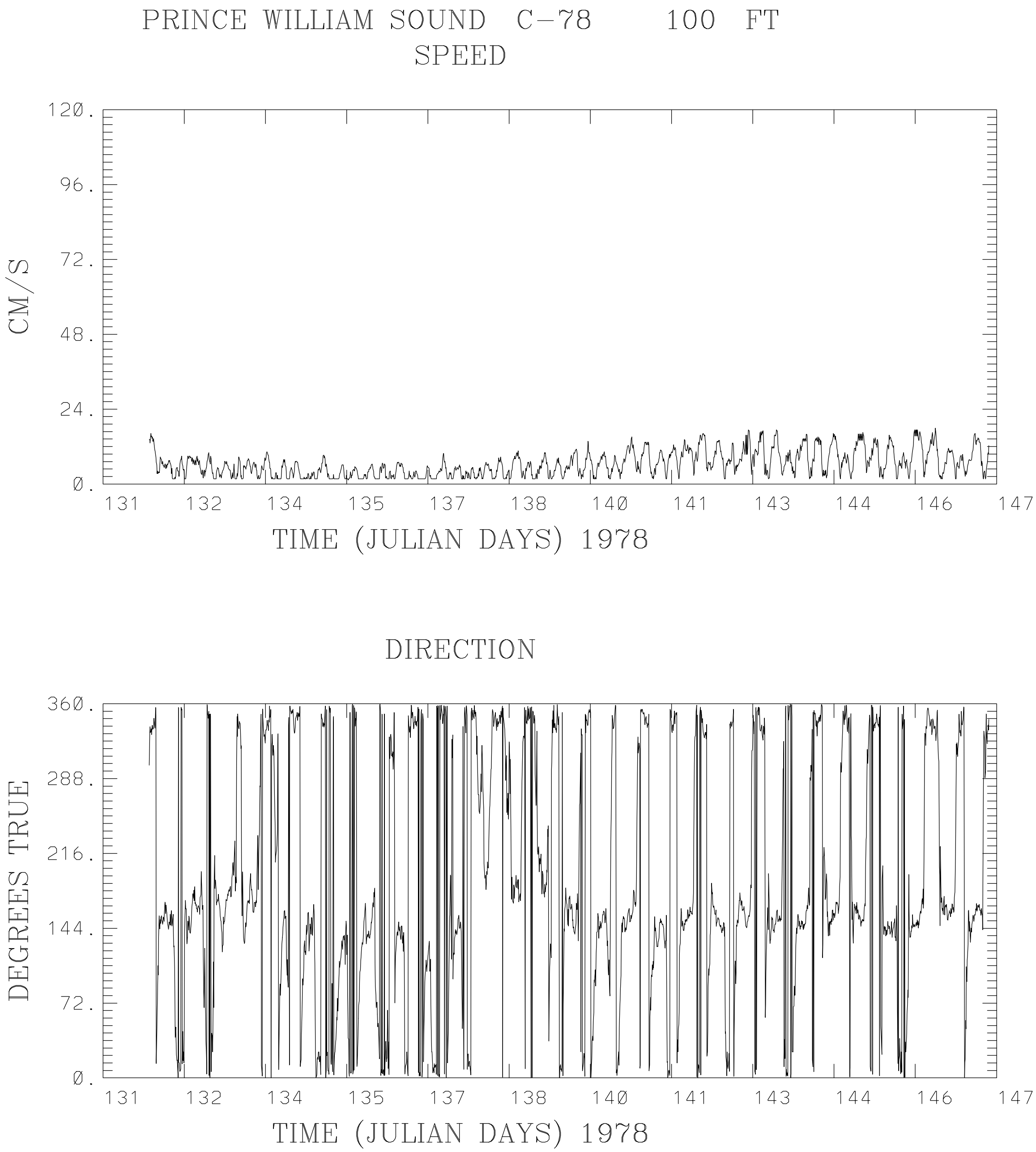


Figure 4.15. Station C-78 Prince William Sound Current Speed and Direction at 100 ft above the bottom in May 1978.

5. ICY BAY

NOS performed a short survey from July 7 to August 16, 1979 to study the circulation in Icy Bay. Over the study period, 16 current meter locations were occupied, with CTD data collected at all current meter stations. The Aanderaa Model RCM-4 current meter recorded and measured current speed and direction and included temperature and conductivity and pressure sensors. Here, we summarize the recovered data and discuss related regional oceanographic characteristics.

Data Inventory and Summary

The datasets obtained from CO-OPS on compact disc are listed in Table 5.1 and constitute the recoverable data. It was necessary to carefully inventory these datasets and determine their data quality. Note neither meteorological data (wind speed and direction, and sea level atmospheric pressure) nor CTD profile data were available.

Table 5.1. Icy Bay Circulation Survey Dataset Inventory.

Directory Name	Number of Files	Data Period	Data Description	Data Quality
ICECAS1	44	1979	Aanderaa Current Meter	OK

CT/Current Data

The salinity and temperature and current data inventoried in Table 5.2 were distributed in one lone directory: Icybay. These data files (FILE1 through FILEn) were concatenated to create a cumulative data file: file_icy. The data in each individual data file (FILE1 through FILEn) represent current and CT data at one specific station location over a given time period. It should be noted that since the focus was on data for model validation and harmonic analysis, only stations with record lengths of 15 days or greater were considered. In general, data quality was sufficient, such that no editing was performed. Station locations in icecas1 are shown in Figure 5.1.

Table 5.2. Icy Bay Circulation Survey Processed Data File Inventory.

Data Type	Location	Filename
CT/Current Raw	~/ICECAS1/	FILE1 – FILE44
CT/Current Edited	~/icecas1/	file_icy
CT/Current Qc	~/qc/	file_icy.qc

~ = /disks/NASUSER/philr/icybay

Dataset 1 is described in Table 5.3, in terms of station location, measurement and station depths and measurement dates and durations. Note in the table the station depths are obtained from Frey (3/1983). Station locations are shown in Figure 5.1.

Table 5.3. Icy Bay Dataset 1.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (ft)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-11	60.013	141.374	-53	321	7/ 8/79	7/24/79	15.83	
C-1	59.892	141.670	-14	44	7/10/79	7/26/79	15.85	xxxx
C-1	59.892	141.670	12	44	7/10/79	7/26/79	16.04	x
C-2	59.855	141.504	-13	54	7/10/79	7/26/79	16.00	x
C-2	59.855	141.504	12	54	7/10/79	7/26/79	16.01	x
C-3	59.909	141.595	-17	85	7/10/79	7/26/79	16.21	x xx
C-3	59.909	141.595	12	85	7/10/79	7/26/79	16.19	
C-6	59.928	141.473	-48	161	7/11/79	7/26/79	15.01	
C-6	59.928	141.473	10	161	7/11/79	7/26/79	15.01	
C-4	59.960	141.530	-15	216	7/11/79	8/ 1/79	21.12	
C-4	59.960	141.530	10	216	7/11/79	8/ 1/79	21.13	
C-12	59.984	141.471	-15	197	7/11/79	8/ 1/79	21.04	
C-14	60.064	141.383	-49	447	7/20/79	8/ 4/79	15.09	
C-5	59.947	141.520	10	220	7/ 7/79	7/26/79	18.91	
C-11	60.013	141.374	10	321	7/ 8/79	7/23/79	15.02	x
C-16	60.035	141.329	12	387	7/ 8/79	7/24/79	15.80	
C-4	59.960	141.530	-50	216	7/11/79	8/ 1/79	21.13	
C-12	59.984	141.471	12	197	7/11/79	8/ 1/79	21.04	xxxx
C-14	60.064	141.383	12	447	7/20/79	8/ 4/79	15.06	xx
C-15	60.066	141.341	-14	340	7/20/79	8/ 4/79	15.00	xx
C-15	60.066	141.341	-49	340	7/20/79	8/ 4/79	15.06	x x
C-15	60.066	141.341	12	340	7/20/79	8/ 4/79	15.02	x
C-16	60.036	141.326	-46	379	7/24/79	8/14/79	20.90	
C-16	60.036	141.326	10	379	7/24/79	8/14/79	20.90	x
C-7	59.987	141.438	-50	107	7/24/79	8/10/79	16.85	
C-7	59.987	141.438	10	107	7/24/79	8/10/79	16.85	
C-8	59.971	141.414	-59	86	7/24/79	8/10/79	16.76	x
C-9	59.961	141.408	-49	88	7/25/79	8/10/79	16.69	x
C-5	59.948	141.518	-50	216	7/27/79	8/15/79	19.81	
C-8	59.971	141.414	10	86	7/24/79	8/10/79	16.76	xx x
C-9	59.961	141.408	-14	88	7/25/79	8/10/79	16.72	x xx
C-9	59.961	141.408	10	88	7/25/79	8/10/79	16.71	
C-5	59.948	141.518	-15	216	7/27/79	8/15/79	19.87	
C-5	59.948	141.518	10	216	7/27/79	8/15/79	19.85	
C-13	59.985	141.294	-18	302	8/ 1/79	8/16/79	15.00	x
C-13	59.985	141.294	-53	302	8/ 1/79	8/16/79	15.01	x
C-13	59.985	141.294	10	302	8/ 1/79	8/16/79	15.01	x
C-10	59.930	141.368	-15	38	8/ 1/79	8/16/79	15.15	
C-10	59.930	141.368	10	38	8/ 1/79	8/16/79	15.17	
C-16	60.036	141.326	-11	379	7/24/79	8/14/79	20.90	
C-8	59.971	141.414	-14	86	7/24/79	8/ 9/79	15.69	x xx
C-11	60.013	141.374	-18	321	7/ 8/79	7/24/79	15.84	

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth with respect to MLLW. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

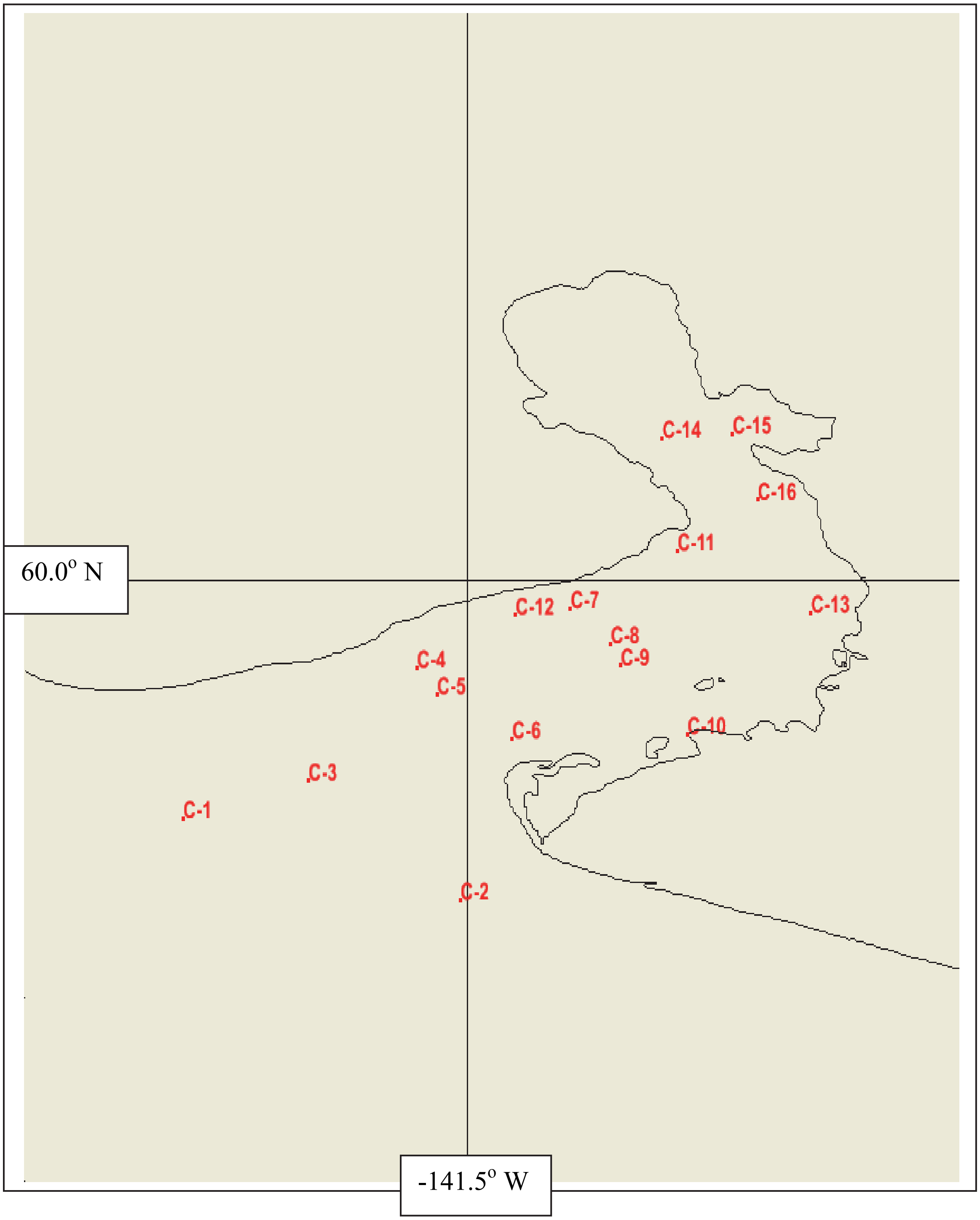


Figure 5.1. Station Locations for Icy Bay Dataset 1.

Regional Oceanographic Characteristics

Icy Bay is located to the east of Prince William Sound with its entrance to the Gulf of Alaska (GOA). The GOA is a semi-enclosed basin in the North Pacific Ocean, bounded by the mountainous coast of Alaska to the west, north, and east, and open to the south. The bottom topography is complex with several seamount complexes and numerous bays and inlets intersect the coast. The following two paragraphs summarize the oceanographic characteristics of Icy Bay (Stabeno et al., 2004).

The GOA is dominated by the Alaska Coastal Current (ACC), which is forced by along-shore winds and large freshwater runoff. Substantial runoff occurs from late spring through fall, with annual distributed freshwater discharge greater than that of the Mississippi River. Two current systems dominate the circulation of the GOA: one being the subarctic gyre in the ocean basin and the other being the Alaska Coastal Current (ACC) on the continental shelf. The Alaska Coastal current is a typical eastern boundary current, rich with eddies and meanders. The atmospheric forcing of the GOA is dominated by the effects of cyclonic storm systems. Their precipitation is the principal cause of the upper ocean's pycnocline in the coastal zone, and their winds are a primary contributor to the local ocean circulation. Storms originating in the Pacific tend to wind down in the GOA. Even though these storm systems are winding down, they are so prevalent that the Gulf experiences mean wind speeds and frequency of gale-force winds similar to that of the western and central North Pacific. Storms tend to linger, slowly spinning down, largely due to the coastal mountains bordering the Gulf. The weather of the GOA includes a pronounced, though not sharply defined, seasonal cycle. There is a strong tendency for the winds in the Gulf to be cyclonic during the fall through to the spring, with a broad peak in storminess occurring from October through March. The seasonal variability in precipitation in the coastal GOA features a prominent wet period from September through November, and a minor, relatively dry period in June and July.

The ACC, driven by winds and freshwater runoff, dominates circulation on the shelf and controls the transport of dissolved substances and planktonic material. While much is known of the continuity, seasonal variability, and mean flow of the ACC west of the Seward Line, less is known in the regions south and east of Prince William Sound at the entrance to Icy Bay.

Here we examine CT/Current time series in July 1979 at Station C-1 at the entrance. For salinity and temperature time series at 14 ft below the surface in Figure 5.2, there is some high frequency content, which may need filtering. In Figure 5.3 for currents 14 ft below the surface, peak current speeds are order 110 cm/s and there is evidence of a rotary current structure. Again high frequency content is present in the time series, which may require filtering. In Figure 5.4, the currents at 12 ft above the bottom exhibit less high frequency content with peak speeds of order 60 cm/s. At Station C-14 in the upper Bay during July 1979 at 49 ft below the surface, as shown in Figure 5.5, the salinity remains relatively constant at around 29 PSU, while the temperature increases from 4.5^{o}C to over 6.0^{o}C in just 17 days. In Figure 5.6 the currents at 49 ft exhibit some high frequency content with peak speeds order 25 cm/s. At 12 feet above the bottom, the salinity and temperature are constant at 31.6 PSU and 4.5^{o}C as shown in Figure 5.7. For the currents, while considerable high frequency content is shown in Figure 5.8, the currents speeds are probably very low.

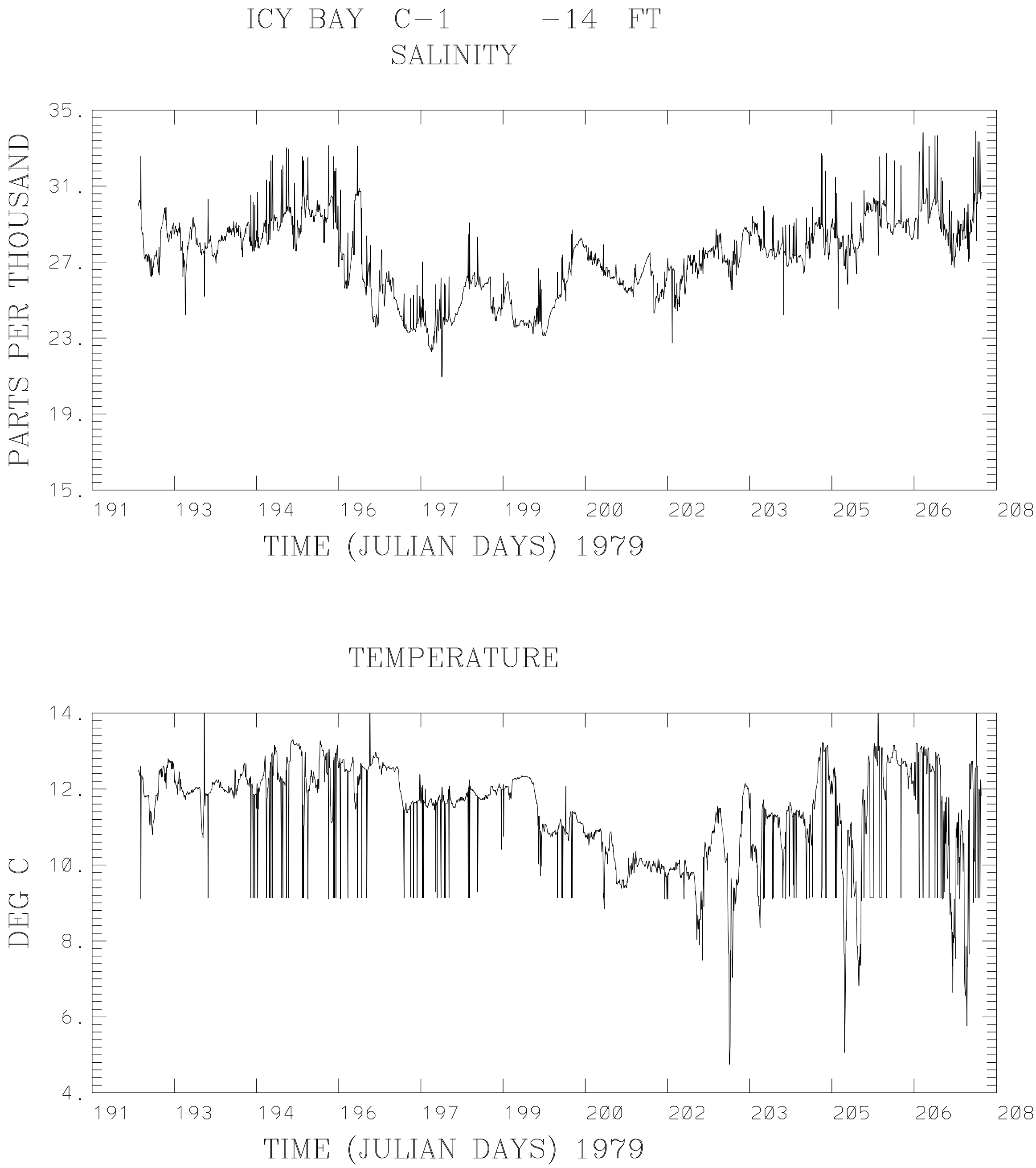


Figure 5.2. Station C-1 Icy Bay Salinity and Temperature at 14 ft below the surface in July 1979.

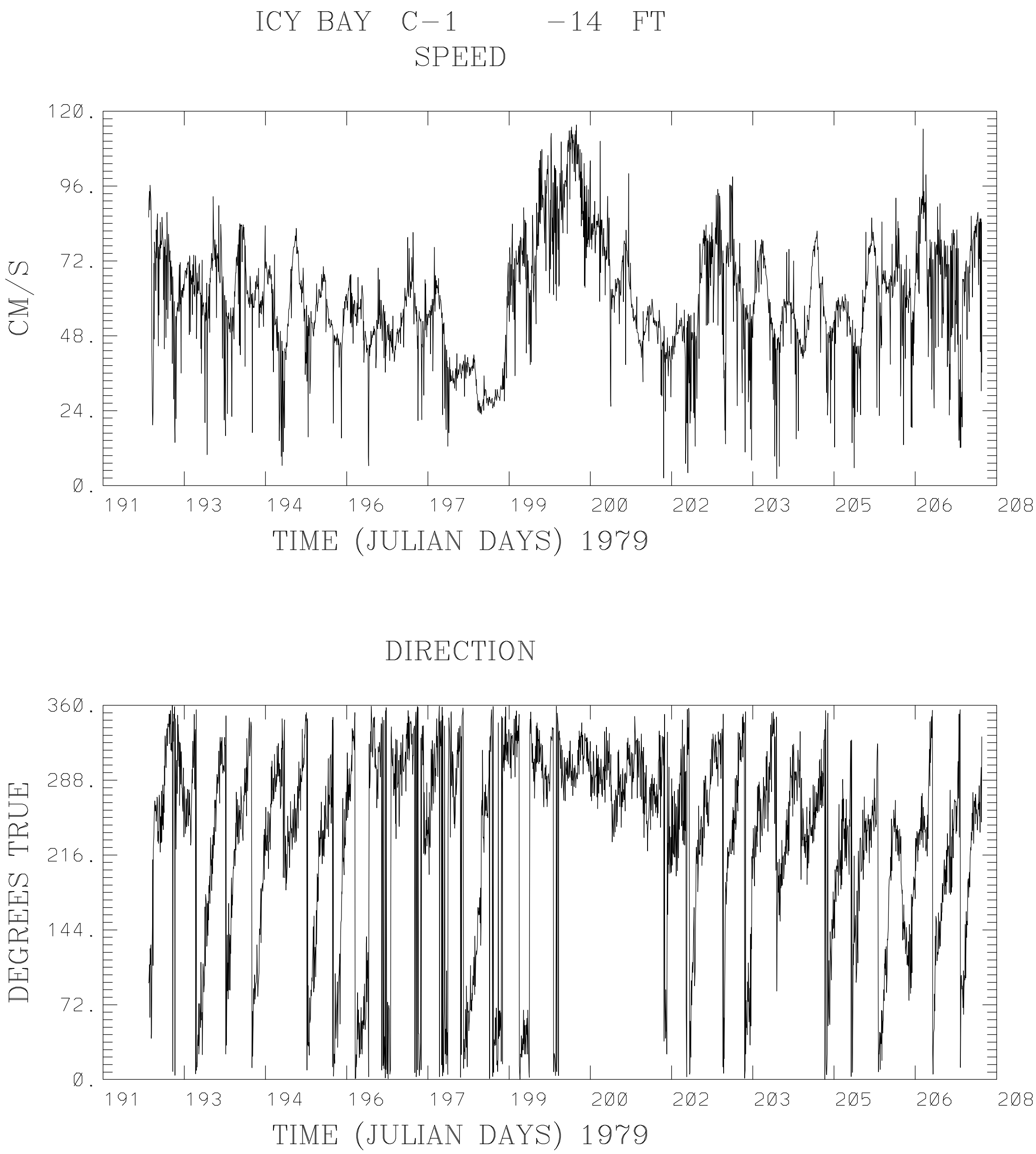


Figure 5.3. Station C-1 Icy Bay Current Speed and Direction at 14 ft below the surface in July 1979.

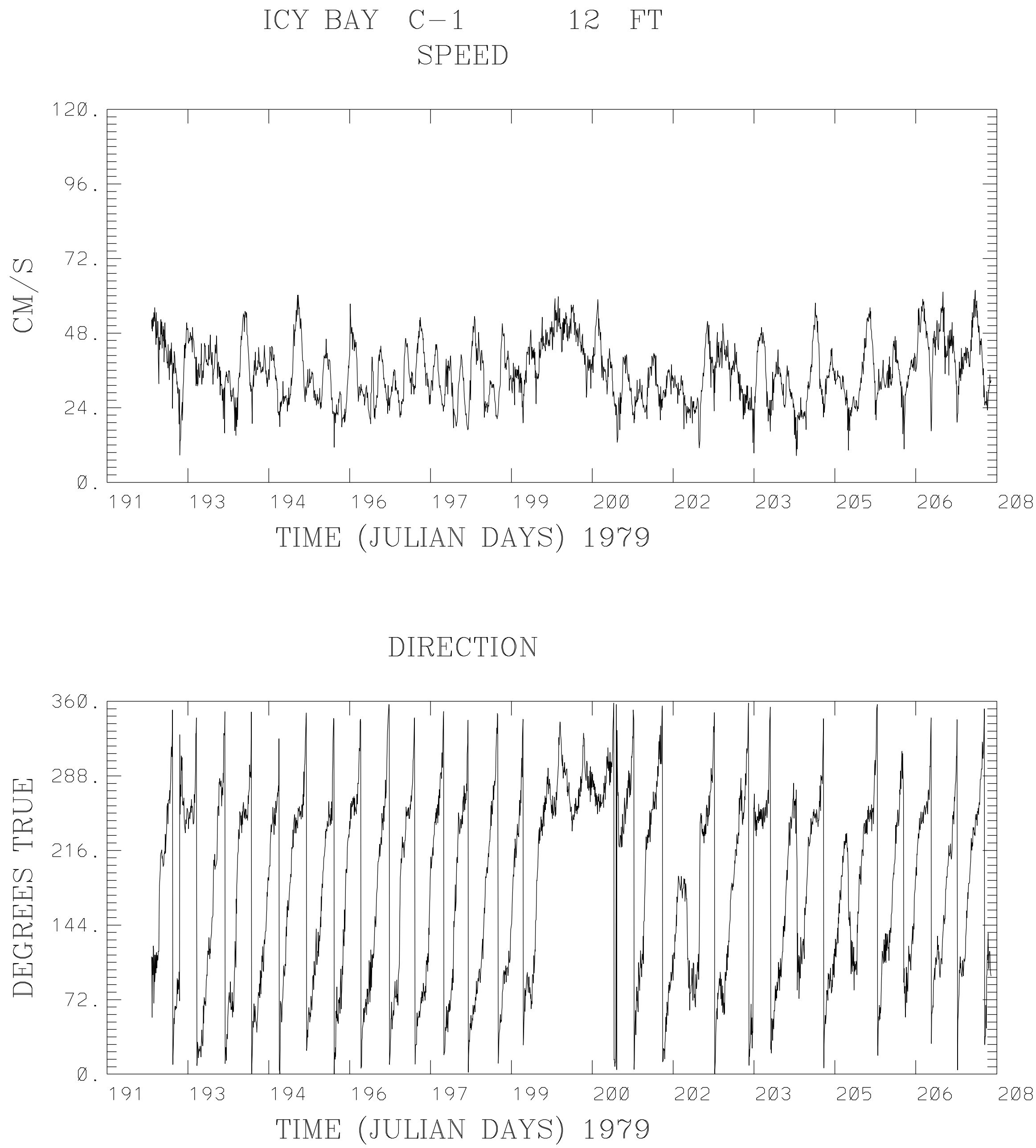


Figure 5.4. Station C-1 Icy Bay Current Speed and Direction at 12 ft above the bottom in July 1979.

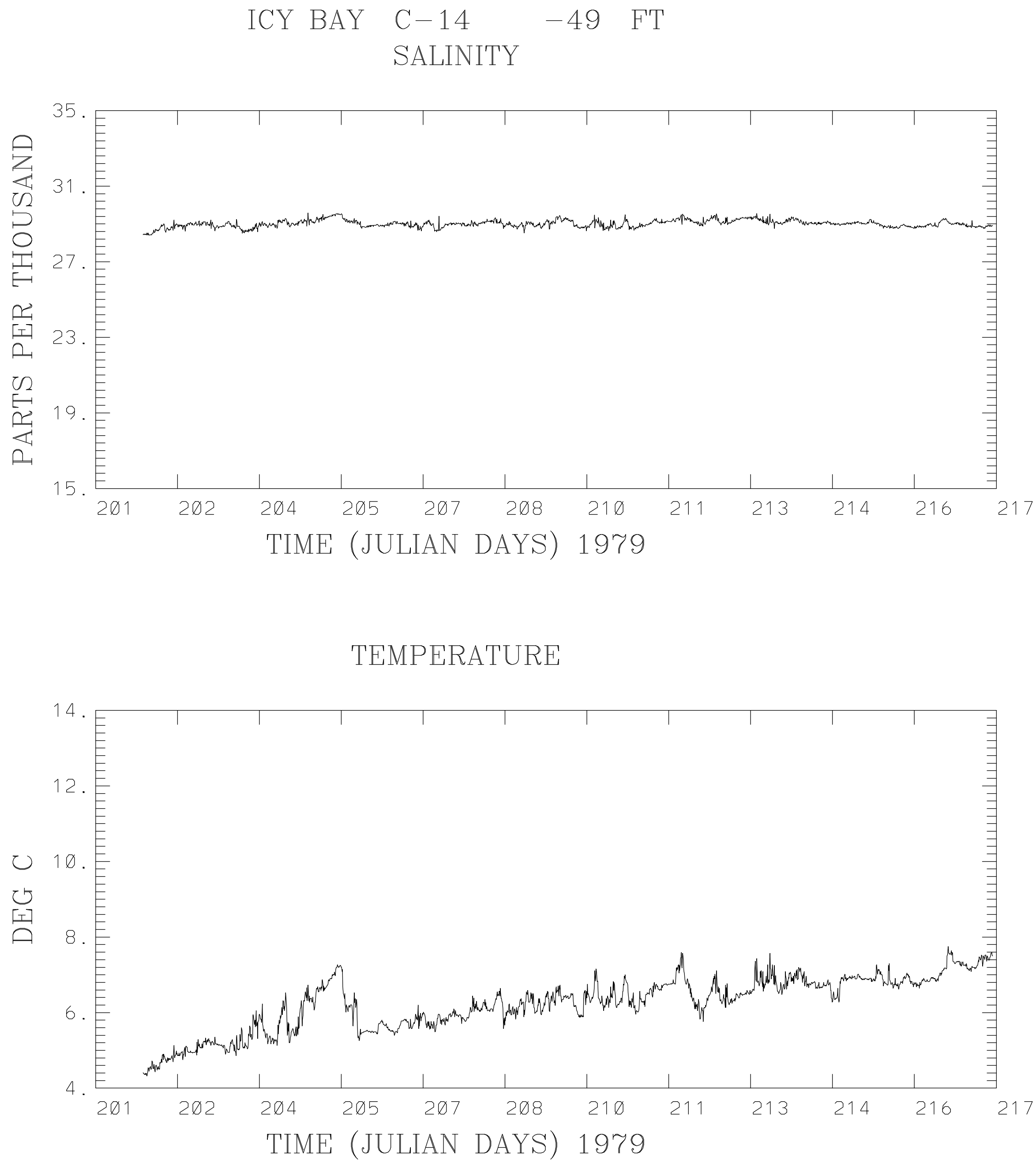


Figure 5.5. Station C-14 Icy Bay Salinity and Temperature at 49 ft below the surface in July 1979.

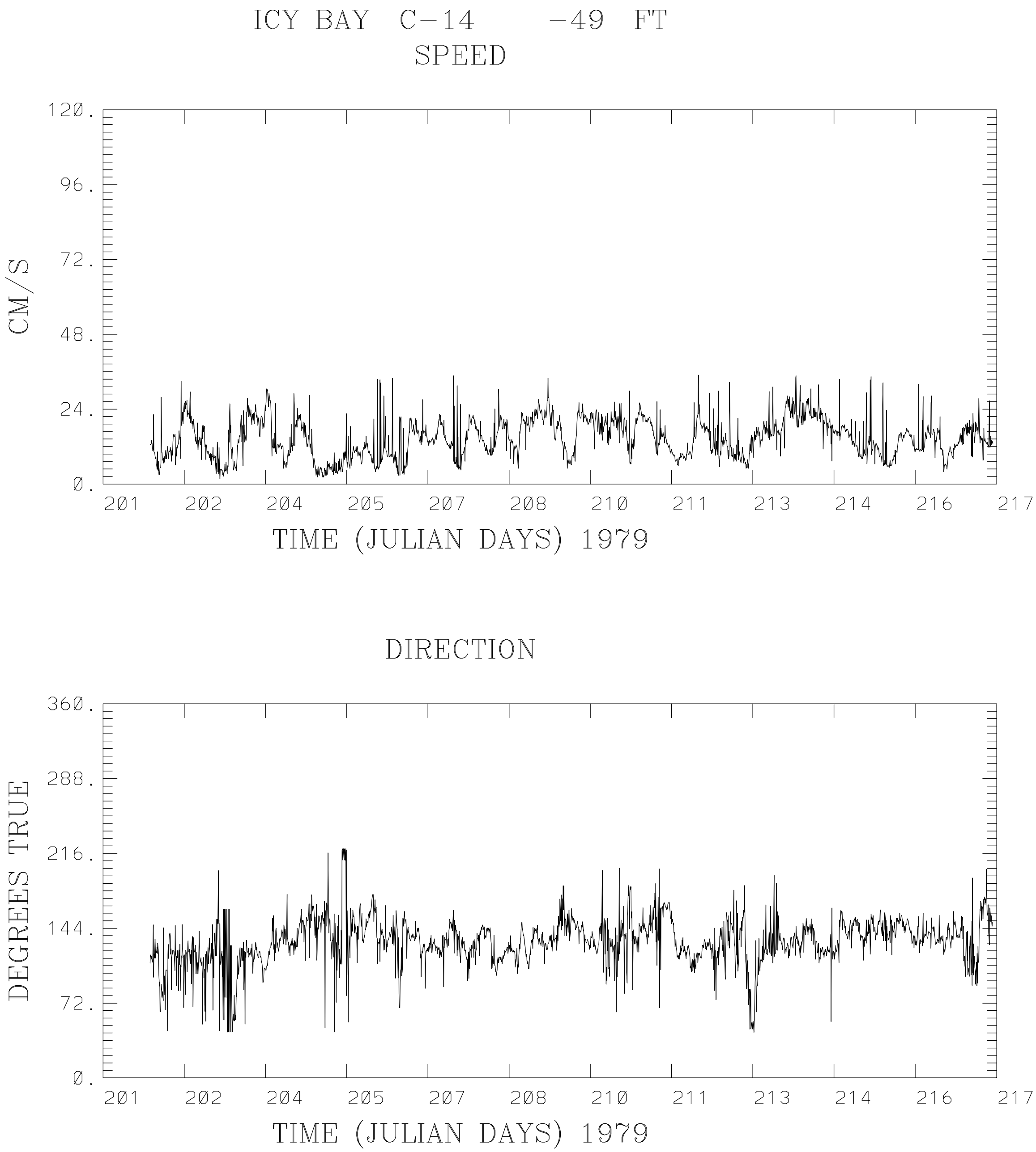


Figure 5.6. Station C-14 Icy Bay Current Speed and Direction at 49 ft below the surface in July 1979.

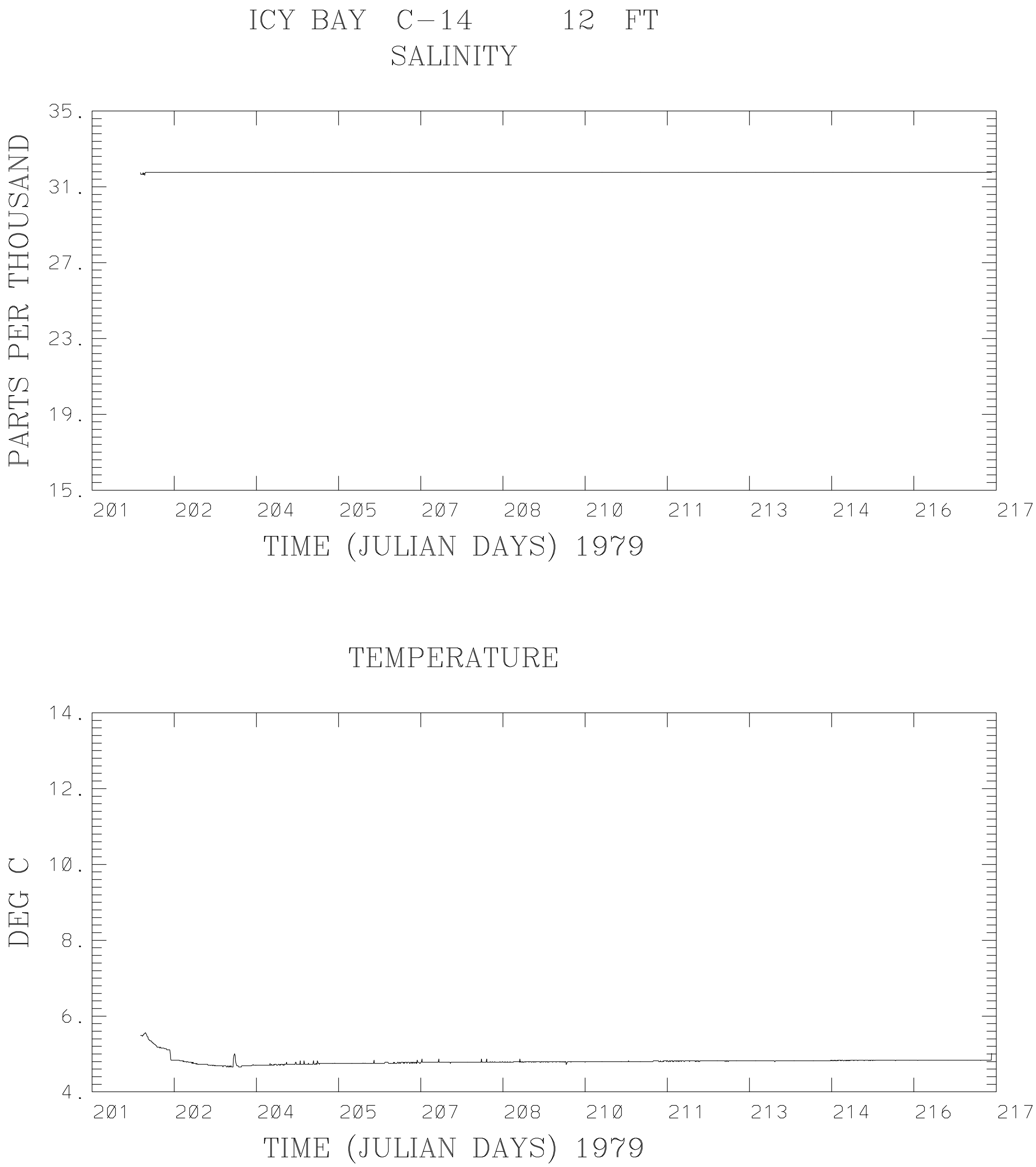


Figure 5.7. Station C-14 Icy Bay Salinity and Temperature at 12 ft above the bottom in July 1979.

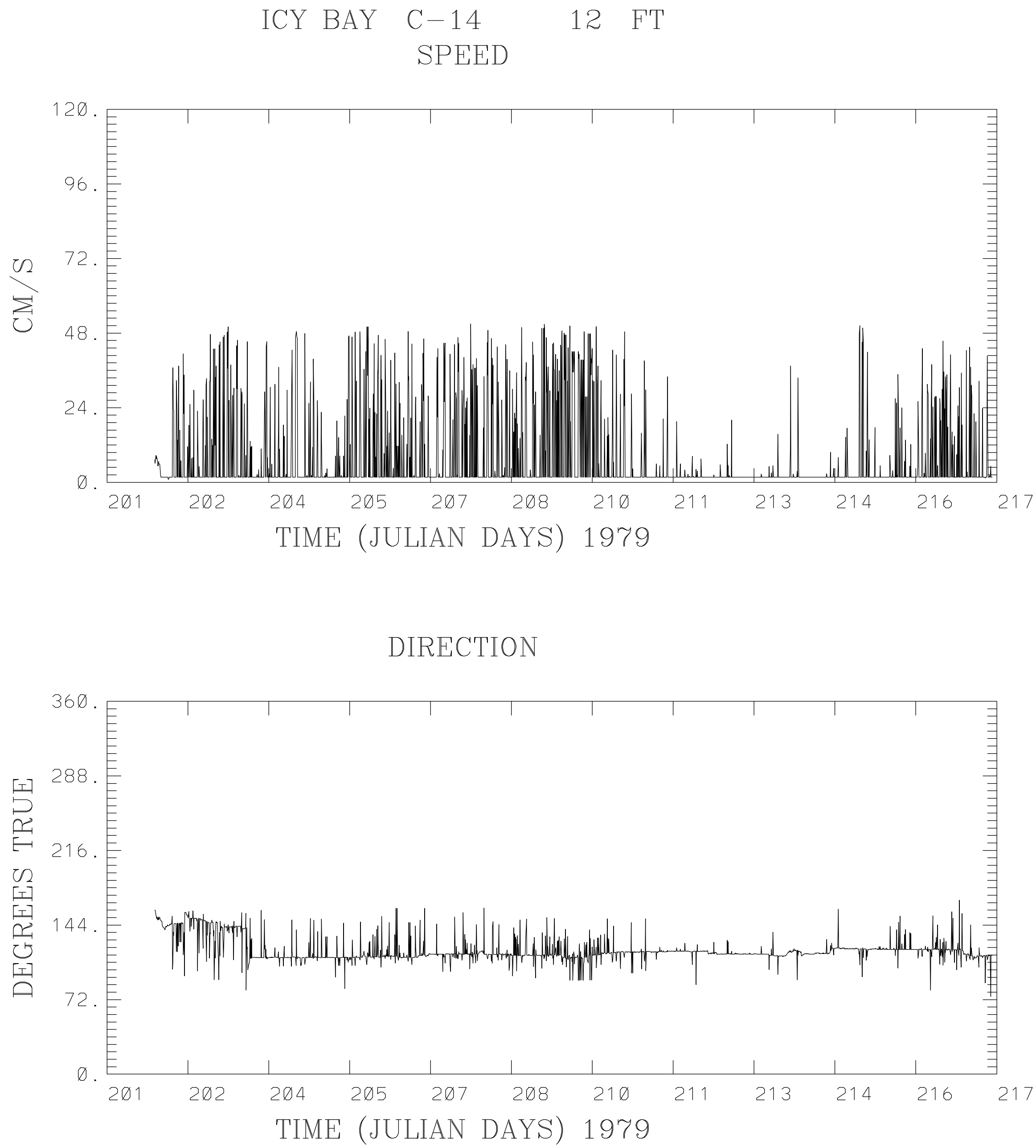


Figure 5.8. Station C-14 Icy Bay Current Speed and Direction at 12 ft above the bottom in July 1979.

6. SOUTHEAST ALASKA

NOS performed an intensive survey from April through June 1984 to study the circulation in coastal sections of Southeast Alaska. While no record of this circulation survey is available, it is known that the Aanderaa Model RCM-4 current meter recorded and measured current speed and direction and included temperature and conductivity and pressure sensors. Here, we summarize the recovered data and discuss related regional oceanographic characteristics.

Data Inventory and Summary

The datasets obtained from CO-OPS on compact disc are listed in Table 6.1 and constitute the recoverable data. It was necessary to carefully inventory these datasets and determine their data quality. Note neither meteorological data (wind speed and direction, and sea level atmospheric pressure) nor CTD profile data were available.

Table 6.1. Southeast Alaska Circulation Survey Dataset Inventory.

Directory Name	Number of Files	Data Period	Data Description	Data Quality
Alaska1	48	1984	Aanderaa Current Meter	OK

CT/Current Data

The salinity and temperature and current data inventoried in Table 6.2 were distributed in one lone directory: Alaska1. These data files (FILE1 through FILEn) were concatenated to create a cumulative data file: file_alaska1. The data in each individual data file (FILE1 through FILEn) represent current and CT data at one specific station location over a given time period. It should be noted that since the focus was on data for model validation and harmonic analysis, only stations with record lengths of 15 days or greater were considered. In general, data quality was sufficient, such that no filtering or editing was performed. Station locations in Alaska1 are shown in Figure 6.1 for the western stations, in Figure 6.2 for the eastern stations, and in Figure 6.3 for the central stations.

Table 6.2. Southeast Alaska Circulation Survey Processed Data File Inventory.

Data Type	Location	Filename
CT/Current Raw	~/Alaska1/	FILE1 – FILE48
CT/Current Edited	~/alaska1/	file_alaska1
CT/Current Qc	~/qc/	file_alaska1.qc

~ = /disks/NASUSER/philr/SEalaska

Dataset 1 is described in Table 6.3, in terms of station location, measurement and station depths and measurement dates and durations. Note in the table the station depths with respect to MLLW are estimated from Edition 31 of Nautical Chart 17300 and Edition 24 of Nautical Chart 17315. In cases, where the depths could not be reliably estimated, a fifteen feet separation distance between instruments or below the water surface was assumed. Western station locations are shown in Figure 6.1 with eastern stations shown in Figure 6.2. Central station locations are shown in Figure 6.3.

Table 6.3. Southeast Alaska Dataset 1.

Station No.	Latitude (°N)	Longitude (°W)	M-Depth (ft)	S-Depth (fathoms)	Measurement Dates mm/dd/yr		Data Length Days	Data Quality STAD
C-33	58.283	134.394	80	16*	4/23/84	5/11/84	17.95	xx
C-33	58.283	134.394	70	16*	4/23/84	5/11/84	17.95	
C-34	58.280	134.370	78	16*	4/25/84	5/11/84	16.85	
C-31	58.294	134.407	75	15*	4/23/84	5/12/84	18.21	
C-31	58.294	134.407	65	15*	4/23/84	5/12/84	18.22	
C-32	58.291	134.407	81	17	4/23/84	5/12/84	18.19	
C-27	58.296	134.402	83	18	4/23/84	5/11/84	18.01	
C-27	58.296	134.402	73	18	4/23/84	5/11/84	18.02	
C-29	58.296	134.424	66	18	4/24/84	5/12/84	17.24	
C-11	58.208	134.238	188	34*	4/25/84	5/14/84	19.68	
C-11	58.208	134.238	143	34*	4/25/84	5/14/84	19.77	
C-11	58.208	134.238	163	34*	4/25/84	5/14/84	19.78	
C-9	58.318	134.711	224	86*	4/26/84	5/18/84	21.18	
C-9	58.318	134.711	179	86*	4/26/84	5/18/84	21.18	
C-9	58.318	134.711	50	86*	4/26/84	5/18/84	21.19	
C-1	59.445	135.329	351	61*	5/16/84	6/19/84	33.97	
C-2	59.282	135.450	164	35	5/16/84	6/19/84	34.06	
C-3	59.107	135.243	729	125	5/15/84	6/19/84	34.78	
C-3	59.107	135.243	684	125	5/15/84	6/19/84	34.78	
C-3	59.107	135.243	50	125	5/15/84	6/19/84	34.79	
C-4	59.105	135.372	467	81	5/16/84	6/19/84	34.68	
C-4	59.105	135.372	50	81	5/16/84	6/19/84	34.70	
C-4	59.105	135.372	422	81	5/16/84	6/19/84	34.69	
C-5	58.847	135.197	874	150	5/15/84	6/14/84	30.06	
C-5	58.847	135.197	50	150	5/15/84	6/14/84	30.06	
C-6	58.699	135.033	714	128	5/15/84	6/20/84	35.92	
C-6	58.699	135.033	50	128	5/15/84	6/20/84	35.91	
C-7	58.536	134.934	718	130	5/15/84	6/20/84	36.06	
C-7	58.536	134.934	673	130	5/15/84	6/20/84	36.06	
C-7	58.536	134.934	50	130	5/15/84	6/20/84	36.08	
C-8	58.405	134.885	174	32*	5/17/84	6/20/84	34.10	
C-8	58.405	134.885	129	32*	5/17/84	6/20/84	34.09	
C-12	58.237	134.076	557	95*	5/14/84	6/15/84	31.79	
C-12	58.237	134.076	513	95*	5/14/84	6/15/84	31.79	
C-12	58.237	134.076	50	95*	5/14/84	6/15/84	31.80	
C-13	58.144	134.107	664	115	5/14/84	6/15/84	31.79	
C-13	58.144	134.107	50	115	5/14/84	6/15/84	31.80	
C-10	58.256	134.683	237	42*	5/15/84	6/18/84	34.67	
C-10	58.256	134.683	192	42*	5/15/84	6/18/84	34.67	
C-10	58.256	134.683	50	42*	5/15/84	6/18/84	34.67	
C-9	58.319	134.711	202	86*	5/18/84	6/22/84	35.49	
C-9	58.319	134.711	500	86*	5/18/84	6/22/84	35.49	
C-9	58.319	134.711	157	86*	5/18/84	6/22/84	35.49	
C-14	58.249	134.963	1937	325*	5/18/84	6/22/84	34.97	
C-14	58.249	134.963	50	325*	5/18/84	6/22/84	34.99	
C-15	58.025	134.873	1936	360	5/17/84	6/21/84	34.96	

Notes: M-Depth=measurement depth with respect to MLLW, where positive numbers are distance above the bottom and negative numbers are distance below the surface. S-Depth=station depth in fathoms with respect to MLLW either estimated from Edition 31 of Nautical Chart 17300 and Edition 24 of Nautical Chart 17315 or from measurement depths as indicated by asterisk. Note x denotes bad data within the STAD station matrix where S=salinity, T=temperature, A=current speed, and D=current direction.

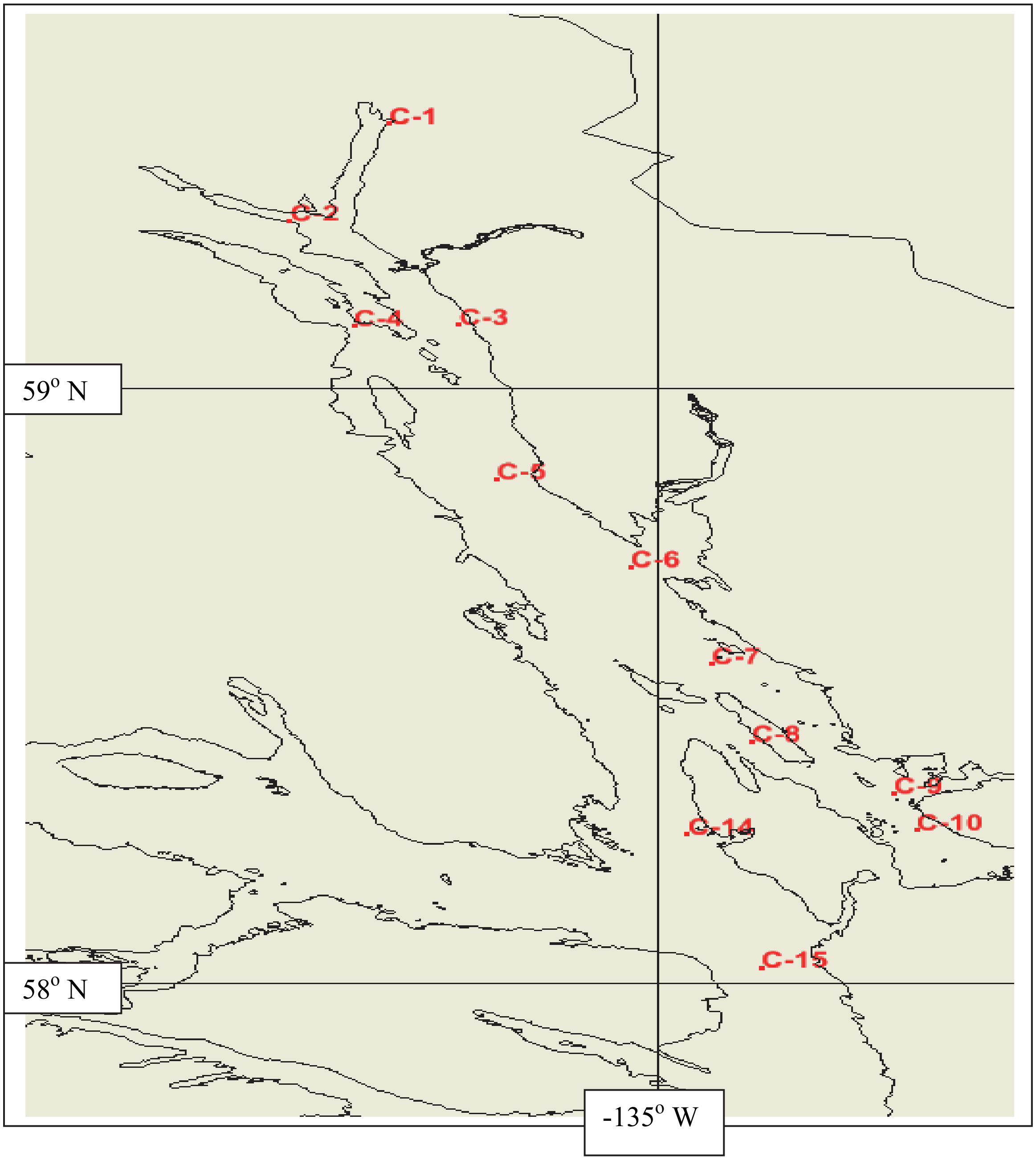


Figure 6.1. Western Station Locations for Southeast Alaska Dataset 1.

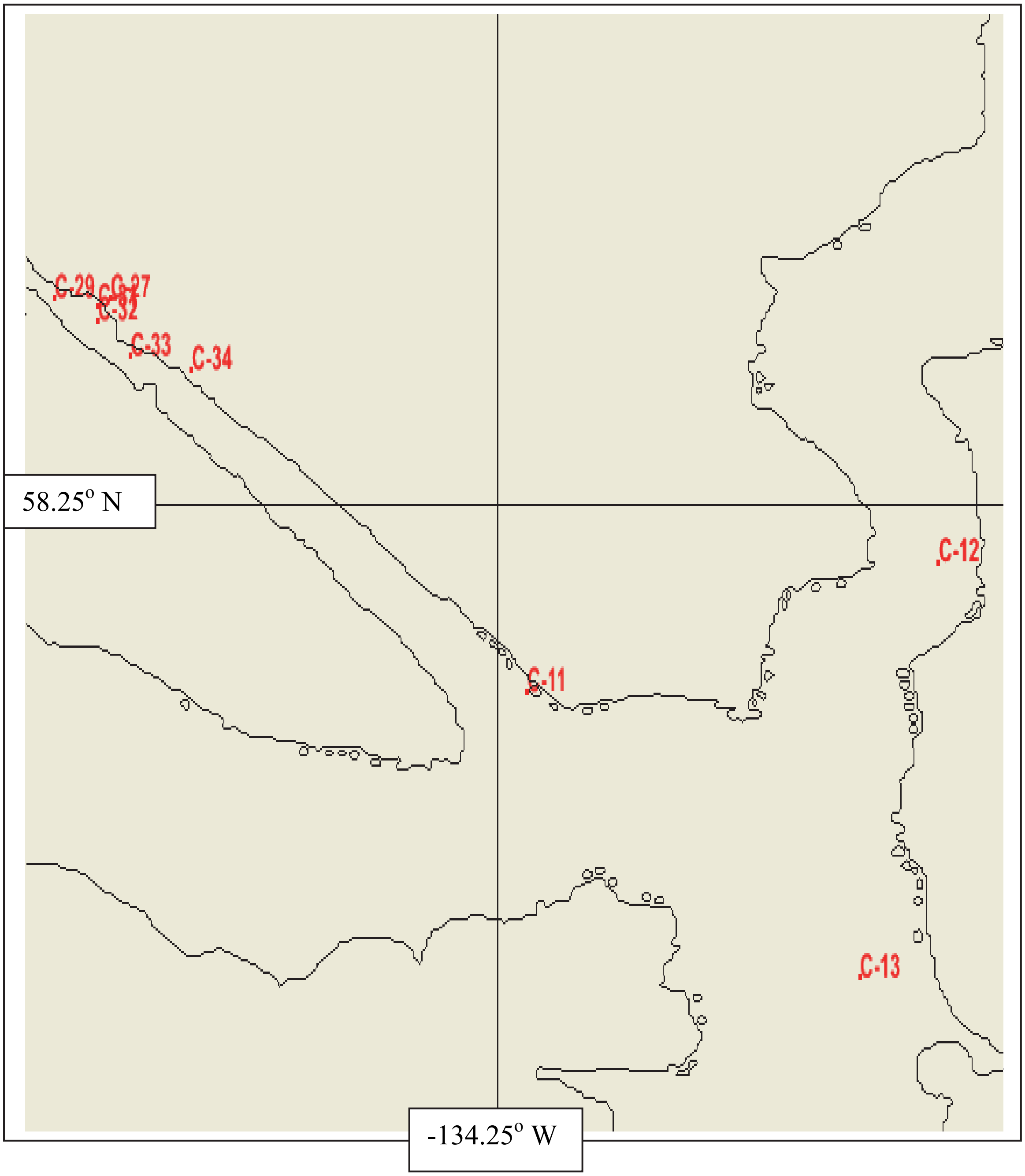


Figure 6.2. Eastern Station Locations for Southeast Alaska Dataset 1.

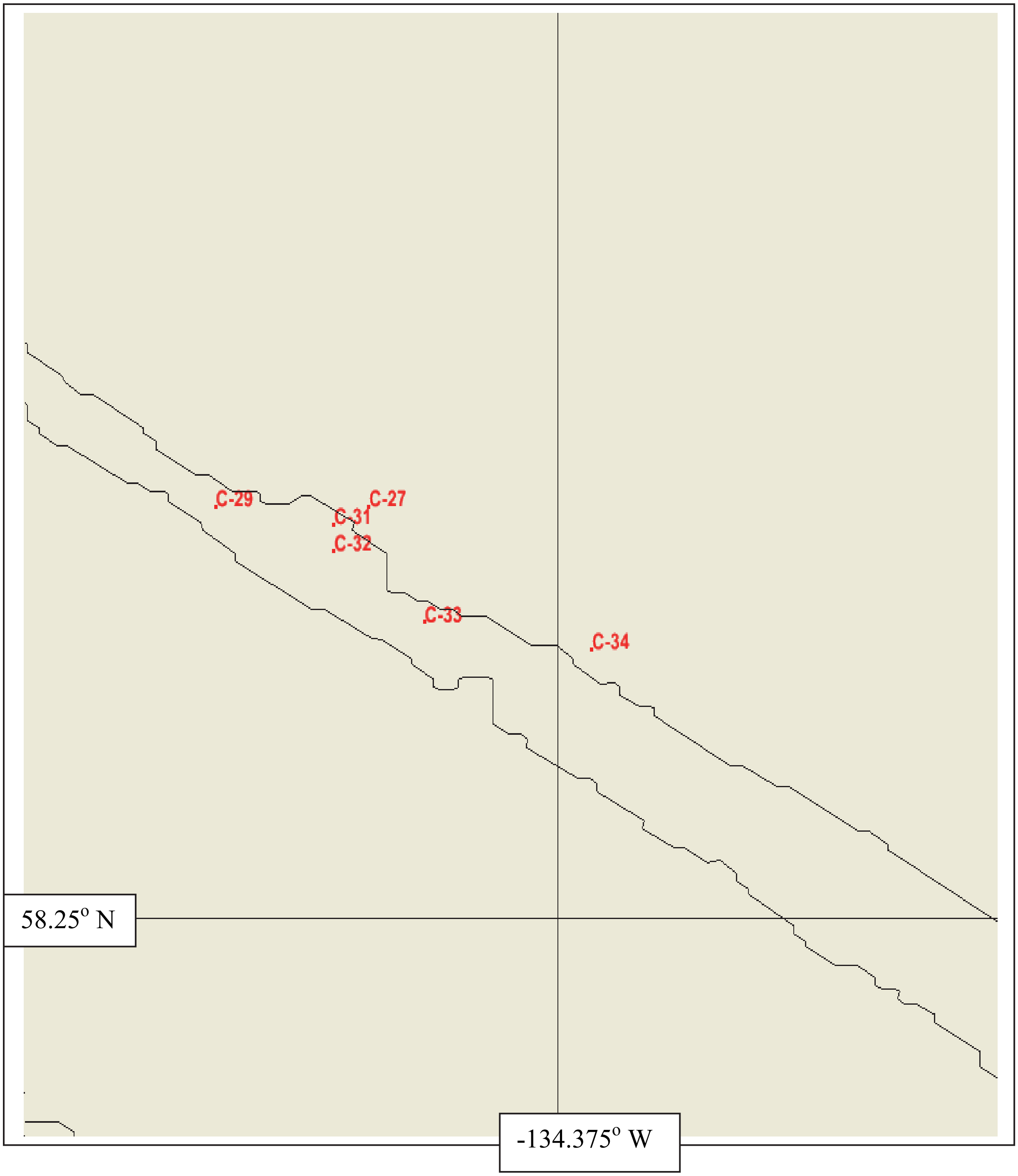


Figure 6.3. Central Stations for Southeast Alaska Dataset 1.

Regional Oceanographic Characteristics

Eckert (2005) developed a synthesis of the marine biology and oceanography of the Southeast Alaska Region. The following paragraphs are slight revisions of his workshop report.

Southeast Alaska has many unique features including tidewater and coastal glaciers, large input of freshwater from precipitation, and an intricate network of islands. The Alaska Current, adjacent to Southeast Alaska, transports relatively warm water from further south into the Gulf of Alaska.

The oceanography of Southeast Alaska is intimately linked to its complex geological structure and meteorology. Glaciers and tectonic processes carved a complex of channels and fjords throughout the archipelago. The region is bounded by steep mountains and influenced by storms associated with the Aleutian low. These storms result in strong winds and heavy precipitation year-round.

The Alaska current connects the Gulf of Alaska to the North Pacific Ocean and advects relatively warm water into the region. The location and strength of the Aleutian Low governs the strength of the Alaska Current and the bifurcation latitude of the North Pacific Current.

Winds and precipitation vary seasonally, resulting in seasonal changes in circulation, mixing, and stratification. The shelf wind field is divergent year-round with potentially important consequences for the shelf and archipelago. Within the archipelago, orography steers winds, resulting in large spatial gradients in wind velocity, circulation, and mixing.

Runoff is minimal in winter due to precipitation being stored in the mountain snowpack. Runoff increases in summer with melting, and reaches its maximum in fall when precipitation is heaviest. Coastal runoff affects seasonal variations in stratification and promotes fjordal circulations in coastal embayments. In conjunction with the downwelling favorable winds, runoff also forces a northward mean flow along the coast. This mean flow contributes to the Alaska Coastal Current.

The analysis of temperature and salinity in the Gulf of Alaska reveals eddies that persistently form in two locations. There is the Haida eddy that is generated at the southwestern tip of the Queen Charlotte Islands and the Sitka eddy west of Sitka.

Since no CTD data are available to develop the density structures, one must totally rely on the CT/Current time series. In contrast to the Cook Inlet and Prince William Sound circulation survey, salinity data are available at most station depths. Here we examine the response at Stations C-13, C-27, and C-5, proceeding from south to north. At Station C-13 at 664 ft above the bottom during May 1984 the salinity and temperature time series shown in Figure 6.4 and the current speed and directions shown in Figure 6.5 are free of high frequency content. At 50 ft above the bottom during May 1984 the current speed and directions shown in Figure 6.6 are free of high frequency content. Peak current speeds are reduced from order 40 cm/s to 20 cm/s. At Station C-27 during April 1984 at 83 ft above the bottom, located in a narrow passage, significant perturbations in salinity and temperature are shown in Figure 6.7 indicating the presence of large horizontal gradients. In Figure 6.8 peak current strengths are order 35 cm/s with a general rectilinear structure. At Station C-5 at 874 ft above the bottom during May 1984, current strengths are order 25 cm/s with interruptions in the rectilinear current structure as shown in Figure 6.9, while in Figure 6.10 at 50 ft above the bottom the currents are of equal strength.

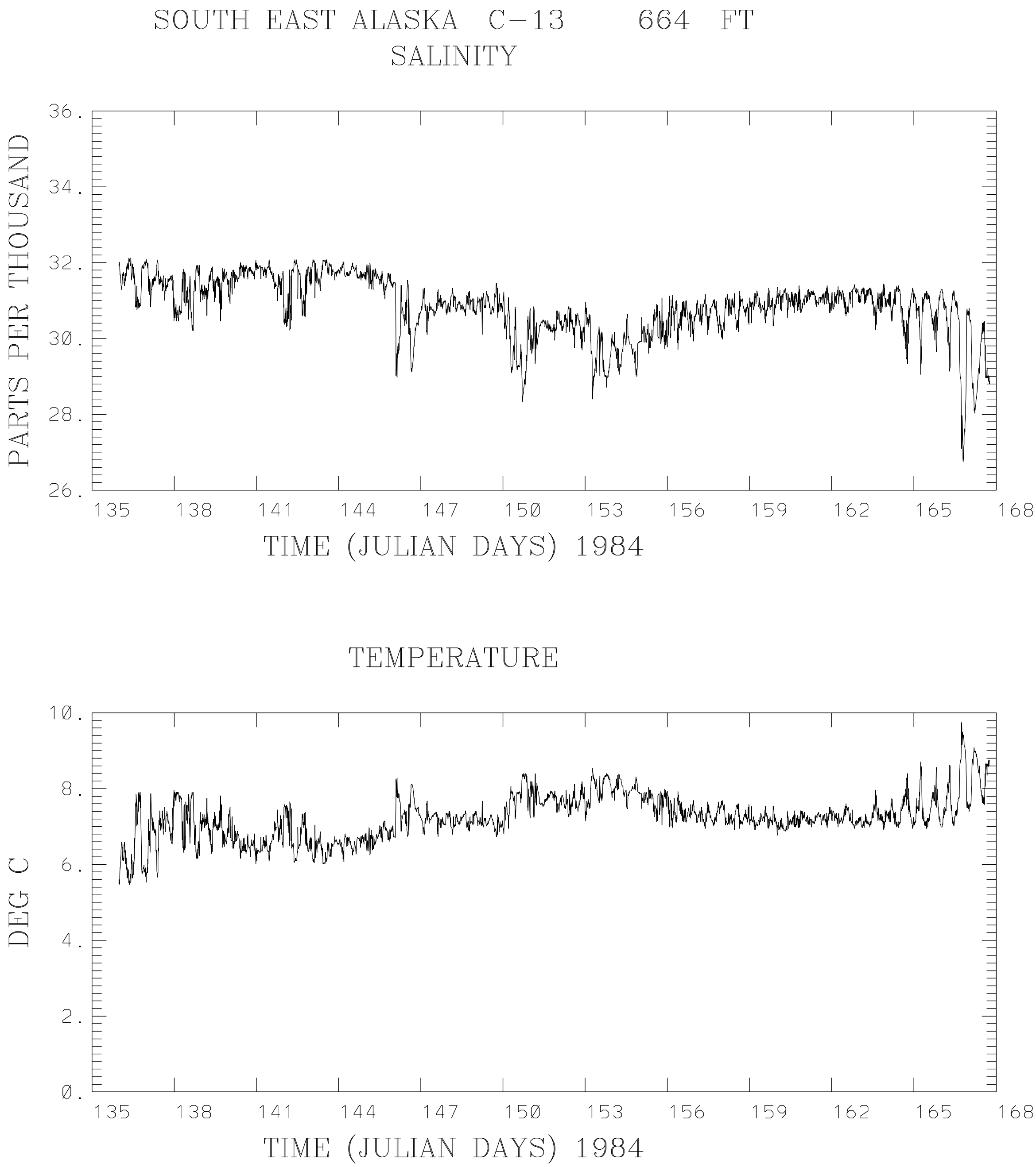
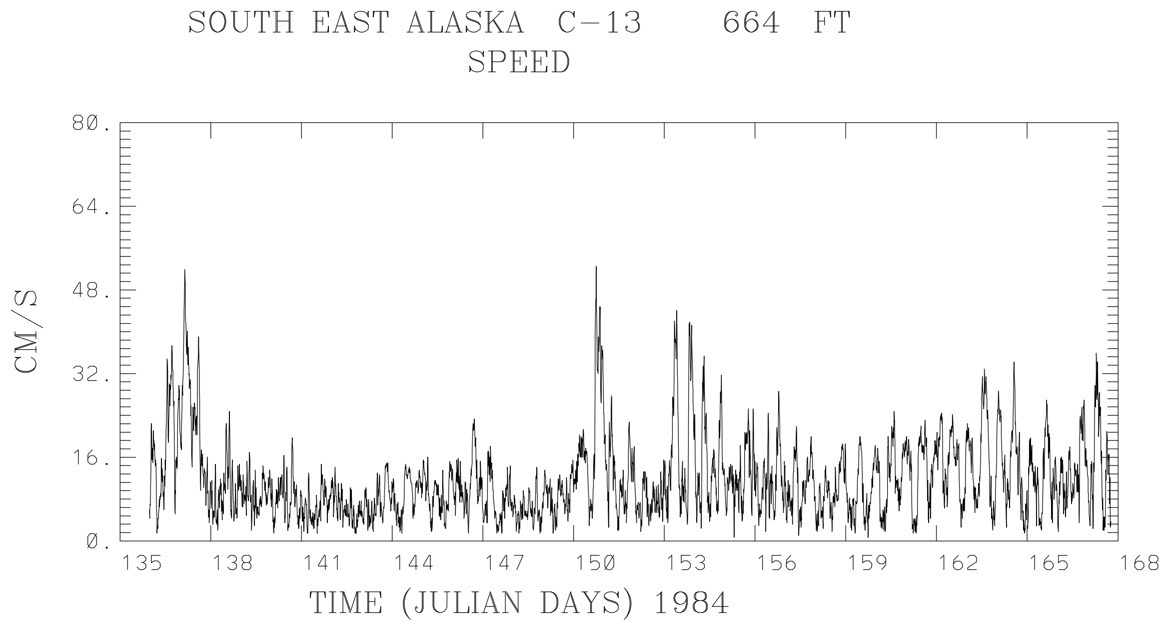


Figure 6.4. Station C-13 Southeast Alaska Salinity and Temperature at 664 ft above the bottom in May 1984.



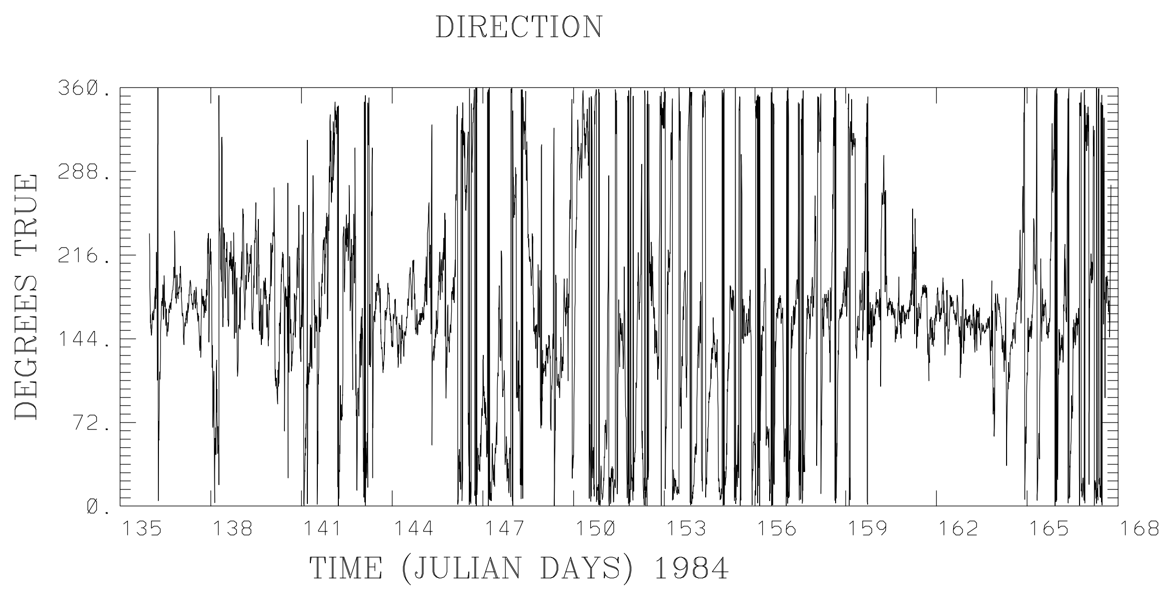
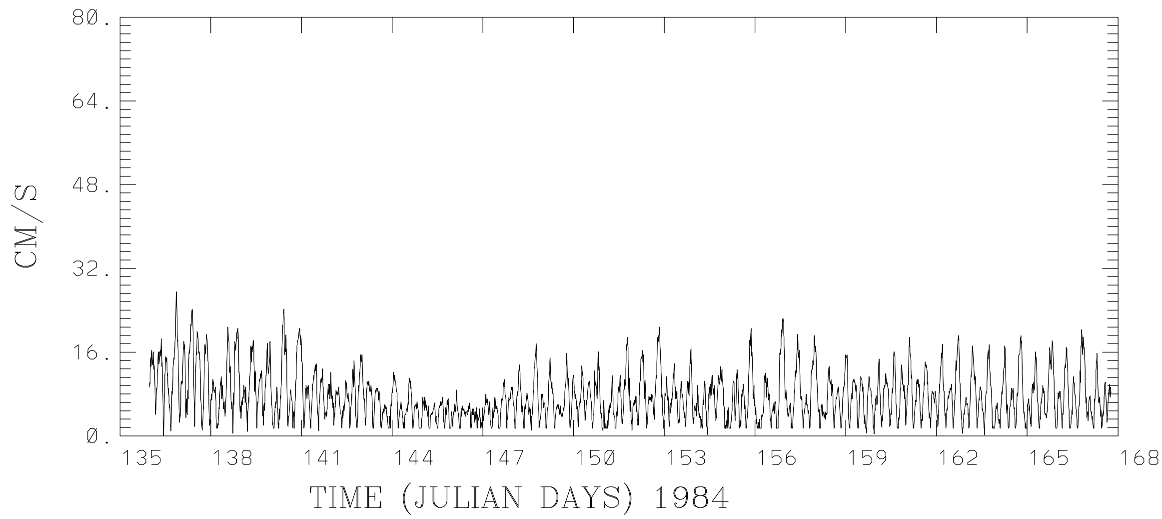


Figure 6.5. Station C-13 Southeast Alaska Current Speed and Direction at 664 ft above the bottom in May 1984.

SOUTH EAST ALASKA C−13 50 FT

SPEED



DIRECTION

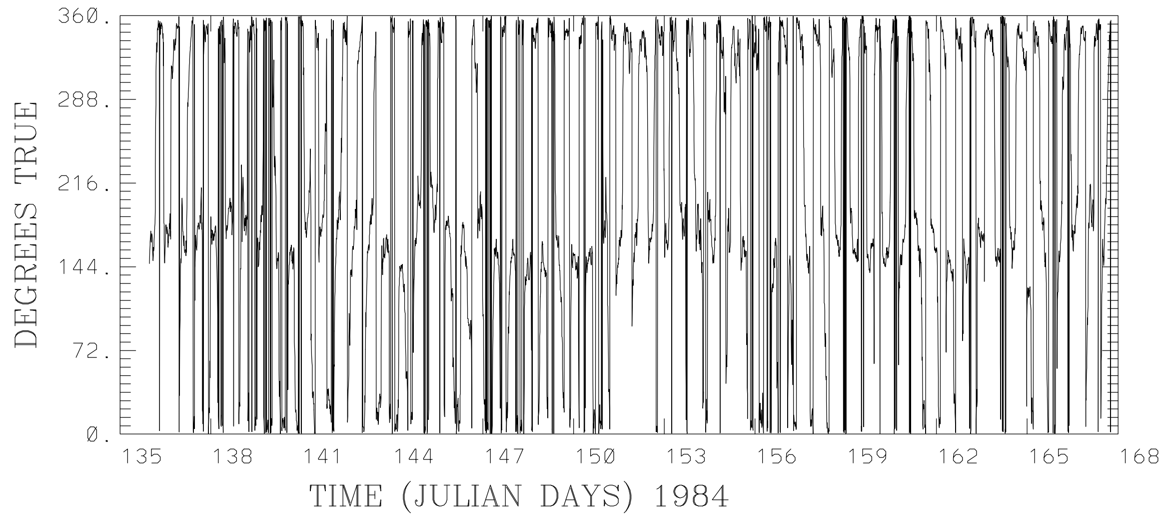


Figure 6.6. Station C-13 Southeast Alaska Current Speed and Direction at 50 ft above the bottom in May 1984.

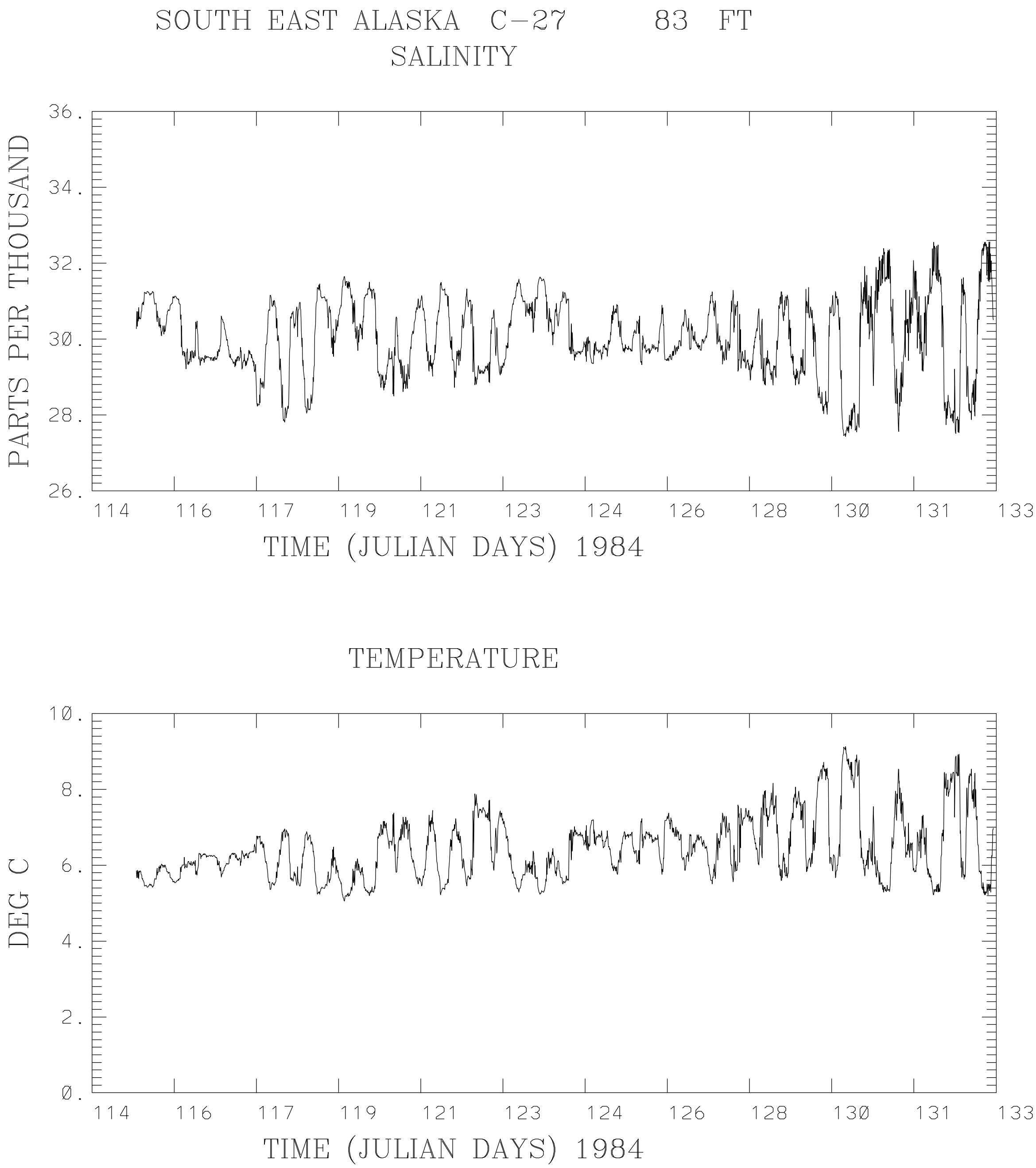


Figure 6.7. Station C-27 Southeast Alaska Salinity and Temperature at 83 ft above the bottom in April 1984.

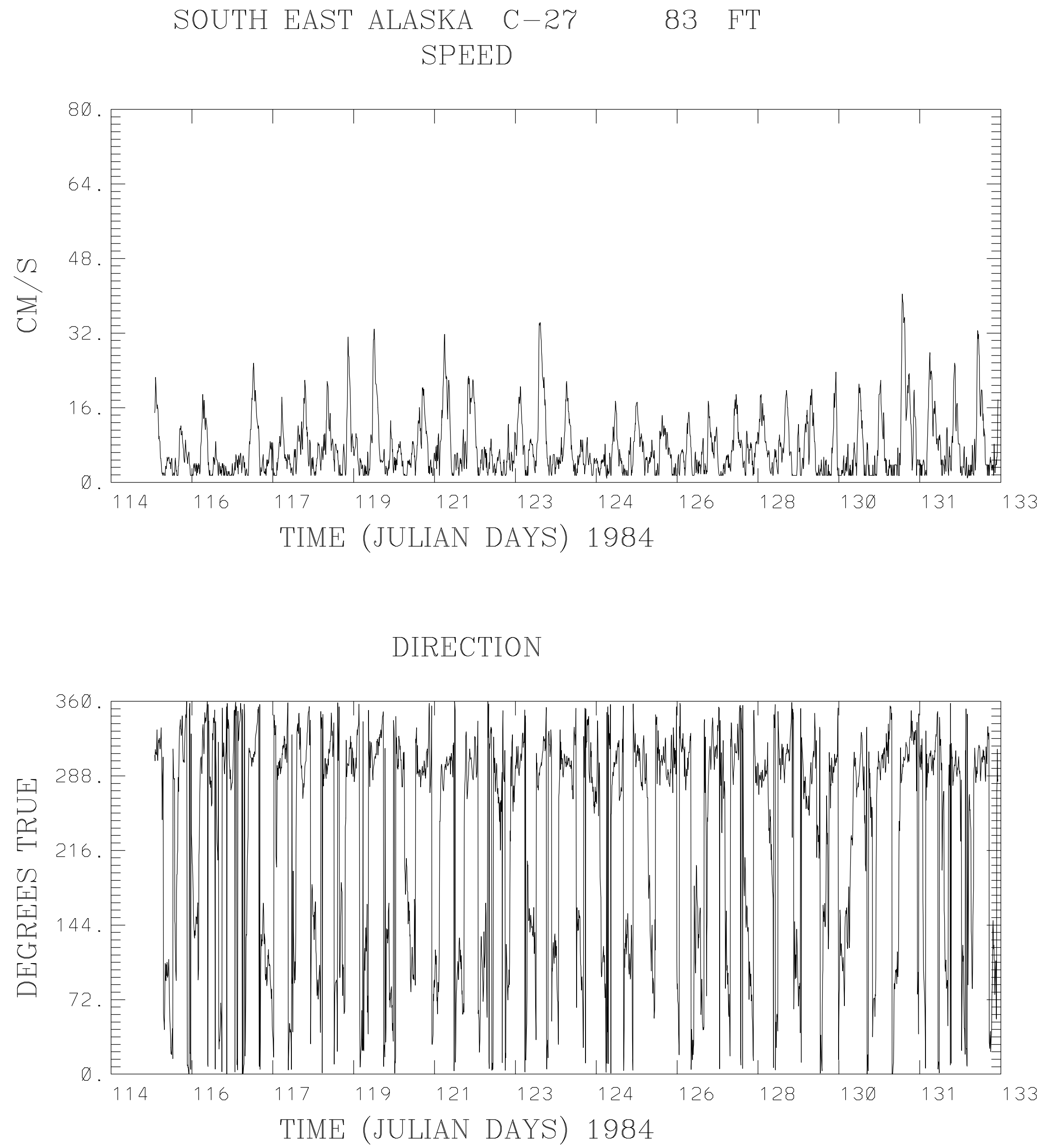


Figure 6.8. Station C-27 Southeast Alaska Sound Current Speed and Direction at 83 ft above the bottom in April 1984.

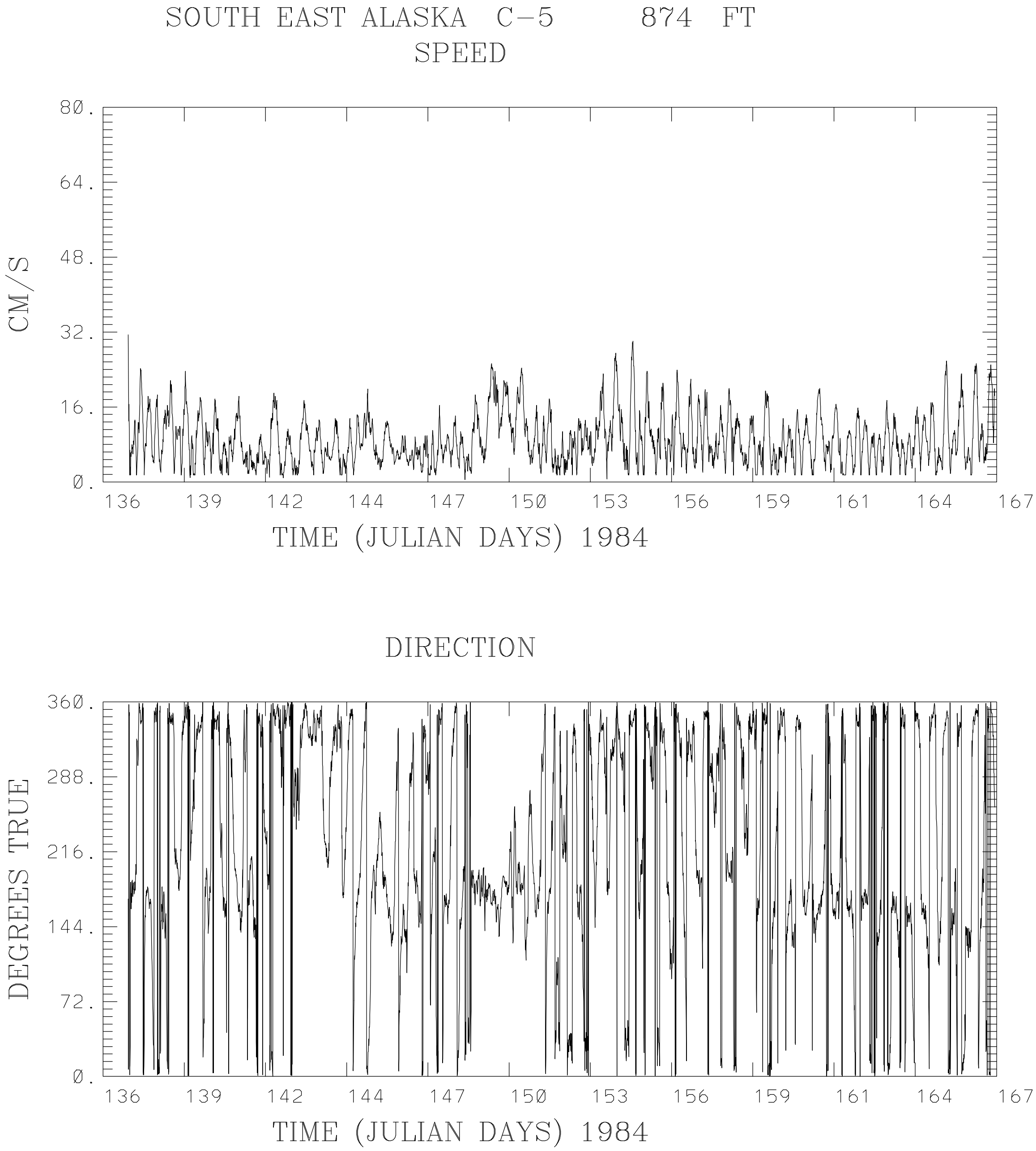


Figure 6.9. Station C-5 Southeast Alaska Current Speed and Direction at 874 ft above the bottom in May 1984.

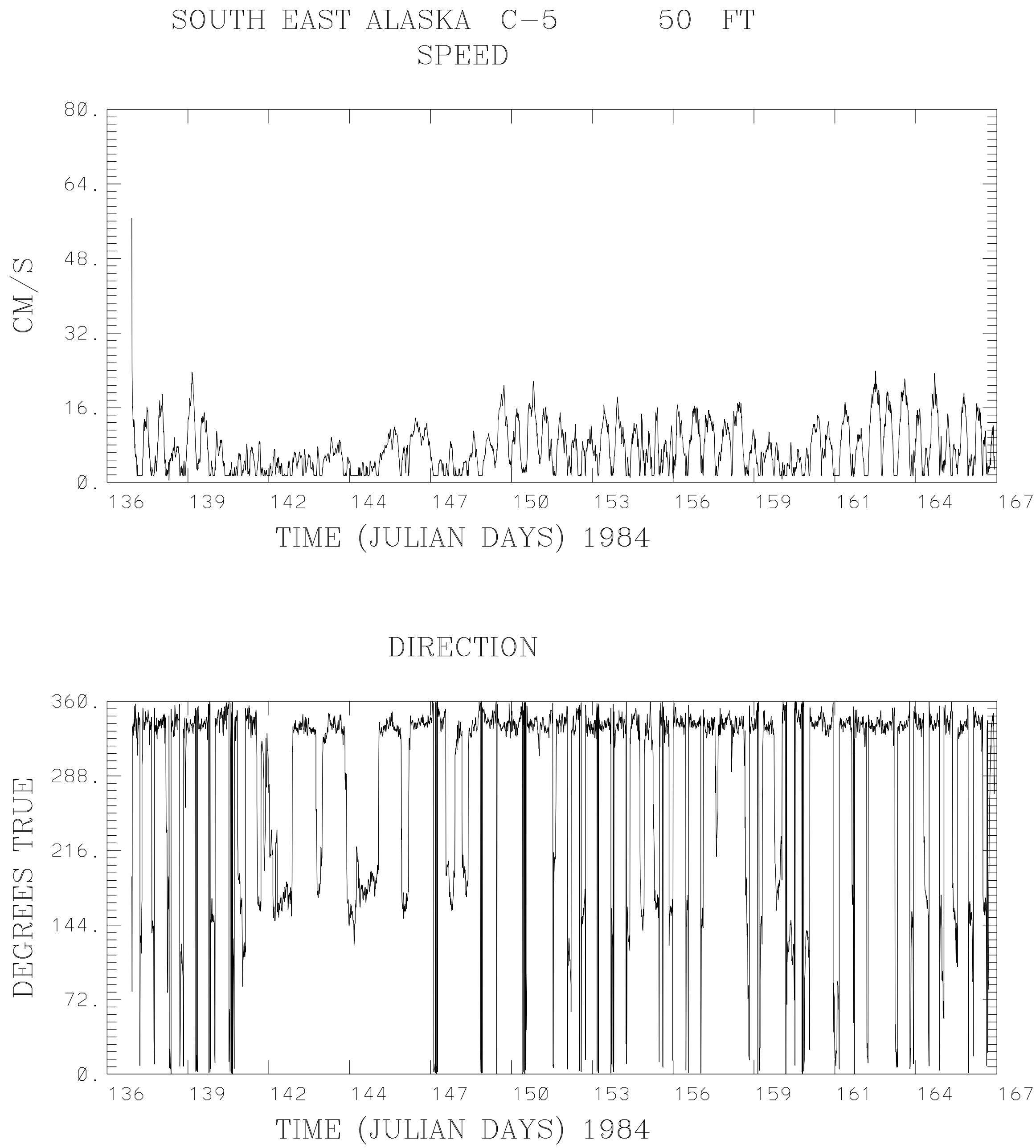


Figure 6.10. Station C-5 Southeast Alaska Current Speed and Direction at 50 ft above the bottom in May 1984.

7. DATA PRESERVATION AND USE ISSUES

Preservation

An NOS circulation survey report is available for Cook Inlet (Patchen et al. 1981), while a memorandum for record final project report is available for Prince William Sound (Frey, 7/1983) and Icy Bay (Frey, 3/1983). No records are available for the Southeast Alaska survey. In each of these documents, data dissemination is addressed as well as a submittal to NODC for archiving and preservation. However, NODC archives did not contain the original datasets in uncorrupted format. The data corruption and preservation issues are discussed in CO-OPS (1999), particularly with respect to CTD time stamp corruption. In large measure data were corrupted in migration from storage media associated with each new computer system. To prevent this, data redundancy and backup procedures need to be addressed.

Use

The primary use of these processed circulation survey datasets is anticipated to be in the support of model evaluation environments and in supporting the development of nowcast/forecast systems in Cook Inlet and Prince William Sound. This effort focused on the restoration and quality control of these datasets. It should be noted that the final processed data were written in the same format as the original data and no rearrangement of the data file structures was undertaken. No data editing and filtering were performed to remove bad portions of data. Therefore additional consistency checking should be performed by each user in consultation with the NOS circulation survey reports and memoranda, which give exact station location and water depth. Since no station depths are available for the Prince William Sound and Southeast Alaska circulation surveys, these were estimated from the latest edition nautical charts.

For current meter data, computer programs developed by Richardson and Schmalz (2006) can be used to determine the principal component directions using the Preisendorfer scheme and to automatically prepare control and input data files for the NOS 29-day harmonic analysis program (Zervas, 1999). Harmonic analysis results for currents in Cook Inlet are available in the circulation survey report (Patchen et al., 1981). These programs may be used to perform 29-day harmonic analysis of currents in the other estuaries.

8. SUMMARY AND RECOMMENDATIONS

Three sets of programs have been developed to analyze the circulation survey data. The first set of programs was not used to plot and edit CTD profiles since no CTD data were available. The second two programs were used to analyze the CT/Current meter files. The first program was used to plot station time series data in Cook Inlet, Prince William Sound, Icy Bay and Southeast Alaska. Since this effort focused on the data restoration and inventory of available data, no formal data quality was performed. However, within the present plot program, editing, and filtering steps are included and can be exercised in the future as required. All time series greater than 15 days were written for incorporation in the CSDL Oracle database.

The first program was modified to write out the final quality control station data in NOS skill assessment format as discussed by Zhang et al. (2009) and was used to process the Cook Inlet data. The second program is available to determine the principal current direction using the Preisendorfer scheme and to prepare the control and data files for use in the NOS 29-day harmonic analysis program. (Minor modification may be required to prepare the inputs for the NOS 15-day harmonic analysis program.) Since harmonic analysis results have been described in the Cook Inlet survey report (Patchen et al., 1981), this program was not used in this study.

In summary, this report has documented the restoration of the NOS historical circulation surveys in Cook Inlet, Prince William Sound, Icy Bay and Southeast Alaska. The report serves as a circulation survey report for the Prince William Sound, Icy Bay and Southeast Alaska surveys and complements the Cook Inlet survey report by Patchen et al. (1981). All restored files will be available on CSDL/MMAP servers on /disks/NASUSER until they are transferred to NODC and CO-OPS for data request, redundancy and archival purposes.

ACKNOWLEDGMENTS

Dr. Frank Aikman, Chief of Marine Modeling and Analysis Programs, Coast Survey Development Laboratory (CSDL) provided overall project direction and critical resources. Richard Patchen, Chief Science Officer, CSDL, provided the original circulation survey data reports and memoranda. Peter Stone, Center for Operational Oceanographic Products and Services (CO-OPS) provided the original circulation survey datasets.

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