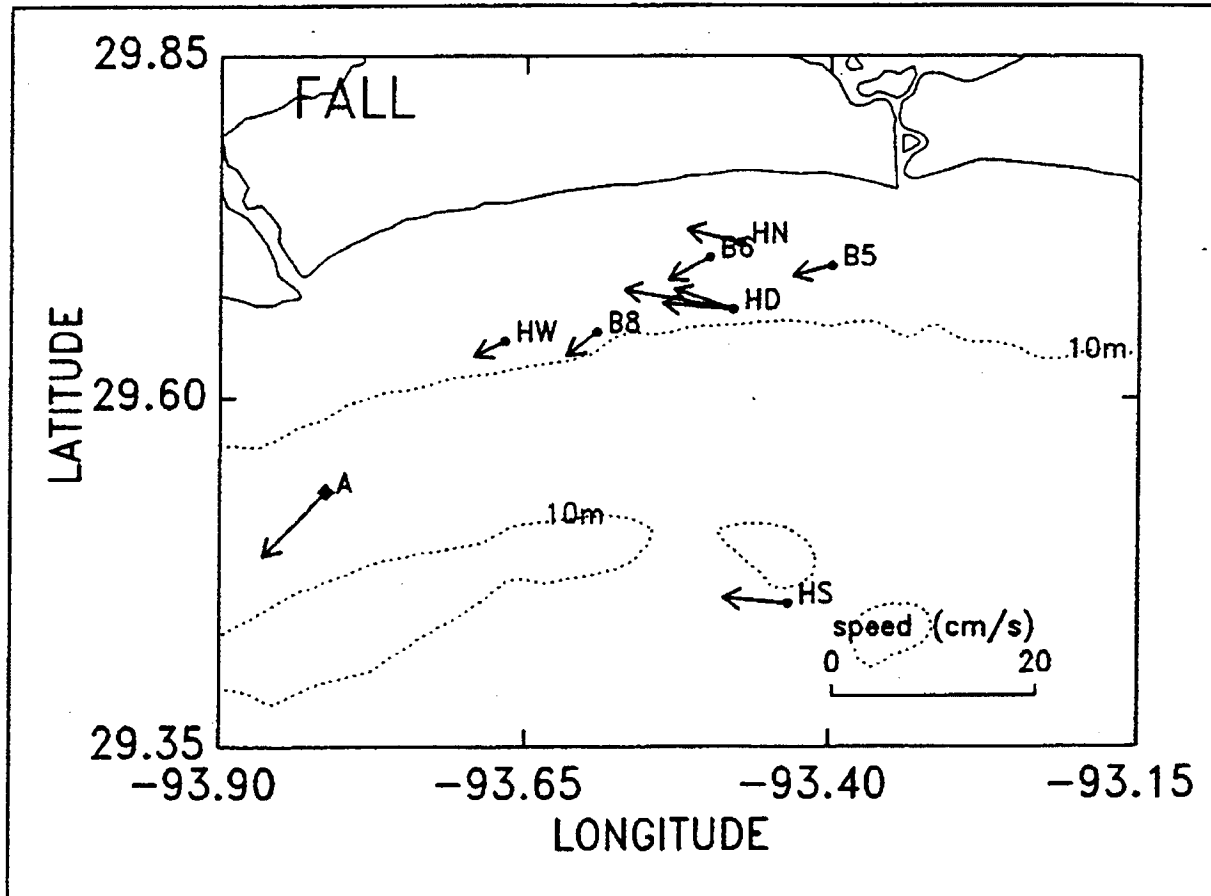


Coastal Marine Institute

Coastal Currents in the Northern Gulf of Mexico

Dixie County, Florida,
to the U.S.-Mexico Border



Coastal Marine Institute

Coastal Currents in the Northern Gulf of Mexico

Dixie County, Florida, to the U.S.-Mexico Border

Authors

Scott P. Dinnel
William J. Wiseman, Jr.
Lawrence J. Rouse, Jr.

Prepared under MMS Contract
14-35-0001-30660-19928
by
Coastal Marine Institute
Louisiana State University
Baton Rouge, Louisiana 70803

Published by

**U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region**

**New Orleans
March 1997**

DISCLAIMER

This report was prepared under contract between the Minerals Management Service (MMS) and the Coastal studies Institute, Louisiana State University. This report has been technically reviewed by MMS and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Service, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. It is, however, exempt from review and compliance with MMS editorial standards.

REPORT AVAILABILITY

Extra copies of the report may be obtained from the Public Information Office (Mail Stop 5034) at the following address:

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region
Attn: Public Information Office (MS 5034)
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

Telephone Number: 504-736-2519
1-800-200-GULF

CITATION

Suggested citation:

Dinnel, S.P., Wm., J. Wiseman, Jr., and L.J. Rouse, Jr. 1997. Coastal currents in the northern Gulf of Mexico. OCS Study MMS 97-0005. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La. 113 pp.

ABOUT THE COVER

Cover figure shows fall mean-velocity vectors for a region of the Louisiana inner continental shelf near the Louisiana-Texas border.

ABSTRACT

Historical observations from moored current meters were statistically analyzed to describe the inner-shelf surface currents of the northern Gulf of Mexico. Specific objectives were to describe the mean flows and the flow variability, and to describe the along-shore current maximum velocities and along-shore flow persistence. Data from 12 different programs, at 47 locations on the northern Gulf of Mexico continental shelf, from Dixie County, Florida, to the U.S.-Mexico international border, from the coastline seaward to a distance of 20 NM (36.5 km) were used in the analysis. Data were segmented into four seasons of three month durations, with December-February as winter, March-May as spring, June-August as summer, and September-November as fall. Three seasons, winter, spring and fall, exhibited predominantly westward mean flows. Spring mean flows were westward on the inner shelf west of the Mississippi Delta and eastward east of the Delta. The summer season exhibited as many occurrences of westward as eastward mean flows, with a general flow reversal to the east on the south Texas inner shelf. Maximum along-shore current magnitudes exceeded maximum cross-shore current magnitudes in all seasons. Maximum along-shore currents to the west and the along-shore variance magnitude increased to the west in all seasons. The percentage of westward alongshore flow from individual records exceeded 50% and increased in percentage to the west in all seasons except summer, when the percentage of eastward flow from individual records was similar to westward flow.

TABLE OF CONTENTS

		PAGE
	List of Figures	ix
	List of Tables	xiii
1.	Introduction	1
2.	Data	4
2.1	Data Coverage: Spatial and Temporal	4
2.2	Data Sources	5
	2.2.1 Moored Current Meter Data	5
	2.2.2 Moored Buoy Current Meter Data	7
	2.2.3 Report Nomenclature	7
2.3	Data Analysis	7
	2.3.1 The Data	7
	2.3.1.1 Temporal Sampling	7
	2.3.1.2 Concatenation and Gap Filling	7
	2.3.1.3 Data Rotation	11
	2.3.1.4 Seasonal Segmentation	11
	2.3.1.5 Low Pass Filtering	11
	2.3.2 Statistical Analyses	12
	2.3.2.1 First Order Statistics	12
	2.3.2.2 Alongshore Flow Persistence	34
3.	Results	35
3.1	Seasonal Flows	35
	3.1.1 Winter	35
	3.1.2 Spring	97
	3.1.3 Summer	98
	3.1.4 Fall	99
3.2	Alongshore Flow Persistence	100
	3.2.1 Persistence	100
	3.2.2 Persistence Example	102
4.	Discussion and Interpretation	105
4.1	Seasonal Flows	105
4.2	Alongshore Flow Persistence	110
5.	References	111
	Appendix A	Diskette*

* Diskette available from Public Information Unit upon request

LIST OF FIGURES

<u>FIGURE</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1a	Northeastern Gulf of Mexico locations of data used in analyses.	2
1b	Northwestern Gulf of Mexico locations of data used in analyses.	3
2	General time line of current meter data showing seasonal coverage.	6
3a	Winter mean velocity vectors for eastern region.	36
3b	Winter mean velocity vectors for eastern region close packed stations.	37
3c	Winter mean velocity vectors for central region.	38
3d	Winter mean velocity vectors for central region close packed stations.	39
3e	Winter mean velocity vectors for (north) western region.	40
3f	Winter mean velocity vectors for (north) western region close packed stations.	41
3g	Winter mean velocity vectors for (south) western region.	42
4a	Winter velocity variance axes for eastern region.	43
4b	Winter velocity variance axes for eastern region close packed stations.	44
4c	Winter velocity variance axes for central region.	45
4d	Winter velocity variance axes for central region close packed stations.	46
4e	Winter velocity variance axes for (north)western region.	47
4f	Winter velocity variance axes for (north)western region close packed stations.	48
4g	Winter velocity variance axes for (south)western region.	49
5a	Spring mean velocity vectors for eastern region.	50
5b	Spring mean velocity vectors for eastern region close packed stations.	51

5c	Spring mean velocity vectors for central region.	52
5d	Spring mean velocity vectors for central region close packed stations.	53
5e	Spring mean velocity vectors for (north) western region.	54
5f	Spring mean velocity vectors for (north) western region close packed stations.	55
5g	Spring mean velocity vectors for (south) western region.	56
6a	Spring velocity variance axes for eastern region.	57
6b	Spring velocity variance axes for eastern region close packed stations.	58
6c	Spring velocity variance axes for central region.	59
6d	Spring velocity variance axes for central region close packed stations.	60
6e	Spring velocity variance axes for (north)western region.	61
6f	Spring velocity variance axes for (north)western region close packed stations.	62
6g	Spring velocity variance axes for (south)western region.	63
7a	Summer mean velocity vectors for eastern region.	64
7b	Summer mean velocity vectors for eastern region close packed stations.	65
7c	Summer mean velocity vectors for central region.	66
7d	Summer mean velocity vectors for central region close packed stations.	67
7e	Summer mean velocity vectors for (north) western region.	68
7f	Summer mean velocity vectors for (north) western region close packed stations.	69
7g	Summer mean velocity vectors for (south) western region.	70
8a	Summer velocity variance axes for eastern region.	71

8b	Summer velocity variance axes for eastern region close packed stations.	72
8c	Summer velocity variance axes for central region.	73
8d	Summer velocity variance axes for central region close packed stations.	74
8e	Summer velocity variance axes for (north)western region.	75
8f	Summer velocity variance axes for (north) western region close packed stations.	76
8g	Summer velocity variance axes for (south)western region.	77
9a	Fall mean velocity vectors for eastern region.	78
9b	Fall mean velocity vectors for eastern region close packed stations.	79
9c	Fall mean velocity vectors for central region.	80
9d	Fall mean velocity vectors for central region close packed stations.	81
9e	Fall mean velocity vectors for (north) western region.	82
9f	Fall mean velocity vectors for (north) western region close packed stations.	83
9g	Fall mean velocity vectors for (south) western region.	84
10a	Fall velocity variance axes for eastern region.	85
10b	Fall velocity variance axes for eastern region close packed stations.	86
10c	Fall velocity variance axes for central region.	87
10d	Fall velocity variance axes for central region close packed stations.	88
10e	Fall velocity variance axes for (north) western region.	89
10f	Fall velocity variance axes for (north) western region close packed stations.	90
10g	Fall velocity variance axes for (south) western region.	91

11	Seasonal alongshore mean velocity versus alongshelf distance.	92
12	Seasonal cross-shore mean velocity versus alongshelf distance.	94
13	Seasonal alongshore maximum velocity versus alongshelf distance.	95
14	Percent low-pass alongshore seasonal variance versus alongshelf distance.	96
15	Percent of record with westward alongshore velocity versus alongshelf distance.	101
16	Seasonal maximum westward displacement versus alongshelf distance.	103
17	Seasonal maximum eastward displacement versus alongshelf distance.	104

LIST OF TABLES

<u>TABLE</u>	<u>PAGE</u>
1 Current meter data sources.	8
2 Seasonal statistics.	13
3 Seasonal 40-hour low-passed statistics.	24
4 Seasonal alongshore flow durations for station EPA GS G1.	106

1. INTRODUCTION

The Minerals Management Service (MMS) Gulf of Mexico (GOM) Outer Continental Shelf (OCS) Region acquired recently responsibility for oil spill contingency plan evaluation within the state waters in the Gulf of Mexico. MMS has extensive experience predicting the movement of contaminants (oil) across the continental shelf from OCS waters into state waters. As contaminants approach the shore, the currents responsible for advecting these contaminants are increasingly influenced by the coastal constraint (Csanady 1982); they turn and flow predominantly alongshore. The coastal currents are further accelerated by the wind and alongshore pressure gradients. Existing numerical models are unable to adequately predict these motions.

In order to make strategic management and planning decisions, statistical knowledge of the coastal currents is needed. Data sets with the desired geographical and temporal coverage do not fully exist at present. Yet, decisions must be made in the immediate future. Contingency planning will need to resort to statistics derived from analyses of the existing historical data sets. Observational studies have shown variability on time scales of days to seasons. What these studies have not shown were a consistent picture of the amplitudes and persistence of alongshore currents. To determine the maximum likely distance that contaminants could be transported in a surface or near-surface current over a designated time period, additional statistical analyses of GOM coastal currents are necessary.

The seasonal directionality of the mean currents along the northern Gulf of Mexico inner shelf is reasonably well known (Smith 1975, 1978; Hann and Randall 1981; Chuang et al. 1982; Cochran and Kelly 1986; Schroeder et al. 1987; Wiseman and Dinnel 1988; Dinnel 1988). The intensity of these mean currents, their maximum expected values, and their persistence are less well known.

Ideally long concurrent time series, of one year or more duration, of coastal surface currents at regular positions along the GOM coast would be desirable in producing these statistics. Unfortunately less than ideal data sets are presently available. Although current meter records from the inner shelf of the northern Gulf of Mexico within 36.5 km (20 nm) of shore have been obtained, they are spotty in their spatial coverage (Figure 1). Record lengths are also variable. Only a portion of the obtained records are more than one year in duration, the rest are just a few months long. Those collected during the past decade tend to be longer and more reliable.

We provide this analysis in support of MMS oil spill response planning in state waters. We have collected, quality controlled and statistically described the available surface and near-surface current meter records for the inner shelf of the northern Gulf of Mexico. These statistics describe the record mean flows and the flow variability. They also describe measures of alongshore current maximum velocities and alongshore flow persistence.

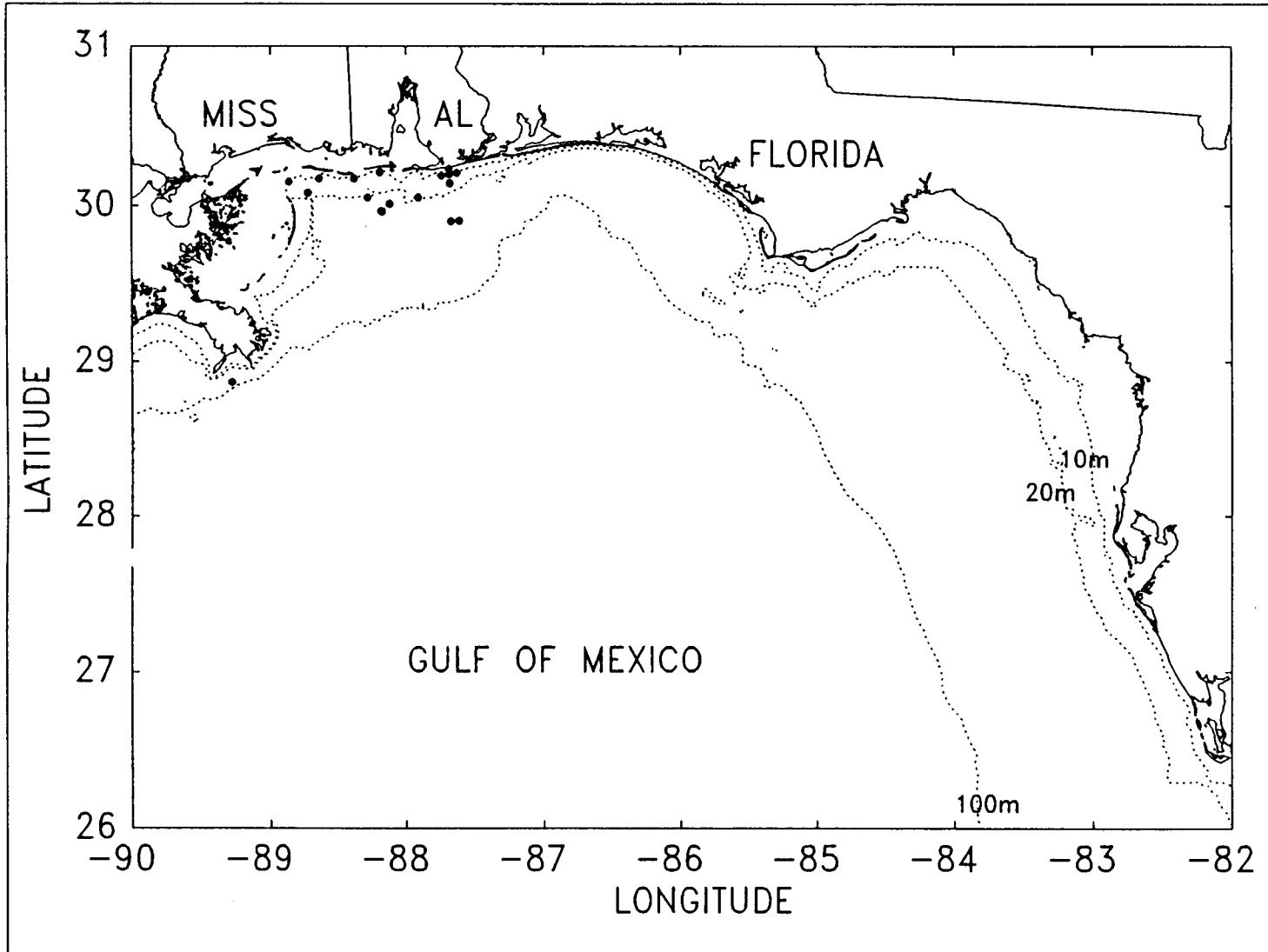


Figure 1a. Northeastern Gulf of Mexico locations of data used in analyses.

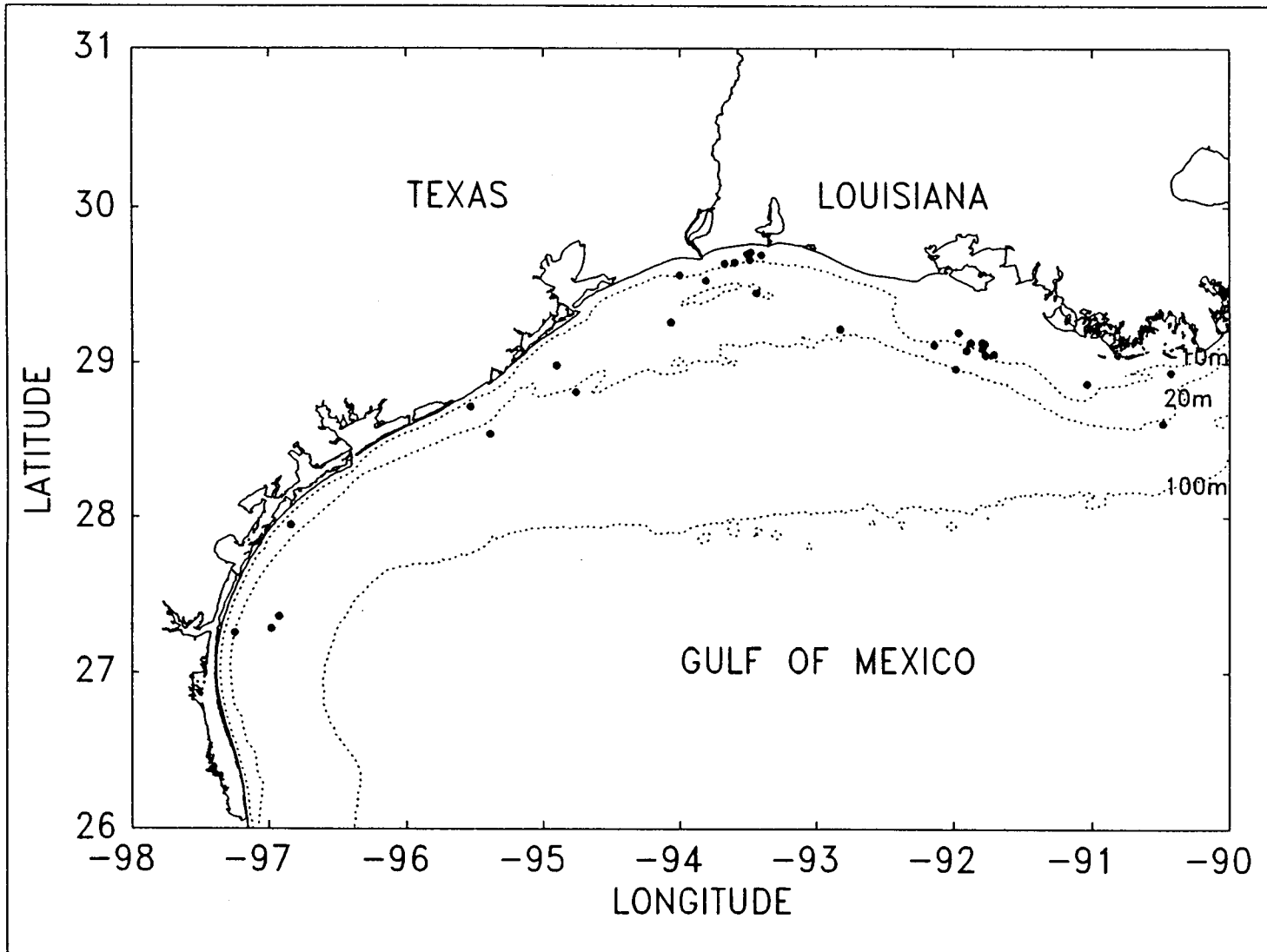


Figure 1b. Northwestern Gulf of Mexico locations of data used in analyses.

2. DATA

2.1 Data Coverage: Spatial and Temporal

Long-term, moored surface current records from the inner continental shelf of the northern Gulf of Mexico coast were identified and obtained. The geographical scope of the project was defined to extend from Dixie County, FL to the Texas-Mexico border. Current records, though, were identified and acquired only from Baldwin County, AL, east of Mobile Bay, to the south Texas coast (Figure 1). Data acquisition was limited to locations within 36.5 km (~20 NM), an arbitrary seaward boundary of the innershelf defined in consultation with MMS scientists. This boundary is within federal waters, but encompasses the seaward of the narrower band of state waters that the MMS has acquired responsibility. Water depths, at this seaward boundary, varied from ~20 m along the east Texas and western Louisiana coasts to ~30 m along the south Texas coast and east of the Mississippi Delta.

Two types of moored current meter data were acquired. The majority of the data sets were from subsurface, taut-line moorings or fixed bottom-mounted platforms. An additional data set was from moored surface buoys.

Current meter data from 12 programs and 47 different locations were used in the analyses. Current meter data used in this study were decomposed into orthogonal, horizontal velocity components. The longest continuous data records were desired for the subsequent statistical analyses in order to statistically document velocity component means, therefore only data records longer than 27 days were used. This value was arbitrary, but it was based on the number of records necessary to contain sufficient independent samples so as to determine statistically significant mean flows. The longest continuous record was over 772 days in duration. Acquired data was sampled in many years, ranging from 1977 to 1996, and so will conceivably contain a good deal of inter-annual variability.

Some of the data records were not truly near-surface records. These were used in order to insure the largest possible spatial coverage. Data was acquired from projects that investigated near bottom and mid-depth flow. All data was used from innershelf locations in less than 10 m water depth. The water column was considered to be vertically homogeneous in these shallow regions. We recognized that some frictional shear modified these records. Data from moorings in water depths greater than 10 m were not included if velocity observations were in the lower quarter of the water column as currents could be subject to considerable baroclinic vertical shear (Dinnel 1988; Wiseman and Dinnel 1988; SAIC 1989).

Geographical coverage was divided into three arbitrary regions for ease of presentation. The eastern region extends from the Mississippi River mouth eastward and includes the Mississippi and Alabama inner shelves. The central region extends from near the Mississippi River delta westward into western Louisiana, covering the shelf adjacent to the Atchafalaya River delta. The western region includes the western Louisiana shelf and extends to the Texas-Mexico border. In the figures, the western region is presented as two sections for graphical simplification (preservation of the horizontal scale), the (north)western region covers the shelf adjacent to the Louisiana-Texas border and Galveston Bay, TX, the (south)western region covers the shelf adjacent to south Texas. Three subregion figures (with expanded horizontal scales) are presented where close-packed stations make larger scale figures difficult to interpret. These are presented for the eastern, central and (north)western regions. The

division of the data locations into geographical regions, *in no way*, is meant to group or categorize the inner shelf currents as similar, they are only intended to facilitate graphical presentation of the data.

For purposes of this analysis the temporal context of each record, in absolute time, was unimportant as analyses did not include rigorous contemporaneous comparisons. There was a need, though, for a relative context within the calendar year (see Section 2.1.3.4). Figure 2 depicts relative time lines for all data records. Multiple year records and programs are depicted in their entirety, single year programs are arbitrarily adjusted to an annual reference point.

2.2 Data Sources

2.2.1 Moored Current Meter Data

The following moored current meter data were acquired:

US Corps of Engineers (COE) sediment disposal study, Mississippi inner shelf (MS), 1980-1981. Eight surface meters. See Kjerfve and Sneed (1984), and Dinnel (1988) for additional information on the program, mooring deployment and data.

US Environmental Protection Agency (EPA) sewage outflow study, Gulf Shores (GS), AL, Alabama inner shelf, 1986-1987. Four surface meters and one mid-column meter.

Office of Naval Research (ONR) Louisiana Shelf (LS) study, 1983. One mid-column meter.

Minerals Management Service (MMS) Year 5 of the Gulf of Mexico Physical Oceanography program (YR5), Louisiana shelf, 1987-1988. One mid-column meter. See SAIC (1989) for additional information on the program, mooring deployment and data.

Minerals Management Service (MMS) Year 3 of the Gulf of Mexico Physical Oceanography program, Mississippi River delta study (DELTA), 1984. One near-surface meter. See Wiseman and Dinnel (1988) for additional information on the program, mooring deployment and data.

Minerals Management Service (MMS) Mississippi-Alabama Continental Shelf Ecosystem Study (MAMES), Mississippi-Alabama shelf, 1987-1989. One near-surface meter. See Kelly (1991) for additional information on the program, mooring deployment and data.

Minerals Management Service (MMS) Texas-Louisiana Shelf Circulation Program (LTX), 1992-1994. Data was provided by the LATEX Program Office, Texas A&M University. Two surface and seven near-surface meters. See Jochens and Nowlin (1994), Jochens and Nowlin (1995), and Reap et al. (1996) for additional information on the program, mooring deployment and data.

US Department of Energy (DOE) Strategic Petroleum Reserve Louisiana brine disposal analysis program (BD), 1977-1978. Four surface and four mid-column meters. Data acquired from the National Oceanographic Data Center.

The National Oceanic and Atmospheric Administration (NOAA), collected data for the US Department of Energy, Strategic Petroleum Reserve Louisiana Weeks Island (WI), LA, brine disposal analysis program, 1978-1979. Data acquired from the National Oceanographic Data Center. Five

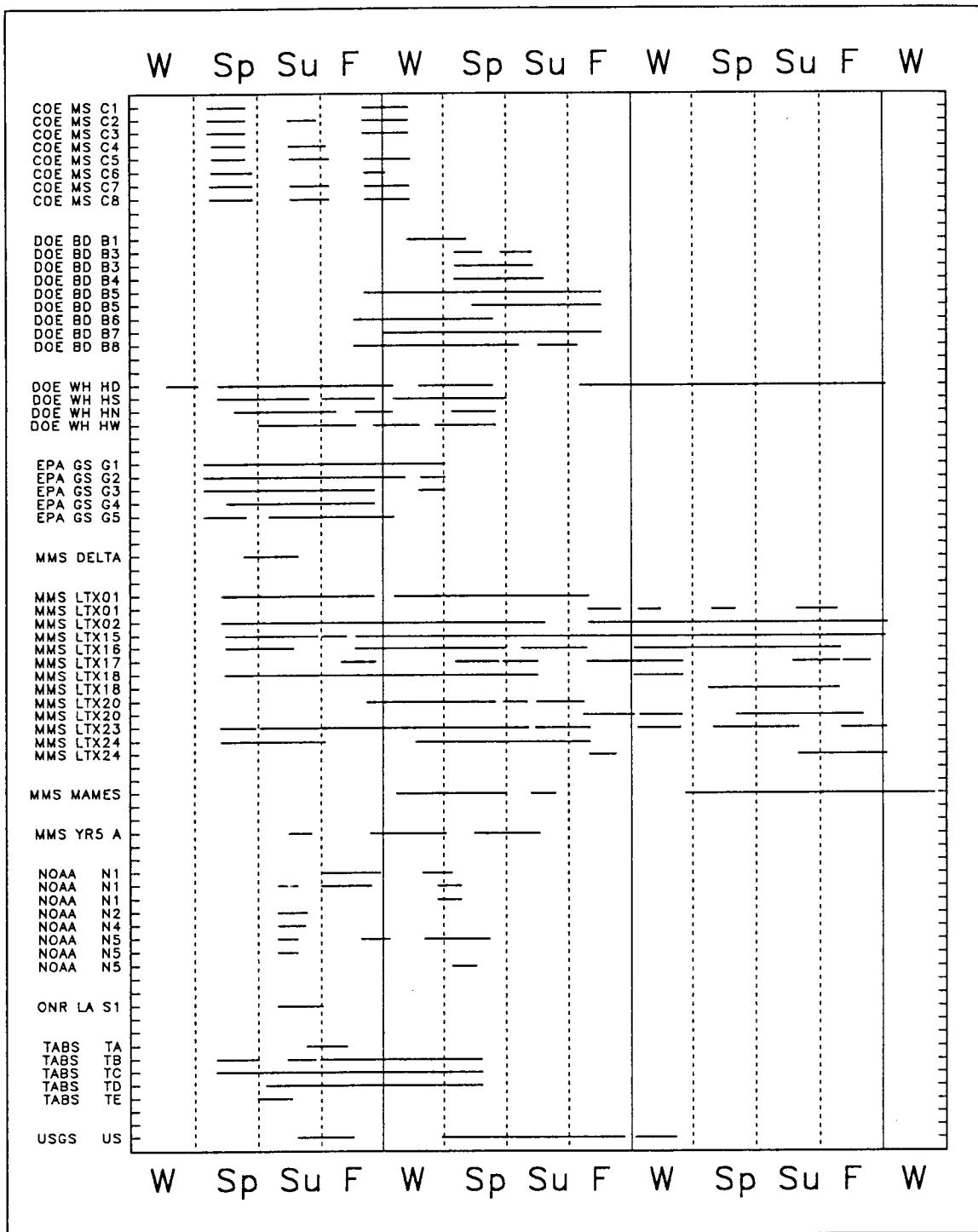


Figure 2. General time line of current meter data showing seasonal coverage. Meter locations are listed alphabetically by sponsoring agency and program. Temporal coverage by seasons are for relative years.

mid-column meters. See Frey et al. (1981) for additional information on the program, mooring deployment and data.

US Department of Energy (DOE) Strategic Petroleum Reserve West Hackberry brine diffuser monitoring program (WH), 1981-1983. Three surface and one mid-column meter. See Hann et al. (1984) for additional information on the program, mooring deployment and data.

US Geological Survey (USGS) sediment transport study, Mississippi-Alabama shelf, 1990-1992. Data was provided by the USGS. One surface meter. See Kinoshita and Noble (1995) for additional information on the program, mooring deployment and data.

2.2.2 Moored Buoy Current Meter Data

The following moored buoy current meter data were acquired:

Texas General Land Office (TGLO) Texas Automated Buoy System (TABS), Texas shelf, 1995-1996. Five surface meters. Data was provided by the TGLO.

2.2.3 Report Nomenclature

For the purposes of this analysis report the naming convention will include a data source such as the funding agency, a project/program acronym unique within this report, a mooring identification that can be either a number or letter, and in some circumstances, a geographical positional or vertical positional change identification (see section 2.3.1.2). Some mooring naming schemes were maintained from the original program, some were generated or renamed to enable their unique identification (Table 1, Figure 1) in this analysis and report. Table 1 also lists the location, temporal coverage, water depth, current meter depth, and time characteristics of the records.

2.3 Data Analysis

2.3.1 The Data

All current meter data were transformed to orthogonal velocity components. These components were normalized to standard compass orientation, positive U being eastward flow, positive V being northward flow.

2.3.1.1 Temporal Sampling

It was desired that all data records have similar sample intervals or time steps. Most records were sampled with time steps of one-half or one hour. Those data records that had shorter time steps, specifically the USGS data, were filtered, using a two-hour low-pass filter, and subsampled at one-half hour intervals following procedures in Bendat and Piersol (1986). See section 2.3.1.5 for more information on the filter characteristics.

2.3.1.2 Concatenation and Gap Filling

Data records were concatenated to obtain the longest continuous records from any given data location. When data gaps due to missing or obviously incorrect values were less than 24 hours in duration, gaps were filled by linear interpolation. No concatenation was performed across data gaps in excess of 24 hours in length.

Table 1.

Current meter data sources. Alphabetized by sponsoring agent (SA), program identification (PGM), then ordered by observational meter identification (M) where lower case character denotes a meter depth and/or a mooring location change, observational meter water depth (D_O), water depth at location (D_w), observational meter latitude (LAT) and longitude (LON) in degrees, observations start and end dates and times (in Central Standard Time), and the approximate total record coverage (T) in days.

SA *	PGM ⁺	M	D_O	D_w	LAT	LON	START DATE	TIME	END DATE	TIME	T (d)
COE	MS	C1	3.0	11.3	30.15	88.86	11/01/80	1100	1/06/81	1200	66
COE	MS	C1	3.0	11.3	30.15	88.86	3/21/81	1100	5/13/81	0900	52
COE	MS	C2	3.0	12.8	30.08	88.72	11/01/80	1400	1/06/81	1330	66
COE	MS	C2	3.0	12.8	30.08	88.72	3/21/81	0900	5/13/81	1030	52
COE	MS	C2	3.0	12.8	30.08	88.72	8/15/81	1400	8/24/81	1900	40
COE	MS	C3	3.0	13.7	30.17	88.64	11/01/80	1500	1/06/81	1400	66
COE	MS	C3	3.0	13.7	30.17	88.64	3/21/81	0700	5/13/81	1130	53
COE	MS	C4	3.0	14.6	30.17	88.38	3/27/81	1230	5/13/81	1300	47
COE	MS	C4	3.0	14.6	30.17	88.38	8/16/81	1830	9/08/81	1200	53
COE	MS	C5	3.0	19.5	30.05	88.28	11/03/80	1400	1/09/81	1400	67
COE	MS	C5	3.0	19.5	30.05	88.28	3/27/81	1800	5/13/81	1430	47
COE	MS	C5	3.0	19.5	30.05	88.28	8/18/81	1030	9/12/81	1200	57
COE	MS	C6	3.0	11.6	30.21	88.19	11/03/80	1730	12/04/80	0930	29
COE	MS	C6	3.0	11.6	30.21	88.19	3/26/81	1700	5/23/81	2000	58
COE	MS	C7	3.0	21.9	30.01	88.12	11/04/80	1930	1/07/81	2130	64
COE	MS	C7	3.0	21.9	30.01	88.12	3/24/81	1930	5/23/81	1230	59
COE	MS	C7	3.0	21.9	30.01	88.12	8/19/81	1430	9/12/81	0900	55
COE	MS	C8	3.0	16.8	30.05	87.91	11/04/80	1700	1/08/81	1700	65
COE	MS	C8	3.0	16.8	30.05	87.91	3/24/81	1730	5/13/81	1800	60
COE	MS	C8	3.0	16.8	30.05	87.91	8/19/81	1200	9/12/81	0630	55
DOE	BD	B1	4.0	5.0	29.0825	91.90767	1/07/78	1030	4/03/78	0400	85
DOE	BD	B3a	5.0	10.0	29.05167	91.77	3/18/78	1730	4/27/78	1500	39
DOE	BD	B3a	5.0	10.0	29.05167	91.77	5/25/78	0800	7/08/78	2000	44
DOE	BD	B3b	7.0	10.0	29.05167	91.77	3/18/78	1730	7/10/78	1030	113
DOE	BD	B4	5.0	9.0	28.86667	91.04167	5/30/78	0700	7/26/78	1200	57
DOE	BD	B4	5.0	9.0	28.86667	91.04167	3/17/78	1300	5/25/78	1430	69
DOE	BD	B5a	7.0	9.0	29.69667	93.39833	11/04/77	1430	10/18/78	0830	347
DOE	BD	B5b	3.0	9.0	29.69667	93.39833	4/12/78	1500	10/18/78	0600	188
DOE	BD	B6	6.0	8.0	29.70333	93.49833	10/20/77	2000	5/12/78	1100	203
DOE	BD	B7	7.0	9.0	29.565	94.00000	12/01/77	2030	10/18/78	1300	320
DOE	BD	B8	7.0	9.0	29.64833	93.59167	10/20/77	1600	6/19/78	0730	241
DOE	BD	B8	7.0	9.0	29.64833	93.59167	7/18/78	2000	9/13/78	1000	56
DOE	WH	HD	3.7	9.1	29.66500	93.47883	1/21/81	1130	3/ 6/81	1030	43
DOE	WH	HD	3.7	9.1	29.66500	93.47883	4/ 4/81	1800	12/15/81	1500	254
DOE	WH	HD	3.7	9.1	29.66500	93.47883	1/24/82	1330	5/12/82	1730	108
DOE	WH	HD	3.7	9.1	29.66500	93.47883	9/18/82	1200	12/ 4/83	1000	441
DOE	WH	HS	3.7	12.5	29.45200	93.43333	4/ 4/81	1300	8/13/81	1530	131
DOE	WH	HS	3.7	12.5	29.45200	93.43333	9/ 3/81	1300	11/18/81	0800	75
DOE	WH	HS	3.7	12.5	29.45200	93.43333	12/15/81	1600	5/31/82	0600	166
DOE	WH	HN	4.9	6.7	29.71400	93.47333	4/28/81	1300	9/22/81	1430	154
DOE	WH	HN	4.9	6.7	29.71400	93.47333	10/22/81	1130	12/15/81	1530	53
DOE	WH	HN	4.9	6.7	29.71400	93.47333	3/14/82	1300	5/16/82	1200	62
DOE	WH	HW	3.7	9.4	29.64167	93.66667	6/ 2/81	1300	10/22/81	1100	141

Table 1. Current meter data sources. (continued)

SA	PGM	M	D _O	D _W	LAT	LON	START DATE	TIME	END DATE	TIME	T (d)
DOE	WH	HW	3.7	9.4	29.64167	93.66667	11/18/81	1500	1/24/82	0900	66
DOE	WH	HW	3.7	9.4	29.64167	93.66667	2/17/82	1100	5/16/82	0930	87
EPA	GS	G1	5.2	10.4	30.23000	87.68500	3/15/86	1600	3/02/87	1300	351
EPA	GS	G2	3.0	11.3	30.19667	87.68333	3/15/86	1400	1/02/87	1800	293
EPA	GS	G2	3.0	11.3	30.19667	87.68333	1/26/87	1000	3/02/87	1100	35
EPA	GS	G3	3.0	15.2	30.14000	87.67833	3/15/86	0930	11/18/86	1000	248
EPA	GS	G3	3.0	15.2	30.14000	87.67833	1/24/87	1030	3/02/87	0730	36
EPA	GS	G4	3.0	11.3	30.18833	87.74000	4/17/86	1500	11/18/86	1100	214
EPA	GS	G5	3.0	11.3	30.20500	87.62833	3/15/86	1130	5/14/86	1000	59
EPA	GS	G5	3.0	11.3	30.20500	87.62833	6/17/86	1030	12/17/86	0830	182
MMS	DELTA	MD	13.0	82.0	28.86050	89.27833	5/10/84	1630	7/27/84	1000	77
MMS	LTX	01a	11.0	23.0	27.256	97.246	4/09/92	1200	11/16/92	1730	221
MMS	LTX	01a	11.0	23.0	27.256	97.246	12/17/92	1200	9/29/93	0700	285
MMS	LTX	01b	14.0	23.0	27.323	97.307	9/29/93	0830	11/14/93	0530	45
MMS	LTX	01b	14.0	23.0	27.323	97.307	12/11/93	0800	1/11/94	0830	31
MMS	LTX	01b	14.0	23.0	27.323	97.307	3/28/94	0900	4/30/94	1700	33
MMS	LTX	01b	14.0	23.0	27.323	97.307	7/29/94	0630	9/24/94	1600	57
MMS	LTX	02	13.0	37.0	27.284	96.980	4/09/92	1200	7/26/93	1730	473
MMS	LTX	02	13.0	37.0	27.284	96.980	9/29/93	1300	12/06/94	1100	432
MMS	LTX	15	10.0	27.0	28.608	90.492	4/14/92	1200	8/25/92	1530	133
MMS	LTX	15	10.0	27.0	28.608	90.492	9/02/92	1200	10/06/92	1730	34
MMS	LTX	15	10.0	27.0	28.608	90.492	10/21/92	1800	12/03/94	1000	772
MMS	LTX	16a	10.0	20.0	28.867	90.490	4/14/92	1200	7/21/92	1430	98
MMS	LTX	16a	10.0	20.0	28.867	90.490	10/21/92	1200	5/29/93	0600	219
MMS	LTX	16a	10.0	20.0	28.867	90.490	6/23/93	1300	9/26/93	0530	94
MMS	LTX	16b	9.0	16.0	28.939	90.435	12/06/93	0800	9/29/94	1000	297
MMS	LTX	17	3.0	7.0	29.197	91.964	8/31/92	1830	10/20/92	0630	49
MMS	LTX	17	3.0	7.0	29.197	91.964	3/18/93	1430	5/19/93	1300	61
MMS	LTX	17	3.0	7.0	29.197	91.964	5/27/93	0640	7/16/93	1500	50
MMS	LTX	17	3.0	7.0	29.197	91.964	9/27/93	0800	2/13/94	0930	139
MMS	LTX	17	3.0	7.0	29.197	91.964	7/24/94	0700	9/28/94	0700	66
MMS	LTX	17	3.0	7.0	29.197	91.964	10/04/94	0400	11/11/94	1630	38
MMS	LTX	18a	10.0	22.0	28.963	91.984	4/13/92	1800	7/16/93	1200	458
MMS	LTX	18b	12.0	22.0	28.963	91.984	12/05/93	1230	2/18/94	1000	69
MMS	LTX	18b	12.0	22.0	28.963	91.984	3/23/94	1400	9/28/94	1430	188
MMS	LTX	20a	3.0	16.0	29.261	94.064	11/06/92	1730	5/17/93	1930	190
MMS	LTX	20a	3.0	16.0	29.261	94.064	5/27/93	2000	6/30/93	1530	33
MMS	LTX	20a	3.0	16.0	29.261	94.064	7/15/93	0730	9/22/93	0830	69
MMS	LTX	20b	2.0	12.0	29.500	94.022	9/22/93	1200	12/04/93	0800	72
MMS	LTX	20b	2.0	12.0	29.500	94.022	12/13/93	1030	2/12/94	0730	60
MMS	LTX	20b	2.0	12.0	29.500	94.022	3/31/94	1100	11/30/94	0730	181
MMS	LTX	23a	9.0	15.0	28.714	95.537	4/07/92	1800	5/27/92	0300	49
MMS	LTX	23a	9.0	15.0	28.714	95.537	6/04/92	0600	7/03/93	0500	393
MMS	LTX	23b	10.0	15.0	28.714	95.537	7/14/93	0830	9/30/93	1500	78
MMS	LTX	23b	10.0	15.0	28.714	95.537	12/10/93	1100	2/10/94	0300	61
MMS	LTX	23b	10.0	15.0	28.714	95.537	3/30/94	1400	7/31/94	0800	122
MMS	LTX	23b	10.0	15.0	28.714	95.537	10/02/94	0930	12/05/94	0930	64
MMS	LTX	24a	11.0	30.0	28.474	95.437	4/08/92	0000	9/05/92	1100	150
MMS	LTX	24b	11.0	28.0	28.537	95.393	1/18/93	1200	9/30/93	1300	255
MMS	LTX	24c	8.0	26.0	28.537	95.393	9/30/93	1900	11/31/93	0830	32
MMS	LTX	24c	8.0	26.0	28.537	95.393	7/31/94	1030	12/05/94	0700	126

Table 1. Current meter data sources. (continued)

SA	PGM	M	D _O	D _w	LAT	LON	START DATE	TIME	END DATE	TIME	T (d)
MMS	MAMES	Ma	10.0	31.0	29.900	87.67	12/21/87	1900	5/29/88	0200	159
MMS	MAMES	Mb	10.0	31.0	29.90333	87.61	7/05/88	1700	9/09/88	2000	35
MMS	MAMES	Mb	10.0	31.0	29.90333	87.61	2/18/89	0430	2/11/90	1730	358
MMS	YR5	AA	7.0	14.0	29.11718	92.14430	7/17/87	0100	8/17/87	2200	31
MMS	YR5	AA	7.0	14.0	29.11718	92.14430	11/13/87	1000	3/03/88	0500	110
MMS	YR5	AA	7.0	14.0	29.11718	92.14430	4/14/88	0800	7/18/88	0900	95
NOAA	WI	N1a	6.9	7.6	29.09500	91.79333	9/ 1/78	1530	11/26/78	2300	86
NOAA	WI	N1a	6.9	7.6	29.09500	91.79333	1/29/79	1530	3/12/79	1300	41
NOAA	WI	N1b	4.9	7.9	29.09500	91.79333	6/30/78	2050	7/28/78	0800	27
NOAA	WI	N1b	4.9	7.9	29.09500	91.79333	9/ 1/78	1550	11/13/78	1130	72
NOAA	WI	N1b	4.9	7.9	29.09500	91.79333	2/20/79	1500	3/26/79	1500	34
NOAA	WI	N1c	5.9	7.9	29.09500	91.79333	2/20/79	1500	3/26/79	1600	34
NOAA	WI	N2	4.8	5.8	29.12472	91.77583	6/30/78	1730	8/10/78	0100	41
NOAA	WI	N4	6.7	7.0	29.05722	91.70944	6/30/78	2000	8/ 8/78	0900	38
NOAA	WI	N5a	7.9	8.2	29.13250	91.87695	6/30/78	1230	7/28/78	0600	27
NOAA	WI	N5a	7.9	8.2	29.13250	91.87695	10/30/78	1730	12/10/78	1100	40
NOAA	WI	N5a	7.9	8.2	29.13250	91.87695	2/ 1/79	0830	5/ 7/79	0930	95
NOAA	WI	N5b	5.2	8.2	29.13250	91.79361	6/30/78	1300	7/28/78	0600	27
NOAA	WI	N5c	7.3	8.2	29.13250	91.87695	3/14/79	0830	4/17/79	1300	34
ONR	LS	S1	7.0	18.0	29.21750	92.82750	6/30 83	1300	9/02/83	1430	64
TLGO	TABS	TA	1.8	12.2	29.53202	93.81217	8/11/95	1800	10/08/95	1700	57
TLGO	TABS	TB	1.8	19.2	28.98163	94.89967	4/02/95	1800	5/31/95	2330	59
TLGO	TABS	TB	1.8	19.2	28.98163	94.89967	7/15/95	0000	8/23/95	0830	39
TLGO	TABS	TB	1.8	19.2	28.98163	94.89967	8/31/95	1230	4/24/96	1200	236
TLGO	TABS	TC	1.8	22.0	28.81095	94.75998	4/02/95	1200	4/25/96	1800	389
TLGO	TABS	TD	1.8	18.3	27.94917	96.84217	6/12/95	1230	4/25/96	1800	318
TLGO	TABS	TE	1.8	27.4	27.36050	96.92533	5/31/95	1800	7/20/95	1300	49
USGS		USa	5.0	30.0	29.96200	88.17400	7/28/90	1630	10/18/90	0630	81
USGS		USb	5.0	29.0	29.96283	88.17833	2/26/91	1430	11/19/91	1200	265
USGS		USc	5.0	30.0	29.96350	88.18083	12/07/91	1930	2/04/92	1030	58

*SA	<u>Sponsoring Agent</u>	+PGM	<u>Program Identification</u>
COE	Corps of Engineers	MS	Mississippi Shelf
DOE	Department of Energy	BD	Brine Disposal
DOE	Department of Energy	WH	West Hackberry, LA
NOAA	National Oceanic and Atmospheric Administration	WI	Weeks Island, LA
EPA	Environmental Protection Agency	GS	Gulf Shores, AL
MMS	Minerals Management Service	DELTA	Mississippi Delta
MMS	Minerals Management Service	YR5	Year 5, GOM
MMS	Minerals Management Service	MAMES	Marine Ecosystem Study
MMS	Minerals Management Service	LTX	Louisiana-Texas
ONR	Office of Naval Research	LS	Louisiana Study
TGLO	Texas General Land Office	TABS	Texas Automated Buoy System
USGS	US Geological Survey		

Only records from the same location were concatenated. Those records that changed geographic location, vertical position, or apparent water depth between deployments, but retained their program mooring identification, are identified by a lower case character appended to the mooring identification, e.g. DOE BD B5a and DOE BD B5b.

2.3.1.3 Data Rotation

While data were initially decomposed into east-west and north-south components, all data were subsequently rotated so that one velocity component would be alongshore. The orientation of the local coastline was determined as the angle from true east of the coastline at the point on the coastline closest to that individual mooring. In regions where the coastline was heavily convoluted or perforated an average orientation was used. After rotation each data record consisted of an alongshore velocity component, positive to the observers' right when facing the coast, and a cross-shore velocity component, always positive onshore. Positive alongshore velocity is in the general direction of east, except on the south Texas shelf where alongshore is positive towards the general direction of northeast.

It should be noted that in some cases this alignment of a velocity component with the alongshore direction may differ from the orientation of bathymetry on the inner shelf. This is especially true the more distance lies between the coast and the mooring.

2.3.1.4 Seasonal Segmentation

All rotated data records were partitioned into four seasonal segments. The seasons were Winter (December-February), Spring (March-May), Summer (June-August) and Fall (September-November). These are consistent with the seasons used by Gutierrez de Velasco and Winant (1996) in an analysis of Gulf of Mexico wind variance, but not with the Florida A&M University (1988) five month winter and summer seasons. The latter study had single month transitions between seasons, we prefer a longer, three month, transition to account for interannual variability in the meteorological forcing. Our seasonal designations are also based on consideration of the average monthly Mississippi River discharge (Dinnel and Bratkovich 1993) and average monthly regional river discharge (van der Leeden et al. 1990), the average monthly wind directions and magnitudes for the entire Gulf of Mexico (Rhodes et al. 1985; Gutierrez de Velasco and Winant 1996) and the northeastern Gulf of Mexico (Schroeder and Wiseman 1985), the average number of monthly frontal occurrences of the northern Gulf of Mexico (DiMego et al. 1976) and the average type and number of frontal occurrences in the Gulf of Mexico (Henry 1979). These latter parameters are considered very important in determining the level of wind variance around the Gulf of Mexico, an important parameter driving coastal current variation. Not all the evaluated parameters had similar values throughout the northern Gulf of Mexico, nor did they consistently covary in time, but there were great similarities in parameter values within the different regions and in the timing of parameter changes, i.e. our seasonal breaks, between the different regions. Meteorological and riverine characteristics from the south Texas shelf, the west Louisiana shelf, and those of the Mississippi-Alabama shelf consistently changed at our seasonal boundaries.

2.3.1.5 Low Pass Filtering

All velocity component records were low-pass filtered to create records that contained the information with greater periods (lower frequencies)

passed records, allowed the analysis of the subtidal variations (frequencies less than the tidal frequencies). It also allowed the determination of the percentage of low-frequency energy (variance) in the total records. The percentage of variation not contained in the low-passed records was primarily attributed to tidal and inertial motions.

All filtering was low-pass and performed with an FFT algorithm. Each velocity component was transformed to the frequency domain, the coefficients of unwanted frequencies set to zero, and then inverse transformed. Data records were trimmed at the beginning and end by lengths equal to one-half the filter width, as determined by the frequency cutoff. A 40-hour low-pass filter was used to remove variations with periods less than 40 hours from the velocity components. Twenty hours of data were lost at the beginning and end of each low-passed record.

2.3.2 Statistical Analyses

2.3.2.1 First Order Statistics

Along- and cross-shore velocity component means, standard errors, maxima, minima, variances, and variance principal axis orientation were determined for each current meter record (Table 2). Low-passed velocity component autocorrelation time scales, degrees of freedom, maxima, minima, variances, the percent of low-passed to total variance, and the variance principle axis orientation were determined for each current meter record (Table 3).

The record mean was computed using

$$\text{MEAN} = \frac{1}{n} \sum_{i=1}^n (V_i),$$

where n is the number of observations in the velocity component record, V . The biased sample variance was computed using

$$s^2 = \frac{1}{n} \sum_{i=1}^n (V_i - \text{MEAN})^2.$$

The standard error of the mean was computed using

$$\text{SE} = \left(\frac{s^2}{(T/t_0)} \right)^{1/2}$$

where T is the total record length and t_0 is the low-passed record autocorrelation time scale. The maximum and minimum velocity component were the greatest magnitudes in the positive direction and the greatest magnitude in the negative direction, respectively. The principal axis of variation orientation, α , was defined as the rotation angle relative to the coordinate axes, necessary to decorrelate the velocity components.

The autocorrelation time scale, t_0 , is defined as the time lag at which the velocity record's autocorrelation function is not statistically different from zero. This scale is determined as the time lag at which the autocorrelation function falls below the standard error of the autocorrelation as defined by Newton (1988). The standard error of the sampled autocorrelation function, $p(i)$, can be approximated by

Table 2.

Seasonal statistics. Stations are listed seasonally, counterclockwise around Gulf of Mexico, and from on- to off-shore. With sponsoring agent, SA, program identification, PGM, observational meter identification, M, and where lower case character denotes a meter depth and/or a mooring location change, observational record length (days), T, where + denotes a sample time interval of 1.0 hr, all others are 0.5 hr, along- and cross-shore velocity mean ($\text{cm}\cdot\text{s}^{-1}$), MEAN, where * indicates mean values that are statistically significant at the 95% level, i.e. greater than ± 2 SE, along- and cross-shore velocity standard error of the mean ($\text{cm}\cdot\text{s}^{-1}$), SE, along- and cross-shore maximum velocity ($\text{cm}\cdot\text{s}^{-1}$), MAX, along- and cross-shore minimum velocity ($\text{cm}\cdot\text{s}^{-1}$), MIN, along- and cross-shore velocity variance ($\text{cm}^2\cdot\text{s}^{-2}$), S^2 , and principal axis of variation, α , in an along- and cross-shore coordinate system (a positive value is a counterclockwise rotation relative to the axes).

Seasonal statistics, winter.										
SA	PGM	M	T		MEAN	SE	MAX	MIN	S^2	α
EPA	GS	G1	90.0000	ALS	-2.10	1.26	46.52	-43.26	108.74	-20.23
				CRS	2.82*	0.65	53.68	-15.02	33.44	
EPA	GS	G2	32.7500	ALS	-8.36*	1.79	38.15	-49.11	109.30	-30.62
				CRS	4.51*	1.17	61.98	-17.62	51.21	
EPA	GS	G2	35.0417	ALS	0.10	4.18	82.57	-64.06	319.26	-22.96
				CRS	1.29	1.61	57.98	-25.81	85.72	
EPA	GS	G3	36.8750	ALS	1.69	4.31	66.09	-68.23	301.84	-26.96
				CRS	-2.29	1.85	45.74	-53.20	134.86	
MMS	MAMES	Ma	70.2083	ALS	-0.90	1.32	27.30	-35.01	86.29	0.47
				CRS	0.45	0.74	17.41	-21.22	24.69	
COE	MS	C8	38.7083	ALS	-3.22	1.72	42.25	-35.81	124.30	-37.99
				CRS	-2.13	1.97	23.65	-37.06	93.30	
COE	MS	C7	37.8958	ALS	-4.34*	1.53	33.55	-42.05	114.51	-6.30
				CRS	-3.70*	1.24	30.30	-32.71	65.51	
USGS		USc	58.6250	ALS	-6.20*	2.87	34.56	-57.01	238.48	-0.97
				CRS	1.11	1.16	33.14	-37.54	93.09	
COE	MS	C5	39.5833	ALS	-5.29	2.46	32.76	-52.27	169.06	-29.25
				CRS	3.40*	1.52	34.54	-26.44	88.37	
COE	MS	C3	36.5833	ALS	-6.22	3.16	30.86	-45.88	145.88	-19.03
				CRS	0.01	1.20	28.70	-28.47	52.57	
COE	MS	C2	36.5625	ALS	-2.44	1.72	39.51	-43.03	136.36	-44.33
				CRS	-2.04	3.30	22.34	-47.46	132.10	
COE	MS	C1	36.5000	ALS	2.63	1.62	54.92	-49.57	135.39	2.91
				CRS	-5.59*	1.42	31.84	-33.91	75.33	
MMS	LTX	16a	90.0000	ALS	-2.91	1.46	48.30	-55.12	183.66	0.75
				CRS	-1.14	1.01	30.39	-35.15	94.49	
MMS	LTX	16b	84.6667	ALS	-5.59*	1.55	32.84	-51.71	187.97	10.84
				CRS	-0.35	0.88	44.24	-39.15	70.64	
MMS	LTX	15	90.0000	ALS	-7.51*	1.74	33.51	-64.91	200.52	-12.07
				CRS	1.99	1.59	35.30	-33.88	83.00	

Table 2. Seasonal statistics, winter. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
MMS	LTX	15	90.0000	ALS	-11.27*	2.56	46.38	-68.62	284.08	-4.57
				CRS	-0.21	0.99	35.66	-38.97	83.34	
NOAA	WI	N1a	41.8958	ALS	-0.62	1.42	52.43	-34.12	97.09	8.61
				CRS	1.31	1.06	29.12	-37.13	72.77	
NOAA	WI	N5a	27.6458	ALS	-0.39	1.64	51.83	-30.37	87.22	16.90
				CRS	0.70	1.16	25.37	-21.20	57.89	
DOE	BD	B1	52.5625	ALS	-3.83	3.11	125.07	-57.32	508.56	-28.63
				CRS	-1.42	2.14	40.62	-85.58	263.25	
MMS	LTX	17	74.4167	ALS	-7.33*	2.82	83.79	-114.46	526.45	13.15
				CRS	-2.44	2.70	88.55	-106.05	413.09	
MMS	LTX	18a	90.0000	ALS	-8.91*	2.11	41.50	-72.97	279.40	5.40
				CRS	-1.51	1.01	45.69	-41.25	106.85	
MMS	LTX	18b	69.9167	ALS	-5.80*	2.70	62.08	-61.21	236.68	5.82
				CRS	-1.80	0.96	27.57	-31.00	74.32	
MMS	YR5	AA	110.7917+	ALS	-4.53*	1.82	78.21	-54.25	237.88	40.80
				CRS	-0.99	1.59	55.84	-66.28	204.86	
DOE	BD	B5a	90.0000	ALS	-4.55*	1.49	52.19	-48.49	165.75	26.00
				CRS	-2.39	0.91	28.46	-32.80	66.51	
DOE	WH	HS	74.3333	ALS	-9.35*	1.32	54.71	-70.33	141.51	-4.66
				CRS	-0.00	0.90	36.13	-25.82	59.56	
DOE	WH	HD	43.9792	ALS	-3.21	1.85	37.92	-33.94	115.25	-13.07
				CRS	1.50*	0.71	18.46	-12.42	22.42	
DOE	WH	HD	35.4375	ALS	-7.95*	2.51	39.16	-83.57	289.41	-7.63
				CRS	1.53	1.09	24.92	-28.34	51.58	
DOE	WH	HD	90.0000	ALS	-6.58*	2.36	45.70	-65.05	359.27	-12.77
				CRS	3.05*	0.94	31.86	-24.98	78.18	
DOE	BD	B6	90.0000	ALS	-3.28*	1.57	40.19	-51.61	148.15	41.01
				CRS	-3.35*	1.32	41.98	-40.61	125.03	
DOE	BD	B8	90.0000	ALS	-6.70*	1.35	35.94	-47.54	122.78	39.10
				CRS	-2.98*	1.15	36.92	-27.37	96.78	
DOE	WH	HW	66.7708	ALS	-7.79*	1.50	30.30	-47.63	122.95	8.42
				CRS	0.69	0.55	28.57	-17.82	22.27	
DOE	BD	B7	89.1458	ALS	-4.45*	1.45	44.44	-50.22	155.25	25.79
				CRS	-1.47	0.93	27.78	-29.64	70.05	
MMS	LTX	20a	90.0000	ALS	-19.34*	1.77	17.96	-83.16	158.55	17.30
				CRS	8.62*	1.32	45.63	-47.32	137.06	
MMS	LTX	20b	60.8958	ALS	-33.10*	4.46	79.51	-93.48	829.59	-17.56
				CRS	3.72	2.50	63.21	-59.42	331.56	
TLGO	TABS	TB	91.0000	ALS	-13.18*	3.87	59.31	-88.41	536.21	0.63
				CRS	-3.12*	1.49	50.05	-57.40	95.68	
TLGO	TABS	TC	91.0000	ALS	-3.25*	1.21	39.83	-63.06	111.04	-6.73
				CRS	-2.64*	0.88	20.66	-41.30	55.77	
MMS	LTX	23b	90.0000	ALS	-23.53*	2.41	36.14	-75.57	387.08	-11.25
				CRS	2.99*	0.79	35.46	-27.26	57.54	
MMS	LTX	23b	61.6875	ALS	-18.98*	4.26	65.72	-72.82	511.64	-3.23
				CRS	1.97*	0.59	23.24	-15.75	24.73	
MMS	LTX	24b	41.5000	ALS	-20.62*	3.83	17.82	-96.76	365.56	-4.53
				CRS	0.29	1.06	23.91	-26.06	62.29	

Table 2. Seasonal statistics, winter. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
TLGO	TABS	TD	91.0000	ALS	-8.32	5.05	77.72	-85.26	845.00	2.13
				CRS	-2.14*	0.54	28.98	-23.79	32.21	
MMS	LTX	01a	73.5000	ALS	-23.27*	3.19	33.94	-82.98	381.24	-4.23
				CRS	0.43	0.74	25.33	-23.59	48.48	
MMS	LTX	01b	31.0417	ALS	-5.85*	2.32	21.50	-37.65	129.52	2.02
				CRS	1.07*	0.42	14.12	-13.56	8.66	
MMS	LTX	02	90.0000	ALS	-14.39*	2.22	23.92	-71.57	249.42	-3.53
				CRS	-0.45	0.64	22.34	-29.30	39.91	
MMS	LTX	02	90.0000	ALS	-14.14*	3.03	44.26	-76.48	318.86	2.71
				CRS	-1.32*	0.58	16.04	-27.38	31.78	

Seasonal statistics, spring.

EPA	GS	G5	59.9375	ALS	7.52*	2.22	64.04	-38.43	225.15	-35.43
				CRS	-0.17	2.03	48.16	-35.63	169.10	
EPA	GS	G1	77.3333	ALS	1.63	1.79	46.31	-50.48	174.72	-19.69
				CRS	1.36	0.94	39.81	-21.78	49.29	
EPA	GS	G2	77.4167	ALS	4.92*	2.10	62.39	-38.13	208.17	-23.04
				CRS	1.67	1.35	47.93	-23.38	74.62	
EPA	GS	G3	77.6042	ALS	4.20	3.82	87.47	-48.93	279.48	-18.21
				CRS	2.24	1.31	37.91	-49.42	119.88	
EPA	GS	G4	44.3750	ALS	3.23	3.30	52.59	-36.54	158.51	-20.62
				CRS	0.47	1.35	23.26	-24.48	46.69	
MMS	MAMES	Ma	92.0000	ALS	5.09*	2.10	58.68	-39.75	133.09	4.41
				CRS	1.21	1.01	29.78	-39.90	85.24	
MMS	MAMES	Mb	92.0000	ALS	1.24	1.65	36.81	-35.64	116.38	-0.46
				CRS	0.40	1.34	32.41	-26.98	68.08	
COE	MS	C8	60.0208	ALS	2.41	3.11	58.04	-45.38	203.22	-13.83
				CRS	2.05	1.72	40.56	-48.08	95.86	
COE	MS	C7	60.1250	ALS	2.71	2.59	38.56	-45.55	148.10	-17.01
				CRS	1.55	1.65	29.79	-43.20	71.85	
USGS		Usb	94.3958	ALS	-6.22	3.12	60.38	-67.11	405.93	-4.15
				CRS	-0.69	1.73	51.17	-73.86	251.98	
COE	MS	C6	58.1250	ALS	5.11*	1.43	43.07	-24.69	84.99	-35.95
				CRS	-0.37	1.27	37.84	-38.61	63.54	
COE	MS	C5	46.8542	ALS	-0.82	2.44	66.20	-38.72	178.29	26.78
				CRS	2.14	3.22	56.27	-50.54	259.42	
COE	MS	C4	47.0208	ALS	-0.45	2.54	52.61	-46.70	224.07	-39.24
				CRS	3.81	2.16	64.06	-30.35	188.07	
COE	MS	C3	53.0208	ALS	4.56	3.03	54.86	-51.88	236.42	-14.87
				CRS	2.31	1.44	40.30	-32.64	110.07	
COE	MS	C2	52.8958	ALS	2.39	2.74	43.25	-34.01	181.51	30.01
				CRS	-0.86	3.49	43.47	-73.65	306.53	
COE	MS	C1	52.7500	ALS	7.00	4.08	77.30	-34.49	366.44	-19.29
				CRS	-0.28	1.64	39.36	-36.59	115.30	
MMS	LTX	16a	47.5000	ALS	-4.46*	1.51	31.58	-39.96	111.02	37.13
				CRS	-0.92	1.40	24.16	-36.27	104.04	

Table 2. Seasonal statistics, spring. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
MMS	LTX	16a	92.0000	ALS	-5.20*	1.45	35.38	-66.37	168.88	23.38
				CRS	-0.90	1.09	29.96	-45.25	107.38	
MMS	LTX	16b	92.0000	ALS	-1.49	1.09	42.06	-69.67	109.24	38.94
				CRS	-0.38	1.06	38.38	-56.05	101.22	
MMS	LTX	15	47.5000	ALS	-1.45	1.57	29.31	-36.17	108.27	-0.66
				CRS	-0.70	1.52	26.12	-44.95	81.15	
MMS	LTX	15	92.0000	ALS	-2.34	1.67	49.44	-94.63	208.02	9.93
				CRS	0.70	0.85	29.71	-37.95	77.44	
MMS	LTX	15	92.0000	ALS	-1.15	2.92	31.10	-48.39	155.16	-2.56
				CRS	1.24	0.86	38.40	-27.47	68.77	
DOE	BD	B4	69.0417	ALS	-4.17*	1.10	22.29	-37.30	74.19	29.33
				CRS	-2.96	0.82	22.87	-27.25	48.82	
DOE	BD	B3a	39.9167	ALS	-6.36	3.35	43.94	-60.00	321.67	-13.68
				CRS	0.34	1.65	42.29	-39.21	149.53	
DOE	BD	B3b	74.2708	ALS	-7.68*	2.14	44.45	-56.28	242.55	-15.72
				CRS	-0.36	1.92	36.86	-47.97	124.46	
NOAA	WI	N1b	34.0000	ALS	-1.81	3.29	69.13	-40.47	321.07	-3.75
				CRS	-0.19	1.74	34.99	-49.44	144.78	
NOAA	WI	N1c	34.0417	ALS	-1.63	2.67	63.26	-33.36	215.07	0.40
				CRS	-0.12	1.44	30.26	-30.97	99.50	
NOAA	WI	N5a	67.3958	ALS	-5.65*	1.47	41.50	-37.07	89.79	24.60
				CRS	-0.86	0.95	22.73	-30.68	61.87	
NOAA	WI	N5c	34.1875	ALS	-9.01*	3.43	52.44	-44.98	219.18	23.40
				CRS	-0.48	2.13	46.86	-34.89	132.69	
DOE	BD	B1	33.1875	ALS	-3.83	2.67	73.79	-53.60	236.37	-33.48
				CRS	0.48	2.11	46.95	-60.41	197.33	
MMS	LTX	17	61.9583	ALS	-5.30	2.70	76.83	-68.88	416.88	-4.22
				CRS	-1.50	1.78	44.10	-102.01	241.27	
MMS	LTX	18a	48.2500	ALS	-2.87	3.75	34.90	-59.74	264.82	3.25
				CRS	-1.51	1.50	36.10	-53.39	137.56	
MMS	LTX	18a	92.0000	ALS	0.02	3.05	65.20	-77.66	347.48	15.19
				CRS	0.09	1.34	46.77	-56.78	155.83	
MMS	LTX	18b	69.4167	ALS	-5.36	2.81	48.77	-61.32	178.06	0.48
				CRS	-0.95	1.16	44.08	-51.43	109.31	
MMS	YR5	AA	46.6667+	ALS	-4.45	4.25	49.64	-65.64	361.61	33.31
				CRS	-2.50	3.14	39.01	-42.84	225.42	
DOE	BD	B5a	92.0000	ALS	-2.32*	1.10	34.42	-40.90	81.26	31.88
				CRS	-1.66	1.04	17.36	-29.00	52.13	
DOE	BD	B5b	49.3750	ALS	-3.53	3.18	63.91	-53.39	314.72	21.03
				CRS	-2.98*	1.41	26.29	-31.94	74.91	
DOE	WH	HS	57.4583	ALS	-10.01*	1.95	22.27	-40.63	116.41	-6.51
				CRS	0.92	1.16	26.37	-29.58	63.94	
DOE	WH	HS	92.2708	ALS	-12.95*	1.63	31.05	-70.38	167.41	8.63
				CRS	-1.52	1.19	51.70	-43.67	104.72	
DOE	WH	HN	33.4583	ALS	-5.44	3.02	20.04	-44.12	197.63	-5.31
				CRS	0.74	1.00	17.90	-19.20	39.13	
DOE	WH	HN	62.9792	ALS	-10.69*	1.82	26.18	-46.74	164.15	-23.96
				CRS	2.63*	1.23	32.10	-29.86	85.05	

Table 2. Seasonal statistics, spring. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
DOE	WH	HD	57.2500	ALS	-13.32*	3.21	22.74	-52.77	254.44	-12.94
				CRS	2.42*	0.92	22.43	-28.14	41.97	
DOE	WH	HD	72.7500	ALS	-17.40*	3.36	31.47	-61.51	261.53	-15.92
				CRS	2.21	1.48	27.41	-29.90	73.81	
DOE	WH	HD	92.0000	ALS	-10.75*	3.29	73.15	-84.71	482.39	-10.23
				CRS	3.03*	1.02	46.29	-35.61	91.32	
DOE	BD	B6	92.0000	ALS	-2.43	1.26	30.07	-36.44	90.56	34.16
				CRS	-1.81	1.01	20.13	-25.60	54.66	
DOE	BD	B8	92.0000	ALS	-2.71	1.38	27.87	-39.61	86.38	-42.58
				CRS	-2.66	1.40	32.45	-33.81	93.30	
DOE	WH	HW	87.9583	ALS	-14.67*	3.15	34.47	-75.59	310.71	-3.14
				CRS	0.97	0.87	28.14	-36.18	68.29	
DOE	BD	B7	92.0000	ALS	-4.71*	1.88	44.41	-58.86	160.93	27.86
				CRS	-2.70*	1.28	35.90	-34.77	75.75	
MMS	LTX	20a	75.8333	ALS	-15.52*	3.00	25.28	-82.98	318.60	-19.43
				CRS	2.35	1.93	48.22	-62.49	193.25	
MMS	LTX	20b	28.5208	ALS	12.47	6.25	76.10	-74.22	629.58	-26.36
				CRS	4.47	4.66	55.33	-55.43	316.89	
TLGO	TABS	TB	59.2500	ALS	-15.50*	3.64	21.79	-132.85	396.03	5.16
				CRS	0.14	1.41	58.84	-63.62	113.75	
TLGO	TABS	TB	54.4375	ALS	-22.76*	6.05	65.01	-117.13	683.35	-1.74
				CRS	-1.17	1.63	34.00	-50.61	141.60	
TLGO	TABS	TC	53.5000	ALS	-20.96*	2.66	34.46	-92.96	331.22	-1.63
				CRS	5.22*	1.99	53.25	-47.66	215.58	
TLGO	TABS	TC	55.7708	ALS	-12.01*	2.68	36.41	-75.38	247.23	-1.96
				CRS	2.86*	1.35	31.36	-41.97	83.25	
MMS	LTX	23a	49.3958	ALS	-2.30	3.79	45.23	-66.08	355.32	-15.21
				CRS	-0.18	1.35	35.91	-24.11	75.92	
MMS	LTX	23b	92.0000	ALS	-8.84*	2.82	57.76	-84.97	443.56	-6.96
				CRS	1.18	0.74	29.86	-32.76	59.12	
MMS	LTX	23b	62.4167	ALS	-14.41*	5.60	38.40	-77.19	407.87	-4.33
				CRS	0.96	0.72	19.44	-20.84	37.99	
MMS	LTX	24a	52.6875	ALS	-3.82	3.05	41.99	-45.40	197.54	-11.51
				CRS	-3.70	1.44	33.32	-36.80	100.56	
MMS	LTX	24b	92.0000	ALS	-8.27*	3.04	50.73	-119.74	424.47	3.61
				CRS	-1.48	0.93	30.89	-29.88	68.92	
TLGO	TABS	TD	55.7708	ALS	-12.26*	5.37	62.71	-85.63	757.59	3.36
				CRS	-1.46	0.88	22.19	-24.42	43.61	
MMS	LTX	01a	52.5000	ALS	-1.43	4.76	86.00	-66.90	570.22	-7.22
				CRS	0.15	1.14	25.55	-26.97	64.11	
MMS	LTX	01a	92.0000	ALS	-5.97	3.19	55.54	-80.99	477.12	-1.22
				CRS	-0.47	1.05	26.30	-23.26	40.20	
MMS	LTX	01b	33.3542	ALS	-5.99*	1.83	19.31	-44.42	111.72	2.63
				CRS	-0.72	0.67	13.41	-19.93	17.34	
MMS	LTX	02	52.5000	ALS	-1.81	4.66	55.07	-64.27	382.54	4.29
				CRS	-1.57	1.70	33.60	-40.85	132.06	
MMS	LTX	02	92.0000	ALS	-5.77	4.41	44.94	-92.80	446.89	4.90
				CRS	-0.03	1.12	36.05	-39.30	96.75	

Table 2. Seasonal statistics, spring. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
MMS	LTX	02	92.0000	ALS	-12.65*	2.77	24.49	-69.03	205.54	4.62
				CRS	-1.35	0.95	21.82	-28.09	62.01	

Seasonal statistics, summer.

EPA	GS	G5	75.5625	ALS	4.28	2.63	67.81	-30.34	211.99	-21.17
				CRS	0.24	1.32	32.84	-58.01	71.29	
EPA	GS	G1	92.0000	ALS	0.09	1.02	31.81	-32.74	58.68	-11.27
				CRS	1.56*	0.49	19.02	-14.77	16.29	
EPA	GS	G2	92.0000	ALS	4.10*	2.05	59.34	-37.50	164.77	-19.33
				CRS	0.26	0.94	28.97	-25.19	43.45	
EPA	GS	G3	92.0000	ALS	8.10*	3.97	82.22	-32.72	335.56	-13.23
				CRS	-0.27	1.46	37.81	-36.81	92.05	
EPA	GS	G4	92.0000	ALS	3.97	2.05	59.55	-39.26	167.38	-18.50
				CRS	0.69	0.97	28.17	-29.64	43.13	
MMS	MAMES	Mb	35.1042	ALS	-0.75	1.92	29.62	-42.93	96.82	-16.41
				CRS	0.10	1.91	19.11	-31.91	53.48	
MMS	MAMES	Mb	92.0000	ALS	0.15	1.47	33.84	-28.90	59.34	18.63
				CRS	1.37	1.40	26.83	-30.18	41.34	
COE	MS	C8	55.7708	ALS	-4.81	4.28	66.78	-55.49	294.04	-20.69
				CRS	1.86	2.42	50.38	-46.33	137.67	
COE	MS	C7	55.7708	ALS	-5.87*	2.74	46.27	-42.62	132.25	-4.56
				CRS	0.55	1.00	30.62	-38.12	54.52	
USGS		USa	34.3125	ALS	9.25	5.51	76.12	-47.06	480.93	15.77
				CRS	2.77	3.39	47.59	-43.30	402.97	
USGS		USb	92.0000	ALS	3.21	3.83	79.90	-57.82	405.05	-16.79
				CRS	0.24	2.92	59.39	-56.84	341.18	
COE	MS	C5	57.0625	ALS	-3.72	2.96	46.18	-41.11	143.29	-19.82
				CRS	0.85	1.77	35.71	-38.07	82.80	
COE	MS	C4	53.7292	ALS	2.57	3.30	67.94	-34.10	205.46	-22.22
				CRS	-0.44	2.21	32.02	-52.62	79.03	
COE	MS	C2	40.2083	ALS	-1.46	2.25	32.81	-34.39	86.49	41.64
				CRS	1.44	2.12	34.78	-27.74	93.46	
MMS	DELTA	MD	78.5625	ALS	-5.68	3.68	44.98	-79.75	429.13	10.76
				CRS	-0.11	1.63	38.70	-38.69	77.23	
MMS	LTX	16a	50.6250	ALS	2.70	1.53	36.88	-28.92	98.11	12.23
				CRS	1.97	1.38	29.72	-22.17	68.29	
MMS	LTX	16a	69.4583	ALS	1.71	1.90	29.77	-21.07	68.55	18.45
				CRS	1.34	1.22	33.57	-23.08	46.96	
MMS	LTX	16b	92.0000	ALS	-3.21*	1.50	26.05	-46.60	77.43	17.23
				CRS	-0.91	1.04	34.22	-26.38	37.87	
MMS	LTX	15	85.6667	ALS	11.11*	2.46	72.57	-107.98	188.28	0.27
				CRS	3.72*	1.14	48.03	-42.55	97.13	
MMS	LTX	15	92.0000	ALS	9.65	5.97	76.59	-48.31	357.02	7.63
				CRS	1.38	1.81	56.04	-44.04	122.51	
MMS	LTX	15	92.0000	ALS	9.28*	2.95	64.19	-46.32	230.78	6.26
				CRS	1.29	1.72	41.73	-31.57	119.91	

Table 2. Seasonal statistics, summer. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
DOE	BD	B4	57.2292	ALS	-1.95	3.04	28.56	-45.48	138.03	21.13
				CRS	-1.18	1.87	21.00	-33.17	66.36	
DOE	BD	B4	63.1458	ALS	-2.44	1.70	23.47	-38.01	87.16	13.82
				CRS	-1.15	1.26	24.82	-24.57	41.68	
NOAA	WI	N4	38.5417	ALS	1.40	1.85	27.70	-40.65	71.85	19.29
				CRS	-0.90	1.10	26.78	-26.21	52.13	
DOE	BD	B3a	44.5208	ALS	-2.95	2.35	25.82	-37.61	120.06	-33.01
				CRS	1.54	1.80	37.31	-27.00	82.64	
DOE	BD	B3b	39.4583	ALS	-4.76	3.27	29.34	-49.43	182.50	-19.88
				CRS	2.50	1.43	33.70	-22.57	74.59	
NOAA	WI	N2	41.3125	ALS	0.35	1.30	28.56	-29.15	81.14	-43.45
				CRS	0.25	1.34	28.56	-29.15	88.79	
NOAA	WI	N1b	27.4792	ALS	0.60	2.81	32.58	-46.14	157.71	-41.49
				CRS	0.77	1.93	40.80	-38.08	148.86	
NOAA	WI	N5a	27.7292	ALS	-1.14	1.43	13.51	-26.47	38.91	-13.98
				CRS	-0.25	1.51	20.82	-25.37	57.59	
NOAA	WI	N5b	27.7083	ALS	-0.75	2.95	34.98	-56.35	186.54	0.66
				CRS	0.63	2.30	39.25	-52.58	135.79	
MMS	LTX	17	50.3542	ALS	-9.88	7.68	101.24	-87.21	769.77	-11.03
				CRS	-3.65	3.66	73.72	-128.28	659.58	
MMS	LTX	17	38.7083	ALS	-2.27	4.30	69.29	-60.61	408.79	9.77
				CRS	-0.72	2.69	54.87	-44.78	236.60	
MMS	LTX	18a	92.0000	ALS	10.41*	2.62	87.14	-27.97	169.01	9.12
				CRS	2.54	1.61	47.05	-28.41	92.07	
MMS	LTX	18a	45.5208	ALS	12.22*	4.81	57.99	-88.51	388.15	17.17
				CRS	-0.42	2.09	32.52	-45.92	169.87	
MMS	LTX	18b	92.0000	ALS	7.21*	3.15	69.30	-29.03	166.31	12.87
				CRS	3.11*	1.25	31.59	-22.87	83.89	
MMS	YR5	AA	31.8750+	ALS	2.73	3.80	54.93	-46.71	269.08	22.29
				CRS	-0.84	2.29	23.84	-40.04	83.88	
MMS	YR5	AA	49.3750+	ALS	-4.39	3.21	30.49	-61.86	244.36	29.76
				CRS	-2.02	2.32	29.94	-42.84	127.64	
ONR	LS	S1	64.0625	ALS	-1.30	1.71	35.63	-50.29	166.07	25.60
				CRS	-2.90	2.72	33.37	-43.57	177.00	
DOE	BD	B5a	92.0000	ALS	2.01	1.29	24.62	-65.98	62.64	7.61
				CRS	1.22*	0.54	33.45	-25.96	26.82	
DOE	BD	B5b	92.0000	ALS	1.61	3.41	52.93	-107.59	311.71	10.10
				CRS	0.35	1.23	46.49	-26.80	48.91	
DOE	WH	HS	73.6667	ALS	-0.42	2.90	46.66	-63.27	232.18	8.28
				CRS	-1.97	2.14	33.81	-57.46	126.94	
DOE	WH	HN	92.0000	ALS	-3.27*	1.89	29.77	-49.87	135.96	-7.74
				CRS	0.54	0.72	25.77	-36.65	51.00	
DOE	WH	HD	92.0000	ALS	-2.80	3.13	46.25	-64.73	291.48	-11.09
				CRS	-0.03	0.88	27.96	-31.54	61.28	
DOE	WH	HD	92.0000	ALS	-2.42	2.34	43.27	-59.03	230.55	-13.43
				CRS	0.62	0.98	29.71	-33.02	100.19	
DOE	BD	B8	56.6042	ALS	-1.78	2.61	26.92	-82.38	158.49	16.35
				CRS	-0.64	1.19	22.57	-35.34	67.24	

Table 2. Seasonal statistics, summer. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
DOE	WH	HW	90.4583	ALS	-2.49	2.15	35.06	-55.15	166.56	14.19
				CRS	1.21	1.35	38.93	-31.39	60.85	
DOE	BD	B7	92.0000	ALS	-0.95	1.88	32.89	-85.68	134.25	-0.22
				CRS	-0.11	1.23	60.81	-30.93	63.91	
MMS	LTX	20a	33.8333	ALS	-7.27	5.51	55.36	-79.69	608.61	-24.10
				CRS	4.42	4.22	58.10	-64.55	459.85	
MMS	LTX	20a	69.0625	ALS	5.37	4.97	72.54	-82.42	778.43	-10.37
				CRS	7.96*	3.73	72.53	-52.13	507.41	
TLGO	TABS	TB	39.3750	ALS	5.35*	2.63	79.68	-119.75	1112.54	0.18
				CRS	0.84	1.40	39.53	-48.76	86.08	
TLGO	TABS	TC	92.0000	ALS	3.50	5.00	75.73	-119.64	649.56	-15.45
				CRS	-3.53	2.94	88.51	-65.79	324.36	
MMS	LTX	23a	88.7500	ALS	6.75	4.66	53.38	-52.39	340.58	-11.32
				CRS	-2.05	1.32	28.45	-28.14	53.11	
MMS	LTX	23b	32.2292	ALS	0.15	6.42	60.02	-87.99	613.05	-8.66
				CRS	-2.03	1.15	14.64	-19.45	37.15	
MMS	LTX	23b	48.6458	ALS	8.45*	2.74	49.13	-42.54	170.41	-1.05
				CRS	0.25	0.83	18.06	-14.56	14.12	
MMS	LTX	23b	60.3542	ALS	6.93	3.48	61.41	-56.73	251.82	-1.21
				CRS	-1.35	0.63	19.06	-21.48	24.72	
MMS	LTX	24a	92.0000	ALS	2.62	3.00	48.06	-33.63	224.23	-9.64
				CRS	1.11	1.45	36.43	-35.16	81.29	
MMS	LTX	24b	92.0000	ALS	5.52	3.60	63.81	-88.63	367.18	-9.89
				CRS	-2.41	1.62	39.15	-43.70	122.62	
MMS	LTX	24c	31.5625	ALS	-7.35	3.97	36.82	-45.26	186.19	-4.39
				CRS	0.05	1.22	17.43	-20.99	37.33	
TLGO	TABS	TD	81.4792	ALS	2.89	5.57	112.33	-75.59	859.60	4.12
				CRS	0.14	1.38	32.33	-34.52	61.30	
TLGO	TABS	TE	49.8125	ALS	15.19	9.37	114.61	-66.36	981.81	10.24
				CRS	8.15*	3.94	73.33	-39.56	374.90	
MMS	LTX	01a	92.0000	ALS	3.24	2.59	54.48	-32.88	205.66	-0.95
				CRS	-0.40	0.51	19.06	-21.34	25.19	
MMS	LTX	01a	92.0000	ALS	-0.45	3.19	67.90	-95.35	292.28	2.49
				CRS	1.31	0.90	26.54	-33.56	39.48	
MMS	LTX	01b	57.5000	ALS	-2.46	2.35	21.34	-23.72	80.83	5.14
				CRS	-1.09*	0.51	12.30	-13.63	6.32	
MMS	LTX	02	52.5000	ALS	14.81*	4.80	65.69	-33.78	354.28	-3.10
				CRS	1.72	1.12	29.05	-32.75	67.13	
MMS	LTX	02	55.5625	ALS	7.80	7.57	68.72	-95.21	649.13	-5.33
				CRS	2.84	2.84	35.63	-38.69	155.57	
MMS	LTX	02	92.0000	ALS	2.74	4.01	60.00	-56.40	287.53	3.60
				CRS	0.27	1.18	33.03	-36.71	60.09	
Seasonal statistics, fall.										
EPA	GS	G5	107.3542	ALS	-5.16*	1.34	33.98	-49.90	77.99	25.83
				CRS	3.32*	1.55	60.97	-53.94	104.84	

Table 2. Seasonal statistics, fall. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
EPA	GS	G1	91.0000	ALS	-2.01*	0.84	30.97	-31.04	48.22	-23.64
				CRS	2.00*	0.49	20.16	-12.17	15.60	
EPA	GS	G2	91.0000	ALS	-4.17*	1.17	35.06	-36.78	70.03	-24.79
				CRS	1.71*	0.62	33.69	-21.29	23.15	
EPA	GS	G3	78.4167	ALS	-3.36*	1.05	28.93	-29.76	57.97	-30.10
				CRS	0.86	0.76	30.19	-19.45	32.43	
EPA	GS	G4	78.4583	ALS	-3.19*	1.50	30.76	-31.70	64.37	-23.23
				CRS	1.74*	0.75	25.73	-18.19	21.66	
MMS	MAMES	Mb	91.0000	ALS	-3.03*	1.36	29.65	-33.88	67.04	10.87
				CRS	-1.13	0.77	26.75	-26.78	30.76	
COE	MS	C8	26.2917	ALS	-6.35*	3.01	27.08	-47.19	134.46	41.21
				CRS	2.46	3.32	41.34	-34.04	165.69	
COE	MS	C7	26.1875	ALS	-6.48*	3.18	29.17	-52.70	158.83	-25.20
				CRS	1.09	2.02	34.16	-21.86	87.07	
USGS		USa	47.0000	ALS	-1.04	4.48	69.58	-42.71	335.07	24.23
				CRS	2.26	2.69	59.16	-40.12	251.18	
USGS		USb	79.5000	ALS	-9.66*	2.69	19.59	-45.11	138.64	-22.48
				CRS	2.63	1.34	31.34	-27.35	74.66	
COE	MS	C6	29.6667	ALS	5.25*	1.51	26.27	-22.35	73.38	-23.23
				CRS	1.62	1.02	32.05	-12.05	36.74	
COE	MS	C5	27.4167	ALS	-6.73	3.38	33.25	-43.96	208.72	-33.50
				CRS	4.98	2.36	35.09	-33.09	124.20	
COE	MS	C3	29.3750	ALS	-6.13	3.21	27.16	-39.14	156.17	-24.20
				CRS	1.95	1.25	39.19	-17.92	61.42	
COE	MS	C2	29.4167	ALS	-2.92	1.71	31.31	-33.57	103.38	40.19
				CRS	-2.30	2.03	22.97	-41.46	128.89	
COE	MS	C1	29.5417	ALS	-1.44	2.31	60.57	-44.75	210.29	-18.12
				CRS	-0.10	1.14	58.42	-26.31	58.95	
MMS	LTX	16a	40.5000	ALS	-4.99*	1.83	27.36	-40.51	114.47	5.78
				CRS	0.83	0.95	31.69	-22.88	39.49	
MMS	LTX	16a	25.2500	ALS	-0.42	3.79	48.04	-31.49	205.26	-3.18
				CRS	0.53	2.50	40.58	-29.15	137.26	
MMS	LTX	16b	28.4375	ALS	-5.03	3.06	20.72	-58.82	177.74	8.61
				CRS	-0.74	1.26	16.42	-26.99	47.92	
MMS	LTX	15	34.2500	ALS	-13.91*	4.09	36.22	-64.51	312.89	2.78
				CRS	-2.69	2.37	30.54	-35.98	90.60	
MMS	LTX	15	40.2500	ALS	-1.88	3.17	42.21	-55.58	192.53	3.38
				CRS	0.44	1.43	29.11	-26.86	68.23	
MMS	LTX	15	91.0000	ALS	-7.36*	2.64	28.32	-54.07	158.20	1.83
				CRS	-0.19	1.20	36.25	-32.32	50.90	
MMS	LTX	15	93.4375	ALS	-15.07*	2.44	19.38	-61.16	197.26	-10.37
				CRS	0.54	1.45	43.18	-28.25	75.77	
NOAA	WI	N1a	86.3125	ALS	-3.51*	0.87	62.97	-29.06	63.65	-28.54
				CRS	0.39	0.77	33.10	-38.98	57.06	
NOAA	WI	N1b	72.8333	ALS	-6.00*	1.76	27.64	-35.29	85.11	35.80
				CRS	0.58	1.06	39.93	-29.15	96.00	
NOAA	WI	N5a	40.7292	ALS	-3.65*	1.20	20.43	-31.80	62.30	40.70
				CRS	0.83	1.27	25.06	-25.23	59.60	

Table 2. Seasonal statistics, fall. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
MMS	LTX	17	49.5417+	ALS	-9.62*	2.46	37.60	-72.10	277.74	-12.87
				CRS	-3.80	2.84	66.55	-67.05	330.56	
MMS	LTX	17	64.6667	ALS	-9.76*	2.52	42.16	-69.41	294.18	12.13
				CRS	-1.77	1.83	56.52	-51.95	216.18	
MMS	LTX	17	27.3125	ALS	-4.54	3.07	39.14	-39.17	232.65	29.90
				CRS	-1.28	2.30	37.68	-37.14	216.79	
MMS	LTX	17	38.5417	ALS	-9.34*	3.86	35.06	-66.83	299.30	21.64
				CRS	-1.63	2.78	47.79	-52.79	275.94	
MMS	LTX	18a	91.0000	ALS	-7.10*	2.67	30.36	-64.92	232.38	10.53
				CRS	-1.07	1.16	32.78	-34.56	62.79	
MMS	LTX	18b	27.4583	ALS	-4.55	3.31	16.82	-36.84	120.18	9.23
				CRS	-0.20	0.85	17.01	-19.87	23.38	
DOE	BD	B5a	26.3958	ALS	-3.96	2.43	27.58	-40.99	150.12	16.18
				CRS	-0.76	1.25	15.98	-24.63	35.14	
DOE	WH	HS	75.8125	ALS	-6.35*	1.20	22.08	-39.87	84.48	17.25
				CRS	0.93	1.62	37.42	-22.47	53.64	
DOE	WH	HN	53.9792	ALS	-5.26*	1.42	25.82	-36.35	96.28	-6.46
				CRS	1.61*	0.65	26.20	-26.60	28.12	
DOE	WH	HD	91.0000	ALS	-7.05*	1.58	22.61	-42.18	107.59	-10.30
				CRS	1.25*	0.60	25.62	-17.85	29.57	
DOE	WH	HD	73.5000	ALS	-10.76*	1.74	26.15	-49.50	146.98	-11.82
				CRS	2.97*	0.82	29.65	-21.15	40.56	
DOE	WH	HD	94.4375	ALS	-5.70*	1.35	26.17	-56.45	133.55	-11.94
				CRS	2.56*	0.58	27.38	-16.94	36.20	
DOE	BD	B6	41.1667	ALS	-4.36	3.05	28.37	-48.93	185.34	16.73
				CRS	-1.81	1.49	23.42	-39.73	60.80	
DOE	BD	B8	41.3333	ALS	-3.32	2.15	25.45	-35.46	81.39	42.76
				CRS	-1.90	1.95	20.99	-31.72	74.11	
DOE	WH	HW	51.4792	ALS	-3.21*	1.09	27.29	-36.79	73.91	6.81
				CRS	-0.96	0.83	19.23	-29.45	42.58	
TLGO	TABS	TA	57.9792	ALS	-7.32*	3.30	48.12	-57.52	256.96	13.98
				CRS	-5.15	2.63	40.87	-51.09	175.52	
MMS	LTX	20a	24.2708	ALS	-13.09*	1.84	25.12	-39.43	94.22	35.28
				CRS	0.65	3.06	32.73	-31.52	108.05	
MMS	LTX	20b	72.8125	ALS	-7.21*	2.65	49.83	-86.72	471.60	-13.63
				CRS	4.97*	2.49	73.74	-63.10	343.56	
MMS	LTX	20b	61.0833	ALS	-20.15*	3.10	75.19	-68.02	268.99	-30.00
				CRS	4.14	2.96	51.98	-96.70	204.85	
TLGO	TABS	TB	92.4792	ALS	-20.44*	3.60	89.57	-115.58	463.57	-4.40
				CRS	-1.63	1.42	87.79	-99.78	191.13	
TLGO	TABS	TC	91.0000	ALS	11.24*	2.65	66.62	-40.01	275.38	39.39
				CRS	8.52*	2.37	80.39	-35.51	219.90	
MMS	LTX	23b	91.0000	ALS	-12.65*	3.40	43.29	-100.73	385.99	-6.82
				CRS	1.81	0.91	28.33	-21.31	27.21	
MMS	LTX	23b	29.6458	ALS	-11.24*	4.83	32.83	-64.48	376.82	-0.41
				CRS	0.96	0.71	19.25	-11.83	14.70	
MMS	LTX	23b	64.0208	ALS	-20.53*	2.65	29.97	-56.59	235.40	-1.84
				CRS	1.33*	0.64	24.78	-28.31	31.18	

Table 2. Seasonal statistics, fall. (continued)

SA	PGM	M	T		MEAN	SE	MAX	MIN	S ²	α
MMS	LTX	24b	29.5625	ALS	-7.59*	2.78	24.34	-48.04	156.68	-0.71
				CRS	-0.37	0.62	18.90	-14.19	13.86	
MMS	LTX	24c	37.3125	ALS	-21.95*	4.57	15.32	-83.13	298.86	-4.02
				CRS	1.66	1.38	37.26	-30.93	80.65	
MMS	LTX	24c	95.3125	ALS	-18.49*	2.66	29.27	-76.55	269.33	-5.27
				CRS	1.48	0.90	30.68	-25.06	62.24	
TLGO	TABS	TD	91.0000	ALS	-22.04*	3.98	72.01	-136.04	693.10	4.15
				CRS	-3.07*	0.92	52.30	-44.32	58.91	
MMS	LTX	01a	76.7500	ALS	-7.36*	3.30	37.37	-57.93	291.01	6.71
				CRS	-1.04	0.96	15.30	-24.34	26.24	
MMS	LTX	01a	28.0625	ALS	-5.69*	2.02	24.26	-39.25	103.34	18.67
				CRS	-1.26	0.84	21.46	-25.78	23.52	
MMS	LTX	01b	45.8958	ALS	-6.41*	1.80	23.38	-34.14	122.42	5.82
				CRS	0.40	0.65	14.53	-20.68	16.33	
MMS	LTX	02	91.0000	ALS	-12.34*	4.04	47.24	-77.14	400.50	1.75
				CRS	-3.01*	0.80	20.95	-39.76	61.63	
MMS	LTX	02	62.4583	ALS	-14.61*	3.99	17.79	-97.94	415.00	-1.68
				CRS	0.85	0.81	28.28	-32.49	49.29	
MMS	LTX	02	96.4792	ALS	-16.74*	2.67	31.48	-59.18	254.72	0.31
				CRS	-0.37	0.91	28.54	-35.28	70.47	

Table 3.

Seasonal 40-hour low-passed statistics. Stations listed counterclockwise around the Gulf of Mexico, from on- to off-shore. With sponsoring agent, SA, program identification, PGM, observational meter identification, M, and where lower case character denotes a meter depth and/or a mooring location change, observational record length (days), T, where + denotes a sample time interval of 1.0 hr, all others being 0.5 hr, along- and cross-shore velocity autocorrelation time period (hr), AC, along- and cross-shore velocity degrees of freedom, DF, along- and cross-shore maximum velocity ($\text{cm}\cdot\text{s}^{-1}$), MAX, along- and cross-shore minimum velocity ($\text{cm}\cdot\text{s}^{-1}$), MIN, along- and cross-shore velocity variance ($\text{cm}^2\cdot\text{s}^{-2}$), S^2 , low-passed velocity variance as a percentage of the total velocity variance, %TOTAL, and principal axis of variation, α , in along- and cross-shore coordinate system (a positive value is a counterclockwise rotation relative to the axes).

Seasonal 40-hour low-passed statistics, winter.											
SA	PGM	M	T		AC	DF	MAX	MIN	S^2	%TOTAL	α
EPA	GS	G1	88.3333	ALS	31.5	68.57	21.04	-32.35	78.24	71.95	-21.03
				CRS	27.0	80.00	27.44	-4.09	19.41	58.04	
EPA	GS	G2	31.0000	ALS	23.0	34.17	22.48	-35.27	79.18	72.44	-31.64
				CRS	21.0	37.43	28.17	-9.69	34.59	67.55	
EPA	GS	G2	33.3750	ALS	46.0	18.28	39.80	-35.61	259.25	81.20	-22.83
				CRS	25.5	32.98	23.89	-13.29	60.50	70.58	
EPA	GS	G3	35.1667	ALS	54.5	16.24	35.59	-40.66	219.48	72.71	-24.01
				CRS	22.5	39.33	23.00	-22.87	74.76	55.44	
MMS	MAMES	Ma	68.4792	ALS	34.0	49.56	21.84	-21.97	67.33	78.03	2.71
				CRS	37.5	44.93	9.09	-8.66	11.29	45.73	
COE	MS	C8	37.0000	ALS	22.0	42.23	25.37	-21.93	87.15	70.11	-38.53
				CRS	38.5	24.13	11.16	-27.15	63.29	67.83	
COE	MS	C7	36.1458	ALS	18.5	49.16	19.03	-28.21	73.40	64.10	-13.98
				CRS	21.5	42.30	14.17	-24.25	40.11	61.23	
USGS		USc	56.9167	ALS	48.5	29.01	20.20	-34.87	161.35	67.66	2.60
				CRS	20.5	68.63	14.91	-18.80	30.20	32.44	
COE	MS	C5	37.9167	ALS	34.0	27.94	20.98	-33.88	129.87	76.82	-26.12
				CRS	25.0	38.00	21.86	-19.85	47.78	54.07	
COE	MS	C3	34.8958	ALS	60.0	14.63	14.61	-24.12	74.67	51.19	-4.95
				CRS	24.0	36.58	15.11	-9.80	15.77	30.00	
COE	MS	C2	34.8958	ALS	19.0	46.18	8.90	-15.01	30.37	22.27	29.93
				CRS	72.5	12.10	11.32	-17.05	42.35	32.06	
COE	MS	C1	34.7917	ALS	17.0	51.53	16.06	-5.15	19.68	14.54	-23.82
				CRS	23.5	37.28	3.17	-15.42	17.17	22.79	
MMS	LTX	16a	88.3333	ALS	25.0	86.40	28.58	-43.45	127.45	69.39	2.48
				CRS	23.5	91.91	22.50	-19.57	45.33	47.97	
MMS	LTX	16b	82.9167	ALS	26.0	78.15	23.12	-37.18	127.08	67.61	11.41
				CRS	22.5	90.31	18.48	-15.20	26.16	37.03	
MMS	LTX	15	88.3333	ALS	32.5	66.46	19.75	-44.10	130.89	65.28	-9.74
				CRS	66.0	32.73	22.68	-16.98	41.45	49.94	
MMS	LTX	15	88.3333	ALS	50.0	43.20	27.69	-49.64	188.64	66.40	-1.95
				CRS	25.5	84.71	16.40	-23.65	32.06	38.47	
NOAA	WI	N1	40.1875	ALS	21.0	47.88	38.25	-26.33	70.31	72.42	7.68
				CRS	15.5	64.87	18.93	-8.29	22.03	30.27	
NOAA	WI	N5a	25.9583	ALS	20.5	32.37	37.13	-21.67	71.47	81.94	14.26
				CRS	15.5	42.81	16.13	-10.67	24.61	42.51	
DOE	BD	B1	50.8958	ALS	24.0	52.56	70.91	-39.86	392.84	77.25	-24.57
				CRS	22.0	57.34	18.60	-44.09	98.27	37.33	

Table 3. Seasonal 40-hour low-passed statistics, winter.

(continued)

SA	PGM	M	T	AC	DF	MAX	MIN	S ²	%TOTAL	α	
MMS	LTX	17	72.7500	ALS	27.0	66.15	53.91	-42.05	269.58	51.21	16.03
				CRS	31.5	56.70	23.26	-37.68	75.83	18.36	
MMS	LTX	18a	88.3333	ALS	34.5	62.61	17.67	-45.31	185.80	66.50	7.36
				CRS	20.5	105.37	13.55	-14.26	22.62	21.17	
MMS	LTX	18b	68.2083	ALS	51.5	32.58	38.52	-32.62	182.07	76.93	8.81
				CRS	21.0	79.90	13.44	-18.68	23.73	31.93	
MMS	YR5	AA	108.8333+	ALS	37.0	71.86	46.51	-35.55	144.22	60.63	38.23
				CRS	33.0	80.58	37.17	-20.99	95.17	46.46	
DOE	BD	B5a	88.3333	ALS	29.0	74.48	35.20	-39.23	136.45	82.32	26.26
				CRS	27.0	80.00	15.53	-19.29	46.48	69.88	
DOE	WH	HS	72.6458	ALS	22.0	81.09	38.68	-51.17	103.73	73.30	-3.58
				CRS	24.0	74.33	11.07	-13.77	15.16	25.45	
DOE	WH	HD	42.2708	ALS	31.5	33.51	28.42	-30.28	93.09	80.77	-12.93
				CRS	24.0	43.98	9.08	-5.25	7.61	33.94	
DOE	WH	HD	33.7708	ALS	18.5	45.97	31.07	-65.30	241.02	83.28	-4.60
				CRS	19.5	43.62	11.70	-9.10	12.22	23.69	
DOE	WH	HD	88.3333	ALS	33.5	64.48	33.13	-58.55	309.51	86.15	-11.54
				CRS	24.5	88.16	20.15	-12.71	37.37	47.80	
DOE	BD	B6	88.3333	ALS	36.0	60.00	23.36	-38.57	104.81	70.75	43.59
				CRS	30.0	72.00	20.05	-30.86	97.42	77.92	
DOE	BD	B8	88.3333	ALS	32.0	67.50	22.41	-38.53	89.91	73.23	39.57
				CRS	29.5	73.22	25.21	-18.28	67.57	69.82	
DOE	WH	HW	65.0000	ALS	29.5	54.32	18.31	-38.02	97.29	79.13	9.24
				CRS	22.0	72.84	13.81	-4.53	8.12	36.46	
DOE	BD	B7	87.4583	ALS	29.0	73.78	20.43	-41.30	118.49	76.32	26.62
				CRS	26.5	80.74	20.22	-20.53	44.94	64.15	
MMS	LTX	20a	88.3333	ALS	42.5	50.82	5.53	-60.43	114.00	71.90	3.82
				CRS	27.5	78.55	32.28	-11.37	69.61	50.79	
MMS	LTX	20b	59.0833	ALS	35.0	41.76	64.10	-69.39	676.69	81.57	-16.73
				CRS	27.5	53.15	33.08	-37.20	145.80	43.97	
TLGO	TABS	TB	89.3333	ALS	61.0	35.80	46.44	-65.46	458.52	85.51	-1.26
				CRS	50.5	43.25	13.58	-29.25	44.72	46.74	
TLGO	TABS	TC	89.3333	ALS	29.0	75.31	14.80	-45.55	73.21	65.93	-14.02
				CRS	30.5	71.61	6.27	-24.05	27.24	48.84	
MMS	LTX	23b	88.3333	ALS	32.5	66.46	18.94	-61.77	305.71	78.98	-10.79
				CRS	23.5	91.91	18.75	-13.42	24.37	42.35	
MMS	LTX	23b	60.0208	ALS	52.5	28.20	61.42	-59.96	476.98	93.23	-3.16
				CRS	20.5	72.22	11.17	-9.08	11.48	46.42	
MMS	LTX	24b	39.7708	ALS	40.0	24.90	8.10	-65.31	300.16	82.11	-4.21
				CRS	18.0	55.33	17.21	-19.22	31.56	50.67	
TLGO	TABS	TD	89.3333	ALS	66.0	33.09	61.25	-61.92	797.84	94.42	1.94
				CRS	19.5	112.00	11.60	-11.51	12.05	37.41	
MMS	LTX	01a	71.8333	ALS	47.0	37.53	26.50	-62.73	332.13	87.12	-3.40
				CRS	20.0	88.20	7.58	-11.24	16.47	33.97	
MMS	LTX	01b	29.3333	ALS	31.0	24.03	12.68	-27.74	110.87	85.60	2.69
				CRS	15.5	48.06	7.23	-7.50	5.07	58.55	
MMS	LTX	02	88.3333	ALS	42.5	50.82	17.07	-52.05	212.53	85.21	-2.43
				CRS	22.0	98.18	11.41	-15.78	20.30	50.86	
MMS	LTX	02	88.3333	ALS	62.0	34.84	38.69	-60.79	291.09	91.29	3.73
				CRS	23.0	93.91	8.45	-13.32	15.19	47.80	

Table 3. Seasonal 40-hour low-passed statistics, spring.

(continued)

SA	PGM	M	T	AC	DF	MAX	MIN	S ²	%TOTAL	α	
EPA	GS	G5	58.2292	ALS	31.5	45.67	37.31	-24.66	138.39	61.47	-38.40
				CRS	35.0	41.10	36.00	-26.00	103.83	61.40	
EPA	GS	G1	75.6667	ALS	34.0	54.59	31.37	-32.54	135.54	77.58	-21.39
				CRS	33.5	55.40	31.59	-9.67	34.13	69.24	
EPA	GS	G2	75.6667	ALS	39.5	47.04	46.89	-31.35	159.01	76.38	-24.21
				CRS	45.5	40.84	38.89	-13.15	52.12	69.85	
EPA	GS	G3	75.9167	ALS	97.0	19.20	52.99	-37.35	199.36	71.33	-16.55
				CRS	26.5	70.28	21.50	-22.25	55.71	46.47	
EPA	GS	G4	42.6667	ALS	73.0	14.59	32.85	-20.17	106.87	67.42	-19.95
				CRS	41.5	25.66	12.83	-8.73	23.62	50.59	
MMS	MAMES	Ma	90.3333	ALS	73.5	30.04	41.87	-17.69	75.79	56.95	-.57
				CRS	26.5	83.32	16.04	-23.22	27.69	32.48	
MMS	MAMES	Mb	90.3333	ALS	51.5	42.87	26.76	-26.51	69.11	59.38	4.18
				CRS	58.0	38.07	14.21	-11.78	27.01	39.67	
COE	MS	C8	58.3333	ALS	68.5	21.03	33.44	-32.72	156.04	76.78	-9.69
				CRS	44.5	32.37	23.90	-15.23	46.84	48.86	
COE	MS	C7	58.4583	ALS	65.5	22.03	23.85	-27.30	116.79	78.86	-16.71
				CRS	54.5	26.48	16.47	-10.84	30.40	42.31	
USGS		USb	92.5833	ALS	54.5	41.57	34.23	-45.79	225.13	55.46	-2.76
				CRS	27.0	83.91	28.35	-30.71	90.98	36.11	
COE	MS	C6	56.4583	ALS	33.5	41.64	23.42	-12.31	56.08	65.98	-31.33
				CRS	35.5	39.30	15.55	-16.20	26.87	42.29	
COE	MS	C5	45.0833	ALS	37.5	29.99	23.92	-24.36	81.68	45.81	36.22
				CRS	45.0	24.99	30.99	-18.04	107.74	41.53	
COE	MS	C4	45.3333	ALS	32.5	34.72	25.31	-28.78	160.15	71.47	-36.98
				CRS	28.0	40.30	48.42	-15.69	112.08	59.59	
COE	MS	C3	51.2917	ALS	49.5	25.71	33.53	-18.81	132.25	55.94	1.39
				CRS	24.0	53.02	16.78	-8.59	32.85	29.84	
COE	MS	C2	51.2083	ALS	52.5	24.18	20.88	-15.09	67.35	37.11	19.86
				CRS	50.5	25.14	25.53	-43.06	172.00	56.11	
COE	MS	C1	51.0417	ALS	57.5	22.02	38.02	-14.43	96.94	26.45	-12.23
				CRS	29.5	42.92	16.35	-23.60	36.89	31.99	
MMS	LTX	16a	45.8333	ALS	23.5	48.51	11.78	-19.27	28.21	25.41	28.73
				CRS	21.5	53.02	7.84	-13.73	21.42	20.59	
MMS	LTX	16a	90.3333	ALS	27.5	80.29	17.93	-38.70	92.44	54.74	22.21
				CRS	24.5	90.12	13.02	-23.73	37.46	34.89	
MMS	LTX	16b	90.3333	ALS	24.0	92.00	22.06	-27.54	52.26	47.84	29.00
				CRS	24.5	90.12	26.82	-13.47	32.12	31.73	
MMS	LTX	15	45.8333	ALS	26.0	43.85	14.04	-19.98	41.74	38.55	0.71
				CRS	32.5	35.08	9.39	-16.64	20.76	25.58	
MMS	LTX	15	90.3333	ALS	29.5	74.85	37.95	-49.41	125.83	60.49	12.44
				CRS	20.5	107.71	13.67	-18.53	18.66	24.10	
MMS	LTX	15	90.3333	ALS	121.5	18.17	17.69	-31.97	89.40	57.62	-1.44
				CRS	23.5	93.96	12.24	-12.77	15.99	23.25	
DOE	BD	B4	67.3333	ALS	27.0	59.81	11.67	-28.85	35.97	48.48	31.78
				CRS	23.0	70.22	14.06	-14.65	20.67	43.34	
DOE	BD	B3a	38.2083	ALS	33.5	28.60	28.58	-38.74	173.29	53.87	-1.88
				CRS	17.5	54.74	9.42	-6.16	12.34	8.25	
DOE	BD	B3b	72.6042	ALS	33.5	53.21	29.16	-38.58	137.90	56.85	-1.05
				CRS	53.0	33.63	18.02	-11.42	26.20	21.05	
NOAA	WI	N1	32.3333	ALS	27.5	29.67	54.04	-23.57	255.91	79.71	4.10
				CRS	17.0	48.00	14.55	-8.50	22.50	15.54	
NOAA	WI	N1	32.3750	ALS	27.0	30.26	48.78	-20.22	170.58	79.31	5.71
				CRS	17.0	48.06	15.83	-8.59	20.20	20.30	

Table 3. Seasonal 40-hour low-passed statistics, spring.

(continued)

SA	PGM	M	T	AC	DF	MAX	MIN	S ²	%TOTAL	α	
NOAA	WI	N5a	65.7083	ALS	39.0	41.47	25.52	-28.33	57.23	63.74	19.30
				CRS	23.5	68.83	13.59	-13.00	17.28	27.93	
NOAA	WI	N5c	32.5000	ALS	44.0	18.65	31.48	-26.90	164.35	74.98	22.26
				CRS	28.0	29.30	26.31	-19.22	72.09	54.33	
DOE	BD	B1	31.4792	ALS	24.0	33.19	31.06	-24.42	119.31	50.48	-17.21
				CRS	18.0	44.25	13.34	-14.86	26.88	13.62	
MMS	LTX	17	60.2083	ALS	26.0	57.19	56.20	-43.06	291.54	69.93	-.59
				CRS	19.5	76.26	15.37	-27.14	41.44	17.18	
MMS	LTX	18a	46.5000	ALS	61.5	18.83	17.99	-38.61	139.39	52.64	6.83
				CRS	19.0	60.95	14.01	-18.91	28.30	20.57	
MMS	LTX	18a	90.3333	ALS	59.0	37.42	58.06	-64.61	257.23	74.03	17.41
				CRS	25.5	86.59	20.67	-32.49	63.18	40.54	
MMS	LTX	18b	67.7500	ALS	74.0	22.51	12.57	-37.53	99.02	55.61	6.08
				CRS	20.5	81.27	21.06	-29.53	37.16	34.00	
MMS	YR5	AA	45.0000+	ALS	56.0	20.00	31.84	-46.42	233.45	64.56	31.47
				CRS	49.0	22.86	24.55	-25.36	98.04	43.49	
DOE	BD	B5a	90.3333	ALS	33.0	66.91	26.57	-25.50	56.57	69.62	34.87
				CRS	45.5	48.53	12.07	-15.16	34.08	65.38	
DOE	BD	B5b	47.6667	ALS	38.0	31.18	57.60	-39.39	285.72	90.79	21.30
				CRS	31.5	37.62	12.97	-20.62	52.47	70.04	
DOE	WH	HS	55.7292	ALS	45.0	30.64	14.88	-28.12	90.26	77.54	-5.87
				CRS	29.0	47.55	13.08	-10.58	23.32	36.47	
DOE	WH	HS	90.5833	ALS	35.0	63.27	23.28	-43.25	125.40	74.91	5.85
				CRS	30.0	73.82	18.94	-30.27	46.93	44.81	
DOE	WH	HN	31.6667	ALS	37.0	21.70	17.52	-37.15	178.03	90.08	-5.81
				CRS	20.5	39.17	10.89	-11.13	20.16	51.52	
DOE	WH	HN	61.1667	ALS	30.5	49.56	12.05	-42.54	110.77	67.48	-23.45
				CRS	27.0	55.98	16.89	-13.14	38.84	45.67	
DOE	WH	HD	55.5000	ALS	55.5	24.76	16.58	-46.54	230.17	90.46	-12.06
				CRS	28.0	49.07	11.40	-11.16	21.28	50.70	
DOE	WH	HD	70.9375	ALS	75.5	23.13	26.16	-44.83	208.17	79.60	-14.48
				CRS	51.5	33.90	17.07	-14.92	32.68	44.28	
DOE	WH	HD	90.3333	ALS	49.5	44.61	53.01	-57.33	409.21	84.83	-9.67
				CRS	25.0	88.32	18.37	-14.95	33.03	36.17	
DOE	BD	B6	90.3333	ALS	39.0	56.62	14.52	-27.00	65.66	72.50	36.40
				CRS	41.5	53.20	15.85	-18.84	40.24	73.62	
DOE	BD	B8	90.3333	ALS	49.0	45.06	14.75	-21.78	58.18	67.35	-42.74
				CRS	46.5	47.48	17.07	-22.36	64.53	69.16	
DOE	WH	HW	86.2083	ALS	67.5	31.27	28.34	-53.72	253.13	81.47	-2.94
				CRS	23.5	89.83	18.03	-14.45	28.74	42.09	
DOE	BD	B7	90.3333	ALS	48.5	45.53	25.57	-44.81	130.67	81.20	28.99
				CRS	47.5	46.48	17.69	-17.52	52.77	69.66	
MMS	LTX	20a	74.1667	ALS	51.5	35.34	14.33	-50.24	222.83	69.94	-22.75
				CRS	35.0	52.00	31.40	-24.19	102.54	53.06	
MMS	LTX	20b	26.8542	ALS	42.5	16.11	63.68	-45.34	549.58	87.29	-26.64
				CRS	47.0	14.56	41.60	-29.91	218.38	68.91	
TLGO	TABS	TB	57.5417	ALS	47.5	29.94	11.63	-64.86	262.69	66.33	3.33
				CRS	25.0	56.88	23.83	-15.67	42.39	37.27	
TLGO	TABS	TB	52.7083	ALS	70.0	18.66	52.87	-70.28	571.42	83.62	-2.99
				CRS	24.5	53.33	17.33	-27.93	54.27	38.33	
TLGO	TABS	TC	51.7708	ALS	27.5	46.69	23.40	-55.64	174.85	52.79	-13.89
				CRS	23.5	54.64	35.40	-23.35	125.22	58.09	
TLGO	TABS	TC	54.0208	ALS	39.0	34.32	21.06	-55.49	194.29	78.59	-8.12
				CRS	29.5	45.37	15.14	-20.66	45.00	54.05	

Table 3. Seasonal 40-hour low-passed statistics, spring. (continued)

SA	PGM	M	T	AC	DF	MAX	MIN	S ²	%TOTAL	α	
MMS	LTX	23a	47.6667	ALS	48.0	24.70	42.69	-43.31	289.93	81.60	-15.93
				CRS	28.5	41.60	13.30	-14.60	36.17	47.64	
MMS	LTX	23b	90.3333	ALS	39.5	55.90	47.00	-75.37	380.87	85.87	-7.60
				CRS	20.5	107.71	19.51	-13.76	22.94	38.80	
MMS	LTX	23b	60.6667	ALS	115.0	13.03	21.34	-58.05	350.03	85.82	-3.07
				CRS	20.5	73.07	10.70	-10.81	11.24	29.59	
MMS	LTX	24a	50.9792	ALS	59.5	21.25	23.29	-35.93	143.80	72.80	-12.47
				CRS	26.0	48.63	17.67	-20.68	53.39	53.09	
MMS	LTX	24b	90.3333	ALS	48.0	46.00	41.69	-90.80	363.87	85.72	3.01
				CRS	28.0	78.86	16.81	-16.26	29.61	42.96	
TLGO	TABS	TD	54.0208	ALS	51.0	26.25	54.17	-72.02	700.87	92.51	3.46
				CRS	23.5	56.96	7.19	-11.73	16.76	38.43	
MMS	LTX	01a	50.8333	ALS	50.0	25.20	80.15	-58.02	541.05	94.88	-6.88
				CRS	25.5	49.41	12.35	-12.72	30.13	47.00	
MMS	LTX	01a	90.3333	ALS	47.0	46.98	42.86	-65.25	433.91	90.94	-1.10
				CRS	60.5	36.50	11.90	-11.61	13.95	34.70	
MMS	LTX	01b	31.6667	ALS	24.0	33.35	10.90	-30.20	92.26	82.58	3.63
				CRS	21.0	38.12	6.05	-7.41	7.79	44.93	
MMS	LTX	02	50.8333	ALS	71.5	17.62	41.82	-62.34	330.13	86.30	4.16
				CRS	27.5	45.82	18.32	-26.02	73.46	55.63	
MMS	LTX	02	90.3333	ALS	96.0	23.00	26.34	-82.48	396.94	88.82	5.12
				CRS	28.5	77.47	15.41	-26.47	57.21	59.13	
MMS	LTX	02	90.3333	ALS	82.5	26.76	15.98	-52.72	166.21	80.87	5.12
				CRS	32.0	69.00	11.51	-22.27	31.91	51.46	

Seasonal 40-hour low-passed statistics, summer.

EPA	GS	G5	73.8958	ALS	59.0	30.74	44.77	-20.59	161.34	76.11	-22.67
				CRS	44.5	40.75	18.55	-29.06	40.00	56.11	
EPA	GS	G1	90.3333	ALS	39.0	56.62	18.38	-20.56	43.10	73.45	-11.55
				CRS	32.5	67.94	9.68	-4.05	4.93	30.26	
EPA	GS	G2	90.3333	ALS	56.5	39.08	38.84	-20.74	129.08	78.34	-19.56
				CRS	45.0	49.07	16.61	-17.47	24.78	57.03	
EPA	GS	G3	90.3333	ALS	103.5	21.33	53.67	-22.60	251.08	74.82	-13.43
				CRS	51.0	43.29	22.96	-16.10	32.85	35.69	
EPA	GS	G4	90.3333	ALS	55.5	39.78	39.21	-21.89	132.93	79.42	-18.86
				CRS	48.5	45.53	13.29	-17.60	24.54	56.90	
MMS	MAMES	Mb	33.3958	ALS	32.0	26.33	20.65	-15.72	48.45	50.04	-10.37
				CRS	57.5	14.65	9.75	-13.77	19.21	35.92	
MMS	MAMES	Mb	90.3333	ALS	80.5	27.43	17.35	-11.41	29.38	49.51	25.78
				CRS	104.0	21.23	13.81	-15.40	15.09	36.50	
COE	MS	C8	54.0208	ALS	83.5	16.03	42.10	-40.14	198.86	67.63	-18.69
				CRS	57.0	23.48	22.50	-13.06	41.35	30.04	
COE	MS	C7	54.0208	ALS	76.0	17.61	24.62	-29.36	91.52	69.20	-5.88
				CRS	24.5	54.63	10.26	-5.87	9.08	16.65	
USGS		USa	32.6042	ALS	52.0	15.84	28.74	-11.81	104.71	21.77	6.24
				CRS	23.5	35.04	15.49	-7.97	23.52	5.84	
USGS		USb	90.3333	ALS	80.0	27.60	31.33	-27.92	149.06	36.80	-15.64
				CRS	55.0	40.15	20.54	-18.41	35.24	10.33	
COE	MS	C5	55.3750	ALS	84.0	16.30	22.15	-27.66	89.83	62.69	-18.59
				CRS	52.0	26.34	16.76	-12.67	20.02	24.18	
COE	MS	C4	52.0000	ALS	68.5	18.82	41.25	-22.34	137.32	66.84	-24.78
				CRS	80.0	16.12	18.32	-16.07	33.80	42.77	

Table 3. Seasonal 40-hour low-passed statistics, summer.

(continued)

SA	PGM	M	T		AC	DF	MAX	MIN	S ²	%TOTAL	α
COE	MS	C2	38.4792	ALS	56.5	17.08	6.44	-10.73	11.99	13.86	-5.10
				CRS	46.5	20.75	15.28	-10.06	31.28	33.47	
MMS	DELTA	MD	76.8750	ALS	59.5	31.69	38.40	-57.95	380.54	88.68	11.13
				CRS	65.0	29.01	19.91	-17.74	44.01	56.99	
MMS	LTX	16a	48.9583	ALS	29.0	41.90	17.20	-11.59	22.98	23.42	18.03
				CRS	34.0	35.74	10.48	-5.15	8.64	12.65	
MMS	LTX	16a	67.7500	ALS	88.0	18.94	17.48	-12.35	27.62	40.29	14.84
				CRS	52.5	31.75	15.12	-6.94	12.52	26.66	
MMS	LTX	16b	90.3333	ALS	64.5	34.23	9.84	-38.36	43.67	56.40	12.23
				CRS	63.5	34.77	9.98	-10.68	9.13	24.11	
MMS	LTX	15	83.8958	ALS	66.0	31.15	47.14	-7.68	76.45	40.60	-1.80
				CRS	27.5	74.76	23.98	-17.12	25.65	26.41	
MMS	LTX	15	90.3333	ALS	220.5	10.01	59.25	-17.52	237.02	66.39	9.01
				CRS	59.0	37.42	20.12	-11.27	27.99	22.85	
MMS	LTX	15	90.3333	ALS	83.0	26.60	47.05	-30.97	155.60	67.42	7.81
				CRS	54.5	40.51	21.19	-21.21	47.06	39.25	
DOE	BD	B4	55.5000	ALS	92.0	14.93	15.47	-30.36	84.76	61.41	28.91
				CRS	72.0	19.08	11.82	-20.57	37.65	56.74	
DOE	BD	B4	61.3542	ALS	50.0	30.31	15.82	-21.74	44.41	50.95	25.65
				CRS	57.5	26.36	8.66	-10.13	14.54	34.88	
NOAA	WI	N4	36.8750	ALS	44.0	21.02	10.78	-13.61	33.98	47.29	24.27
				CRS	21.5	43.02	4.32	-12.69	9.25	17.74	
DOE	BD	B3a	42.7500	ALS	49.0	21.81	23.82	-19.81	73.40	61.14	-19.31
				CRS	42.0	25.44	11.97	-6.58	13.48	16.31	
DOE	BD	B3b	37.7500	ALS	55.5	17.06	22.53	-25.40	124.02	67.96	-8.57
				CRS	26.0	36.42	10.13	-6.98	12.63	16.93	
NOAA	WI	N2	39.5833	ALS	20.5	48.37	7.18	-10.28	7.94	9.79	-40.66
				CRS	20.0	49.58	8.31	-13.84	10.42	11.74	
NOAA	WI	N1	25.7500	ALS	33.0	19.98	21.18	-21.86	92.49	58.65	-4.18
				CRS	16.5	39.97	10.88	-9.27	16.14	10.84	
NOAA	WI	N5a	26.0625	ALS	35.0	19.01	5.89	-14.18	18.72	48.11	35.90
				CRS	26.5	25.11	5.80	-10.16	11.98	20.80	
NOAA	WI	N5b	26.0417	ALS	31.0	21.45	19.67	-24.45	104.70	56.13	12.05
				CRS	26.0	25.58	7.54	-9.00	13.28	9.78	
MMS	LTX	17	48.6458	ALS	92.5	13.06	22.84	-62.93	435.93	56.63	3.33
				CRS	24.5	49.33	26.06	-20.04	57.25	8.68	
MMS	LTX	17	37.0000	ALS	42.0	22.12	49.44	-34.03	266.10	65.09	11.54
				CRS	28.5	32.60	12.90	-11.15	26.07	11.02	
MMS	LTX	18a	90.3333	ALS	90.0	24.53	62.85	-19.39	105.76	62.58	12.76
				CRS	62.5	35.33	15.59	-11.78	21.93	23.82	
MMS	LTX	18a	43.8542	ALS	65.0	16.81	42.93	-48.51	303.11	78.09	19.98
				CRS	28.0	39.02	22.68	-24.75	80.67	47.49	
MMS	LTX	18b	90.3333	ALS	132.0	16.73	55.97	-17.90	122.88	73.89	14.38
				CRS	41.0	53.85	18.75	-16.28	36.32	43.29	
MMS	YR5	AA	30.2083+	ALS	41.0	18.66	33.66	-28.91	189.38	70.38	22.57
				CRS	48.0	15.94	10.26	-20.92	40.33	48.08	
MMS	YR5	AA	47.6667+	ALS	50.0	23.70	18.13	-43.38	155.41	63.60	27.49
				CRS	50.0	23.70	14.03	-19.43	46.75	36.63	
ONR	LS	S1	62.3958	ALS	27.0	56.94	17.27	-20.34	66.45	40.01	-10.05
				CRS	64.5	23.84	18.13	-21.53	90.10	50.90	
DOE	BD	B5a	90.3333	ALS	59.0	37.42	14.85	-44.52	44.58	71.17	4.23
				CRS	24.0	92.00	15.39	-12.56	12.56	46.83	
DOE	BD	B5b	90.3333	ALS	82.5	26.76	39.74	-84.41	283.59	90.98	9.85
				CRS	68.0	32.47	16.79	-16.12	26.32	53.81	

Table 3. Seasonal 40-hour low-passed statistics, summer.(continued)

SA	PGM	M	T	AC	DF	MAX	MIN	S ²	%TOTAL	α	
DOE	WH	HS	72.0000	ALS	64.0	27.63	32.95	-35.10	188.79	81.31	8.35
				CRS	63.5	27.84	18.49	-49.76	70.62	55.63	
DOE	WH	HN	90.3333	ALS	58.0	38.07	14.96	-40.09	105.42	77.54	-6.72
				CRS	22.5	98.13	11.80	-14.24	16.34	32.04	
DOE	WH	HD	90.3333	ALS	74.0	29.84	33.06	-51.00	256.58	88.03	-10.48
				CRS	28.0	78.86	10.44	-17.72	23.32	38.05	
DOE	WH	HD	90.3333	ALS	52.5	42.06	30.69	-37.41	163.26	70.81	-9.49
				CRS	21.0	105.14	13.59	-16.75	32.93	32.87	
DOE	BD	B8	54.9375	ALS	58.5	23.22	16.83	-66.57	120.85	76.25	15.85
				CRS	28.5	47.67	10.78	-11.24	27.37	40.70	
DOE	WH	HW	88.7500	ALS	60.0	36.18	19.02	-37.77	126.37	75.87	14.37
				CRS	65.5	33.15	20.95	-8.83	23.50	38.62	
DOE	BD	B7	90.3333	ALS	58.0	38.07	16.43	-56.80	91.55	68.19	3.85
				CRS	52.5	42.06	24.76	-19.97	31.41	49.15	
MMS	LTX	20a	32.1667	ALS	40.5	20.05	27.23	-46.80	298.89	49.11	-18.02
				CRS	31.5	25.78	30.07	-21.45	142.52	30.99	
MMS	LTX	20a	67.3958	ALS	52.5	31.57	55.68	-70.23	544.55	69.95	-11.51
				CRS	45.5	36.43	61.79	-30.56	225.90	44.52	
TLGO	TABS	TB	37.7083	ALS	58.0	16.29	72.62	-102.55	1069.23	96.11	0.36
				CRS	21.5	43.95	10.27	-16.96	31.20	36.25	
TLGO	TABS	TC	90.3333	ALS	85.0	25.98	67.35	-91.59	510.22	78.55	-17.45
				CRS	59.0	37.42	46.56	-44.20	176.34	54.37	
MMS	LTX	23a	87.0208	ALS	136.0	15.66	44.59	-34.37	294.14	86.36	-11.76
				CRS	69.5	30.65	8.67	-20.15	23.40	44.06	
MMS	LTX	23b	30.5625	ALS	52.0	14.88	45.10	-72.42	574.30	93.68	-8.81
				CRS	27.5	28.13	7.38	-15.10	20.85	56.12	
MMS	LTX	23b	46.8958	ALS	51.5	22.67	32.20	-35.50	153.96	90.35	-.23
				CRS	56.5	20.66	8.22	-5.13	4.36	30.88	
MMS	LTX	23b	58.5417	ALS	69.5	20.84	44.17	-33.37	219.15	87.03	-2.03
				CRS	23.0	62.98	3.95	-13.12	7.43	30.06	
MMS	LTX	24a	90.3333	ALS	88.5	24.95	43.51	-23.77	184.50	82.28	-11.91
				CRS	57.5	38.40	18.80	-16.24	42.11	51.80	
MMS	LTX	24b	90.3333	ALS	78.0	28.31	46.64	-70.10	324.33	88.33	-10.07
				CRS	47.0	46.98	25.38	-29.50	83.98	68.49	
MMS	LTX	24c	29.8333	ALS	64.0	11.84	21.57	-30.66	158.18	84.96	-3.86
				CRS	30.0	25.25	8.12	-14.71	16.37	43.85	
TLGO	TABS	TD	79.7917	ALS	70.5	27.74	92.62	-62.83	818.29	95.19	4.06
				CRS	60.5	32.32	17.72	-19.71	23.88	38.96	
TLGO	TABS	TE	48.0625	ALS	107.0	11.17	74.05	-47.61	785.54	80.01	9.22
				CRS	49.5	24.15	35.15	-15.96	143.43	38.26	
MMS	LTX	01a	90.3333	ALS	72.0	30.67	43.10	-28.69	189.16	91.98	-1.43
				CRS	23.0	96.00	6.52	-11.82	6.56	26.04	
MMS	LTX	01a	90.3333	ALS	77.0	28.68	52.26	-85.68	276.06	94.45	2.44
				CRS	45.0	49.07	12.27	-24.72	18.82	47.67	
MMS	LTX	01b	55.8333	ALS	94.0	14.68	19.01	-18.22	76.25	94.33	4.55
				CRS	57.5	24.00	4.99	-8.75	3.18	50.32	
MMS	LTX	02	50.8333	ALS	82.0	15.37	49.05	-24.17	286.78	80.95	-2.72
				CRS	23.5	53.62	11.57	-9.12	19.68	29.32	
MMS	LTX	02	53.8750	ALS	114.0	11.34	49.73	-71.46	592.45	91.27	-5.83
				CRS	67.0	19.29	20.51	-32.12	102.65	65.98	
MMS	LTX	02	90.3333	ALS	123.5	17.88	53.05	-37.76	253.49	88.16	3.23
				CRS	51.5	42.87	20.30	-18.59	32.19	53.57	

Table 3. Seasonal 40-hour low-passed statistics, fall.

(continued)

SA	PGM	M	T	AC	DF	MAX	MIN	S ²	%TOTAL	α	
EPA	GS	G5	105.6667	ALS	59.0	43.67	23.18	-32.64	53.96	69.19	31.09
				CRS	59.0	43.67	47.41	-21.24	63.44	60.51	
EPA	GS	G1	89.3333	ALS	32.0	68.25	13.62	-21.53	34.59	71.73	-23.32
				CRS	33.5	65.19	10.98	-4.45	8.60	55.13	
EPA	GS	G2	89.3333	ALS	42.5	51.39	23.42	-26.07	50.99	72.81	-24.08
				CRS	36.0	60.67	15.48	-9.20	13.85	59.83	
EPA	GS	G3	76.7083	ALS	36.0	52.28	17.49	-22.48	40.92	70.59	-28.95
				CRS	33.5	56.18	15.39	-15.97	19.24	59.33	
EPA	GS	G4	76.7083	ALS	65.5	28.75	21.14	-27.11	48.98	76.09	-21.10
				CRS	49.5	38.04	10.77	-6.05	11.51	53.14	
MMS	MAMES	Mb	89.3333	ALS	60.0	36.40	19.36	-25.93	53.43	79.70	11.96
				CRS	42.0	52.00	14.11	-12.34	18.27	59.40	
COE	MS	C8	24.5833	ALS	42.5	14.85	17.07	-24.80	112.86	83.94	41.37
				CRS	42.0	15.02	33.67	-20.06	141.53	85.42	
COE	MS	C7	24.4583	ALS	40.0	15.71	22.17	-29.25	122.06	76.85	-28.35
				CRS	29.5	21.31	18.83	-13.75	62.09	71.31	
USGS		USa	45.3333	ALS	67.5	16.71	24.48	-27.64	112.21	33.49	17.82
				CRS	32.5	34.71	14.83	-12.11	36.36	14.48	
USGS		USb	77.7708	ALS	99.5	19.18	10.70	-35.69	102.50	73.93	-15.32
				CRS	46.0	41.48	15.51	-14.24	30.31	40.60	
COE	MS	C6	27.9375	ALS	22.0	32.36	21.39	-9.65	48.70	66.37	-27.04
				CRS	20.0	35.60	14.85	-8.68	19.07	51.91	
COE	MS	C5	25.7500	ALS	36.0	18.28	27.52	-33.22	172.73	82.76	-32.73
				CRS	29.5	22.31	24.30	-18.19	86.65	69.77	
COE	MS	C3	27.7083	ALS	46.5	15.16	15.28	-25.45	99.25	63.55	-14.59
				CRS	18.0	39.17	11.25	-8.76	16.74	27.25	
COE	MS	C2	27.7083	ALS	20.0	35.30	11.09	-14.38	22.87	22.12	17.39
				CRS	22.5	31.38	13.94	-22.57	51.80	40.19	
COE	MS	C1	27.7083	ALS	18.0	39.39	17.41	-19.35	53.12	25.26	-21.43
				CRS	15.5	45.74	18.21	-17.64	24.09	40.87	
MMS	LTX	16a	38.8333	ALS	28.5	34.11	13.04	-21.87	79.49	69.44	11.13
				CRS	22.0	44.18	14.04	-5.98	14.33	36.29	
MMS	LTX	16a	23.5417	ALS	42.5	14.26	35.88	-14.84	145.56	70.91	-2.57
				CRS	27.5	22.04	23.73	-23.71	63.02	45.91	
MMS	LTX	16b	26.7708	ALS	36.0	18.96	14.75	-46.58	135.18	76.05	10.38
				CRS	22.5	30.33	10.66	-7.83	14.88	31.05	
MMS	LTX	15	32.5000	ALS	44.0	18.68	32.80	-50.37	213.99	68.39	1.56
				CRS	51.0	16.12	22.42	-15.23	35.96	39.69	
MMS	LTX	15	38.5833	ALS	50.5	19.13	22.00	-28.71	115.65	60.07	9.11
				CRS	29.0	33.31	18.69	-22.48	28.56	41.86	
MMS	LTX	15	89.3333	ALS	96.0	22.75	14.23	-36.58	106.28	67.18	3.89
				CRS	62.0	35.23	17.48	-12.27	20.66	40.59	
MMS	LTX	15	91.7708	ALS	67.5	33.22	11.11	-50.02	154.41	78.28	-6.63
				CRS	62.0	36.17	19.01	-17.00	35.77	47.21	
NOAA	WI	N1	84.5833	ALS	24.5	84.55	12.81	-24.77	32.93	51.74	5.22
				CRS	21.5	96.35	12.72	-7.49	5.59	9.80	
NOAA	WI	N1	71.1667	ALS	63.5	27.53	14.75	-20.31	49.39	58.03	-6.06
				CRS	20.5	85.27	7.31	-6.97	5.65	5.89	
NOAA	WI	N5a	39.0625	ALS	22.5	43.44	17.64	-16.72	33.63	53.98	8.73
				CRS	26.5	36.89	8.55	-3.50	3.95	6.63	
MMS	LTX	17	47.8750+	ALS	26.0	45.73	27.80	-51.57	142.00	51.13	12.36
				CRS	29.0	41.00	18.08	-36.20	98.91	29.92	
MMS	LTX	17	62.9583	ALS	33.5	46.33	25.87	-51.91	180.36	61.31	8.82
				CRS	24.0	64.67	15.09	-11.36	17.92	8.29	

Table 3. Seasonal 40-hour low-passed statistics, fall.

(continued)

SA	PGM	M	T	AC	DF	MAX	MIN	S ²	%TOTAL	α	
MMS	LTX	17	25.6458	ALS	26.5	24.74	17.78	-22.67	97.14	41.75	3.05
				CRS	16.0	40.97	11.55	-12.66	15.89	7.33	
MMS	LTX	17	36.8750	ALS	46.0	20.11	11.44	-46.11	146.04	48.79	-7.04
				CRS	26.0	35.58	6.89	-17.80	25.15	9.11	
MMS	LTX	18a	89.3333	ALS	67.0	32.60	26.33	-47.58	191.08	82.23	11.92
				CRS	47.0	46.47	16.73	-15.14	21.22	33.80	
MMS	LTX	18b	25.7500	ALS	60.0	10.98	10.68	-25.18	104.21	86.71	10.29
				CRS	20.5	32.15	7.67	-5.18	6.38	27.29	
DOE	BD	B5a	24.6875	ALS	25.0	25.34	22.70	-30.06	112.98	75.26	17.84
				CRS	28.0	22.63	8.07	-10.08	18.07	51.42	
DOE	WH	HS	73.9583	ALS	31.0	58.69	12.25	-26.39	59.74	70.71	15.15
				CRS	89.0	20.44	24.20	-13.45	24.01	44.76	
DOE	WH	HN	52.2917	ALS	27.0	47.98	12.84	-27.79	72.89	75.71	-2.37
				CRS	19.5	66.44	12.90	-7.03	10.32	36.70	
DOE	WH	HD	89.3333	ALS	50.5	43.25	16.39	-32.56	79.94	74.30	-6.92
				CRS	26.5	82.42	14.44	-8.35	8.85	29.93	
DOE	WH	HD	71.8333	ALS	36.5	48.33	17.45	-43.02	112.23	76.36	-9.95
				CRS	29.0	60.83	14.99	-8.30	14.34	35.36	
DOE	WH	HD	92.5833	ALS	31.0	73.11	24.21	-39.75	101.70	76.15	-10.27
				CRS	21.0	107.93	14.84	-9.00	11.44	31.60	
DOE	BD	B6	39.5000	ALS	49.5	19.96	21.17	-32.23	142.30	76.78	18.35
				CRS	36.0	27.44	13.50	-23.90	38.38	63.13	
DOE	BD	B8	39.6667	ALS	56.0	17.71	12.64	-22.70	55.80	68.56	44.47
				CRS	49.0	20.24	13.80	-17.60	54.12	73.03	
DOE	WH	HW	49.7917	ALS	20.0	61.78	12.83	-23.80	41.01	55.49	8.50
				CRS	20.0	61.78	9.12	-11.54	15.37	36.10	
TLGO	TABS	TA	56.3125	ALS	59.0	23.58	27.51	-41.62	192.79	75.03	7.76
				CRS	55.0	25.30	19.42	-36.02	111.23	63.37	
MMS	LTX	20a	22.5208	ALS	21.0	27.74	18.85	-21.74	64.50	68.46	-30.82
				CRS	50.5	11.53	10.53	-20.96	49.91	46.19	
MMS	LTX	20b	70.9375	ALS	26.0	67.21	18.92	-55.77	258.03	54.71	-7.59
				CRS	31.5	55.48	38.98	-21.95	145.06	42.22	
MMS	LTX	20b	59.2917	ALS	52.5	27.92	16.31	-48.80	175.24	65.15	-27.54
				CRS	62.5	23.46	29.74	-23.86	90.40	44.13	
TLGO	TABS	TB	90.7708	ALS	62.0	35.80	16.54	-78.41	337.34	72.77	-3.75
				CRS	23.5	94.45	38.32	-24.44	67.70	35.42	
TLGO	TABS	TC	89.3333	ALS	55.5	39.35	50.89	-25.63	219.72	79.79	36.45
				CRS	56.0	39.00	48.00	-17.76	133.46	60.69	
MMS	LTX	23b	89.3333	ALS	65.5	33.34	36.21	-69.66	349.98	90.67	-7.06
				CRS	66.0	33.09	11.42	-13.05	11.94	43.88	
MMS	LTX	23b	27.9375	ALS	44.0	16.17	20.51	-52.29	343.87	91.26	-.47
				CRS	24.5	29.04	7.06	-3.13	4.60	31.29	
MMS	LTX	23b	62.3333	ALS	46.0	33.40	11.57	-52.15	204.71	86.96	-2.40
				CRS	20.0	76.83	8.96	-7.87	8.23	26.40	
MMS	LTX	24b	27.8958	ALS	35.0	20.27	16.44	-42.21	122.02	77.88	0.29
				CRS	19.5	36.38	5.38	-5.42	3.98	28.72	
MMS	LTX	24c	35.5417	ALS	62.5	14.33	3.60	-72.39	260.69	87.23	-5.17
				CRS	21.0	42.64	17.32	-14.45	43.62	54.09	
MMS	LTX	24c	93.3958	ALS	60.0	38.13	17.93	-67.10	228.93	85.00	-5.33
				CRS	30.0	76.25	20.10	-22.55	39.31	63.16	
TLGO	TABS	TD	89.3333	ALS	50.0	43.68	63.48	-106.77	612.98	88.44	4.59
				CRS	31.5	69.33	12.81	-16.91	28.39	48.19	
MMS	LTX	01a	75.0000	ALS	69.0	26.70	34.08	-41.55	274.76	94.42	7.05
				CRS	64.5	28.56	10.99	-14.99	15.68	59.76	

Table 3. Seasonal 40-hour low-passed statistics, fall. (continued)

SA	PGM	M	T		AC	DF	MAX	MIN	S ²	%TOTAL	α
MMS	LTX	01a	26.3333	ALS	26.5	25.42	23.84	-28.04	96.43	93.31	17.09
				CRS	20.0	33.68	10.66	-18.63	12.77	54.29	
MMS	LTX	01b	44.1667	ALS	29.0	37.98	14.20	-29.05	107.07	87.46	5.80
				CRS	28.5	38.65	6.95	-7.33	8.14	49.85	
MMS	LTX	02	89.3333	ALS	89.0	24.54	46.40	-64.75	353.82	88.34	2.55
				CRS	22.5	97.07	11.53	-18.41	25.42	41.25	
MMS	LTX	02	60.7708	ALS	57.5	26.07	14.89	-81.42	377.14	90.88	-1.68
				CRS	20.0	74.95	12.00	-11.69	24.96	50.64	
MMS	LTX	02	94.6875	ALS	65.0	35.62	20.93	-55.83	222.21	87.24	2.06
				CRS	27.0	85.76	15.30	-19.14	44.89	63.70	

$$SE = \left(\frac{1}{n} \left(1 + 2 \sum_{i=1}^q p^2(i) \right) \right)^{1/2}$$

where i is an autocorrelation time lag, and q is the time lag at which the sampled autocorrelation function is essentially zero. We have taken q to be the first zero crossing of the sampled autocorrelation function.

The degrees of freedom, df , i.e. the number of independent samples for each low-passed velocity record, is computed as the total record length divided by the low-passed record autocorrelation time scale.

Linear regression analysis was used following standard practices (Spiegel 1961). Hypotheses that linear regression slopes, a_1 , were equal to zero, i.e. that there was no relationship between the dependent and the independent variable, were tested using a student-t test. A statistic, T , was computed using

$$T = \frac{a_1(N-2)^{1/2}S_x}{S_y(1-r^2)^{1/2}} .$$

Where N is the number of observations, a_1 is the linear regression line slope, S_x is the independent variable standard deviation, S_y is the dependent variable standard deviation, and r is the correlation coefficient. The computed statistic T is then compared to tabulated student-t statistics at various significance levels. If $T < t$, then one accepts the hypothesis that the regression slope is equal to zero, i.e. that there is no significant relationship between the dependent and the independent variables. If $T > t$, then one rejects the hypothesis that the regression slope equals zero, and accepts the alternative hypothesis that the regression slope does not equal zero, i.e. that there is a significant relationship with the independent variable.

2.3.2.2 Alongshore Flow Persistence

Alongshore flow persistence is a general term that has been estimated in four ways. A first estimate was obtained by considering the portion of flow in either alongshore direction for each record (Appendix A). This portion of flow can also be measured in a number of ways, as the total number of hours, as a percentage of the record length, and as the number of events with an uninterrupted velocity component sign. These were determined as a summation of all velocity events with the same sign, i.e. $V > 0$, or $V < 0$. An event was defined as a period with continuous, unidirectional, velocity. Zero velocity following positive (negative) velocities was considered as continued positive (negative) flow. Only when the velocity actually changed sign, became less (greater) than zero if the flow event had positive (negative) flow, was an event considered ended.

The second measure of alongshore flow persistence is similar to the first, except that flow events were considered which exceeded or were less than velocity levels different from zero. Specifically, velocity levels at intervals of $\pm 25 \text{ cm} \cdot \text{s}^{-1}$ were considered. The number of events, the total time, and the percentage of record length contained within these higher velocity level events were determined to estimate the proportion of record that exceeded these selected velocity levels.

The third measure of alongshore flow persistence is the distribution of event durations that exceeded a given velocity level. Only those duration categories with non-zero content are reported in Appendix A.

These duration distributions provide an estimate of the likelihood and the length of time that specific velocity level exceedence events would occur. The duration of the single longest event exceeding a given velocity level is presented as the maximum duration.

The fourth measure of alongshore flow persistence is a distance equivalent to the maximum displacement (distance in kilometers), in either the positive or negative alongshore directions, assuming spatially uniform alongshore flow. This is similar to a progressive vector displacement. It is not a true Lagrangian displacement. Our maximum displacement is only an estimate of the true displacement and serves as an indicator for planning purposes. We cannot even determine whether this is a conservative or liberal indicator of a true Lagrangian displacement.

3. RESULTS

Mean velocity vectors (Figures 3, 5, 7, and 9) and variance axes (Figures 4, 6, 8, and 10) are presented for the winter (Figures 3 and 4), spring (Figures 5 and 6), summer (Figures 7 and 8), and fall (Figures 9 and 10) seasons, for the various geographical regions (eastern, central and western). Note that the western region is presented as two overlapping figures, (north)western and (south)western, to ensure complete geographical coverage at the same horizontal scale. Three subregions, one each in the eastern, central and (north)western regions, are presented with expanded horizontal scales where close packed stations make interpretation difficult. The discussion of results will focus on the alongshore velocity component, although cross-shore component information is presented in the figures and tables.

In the following, eastward flow (positive alongshore velocities) and westward flow (negative alongshore velocities) will refer to flow moving to one's right (left) if facing the coast from the Gulf of Mexico. Although the coast trends roughly east-west across most of the northern Gulf of Mexico, the Texas coast curves to trend nearly north-south. References to onshore flow (positive cross-shore velocities) and off-shore flow (negative cross-shore velocities) are locally normal to the coast.

Linear relationships between various flow statistics and alongshelf distance are presented. These are not meant to be predictive relationships. In many cases larger coefficients of correlation might have been obtained using higher degree polynomials or non-linear models. As general tendencies were desired, the linear models were deemed sufficient.

Distance was measured from the Mississippi River delta, and determined as the longitudinal distance for stations east of 94°W. Here the coastal orientation turns southwest and alongshelf distance was determined as the great circle distance from 29.5°N, 94°W.

3.1 Seasonal Flow

3.1.1 Winter

Winter mean flows were predominantly alongshore to the west in all regions (Figure 3), with an increasing magnitude with alongshelf distance to the west that was statistically significant at the 99% level (Figure 11). The few exceptions to westward flow were found in the eastern region at stations COE MS C1 and MS C2 (Figure 3a) (near 30°N

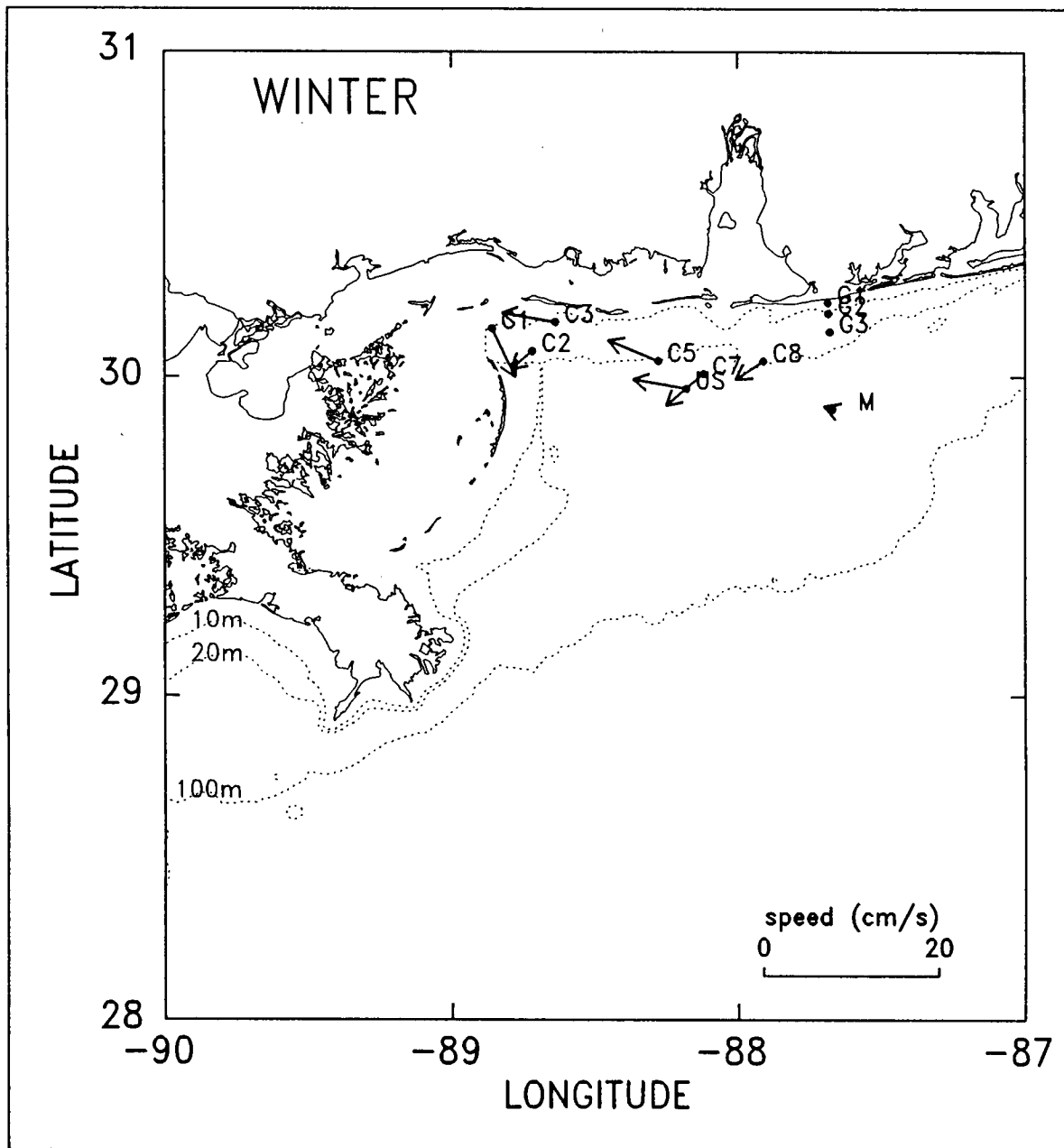


Figure 3a. Winter mean velocity vectors for eastern region. Mooring locations are plotted as dots; the mean vectors are in direction of flow.

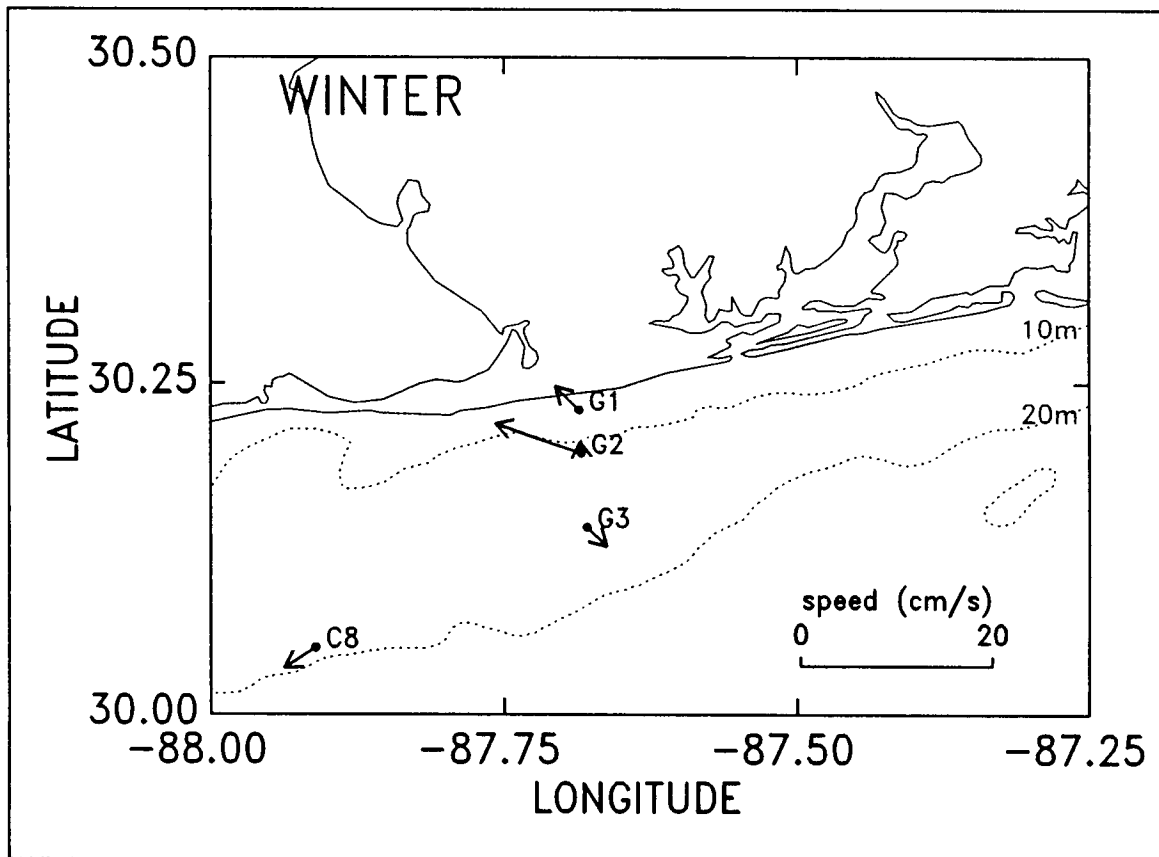


Figure 3b. Winter mean velocity vectors for eastern region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

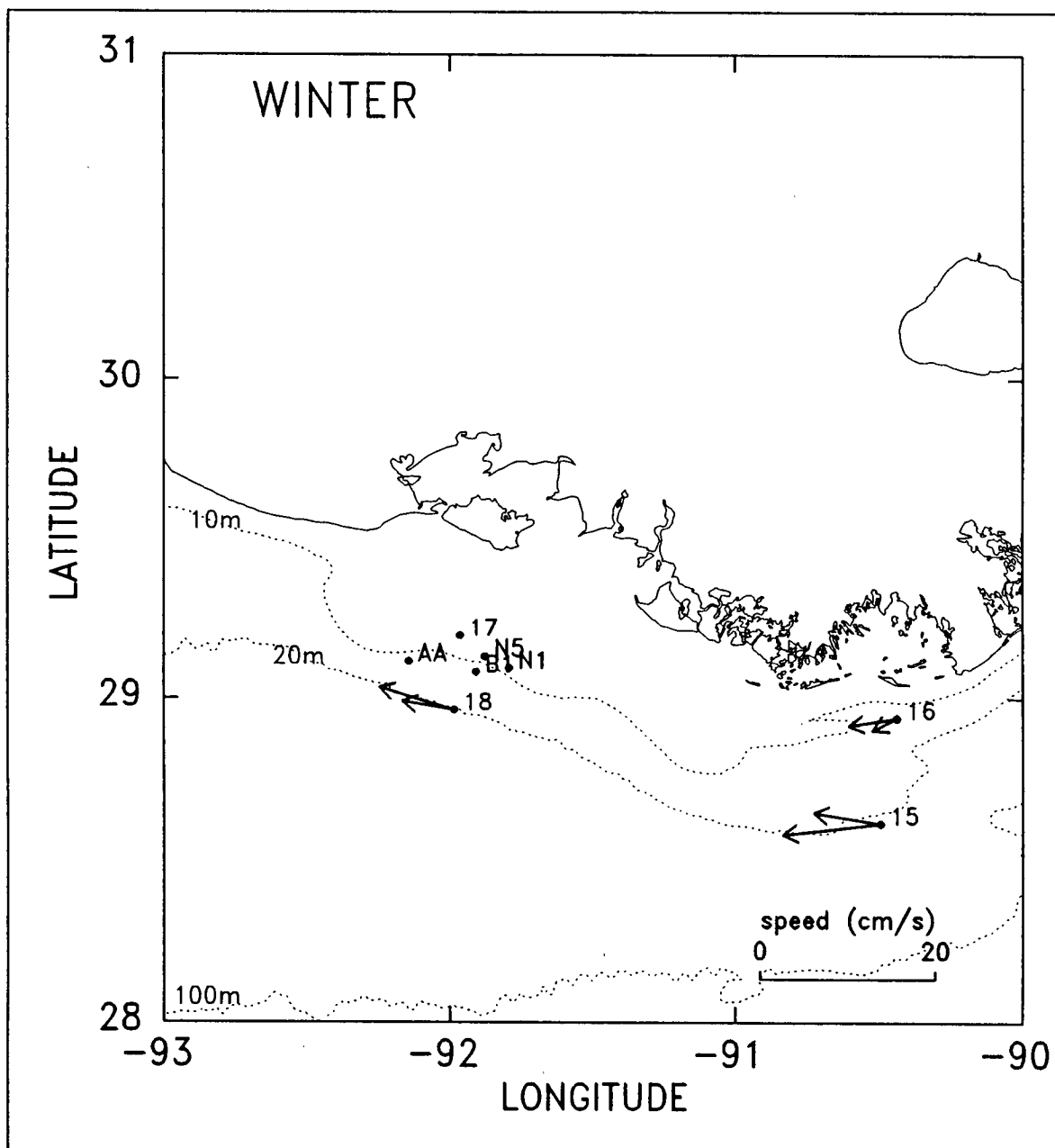


Figure 3c. Winter mean velocity vectors for central region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

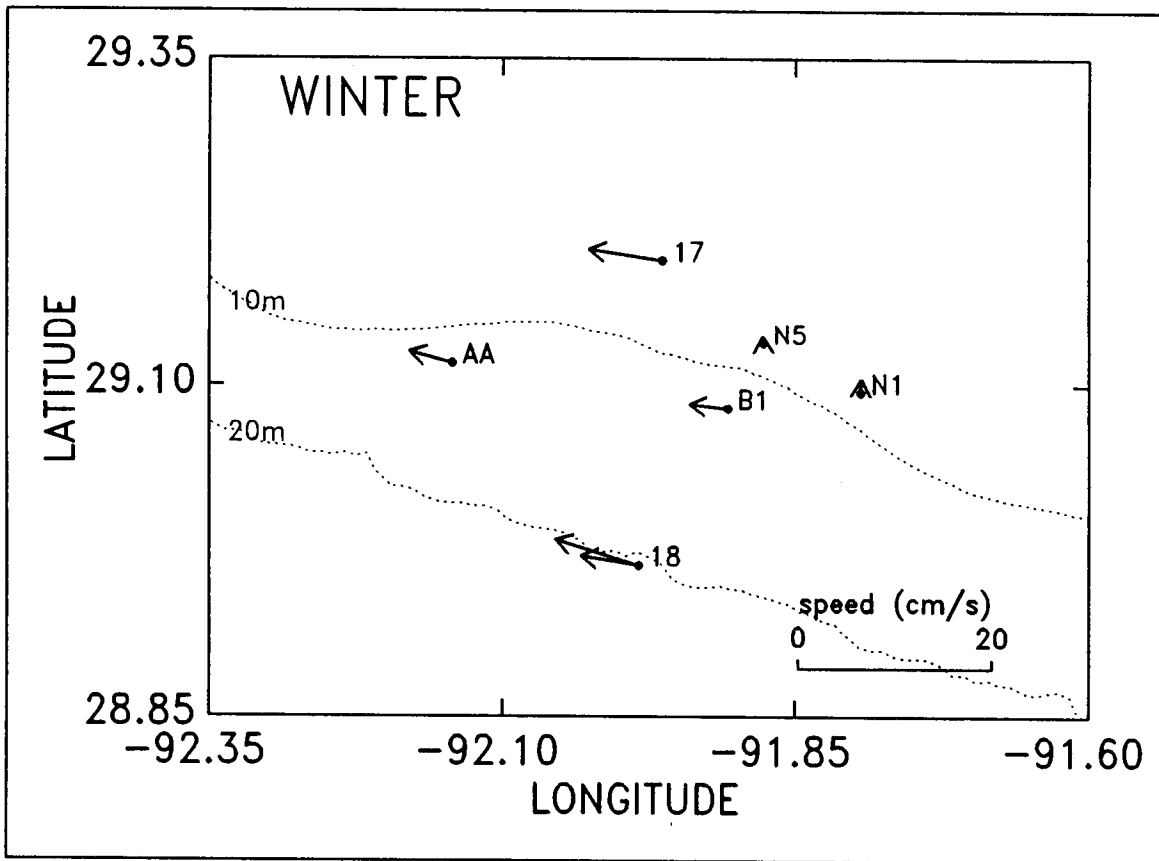


Figure 3d. Winter mean velocity vectors for central region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

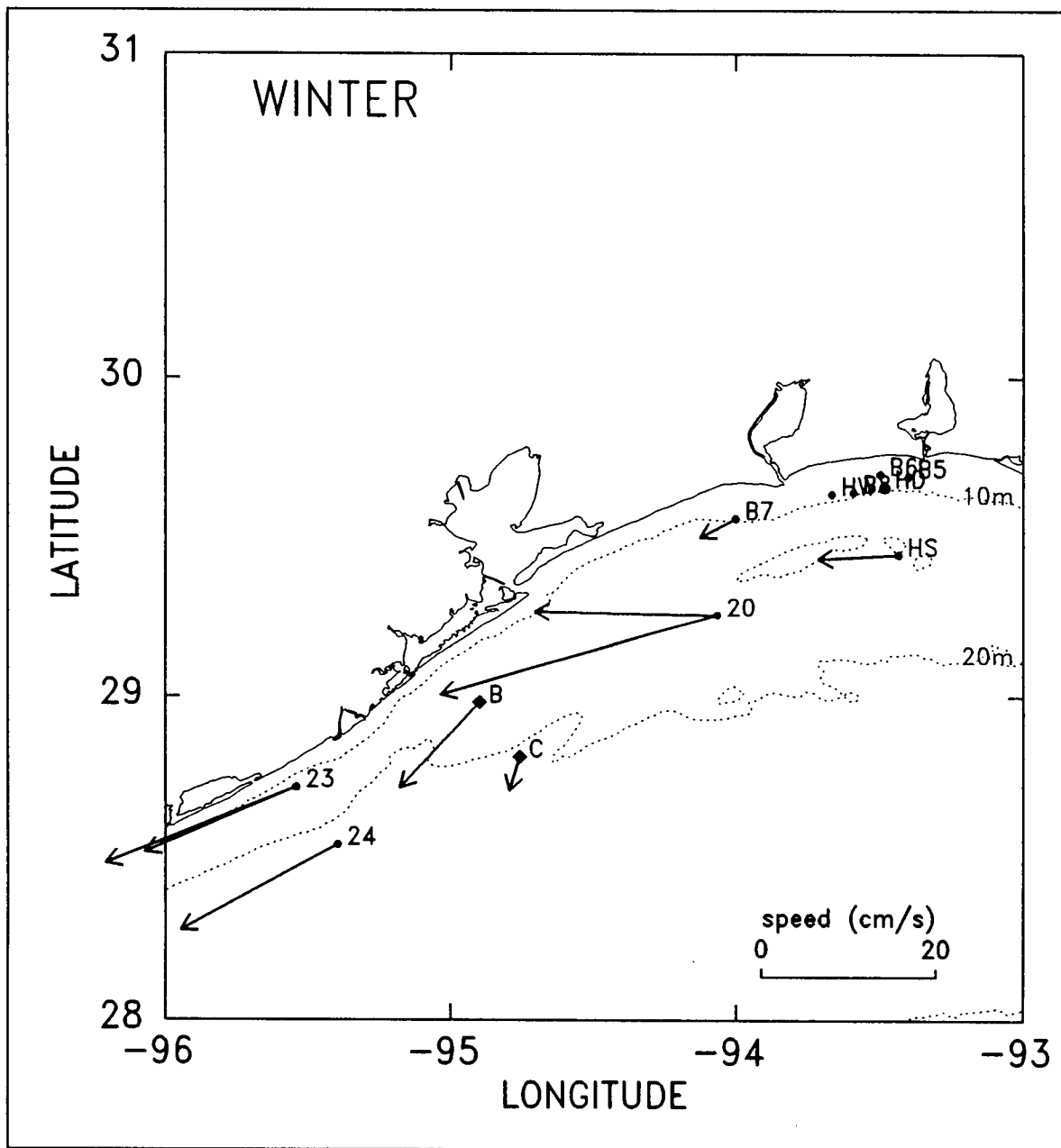


Figure 3e. Winter mean velocity vectors for (north)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

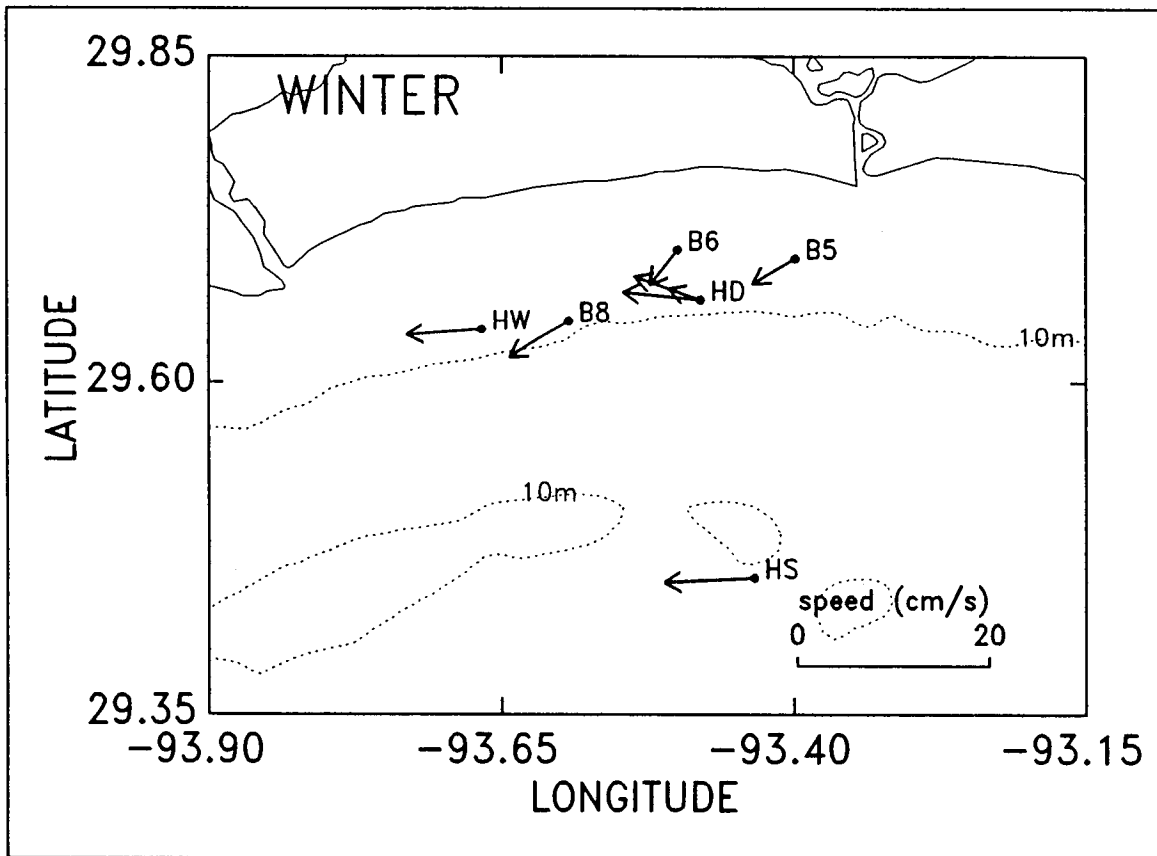


Figure 3f. Winter mean velocity vectors for (north)western region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

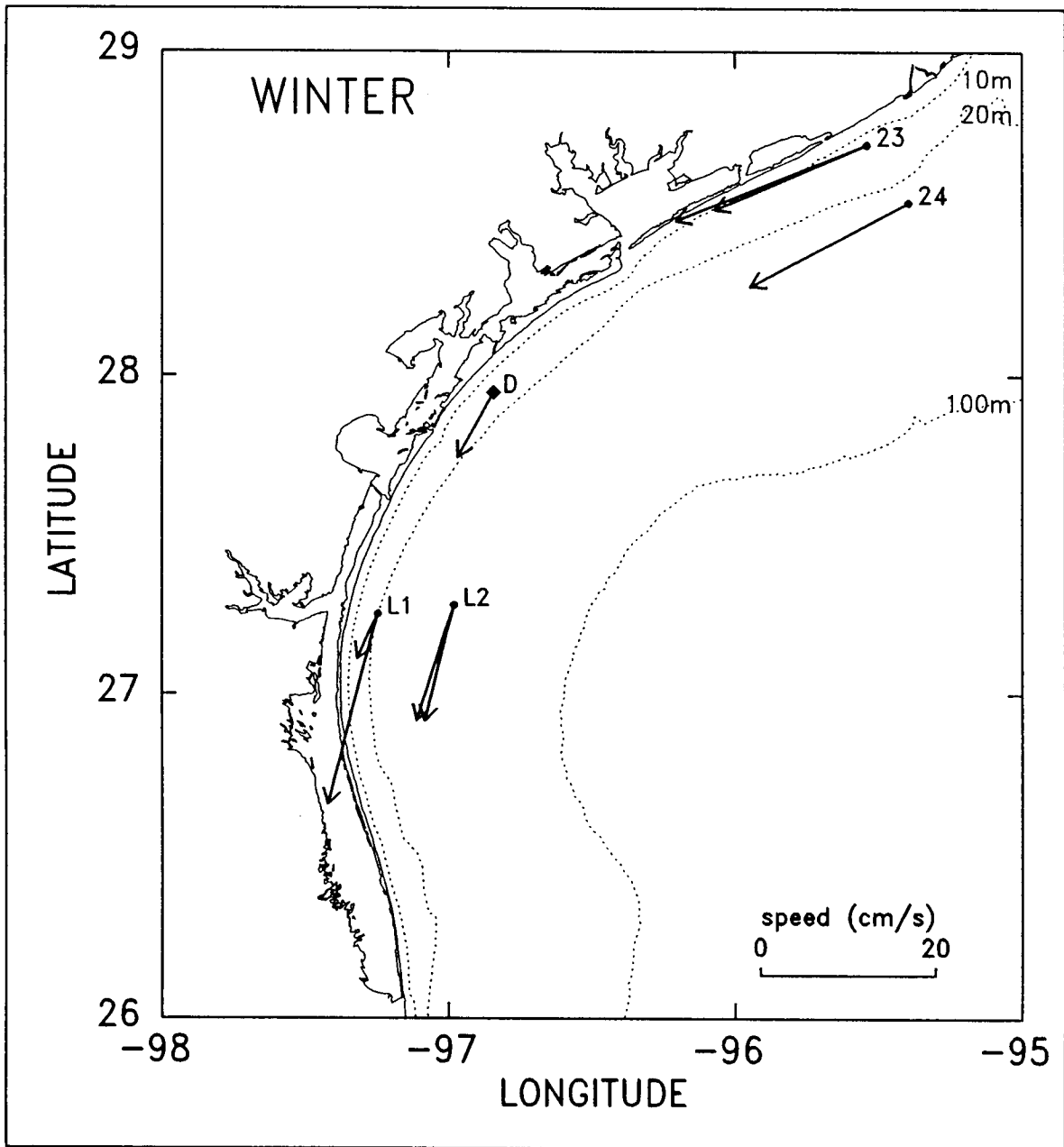


Figure 3g. Winter mean velocity vectors for (south)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

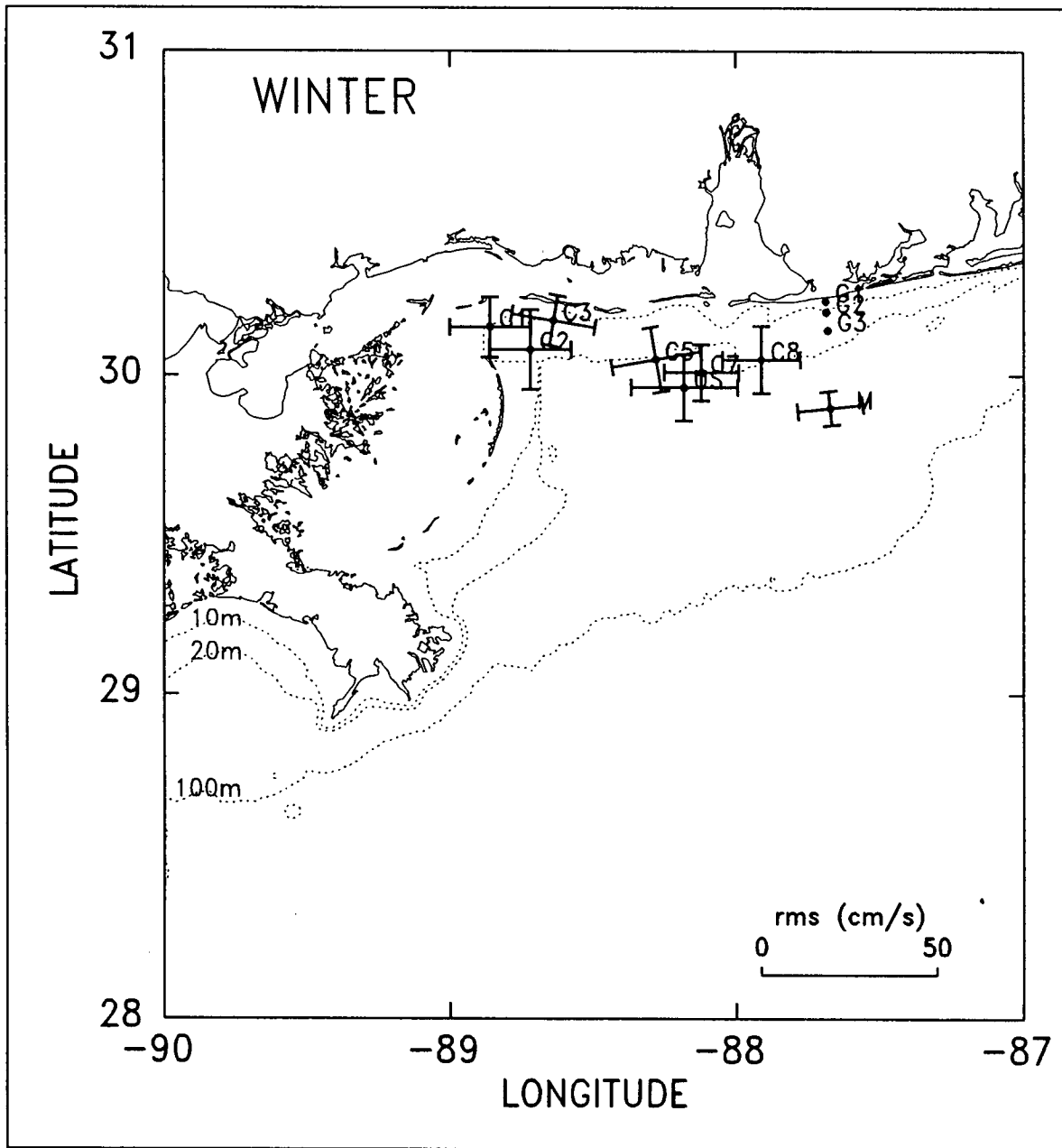


Figure 4a. Winter velocity variance axes for eastern region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore.

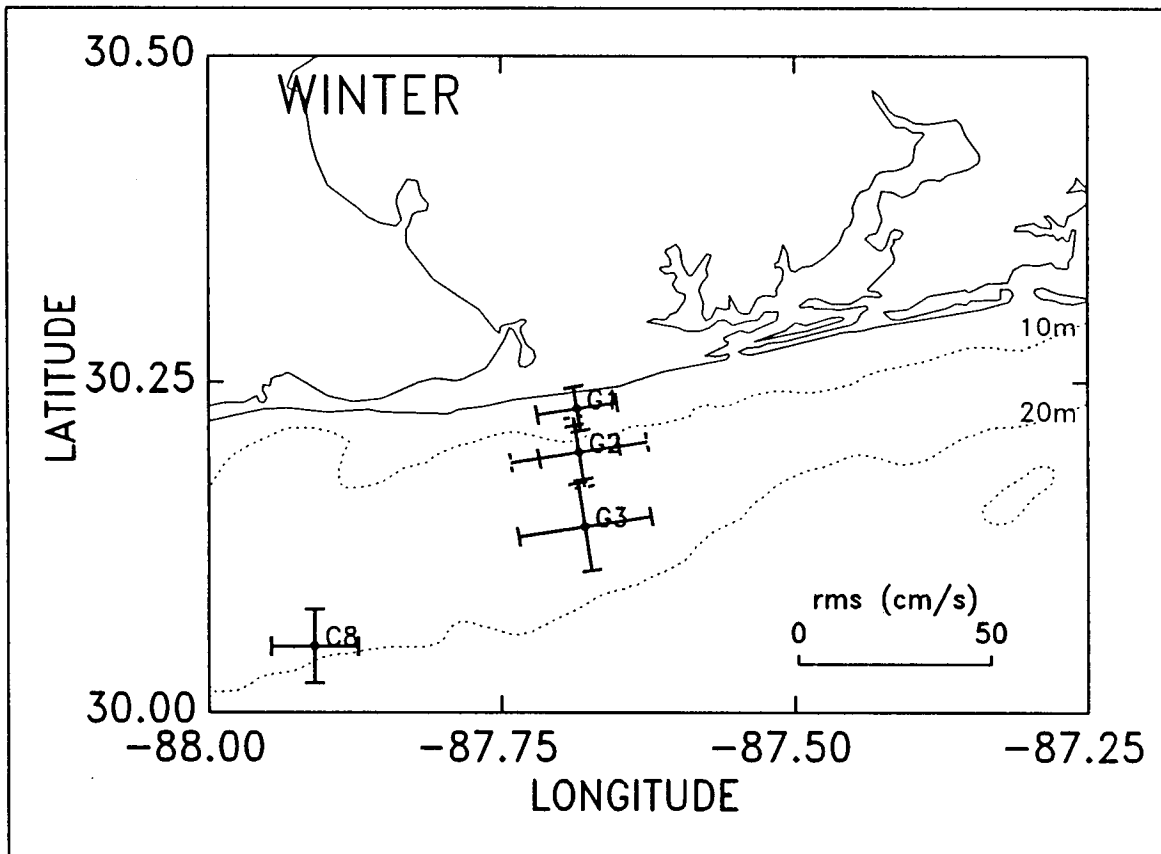


Figure 4b. Winter velocity variance axes for eastern region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

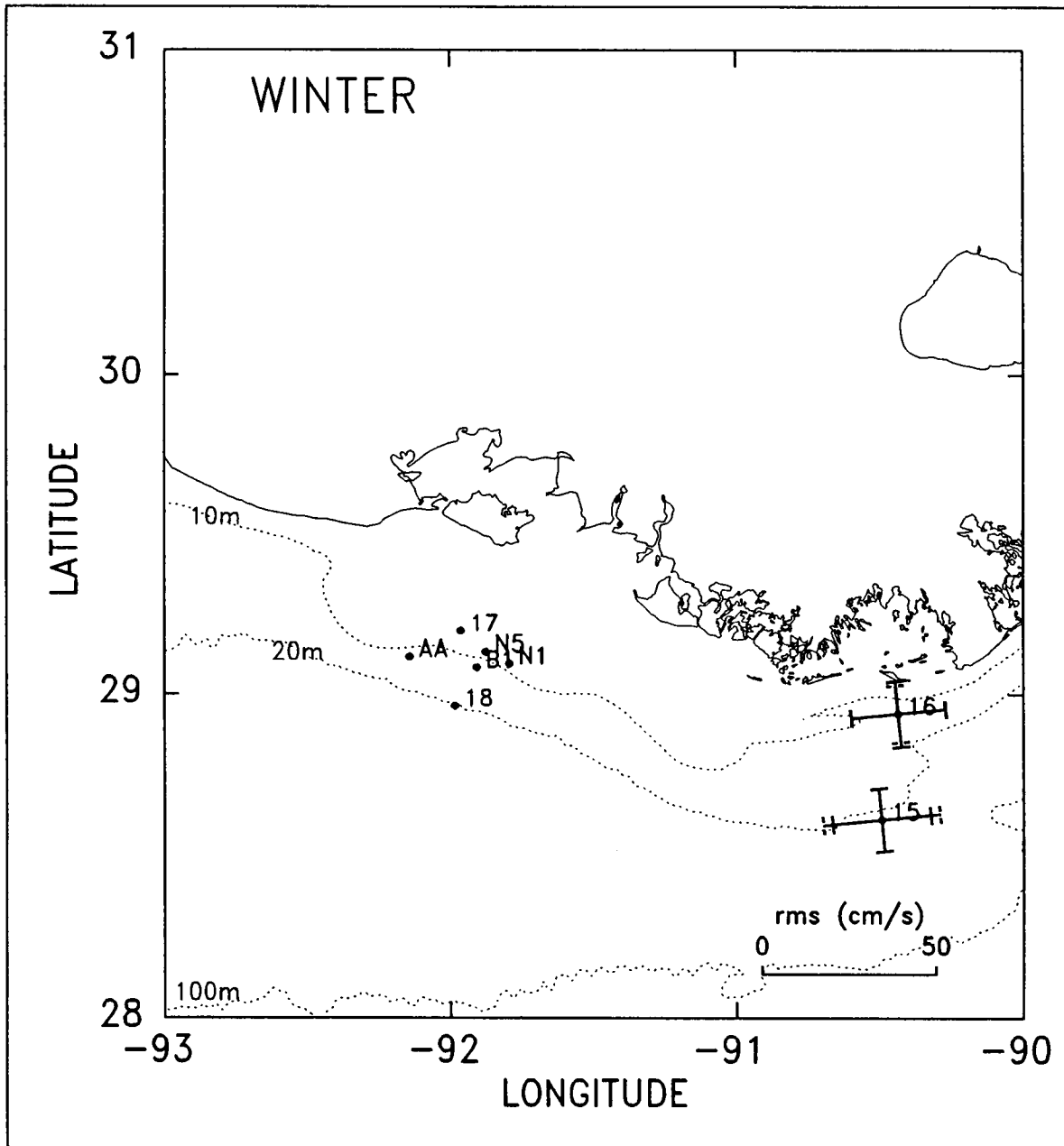


Figure 4c. Winter velocity variance axes for central region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

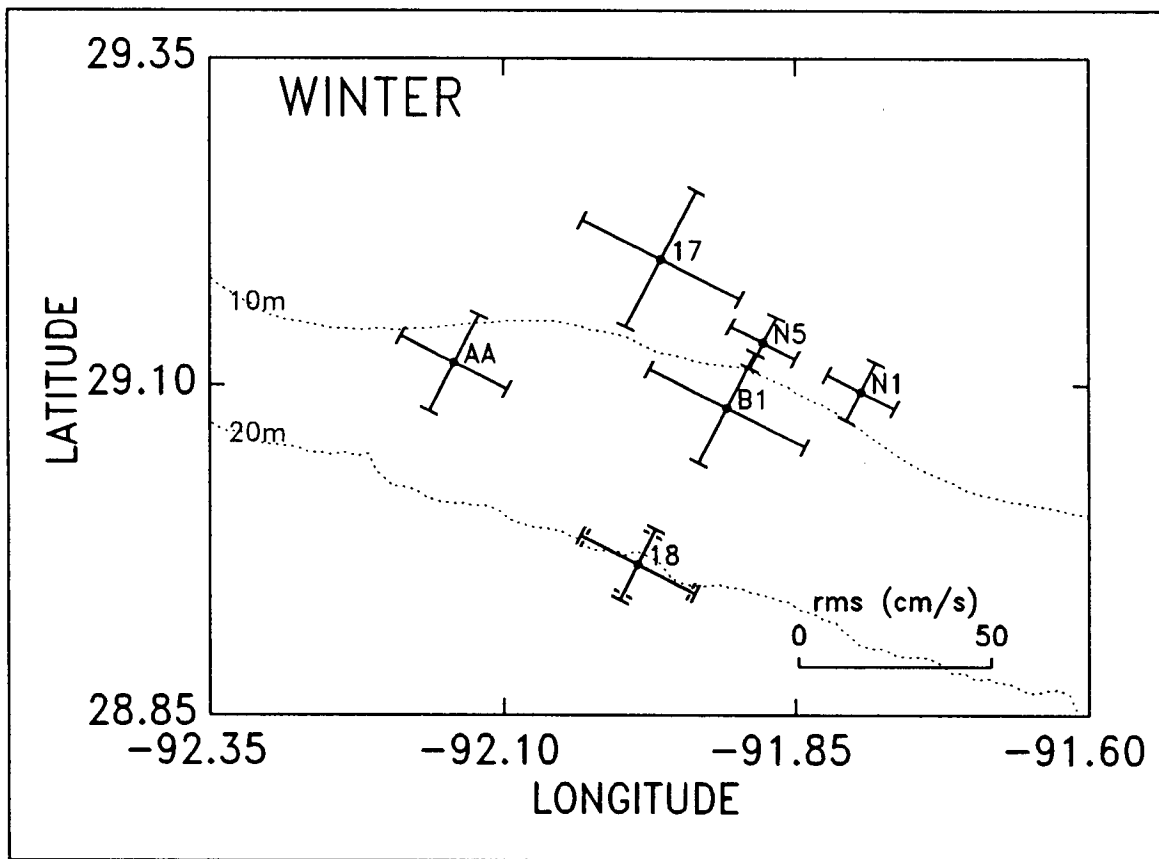


Figure 4d. Winter velocity variance axes for central region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

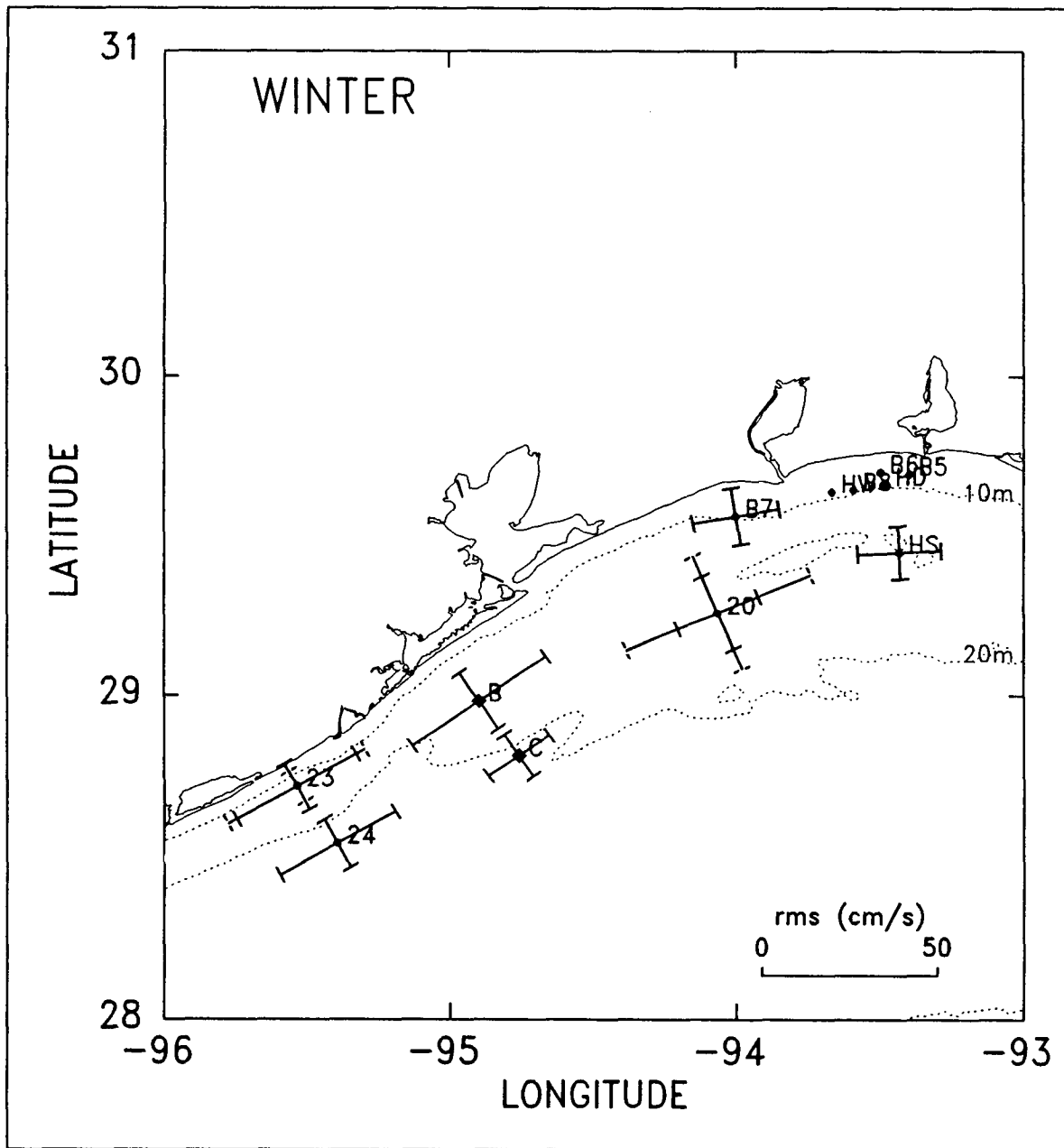


Figure 4e. Winter velocity variance axes for (north)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

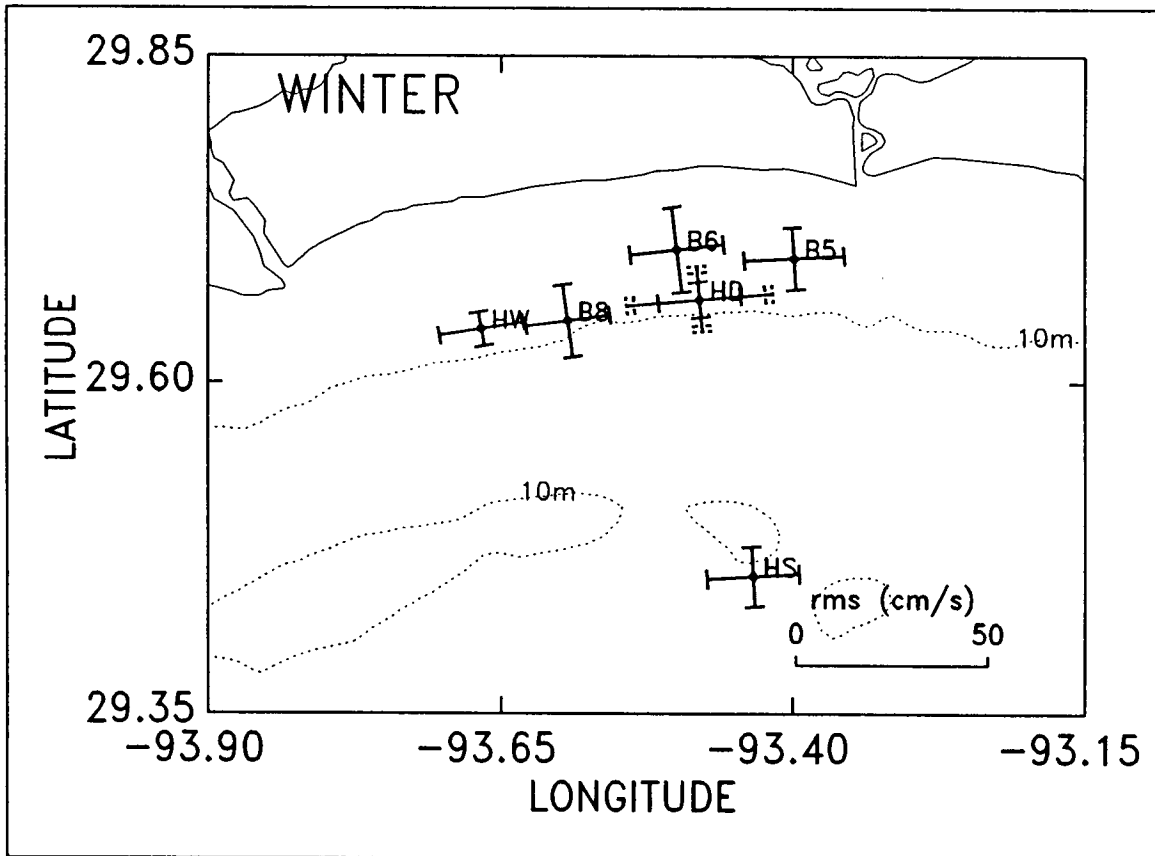


Figure 4f. Winter velocity variance axes for (north)western region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

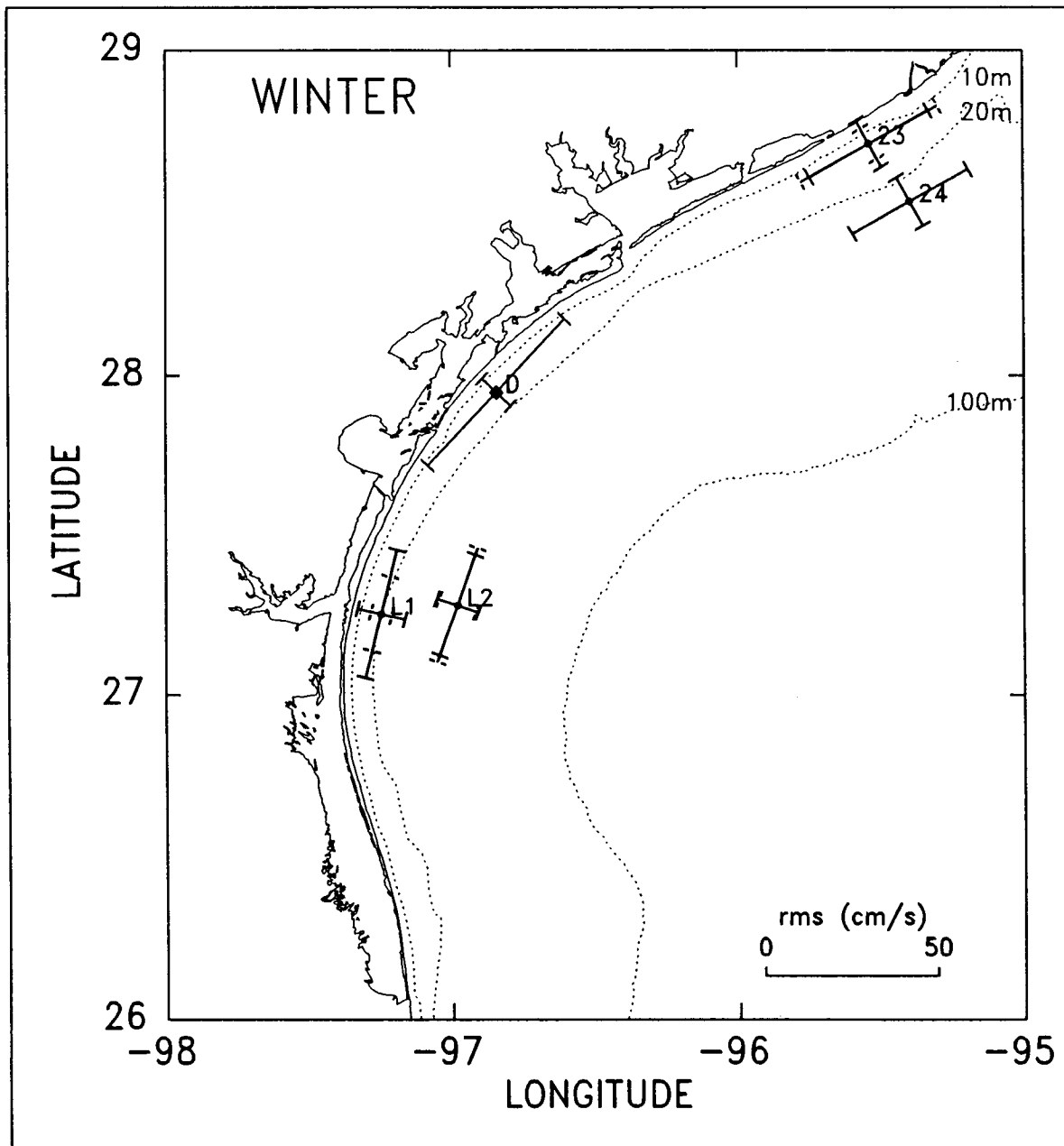


Figure 4g. Winter velocity variance axes for (south)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

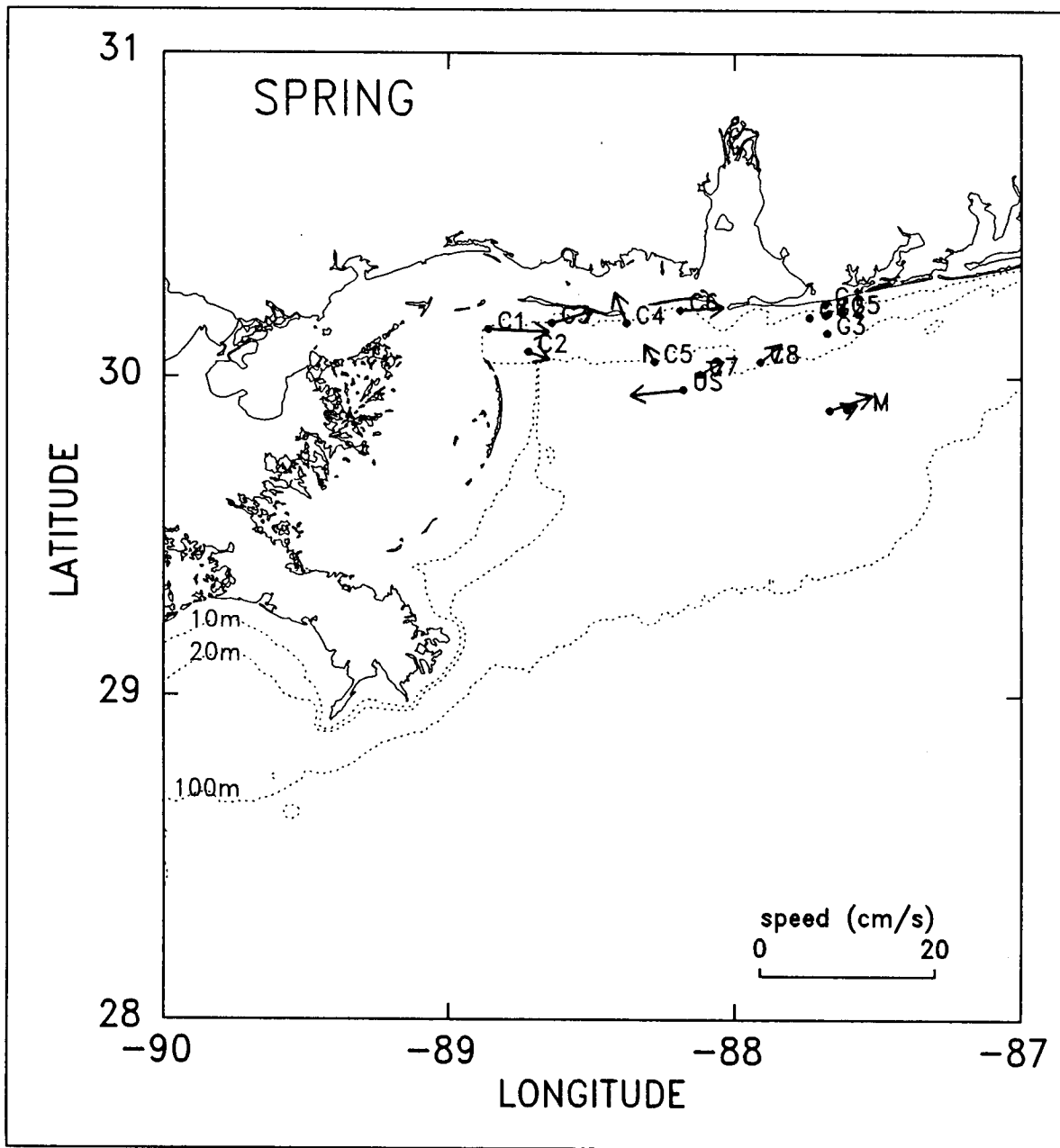


Figure 5a. Spring mean velocity vectors for eastern region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

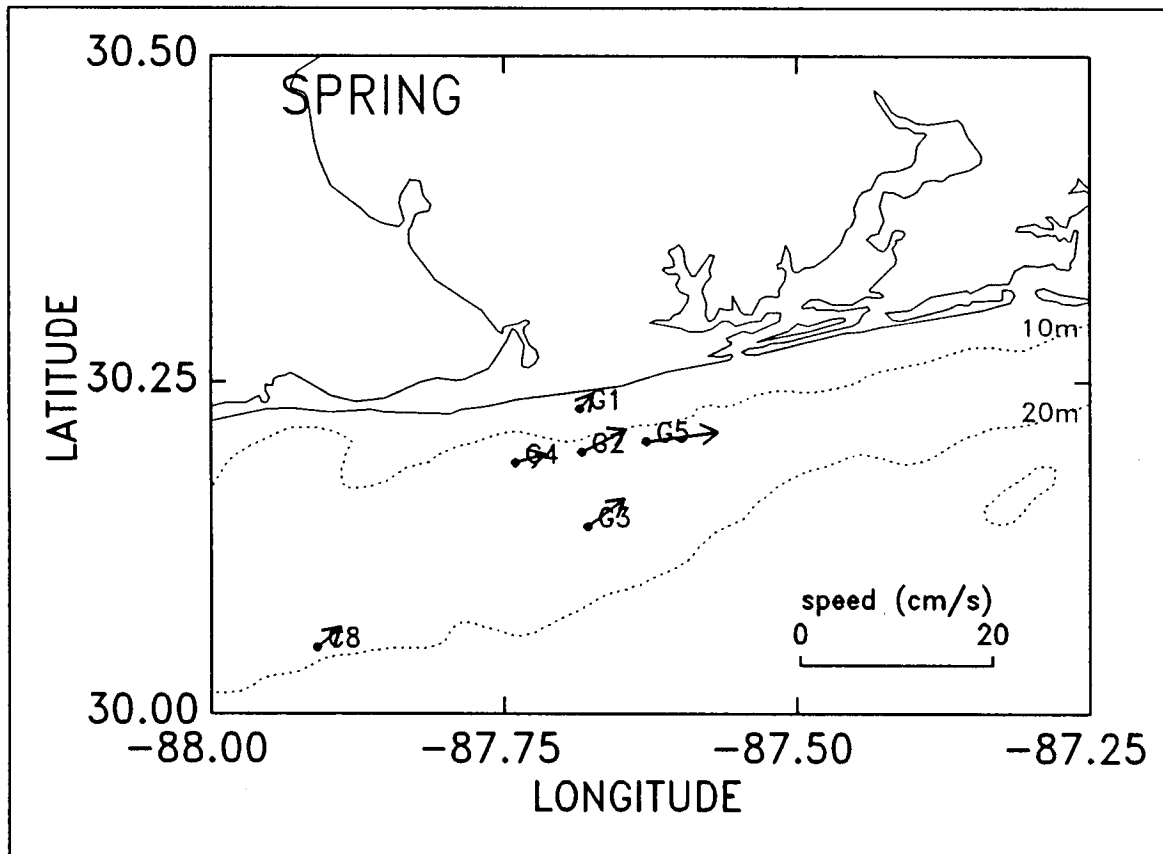


Figure 5b. Spring mean velocity vectors for eastern region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow.

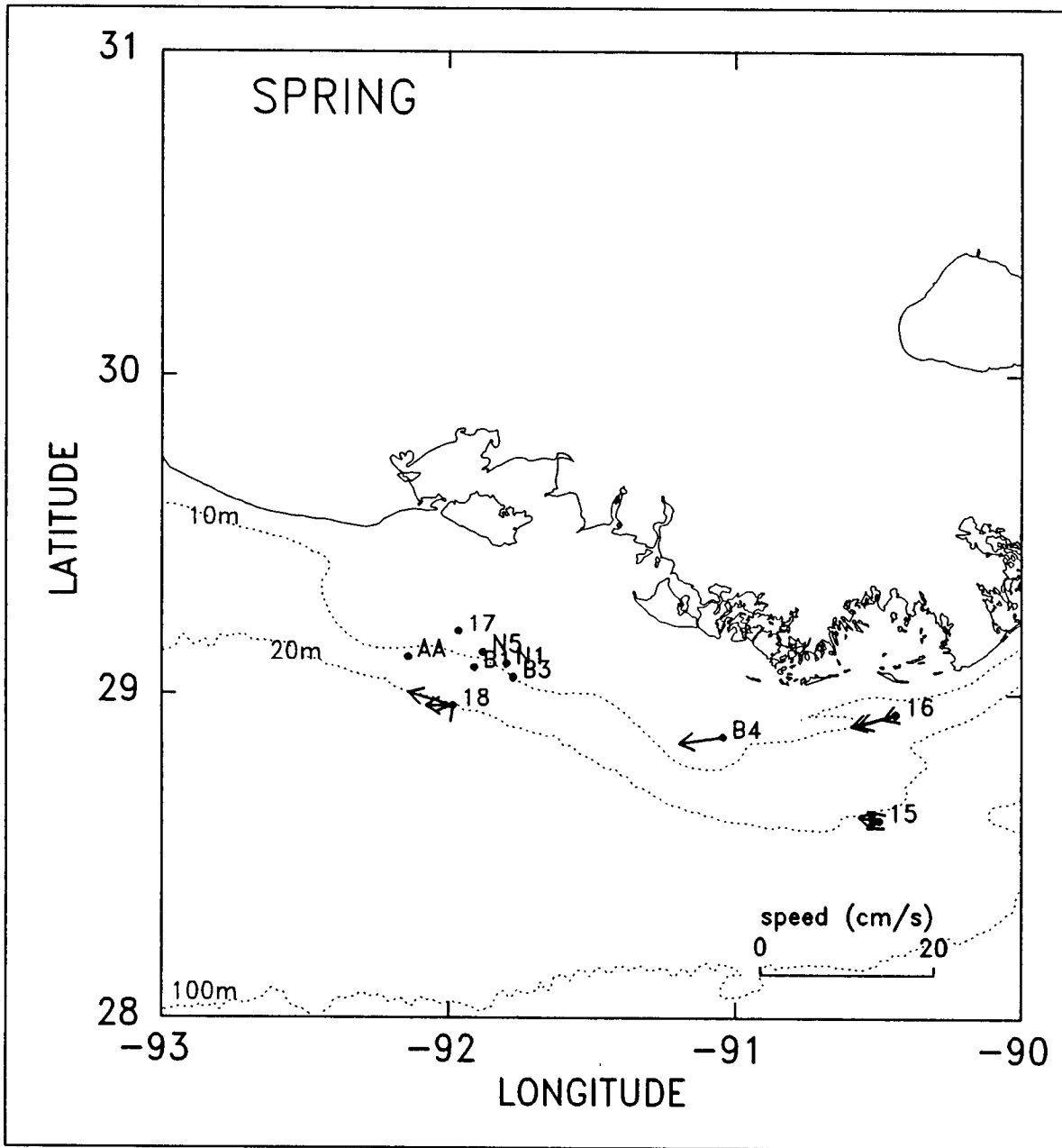


Figure 5c. Spring mean velocity vectors for central region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

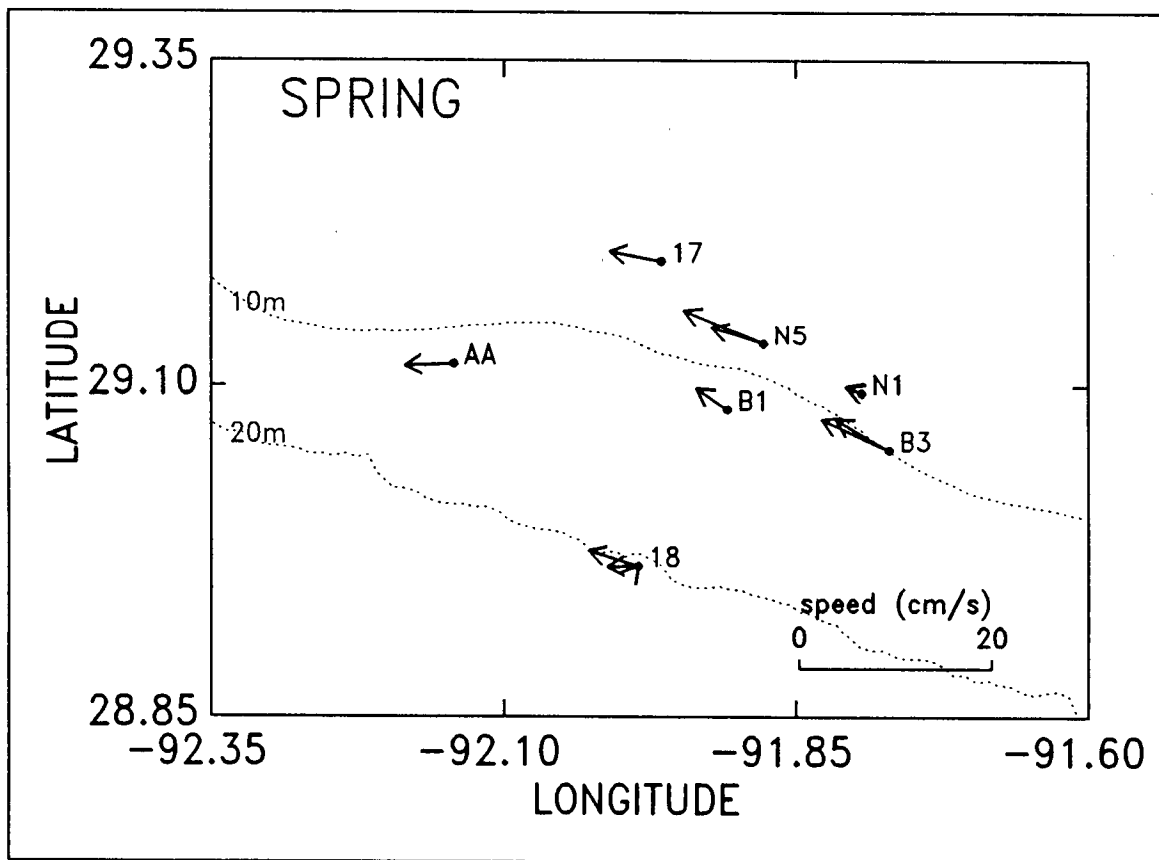


Figure 5d. Spring mean velocity vectors for central region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

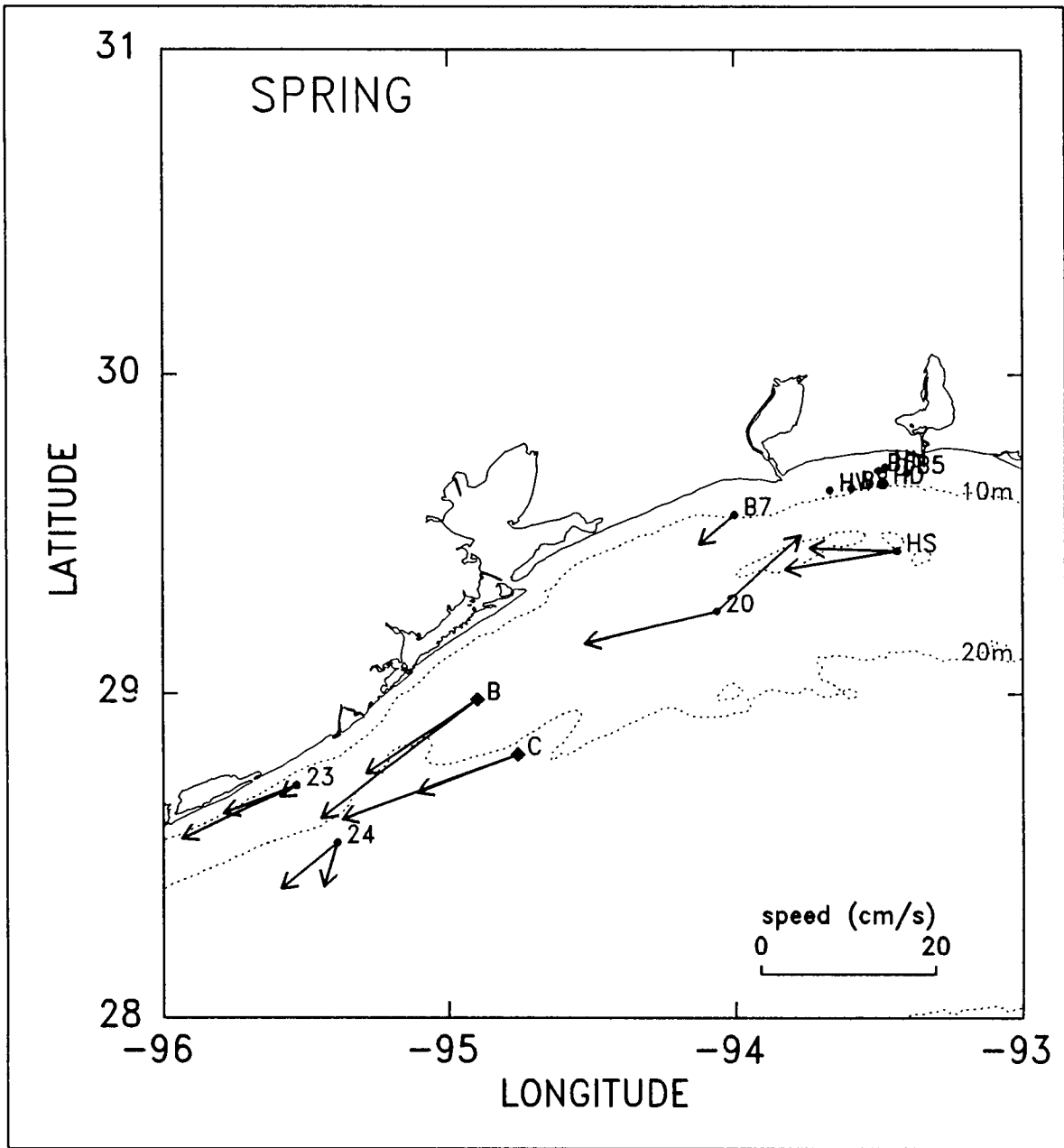


Figure 5e. Spring mean velocity vectors for (north)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

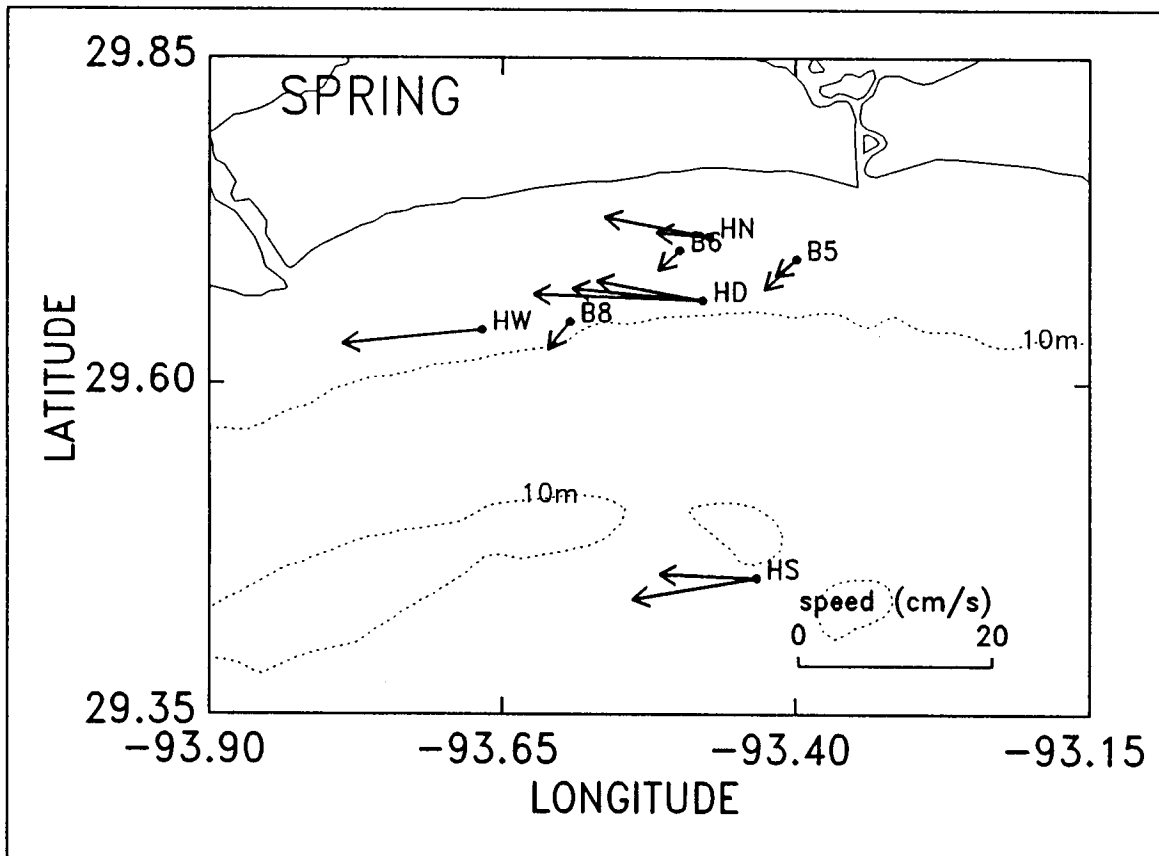


Figure 5f. Spring mean velocity vectors for (north)western region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

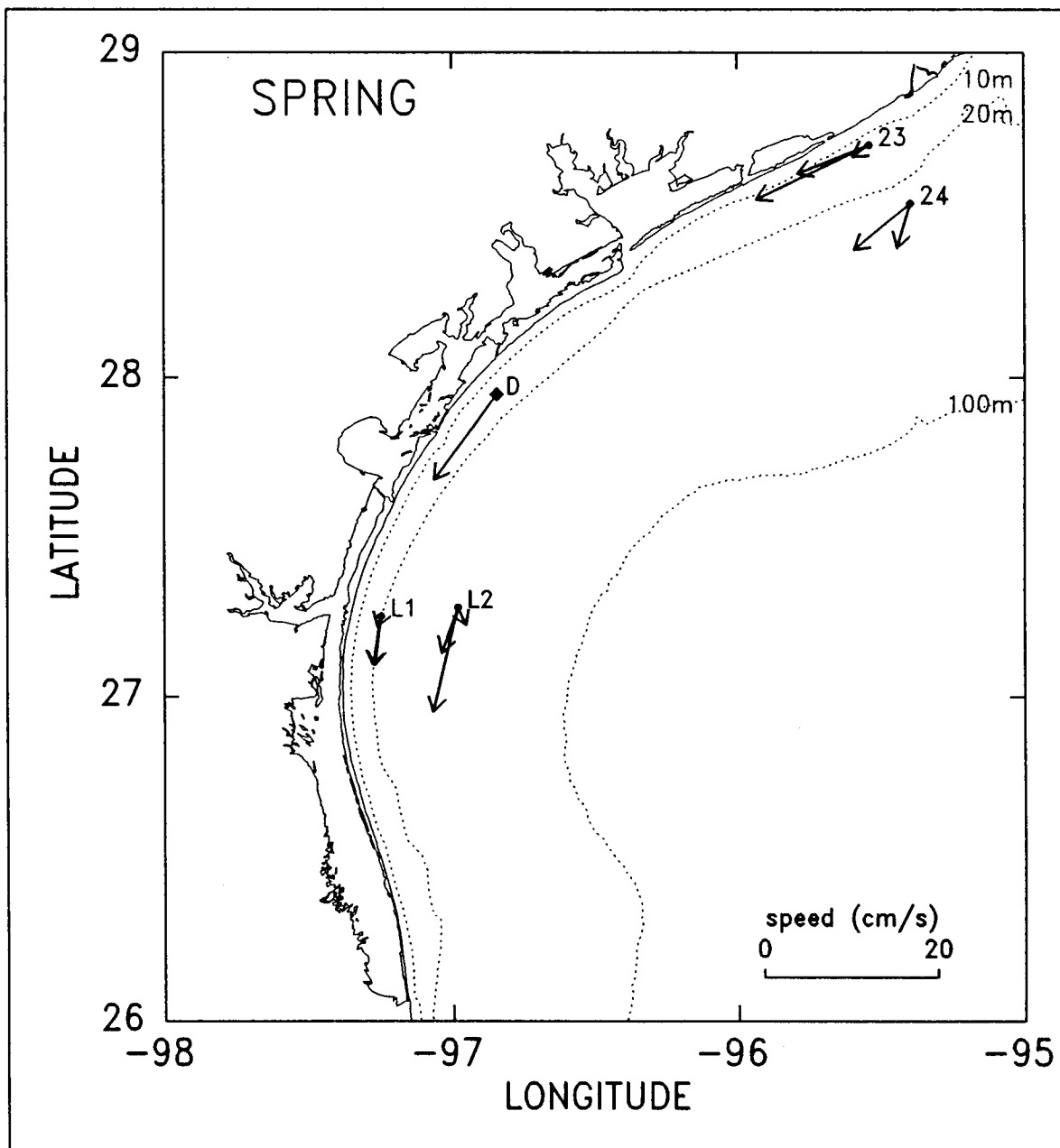


Figure 5g. Spring mean velocity vectors for (south)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

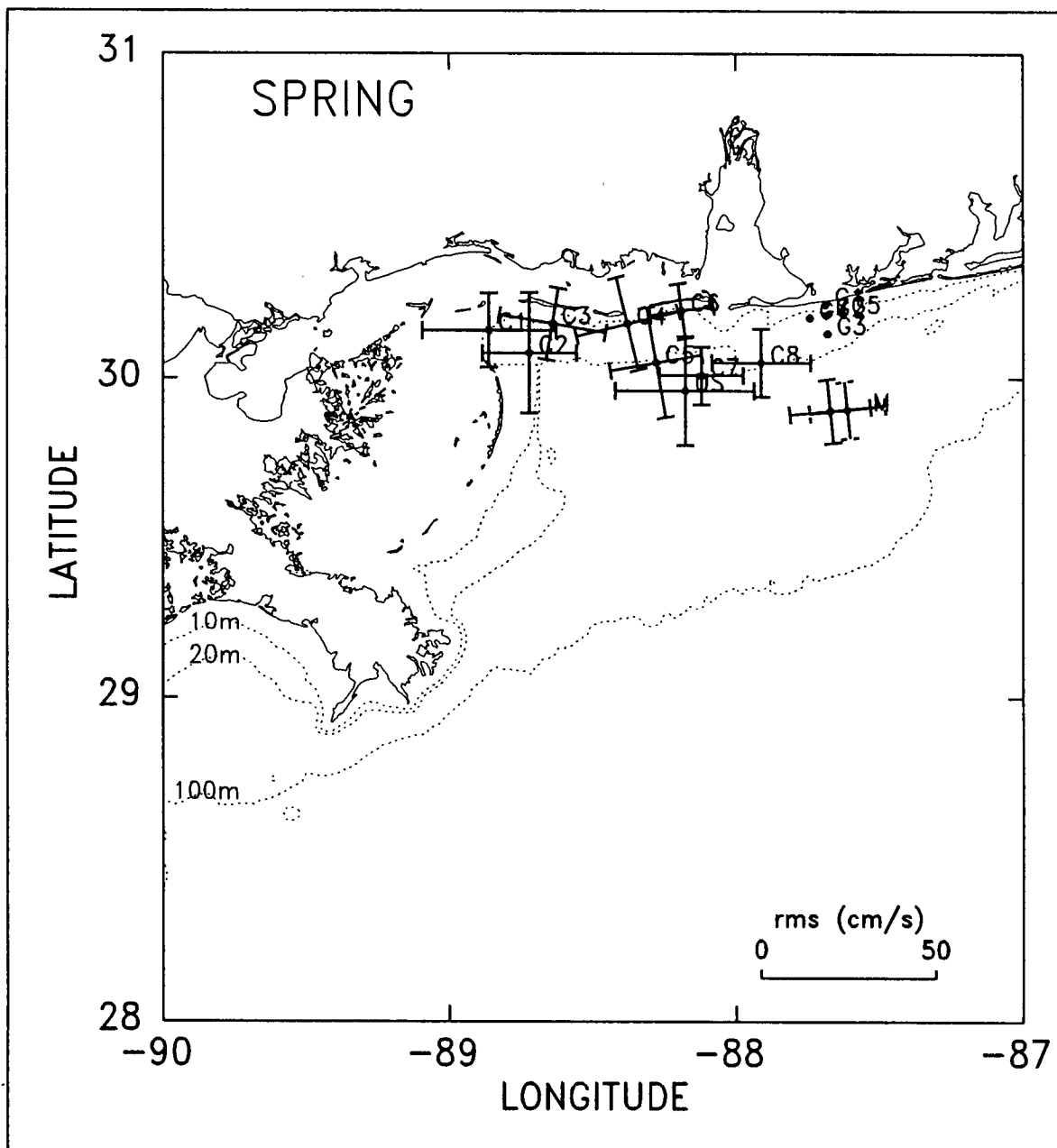


Figure 6a. Spring velocity variance axes for eastern region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

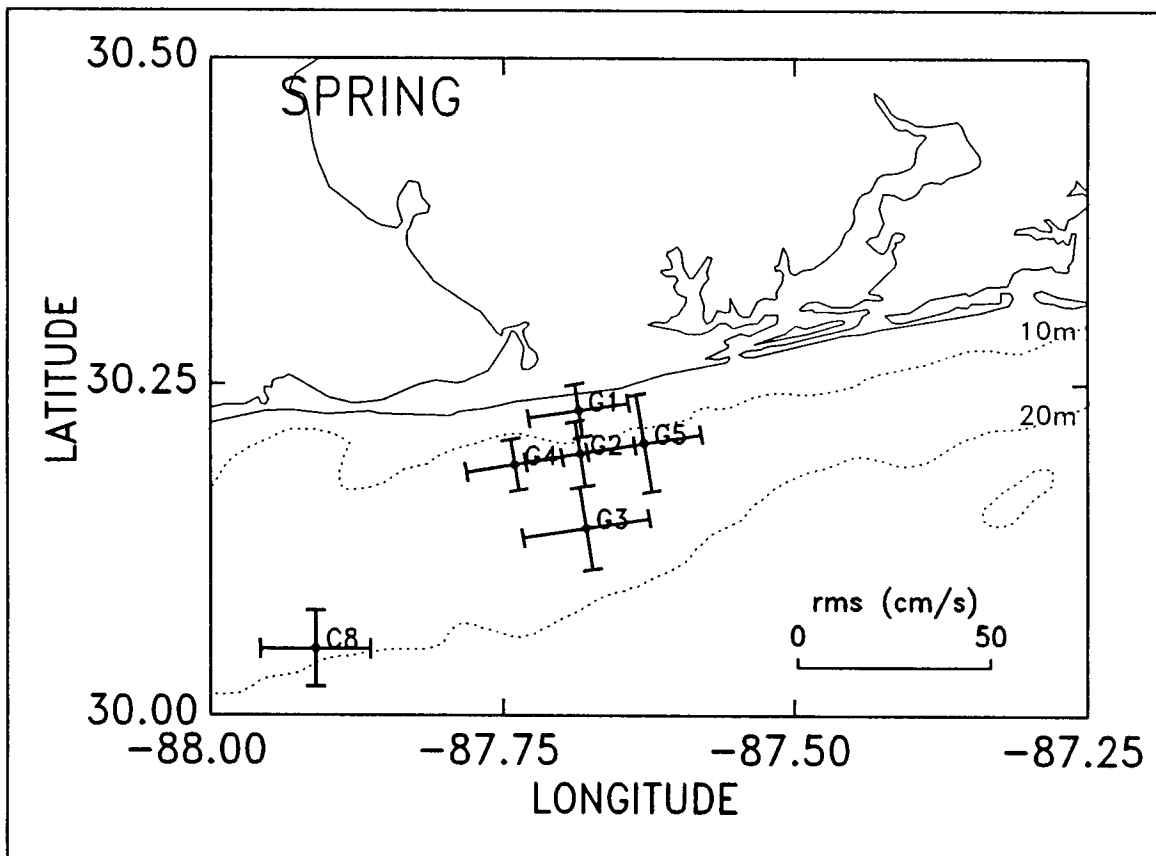


Figure 6b. Spring velocity variance axes for eastern region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore.

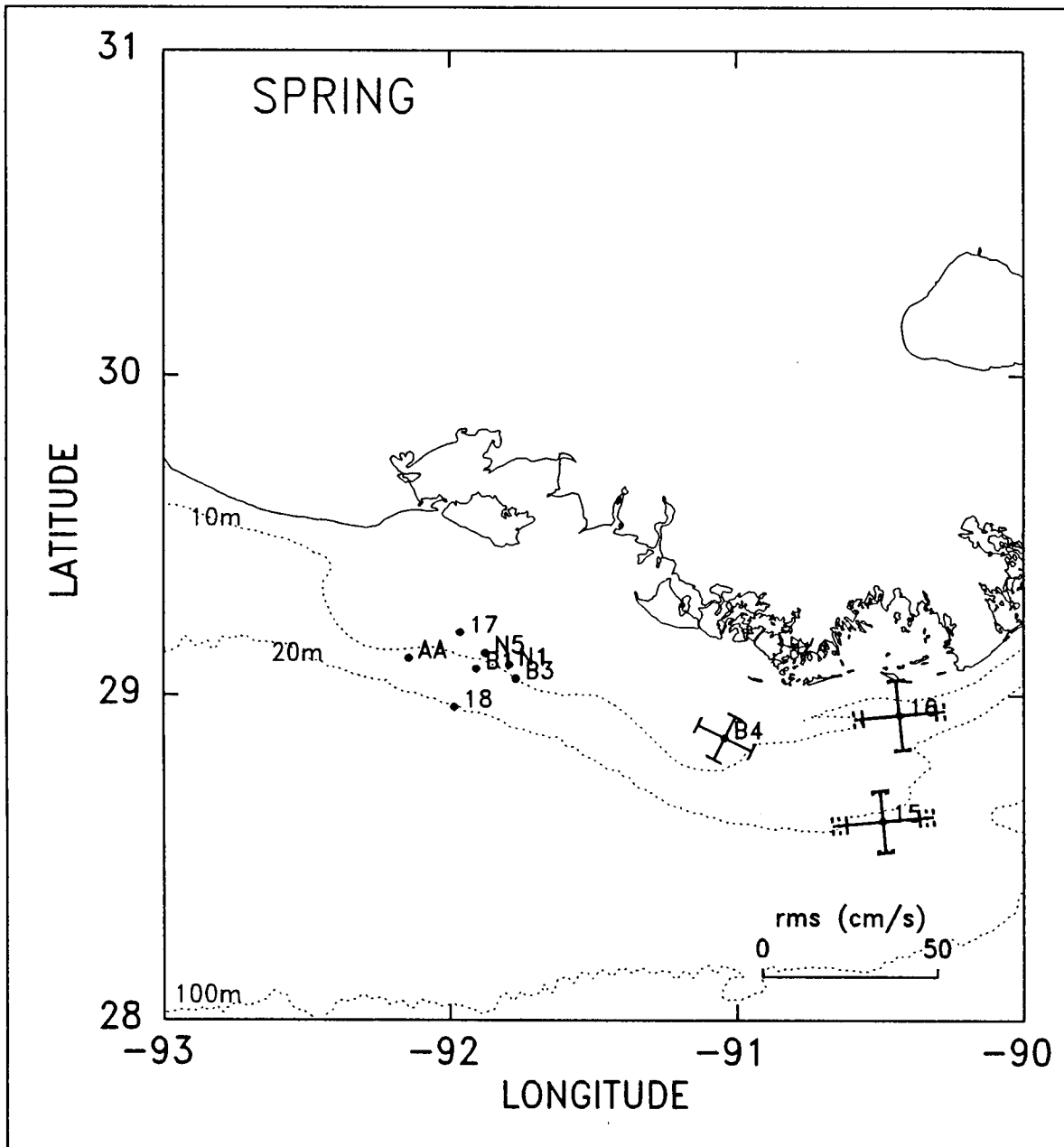


Figure 6c. Spring velocity variance axes for central region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

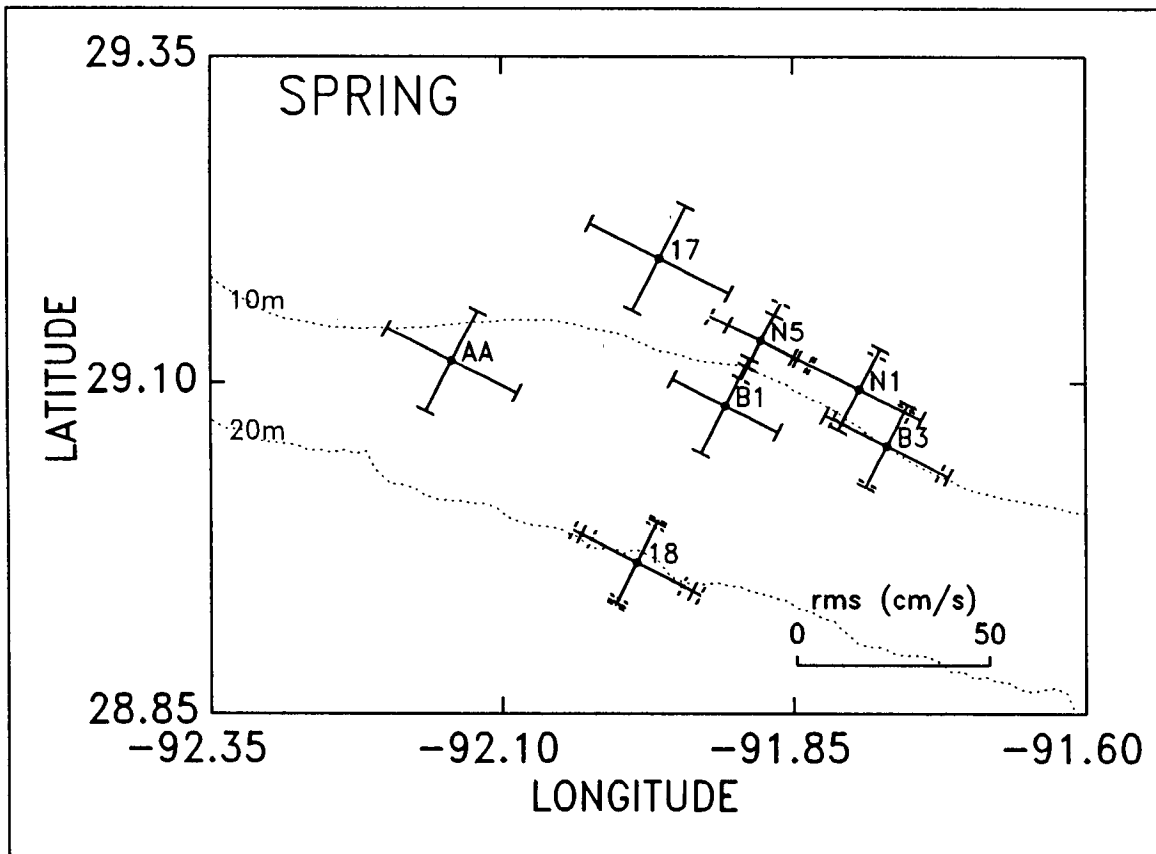


Figure 6d. Spring velocity variance axes for central region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

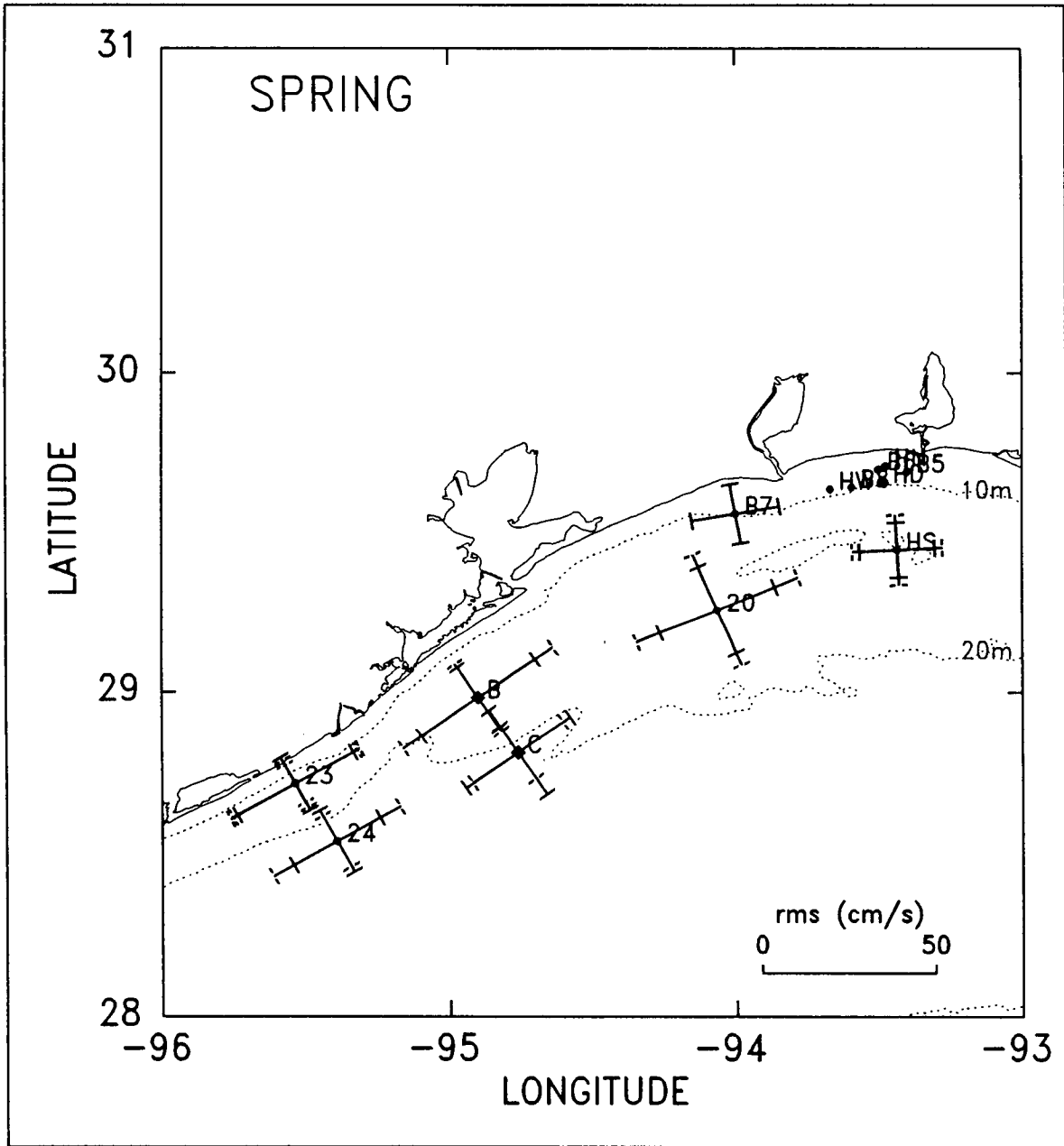


Figure 6e. Spring velocity variance axes for (north)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

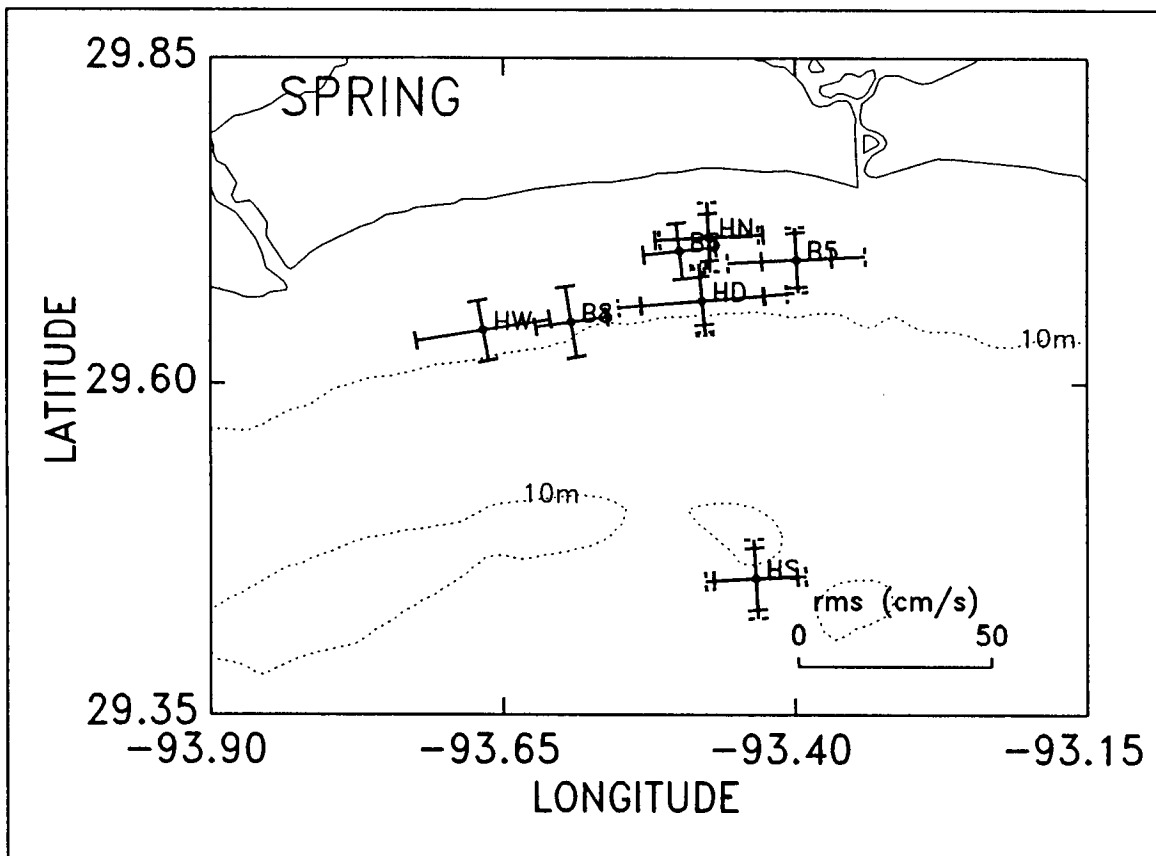


Figure 6f. Spring velocity variance axes for (north)western region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

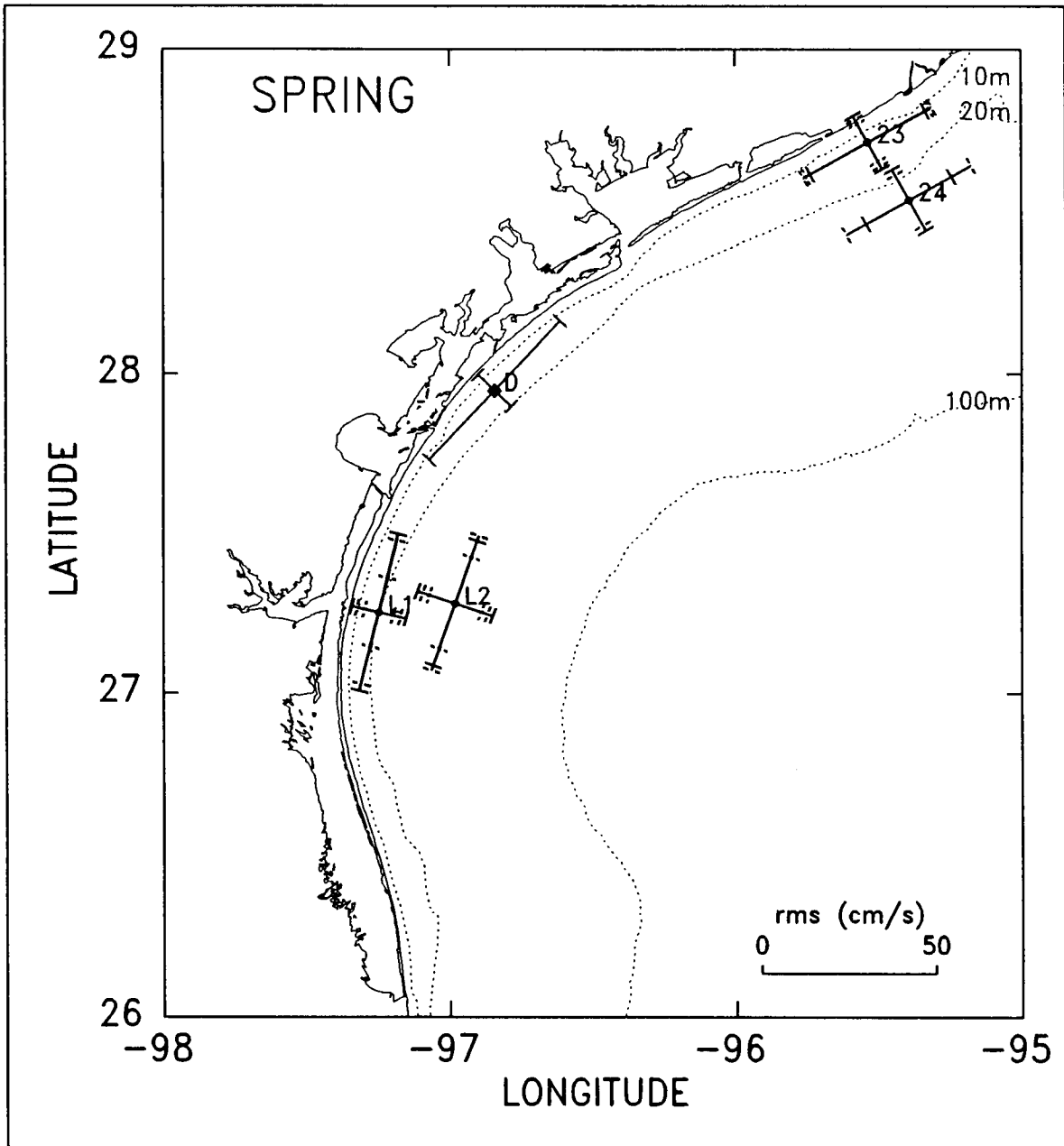


Figure 6g. Spring velocity variance axes for (south)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

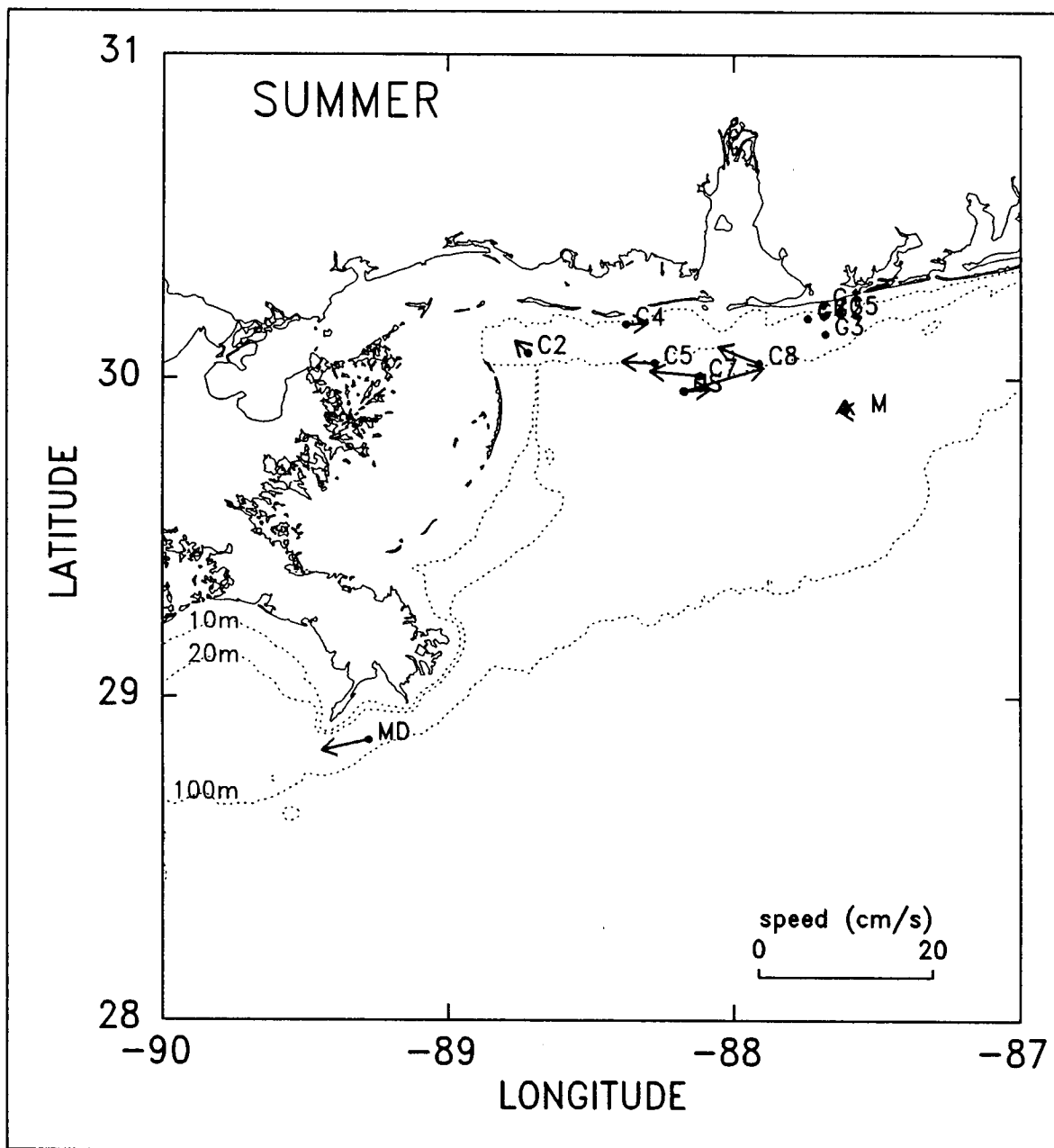


Figure 7a. Summer mean velocity vectors for eastern region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

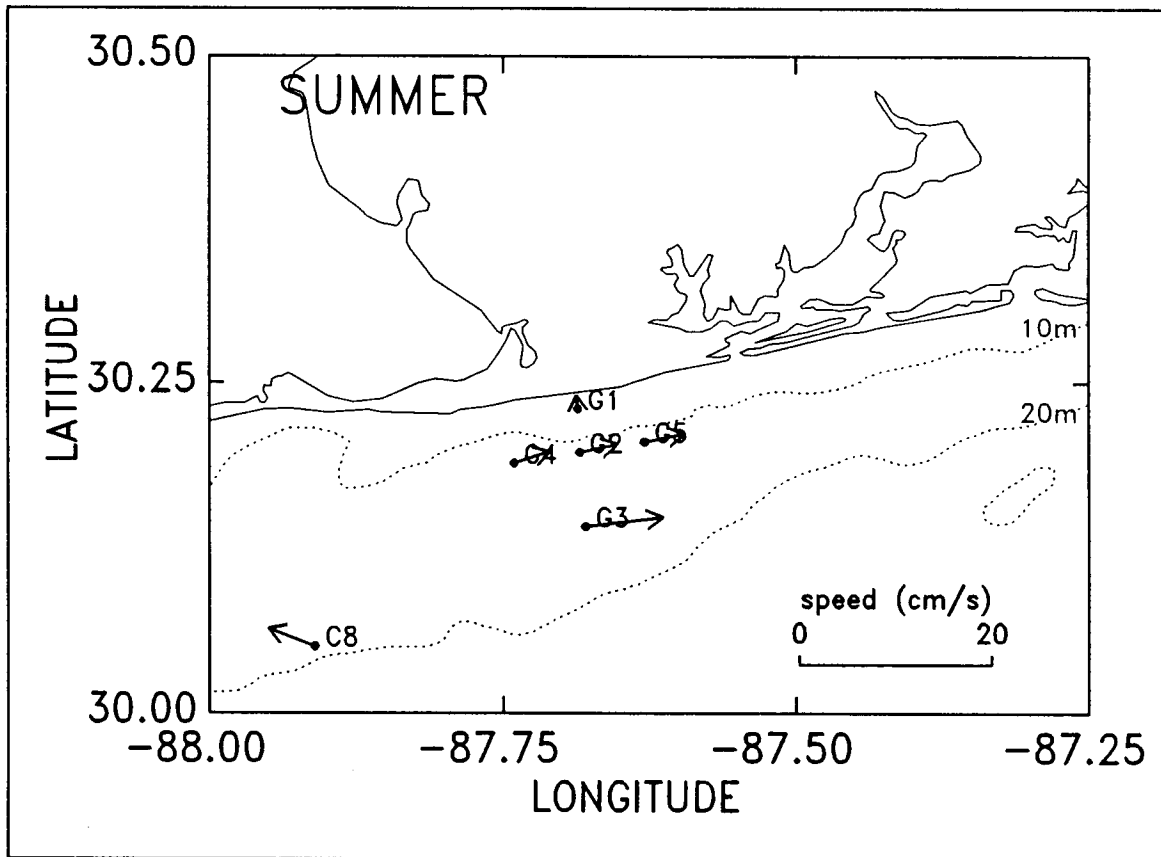


Figure 7b. Summer mean velocity vectors for eastern region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow.

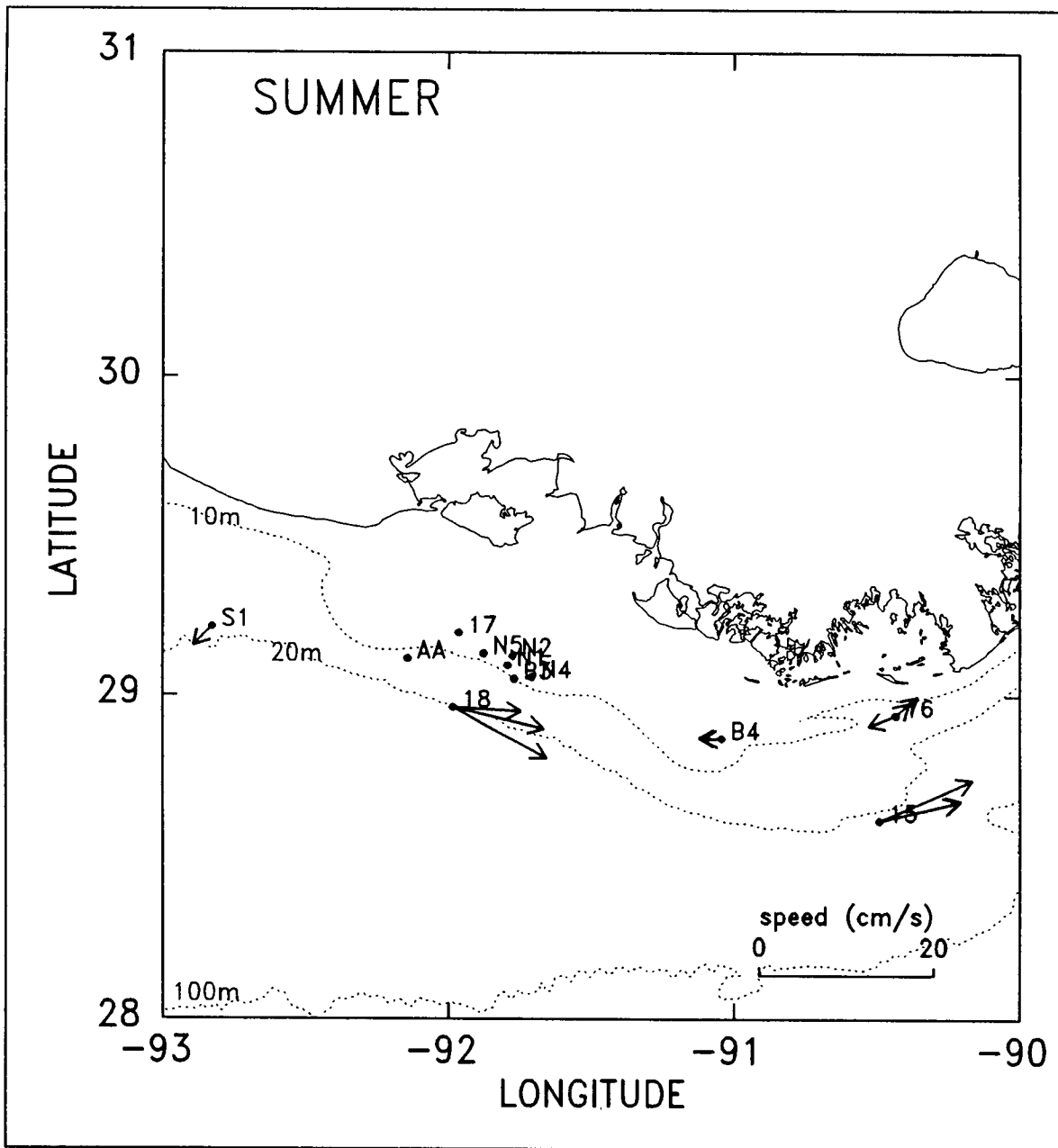


Figure 7c. Summer mean velocity vectors for central region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

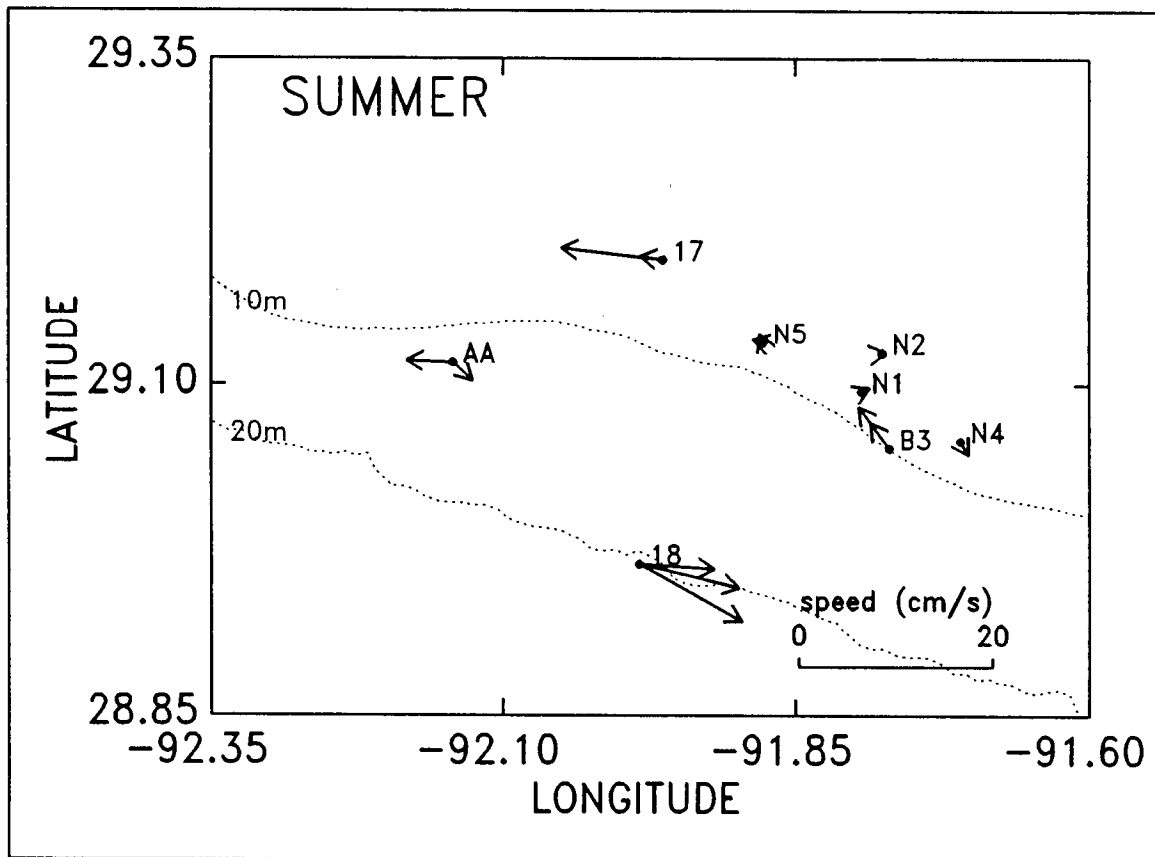


Figure 7d. Summer mean velocity vectors for central region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

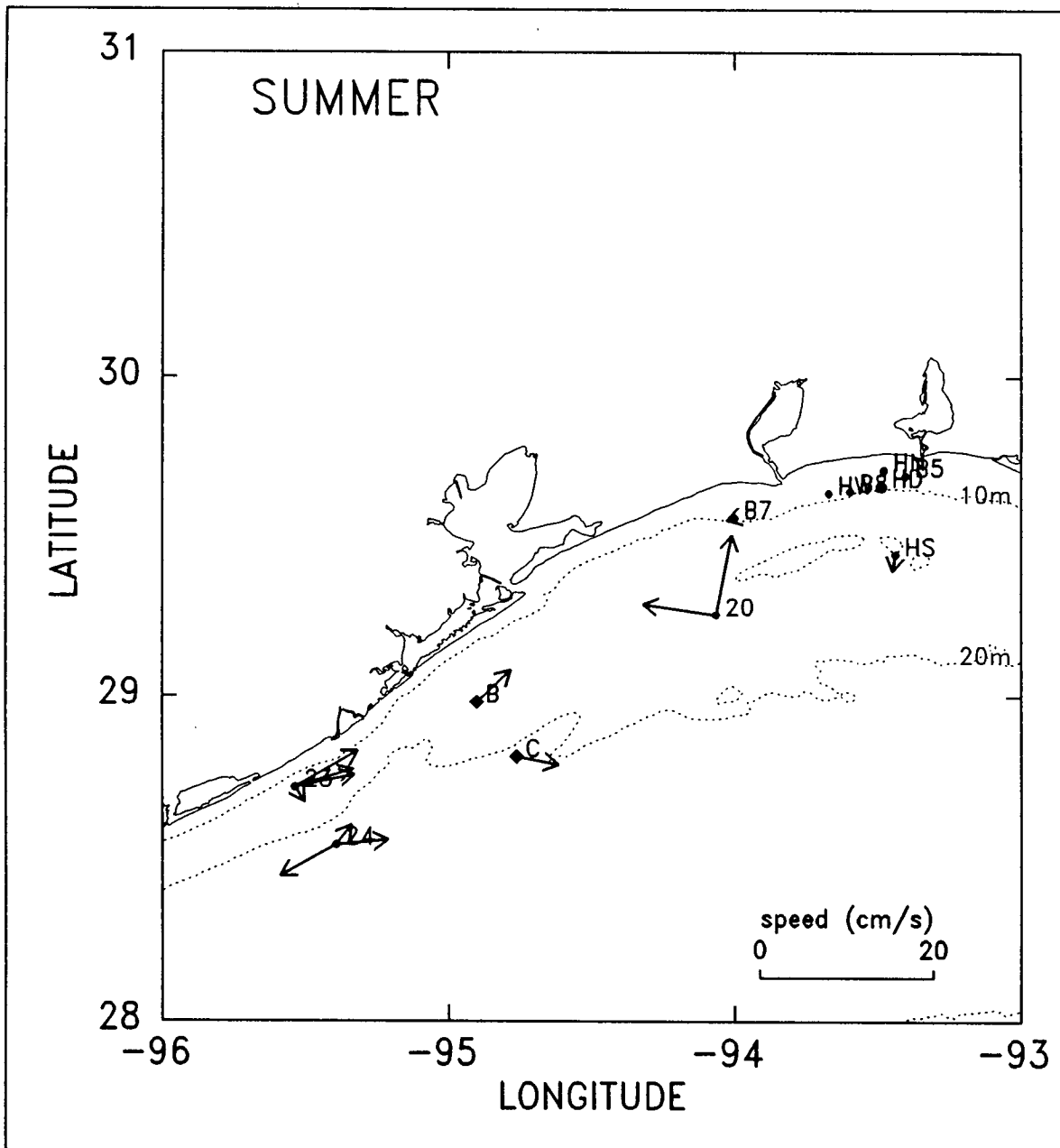


Figure 7e. Summer mean velocity vectors for (north)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

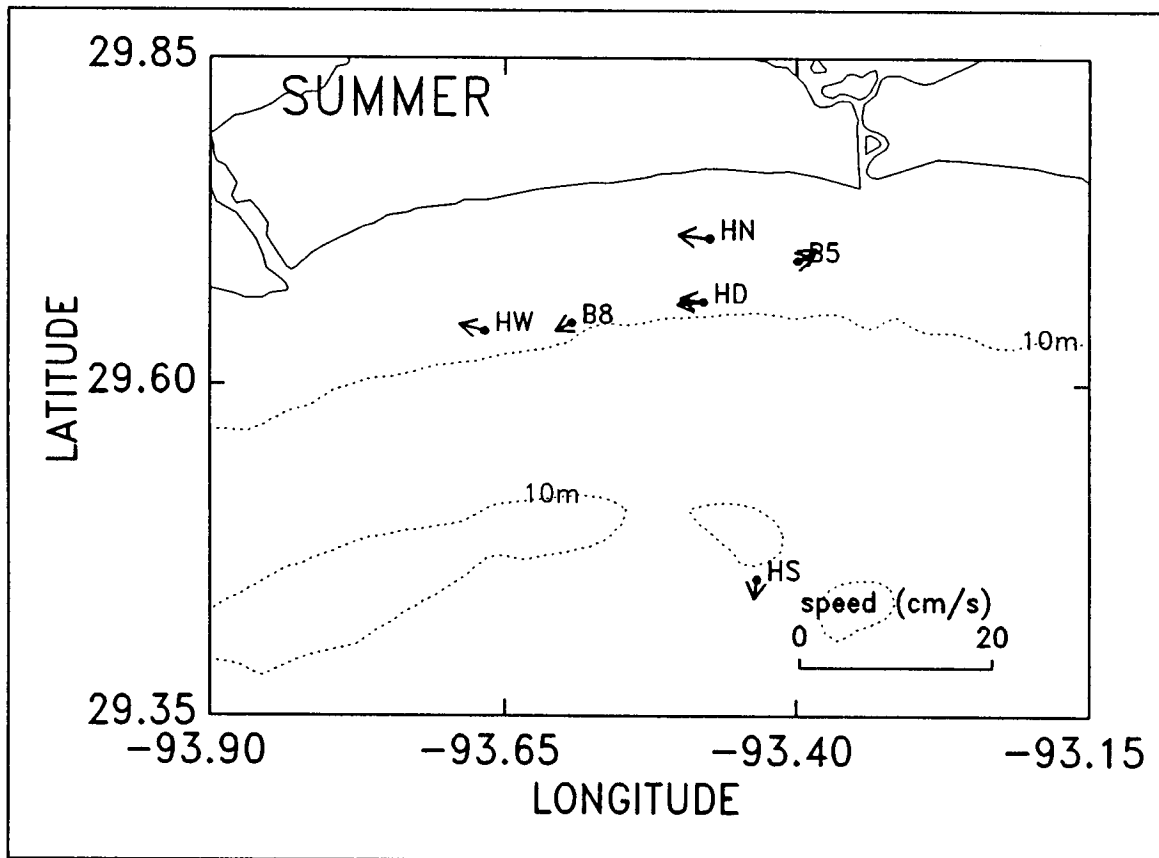


Figure 7f. Summer mean velocity vectors for (north)western region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

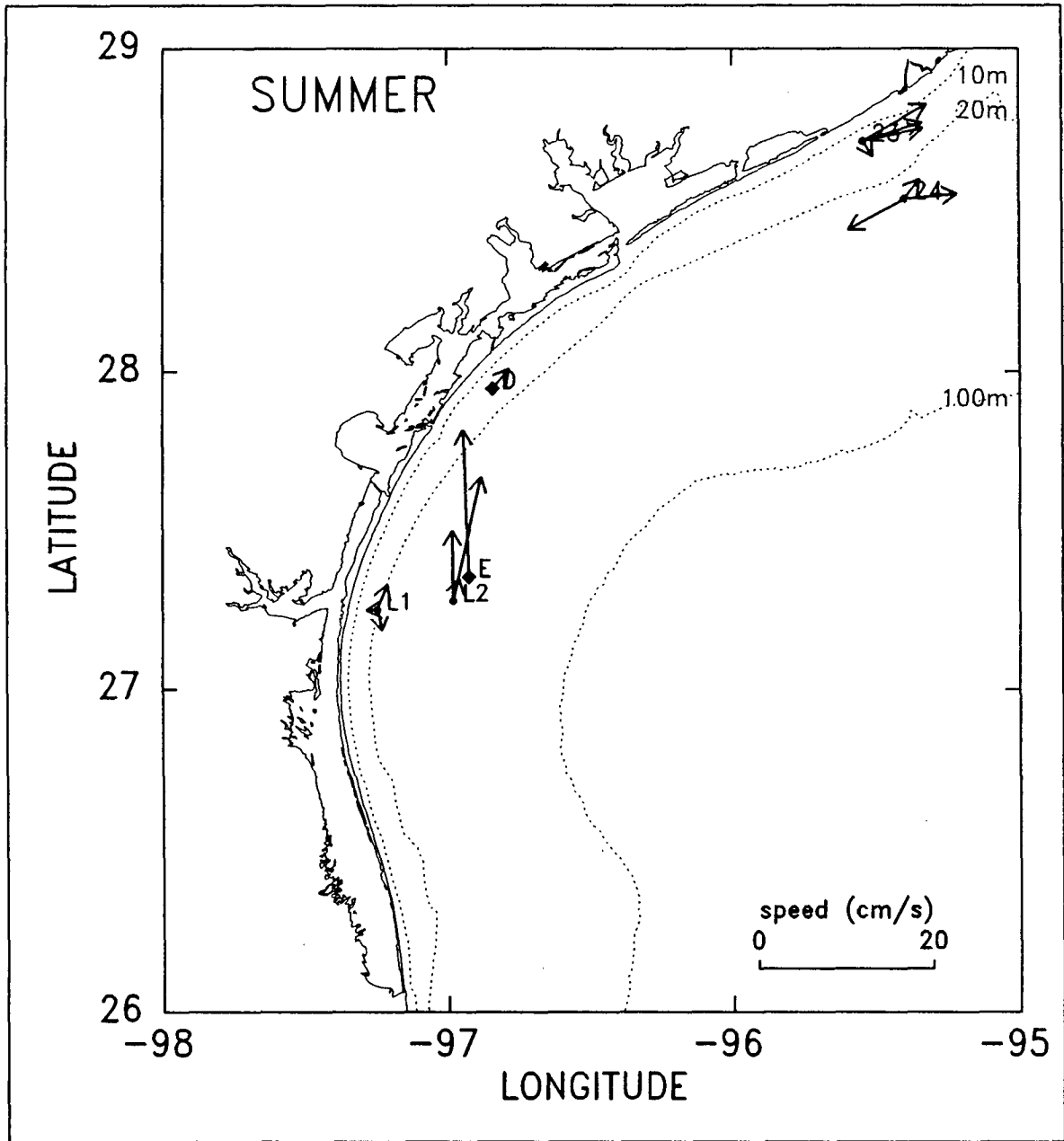


Figure 7g. Summer mean velocity vectors for (south)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

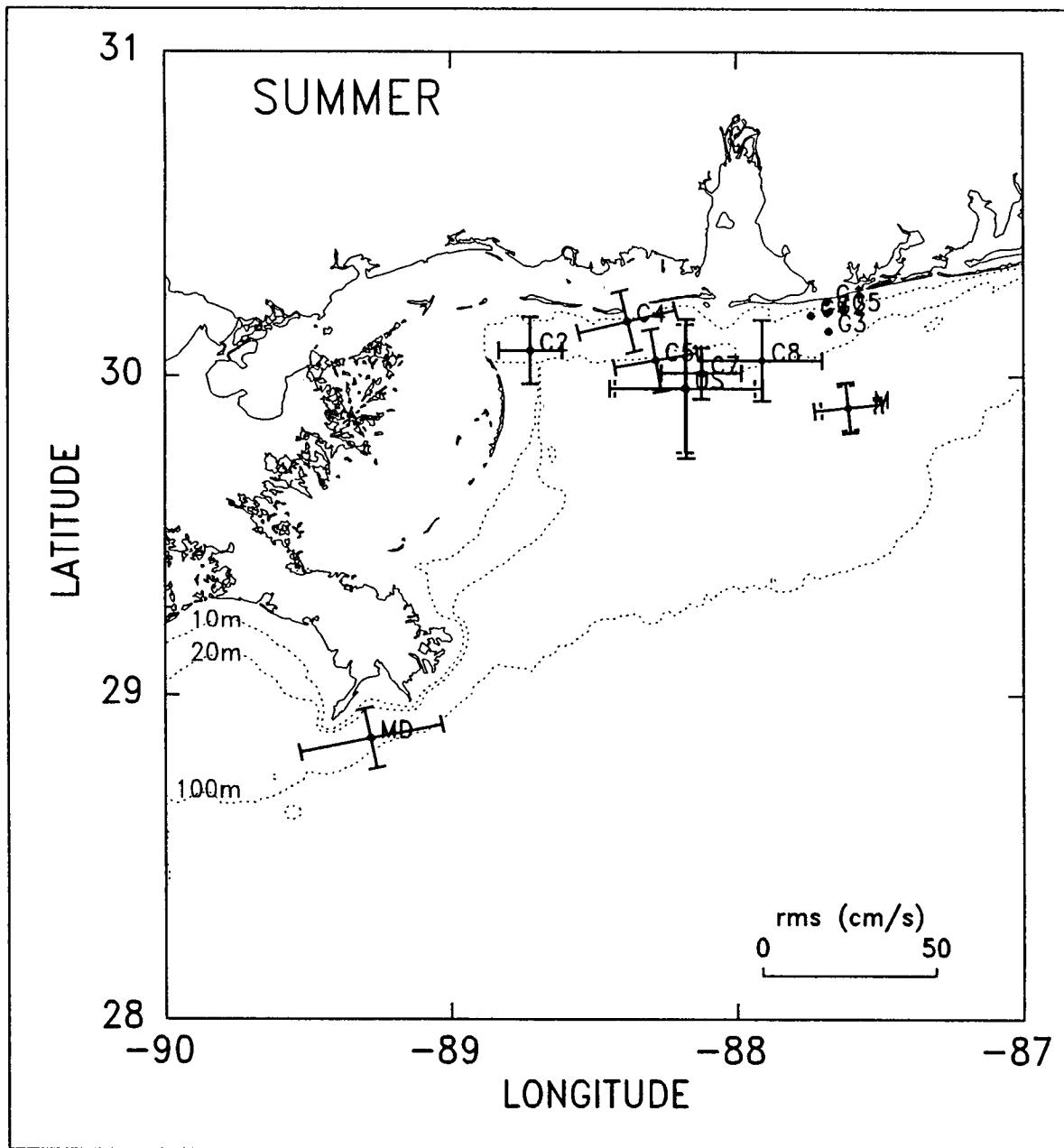


Figure 8a. Summer velocity variance axes for eastern region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

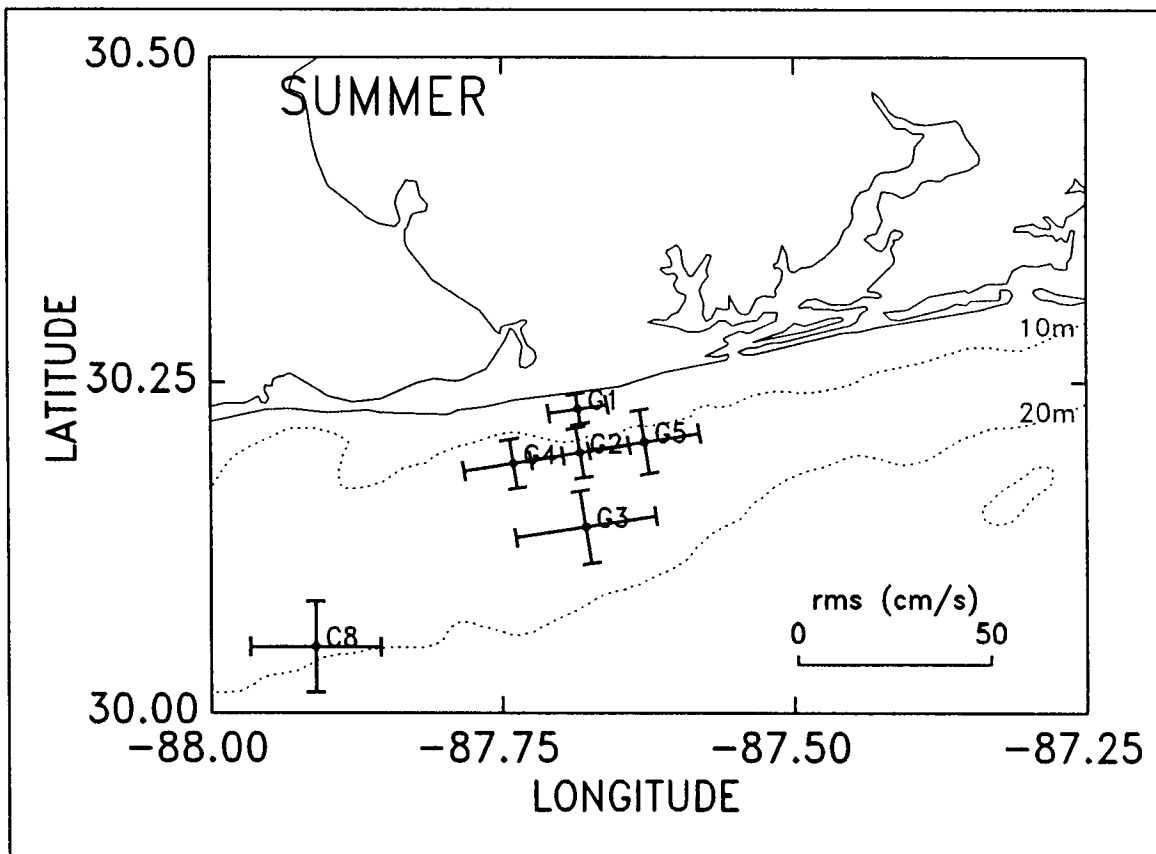


Figure 8b. Summer velocity variance axes for eastern region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore.

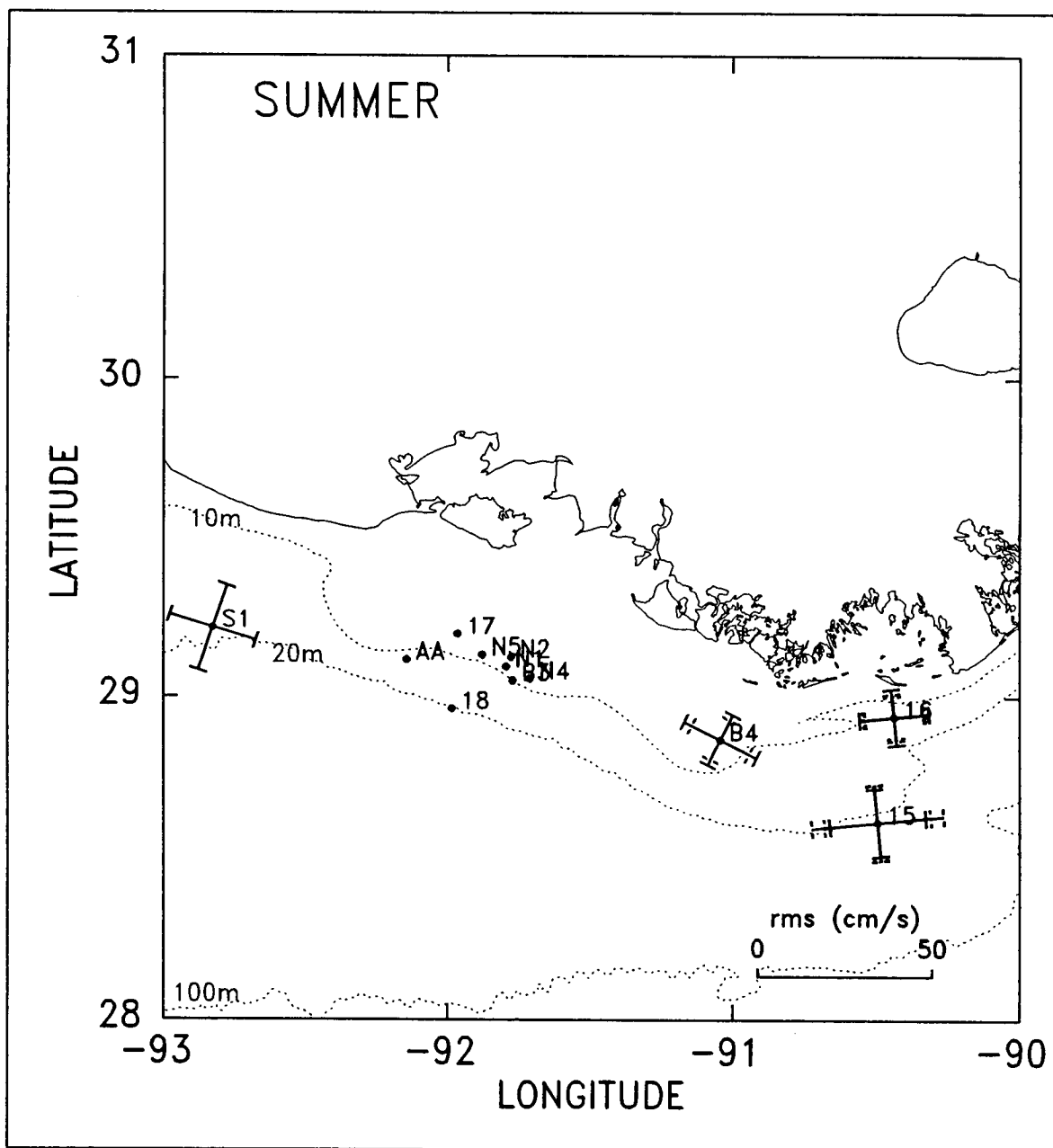


Figure 8c. Summer velocity variance axes for central region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

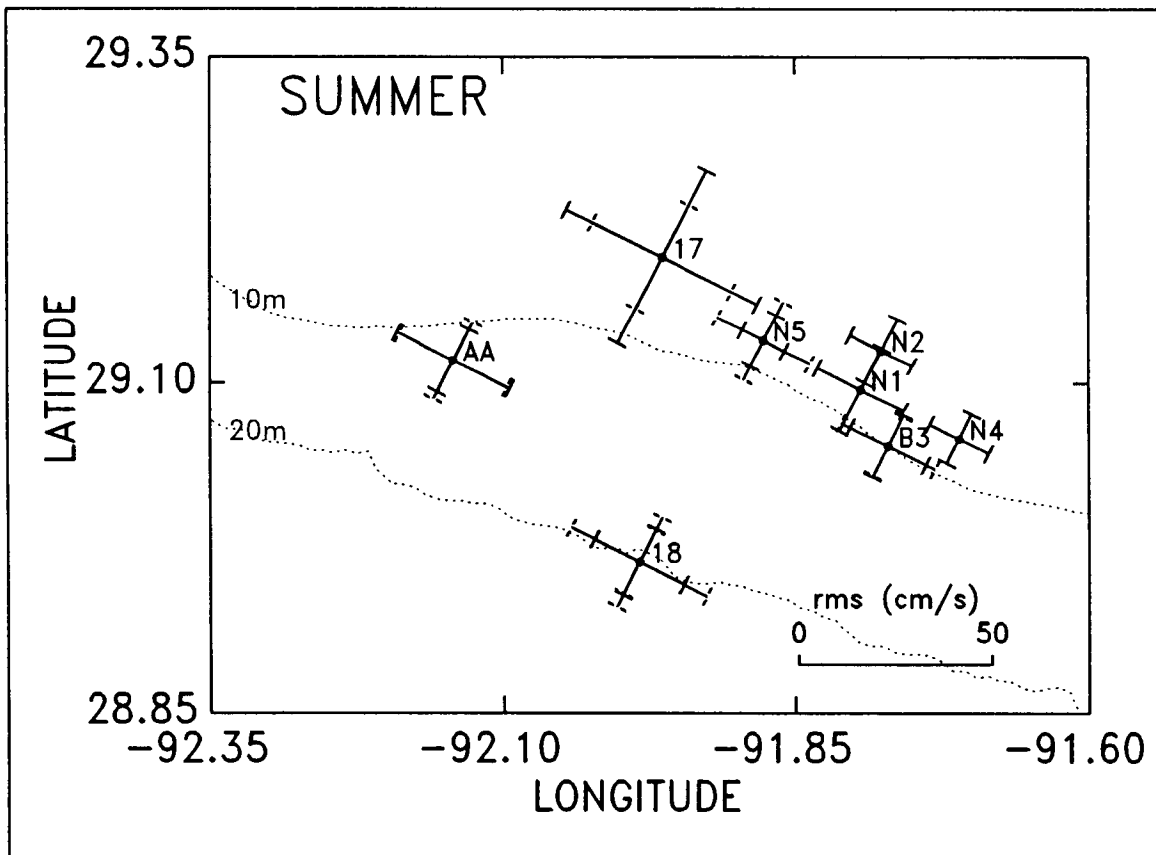


Figure 8d. Summer velocity variance axes for central region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

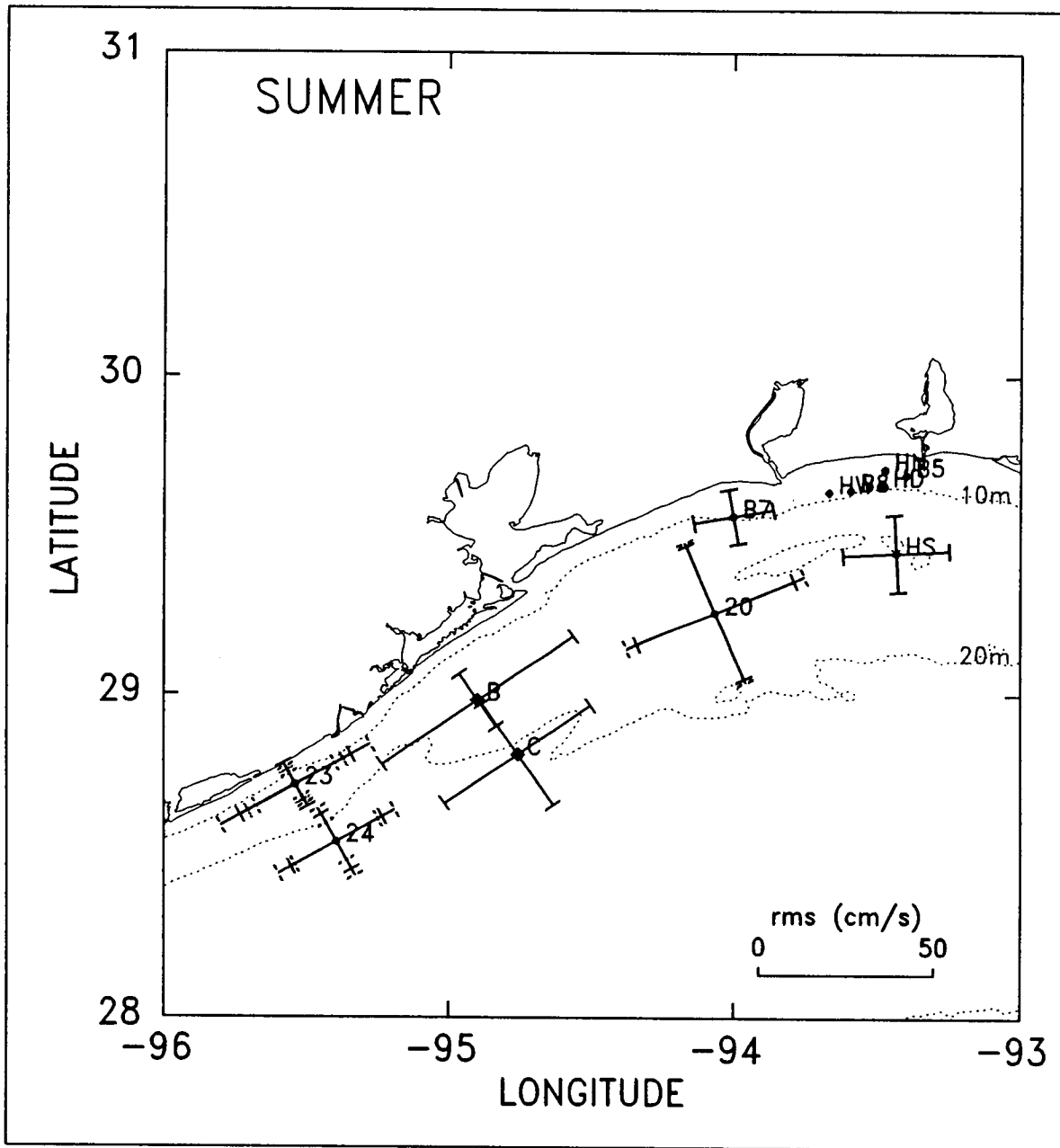


Figure 8e. Summer velocity variance axes for (north)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

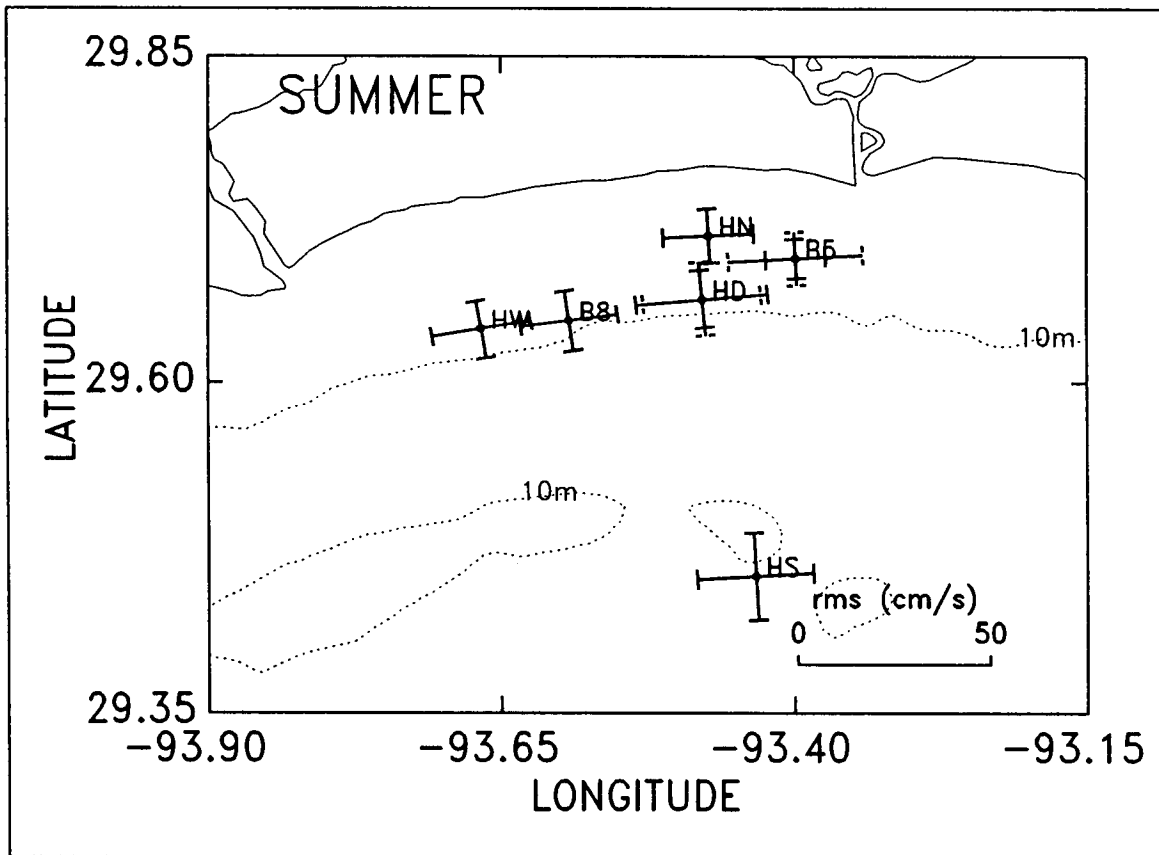


Figure 8f. Summer velocity variance axes for (north)western region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

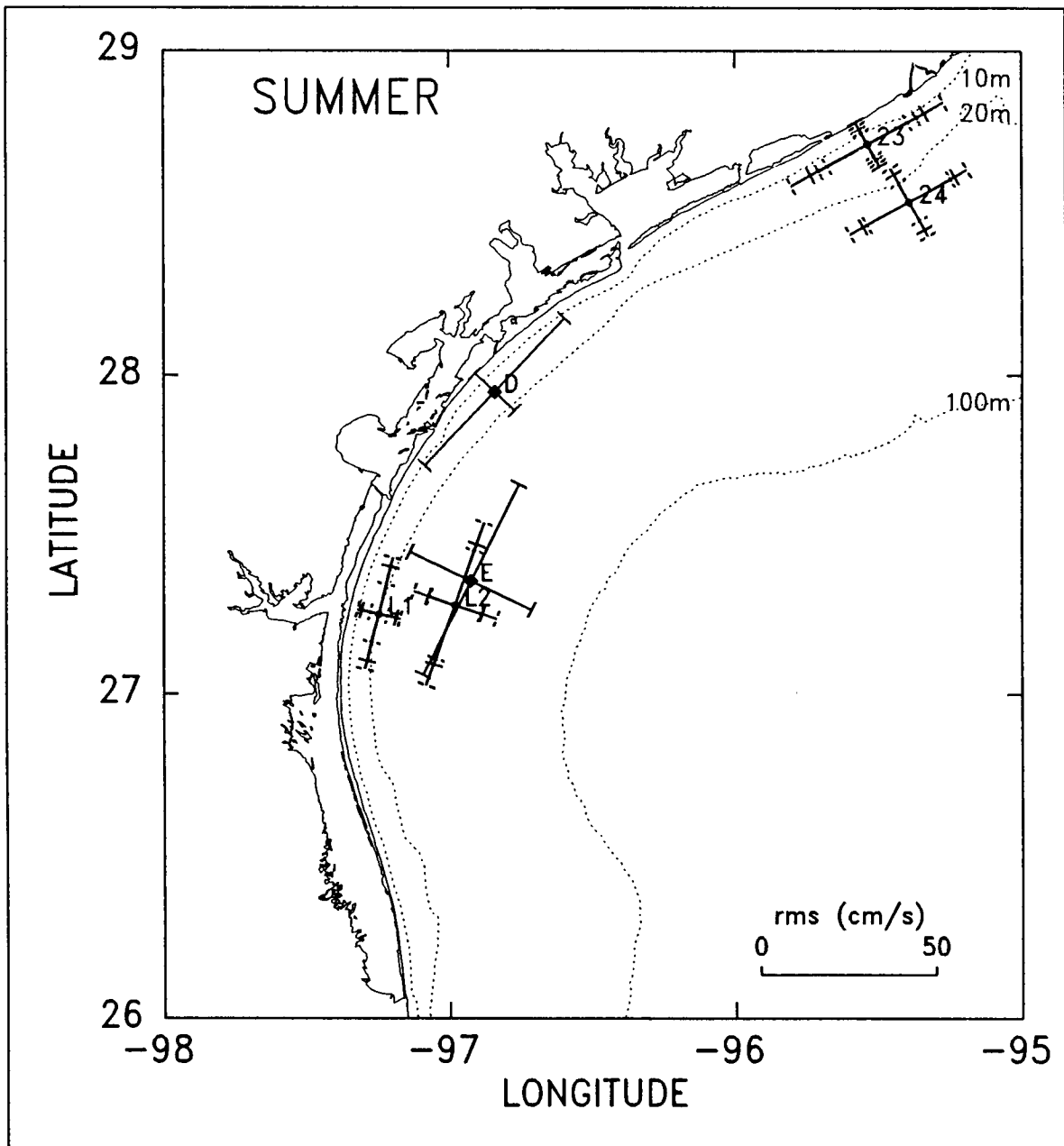


Figure 8g. Summer velocity variance axes for (south)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

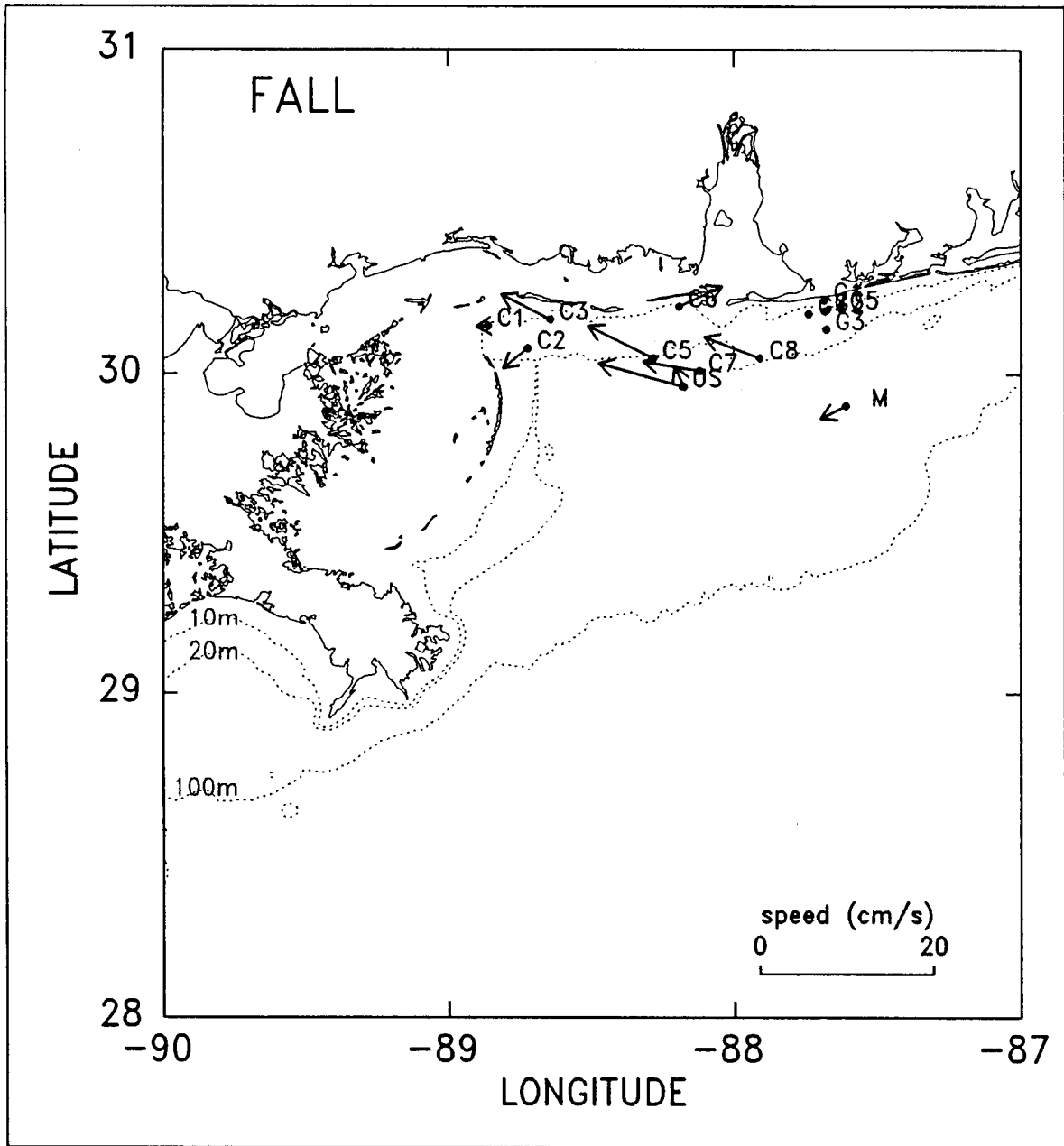


Figure 9a. Fall mean velocity vectors for eastern region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

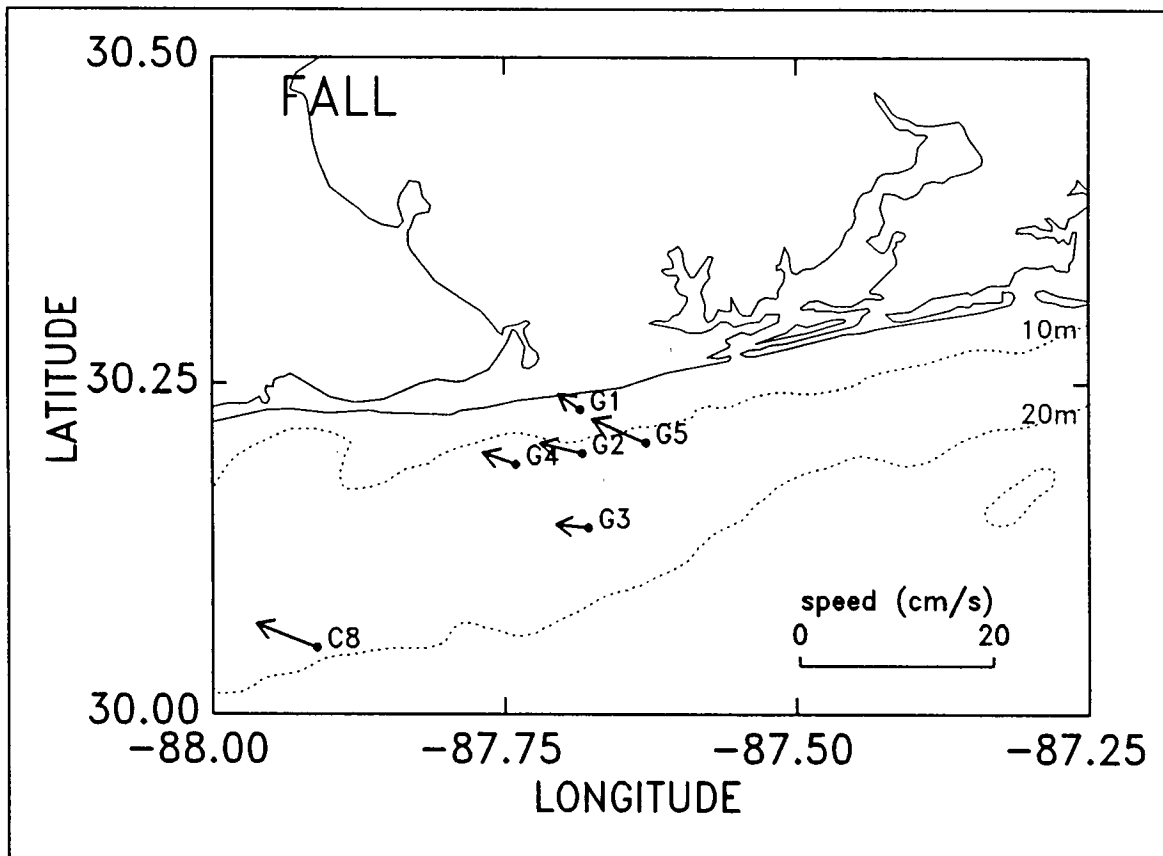


Figure 9b. Fall mean velocity vectors for eastern region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow.

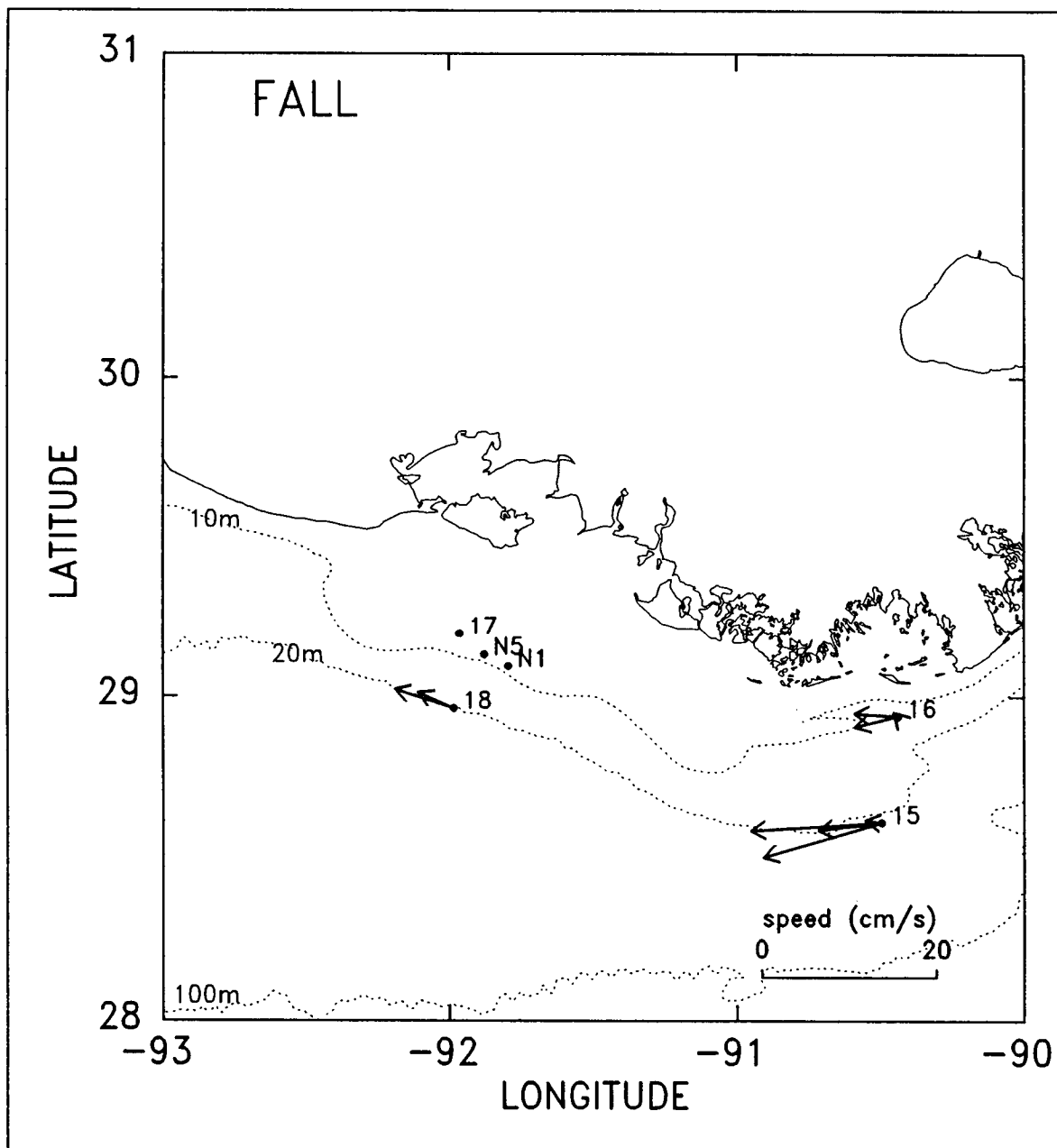


Figure 9c. Fall mean velocity vectors for central region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

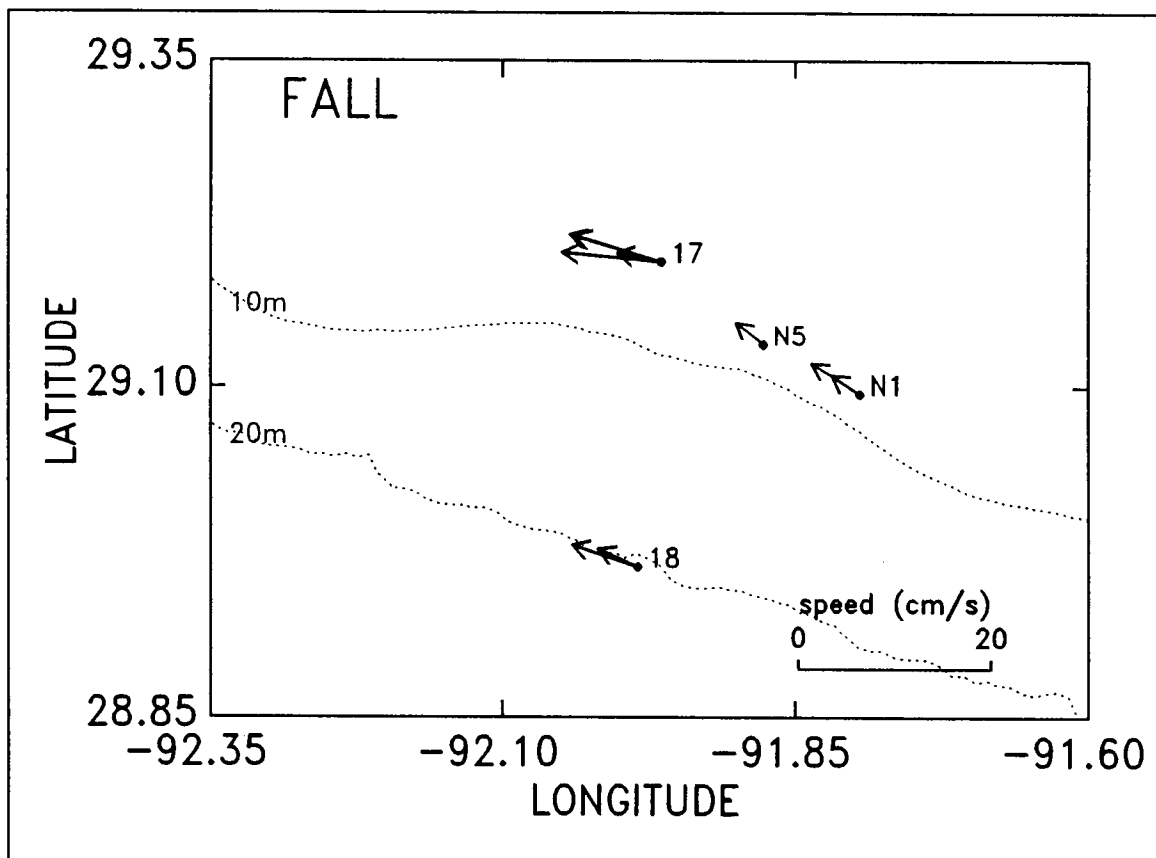


Figure 9d. Fall mean velocity vectors for central region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

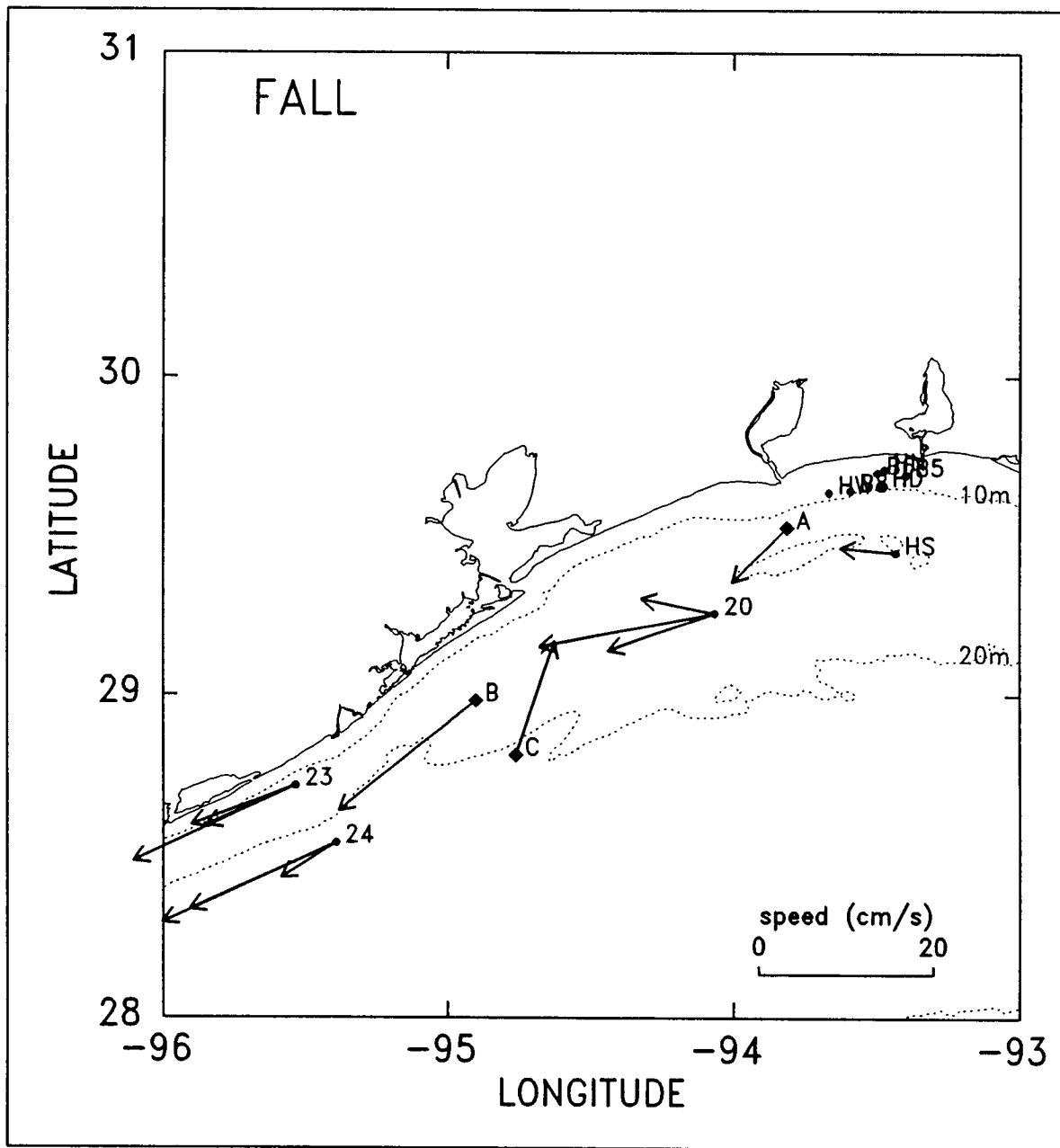


Figure 9e. Fall mean velocity vectors for (north)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

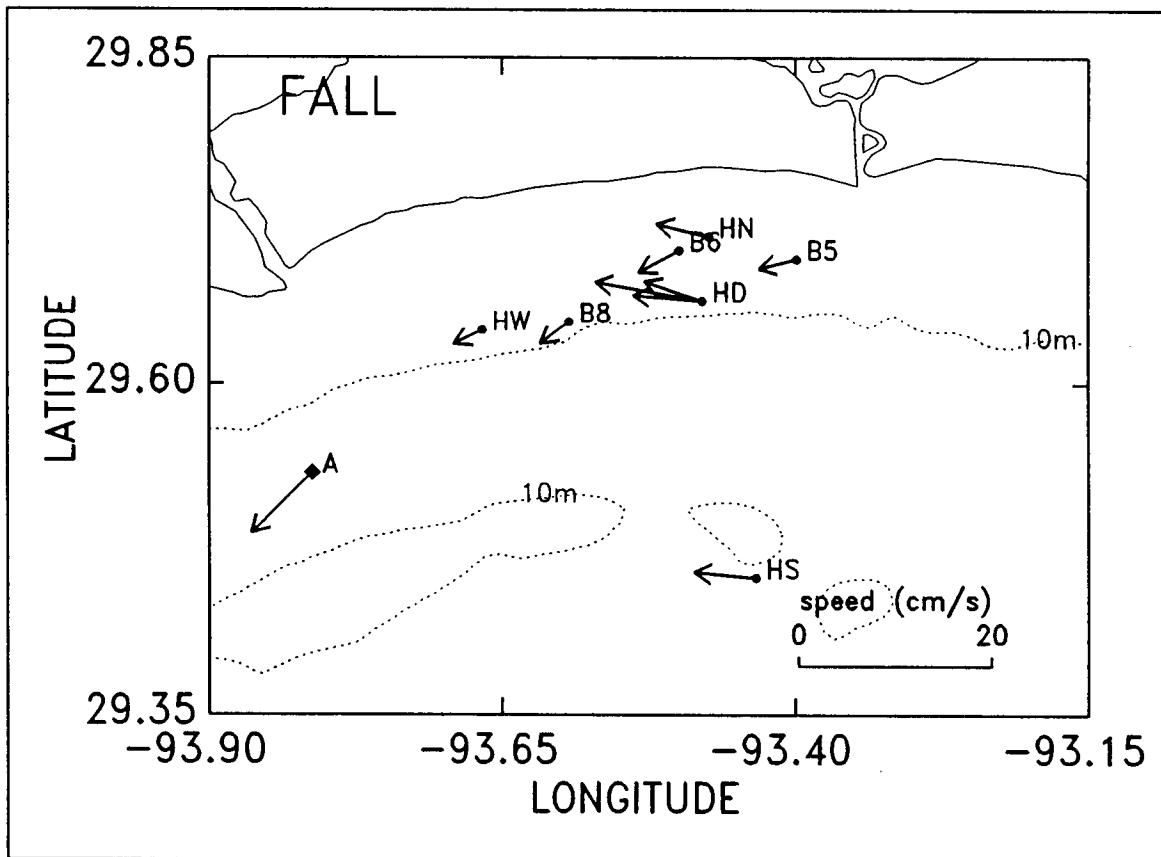


Figure 9f. Fall mean velocity vectors for (north)western region close packed stations. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

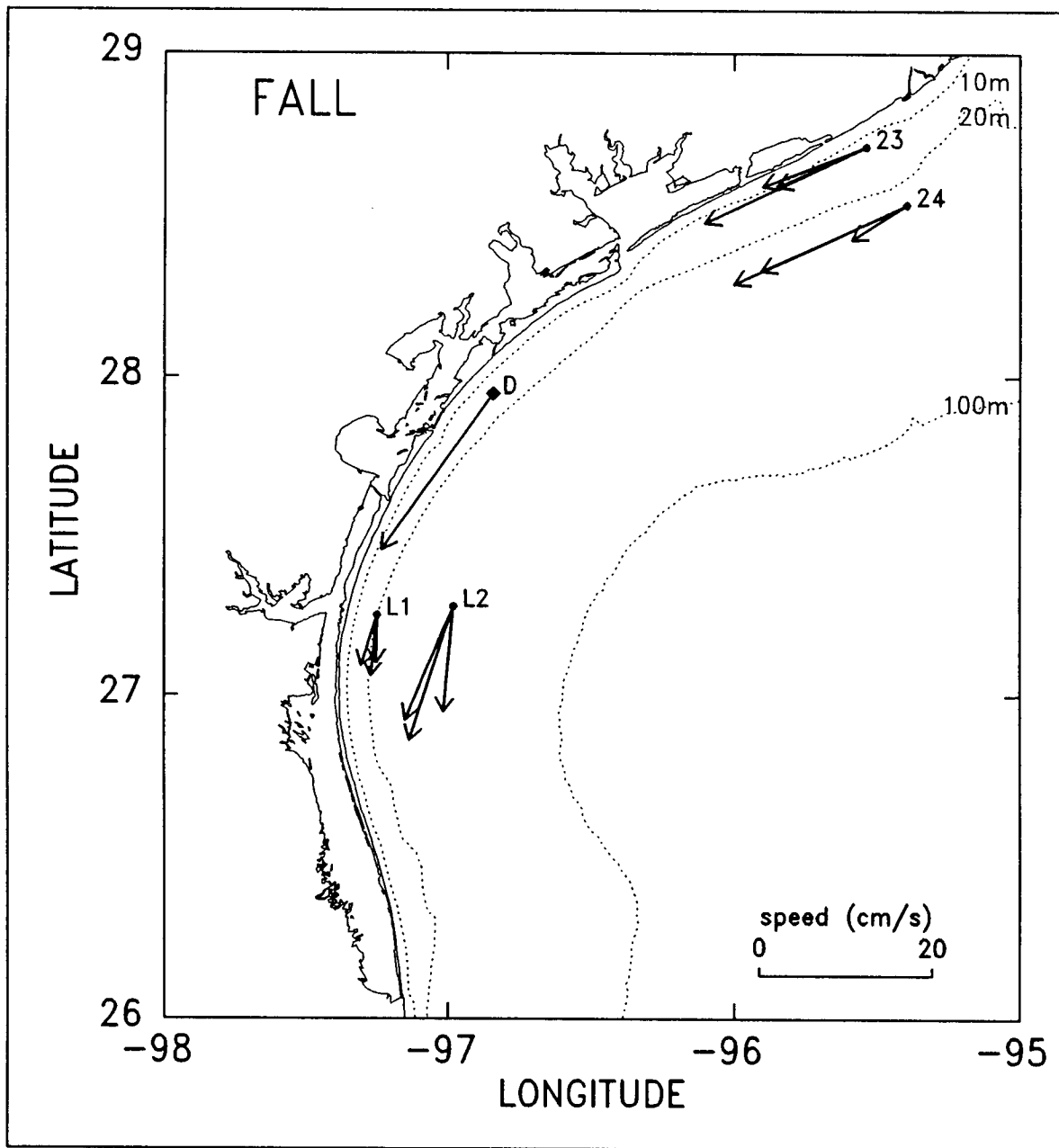


Figure 9g. Fall mean velocity vectors for (south)western region. Mooring locations are plotted as dots; the mean vectors are in direction of flow. Stations with multiple records have multiple vectors.

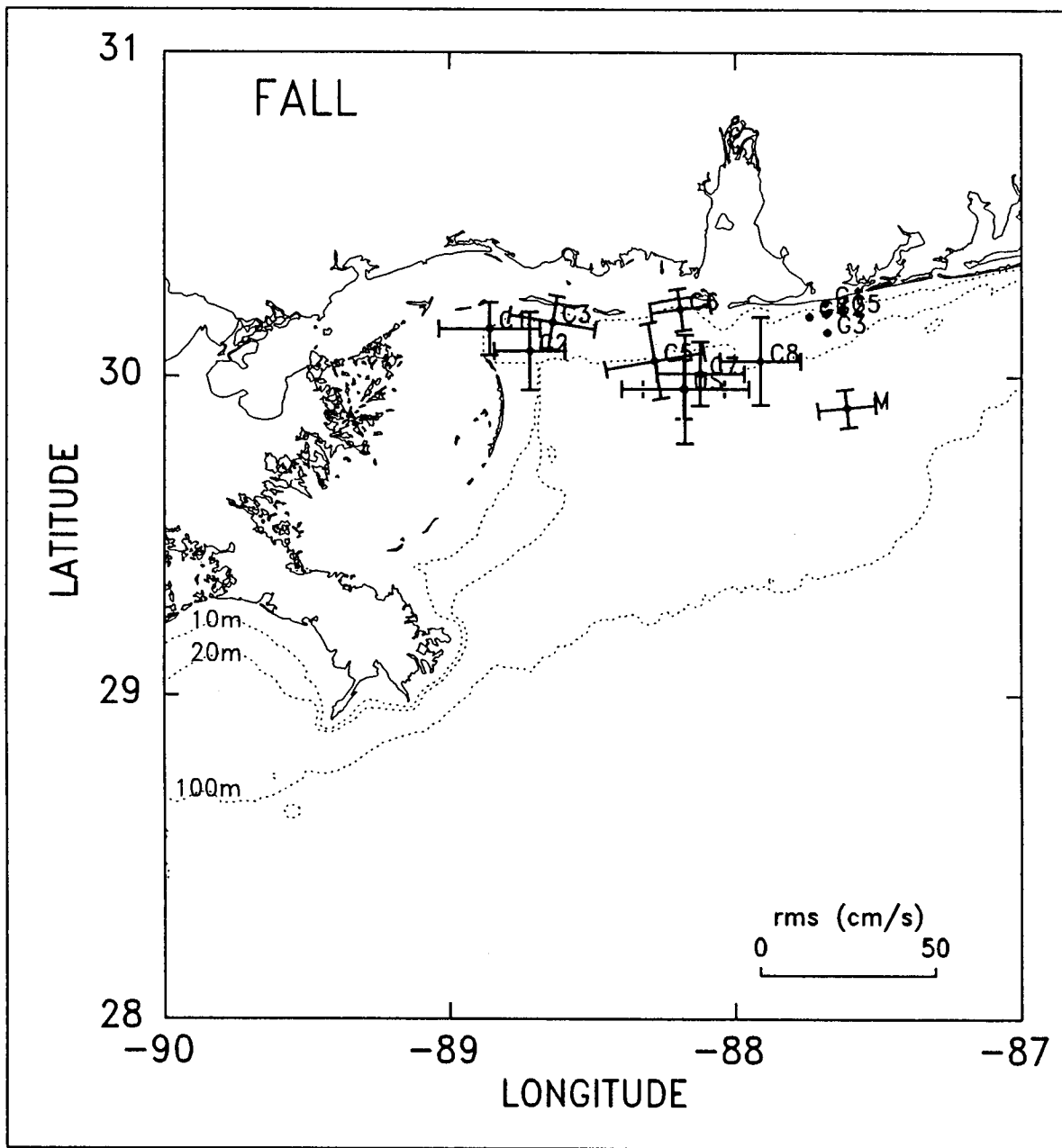


Figure 10a. Fall velocity variance axes for eastern region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

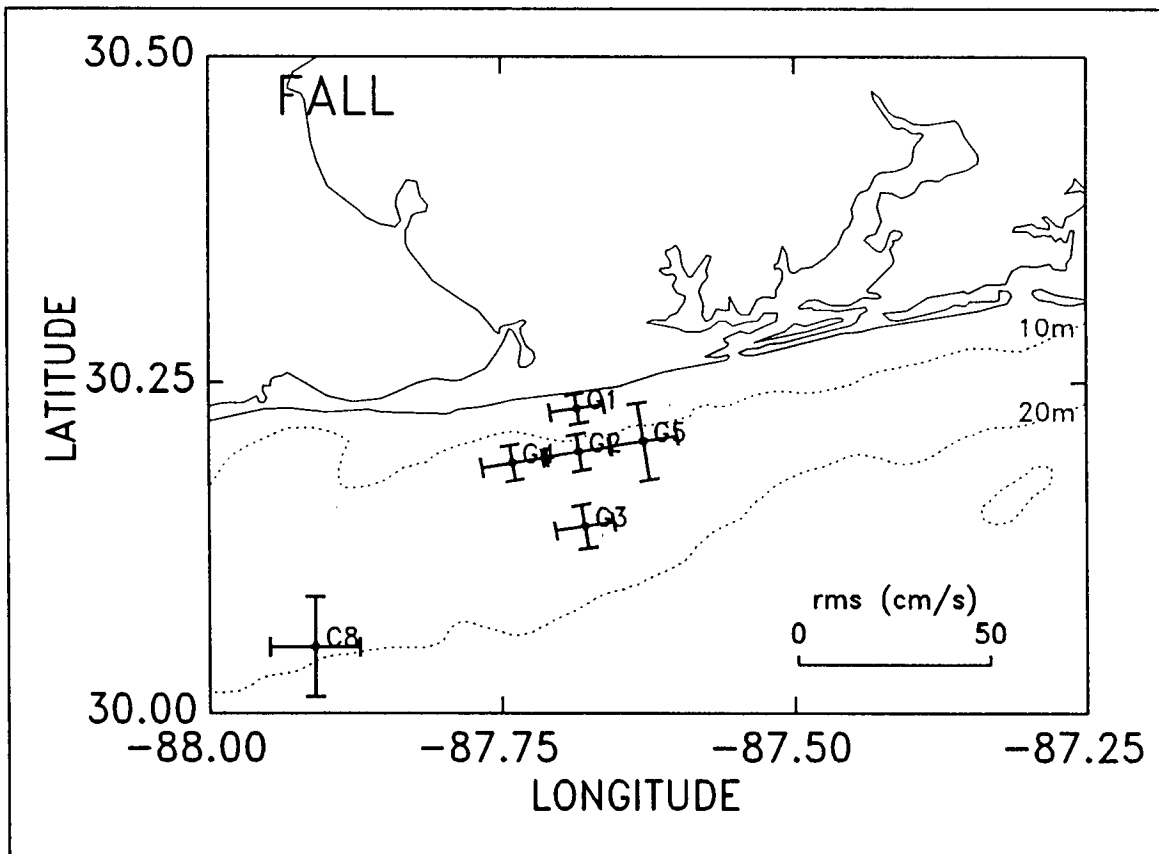


Figure 10b. Fall velocity variance axes for eastern region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore.

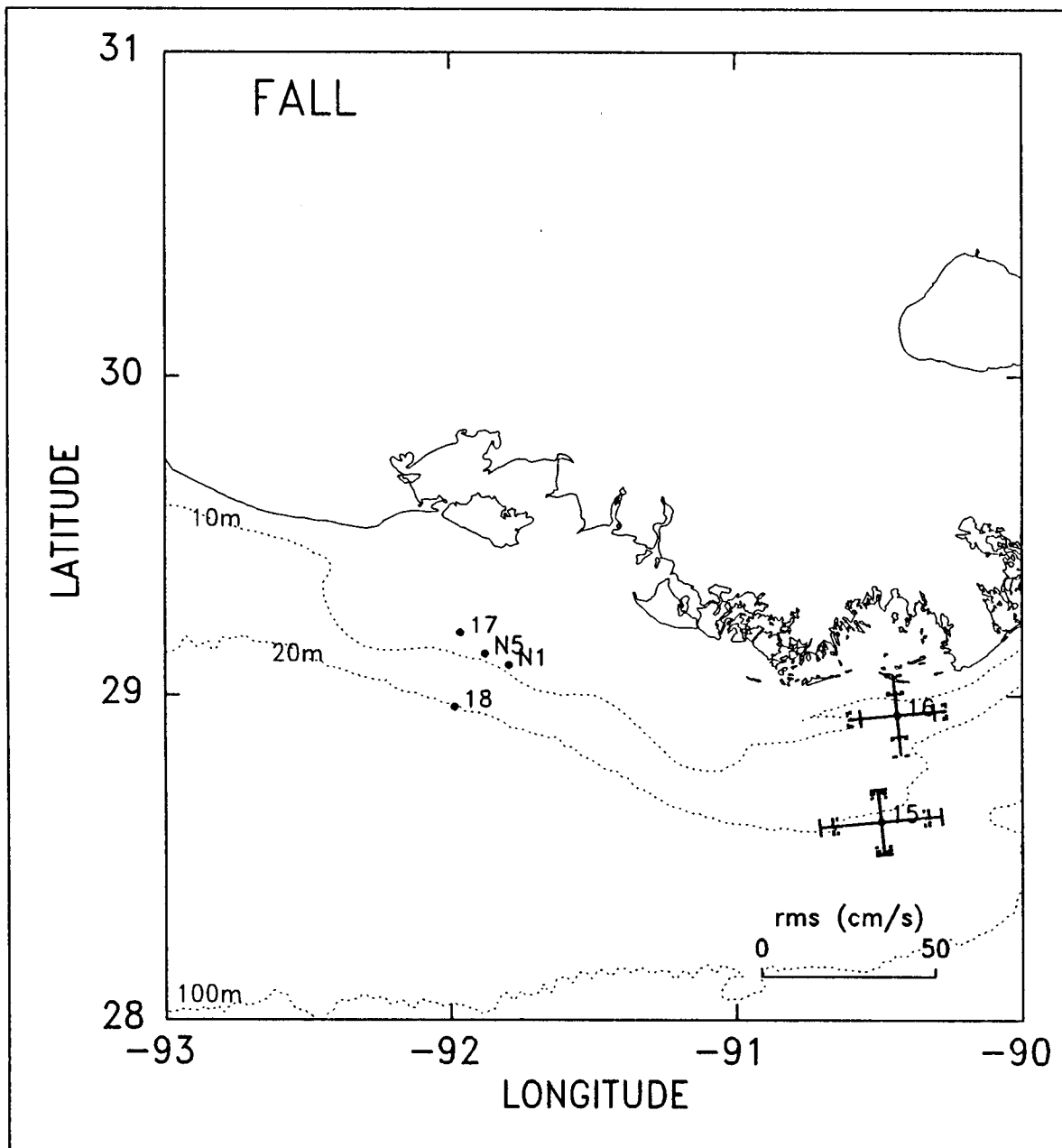


Figure 10c. Fall velocity variance axes for central region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

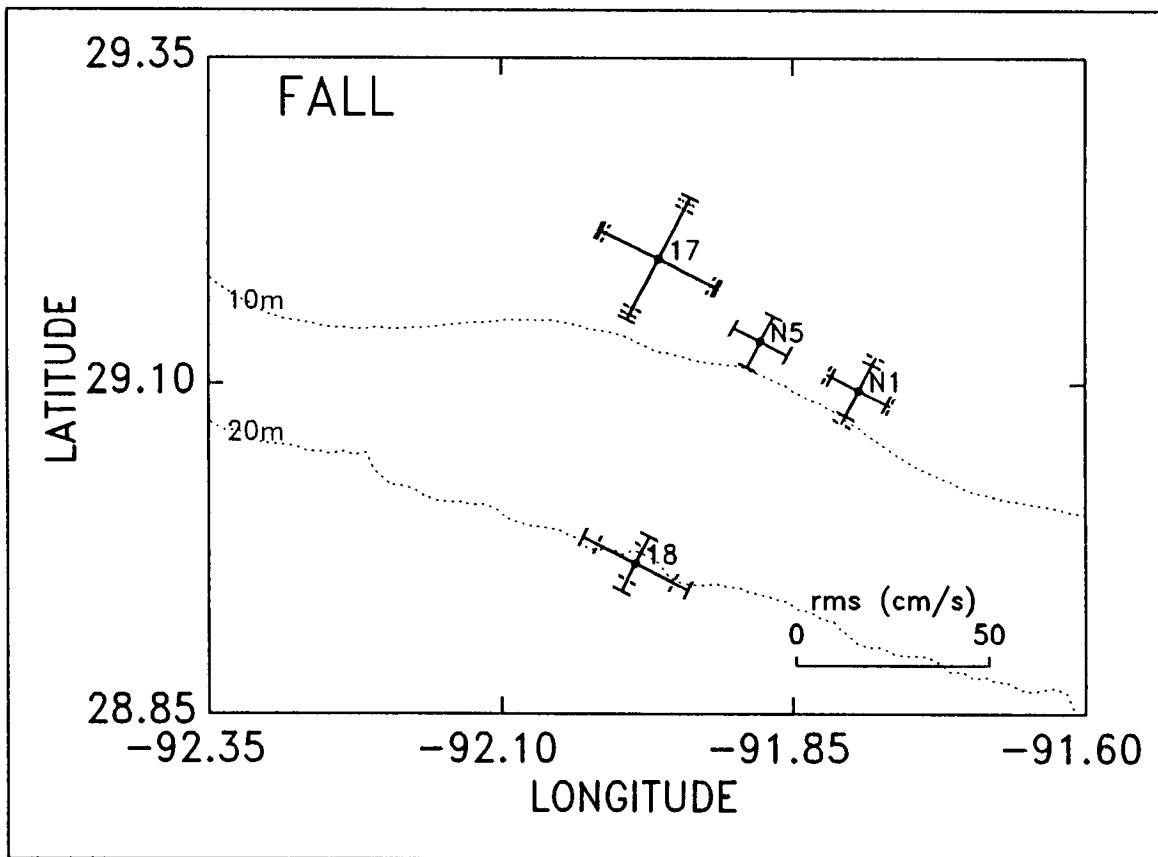


Figure 10d. Fall velocity variance axes for central region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

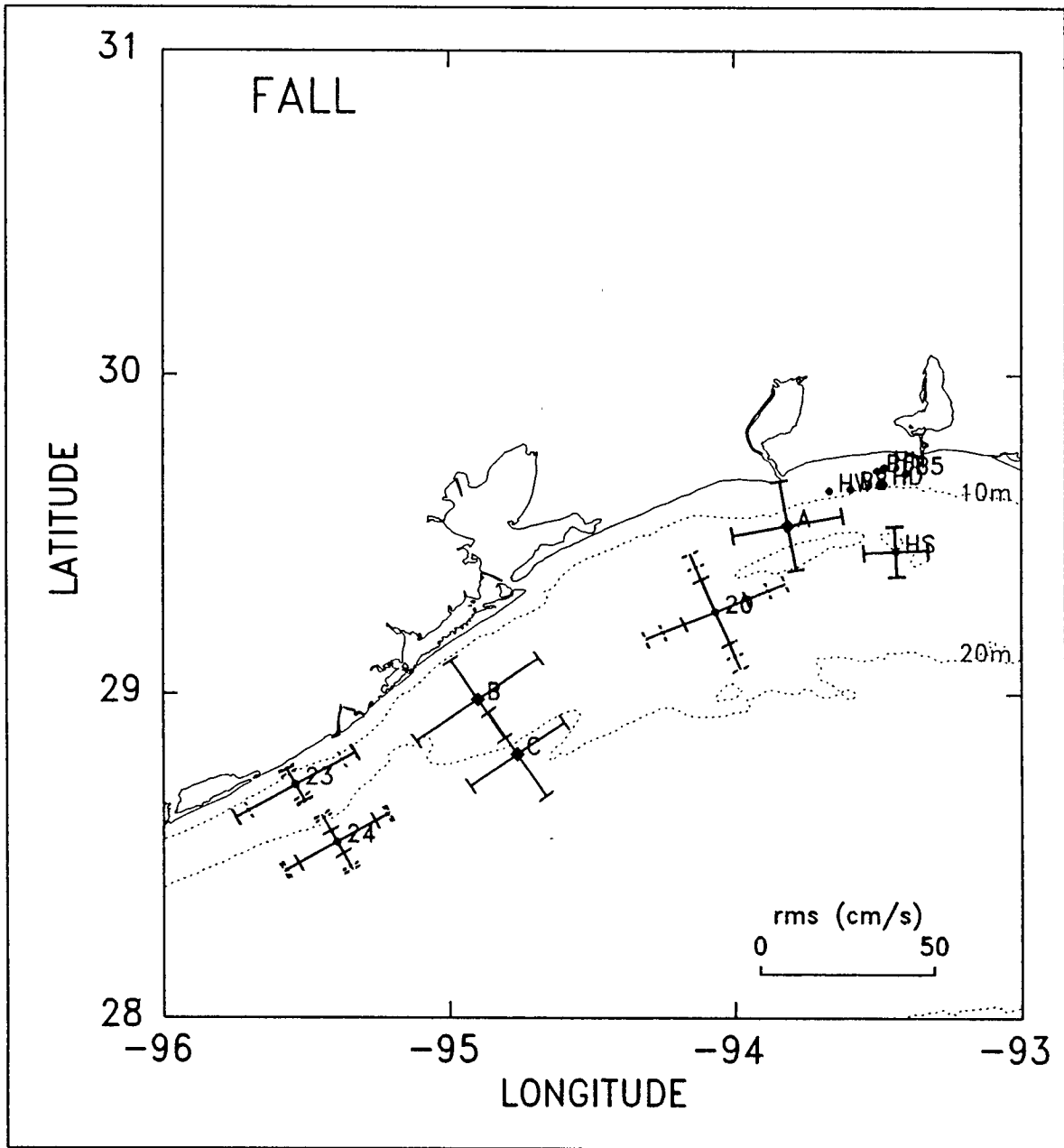


Figure 10e. Fall velocity variance axes for (north)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

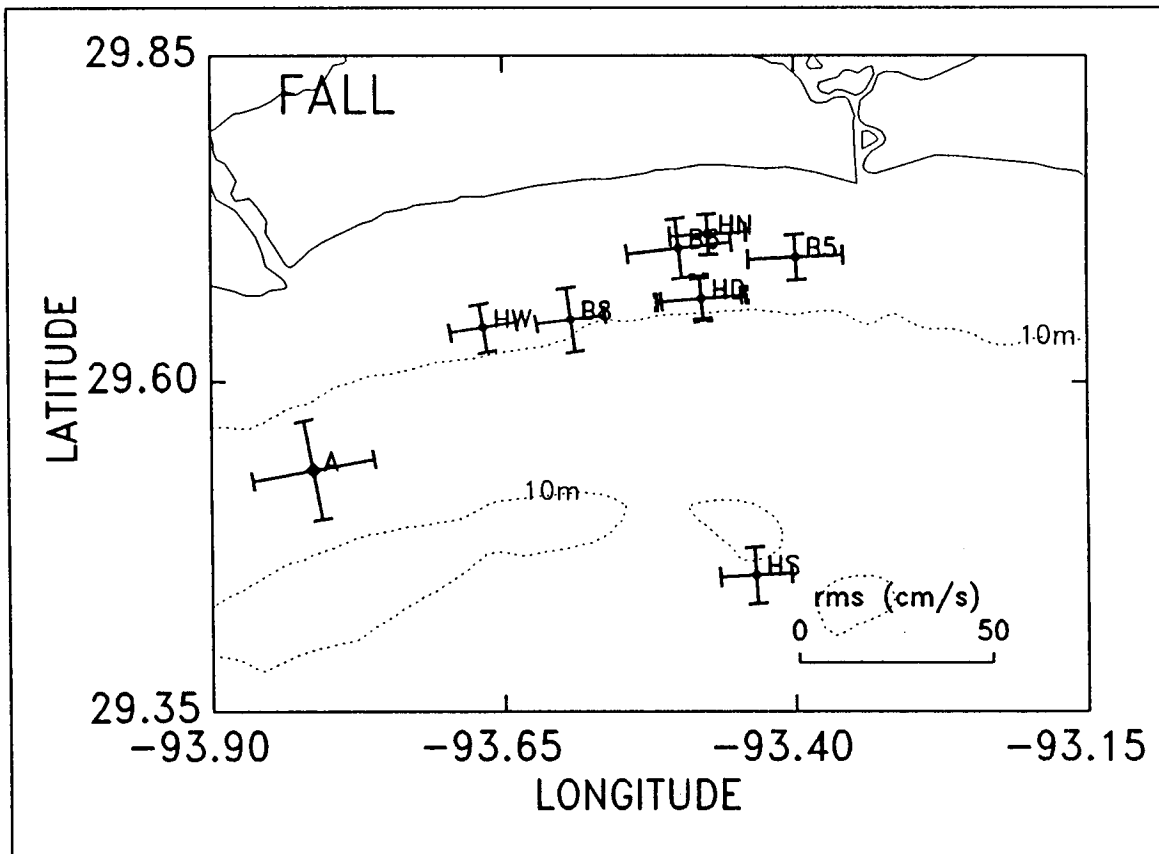


Figure 10f. Fall velocity variance axes for (north)western region close packed stations. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

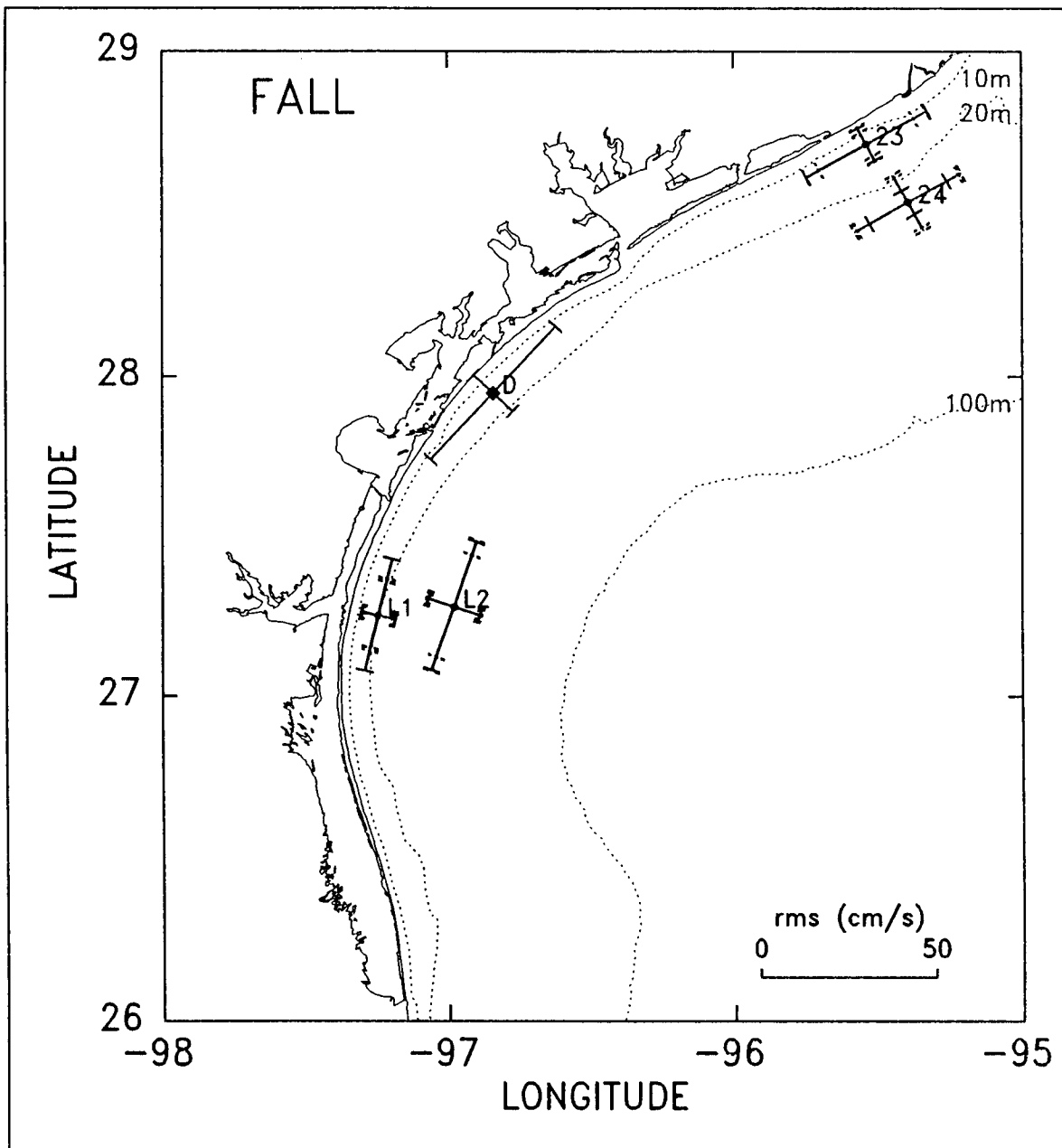


Figure 10g. Fall velocity variance axes for (south)western region. Mooring locations are plotted as dots; axes are plotted along- and cross-shore. Stations with multiple records have multiple endbar patterns.

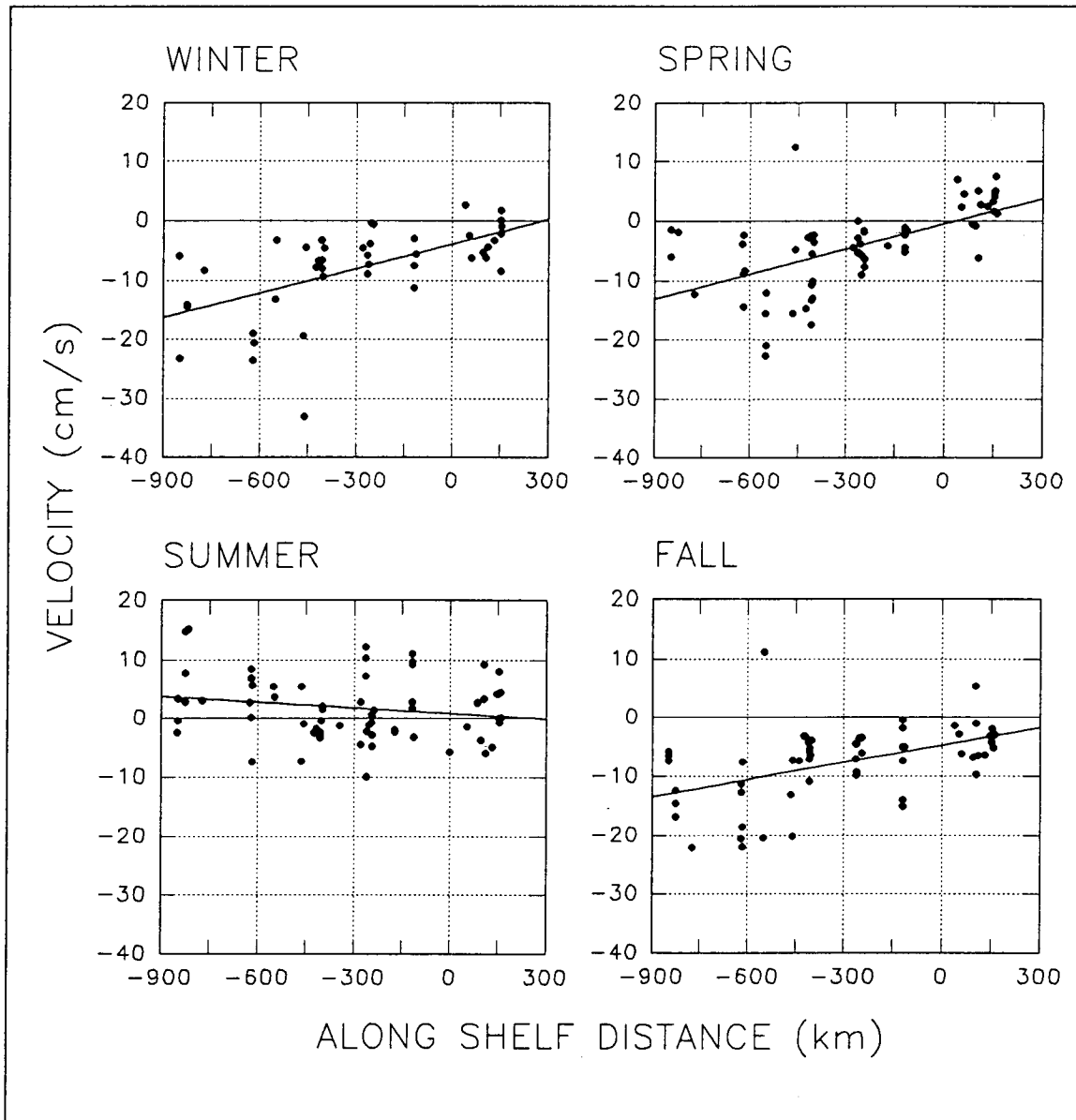


Figure 11. Seasonal alongshore mean velocity versus alongshelf distance. Positive alongshore velocity is eastward. Zero distance is the Mississippi Delta, distance west is negative. Linear regression slopes were tested as different from zero with a student-t test. The slopes for winter, spring, and fall were significantly different from zero at the 99% level ($t=4.615$, $n=44$; $t=6.048$, $n=66$; $t=4.110$, $n=59$, respectively), and the slope for summer was significantly different from zero at the 90% ($t=-1.395$, $n=66$).

89°W) where mean flow directions were likely influenced by the 90° bend of the innershelf bathymetry and the exchange with the backbarrier water bodies, and at the easternmost stations EPA GS G2 and G3 (Figure 3b) (near 30.2°N, 87.7°W) where large alongshore variance and short records combined to cancel out any substantial net alongshore flow. Exceptions to the general westward flow were also found at the central region stations N1 and N5 (Figure 3d) (near 29.1°N, 91.85°W).

Stations with contemporaneous nearby stations had record means that were usually consistent in direction and magnitude. Only in the eastern region at EPA GS stations (30.2°N 87.7°W) was there an apparent contradiction (Figure 3b), with the outer station, G3, exhibiting mean alongshore flow in opposition to stations closer to shore. This was probably associated with different record lengths.

Stations with multiple records were very consistent from year to year in mean direction and magnitude. The statistical significance of alongshore mean flows increased with alongshelf distance westward. Three of the 12 eastern records, 7 of 11 central records, and 19 of 21 western records had statistically significant mean westward flows (Table 2).

Statistically significant alongshore mean flow magnitudes were 4-8 $\text{cm}\cdot\text{s}^{-1}$ in the eastern region, 4-11 $\text{cm}\cdot\text{s}^{-1}$ in the central region, and 4-33 $\text{cm}\cdot\text{s}^{-1}$ in the western region.

Cross-shore mean flows had low magnitudes, -6 to +9 $\text{cm}\cdot\text{s}^{-1}$, with no systematic geographical trend (Figure 12). Only 5 of 12 eastern stations had statistically significant mean flows. No central region station had statistically significant mean flows, but 13 of 21 western stations did.

Record velocity maxima were determined for both positive and negative directions for each component (Table 2). Although not tested statistically, alongshore maxima were larger than cross-shore maxima, and the mean of the westward alongshore velocity maxima was larger than the mean of the eastward alongshore velocity maxima (Table 2). The westward alongshore velocity maxima increased with distance westward (statistically significant at the 99% level) (Figure 13); the eastward alongshore maximum velocity magnitudes showed no difference as a function of alongshelf distance. The cross-shore maximum velocities had the same mean magnitudes on- and off-shore. The on-shore maximum velocity magnitudes increased towards the east (significant at the 90% level), but the off-shore maxima exhibited no alongshelf trend.

All winter variance exhibited shore-parallel major axes (Figure 4), i.e. the alongshore variances were greater than the cross-shore variances, with the ratio of the alongshore to cross-shore variance increasing at the western stations. Alongshore variance was quite variable, with greater range in variation to the west. Cross-shore variances were geographically similar in magnitude, with only a few large values in the central and (north)western regions.

The percent of variance in the low-passed band was a measure of the relative importance of the tidal band variation to the subtidal variation. The alongshore variance was predominantly contained in the low-passed records, with a statistically significant increase (at the 99% level) from 60% in the east to 90% in the west (Figure 14). Low percentages, < 50%, were limited to two stations in the east, COE MS C1 and C2, where flows were highly influenced by backbarrier exchanges. Cross-shore variance was, approximately evenly split between the subtidal and the higher-frequency bands, although the scatter was large (Table 3).

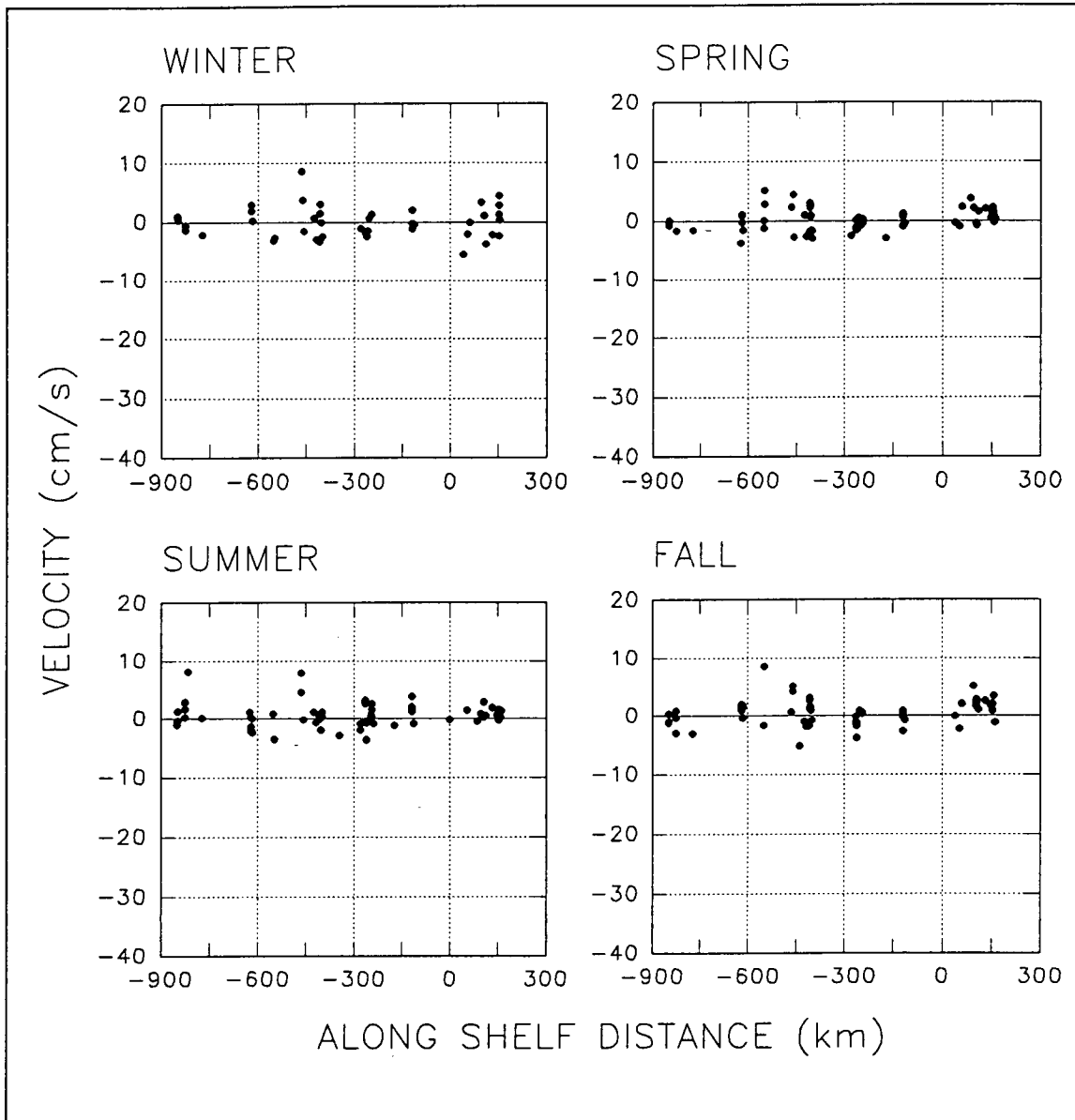


Figure 12. Seasonal cross-shore mean velocity versus alongshelf distance. Positive cross-shore velocity is onshore. Zero distance is the Mississippi Delta, distance west is negative. Linear regression slopes (not shown) were tested as different from zero with a student-t test. The slopes for spring and fall were significantly different from zero at the 80% level ($t=1.62$, $n=66$; $t=1.455$, $n=59$, respectively), and the slopes for winter and summer were below the 80% significance level and considered not different from zero ($t=-0.185$, $n=44$; $t=0.155$, $n=66$, respectively).

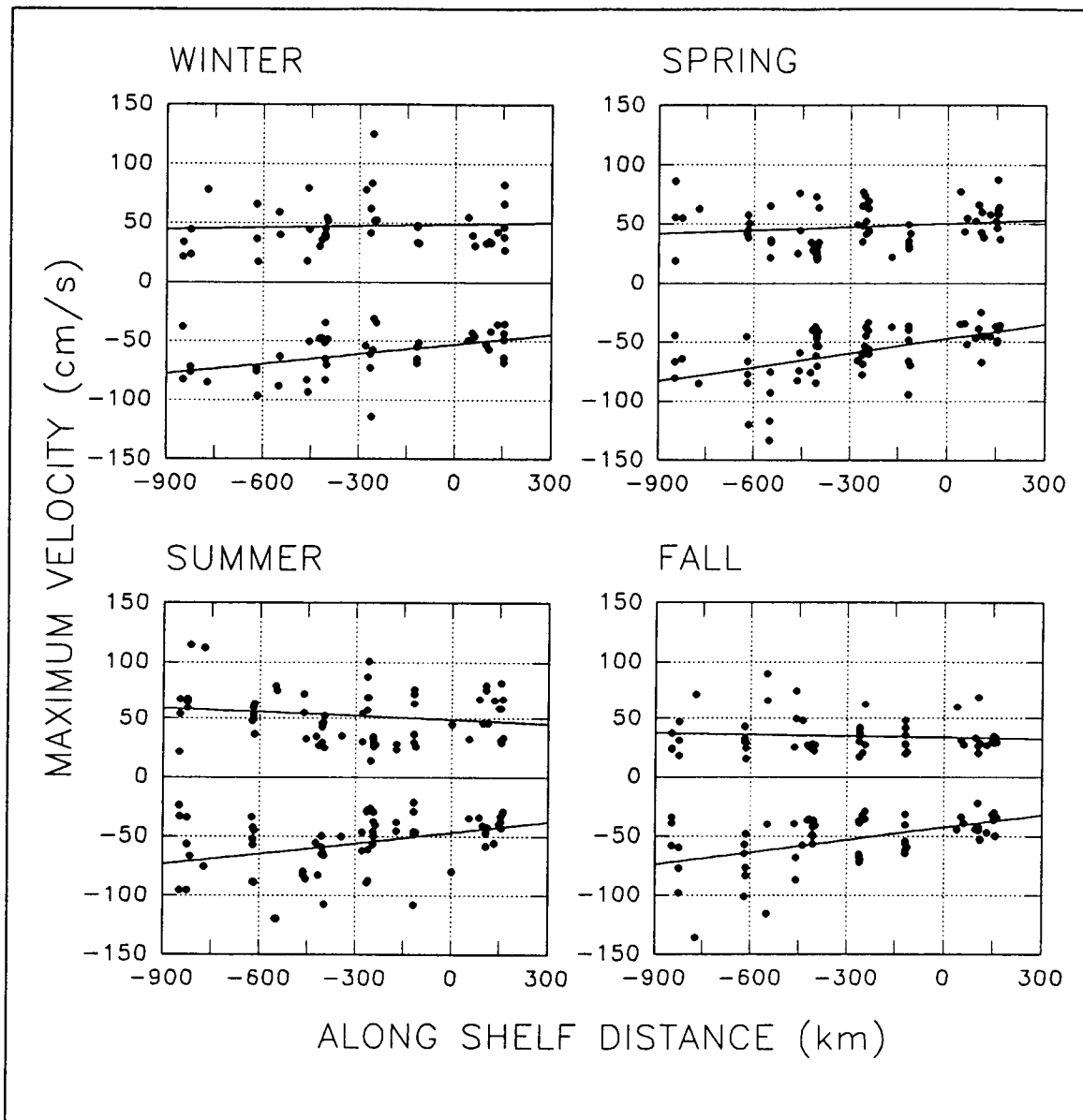


Figure 13. Seasonal alongshore maximum velocity versus alongshelf distance. Positive alongshore velocity is eastward. Zero distance is the Mississippi Delta, distance west is negative. Linear regression slopes were tested as different from zero with a student-t test. The slopes for westward maximum velocity were significantly different from zero at the 99% level for all seasons ($t=3.248$, $n=44$; $t=5.113$, $n=66$; $t=3.180$, $n=66$; $t=4.254$, $n=59$, respectively). The slope for spring eastward maximum velocity was significantly different from zero at the 80% level ($t=1.378$, $n=66$); no other season had a significant relationship between eastward maximum velocity and alongshelf distance.

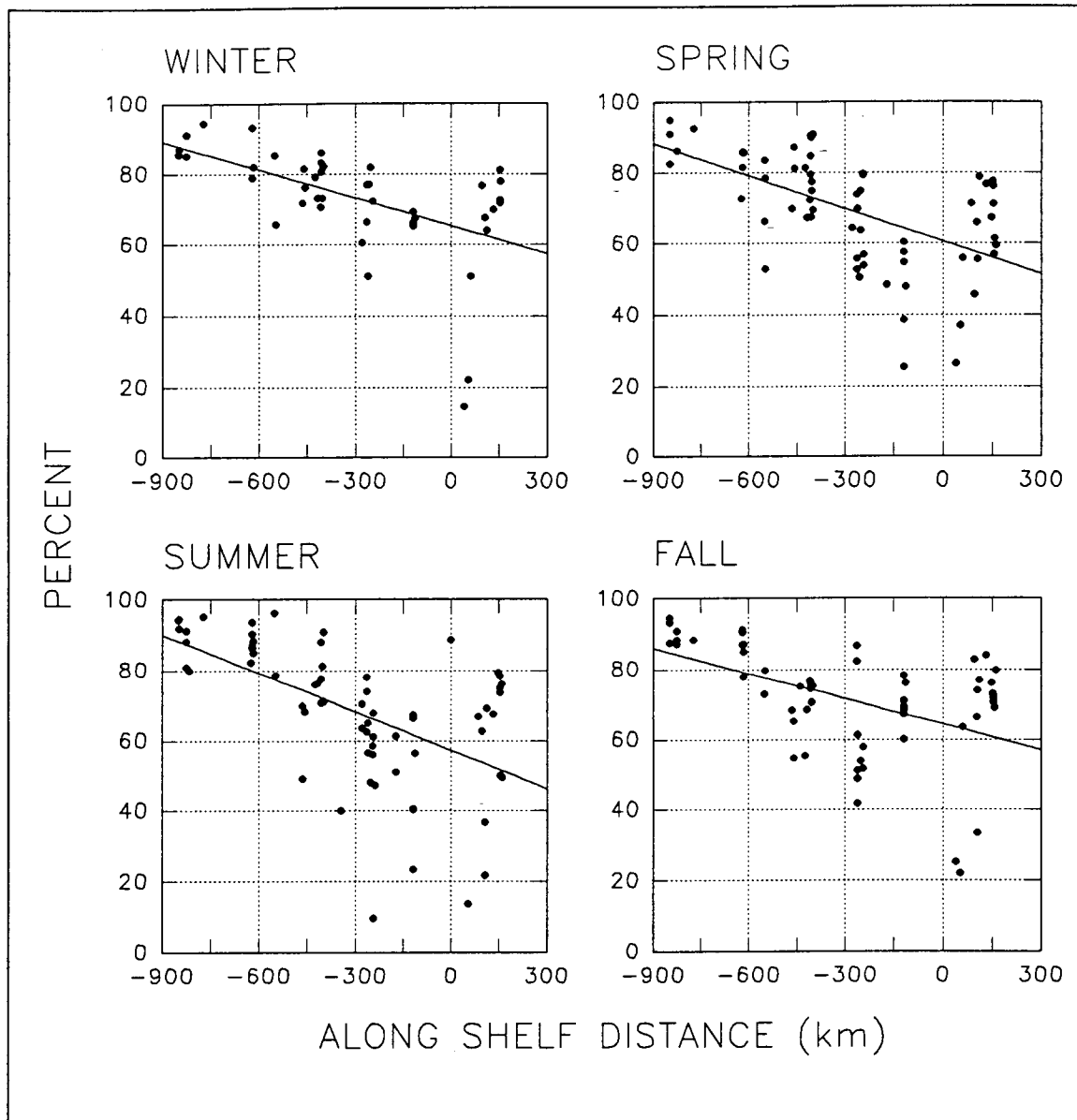


Figure 14. Percent low-pass alongshore seasonal variance versus alongshelf distance. Zero distance is the Mississippi Delta, distance west is negative. Linear regression slopes were tested as different from zero with a student-t test. The slopes for all seasons were significantly different from zero at the 99% level ($t=-4.114$, $n=44$; $t=-5.638$, $n=66$; $t=-5.365$, $n=66$; $t=-4.032$, $n=59$, respectively).

Along-shore winter auto-correlation time scales were between 20 and 70 hours (Table 3), with a marginally statistically significant increase (at the 90% level) towards the west. These time scales, estimates of the length of time velocity component records were correlated with themselves, were determined from the low-passed records. Cross-shore auto-correlation time scales were predominantly between 18 and 40 hours (Table 3), but with a statistically significant increase (at the 90% level) towards the east.

In general there was very good agreement in mean alongshore flow magnitudes and directions, in variance magnitudes and orientations, and the along-shore percentage of low-passed variation at stations with multiple winter records, although along-shore auto-correlation time scales varied inter-annually by a factor of 2.

3.1.2 Spring

Spring mean flows were predominantly eastward in the eastern region, and westward in the central and western regions (Figure 5). There was an increase in westward flow with along shelf distance to the west that was statistically significant at the 99% level (Figure 11). Exceptions to the eastward mean flow at the eastern stations were COE MS C4 (30.17°N 88.38°W), likely influenced by the local tidal pass, COE MS C5 (30.05°N 88.28°W) and USGS US. In the central region the stronger mean flows clustered near the 10 m isobath; those few records near the 20 m isobath had weaker mean flows. There was only one non-westward mean flow in the western records, MMS LTX 20 (29.5°N 94°W).

Stations with multiple spring records were fairly consistent in direction between years and poorly consistent in magnitude.

Four of 16 eastern mean flows (all to the east), 6 of 19 central mean flows (all to the west), and 20 of 31 western mean flows (all to the west) were statistically significant at the 95% level (Table 2). Statistically significant eastern station flow magnitudes were 5-8 $\text{cm}\cdot\text{s}^{-1}$, 4-9 $\text{cm}\cdot\text{s}^{-1}$ at the central stations, and 2-23 $\text{cm}\cdot\text{s}^{-1}$ at the western stations.

Cross-shore mean flows were of low magnitude, -3 to +5 $\text{cm}\cdot\text{s}^{-1}$, with no linear trend with along-shelf distance (Figure 12).

The mean of the velocity maxima were larger alongshore than cross-shore (Table 2). Larger alongshore components were westward and larger cross-shore components were offshore. There was an increase in maximum westward flow with distance to the west (significant at the 99% level), and a small increase in eastward maxima to the east (significant at the 80% level) (Figure 13). On-shore and off-shore velocity maxima increased to the east (significant at the 99% and 80% levels, respectively).

Most spring variance possessed shore-parallel major axes (Figure 6). Three exceptions were noted, two in the eastern region, COE MS C5 and C2, the former unexplained and the latter likely influenced by the 90° bend of the inner shelf bathymetry (near 30°N 89°W), the third exception was in the (north)western region, DOE BD B8, a near bottom meter with almost isotropic variance. The variance axes became less symmetric towards the west. The magnitude of alongshore variance increased towards the west, while the cross-shore variance magnitude increased towards the east.

The alongshore variance was predominantly contained in the low-passed records, with a statistically significant increase (at the 99% level)

from 55% in the east to 85% in the west (Figure 14). Less than 50% of the cross-shore variance was contained in the low-passed records. A local maximum, > 60%, appeared in the (north)western region and a local minimum, > 30%, appeared in the central region, but there was no statistical relationship with alongshelf distance.

Alongshore auto-correlation time scales ranged between 24 and 120 hours (Table 3), although most were less than 75 hours. There was no statistically significant trend in auto-correlation time scale alongshelf. Cross-shore auto-correlation time scales ranged between 18 and 60 hours, and formed two clusters, one around 24 hours, the other around 48 hours. There was a statistically significant increase (at the 90% level) in cross-shore auto-correlation time scale towards the east.

There was general agreement in mean alongshore flow magnitude and direction, in variance axes magnitude and size, in along-shore percentage of variance in the low-pass band, and in along-shore auto-correlation time scales at stations with multiple spring records (Figures 5 and 6; Tables 2 and 3).

3.1.3 Summer

Results from the analysis of summer mean flows were inconsistent; there appeared to be no uniform alongshore flow direction for any region (Figure 5). Mean alongshore flows were distributed fairly uniformly in both directions across the regions. Although there was a slight increase to the west in eastward alongshore flow, it was not statistically significant (Figure 11). This was likely the result of interannual wind variability and unequal record lengths.

In summer there were very few statistically significant record means (Table 2). There were 3 of 15 eastern stations (2 to east), 6 of 23 central stations (5 to east), and 4 of 28 western stations (3 to east) with statistically significant (at the 95% level) alongshore mean flows. One eastern, one central and three western cross-shore means were statistically significant. All the significant cross-shore means, except one in the western region, were onshore.

The mean of the alongshore maximum velocities were approximately equal in the westward and eastward directions, but larger than the cross-shore maximum velocities, which were also approximately equal in the on- and off-shore directions. Westward alongshore maximum velocities increased in magnitude to the west (significant at the 99% level) (Figure 13).

Summer variance were typically oriented with major axes alongshore (Figure 8), and the western stations having larger ratios of major to minor axis length. Alongshore variance was highly variable, with the greatest ranges located in the western region. Cross-shore variances were of similar magnitude as in other seasons, but with more, and larger, outliers than in the other seasons.

The alongshore variance was predominantly contained in the low-passed records, with a statistically significant increase (at the 99% level) from 50% in the east to 95% in the west (Figure 14). Low percentages, < 40%, were located in the eastern region where the inner shelf bathymetry bends 90°, and in the central region. The percentage of cross-shore variance in the low-passed data was usually less than 60%. Low values in the eastern region result in a statistically significant (at the 95% level) increase in percentage towards the west.

The summer season contained the largest observed alongshore auto-correlation time scales, with a number of records with time scales greater than 120 hours, and a maximum of 220 hours. The time scales clustered near 72 hours. There was a statistically significant increase (at the 80% level) towards the west. Cross-shore time scales were predominantly between 18 and 72 hours (Table 3), but with two clusters, 24 and 60 hours. There was no statistically significant trend with alongshelf distance.

In summer the alongshore flows were the most inconsistent interannually. Many stations exhibited opposing means. This was coupled with generally longer alongshore auto-correlation time scales.

3.1.4 Fall

Fall alongshore flows were predominantly to the west in all regions (Figure 3), with magnitude increasing with alongshelf distance to the west (statistically significant at the 99% level) (Figure 11). The two exceptions to westward flow were found at the eastern region station COE MS C6 (Figure 9a) where mean flow direction was likely influenced by the proximity to the major tidal inlet into Mobile Bay, AL, and at the western region station TABS TC (Figure 9e).

Ten of 15 eastern records, 11 of 16 central records, and 25 of 28 western records had statistically significant mean alongshore flows (Table 2). Statistically significant alongshore mean flow magnitudes were 2-9 $\text{cm}\cdot\text{s}^{-1}$ in the eastern region, 4-15 $\text{cm}\cdot\text{s}^{-1}$ in the central region, and 6-22 $\text{cm}\cdot\text{s}^{-1}$ in the western region.

Cross-shore means were similar to observations in other seasons with low magnitudes, -5 to +9 $\text{cm}\cdot\text{s}^{-1}$, and no significant geographical trend (Figure 12). Few records had statistically significant mean flows.

Alongshore velocity maxima to the west were larger than those to the east, and were similar in magnitude to observations during other seasons (Table 2). Alongshore maximum velocities increased towards the west (statistically significant at the 99% level) (Figure 13). Neither the alongshore maximum velocities towards the east, nor the cross-shore maximum velocities had a significant geographical trend.

More fall variance axes (Figure 10) had an isotropic character than in other seasons. No isotropic axes were found in the (south)western region. Along-shore variance was quite variable, with lower magnitude than in the other seasons, and an apparent increase in magnitude to the west.

The percent alongshore variance in the low-passed band was generally greater than 60%, and increased to the west (statistically significant at the 99% level) (Figure 14). Two clusters less than 60% occurred in the eastern region at stations COE MS C1 and C2, where flows were influenced by backbarrier exchanges, and in the central region near 92°W, off-shore of the Atchafalaya River delta. The percent cross-shore variance in the low-passed band was generally less than 60% with the lowest values, ~10%, occurring in the central region (Table 3).

Fall along-shore auto-correlation time scales were generally between 20 and 70 hours and fairly evenly distributed alongshelf (Table 3). A few outliers near 96 hours appeared in each region. No spatial trends were observed in either the along- or the cross-shore time scales.

There was general agreement between alongshore means and variances, in that both increased towards the west. Fall flows were notably westward, more so than in any other season.

3.2 Alongshore Flow Persistence

The proportions of alongshore flow as hours of record, percentage of record length, number of events and distribution of event durations are presented in Appendix A for each station record. Appendix A is a massive table and is therefore distributed on a diskette that accompanies this report. Appendix A is divided into the four seasons, within each season stations are listed in an east to west, on-shore to off-shore pattern.

3.2.1 Persistence

The percentage of flow to the west, the normalized amount of flow in the negative alongshore direction, changed with location and season (Figure 15). Note that the complement of westward flow would be eastward flow.

In winter, generally more than 50% of the alongshore flow was westward, with the lower values occurring in the eastern region. A linear relationship between percent westward flow and alongshelf distance, statistically significant at the 99% level, increased from 60% at the eastern stations to over 80% at the westernmost stations. There was one outlier with only 22% westward flow, COE MS C1, in the eastern region. The location of this station, inside the backbarrier waters of the Chandeleur Sound, has been shown to flow in opposition to the general inner-shelf alongshelf flow directions (Dinnel 1988).

The percentages of westward flows in spring were slightly lower but similar to winter conditions. Although percentages of westward flow were fairly stable near 65% in the (south)western region, 20% higher values were found in the (north)western region. Despite this, there was a statistically significant, at the 99% level, linear increase with alongshelf distance to the west.

The percentages of westward flow in summer were lower. Most values being less than 60%, and had a much larger range, 20-80%, than during any other season. There was a statistically significant, at the 80% level, linear increase with alongshelf distance to the east.

Shelfwide westward flow was reestablished in the fall. Flow increased to the west (statistically significant at the 95% level), although at a lower rate than in winter or spring.

Maximum displacements were defined as the largest single event displacements determined as the vector sum of the product of velocity and sample interval for all events in both the east and west alongshore directions. Maximum displacements westward increased linearly to the west with alongshelf distance. The relationship was significant at the 99% level. Magnitudes of maximum displacements in winter were less than 200 km for those stations east of 94.5°W and generally greater than 200 km for those stations west of 94.5°W. West of 94.5°, with the exception of a 61 km displacement at MMS LTX 1b, a 70 km displacement at TABS TC, and a 60 km displacement at DOE BD B7, the westward maximum displacements had magnitudes greater than 200 km. Spring maximum displacements were similar. The outlier was a 494 km westward displacement at MMS LTX 23b. Summer maximum displacements were all less than 300 km. Fall maximum westward displacements were quite variable, with many exceeding a magnitude of 300 km.

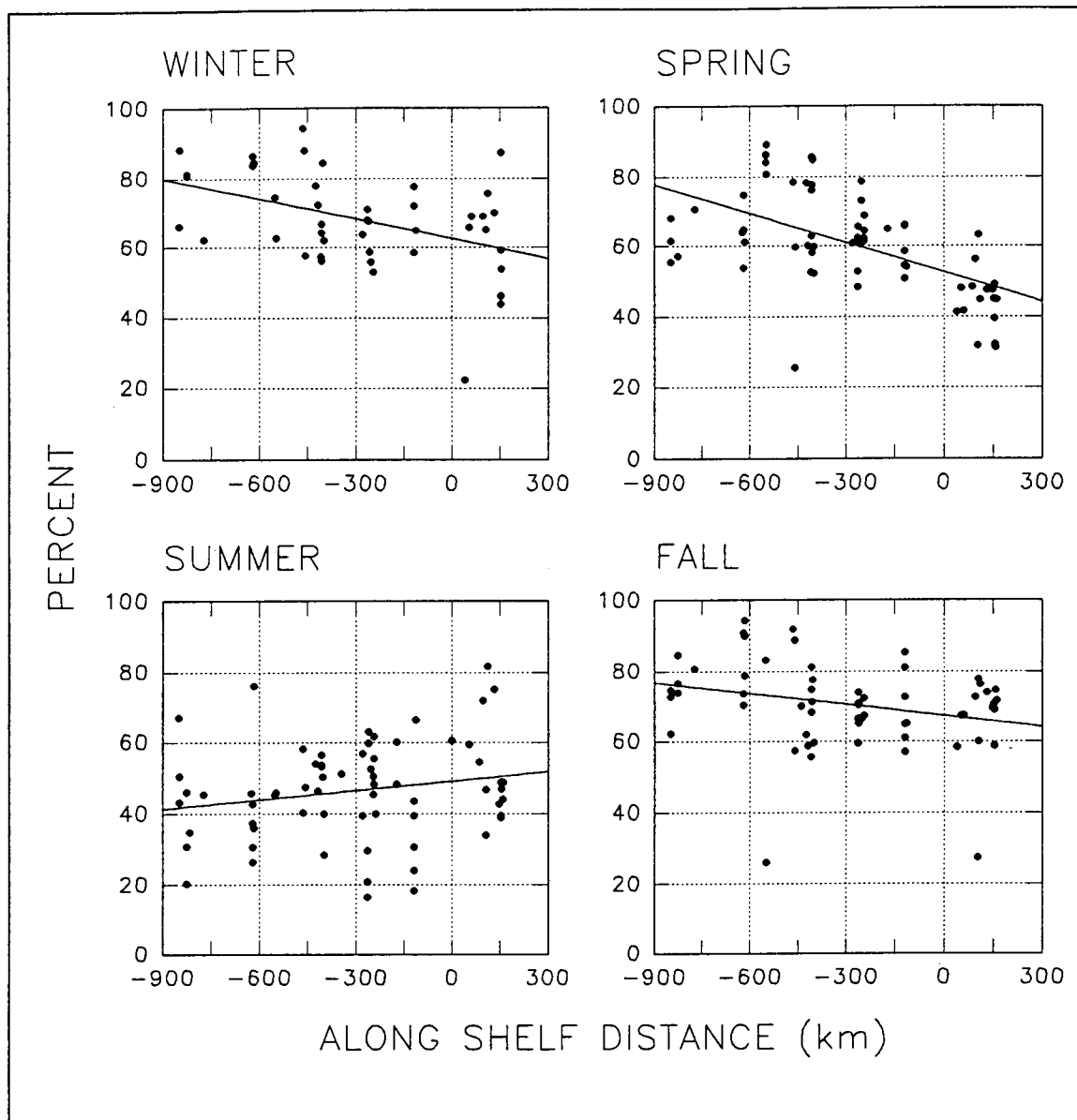


Figure 15. Percent of record with westward alongshore velocity versus alongshelf distance. Positive cross-shore velocity is onshore. Zero distance is the Mississippi Delta, distance west is negative. Linear regression slopes were tested as different from zero with a student-t test. The slopes for winter and spring were significantly different from zero at the 99.9% level ($t=-3.123$, $n=44$; $t=-5.584$, $n=66$), the slope for fall was significantly different from zero at the 95% level ($t=-2.075$, $n=59$), and the slope for summer was significantly different from zero at the 80% level ($t=1.582$, $n=66$).

Maximum displacements eastward were of lesser overall magnitude than those toward the west and had lower variation than maximum displacements westward in all seasons except summer when westward displacements were small (Figure 16) and eastward displacements were large (Figure 17). Magnitudes of maximum eastward displacements were generally less than 100 km in winter. There was a statistically significant (at the 95% level) linear increase in maximum eastward displacement with distance alongshelf to the west. In spring, most maximum eastward displacements were less than 100 km. The few that exceeded 100 km were in the (south)western and eastern regions. There was no statistically significant linear trend in maximum eastward displacement with distance alongshelf. Summer maximum eastward displacements had the highest variation and a statistically significant (at the 99% level) linear increase in maximum eastward displacement with distance alongshelf to the west. Most summer displacements were less than 200 km, but 20% were greater than 200 km; the longest was in the (south)western region. Fall maximum eastward displacements were again quite low; all but one were less than 100 km. There was a statistically significant (at the 95% level) linear increase in maximum eastward displacement with distance alongshelf to the west.

3.2.2 Persistence Example

A single station subset of Appendix A is presented as Table 4. The four seasonal records of station EPA GS G1 are presented to explain the information contained in Appendix A and to provide an example of its use. Table 4 represents alongshore flow statistics, and some stations may have only one seasonal record, while others may have multiple records in a single season. Station EPA GS G1 has one record in each of the four seasons.

The current meter depth and total water depth, 5.2 and 10.4 m for G1, and the latitude and longitude, 30.23° and -87.685° in this case, are listed for each station record in the first line of each seasonal table. The total record length for G1 in winter was 2160.0 hours (90.0 days); the record mean alongshore flow was $-2.10 \text{ cm}\cdot\text{s}^{-1}$. This information is presented in the second line. The negative sign indicates flow to the west (to the viewer's left facing the coast). The maximum displacements during a single event, -50.318 km (to the west) and 35.278 km (to the east) for G1 in winter are presented in the third line. The next line, labeled 'velocity level', defines bins into which the data samples were sorted. Reading from the left, these are the number of samples with velocities greater than $125 \text{ cm}\cdot\text{s}^{-1}$ to the west, greater than $100 \text{ cm}\cdot\text{s}^{-1}$ to the west, etc.. The column labeled '<0' includes all data samples involving westward flow. The bins to the right of the label 'velocity level' are indicative of eastward flow. The next two lines indicate, respectively, that 59.26% of the record, a total of 1280 hours, involved westward flow. This is seen in the column labeled '<0'. The eighth line of this table, in the same column, indicates that there were 80 westward flow events observed, while the seventh line indicates that the longest observed westward flow event lasted 110.0 hours. Looking in the column labeled '>0', one sees that 40.74% of the record or 880.0 hours of record recorded eastward flow. The maximum continuous duration of eastward flow was 123.5 hours. There were 81 events during which flow was eastward. Most of the flow events, in either direction, were weak. The column labeled '<-25' indicates that only 1.78% of the record involved westward flows in the excess of $25 \text{ cm}\cdot\text{s}^{-1}$. This accounted for 38.5 hours of record. Thirty-two such events were recorded. The longest was 9.5 hours in duration. Looking farther down the column label '<0', one sees the westward flow events sorted by duration. Sixty-five had durations less than one day, while 6 had

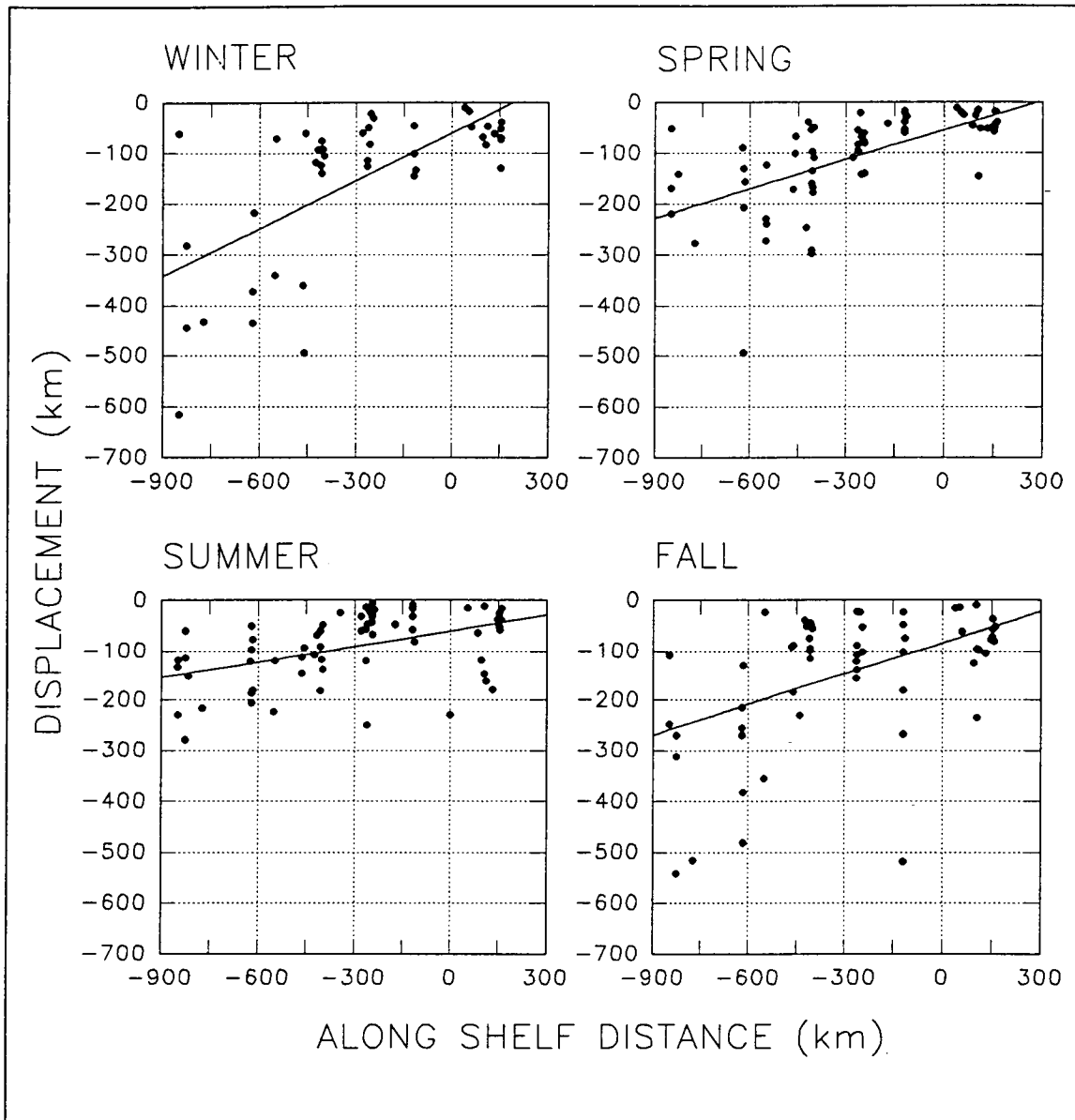


Figure 16. Seasonal maximum westward displacement versus alongshelf distance. Positive cross-shore velocity is onshore. Zero distance is the Mississippi Delta, distance west is negative. Linear regression slopes were tested as different from zero with a student-t test. The slopes for all seasons were significantly different from zero at the 99% level ($t=5.638$, $n=44$; $t=6.134$, $n=66$; $t=4.126$, $n=66$; $t=4.225$, $n=59$, respectively).

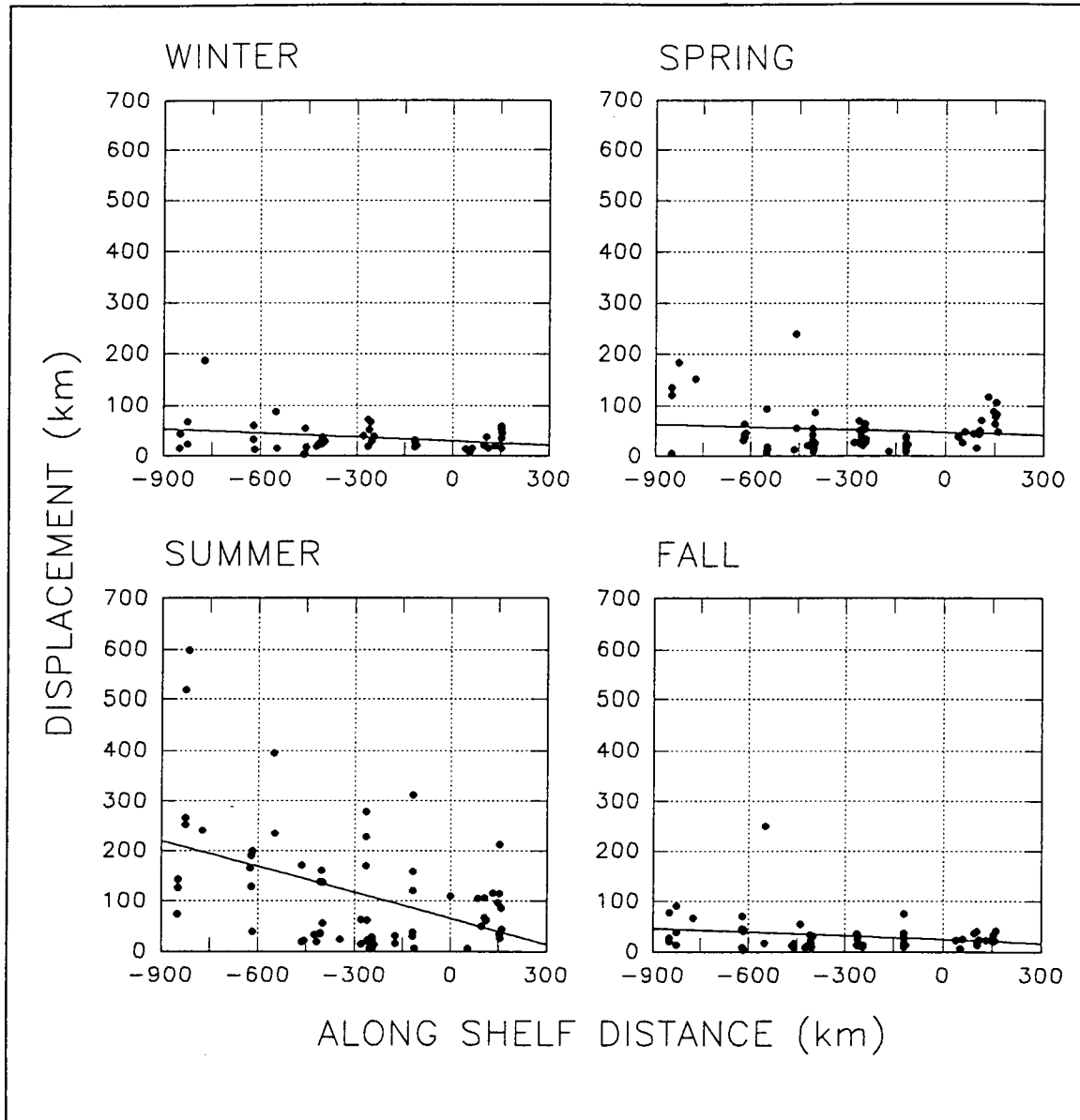


Figure 17. Seasonal maximum eastward displacement versus alongshelf distance. Positive cross-shore velocity is onshore. Zero distance is the Mississippi Delta, distance west is negative. Linear regression slopes were tested as different from zero with a student-t test. The slope for summer was significantly different from zero at the 99% level ($t=-3.991$, $n=66$), the slopes for winter and fall were significantly different from zero at the 95% level ($t=-1.826$, $n=44$; $t=-1.722$, $n=59$), and the slope for spring was below the 80% significance level and considered not different from zero ($t=-0.923$, $n=66$).

durations between 1 and 2 days, etc.. If a duration bin was empty, it was not included in the formal table. Thus, for example, the spring record at G1 included no flow events between 5 and 6 days duration. The line appropriate for this duration bin is missing from the table. The winter record from G1 included no flows in excess of $50 \text{ cm}\cdot\text{s}^{-1}$, as indicated by the zeros in all the columns labeled '<-125', '<-100', '<-75', '<-50', '>50', '>75', '>100', and '>125'. Note that the single event with maximum duration in either the eastward or westward direction is not necessarily the event associated with maximum displacement in that direction. The former is only an indication of event duration. The latter is determined by a product of duration and velocity.

Appendix A could be used to look up alongshore flow persistence at a specific location, defined by latitude and longitude, or general locations along the northern coast of the Gulf of Mexico. Consider a spill just east of the entrance to Mobile Bay, AL, in October. This is in the fall season and the closest station may be EPA GS G1 (which suggests the use of Table 4 in this example), but additional stations nearby contain supporting information. One can see from the fall persistence statistics for EPA GS G1 (Table 4 or Appendix A) that observations indicated a net alongshore flow to the west, the $-2.01 \text{ cm}\cdot\text{s}^{-1}$ mean flow being statistically significant at the 95% level (Table 2). The majority of the flow had magnitudes less than $\pm 25 \text{ cm}\cdot\text{s}^{-1}$; 0.34% of the flow exceeded $25 \text{ cm}\cdot\text{s}^{-1}$ to the west, and 0.02% exceeded $25 \text{ cm}\cdot\text{s}^{-1}$ to the east. At no time during this record did flows exceed $\pm 50 \text{ cm}\cdot\text{s}^{-1}$. Most flow events were less than one day in duration, with the maximum event duration being less than five days, in either direction. Of the eight separate events that exceeded $25 \text{ cm}\cdot\text{s}^{-1}$ to the west, the maximum duration was only 2.5 hours. Only one event exceeded $25 \text{ cm}\cdot\text{s}^{-1}$ to the east; that lasted a single time step, one half hour. Although most of the flow was westward (59%), there was nearly the same duration of flow to the east. The maximum displacements were 37 km west and 21 km east. These statistics provide duration and displacement indications of possible excursions that can occur at this location.

4. DISCUSSION AND INTERPRETATION

4.1 Seasonal Flows

Winter, spring and fall had mean alongshore flows to the west, which increased towards the west; summer flow patterns were different, there was as much flow towards the east as towards the west and no geographical trend in flow direction. Cross-shore flows were consistent throughout the year in magnitude and apparent lack of directional tendencies. Variance axes were of similar orientation and comparable in magnitude in all seasons, with the (south)western region axes being more elongated alongshore than on the other regions. There was a consistent increase towards the west in all seasons in the percentage of alongshore variance in the low-passed band.

Velocity maxima were fairly symmetric between the cross-shore directions; but the alongshore maximum velocities had seasonal asymmetry. Only the summer had balanced maximum velocities in both alongshore directions. The other seasons had higher magnitudes to the west. Although there was no substantial geographical difference in alongshore maximum velocities to the east, there was a consistent increase in maximum westward velocities to the west over all seasons. On-shore maximum velocities increased towards the east in spring and weakly in the winter, but had no trend in other seasons.

Table 4.

Seasonal alongshore flow durations for EPA GS G1. Station designation, current meter depth/total water depth (m), latitude and longitude (°), record length, record mean (cm/s), maximum westward and eastward displacements by a single event (km), the portion of the record, as a percentage (%), as total hours (hr) and as number of events, exceeding specified velocity levels, the number of events within durations of day increments, and the duration (hr) of the single longest event.

Seasonal alongshore flow durations, winter.

STATION: EPA GS G1 (5.2/10.4m)						LATITUDE: 30.23000		LONGITUDE: -87.68500					
RECORD LENGTH: 2160.0 hr = 90.00 d						RECORD MEAN: -2.10 cm/s							
MAX DISPLACEMENT EVENT WEST: -50.318 km						MAX DISPLACEMENT EVENT EAST: 35.278 km							
<-125	<-100	<-75	<-50	<-25	<0	VELOCITY LEVEL	>0	>25	>50	>75	>100	>125	
0.00	0.00	0.00	0.00	1.78	59.26	RECORD (%)	40.74	0.79	0.00	0.00	0.00	0.00	
0.0	0.0	0.0	0.0	38.5	1280.0	RECORD (hr)	880.0	17.0	0.0	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	9.5	111.0	MAX DURATION	123.5	5.0	0.0	0.0	0.0	0.0	
0	0	0	0	32	80	ALL EVENTS	81	10	0	0	0	0	
0	0	0	0	32	65	0 TO 1 DAYS	71	10	0	0	0	0	
0	0	0	0	0	6	1 TO 2 DAYS	8	0	0	0	0	0	
0	0	0	0	0	7	2 TO 3 DAYS	0	0	0	0	0	0	
0	0	0	0	0	1	3 TO 4 DAYS	1	0	0	0	0	0	
0	0	0	0	0	1	4 TO 5 DAYS	0	0	0	0	0	0	
0	0	0	0	0	0	5 TO 6 DAYS	1	0	0	0	0	0	

Table 4. Seasonal alongshore flow durations for EPA GS G1. (continued)

Seasonal alongshore flow durations, spring.

STATION: EPA GS G1 (5.2/10.4m)						LATITUDE: 30.23000		LONGITUDE: -87.68500				
RECORD LENGTH: 1856.0 hr = 77.33 d						RECORD MEAN: 1.63 cm/s						
MAX DISPLACEMENT EVENT WEST: -57.157 km						MAX DISPLACEMENT EVENT EAST: 64.155 km						
<-125	<-100	<-75	<-50	<-25	<0	VELOCITY LEVEL	>0	>25	>50	>75	>100	>125
0.00	0.00	0.00	0.03	3.23	45.04	RECORD (%)	54.96	3.48	0.00	0.00	0.00	0.00
0.0	0.0	0.0	0.5	60.0	836.0	RECORD (hr)	1020.0	64.5	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.5	13.0	159.0	MAX DURATION	103.5	13.5	0.0	0.0	0.0	0.0
0	0	0	1	28	59	ALL EVENTS	59	18	0	0	0	0
0	0	0	1	28	50	0 TO 1 DAYS	47	18	0	0	0	0
0	0	0	0	0	4	1 TO 2 DAYS	7	0	0	0	0	0
0	0	0	0	0	3	2 TO 3 DAYS	2	0	0	0	0	0
0	0	0	0	0	1	3 TO 4 DAYS	1	0	0	0	0	0
0	0	0	0	0	0	4 TO 5 DAYS	2	0	0	0	0	0
0	0	0	0	0	1	6 TO 7 DAYS	0	0	0	0	0	0

Table 4. Seasonal alongshore flow durations for EPA GS G1. (continued)

Seasonal alongshore flow durations, summer.

STATION: EPA GS G1 (5.2/10.4m)						LATITUDE: 30.23000		LONGITUDE: -87.68500				
RECORD LENGTH: 2208.0 hr = 92.00 d						RECORD MEAN: 0.09 cm/s						
MAX DISPLACEMENT EVENT WEST: -25.939 km						MAX DISPLACEMENT EVENT EAST: 35.332 km						
<-125	<-100	<-75	<-50	<-25	<0	VELOCITY LEVEL	>0	>25	>50	>75	>100	>125
0.00	0.00	0.00	0.00	0.38	48.82	RECORD (%)	51.18	0.36	0.00	0.00	0.00	0.00
0.0	0.0	0.0	0.0	8.5	1078.0	RECORD (hr)	1130.0	8.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	3.5	80.5	MAX DURATION	123.5	4.5	0.0	0.0	0.0	0.0
0	0	0	0	10	120	ALL EVENTS	120	5	0	0	0	0
0	0	0	0	10	110	0 TO 1 DAYS	110	5	0	0	0	0
0	0	0	0	0	6	1 TO 2 DAYS	5	0	0	0	0	0
0	0	0	0	0	2	2 TO 3 DAYS	4	0	0	0	0	0
0	0	0	0	0	2	3 TO 4 DAYS	0	0	0	0	0	0
0	0	0	0	0	0	5 TO 6 DAYS	1	0	0	0	0	0

Table 4. Seasonal alongshore flow durations for EPA GS G1. (continued)

Seasonal alongshore flow durations, fall.

STATION: EPA GS G1 (5.2/10.4m)						LATITUDE: 30.23000		LONGITUDE: -87.68500				
RECORD LENGTH: 2184.0 hr = 91.00 d						RECORD MEAN: -2.01 cm/s						
MAX DISPLACEMENT EVENT WEST: -36.632 km						MAX DISPLACEMENT EVENT EAST: 21.205 km						
<-125	<-100	<-75	<-50	<-25	<0	VELOCITY LEVEL	>0	>25	>50	>75	>100	>125
0.00	0.00	0.00	0.00	0.34	58.81	RECORD (%)	41.19	0.02	0.00	0.00	0.00	0.00
0.0	0.0	0.0	0.0	7.5	1284.5	RECORD (hr)	899.5	0.5	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.5	110.0	MAX DURATION	98.5	0.5	0.0	0.0	0.0	0.0
0	0	0	0	8	78	ALL EVENTS	77	1	0	0	0	0
0	0	0	0	8	61	0 TO 1 DAYS	69	1	0	0	0	0
0	0	0	0	0	11	1 TO 2 DAYS	5	0	0	0	0	0
0	0	0	0	0	3	2 TO 3 DAYS	0	0	0	0	0	0
0	0	0	0	0	2	3 TO 4 DAYS	2	0	0	0	0	0
0	0	0	0	0	1	4 TO 5 DAYS	1	0	0	0	0	0

4.2 Alongshore Flow Persistence

Three seasons, winter, spring and fall, exhibit predominantly westward flows. These flows increase in magnitude and proportion of occurrence towards the west. The summer season does not exhibit a systematic flow reversal, but there are as many occurrences of eastward flow as westward flow. A general reversal to eastward flow does occur over the (south)western region.

Most velocity events, regardless of season, in either alongshore direction, are less than one day in duration. Longer durations are possible, and there is a higher number of multiple day flow events in summer than during the other seasons. Velocity events, higher than $\pm 25 \text{ cm}\cdot\text{s}^{-1}$, are usually only a few hours in duration. These higher velocity events are more common in the western regions.

Regardless of season there appear to be larger magnitudes of maximum displacement events, in both alongshore directions, in the western regions. The maximum displacement events decrease in summer for westward displacements and increase for eastward displacements.

5. REFERENCES

- Bendat, J.S. and A.G. Piersol. 1986. Random data, analysis and measurement procedures. Wiley-Interscience. New York. 566 pp.
- Chuang, W.S., W.W. Schroeder, and Wm. J. Wiseman, Jr. 1982. Summer currents observations off the Alabama coast. Contributions in Marine Science 25:121-131.
- Csanady, G.T. 1982. Circulation in the coastal ocean. Reidel. Boston. 279 pp.
- DiMego, G.H., L.F., Bosart, and G.W. Endersen. 1976. An examination of the frequency and mean conditions surrounding frontal excursions into the Gulf of Mexico and Caribbean Sea. Monthly Weather Review 104:709-718.
- Dinnel, S.P. 1988. Circulation and sediment dispersal on the Louisiana-Mississippi-Alabama continental shelf. Ph.D. Dissertation, Louisiana State University. Baton Rouge, LA. 173 pp.
- Dinnel, S.P. and A. Bratkovich. 1993. Water discharge, nitrate concentration and nitrate flux in the lower Mississippi River. Journal of Marine Systems 4:315-326.
- Frey, H.R., M.W. Szabados, and L.E. Hickman. 1981. NOS Strategic Petroleum Reserve Support Project: Final Report. Volume One - Oceanography of the Louisiana inner continental shelf. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
- Florida A&M University. 1988. Meteorological database and synthesis for the Gulf of Mexico. OCS Study, MMS 88-0064. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA. 486 pp.
- Gutierrez de Velasco, G. and C.D. Winant. 1996. Seasonal patterns of wind stress and wind curl over the Gulf of Mexico. Journal of Geophysical Research 101(C8):18127-18140.
- Hann, R.W., Jr. and R.E. Randall. 1981. Evaluation of brine disposal from the Bryan Mound site of the Strategic Petroleum Reserve: Final report, 12-month post disposal studies. Volume I. Texas A&M University.
- Hann, R.W., Jr., C.P. Giammona, and R.E. Randall. 1984. Offshore oceanographic and environmental monitoring services for the Strategic Petroleum Reserve: Eighteen month report for the West Hackberry site from May 1982, through November 1983 to the Department of Energy. Report number DOE/p010850-3. NTIS, Springfield, VA.
- Henry, W.K. 1979. Some aspects of the fate of cold fronts in the Gulf of Mexico. Monthly Weather Review 107:1078-1082.
- Jochens, A.E. and W.D. Nowlin, Jr., eds. 1994. Texas-Louisiana shelf circulation and transport processes study: Year 1 - Annual Report, Volume II: Technical Summary. OCS Report, MMS 94-0029. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA. 207 pp.

Jochens, A.E. and W.D. Nowlin, Jr., eds. 1995. Texas-Louisiana shelf circulation and transport processes study: Year 2 - Annual Report. OCS Report, MMS 95-0028. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA. 172 pp.

Kelly, F.J. 1991. Physical oceanography/water mass characterization. In Brooks, J.M. (ed.) Mississippi-Alabama Continental Shelf Ecosystem Study: Data Summary and Synthesis. Volume II: Technical Narrative. OCS Study, MMS 91-0063. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA.

Kinoshita, K. and M. Noble. 1995. Current data from the northern Gulf of Mexico. Preliminary Open File Report 95-633, U.S. Department of the Interior, Geological Survey, Menlo Park, CA.

Kjerfve, B. and J.E. Sneed. 1984. Analysis and synthesis of oceanographic conditions in the Mississippi Sound offshore region. U.S. Army Corps of Engineers, Mobile District, Final Report, Volumes 1 and 2.

Newton, H.J. 1988. Timeslab: A time series analysis laboratory. Wadsworth and Brooks/Cole Publishing Company, Pacific Grove, CA. 623 pp.

Reap, M.E., A.E. Jochens, and W.D. Nowlin, Jr., eds. 1996. Texas-Louisiana shelf circulation and transport processes Study: Year 3 - Annual Report. OCS Report, MMS 96-0030. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA. 82 pp.

Rhodes, R.C., A.J. Wallcraft, and J.D. Thompson. 1985. Navy-corrected geostrophic wind set for the Gulf of Mexico. NORDA Technical Note 310. Naval Ocean Research and Development Activity, NSTL, MS. 103 pp.

Schroeder, W.W. and W.J., Wiseman, Jr. 1985. An analysis of the winds (1974-1984) and sea level elevations (1973-1983) in coastal Alabama. MASGP-84-024, Mississippi-Alabama Sea Grant Consortium. 102 pp.

Schroeder, W.W., S.P. Dinnel, Wm. J. Wiseman, Jr., and W.J. Merrell, Jr. 1987. Circulation patterns inferred from the movement of detached buoys in the eastern Gulf of Mexico. Continental Shelf Research 7(8):883-894.

Science Applications International Corporation. 1989. Gulf of Mexico physical oceanography program, final report: Year 5. Volume II: Technical Narrative. OCS Report, MMS 89-0067. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA. 333 pp.

Smith, N. 1975. Seasonal variations in near-shore circulation in the northwestern Gulf of Mexico. Contributions in Marine Science 19:49-65.

Smith, N. 1978. Low-frequency reversals in near-shore currents in the northwestern Gulf of Mexico. Contributions in Marine Science 21:103-115.

Spiegel, M.R. 1961. Theory and Problems of Statistics. Schaum's outline series, McGraw-Hill Book Company, New York, NY. 359 pp.

van der Leeden, F., F.L. Troise, and D.K. Todd. 1990. The Water Encyclopedia, 2nd edition. Lewis Publishers, Chelsea, MI. 808 pp.

Wiseman, Wm. J., Jr., and S.P. Dinnel. 1988. Shelf currents near the mouth of the Mississippi River. Journal of Physical Oceanography

Wiseman, Wm. J., Jr., and S.P. Dinnel. 1988. Shelf currents near the mouth of the Mississippi River. *Journal of Physical Oceanography* 18(9):1287-1292.



The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.



The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The **MMS Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.