LATEX Shelf Data Report

Acoustic Doppler Current Profiler

L. C. Bender III
F. J. Kelly

TAMU Oceanography
Technical Report No. 96-3-T

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LA·TEX

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Description of Figures

In lieu of a list of figures with captions, we provide on page vii a table of all the figures contained in this data report. We believe this format of *Figure x.y.z* enhances the usefulness of this report. Where a dash appears in place of a figure number, there are no results to report. The figure numbering for *x*, *y*, and *z* can be decoded as follows:

Figure *x.y.z*

- *x* is the cruise number;
  - — Fig. 2.*y.z* refers to the set of figures for cruise M03.
  - — Fig. 3.*y.z* refers to the set of figures for cruise H03.
  - — Fig. 4.*y.z* refers to the set of figures for cruise H04.
  - — Fig. 5.*y.z* refers to the set of figures for cruise H05.
  - — Fig. 6.*y.z* refers to the set of figures for cruise H06.
  - — Fig. 7.*y.z* refers to the set of figures for cruise H07.
  - — Fig. 8.*y.z* refers to the set of figures for cruise H08.
  - — Fig. 9.*y.z* refers to the set of figures for cruise H09.
  - — Fig. 10.*y.z* refers to the set of figures for cruise H10.

- *y* = 1 refers to the cruise track
  - — *z* = 1 refers to the times of the cruise track, e.g., Fig 4.1.1 gives selected times during the cruise track for cruise H04.
  - — *z* = 2 refers to the transect labels, e.g., Fig 4.1.2 shows the transects for cruise H04.
  - — *z* = 3 refers to the current mooring locations., e.g., Fig 4.1.3 shows the identifier and location of the current meter for which data was obtained that coincided with cruise H04.

- *y* = 2 refers to the horizontal stick plots of the velocity vectors
  - — *z* = 1 refers to the top of the water column, e.g., Fig. 5.2.1 gives the horizontal velocity vectors near the surface for cruise H05..
  - — *z* = 2 refers to the middle of the water column, e.g., Fig. 5.2.2 gives the horizontal velocity vectors at mid-depth for cruise H05.
  - — *z* = 3 refers to the bottom of the water column, e.g., Fig. 5.2.3 gives the horizontal velocity vectors near the bottom for cruise H05.

- *y* = 3 refers to the objectively analyzed horizontal plots
  - — *z* = 1 refers to the top of the water column, e.g., Fig. 6.4.1 gives the objectively analyzed horizontal velocities near the surface for cruise H06.
  - — *z* = 2 refers to the middle of the water column, e.g., Fig. 6.3.2 gives the objectively analyzed horizontal velocities at mid-depth for cruise H06.
  - — *z* = 3 refers to the bottom of the water column, e.g., Fig. 6.3.3 gives the objectively analyzed horizontal velocities near the bottom for cruise H06.

- *y* = 4 refers to the vertical profiles of normal velocity for specific transects, where the transects are given in Figure *x*..1.2.
  - — *z* refers to the specific transect, e.g., Fig. 6.4.10 gives the vertical profile of the horizontal velocity normal to transect 10 (transect location given in Fig. 6.1.2) for cruise H06.

- *y* = 5 refers to figures comparing vertical profiles of horizontal velocity to the nearest current meter, where the current meter mooring locations are given in Figure *x*.1.3.
  - — *z* refers to a specific current meter mooring, e.g., Fig 7.5.21 gives the comparison to current meter 21 (location defined in Figure 7.1.3) for cruise H07.

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	M03	H03	H04	H05	H06	H07	H08	H09	H10
Contoured Profiles									
Transect 5	- -	- -	- -	- -	- -	- -	8.4.5 254	9.4.5 293	10.4.5 334
Transect 6	- -	- -	- -	- -	6.4.6 168	7.4.6 212	8.4.6 255	9.4.6 294	10.4.6 335
Transect 7	2.4.7 37	- -	- -	5.4.7 133	6.4.7 169	7.4.7 213	8.4.7 256	9.4.7 295	10.4.7 336
Transect 8	- -	- -	- -	5.4.8 134	6.4.8 170	7.4.8 214	8.4.8 257	9.4.8 296	10.4.8 337
Transect 9	2.4.9 38	- -	- -	5.4.9 135	6.4.9 171	7.4.9 215	8.4.9 258	9.4.9 297	10.4.9 338
Transect 10	- -	3.4.10 71	4.4.10 100	5.4.10 136	6.4.10 172	7.4.10 216	8.4.10 259	9.4.9 298	10.4.9 339
Transect 11	- -	- -	- -	5.4.11 137	6.4.11 173	7.4.11 217	- -	- -	- -
Transect 12	- -	3.4.12 72	4.4.12 101	5.4.12 138	6.4.12 174	7.4.12 218	- -	- -	- -
Current Meters									
CM01	2.5.01 39	- -	- -	5.5.01 139	6.5.01 175	7.5.01 219	8.5.01 260	9.5.01 299	- -
CM02	2.5.02 40	- -	- -	5.5.02 140	- -	7.5.02 220	8.5.02 261	9.5.02 300	10.5.02 340
CM03	- -	- -	- -	- -	6.5.03 176	7.5.03 221	- -	9.5.03 301	10.5.03 341
CM04	- -	- -	- -	- -	6.5.04 177	7.5.04 222	- -	9.5.04 302	10.5.04 342
CM05	- -	- -	- -	5.5.05 141	6.5.05 178	7.5.05 223	- -	- -	10.5.05 343
CM06	- -	- -	- -	- -	6.5.06 179	7.5.06 224	8.5.06 262	9.5.06 303	10.5.06 344
CM07	- -	- -	- -	5.5.07 142	6.5.07 180	7.5.07 225	8.5.07 263	9.5.07 304	10.5.07 345
CM08	2.5.08 41	- -	4.5.08 102	5.5.08 143	6.5.08 181	7.5.08 226	8.5.08 264	9.5.08 305	10.5.08 346

	M03	H03	H04	H05	H06	H07	H08	H09	H10
Current Meters									
CM09	2.5.09 42	3.5.09 73	4.5.09 103	- -	6.5.09 182	7.5.09 227	8.5.09 265	9.5.09 306	10.5.09 347
CM10	2.5.10 43	- -	4.5.10 104	- -	6.5.10 183	7.5.10 228	8.5.10 266	9.5.10 307	10.5.10 348
CM11	2.5.11 44	3.5.11 74	4.5.11 105	- -	6.5.11 184	- -	8.5.11 267	9.5.11 308	10.5.11 349
CM12	- -	3.5.12 75	4.5.12 106	5.5.12 144	6.5.12 185	7.5.12 229	- -	- -	- -
CM13	2.5.13 45	3.5.13 76	4.5.13 107	- -	6.5.13 186	7.5.13 230	8.5.13 268	9.5.13 309	10.5.13 350
CM14	2.5.14 46	3.5.14 77	4.5.14 108	5.5.14 145	6.5.14 187	7.5.14 231	- -	9.5.14 310	- -
CM15	2.5.15 47	3.5.15 78	- -	5.5.15 146	6.5.15 188	7.5.15 232	8.5.15 269	9.5.15 311	10.5.15 351
CM16	2.5.16 48	3.5.16 79	4.5.16 109	5.5.16 147	- -	- -	8.5.16 270	- -	-
CM17	- -	- -	- -	- -	- -	- -	- -	- -	- -
CM18	- -	3.5.18 80	4.5.18 110	5.5.18 148	- -	- -	8.5.18 271	- -	- -
CM19	- -	3.5.19 81	4.5.19 111	- -	6.5.19 189	- -	8.5.19 272	- -	- -
CM20	- -	- -	- -	- -	- -	- -	- -	9.5.20 312	- -
CM21	- -	- -	4.5.21 112	5.5.21 149	6.5.21 190	7.5.21 233	8.5.21 273	9.5.21 313	10.5.21 352
CM22	- -	- -	4.5.22 113	- -	6.5.22 191	7.5.22 234	- -	9.5.22 314	10.5.22 353
CM23	2.5.23 49	- -	- -	- -	6.5.23 192	- -	8.5.23 274	- -	10.5.23 354
CM24	- -	- -	- -	- -	6.5.24 193	7.5.24 235	8.5.24 275	9.5.24 315	10.5.24 355

	M03	H03	H04	H05	H06	H07	H08	H09	H10
Current Meters									
CM25	2.5.25 50	- -	- -	- -	- -	7.5.25 236	- -	- -	- -
CM46	2.5.46 51	- -	- -	- -	- -	- -	- -	- -	- -
CM48	2.5.48 52	3.5.48 82	4.5.48 114	- -	- -	- -	8.5.48 276	- -	10.5.48 356

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1 INTRODUCTION

1.1 Survey Overview

The purpose of the acoustic Doppler current profiler (ADCP) surveys was to obtain vertical profiles of horizontal velocity by measuring current velocities continuously in conjunction with the hydrographic surveys conducted as part of the Texas-Louisiana Shelf Circulation and Transport Processes Study (LATEX A). ADCP data obtained from a 150-kHz narrow-band instrument were collected as part of the ten LATEX A hydrographic cruises, four conducted during the first field year (April 1992 - March 1993), three during the second field year (April 1993 - March 1994), and three during the third field year (April 1994 - December 1994), and one non-hydrographic cruise, a LATEX A mooring cruise conducted during the first field year. Details of each of the eleven cruises are shown in Table 1.

Table 1. ADCP Surveys

MMS ID	LATEX ID	Start Date	Stop Date	Operator	Ship Speed $cm \cdot s^{-1}$	No. of Ensembles	No. of Depth Bins
H01CGY9205	H01	04/30/92	05/09/92	Evans-Hamilton, Inc.	-	-	-
M03CPW9206	M03	07/13/92	07/27/92	Evans-Hamilton, Inc.	521	1457	29427
H02CGY9208	H02	07/31/92	08/09/92	Evans-Hamilton, Inc.	-	-	-
H03CPW9210	H03	11/06/92	11/12/92	Evans-Hamilton, Inc.	452	699	14116
H04CGY9302	H04	02/05/93	02/13/93	TAMU System	468	939	17179
H05CPW9306	H05	04/26/93	05/11/93	TAMU System	435	1638	6551
H06CPW9311	H06	07/26/93	08/07/93	TAMU System	511	1968	35814
H07CPW9314	H07	11/06/93	11/21/93	TAMU System	499	2068	37157
H08CGY9401	H08	04/24/94	05/07/94	TAMU System	435	1398	37104
H09CPW9410	H09	07/27/94	08/07/94	TAMU System	441	703	14630
H10CGY9409	H10	11/02/94	11/13/94	TAMU System	464	1833	42314

Column six of Table 1 shows the average ship speed computed from the GPS positions at the beginning and end of each five-minute ensemble. Column seven shows the number of five-minute ensembles and column eight the number of depth bins that passed first and second level quality control (see chapter 2). Note that the dates coincide with the start and stop of ADCP data.

1.2 Survey Results

In this data report we present the results from nine of the eleven ADCP surveys. Unfortunately the ADCP data collected during hydrographic cruises H01 and H02 were unusable for the reasons discussed in their respective sections. The data collected during cruises M03, H05, and H09 are presented, but the quality is suspect. The results of the cruises are presented in their respective sections, arranged by field year, and include figures depicting the cruise track, the plan view of stick plot velocity vectors near the surface, 30 m below the surface, and 100 m below the surface, the plan view of objectively analyzed velocity vectors at the same three depths, the contoured profiles of the velocity normal to selected transects, and individual comparisons of the ADCP determined vertical profiles of horizontal velocity against those obtained concurrently from nearby current meters.

1.3 Survey Limitations

There are inherent limitations in the collection and processing of ADCP data of which the reader should be aware:

a. The horizontal velocity data collected by the ADCP instrument on each of the hydrographic cruises are neither Eulerian, because the ship is moving when the data are collected, nor Lagrangian, because a moving ship does not usually follow specific water volumes. The data do not form a `true' synoptic spatial ensemble because the ship's cruise track is designed for its primary mission, that of collecting hydrographic data on the shelf. Hence, the actual velocity field is not adequately sampled by the ADCP instrument in either time or space, and what is recorded is aliased by unresolved temporal and spatial variability. In the case of the Texas-Louisiana continental shelf we suspect the aliasing is primarily due to high frequency, non-deterministic currents, e.g., inertial oscillations (Chen et al., 1996), which are not small and cannot be ignored. Tidal aliasing on the inner and outer shelf is not insignificant either, but because the order of magnitude of the ADCP velocities is larger than the tidal velocities (DiMarco and Reid, 1997), there is some justification for ignoring them. However, on the middle shelf, where the tidal velocities are of the same order as those measured by the ADCP, tidal aliasing is expected to be significant. Finally, significant aliasing in the near surface bins due to high frequency oscillations of approximately 25 $cm \cdot s^{-1}$ should be expected. These oscillations have been observed in the surface current meter data

(DiMarco, personal communication, 1996) and occur during the summer months when the wind speeds are low and the water column is stratified. The results presented herein have not been adjusted to eliminate aliasing, whether from the tides, inertial oscillations, or other high frequency oscillations.

b. The `blank-beyond-transmit' interval and the side-lobe reflections from the bottom limit the collection of velocity data to the 'middle' of the water column. The depth of the center of the first vertical bin of data, referred to in this report as the surface bin, is calculated as the sum of the transducer depth, the blank-beyond-transmit interval, and the nominal bin size. These parameters are input by the operator. The center of the bottom bin is typically no closer to the bottom than a distance equal to 15% of the depth below the transducer plus one bin size for a standard (30°) ADCP head configuration. This implies that the deepest possible bin lies higher above the bottom in water of greater depth. The loss of information at the surface and bottom is a well known limitation of the ADCP instrument and has a significant impact in depths of 25 m and less. In such depths the vertical profile of horizontal velocities is limited to one or two points in the vertical.

c. The sequence of ADCP ensemble averages used to produce this report is quite `gappy'. This is a result of the first level data quality control procedures (described in section 2.3.3) that eliminated data that was collected while the ship was either on-station for a CTD cast, changing course, or exceeding a Global Positioning System (GPS) computed speed of 6.50 $m \cdot s^{-1}$, which is physically impossible. The theoretical upper velocity limit was set as the sum of the fastest possible ship speed of 5.5 $m \cdot s^{-1}$ plus an anticipated current velocity in an eddy of 1 $m \cdot s^{-1}$. Because the ship's heading is used to resolve the ADCP velocities into u and v components, the gyrocompass was connected to the ADCP to provide heading information. Unfortunately the gyrocompass, because it is affected by inertia, had a noticeable time lag during heading changes. Hence during periods when the ship was rapidly changing its heading, such as on-station, the data were eliminated. Another contribution to the gappiness of the record was the short distances of 10 to 20 km between CTD stations. These distances did not allow for many five-minute time ensembles to be taken while in transit - at 5$m \cdot s^{-1}$ it would take approximately 33 minutes to cover 10 km, thus at most five ensembles could be collected. Though this limits the amount of data available, it is generally not a significant problem because of the shear volume of data collected. The biggest potential contribution to the gappy record was hull-induced flow noise. Flow noise, probably due in great part to bubbles created by the hull, could significantly degrade the quality of the data. The contamination shows up as uniformly strong currents through all the depth bins of an ensemble. This was most apparent on cruises H05 and H09, where a large part of the data set was rejected. However, there appears to be no relationship between ship speed and contaminated data. The best quality data set came from cruise H06, during which the average ship speed was 511 $cm \cdot s^{-1}$.

d. It was originally intended to operate the ADCP in the bottom-tracking mode, so that corrections to the measured ADCP velocities would not be dependent on precise navigation information, typically differential Global Positioning System (DGPS) for the ship's velocity. While we anticipated little difficulty in bottom tracking to water depths of 400 m (as stated by the instrument manufacturer, RD Instruments, Inc.), post-processing of the data from cruises H08, H09, and H10 indicated that bottom tracking was only intermittently reliable for water depths exceeding 100 m. To compensate for this problem, on cruises H08, H09, and H10 we relied on bottom tracking for depths less than 100 m and navigational information, in this case DGPS for depths greater than 100m. The first eight cruises were all referenced only to bottom tracking.

2 ADCP DATA

2.1 Data Collection

Two 150-kHz, narrow-band ADCPs manufactured by RD Instruments, Inc. (RDI), were used to collect velocity profiles during the eleven LATEX-A cruises shown in Table 1. The first unit, a `Vessel-Mount' model (S/N 355) had a 30-degree concave arrangement of the transducer heads; the second unit, a `Direct-Reading' model (S/N 385) had a 20-degree convex head arrangement. The smaller beam angle of 20 degrees permits the ADCP to measure horizontal velocities slightly closer to the bottom, but increases the statistical uncertainty of a ping by a factor of 1.4. The Vessel-Mount model did not have pitch and roll sensors but the Direct-Reading model did. The Vessel-Mount model was interchanged between the two research vessels used to conduct the cruises, the R/V *Gyre* and the R/V *J.W. Powell*, whereas the Direct-Reading model was only used on the R/V *J.W. Powell*. The installation of the Vessel-Mount model on the R/V *Gyre* was such that the transducer heads had a fixed alignment to the hull, whereas the installation of either model type on the R/V *J.W. Powell* was such that the unit was first attached to a quadrapod mounting carriage and then placed in a 24-inch diameter through-ship well, commonly referred to as a `moon pool'. The alignment relative to the hull was not fixed as in the case of the R/V *Gyre*, but was aligned visually. The alignment of both installations was then determined precisely by the methods described in section 2.3.4. Further details of the mounting and calibration of the ADCP instruments on the R/V *Gyre* and on the R/V *J.W. Powell* are described in Murphy et al. (1992). Table 2 shows which unit was mounted on which ship for each of the eleven cruises.

The Sperry gyro-compasses on both vessels were connected to the ADCPs to provide heading information. In addition, GPS navigational data were recorded by the RDI software. The ADCPs were controlled by personal computers that also processed and logged the data.

2.2 Unit Alignment

A `check-out' transect was completed on each survey. Typically, this consisted of steaming a five-mile course between two fixed reference points (offshore platforms) while the ADCP logged data in the bottom-tracking mode, and then repeating this course on the opposite heading. For H03 and H04, additional checks were made by comparing the bottom-tracking velocities against the ship's velocity as determined from GPS. The bottom-tracking mode was found to be less reliable than using GPS to determine ship's velocity.

Table 2. ADCP Mounting

Field Year	LATEX ID	Platform	Alignment	Unit Type	Pitch and Roll Sensor
1	H01	R/V *Gyre*	Hull-Fixed	Vessel-Mount	No
1	M03	R/V *Powell*	Well-Variable	Direct-Reading	Yes
1	H02	R/V *Gyre*	Hull-Fixed	Vessel-Mount	No
1	H03	R/V *Powell*	Well-Variable	Direct-Reading	Yes
1	H04	R/V *Gyre*	Hull-Fixed	Vessel-Mount	No
2	H05	R/V *Powell*	Well-Variable	Direct-Reading	Yes
2	H06	R/V *Powell*	Well-Variable	Vessel-Mount	No
2	H07	R/V *Powell*	Well-Variable	Vessel-Mount	No
3	H08	R/V *Gyre*	Hull-Fixed	Vessel-Mount	No
3	H09	R/V *Powell*	Well-Variable	Vessel-Mount	No
3	H10	R/V *Gyre*	Hull-Fixed	Vessel-Mount	No

The check-out transect provided an estimation of the transducer misalignment angle for use during the cruise. The estimated misalignment angle is an input parameter to the data acquisition software that permits the operator to view `corrected' currents while underway. The angle was obtained by having the ship pass over the same course in opposite directions while the transducer offset in the program was adjusted to give similar current velocities for the two directions. A more accurate estimation of the misalignment angle is made during post-processing of the complete data set, as described in section 2.3.4. The misalignment angle of the vessel-mounted ADCP unit on the R/V *Gyre* was typically less than 2 degrees; variations in this angle were due to the gyroscope. The ADCP used in the through-ship well on the R/V *J.W. Powell* was oriented by hand to align with the ship's axis. Once mounted in the well, its orientation remained fixed during the cruise, and small variations in the misalignment angle between the ship's gyro and the ADCP heads were due to the gyro.

During H01 and H02, the ADCP configuration was changed a number of times in an attempt to obtain more information in the shallower depths and to provide real-time current information to the scientists on board. However, many of the configurations chosen by the operator resulted in unusable data. These problems are discussed in greater detail in sections 3.2 and 3.4 and in Jochens and Nowlin (1994). For the remaining cruises, the ADCP configuration was changed less often or not at all, with the goal of keeping the settings constant to assist with data processing and quality control.

2.3 Data Processing

2.3.1 DAS Software

During cruises H01 and H02 the Data Aquisition Software (DAS) software package developed by RDI was used to communicate with and control the ADCP instrument and to log data. DAS receives the raw ping data from the ADCP and averages them for each bin over a selected time interval to reduce statistical variance. The standard averaging interval (called the ensemble length) for the LATEX A project is five minutes. DAS records the ensemble averages in its standard binary format to files called PINGDATA files. It does not record the individual pings used in the average. Thus, DAS does not have a replay mode in which the data can be re-averaged. After the cruises, the RDI program, LOGDAS, was used to convert the binary PINGDATA files to flat ASCII files, named CPING files. The binary PINGDATA files and the ASCII CPING files contain the same averaged data.

The GPS navigational information was made available to DAS through the RDI program NAVSOFT. DAS computes an average position for each ensemble and stores this position, to a thousandth of a degree, with the rest of the ensemble data. At a latitude of 30°, a thousandth of a degree corresponds to a spatial resolution of 111 m in latitude and 96 m in longitude. GPS navigation can provide position information with better resolution than that recorded by DAS. To obtain a time stamp for an ensemble, DAS uses the time of the personal computer at the end of the ensemble, i.e., when the data are stored. Thus, there is an inherent mismatch between average position computed by DAS and the time recorded by DAS; neither can be used quantitatively. DAS can only log the raw navigation data it receives in a 2048-byte user buffer that is part of each ensemble. The buffer size is too small to log navigation at a fast enough rate for an entire ensemble, but the GPS position at the beginning of the ensemble can be stored here. During cruises H01 and H02, this buffer was not used. The navigation data were logged by another program, and a precise link between the time of the navigation data and that of the individual ensembles was lost. Beginning with cruise H03, the ADCP operators switched to RDI's newer TRANSECT software package to control the ADCP and log the data.

2.3.2 TRANSECT Software

The TRANSECT software developed by RDI is a more user-friendly program than DAS and, more importantly, can record both raw and averaged data. The raw data can be replayed and, therefore, re-averaged using other time intervals during post-processing. Thus, some of the operator's choices for parameter settings are less critical because they can be changed and the data re-processed. TRANSECT reads ASCII navigation data from a serial port, marks it with the raw ADCP ensemble number and computer time, and saves it to a file. Of course, recording raw data greatly increases storage requirements to about 15 MB per day.

TRANSECT records raw and averaged data to binary files. ASCII files containing averaged data were created during post processing by replaying the data. The format of the ASCII files is similar to that created by the DAS software.

2.3.3 First Level Quality Control

The ADCP data sets collected from each of the cruises were sufficiently different from each other that each required a separate initial processing program. Once transformed to a common format, each averaged ensemble was checked for the following potential problems:

a. The absence of navigation data;
b. A bottom-tracking depth too shallow for any good data;
c. No change in position from the last ensemble;
d. A computed ship speed greater than 650 $cm \cdot s^{-1}$;
e. The first bin of a given ensemble had the bad data indication (19999) for one or more of the four beam readings; or
f. The percent of good pings for the first bin was less than 30.

Ensembles that met any of the error conditions were rejected. Those that passed were corrected as described below and reformatted. The reformatting was done because CPING files have a cumbersome, space-consuming format.

The first level of processing also performed conversions and computed average ship velocity from the GPS data. For a given ensemble, the great circle distance traveled during that ensemble was computed from the GPS fix at the beginning of that ensemble to the GPS fix at the beginning of the next ensemble. The GPS times of these two fixes were used for the time difference. The output from this step was plotted as time series and scanned for obvious errors. The cruise-averaged ship speed is shown in Table 1.

2.3.4 Determination of Offset and Sensitivity Factors

That subset of the data having both bottom-track and navigation velocities was used to perform a calibration of the ADCP after the manner of Joyce (1989). The errors are of two types: sensitivity and alignment. As Joyce points out, sensitivity errors may arise because the orientation of the acoustic beam is not correct due to factors such as nonzero trim to the transducer and ship, small errors in the beam geometry, or overall system bias. On the other hand, alignment errors are caused by misalignment between the reference frames of the ADCP and the ship gyro. The two errors arise from independent sources and produce errors in the computed velocities that are approximately orthogonal. The sensitivity error induces an error in the velocity component parallel to the ship that is linearly related to ship speed, while the misalignment error induces an error in the velocity component perpendicular to the ship, again in linear proportion to the ship speed.

Statistical Analysis System (SAS) software was used to calculate a least squares regression between the two estimates of mean ship velocity for each ensemble for which both bottom-track and GPS-navigation data are available. The sensitivity error and mean alignment error are shown in Table 3. The mean alignment error was no greater than minus two degrees for the R/V *Gyre*; i.e., viewing the ship from above, the data are rotated clockwise by this angle. The mean sensitivity error typically ranged from 1.005 to 1.006, so the data were scaled up by this value. For the R/V *J.W. Powell*, the alignment error can vary from cruise to cruise because the ADCP was re-mounted in the well each time.

Table 3. Offset and Sensitivity Factors

LATEXID	Platform	Alignment	SensitivityFactor	AlignmentAngle
H01	R/V*Gyre*	Hull-Fixed	-	-
M03	R/V*Powell*	Well-Variable	1.0392	2.3373
H02	R/V*Gyre*	Hull-Fixed	-	-
H03	R/V*Powell*	Well-Variable	1.0147	1.7800
H04	R/V*Gyre*	Hull-Fixed	1.0056	-1.9029
H05	R/V*Powell*	Well-Variable	1.0139	-0.5108
H06	R/V*Powell*	Well-Variable	1.0032	1.4073
H07	R/V*Powell*	Well-Variable	1.0023	1.7188
H08	R/V*Gyre*	Hull-Fixed	1.0046	-1.4530
H09	R/V*Powell*	Well-Variable	1.0139	3.3701
H10	R/V*Gyre*	Hull-Fixed	1.0067	-1.7334

2.3.5 Second Level Quality Control

The foregoing processing rejects ensembles with gross errors and corrects all data in an objective manner. The greatest source of remaining error is the ship's gyrocompass because it is an electro-mechanical servo system with inertia and, therefore, lag. ADCP ensembles collected while the ship was turning frequently exhibit vectors in some depth bins that are obviously inconsistent in direction and/or magnitude with vectors from surrounding ensembles at a given depth and those immediately above and below. Other factors, such as signal interference from CTD cable or significant rolling, also could result in such anomalous vectors. The Vessel-Mount model had no pitch and roll sensors, which could have been used to provide data to compensate for these modes of motion, but the Direct-Reading model did. Ensembles with the above described symptoms often occurred while the ship was on station. Furthermore, the ship's track while on station was usually a set of one or more small erratic loops with very closely spaced ensembles. A plot of the vectors at a given depth for the on-station ensembles sometimes resembles a bird's nest.

An interactive program (DOPNAV) was used to view and remove ensembles with anomalous vectors and the ensembles collected while on station. This editing step was subjective. On-station ensembles, ensembles collected during other small loops, and backtracks in the cruise track were deleted. The vectors in the remaining ensembles were examined at each depth. If an ensemble had an anomalous vector at any depth, the ensemble (not just the data at that depth) was deleted. In deciding which vectors were anomalous, a three-dimensional perspective was taken. This is easy to do with the interactive program because it shows the vectors in plan view, and one can view vectors above and below a given depth; also, vertical profiles of u, v, or speed are easily viewed for any selected ensemble.

2.4 ADCP - Current Meter Statistical Comparison

2.4.1 Introduction

Over the 32-month period of the LATEX A field work, current meter data from the 26 mooring locations shown in Figure 1.1 were collected from a variety of instruments, primarily rotor-vane type instruments such as Endeco SSM-174s and DMT-174s, and Aanderaa RCM-7s and RCM-4s. Data collection and processing are discussed in DiMarco et al. (1997). These data provided an excellent opportunity to statistically compare the ADCP-determined velocity to the velocity from the nearest current meter mooring. Oesterhus and Golman (1988) reported on ADCP data collected during a two-week period as part of a hydrographic transect along a mooring line of seven current meters. They found that the ADCP speeds generally exceeded the speeds measured by the current meters, and the ADCP velocities also had a systematic angle deviation. Chiswell (1994) reported good agreement between ADCP data taken on a north-south transect across the Chatham rise (179° E near New Zealand) and current meters deployed near the crest of the rise. A separate study by Chen and Reid (personal communication, 1997) addresses the degree to which the ADCP shear is geostrophic, using the CTD data collected on the LATEX cruises. Their work is similar to the comparison of geostrophic velocities and profiling ADCP measurements in the Iberian Basin made by Hinrichsen and Lehmann (1995).

2.4.2 Method

The following screening criteria were used in determining which measurements to use for statistical comparison: 1) the distance between the ship when the ADCP profile was recorded and the location of the mooring had to be less than 10 km, hence, there were typically five to ten ensembles per mooring collected as the ship steamed by the mooring location; 2) the difference between the two sample times could not be more than 30

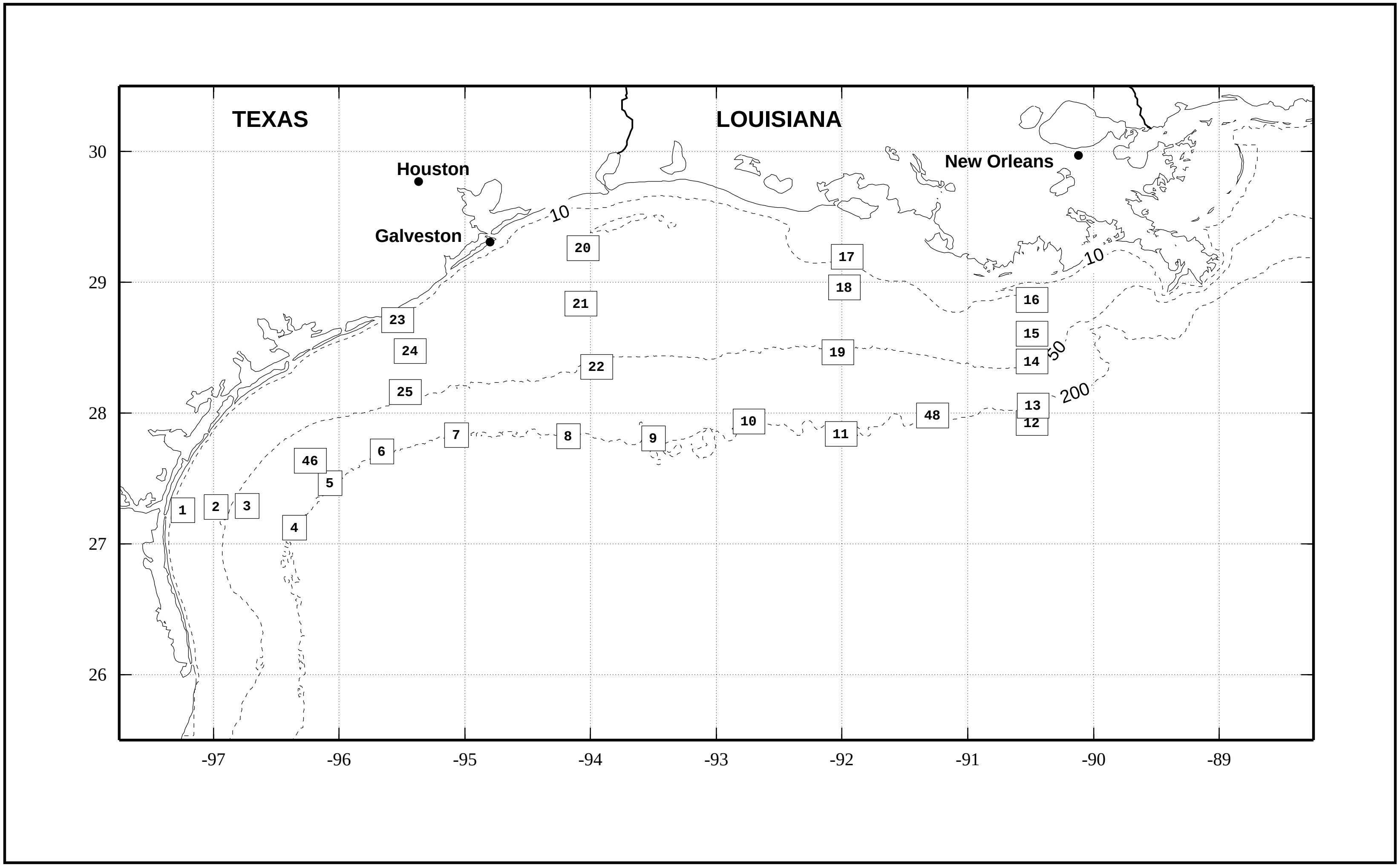

Figure 1.1 Locations and designated numbers of LATEX A current moorings.

minutes; 3) the depth of the moored instrument had to be within a 4-m depth bin of the ADCP current profile; and, 4) the current meters on the mooring had to be recording usable data when the ship steamed by the mooring. Given these criteria, 2551 pairs of current meter and associated ADCP velocities were found: 160 from cruise H03, 294 from M03, 238 from H04, 139 from H05, 416 from H06, 393 from H07, 349 from H08, 184 from H09, and 378 from H10. There were more than enough samples to calculate highly reliable statistical measures.

Two distinct quantitative measures of agreement between current meter and ADCP velocities were employed: the rms error based on the speed and a complex regression analysis to determine the average angle between the two. The rms difference between current meter speed and ADCP speed is given by

$$\text{rms} = \sqrt{\langle (s_C - s_A)^2 \rangle}$$

where s_c is the current meter speed, s_A is the ADCP speed, and the angle brackets < > denote the average over n pairs. The rms difference does not provide any information about the difference in the angles between the ADCP and the current meter velocities. Complex linear regression analysis, on the other hand, yields the average angle between two sets of vectors, as well as a measure of the regression modulus and coherence. The method presented here is further described by Vastano and Barron (1994) and Kundu (1976).

If u_j and v_j are the eastward and northward velocity components, where $j = C$ denotes the current meter velocities and $j = A$ t he ADCP velocities, then it can be shown that the average angle between two sets of vectors is given by

$$\alpha = \arctan\left(\frac{\langle u_C v_A - u_A v_C \rangle}{\langle u_C u_A + v_C v_A \rangle}\right)$$

where the brackets < > denote the average over n pairs. The parameter α is the clockwise regression angle of the ADCP vectors relative to the current meter vectors. It is effectively the phase of the ensemble of the vector pairs, i.e., if the angle of a single current meter velocity vector was 30 degrees and that of an ADCP velocity vector was 45 degrees, then α would be -15 degrees. If we were comparing ship velocities determined by bottom tracking against ship velocities determined by GPS, then the clockwise regression angle α is the alignment error determined after the manner of Joyce (1989) (see section 2.3.4 and Table 3).

The regression modulus b_m is given by

$$b_m = \left(\frac{\langle u_C u_A + v_A v_C \rangle}{\langle u^2_C - v^2_A \rangle} \right) \sec \alpha$$

It provides a measure of the gain or bias between the two vector sets; i.e., all other factors being equal, if the current meter speed was 10 cm•s^{-1} and the ADCP speed was 20 cm•s^{-1} then b_m would be 2.0. If we were comparing ship velocities determined by bottom tracking against ship velocities determined by GPS, then one plus the regression modulus b_m is the sensitivity factor determined after the manner of Joyce (1989) (see section 2.3.4 and Table 3).

The fraction of the variance of the ADCP vector set explained by the linear relation with the current meter vector set is given by ρ, as defined by

$$\rho^2 = b_m^2 \frac{\langle u_C^2 + V_C^2 \rangle}{\langle u_A^2 + V_A^2 \rangle}$$

The parameter ρ is effectively the square of the coherence; i.e., if all of the variance in the ADCP vectors were described by the current meter vectors, then ρ would be 1.0. However, any value above 0.5 is considered good and, as will be seen, many of the results are better than this. An ideal agreement between current meter velocities and ADCP velocities would yield rms = 0, $\alpha = 0$, $b_m = 1.0$, and $\rho^2 = 1.0$. As will be seen, this is rarely approached.

2.4.3. Results

Figure 1.2 shows the statistics, on a cruise by cruise basis, for each pair of current meter and ADCP measurements that met the requirements of distance, time, vertical position, and an operational current meter. Table 4 shows the actual data. The ADCP speeds are clearly biased higher than the current meter speeds. The rms difference in speed averaged for all nine cruises is 12.30 cm•s^{-1} (shown with a dotted line), the regression angle α averaged for all nine cruises is -1.56°, the cruise-averaged regression modulus b_m is 0.835, and the cruise-averaged variance fraction ρ is 0.483 (all shown with a dotted line). The variance fraction can be interpreted as a sensitive indicator of the goodness of the comparison. Using the average variance as the standard, there are three cruises (H05, H06, and H10) that are distinctly better than average, three cruises (H07, H08, and H09) that are slightly worse than average, and three cruises (H03, M03, and H04) that are distinctly worse than average. There appears to be no correlation between the sample size, shown in parentheses, and the statistical measures. The best comparison resulted for cruise H06. The rms speed difference is 12.95 cm•s^{-1}, the regression angle α is 2.75°, the variance fraction ρ is 0.747, and the regression modulus b_m is 1.075.

Table 4. ADCP - Current Meter (CM) Comparison Statistics
≤10-km separation distance

LATEX ID	Sample Size	Mean Speed CM, cm•s^{-1}	Mean Speed ADCP, cm•s^{-1}	rms, cm•s^{-1}	Alignment Angle, α	Regression Modulus, b_m	Variance Fraction, ρ
H03	160	9.38	17.61	14.03	0.02	0.880	0.202
M03	294	14.96	15.81	11.36	-11.17	0.529	0.227
H04	238	11.80	12.96	8.14	-9.58	0.575	0.304
H05	139	20.05	25.40	13.42	-1.57	0.949	0.624
H06	416	20.22	25.79	12.95	2.75	1.075	0.747
H07	393	17.61	18.39	15.45	-2.95	0.569	0.326
H08	349	11.77	16.20	10.30	-2.50	0.803	0.430
H09	184	16.04	19.72	17.62	-11.38	0.853	0.370
H10	378	11.48	14.34	6.62	-1.10	0.993	0.635
All	2551	14.98	18.32	12.30	-1.56	0.835	0.483

The closer the distance between the current meter and the ADCP profile, the better the agreement becomes. Figure 1.3 shows the comparison statistics for all pairs (no distinction is made for individual cruises) within the specified distance range between the ADCP and current meter. Reducing the distance between the ADCP profile and the current meter improves the agreement. The bias between current meter speed and ADCP

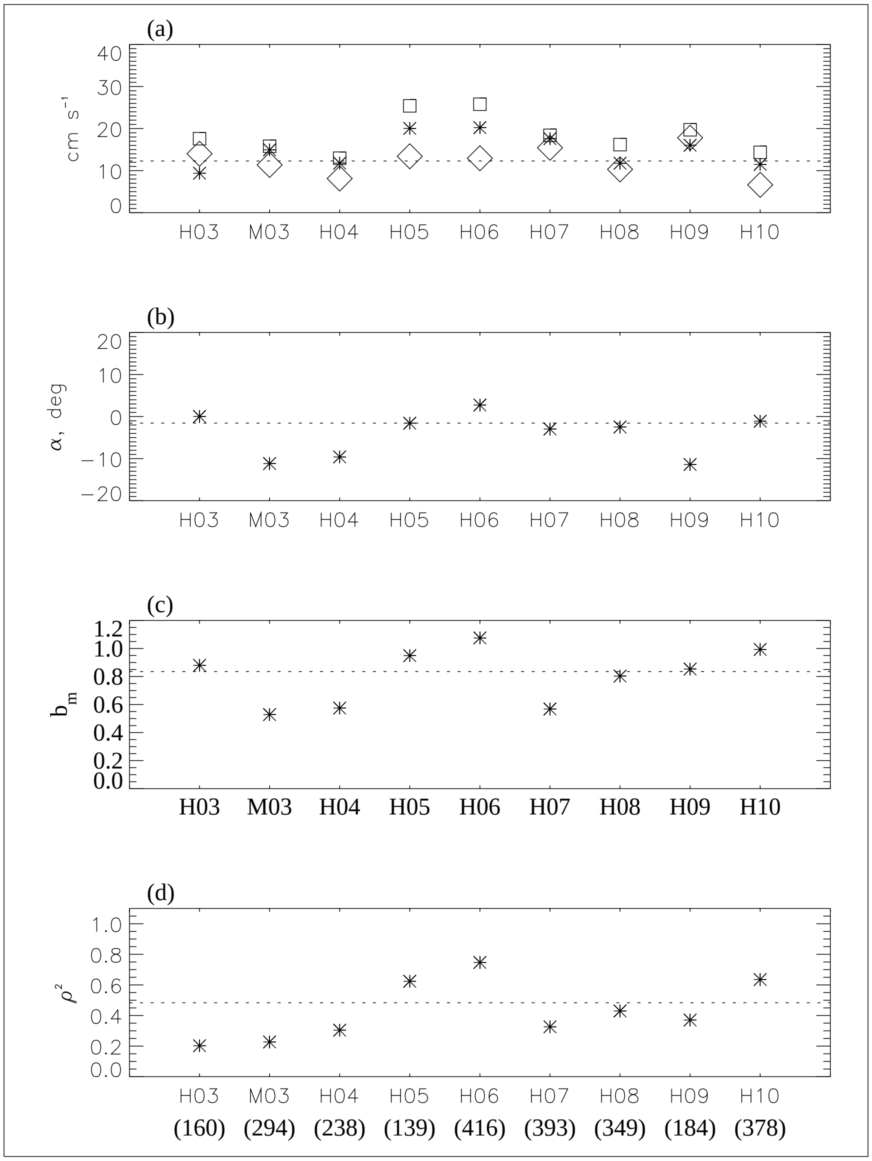

Figure 1.2 Comparison statistics for all pairs that met the primary requirements. Panel (a) shows for each individual cruise the rms error (diamond), average current meter speed (asterisk), and average ADCP speed (square), as well as the cruise averaged rms error (dotted line). Panel (b) shows the counterclockwise regression angle, panel (c) the regression coefficient, b_m, and panel (d) the variance fraction or coherence squared. The sample size is in parenthesis.

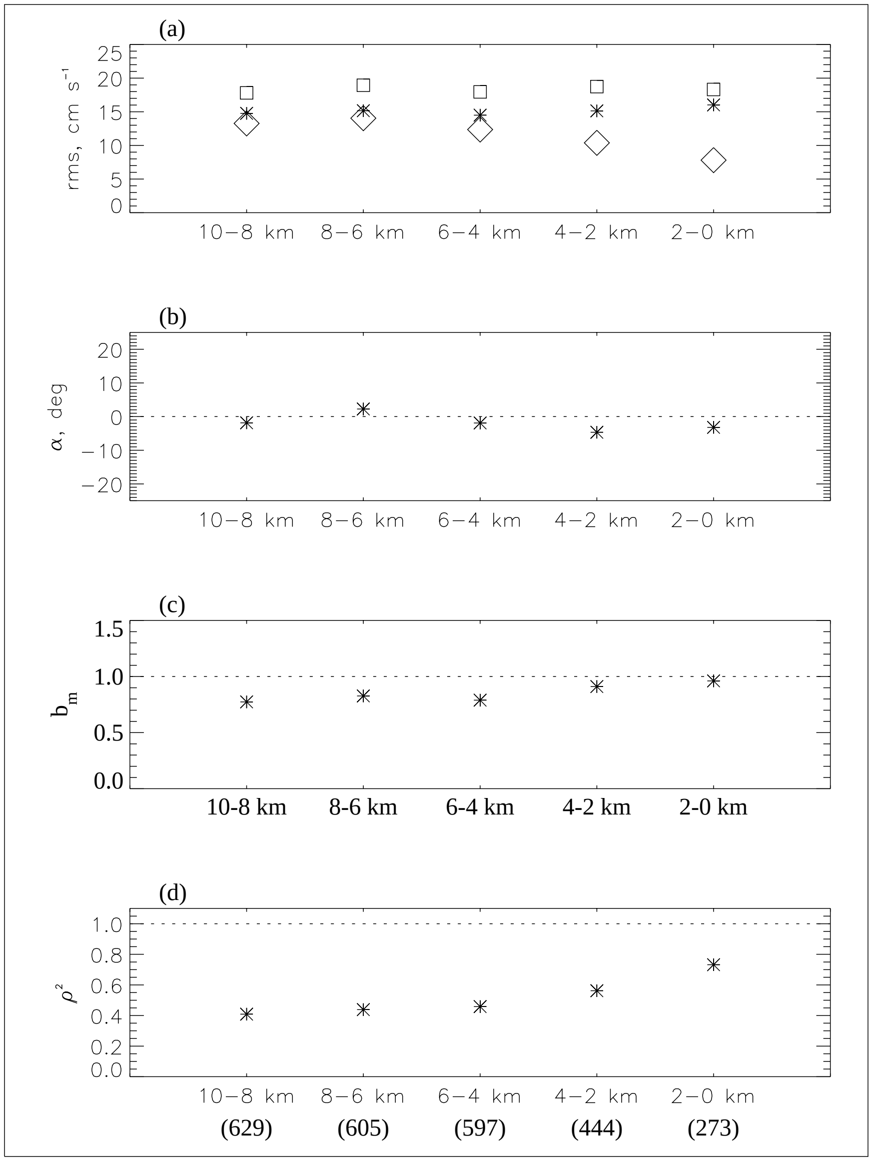

Figure 1.3 Comparison statistics for all pairs within the specified distance range between the ADCP and bottom current meters. Panel (a) shows for each distance the rms error (diamond), average current meter speed (asterisk), and average ADCP speed (square). Panel (b) shows the counterclockwise regression angle, panel (c) the regression coefficient, b_m, and panel (d) the variance fraction or coherence squared.

speed is reduced; the rms difference in speed is greatly reduced; the cruise-averaged regression angle α is not greatly affected, and; the cruise-averaged regression modulus b_m is slightly improved. The most dramatic improvement is seen in the cruise-averaged variance fraction ρ. It can be inferred that, over a long enough period of time, an ADCP and a current meter placed in the same location would produce the same values.

We show in Table 5 the statistics on a cruise by cruise basis for each pair of current meter and ADCP measurements that met the requirements of time, vertical position, and an operational current meter, but were within 2 km rather than 10 km. Comparing with Table 4, we see overall improvement for all cruises except for M03 and H03.

Table 5. ADCP - Current Meter (CM) Comparison Statistics
≤ 2-km separation distance

LATEX ID	Sample Size	MeanSpeed CM, cm•s^{-1}	MeanSpeed ADCP, cm•s^{-1}	rms, cm•s^{-1}	Alignment Angle, α	Regression Modulus, b_m	Variance Fraction, ρ
H03	19	9.50	14.80	8.95	19.48	0.869	0.326
M03	44	14.76	13.78	7.68	-11.85	0.607	0.358
H04	26	16.08	15.14	9.68	-2.21	0.719	0.589
H05	17	24.28	26.77	6.97	-6.94	1.010	0.840
H06	37	18.17	21.43	6.92	-1.38	1.103	0.919
H07	22	19.80	23.12	9.05	2.74	1.029	0.834
H08	43	12.88	17.02	8.83	2.99	0.939	0.638
H09	24	21.03	22.61	6.03	-12.80	1.061	0.929
H10	44	12.95	16.45	5.95	0.24	1.128	0.826
All	276	15.93	18.25	7.79	-3.21	0.961	0.731

As a result of this analysis, we can state with a high degree of confidence that except for M03, H03, and possibly H04, the ADCP and the current meter are measuring the same thing. The fact that the statistics presented in Table 4 for a 10-km separation distance criteria are worse for some cruises (e.g., H04) than for other cruises (e.g., H10) should not necessarily be interpreted as the result of poor quality ADCP data. The differences could also be attributed to the presence of significant horizontal variations (with scales 10 km and less) in the velocity field. Those variations could be more pronounced during some cruises and would result in a poorer agreement when all the pairs within 10 km of a current meter are considered. However, as shown in Figure 1.3 and Table 5, decreasing the separation distance eliminates the effect of horizontal variations and shows a better agreement. Hence, the quality of ADCP data across all cruises appears to be more or less uniform.

3 FIRST FIELD YEAR

3.1 Introduction

Underway ADCP surveys were made on all four hydrographic surveys and on one mooring cruise during the first field year (April 1992 through March 1993). Dates are shown in Table 1 and the ADCP units used are shown in Table 2. Continuous data were obtained along the tracks of the surveys, except during periods when instrument problems occurred or the system was shut off during long periods at a fixed location. Three surveys (H01, H02, and H04) were conducted aboard the R/V *Gyre* and two (M03 and H03) were conducted aboard the R/V *J.W. Powell*. The configurations recorded for each ADCP cruise are shown in Table 6.

Table 6. ADCP configurations for H01, M03, H02, H03, and H04.

System Parameter	H01	M03	H02	H03	H04
Averaging interval (min)	5	5	5	5	5
Depth cell length (m)	various	4	2	4	4
Number of depth cells	various	8 or 64	various	100	100
Time between pings (sec)	unknown	unknown	unknown	1.75	1.75
Transmit pulse length (m)	various	4	2	4 (4.35)	4
Blank after transmit (m)	2, 3, or 4	1	1	4 (4.35)	4
Navigation type	GPS	GPS	GPS	GPS	GPS
Data recorded	no raw averaged partial - navigation	no raw averaged partial-navigation	no raw averaged partial-navigation	raw averaged navigation	raw averaged navigation

3.2 Cruise H01

3.2.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *Gyre*. The Vessel-Mount model ADCP was installed and the DAS software package was used. During this cruise the ADCP operator used a variety of settings for the bin length and blank-beyond-transmit parameters. This made QA/QC processing difficult. The problems were worked through and some of the data were made usable, though none are reported here.

For a 150-kHz, NarrowBand ADCP system, RDI recommends a bin length of at least 4 m because precision becomes worse as the bin length is decreased. Therefore, the ensembles in the data set with bin lengths of 2 m, totaling some two days of records, were flagged as questionable in terms of quality; ensembles with a bin length of 1 m were rejected as unusable. RDI also recommends a blank-beyond-transmit of 4 m to avoid biasing the return signal with the ringing created by the out-going pulse. Unfortunately, a blank-beyond-transmit of 2 m was used throughout most of the cruise. With this value, ringing may slightly affect the data, but the degree cannot be quantified. Ensembles with blank-beyond-transmit values smaller than 2 m were rejected as unusable.

Because of the different combinations of parameter settings, the depth to the first bin and the sequence of depths for the bins change throughout the data set. The depth to the middle of the first bin is equal to the depth of the transducers below the surface, which is 4 m for the R/V *Gyre*, plus the blank-beyond-transmit, plus the bin length. The bin length then determines the sequence of bin depths. The various combinations used during the cruise and their resulting sequence of bin depths are given in Table 7.

Table 7. Parameter settings (in meters) and the resulting sequence of bin depths on survey H01.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
4	2	2	8, 10, 12, 14, ...
4	3	2	9, 11, 13, 15, ...
4	4	2	10, 12, 14, 16, ...
4	2	4	10, 14, 18, 20, ...
4	4	4	12, 16, 20, 24, ...
4	2	8	14, 22, 30, 38, ...
4	4	8	16, 24, 32, 40, ...

3.2.2 Results

Because of the significant quality control problems discussed above we do not present the data.

3.3 Cruise M03

3.3.1 Specific Quality Control Issues

This survey was conducted aboard the R/V*J.W. Powell.* The Direct-Reading model ADCP was installed and the DAS software package was used during this survey. The parameter settings are shown in Table 8.

Table 8. Parameter settings (in meters) and the resulting sequence of bin depths on survey M03.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
3	1	4	8, 12, 16, 20, ...

During the first several days of the cruise the total number of bins was set to 8; later on it was increased to 64. This, of course, limited the depth to which data could be obtained. RDI recommends a blank-beyond-transmit of 4 m to avoid biasing the return signal with the ringing caused by the outgoing pulse. Unfortunately a blank-beyond-transmit of only 1 m was used throughout the cruise. Furthermore, the average ship speed was 522 $cm \cdot s^{-1}$, which could have contaminated the data with flow noise. Consequently all the data from this cruise are considered suspect. The ADCP-Current Meter statistical comparison of section 2.4 supports this conclusion.

3.3.2 Results

While these data are considered suspect, results are presented.

3.3.2.1 General Cruise Track

We show in Figure 2.1.1 a plan view of the general cruise track taken by the R/V *Powell* during M03. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 2.1.2 for which contoured profiles of normal velocity are presented in section 3.3.2.4. Figure 2.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 3.3.2.5.

3.3.2.2 Plan View of Stick Plot Velocity Vectors

Figure 2.2.1 shows the velocity from the surface bin centered at 8 m, Figure 2.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 2.2.3 shows the velocity from the bin centered at 100m below the surface.

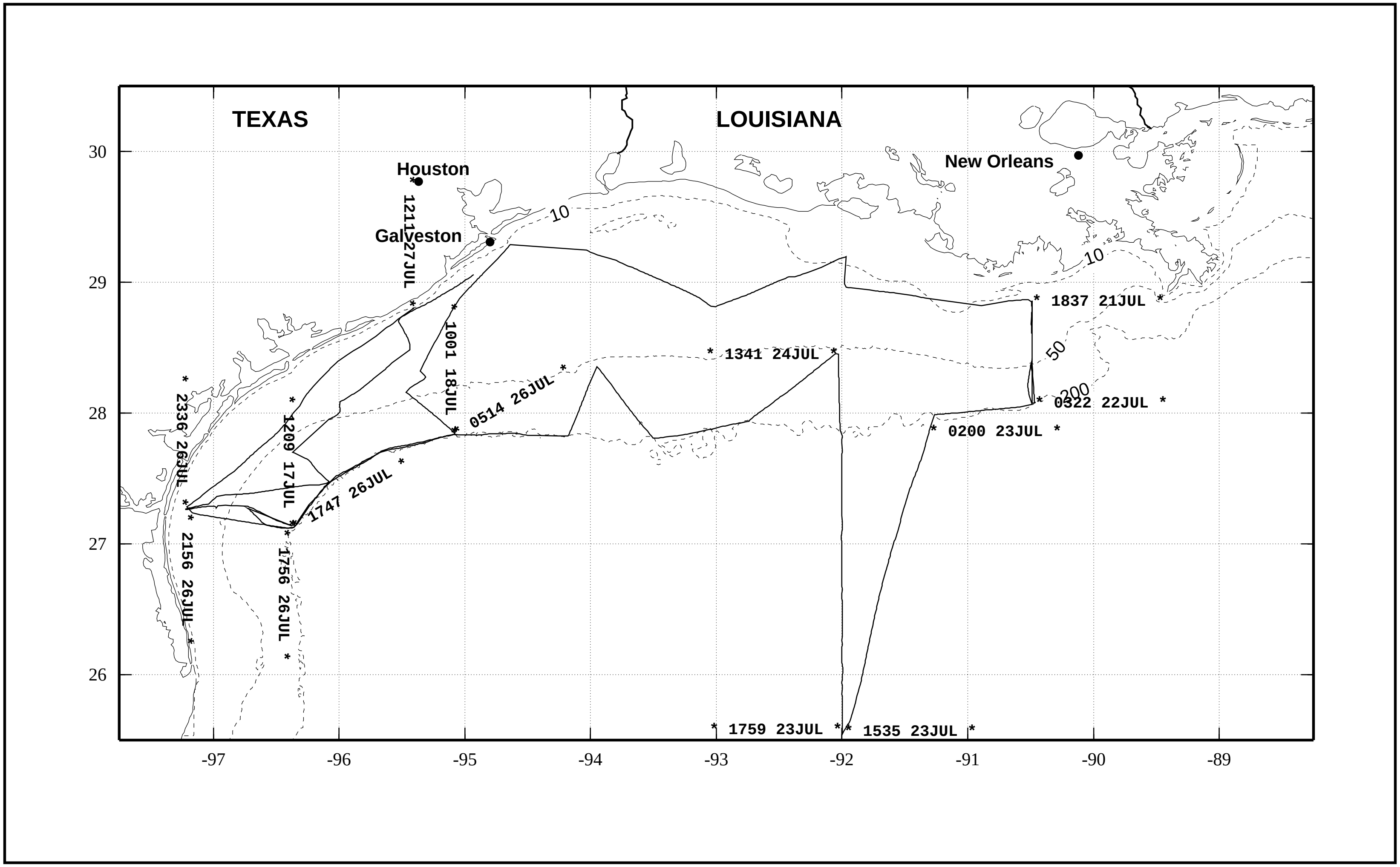

Figure 2.1.1. Cruise track for LATEX A cruise M03 in July 1992, showing times.

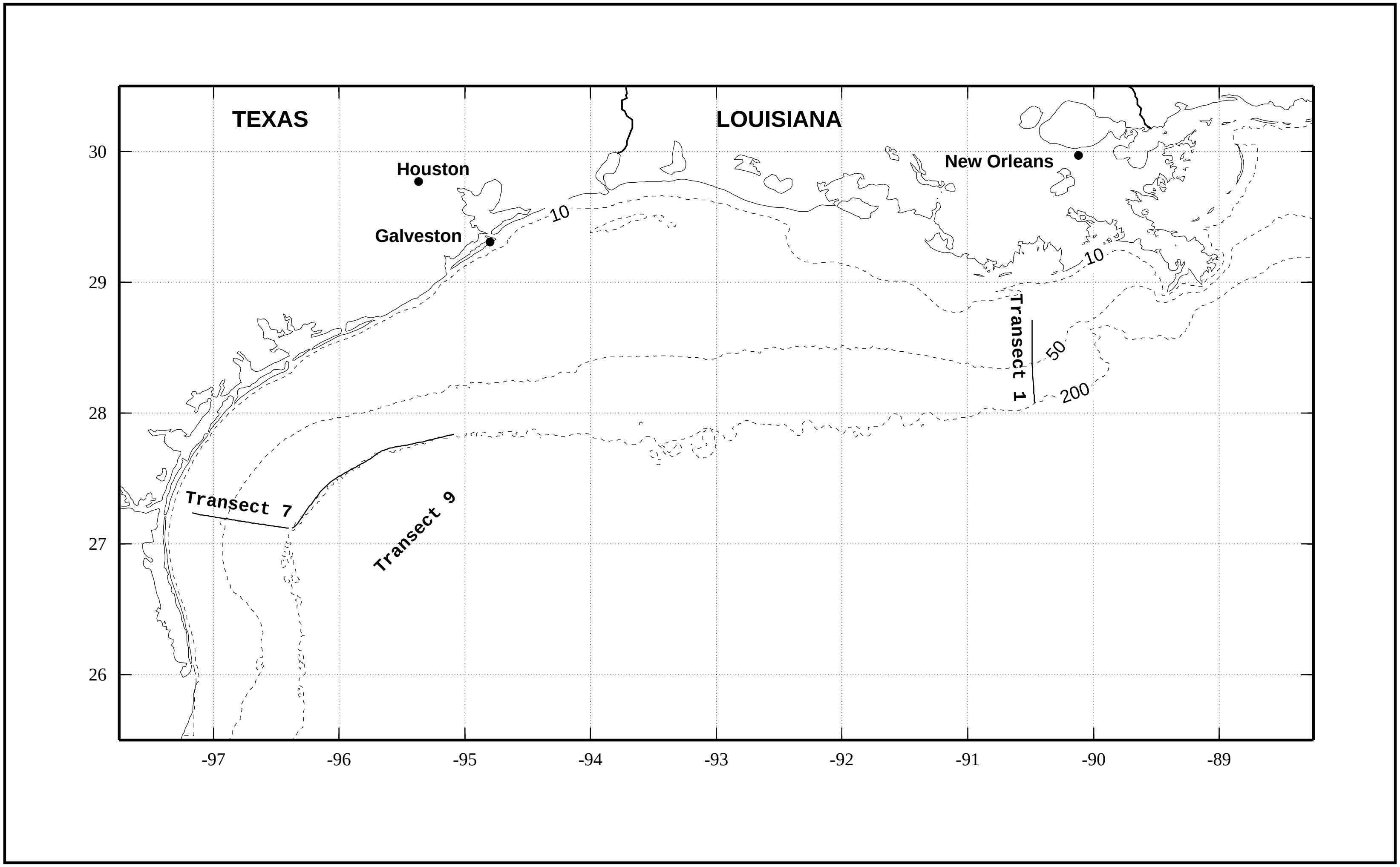

Figure 2.1.2. Cruise track for LATEX A cruise M03 in July 1992, showing individual labeled transects.

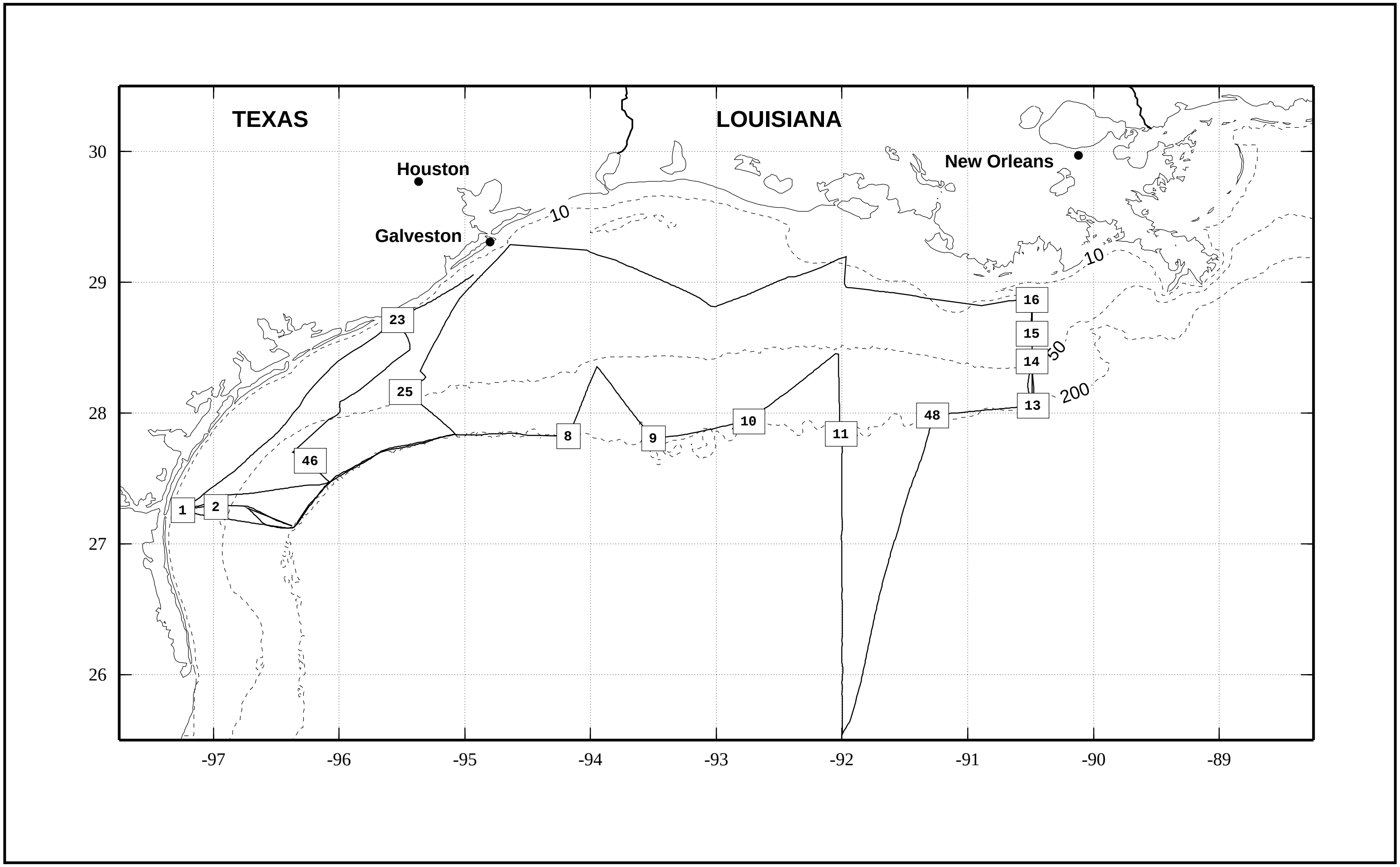

Figure 2.1.3. Cruise track for LATEX A cruise M03 in July 1992, showing current meter locations.

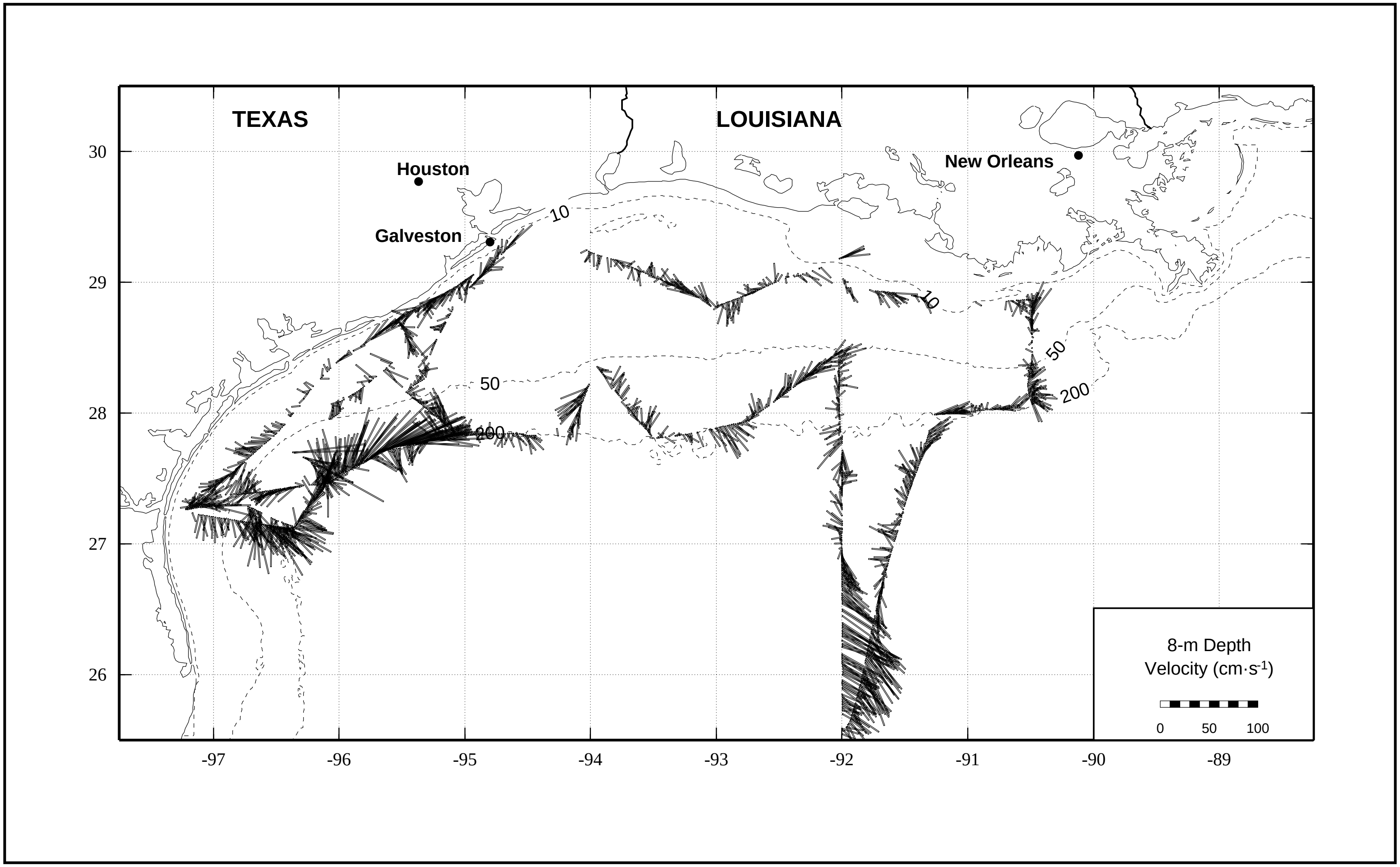

Figure 2.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 8 m depth. The data are from LATEX A cruise M03 conducted in July 1992.

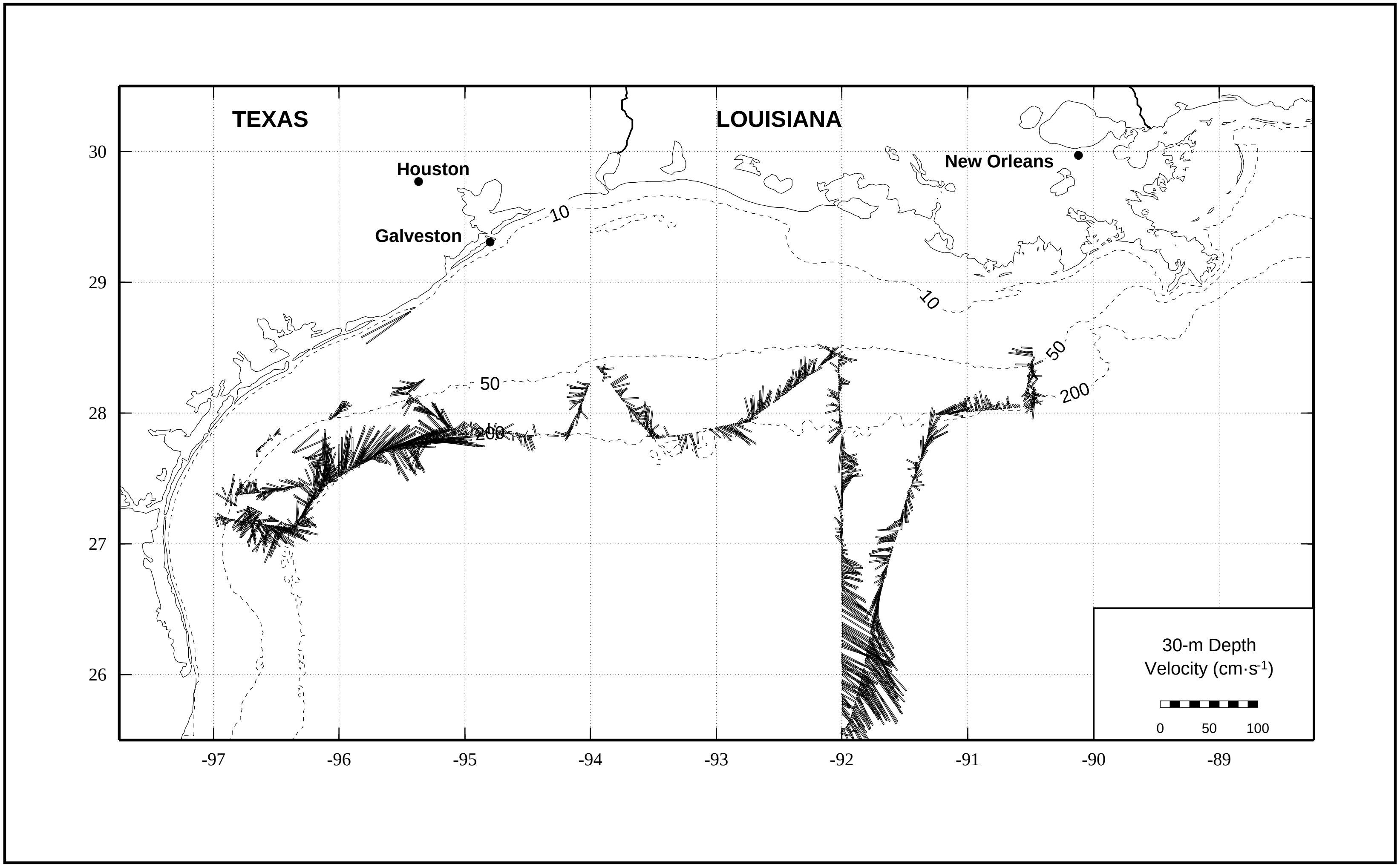

Figure 2.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise M03 conducted in July 1992.

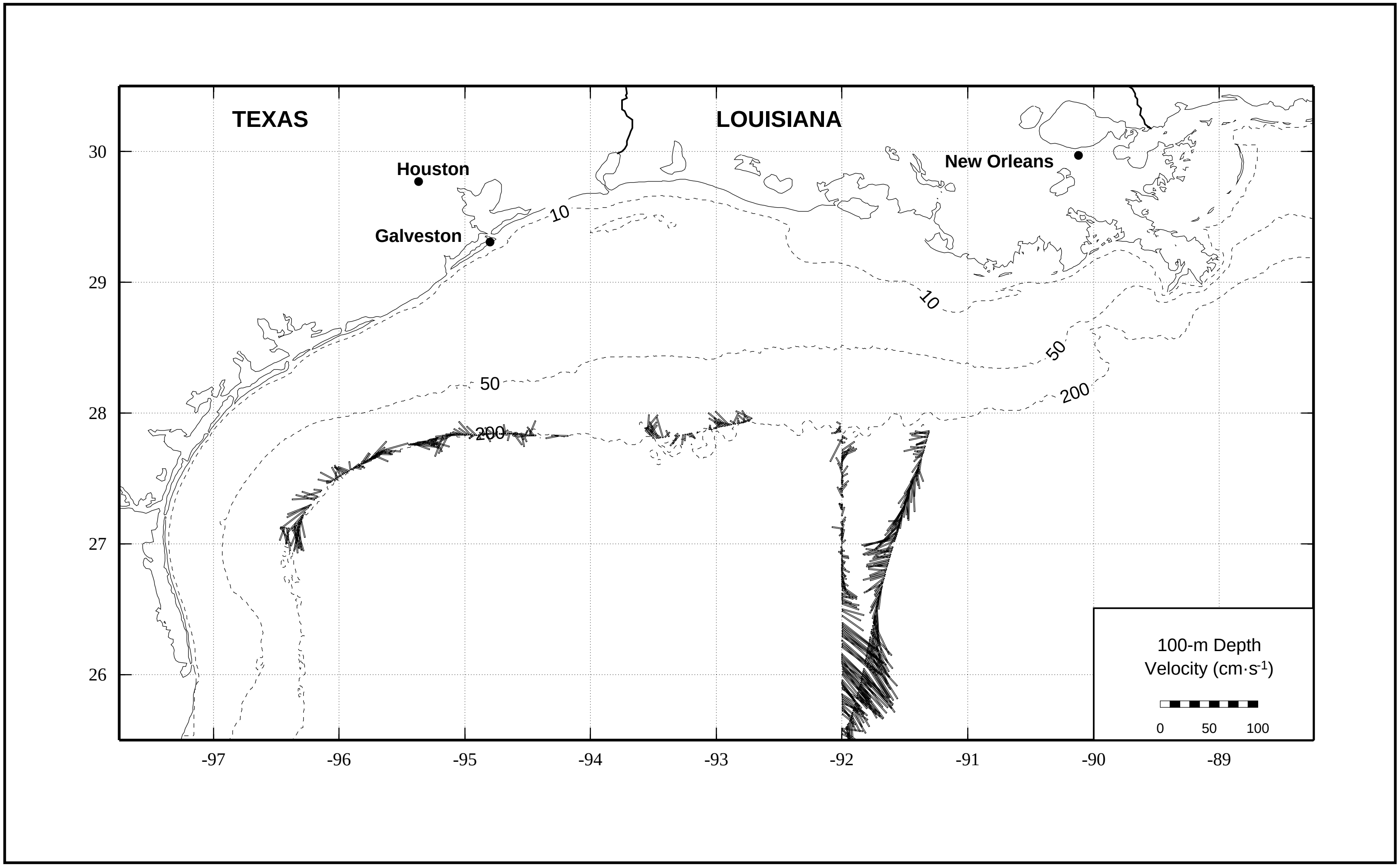

Figure 2.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise M03 conducted in July 1992.

3.3.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (GMT; Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 2.3.1 shows the velocity from the bin centered at 8 m, Figure 2.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 2.3.3 shows the velocity from the bin centered at 100 m below the surface.

3.3.2.4 Contoured Profiles of Normal Velocity

We show in Figures 2.4.1 and 2.4.7 the velocity normal to transects 1 and 7, respectively. For along-shelf transect number 9, taken along the 200-m isobath, we show the normal velocity in Figure 2.4.9. The transects are shown in Figure 2.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of National Ocean Service (NOS) casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

3.3.2.5 Vertical Current Profiles

We show in Figures 2.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 2.1.3.

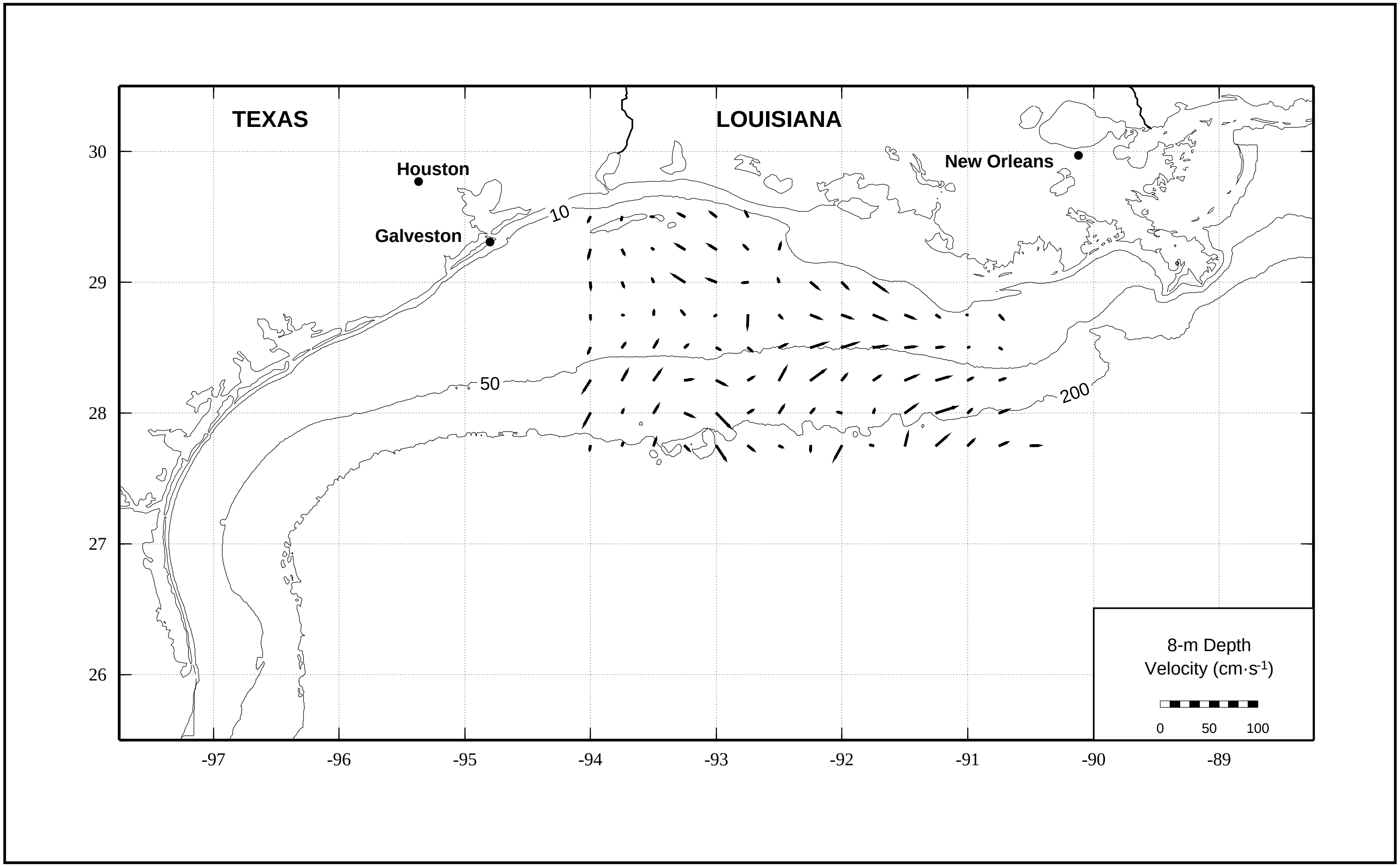

Figure 2.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 8 m depth. The data are from LATEX A cruise M03 conducted in July 1992.

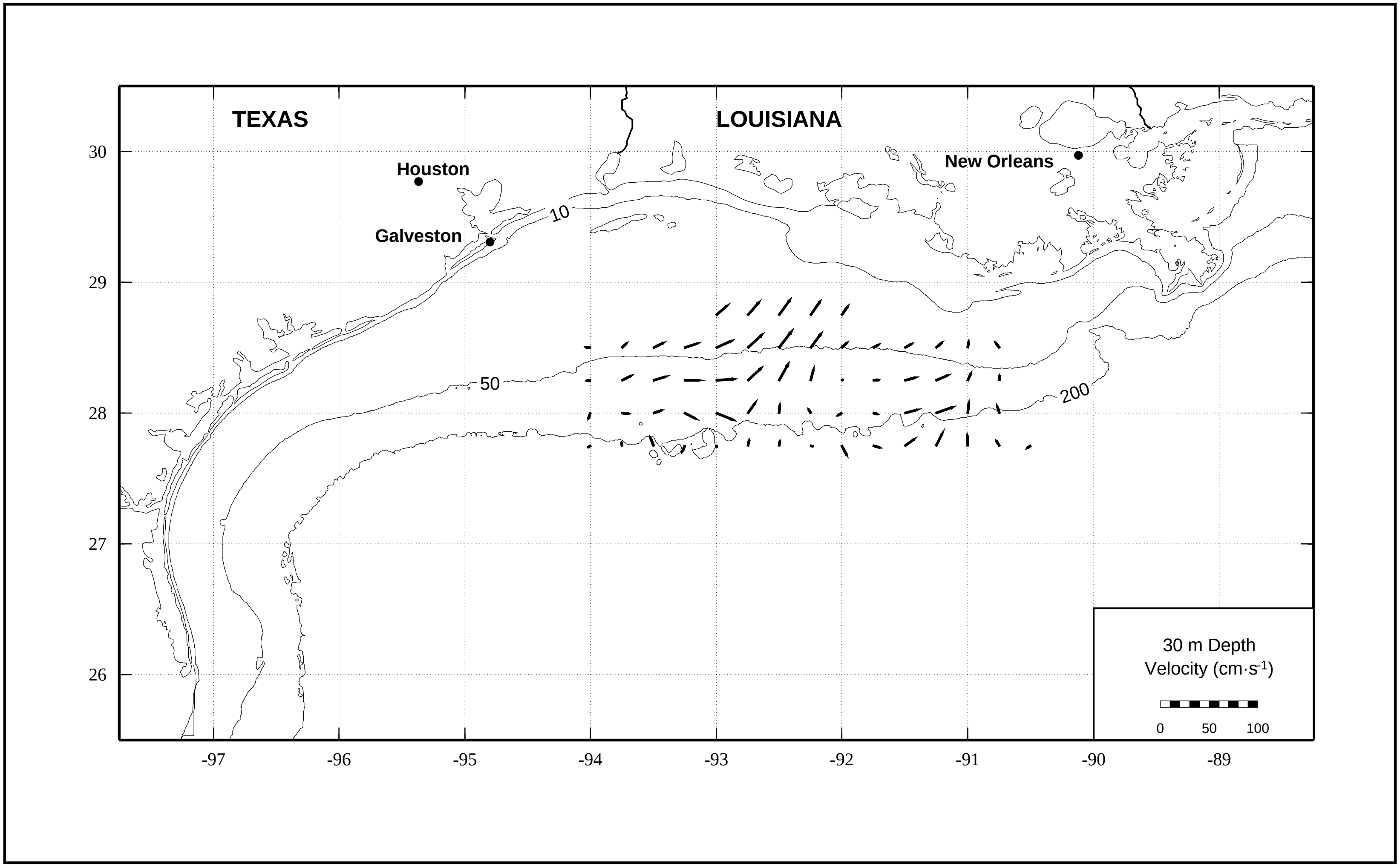

Figure 2.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise M03 conducted in July 1992.

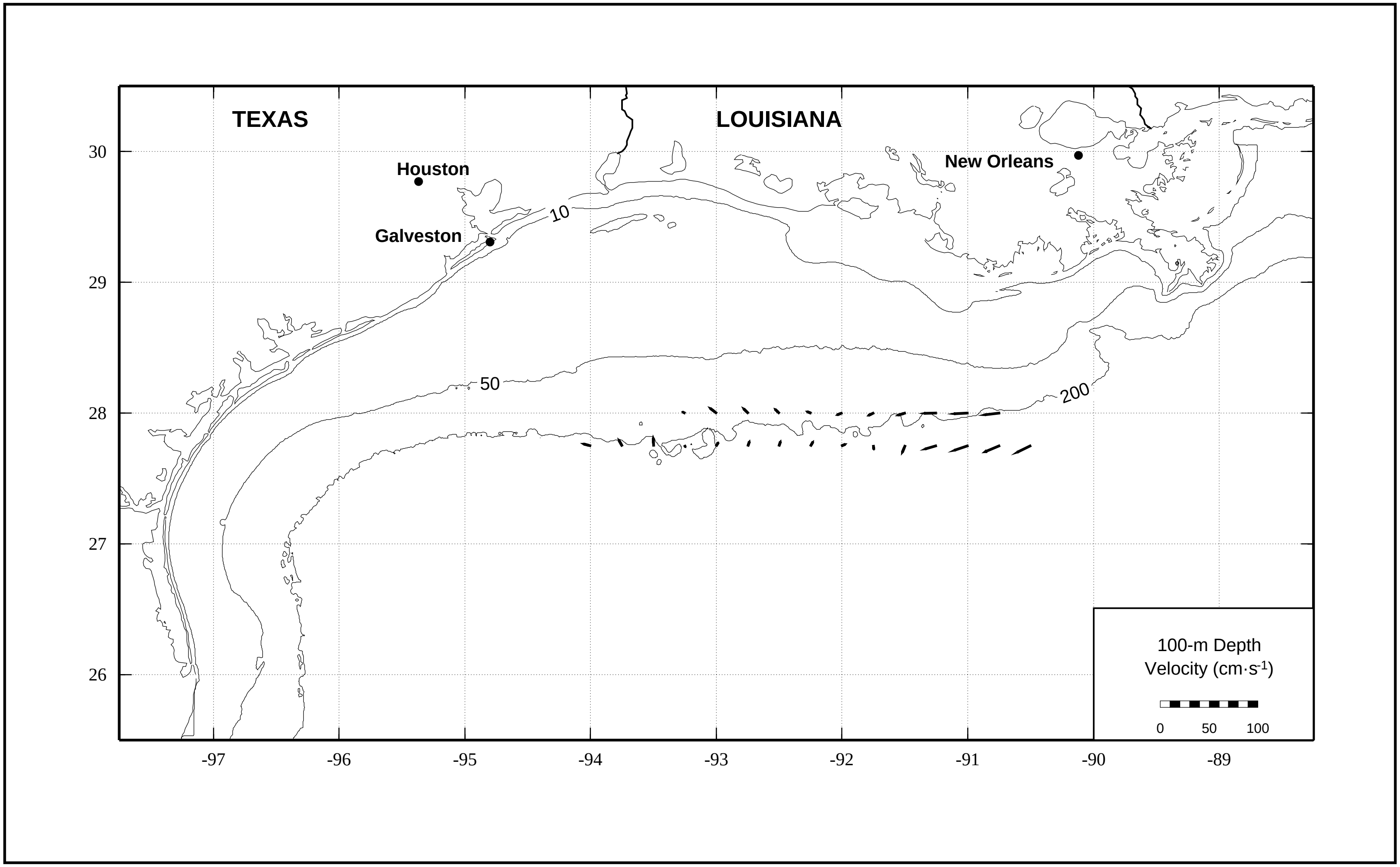

Figure 2.3.3. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise M03 conducted in July 1992.

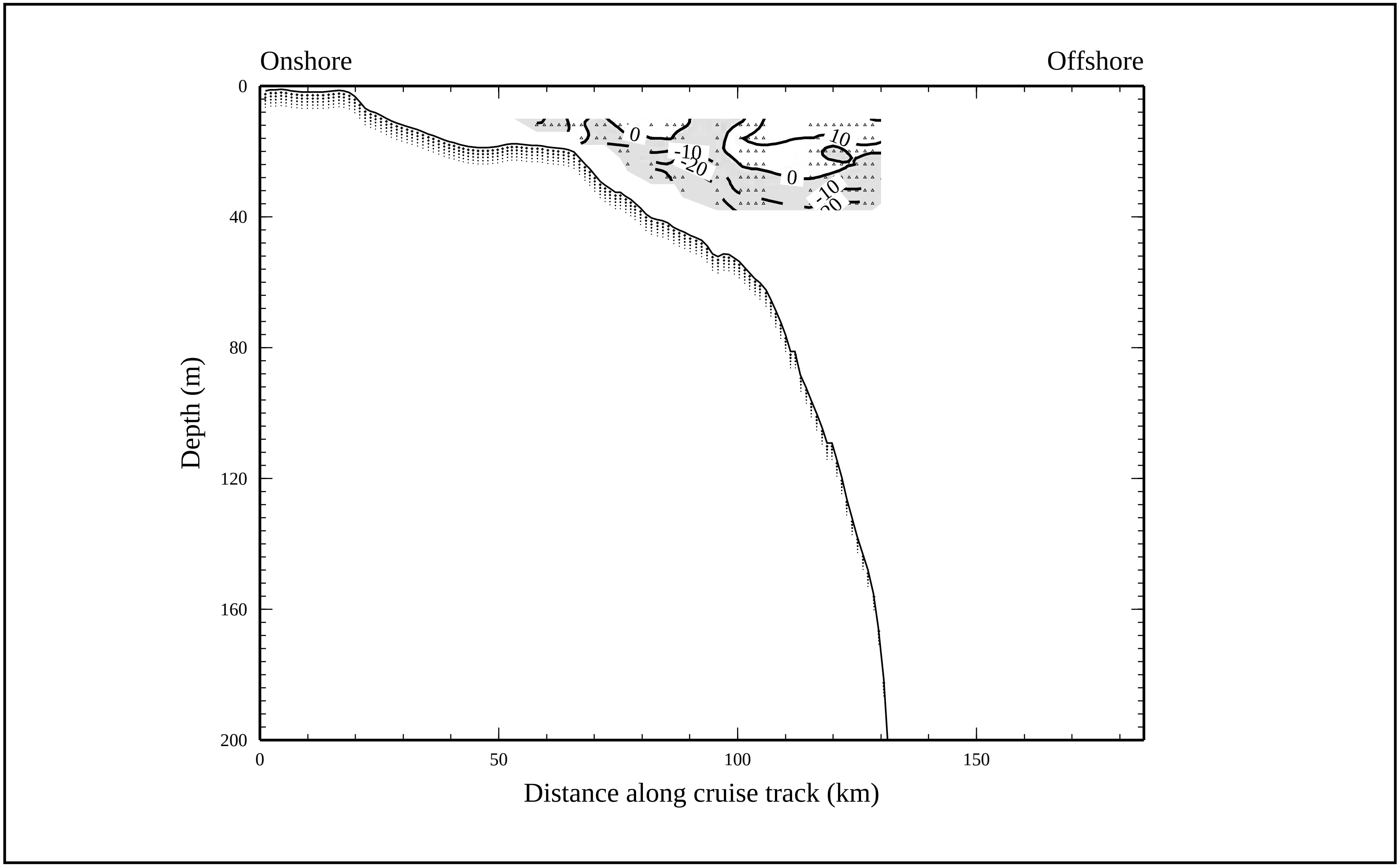

Figure 2.4.1. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 1 for cruise M03, July 1992. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

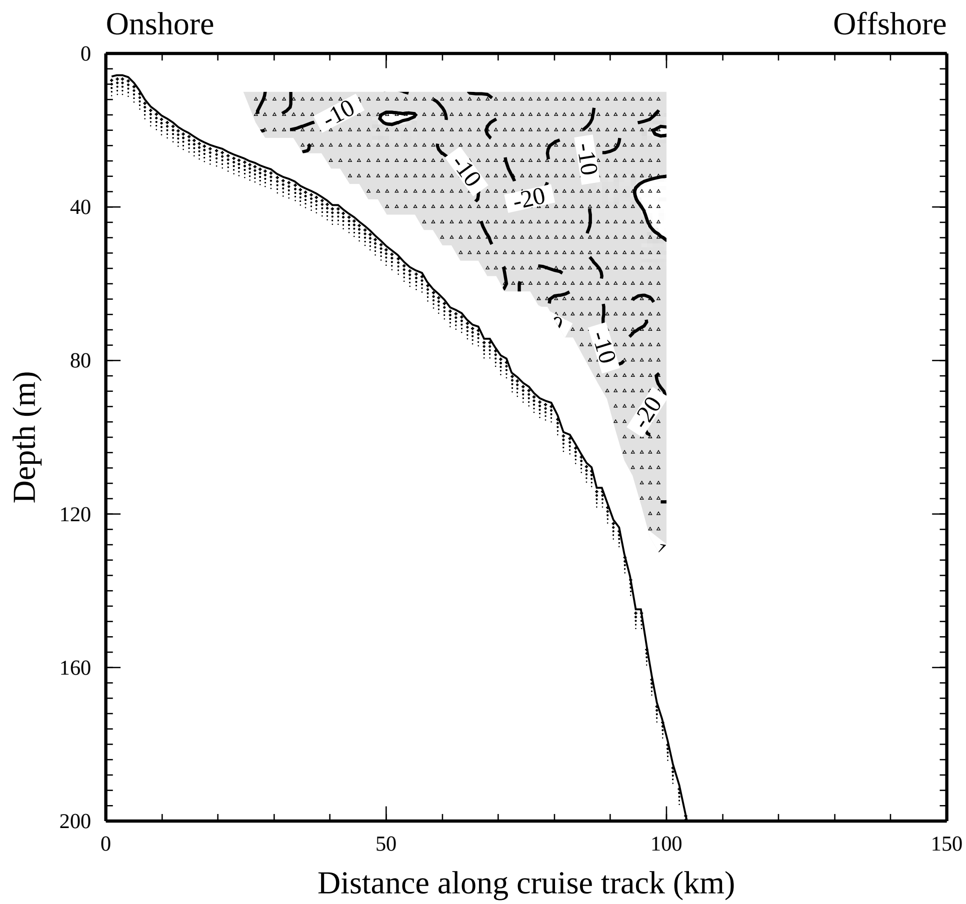

Figure 2.4.7. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 7 for cruise M03, July 1992. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

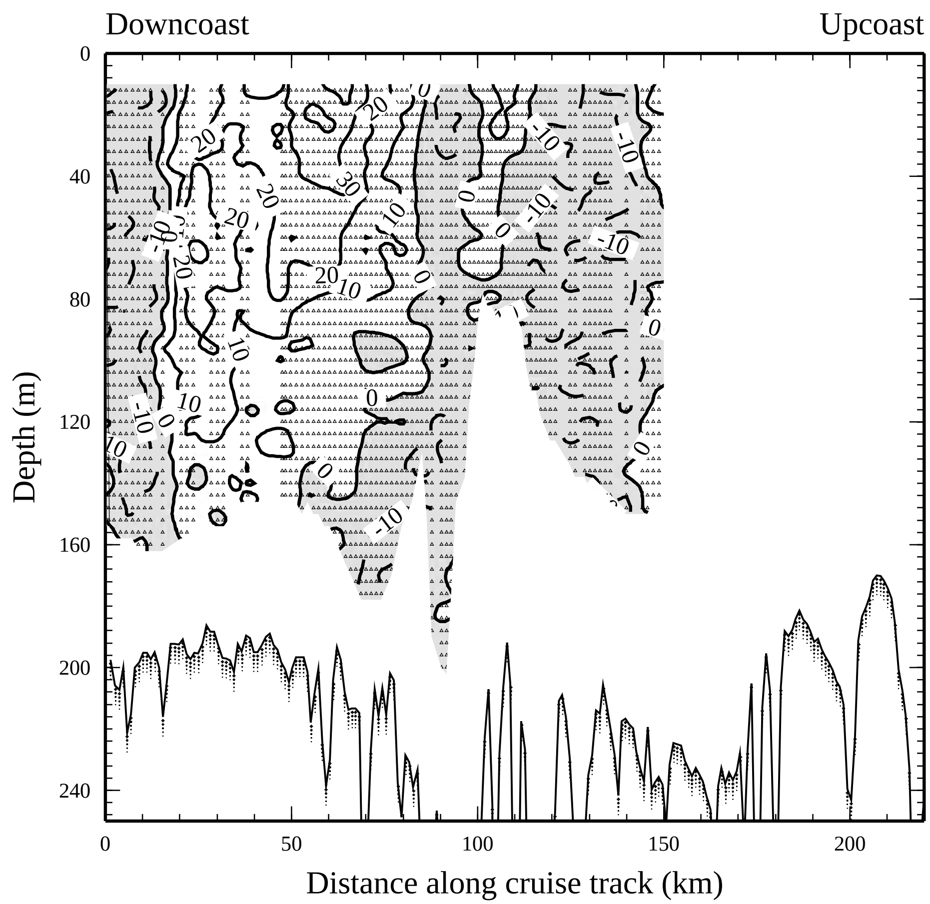

Figure 2.4.9. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 9 for cruise M03, July 1992. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

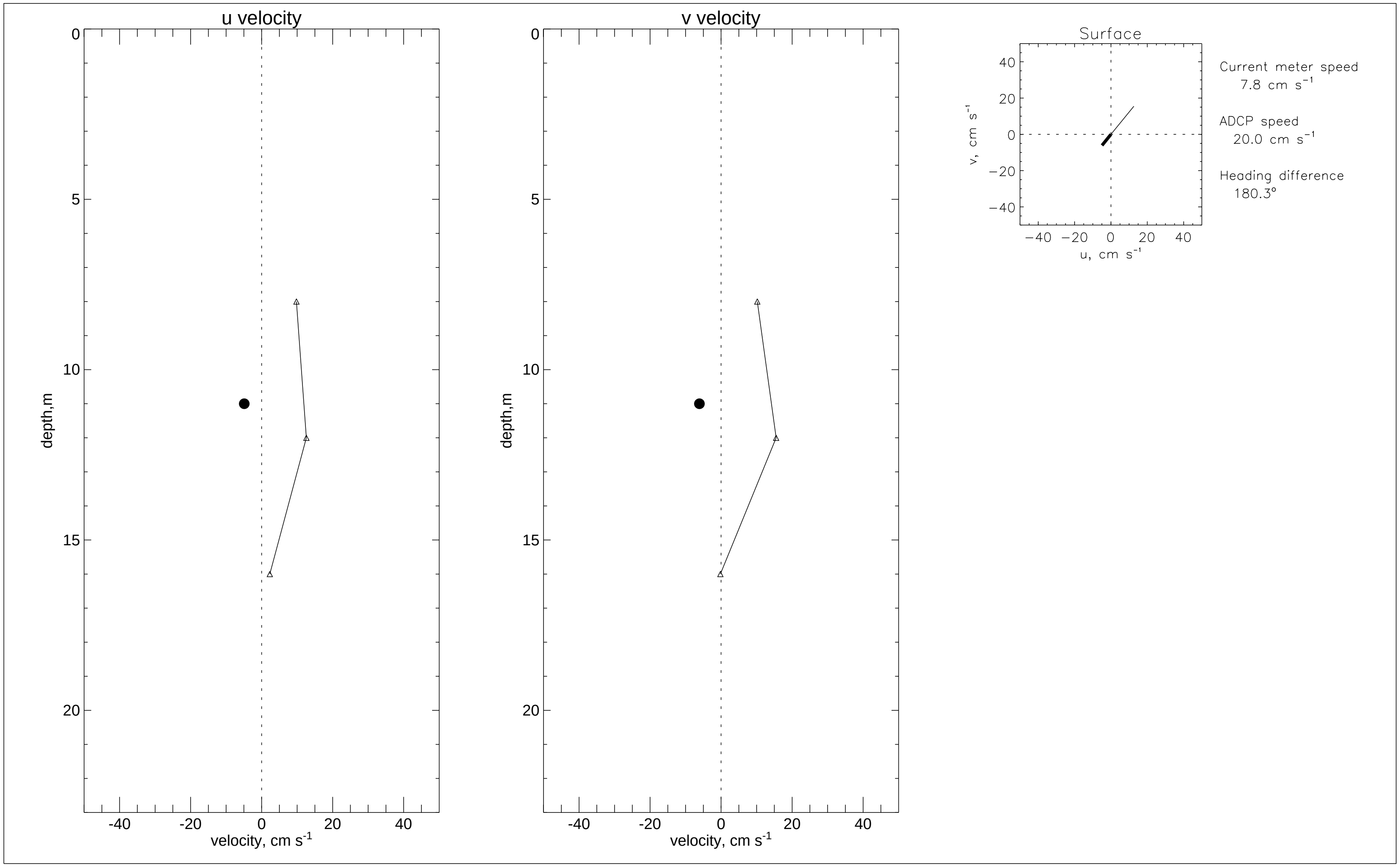

Figure 2.5.01. ADCP profile taken on 15 July 1992 at 0839 UTC (cruise M03) while passing by mooring CM01 at a distance of 2. 5 km. Velocities for the surface meter (11 m) are marked with a circle and were recorded on 15 July 1992 at 0830 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

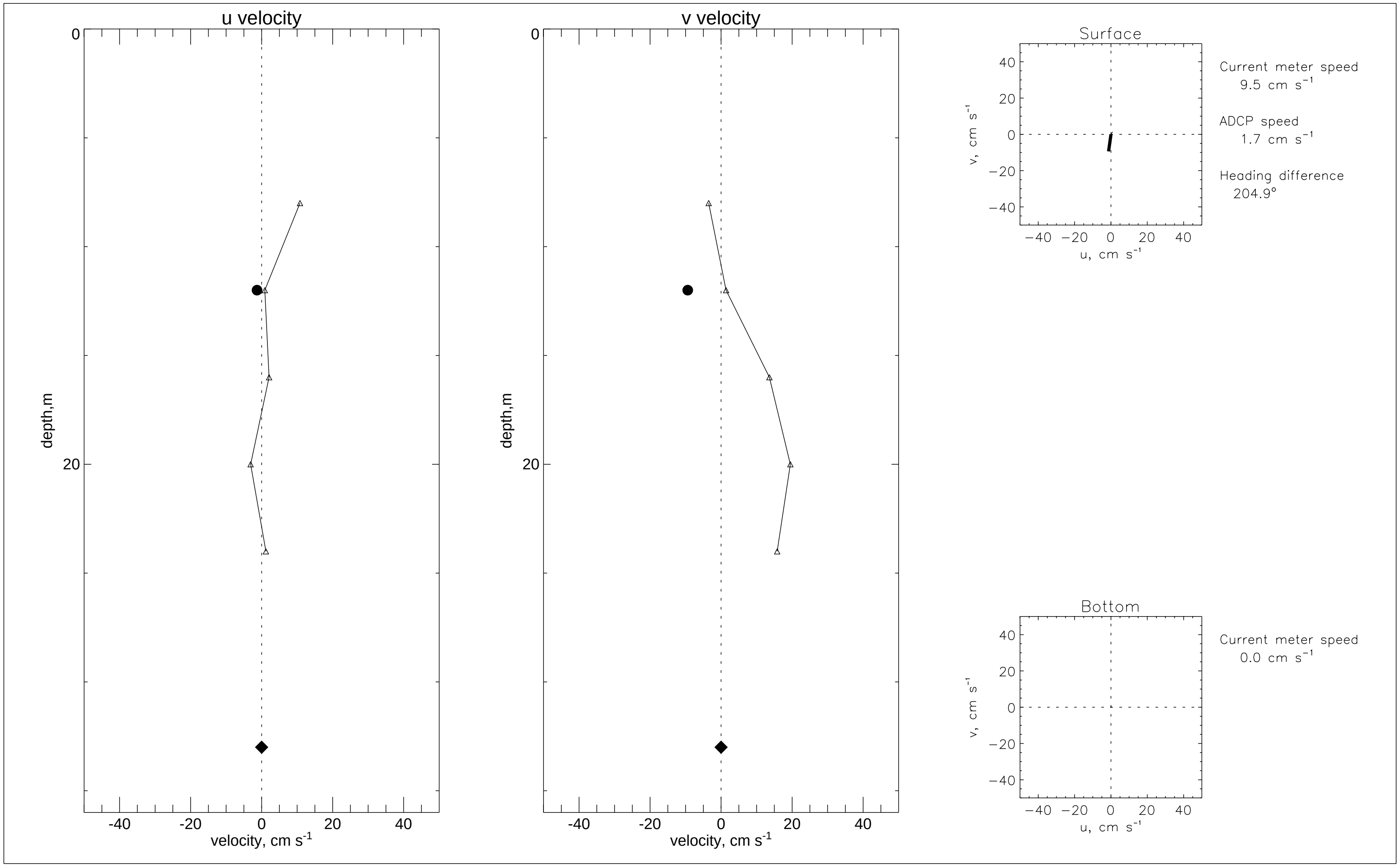

Figure 2.5.02. ADCP profile taken on 15 July 1992 at 1910 UTC (cruise M03) while passing by mooring CM02 at a distance of 0. 4 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 15 July 1992 at 1900 UTC. Velocities for the bottom meter (33 m) are marked with a diamond and were recorded on 15 July 1992 at 1910 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

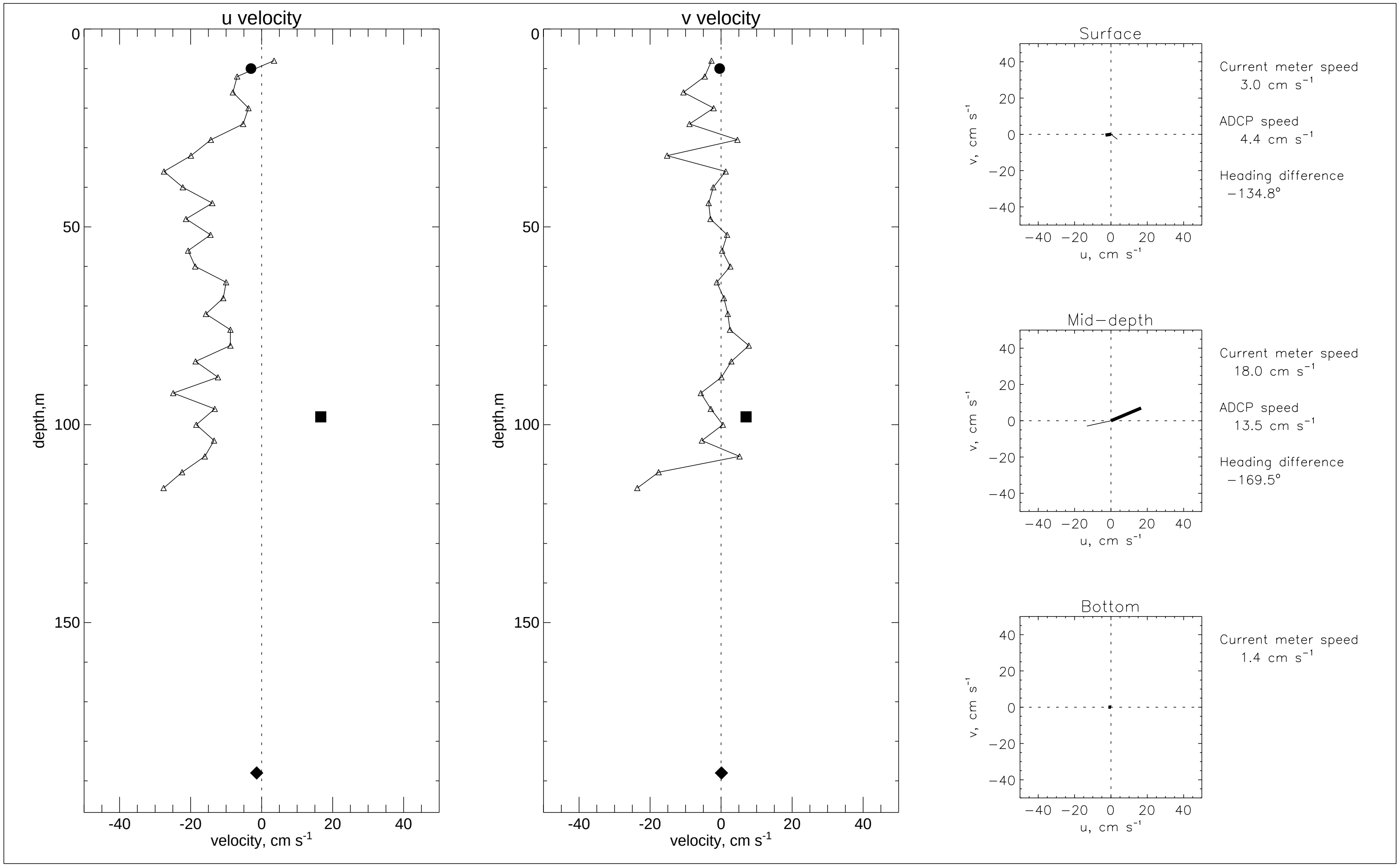

Figure 2.5.08. ADCP profile taken on 24 July 1992 at 2259 UTC (cruise M03) while passing by mooring CM08 at a distance of 0. 1 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 24 July 1992 at 2300 UTC. Velocities for the mid-depth meter (98 m) are marked with a square and were recorded on 24 July 1992 at 2300 UTC. Velocities for the bottom meter (188 m) are marked with a diamond and were recorded on 24 July 1992 at 2300 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

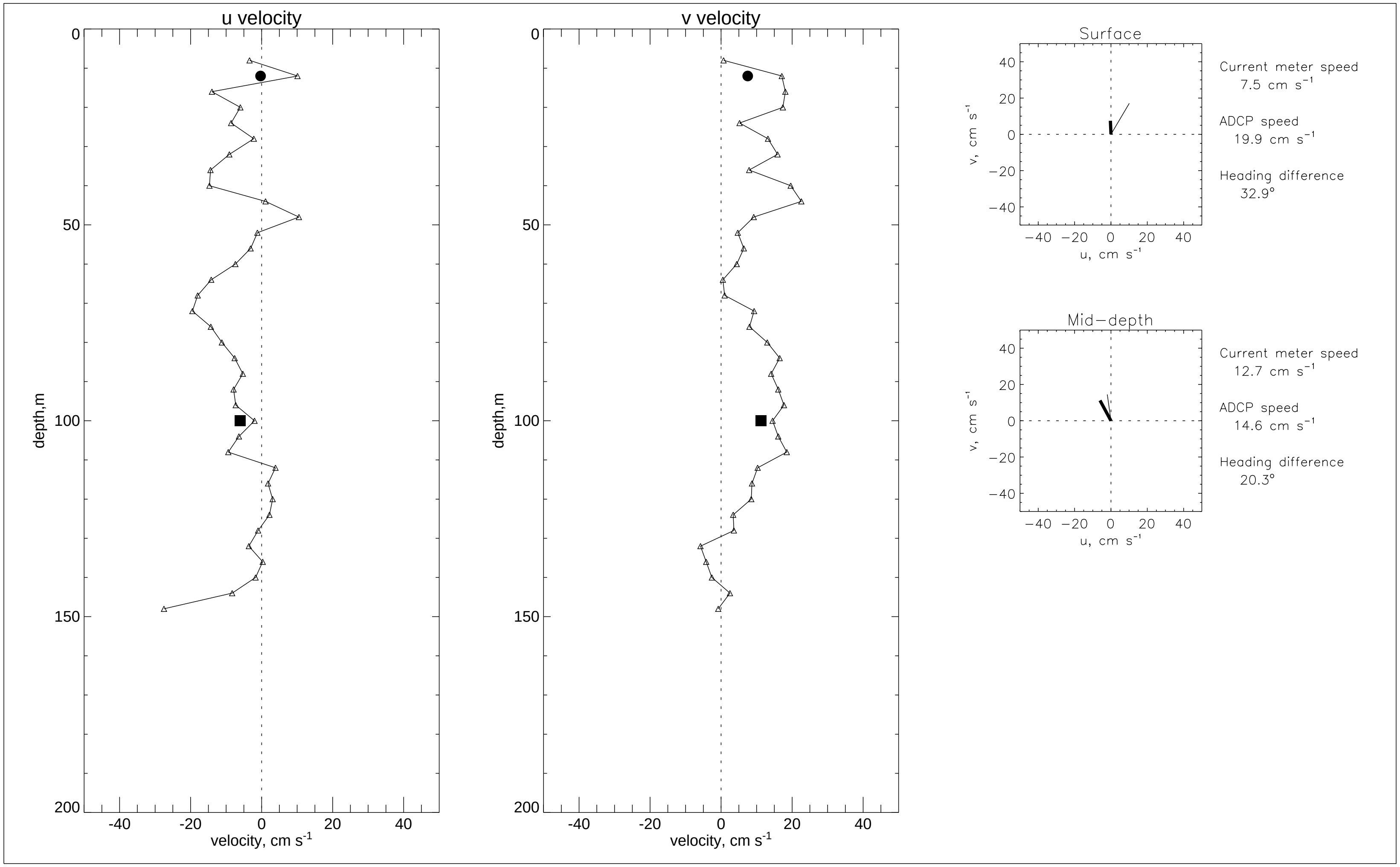

Figure 2.5.09. ADCP profile taken on 24 July 1992 at 0632 UTC (cruise M03) while passing by mooring CM09 at a distance of 0. 1 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 24 July 1992 at 0630 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 24 July 1992 at 0630 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

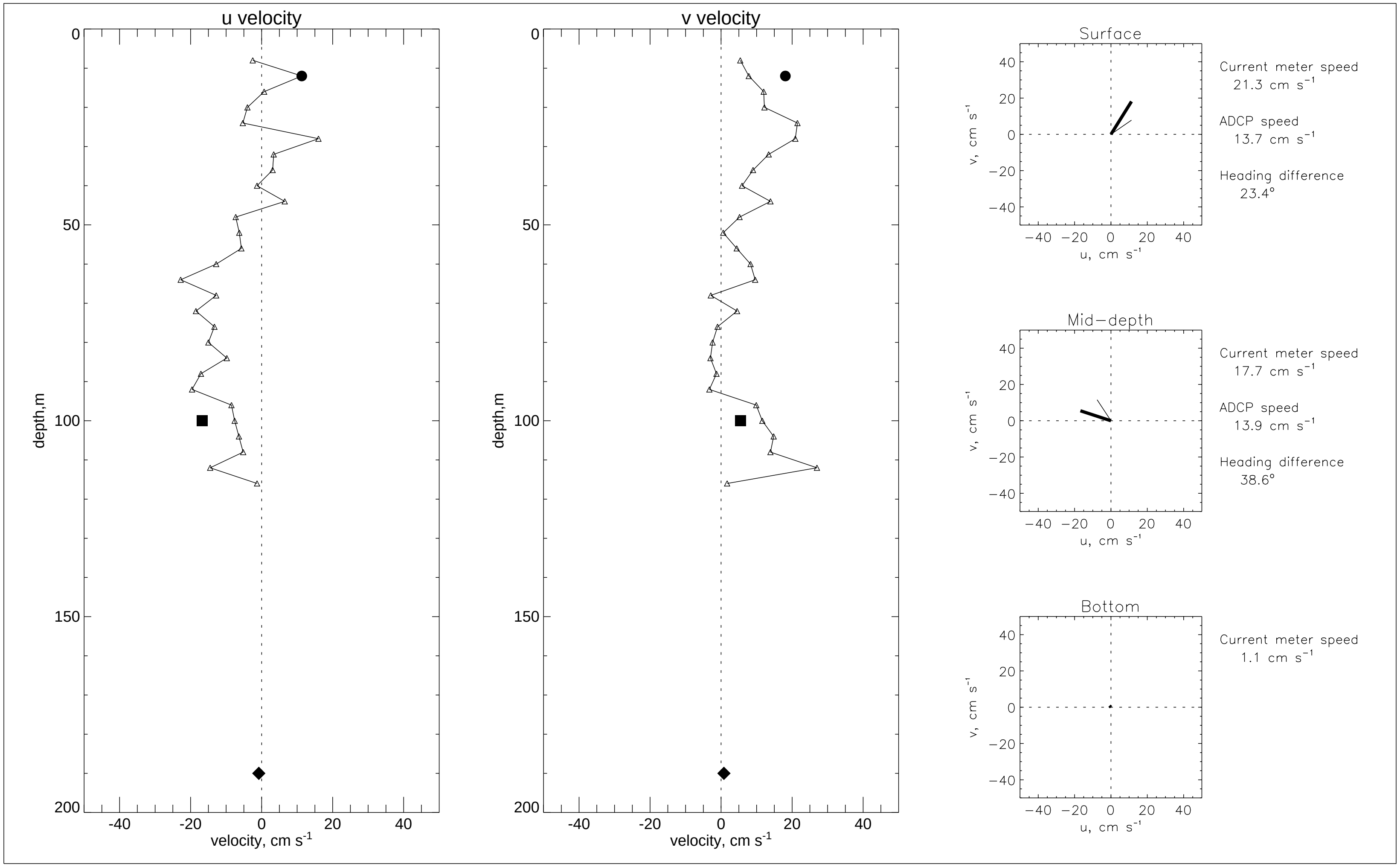

Figure 2.5.10. ADCP profile taken on 24 July 1992 at 0142 UTC (cruise M03) while passing by mooring CM10 at a distance of 0. 5 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 24 July 1992 at 0130 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 24 July 1992 at 0130 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 24 July 1992 at 0130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

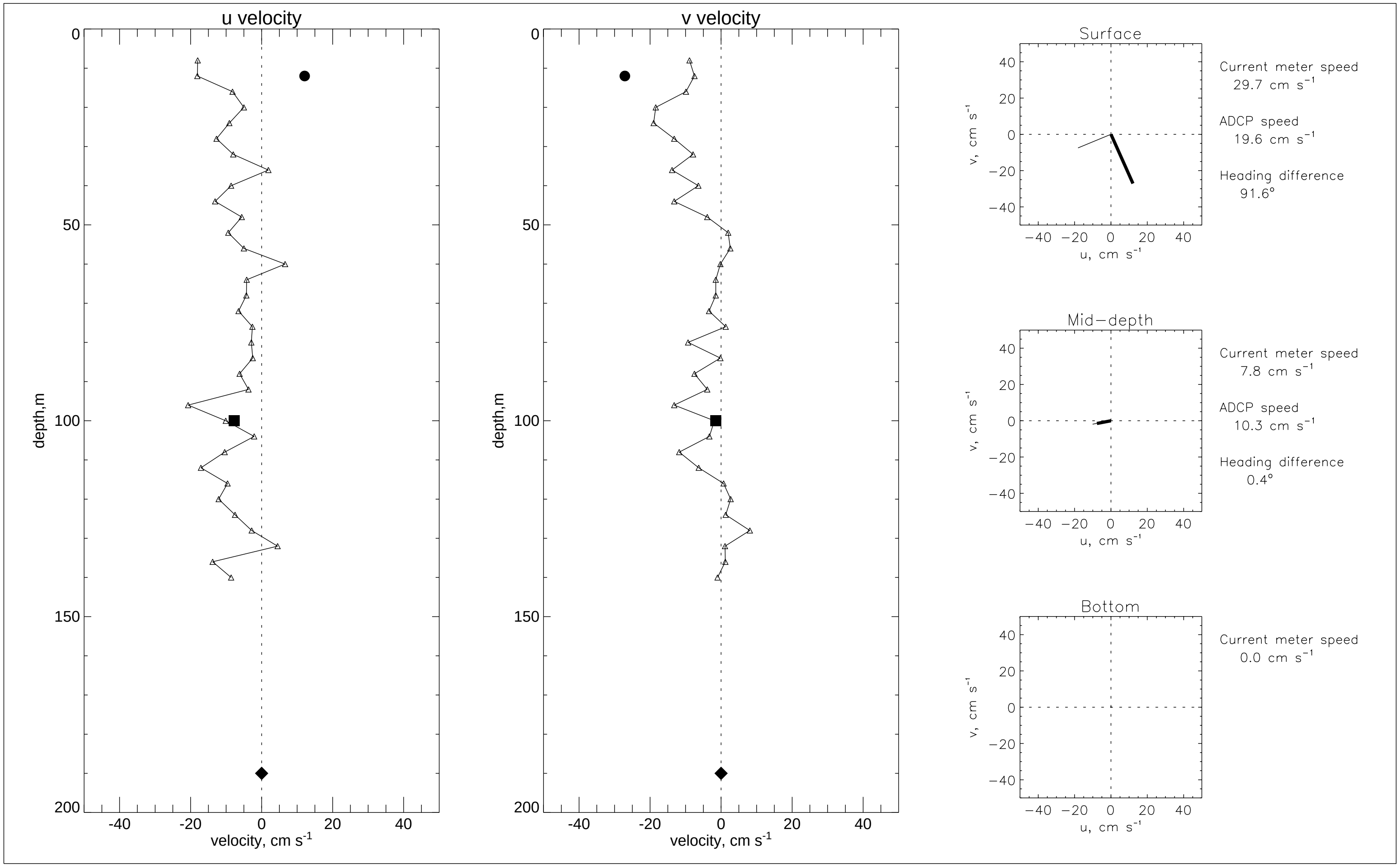

Figure 2.5.11. ADCP profile taken on 23 July 1992 at 1027 UTC (cruise M03) while passing by mooring CM11 at a distance of 1. 6 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 23 July 1992 at 1030 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 23 July 1992 at 1030 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 23 July 1992 at 1030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

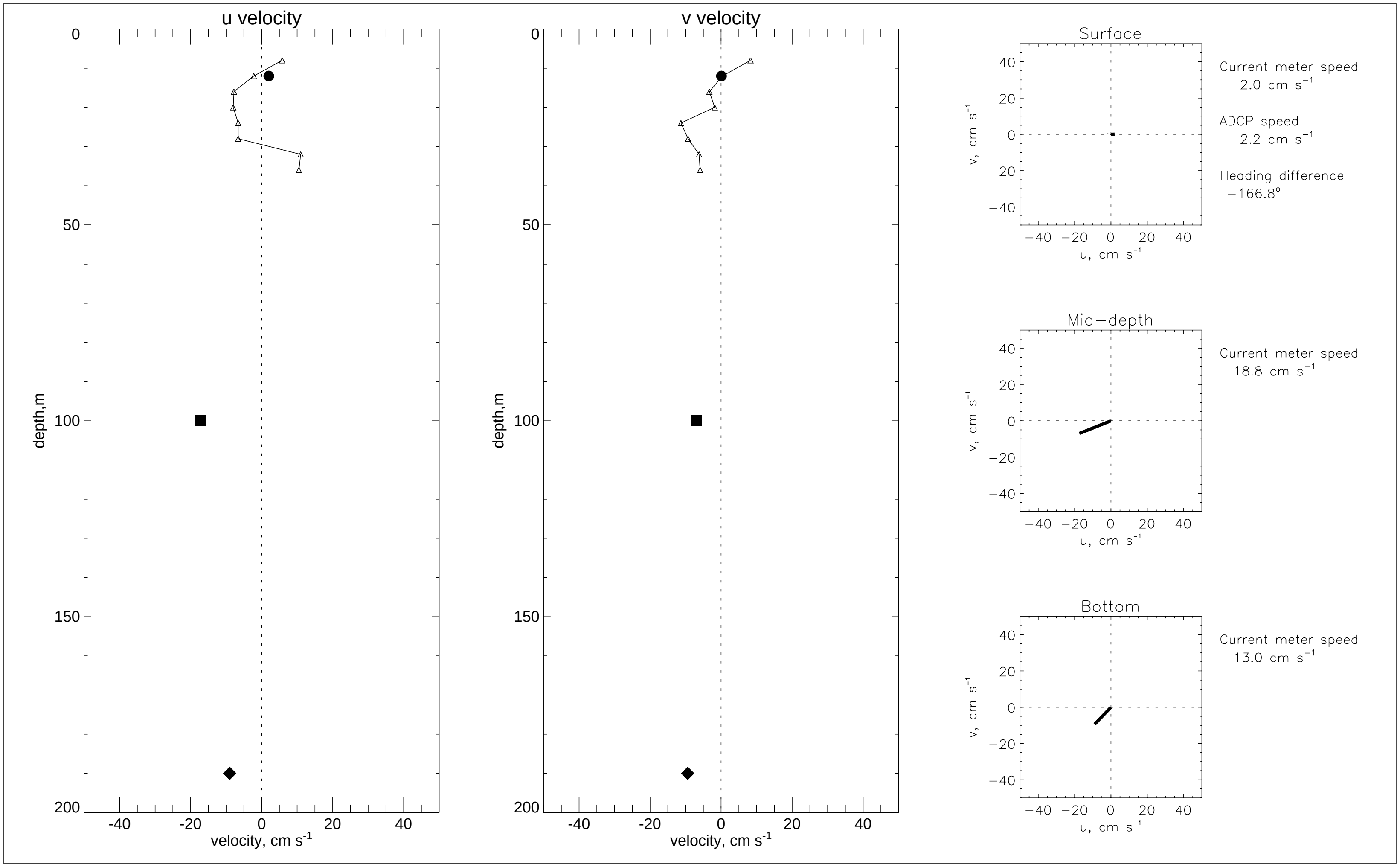

Figure 2.5.13. ADCP profile taken on 21 July 1992 at 1606 UTC (cruise M03) while passing by mooring CM13 at a distance of 0. 7 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 21 July 1992 at 1600 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 21 July 1992 at 1600 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 21 July 1992 at 1600 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

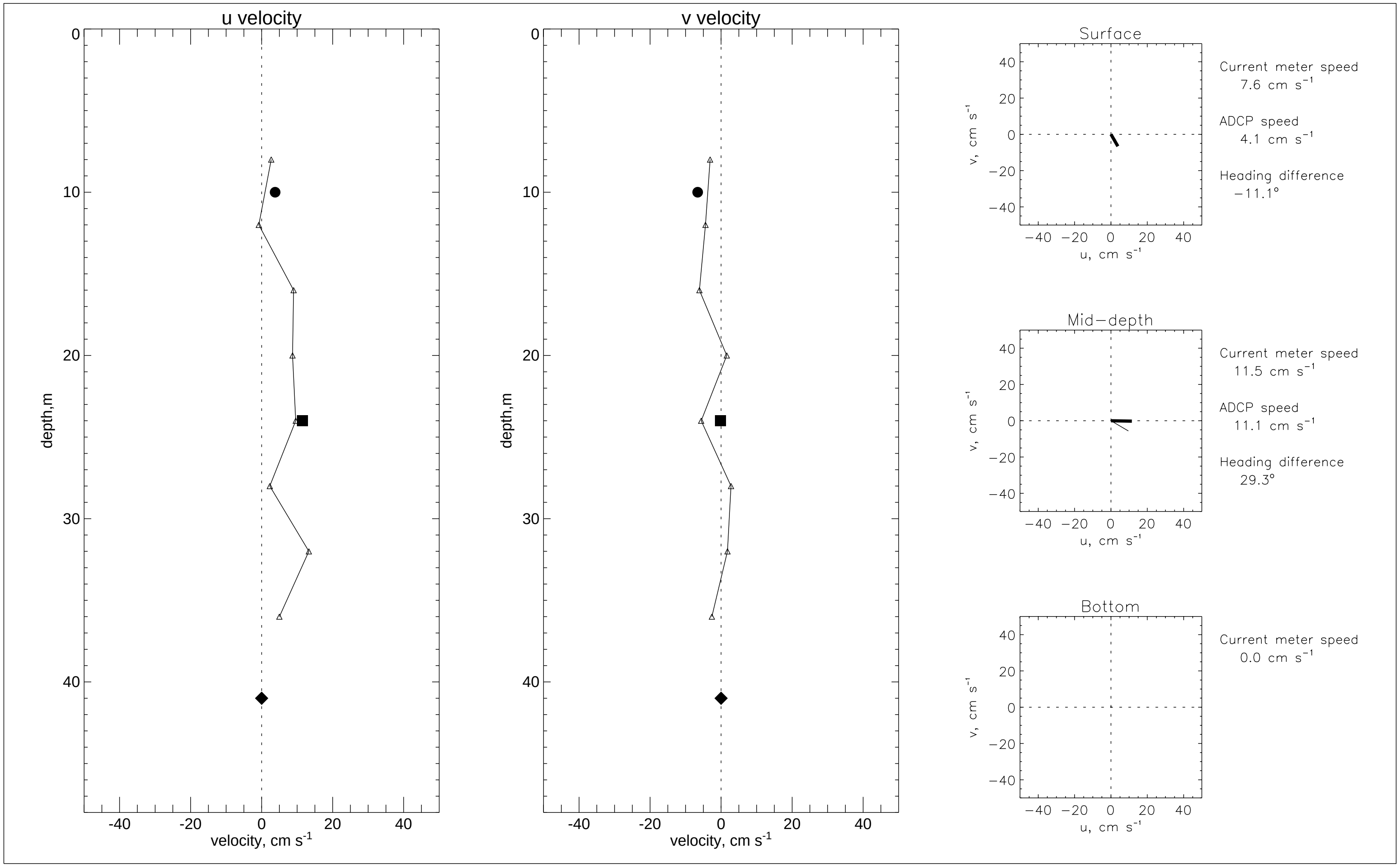

Figure 2.5.14. ADCP profile taken on 21 July 1992 at 0925 UTC (cruise M03) while passing by mooring CM14 at a distance of 0. 2 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 21 July 1992 at 0925 UTC. Velocities for the mid-depth meter (24 m) are marked with a square and were recorded on 21 July 1992 at 0930 UTC. Velocities for the bottom meter (41 m) are marked with a diamond and were recorded on 21 July 1992 at 0925 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

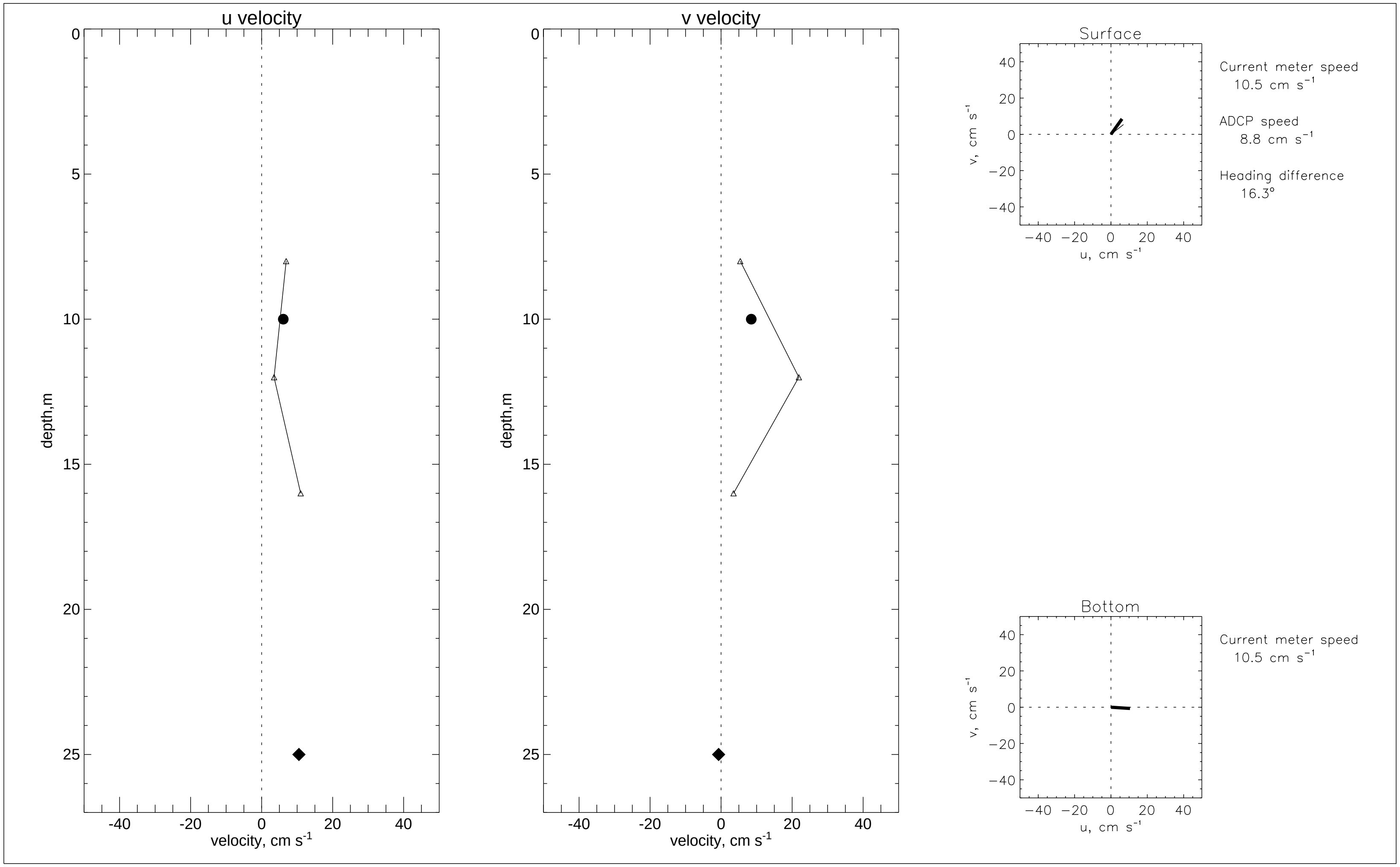

Figure 2.5.15. ADCP profile taken on 20 July 1992 at 1628 UTC (cruise M03) while passing by mooring CM15 at a distance of 0. 3 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 20 July 1992 at 1630 UTC. Velocities for the bottom meter (25 m) are marked with a diamond and were recorded on 20 July 1992 at 1630 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

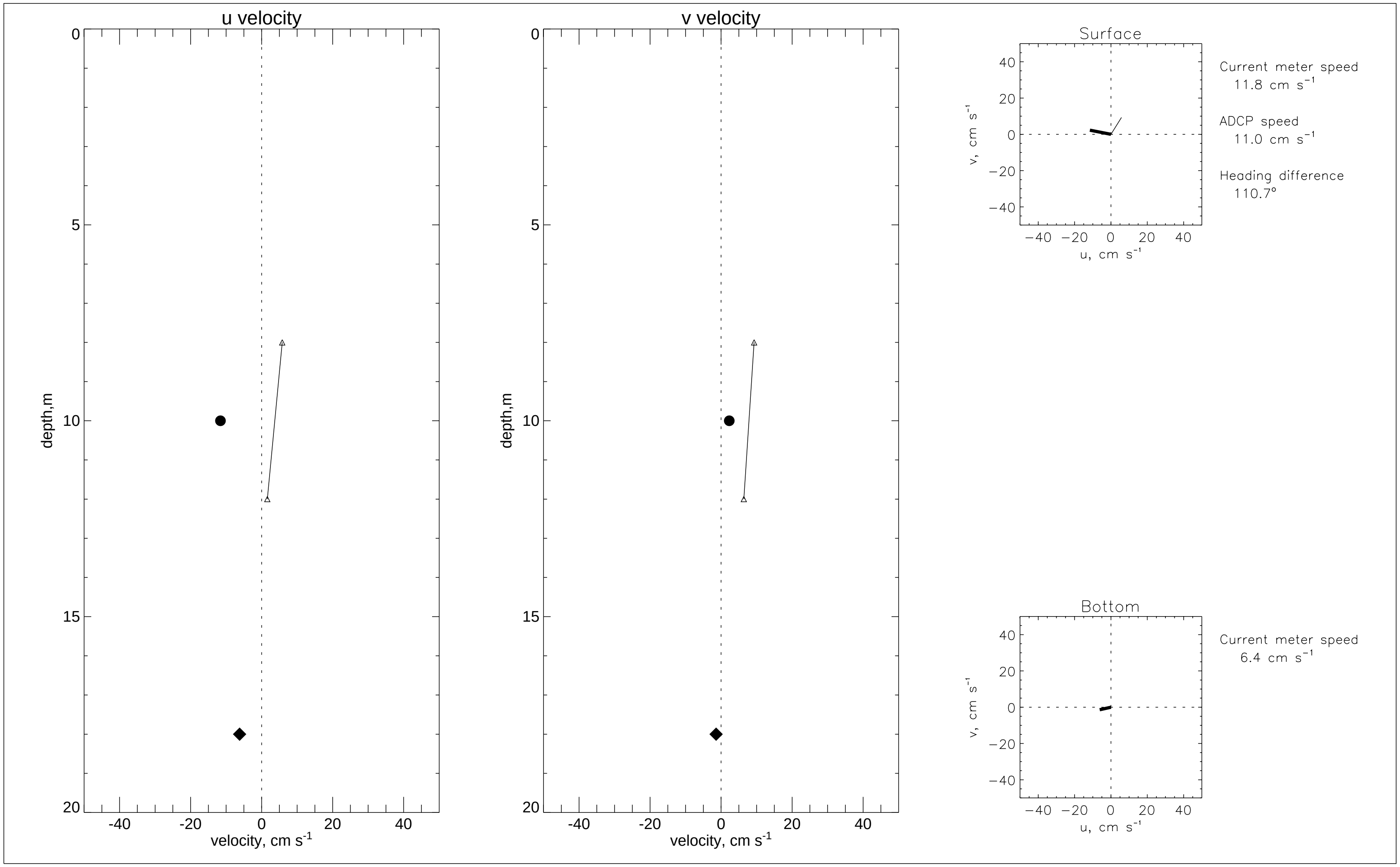

Figure 2.5.16. ADCP profile taken on 20 July 1992 at 1837 UTC (cruise M03) while passing by mooring CM16 at a distance of 0. 6 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 20 July 1992 at 1830 UTC. Velocities for the bottom meter (18 m) are marked with a diamond and were recorded on 20 July 1992 at 1830 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

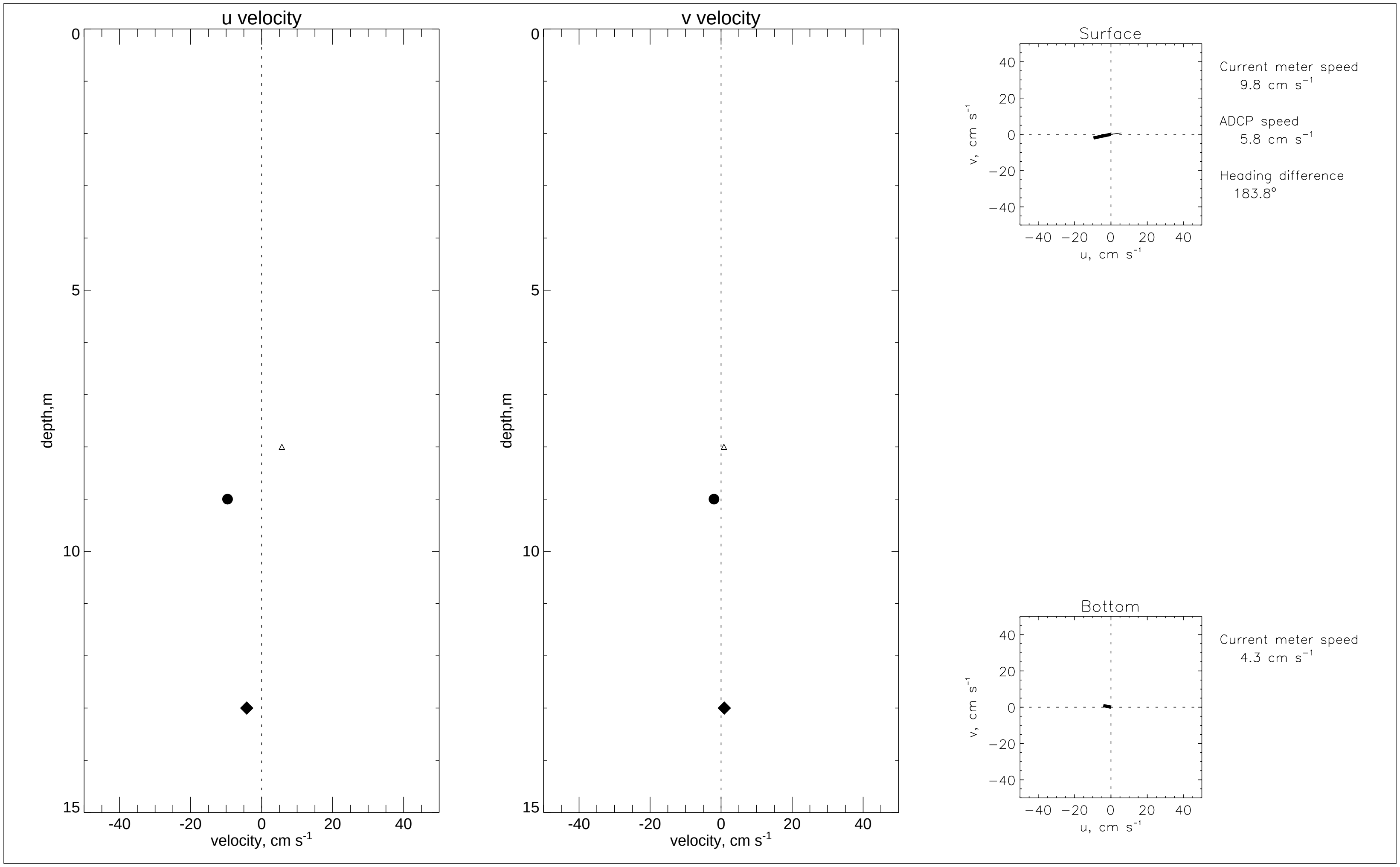

Figure 2.5.23. ADCP profile taken on 26 July 1992 at 1121 UTC (cruise M03) while passing by mooring CM23 at a distance of 0. 2 km. Velocities for the surface meter (9 m) are marked with a circle and were recorded on 26 July 1992 at 1130 UTC. Velocities for the bottom meter (13 m) are marked with a diamond and were recorded on 26 July 1992 at 1130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

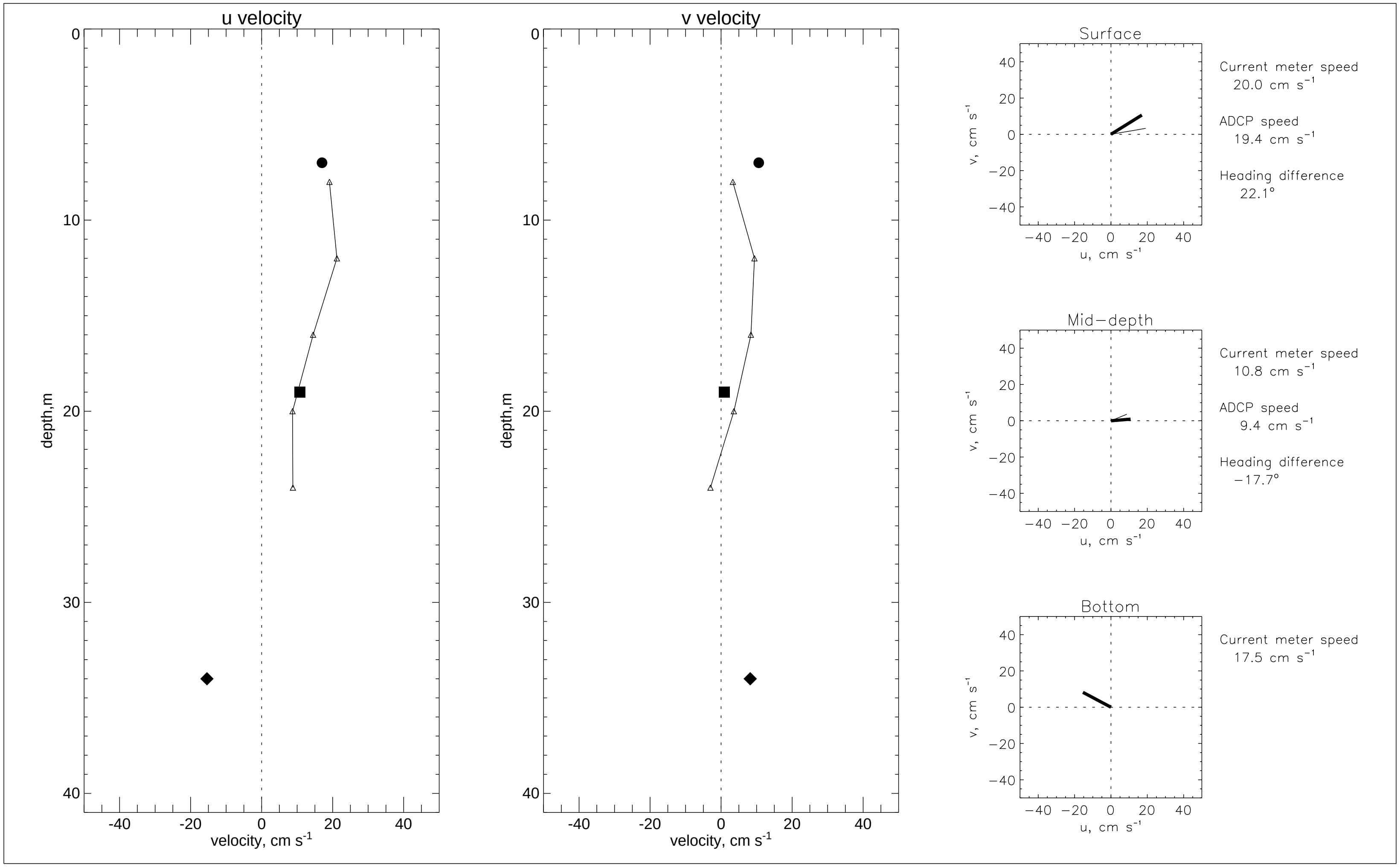

Figure 2.5.25. ADCP profile taken on 17 July 1992 at 1912 UTC (cruise M03) while passing by mooring CM25 at a distance of 0. 4 km. Velocities for the surface meter (7 m) are marked with a circle and were recorded on 17 July 1992 at 1900 UTC. Velocities for the mid-depth meter (19 m) are marked with a square and were recorded on 17 July 1992 at 1910 UTC. Velocities for the bottom meter (34 m) are marked with a diamond and were recorded on 17 July 1992 at 1910 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

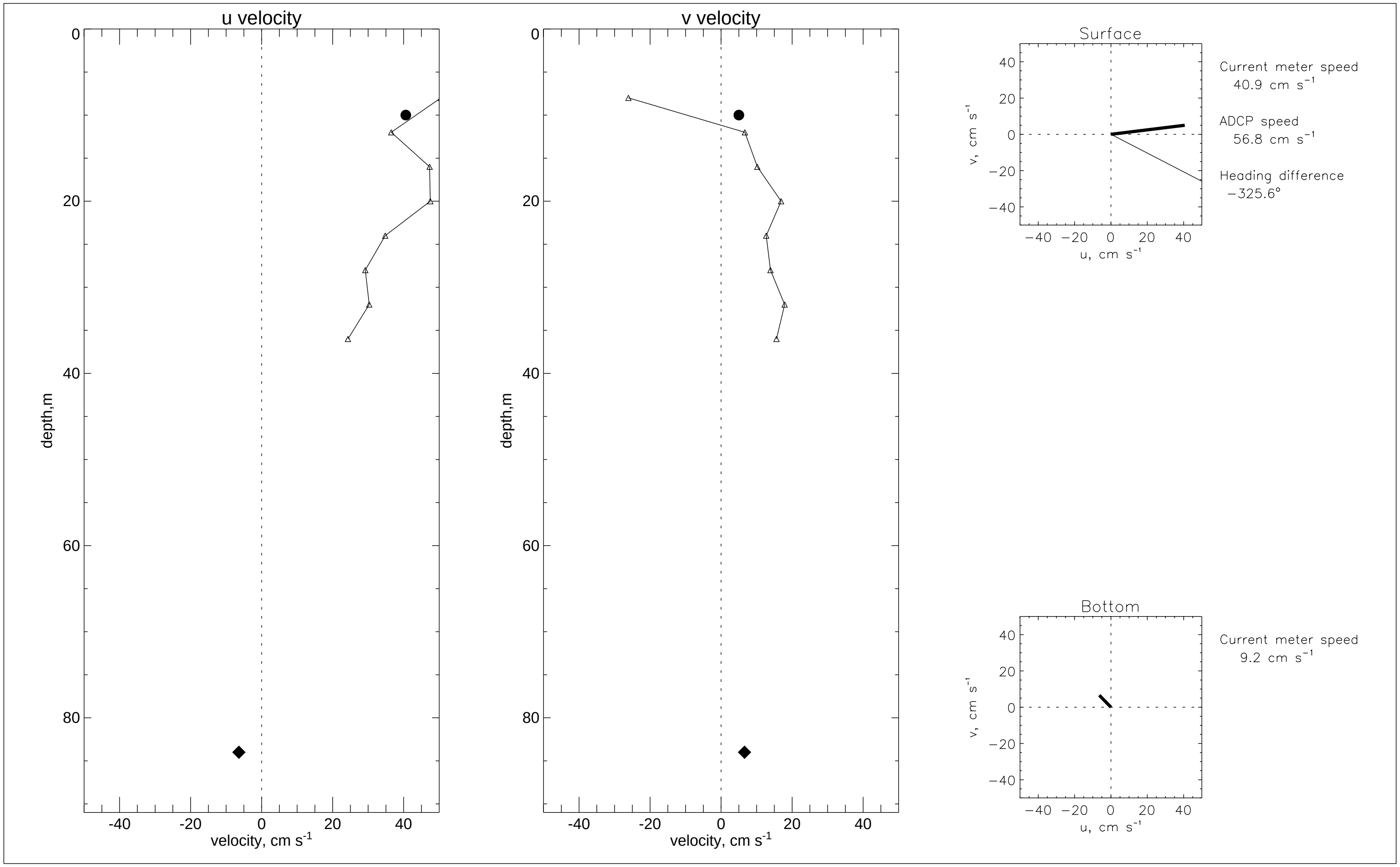

Figure 2.5.46. ADCP profile taken on 14 July 1992 at 1745 UTC (cruise M03) while passing by mooring CM46 at a distance of 1. 1 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 14 July 1992 at 1730 UTC. Velocities for the bottom meter (84 m) are marked with a diamond and were recorded on 14 July 1992 at 1730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

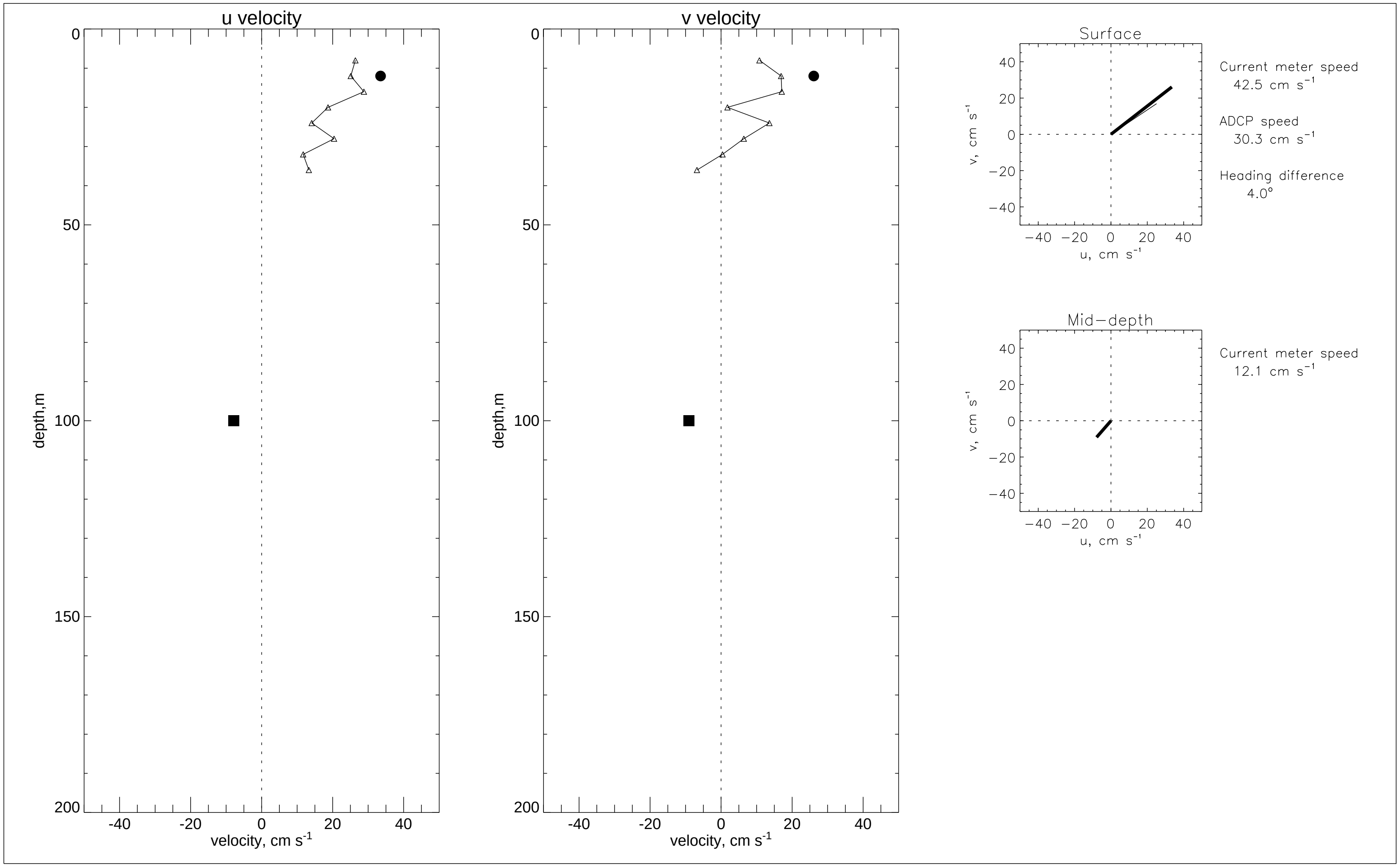

Figure 2.5.48. ADCP profile taken on 21 July 1992 at 2333 UTC (cruise M03) while passing by mooring CM48 at a distance of 1. 9 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 21 July 1992 at 2330 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 21 July 1992 at 2330 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

3.4 Cruise H02

3.4.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *Gyre*. The Vessel-Mount model ADCP was installed and the DAS software package was used during this survey. The ADCP data from the H02 survey were carefully reviewed, and it was concluded that a combination of problems rendered this data set unusable. First, the blank-beyond-transmit was set to 1 m throughout the survey. As a result, the ringing from the outgoing pulse saturated the automatic gain control and biased the return signal. The effect is clearly evident in the amplitude values of the vertical profiles, which indicate return signal strength. Typically, the amplitude (in units of counts) is low for the first bin (160), rises to values between 190-250 over the next few bins, and then slowly decreases with depth.

Second, the bin size was set to 2 m, but the transmit pulse length was set to 4 m throughout the survey. The manufacturer recommends that these parameters be set to equal values. When the transmit pulse is made longer than the bin size, the data are smoothed over the range covered by the transmit pulse, reducing the spatial resolution. This smoothing reduces the amount of information collected in the profile relative to the number of measured depth cells. The parameter settings are shown in Table 9. Third, the number of bins was set to 20, so the maximum depth of a profile was 40 m (2-m bin size times 20 bins).

Table 9. Parameter settings (in meters) and the resulting sequence of bin depths on survey H02.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
4	1	2	7, 9, 11, 13, ...

Finally, the navigation data were not recorded in the user buffer of each ensemble average. The only way to tie the navigation data to a specific ensemble is through the PC-computer clock time recorded at the end of each ensemble. However, the PC clock drifts at a substantial rate, while the GPS navigation time is accurate to nanoseconds. There is no information to indicate how often, or even if, the operator synchronized the PC clock to the navigation time. Thus, the statistical comparison of ship speed as computed from navigation data with that measured by bottom tracking cannot be made with any confidence that identical time periods are being used.

3.4.2 Results

Because of the significant quality control problems discussed above we do not present the data.

3.5 Cruise H03

3.5.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *J.W. Powell*. The Direct-Reading model ADCP was installed and the TRANSECT program was used during this survey. The QA/QC processing produced usable data. The parameter settings are shown in Table 10.

Table 10. Parameter settings (in meters) and the resulting sequence of bin depths on survey H03.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
3	4 (4.35)	4 (4.35)	12, 16, 20, 25, 29, ...

The bin depth sequence is not an even multiple of 4. This is due to the fact that the electronic timing circuitry for the narrowband type ADCP model used during LATEX A is fixed for a transducer head angle of 30°. Neither the ADCP's electronic circuitry nor the data collection software can be adjusted by the user if transducers with 20° heads are used, as were on this cruise. As a simple consequence of trigonometry, a unit with 20° heads has a longer bin than the nominal value input by the operator. In this case, a 4 m `setting' results in 4.35 m for both the blank-beyond-transmit and the bin length. The first bin occurs at 11.7 m and every 4.35 m after that. In the post-processing step, the bin depth was rounded to the nearest integer depth, resulting in the above sequence.

There were several hardware problems, which the operator successfully fixed. At one point (November 9), the ADCP was pulled from the through-ship well and dismantled to replace several circuit boards. The well, the ADCP, and the mounting system were carefully marked prior to removal so that the alignment angle was not significantly altered when the ADCP was reinstalled.

The principal quality control problem was that the computer clock and the navigation time were not continuously synchronized. The maximum difference reached one minute and fourteen seconds. However, TRANSECT automatically logs each navigation string (including satellite time) received, together with each raw ensemble number and its associated PC time.

When writing the TRANSECT software, RDI assumed the time would be used to match the raw ensembles to navigation fixes. At our request RDI modified the TRANSECT software to output the specific raw ensemble numbers used in five-minute segment averages. This modification allowed us to correctly match ship speed as computed from navigation with the measured bottom-track speed.

3.5.2 Results

3.5.2.1 General Cruise Track

We show in Figure 3.1.1 a plan view of the general cruise track taken by the R/V *Powell* during H03. The cruise covered the eastern LATEX shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 3.1.2 for which contoured profiles of normal velocity are presented in section 3.5.2.4. Figure 3.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 3.5.2.5.

3.5.2.2 Plan View of Stick Plot Velocity Vectors

Figure 3.2.1 shows the velocity from the surface bin centered at 12 m, Figure 3.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 3.2.3 shows the velocity from the bin centered at 100m below the surface.

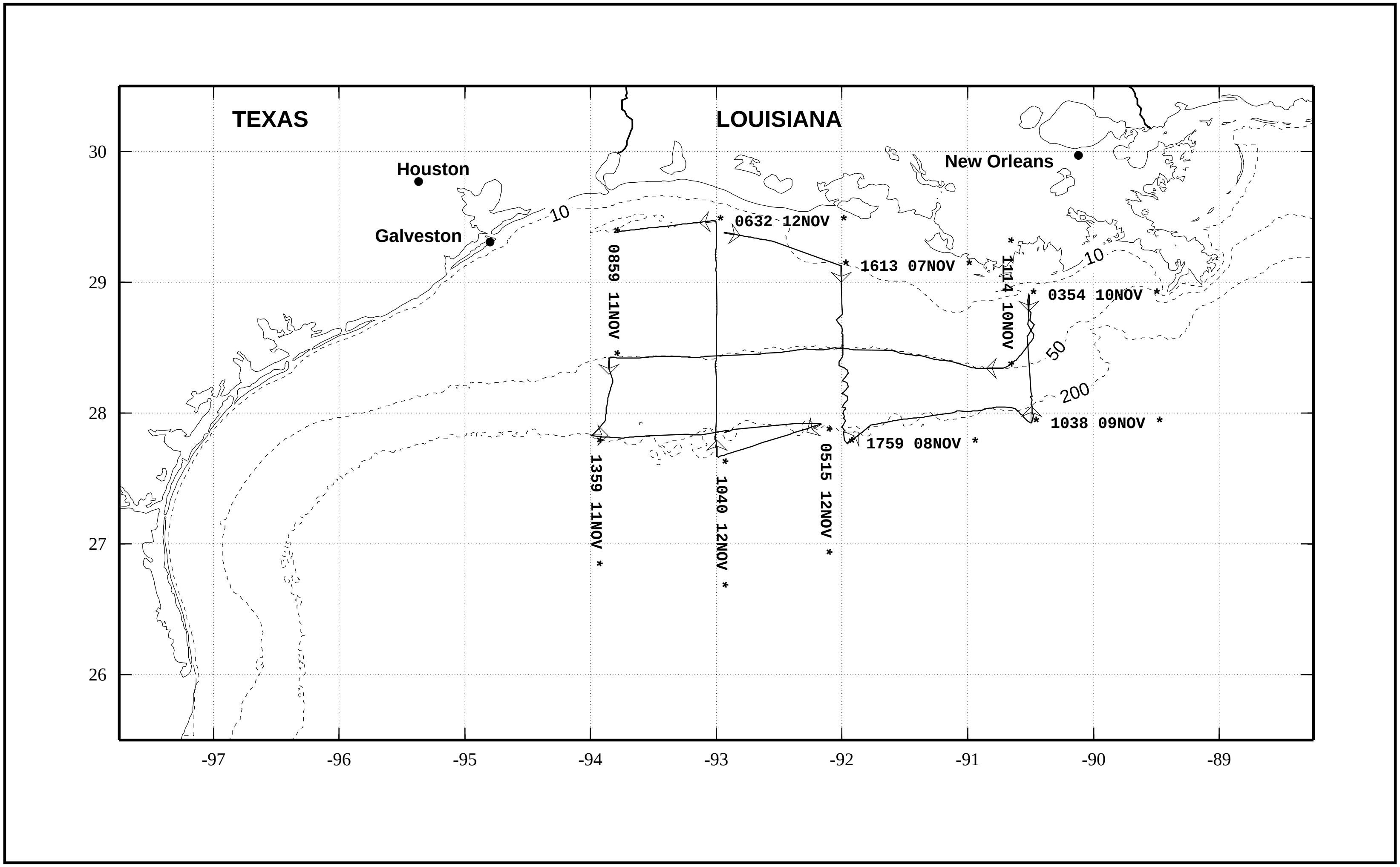

Figure 3.1.1. Cruise track for LATEX A cruise H03 in November 1992, showing times and directions.

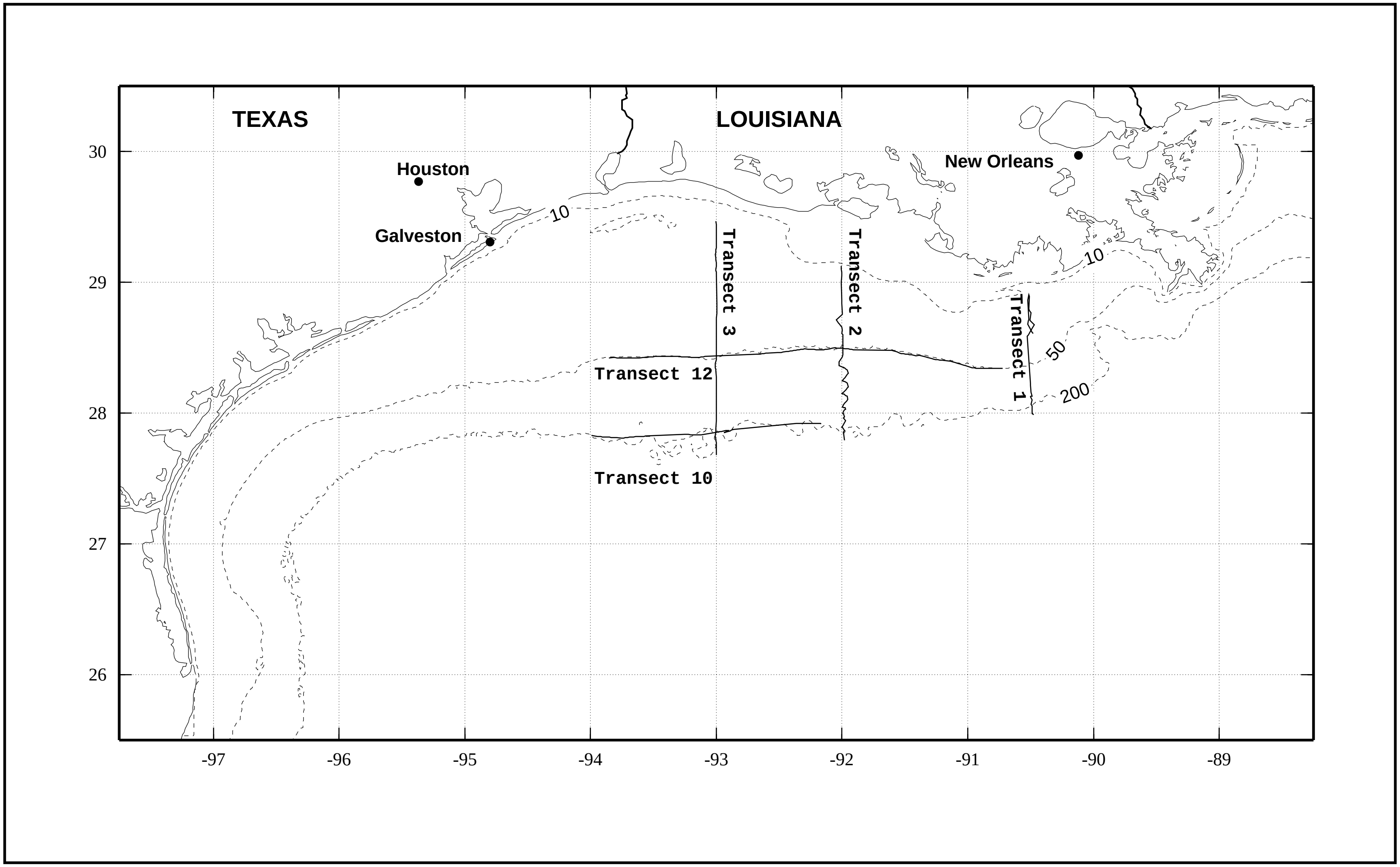

Figure 3.1.2. Cruise track for LATEX A cruise H03 in November 1992, showing individual labeled transects.

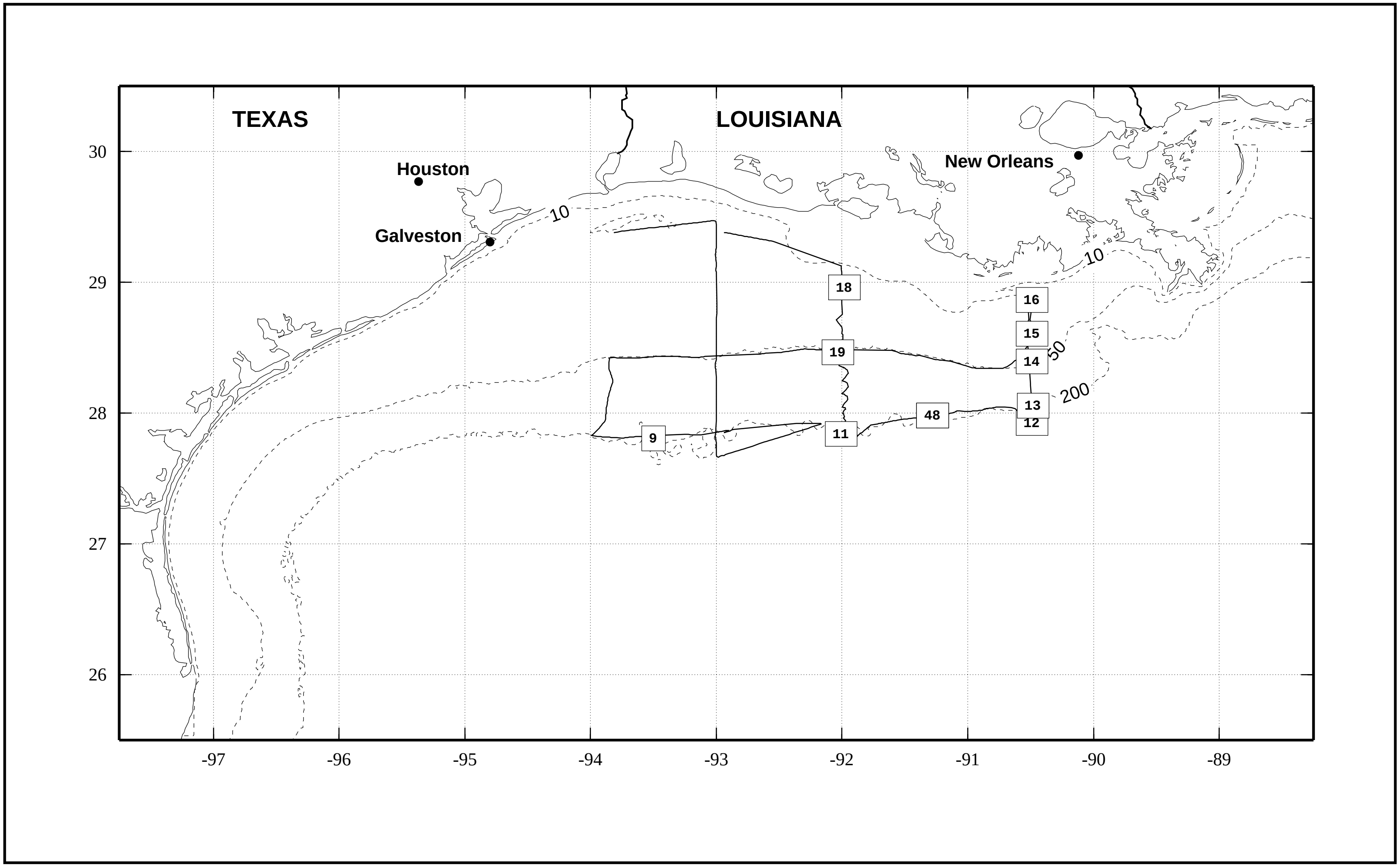

Figure 3.1.3. Cruise track for LATEX A cruise H03 in November 1992, showing current meter locations.

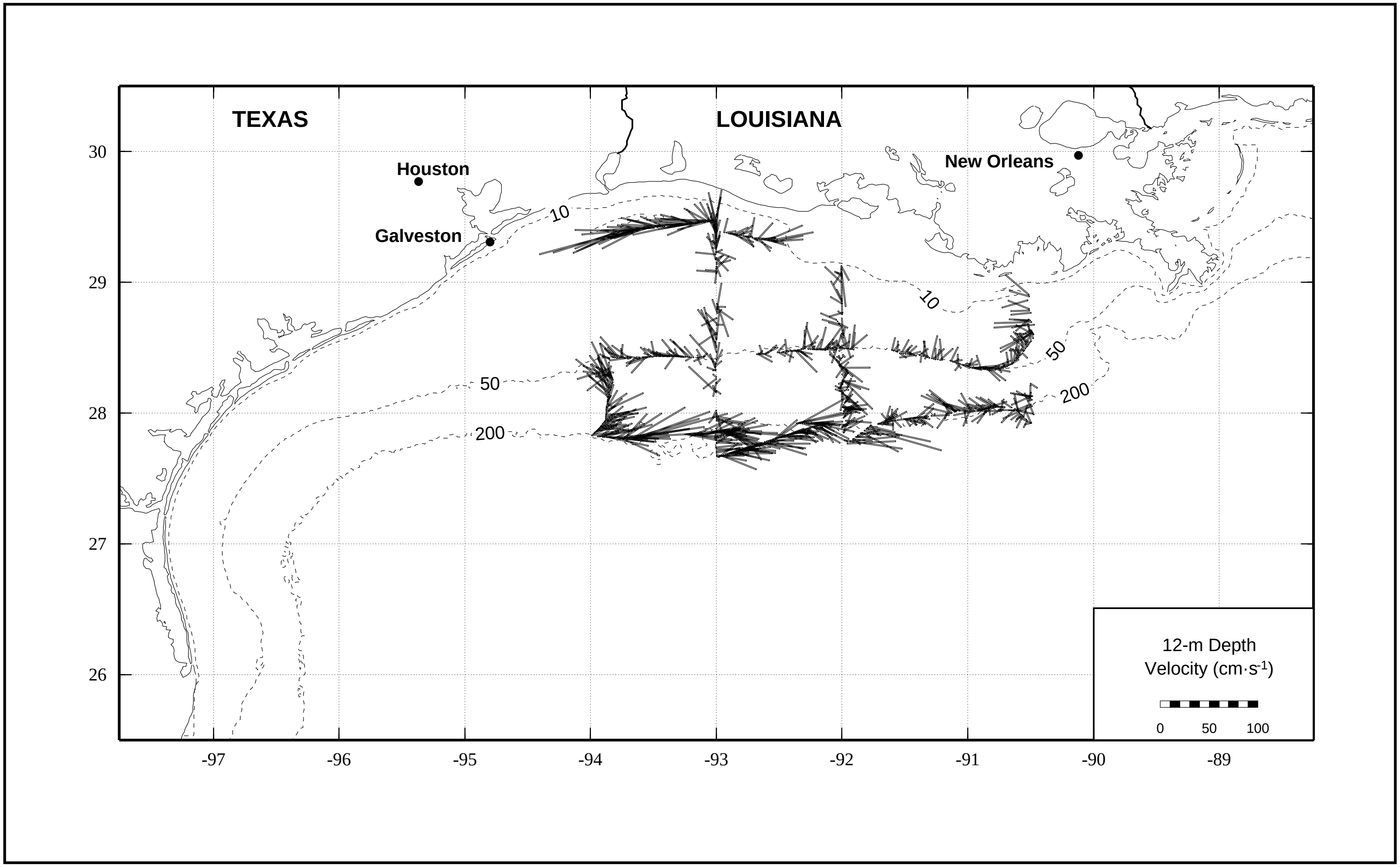

Figure 3.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H03 conducted in November 1992

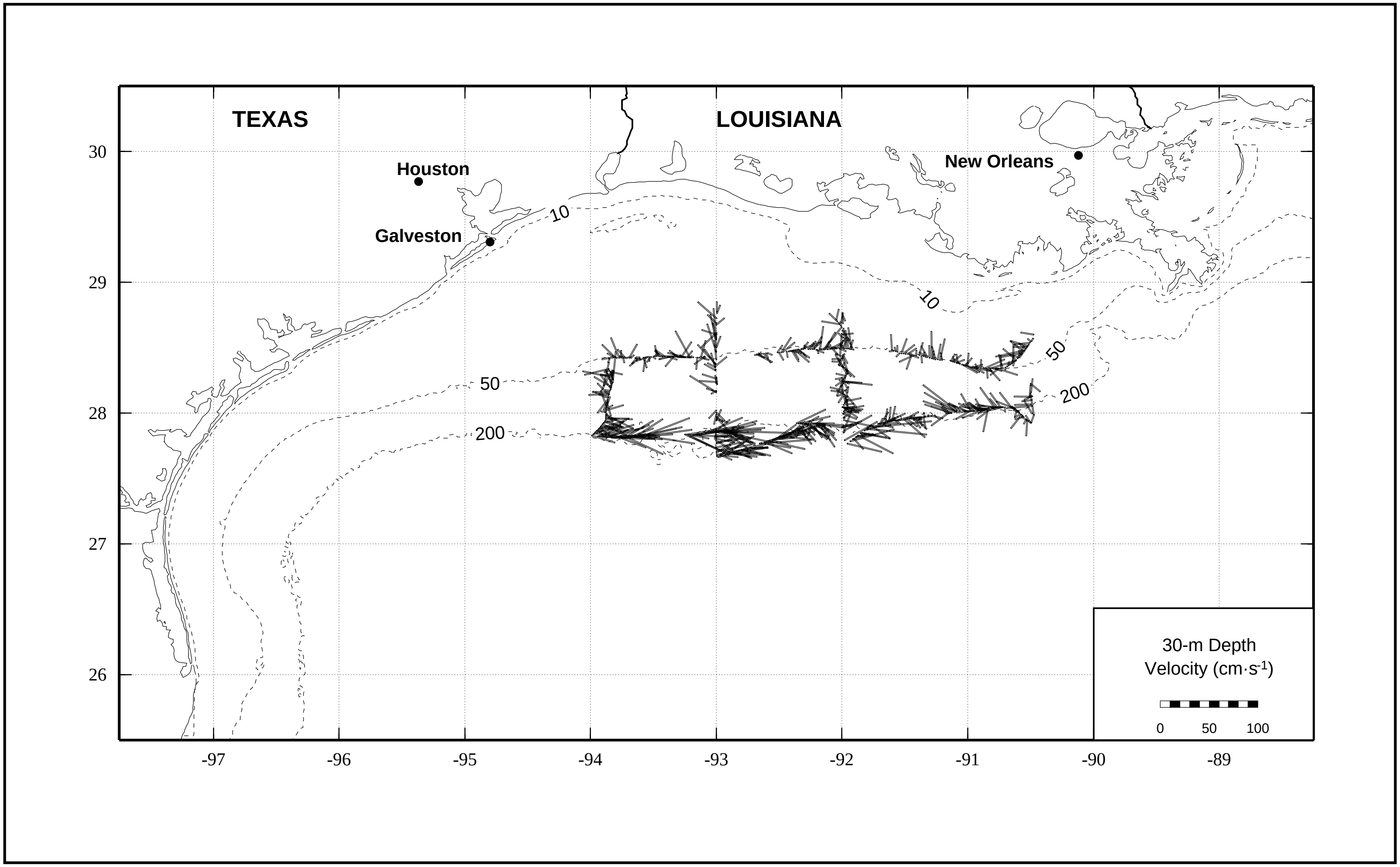

Figure 3.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H03 conducted in November 1992

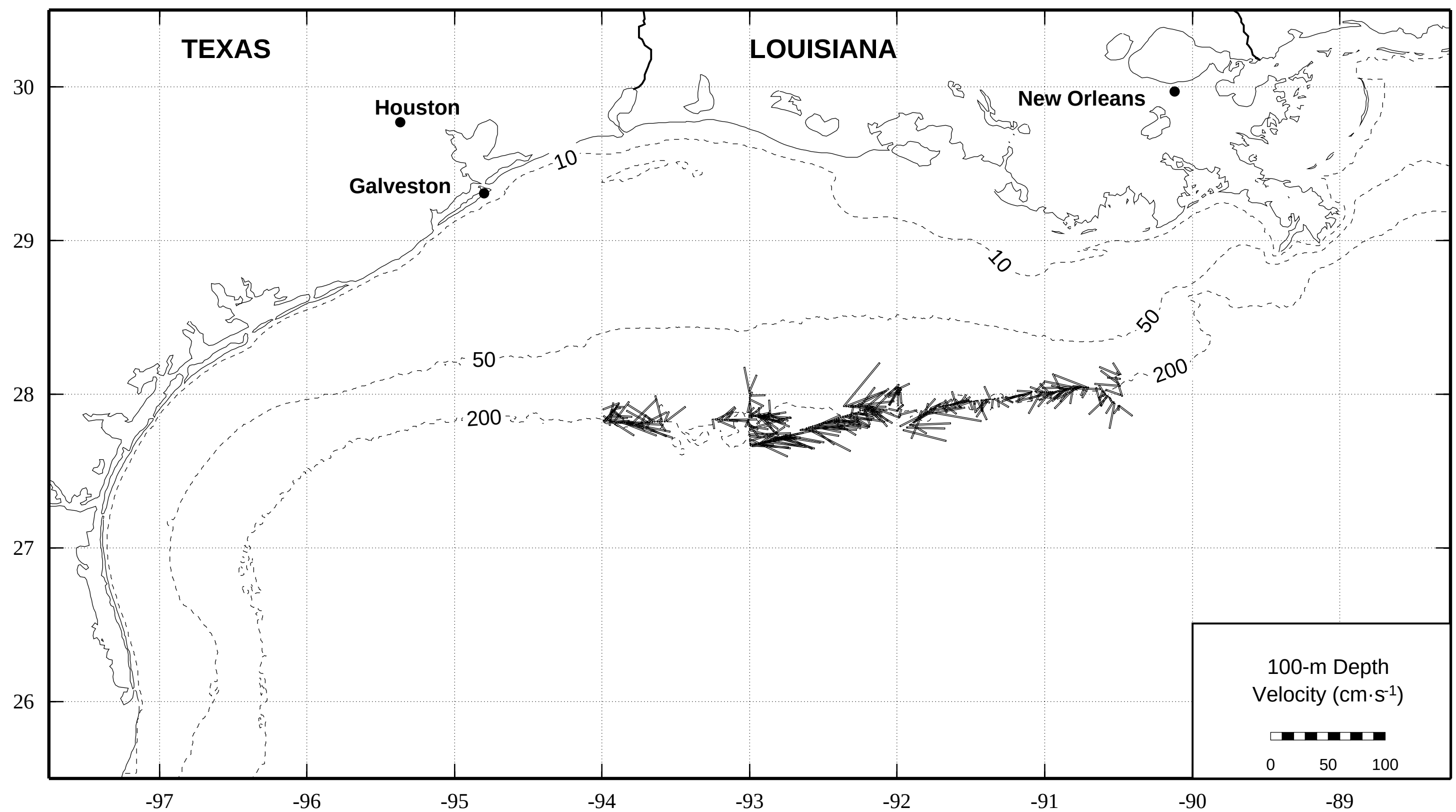

Figure 3.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H03 conducted in November 1992

3.5.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (GMT; Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 3.3.1 shows the velocity from the bin centered at 8 m, Figure 3.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 3.3.3 shows the velocity from the bin centered at 100 m below the surface.

3.5.2.4 Contoured Profiles of Normal Velocity

We show in Figures 3.4.1, 3.4.2 and 3.4.3 the velocity normal to transects 1, 2 and 3, respectively. For along-shelf transect number 10, taken along the 200-m isobath, we show the normal velocity in Figure 3.4.10. For along-shelf transect number 12, taken along the 50-m isobath, we show the normal velocity in Figure 3.4.12. The transects are shown in Figure 3.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

3.5.2.5 Vertical Current Profiles

We show in Figures 3.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 3.1.3.

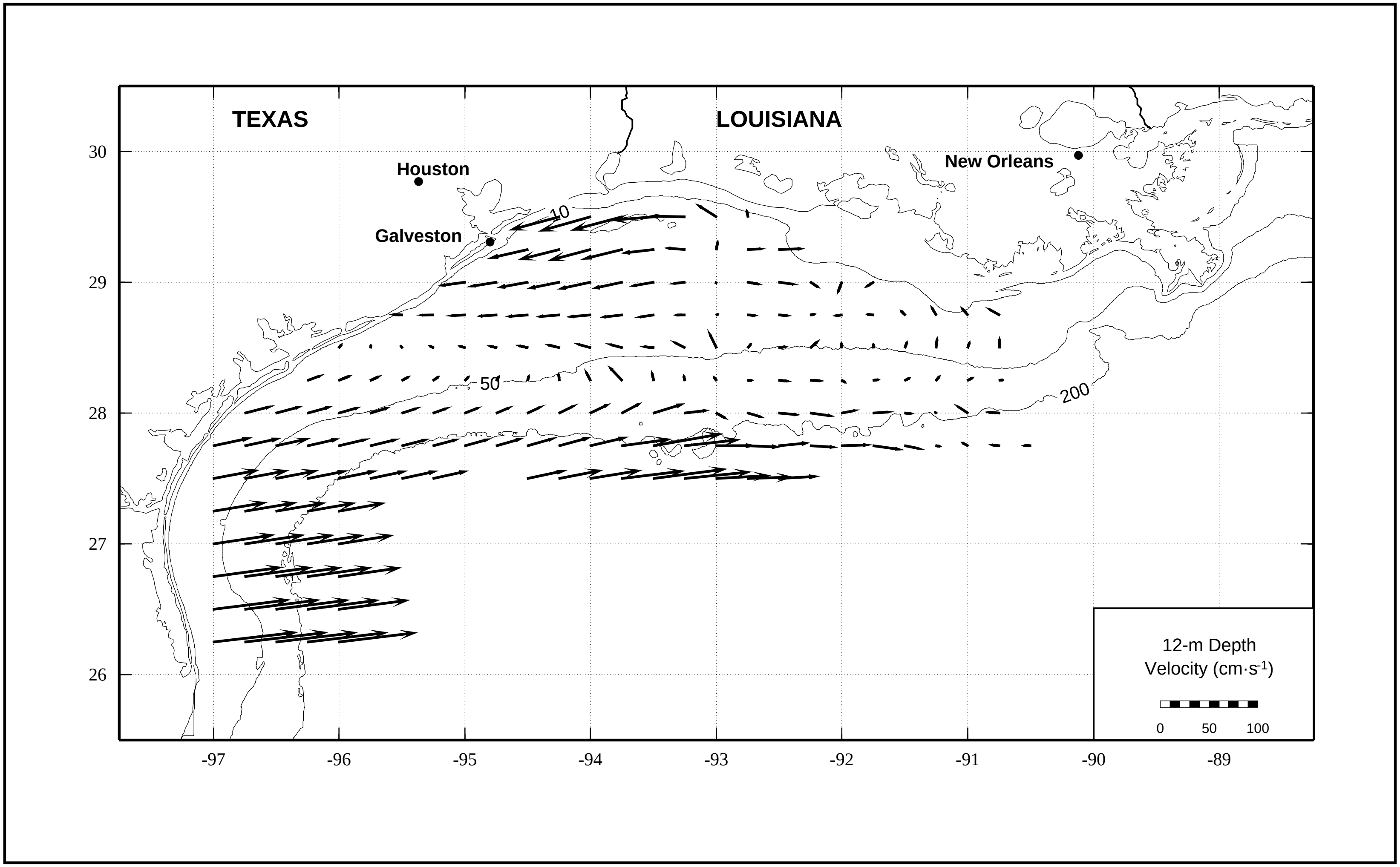

Figure 3.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H03 conducted in November 1992

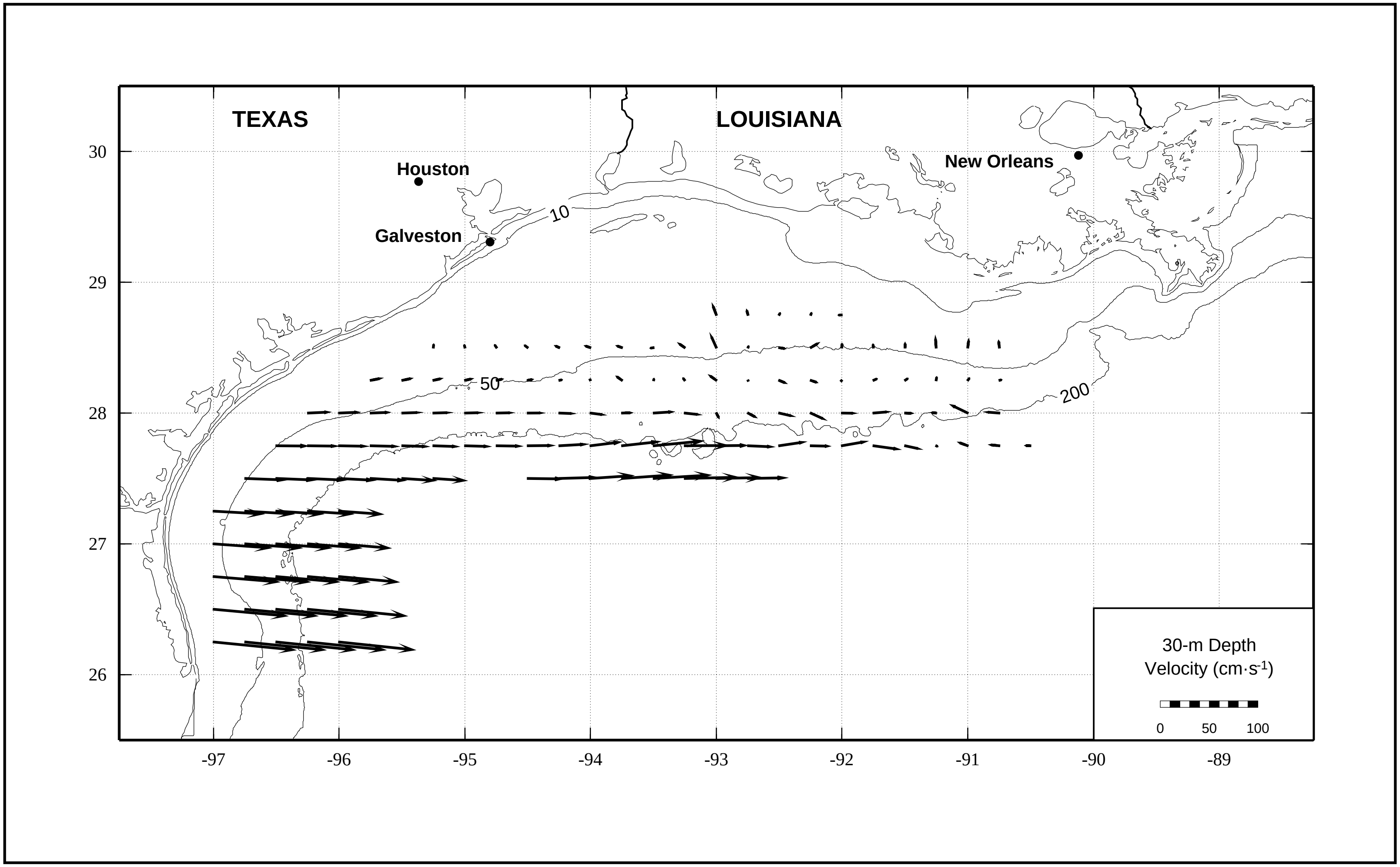

Figure 3.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H03 conducted in November 1992

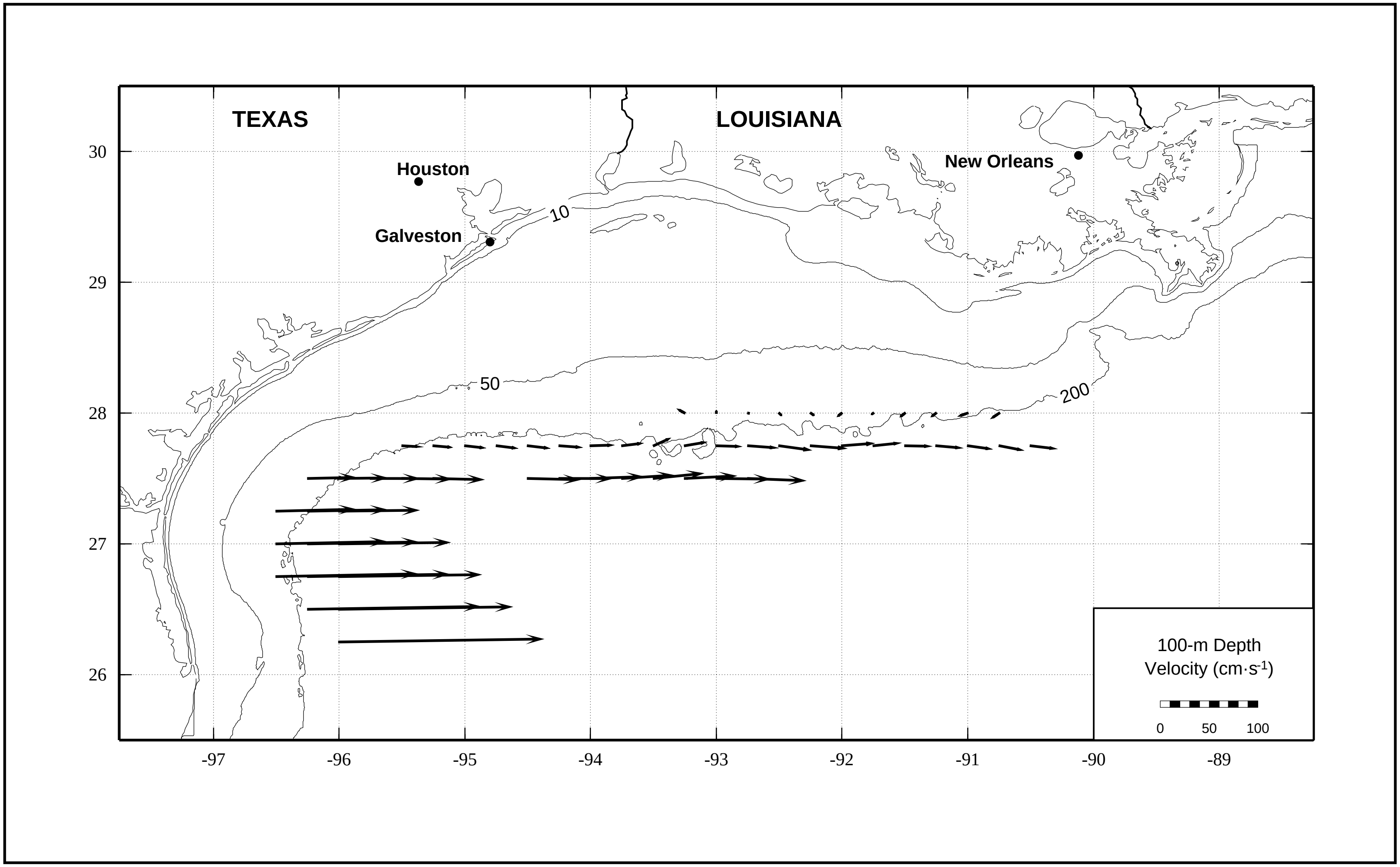

Figure 3.3.3. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H03 conducted in November 1992

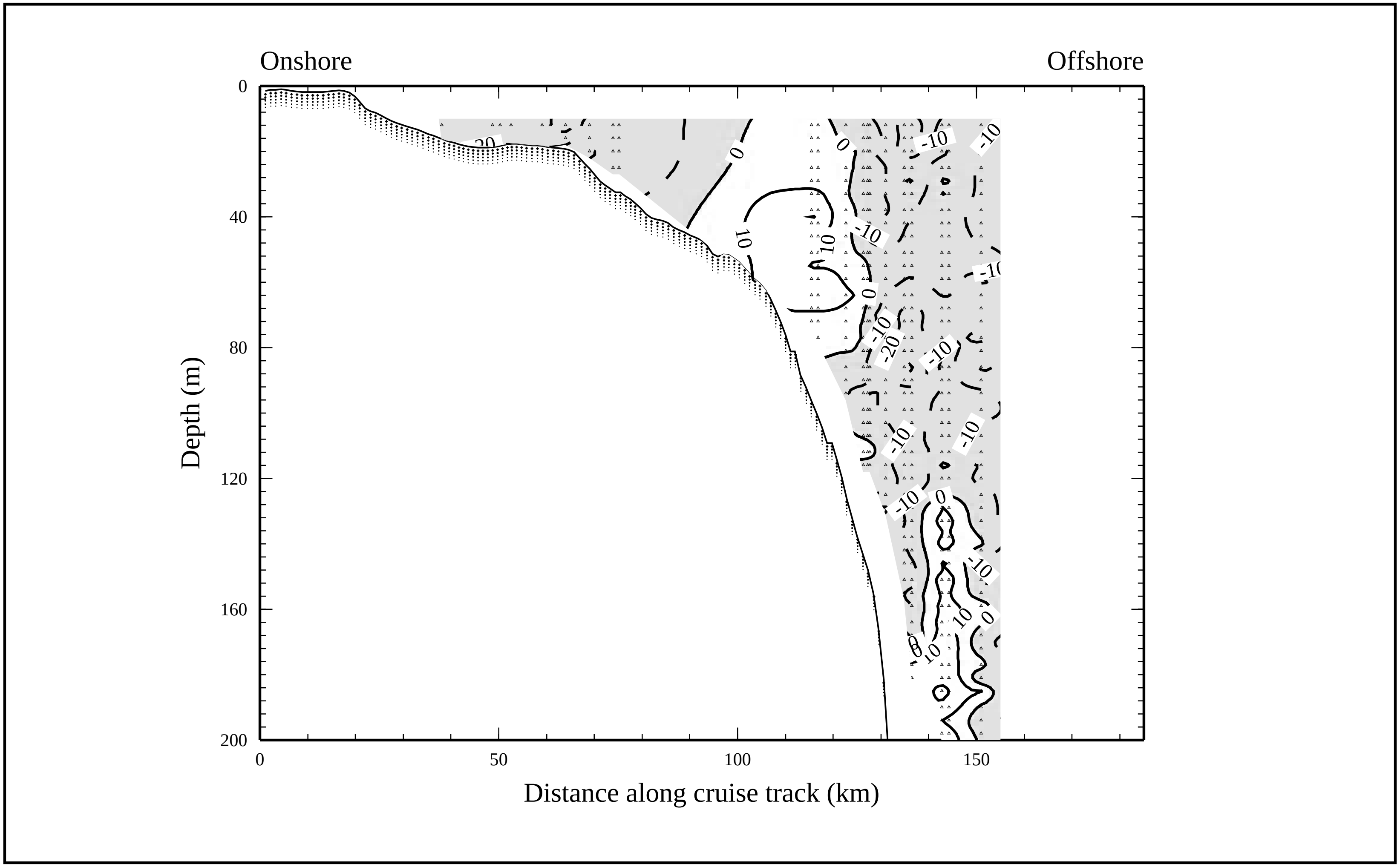

Figure 3.4.1. Vertical section of ADCP velocities (cm/sec) normal to transect 1 for cruise H03, November 1992. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

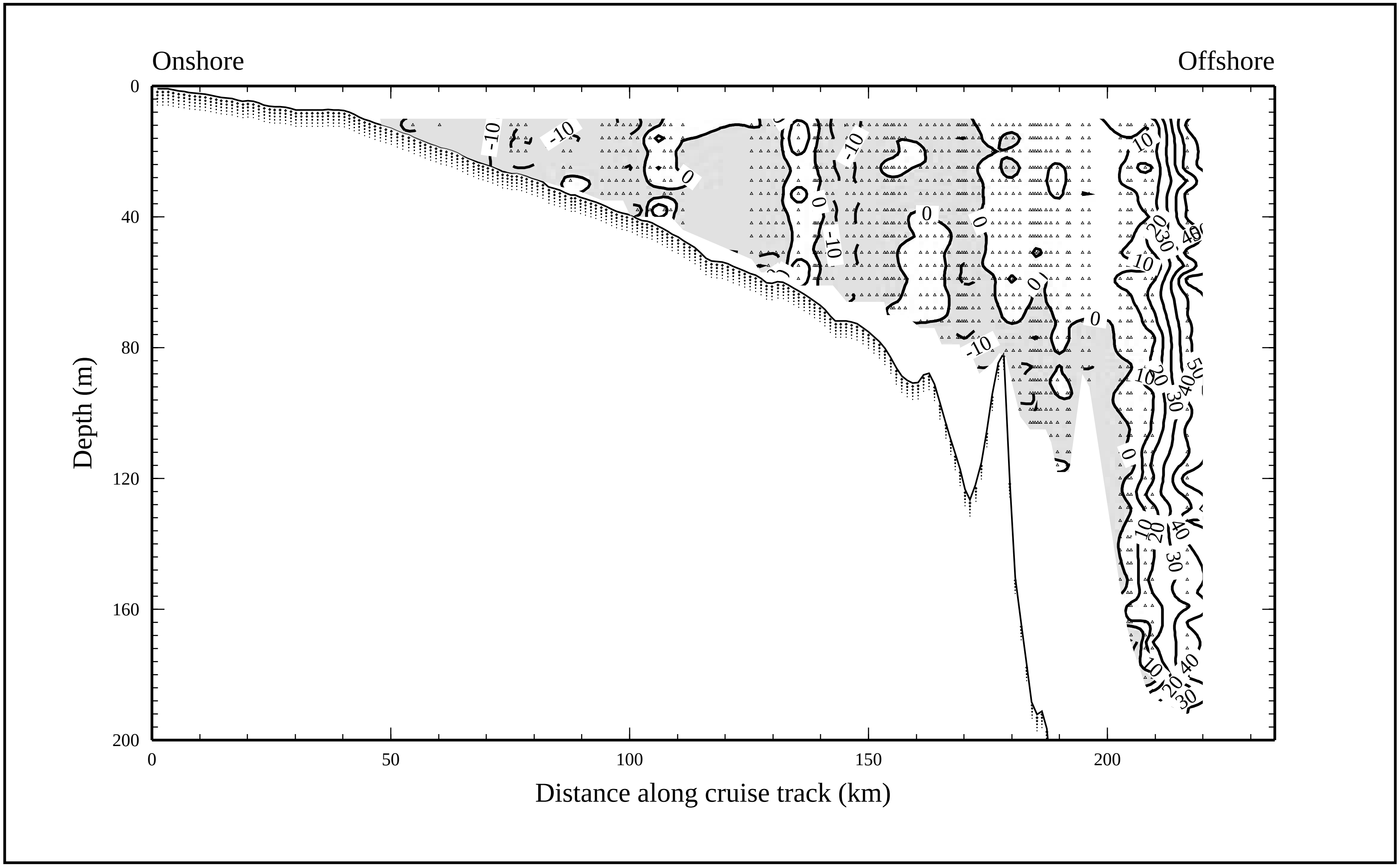

Figure 3.4.2. Vertical section of ADCP velocities (cm/sec) normal to transect 2 for cruise H03, November 1992. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

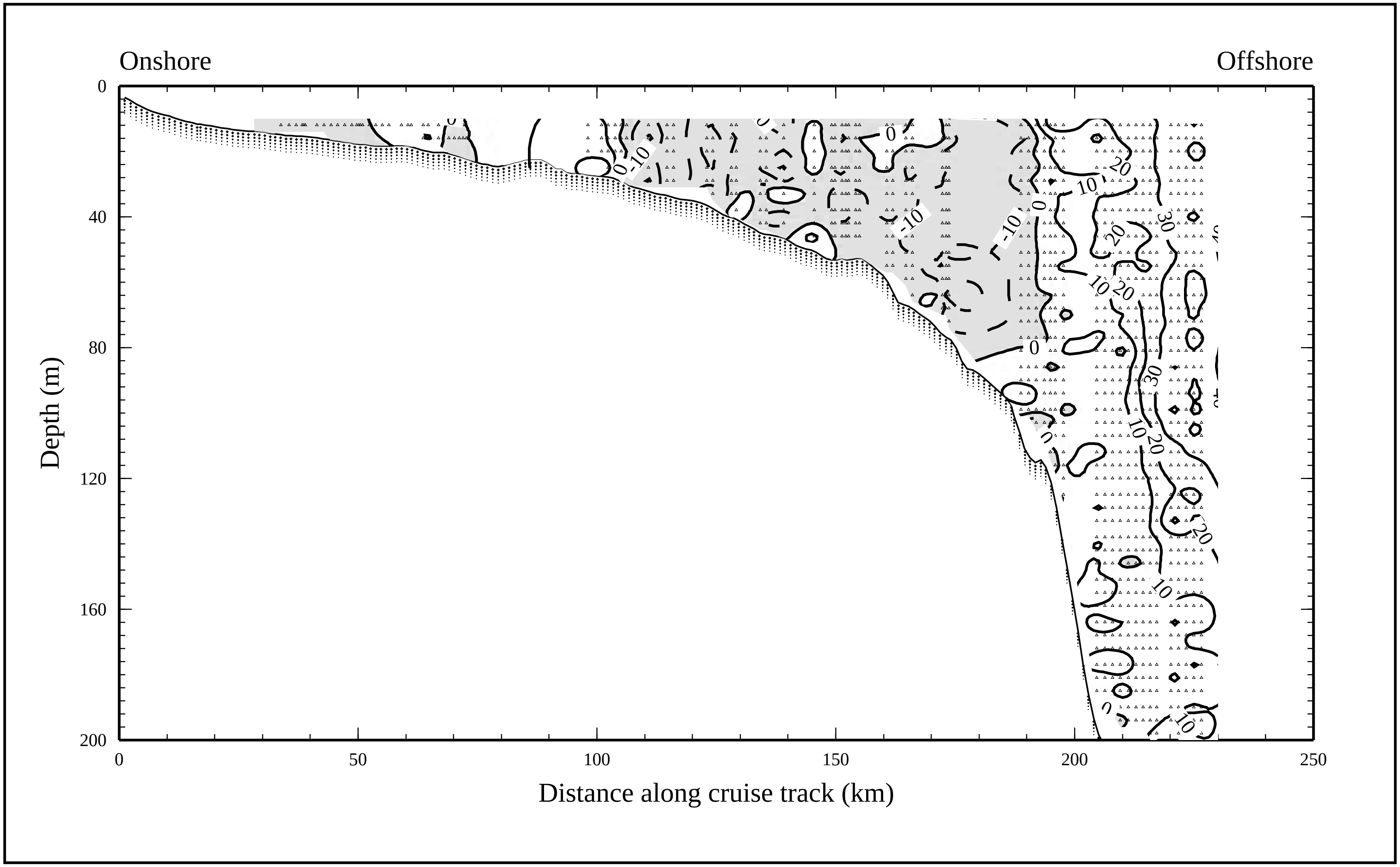

Figure 3.4.3. Vertical section of ADCP velocities (cm/sec) normal to transect 3 for cruise H03, November 1992. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

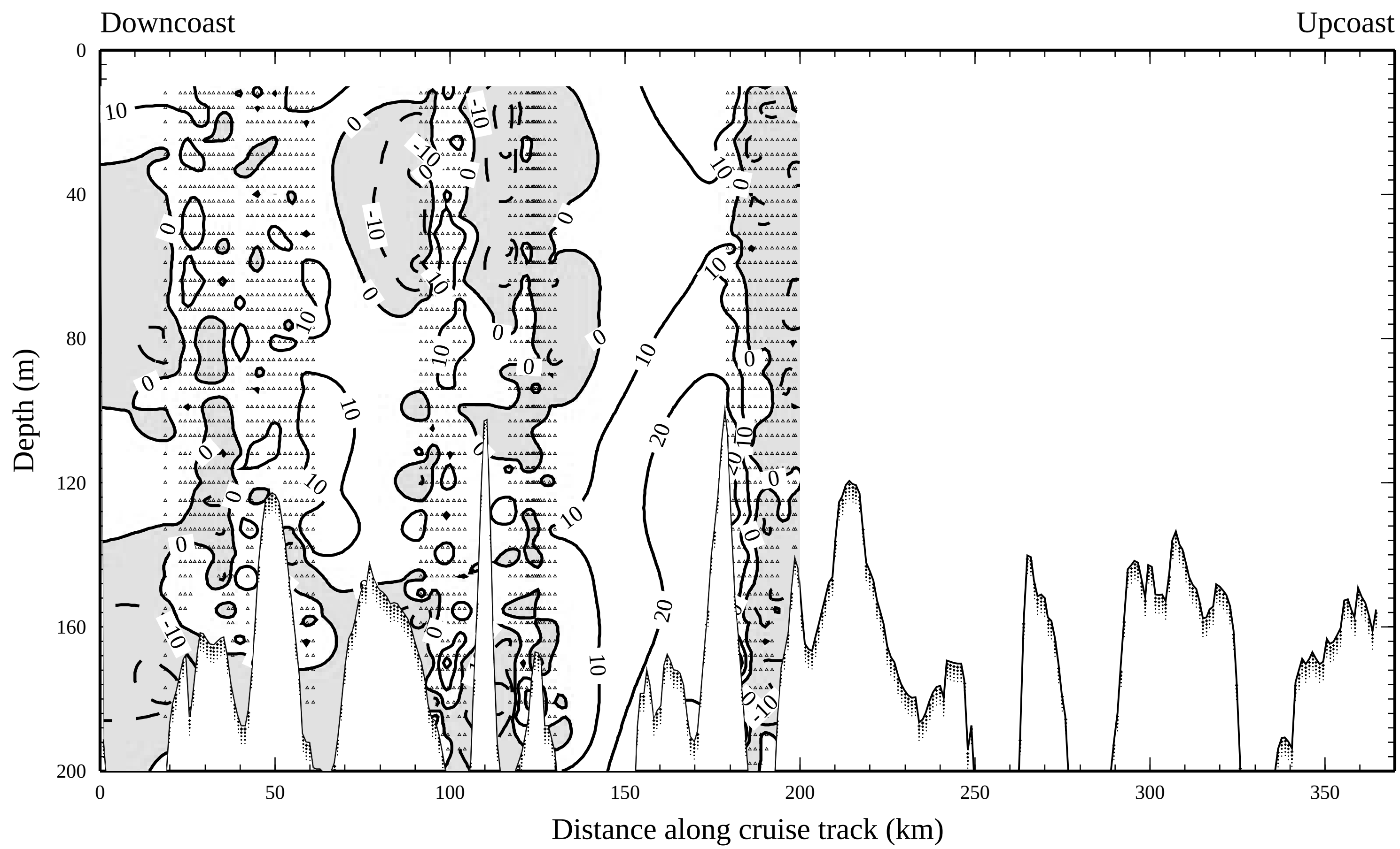

Figure 3.4.10. Vertical section of ADCP velocities (cm/sec) normal to transect 10 for cruise H03, November 1992. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

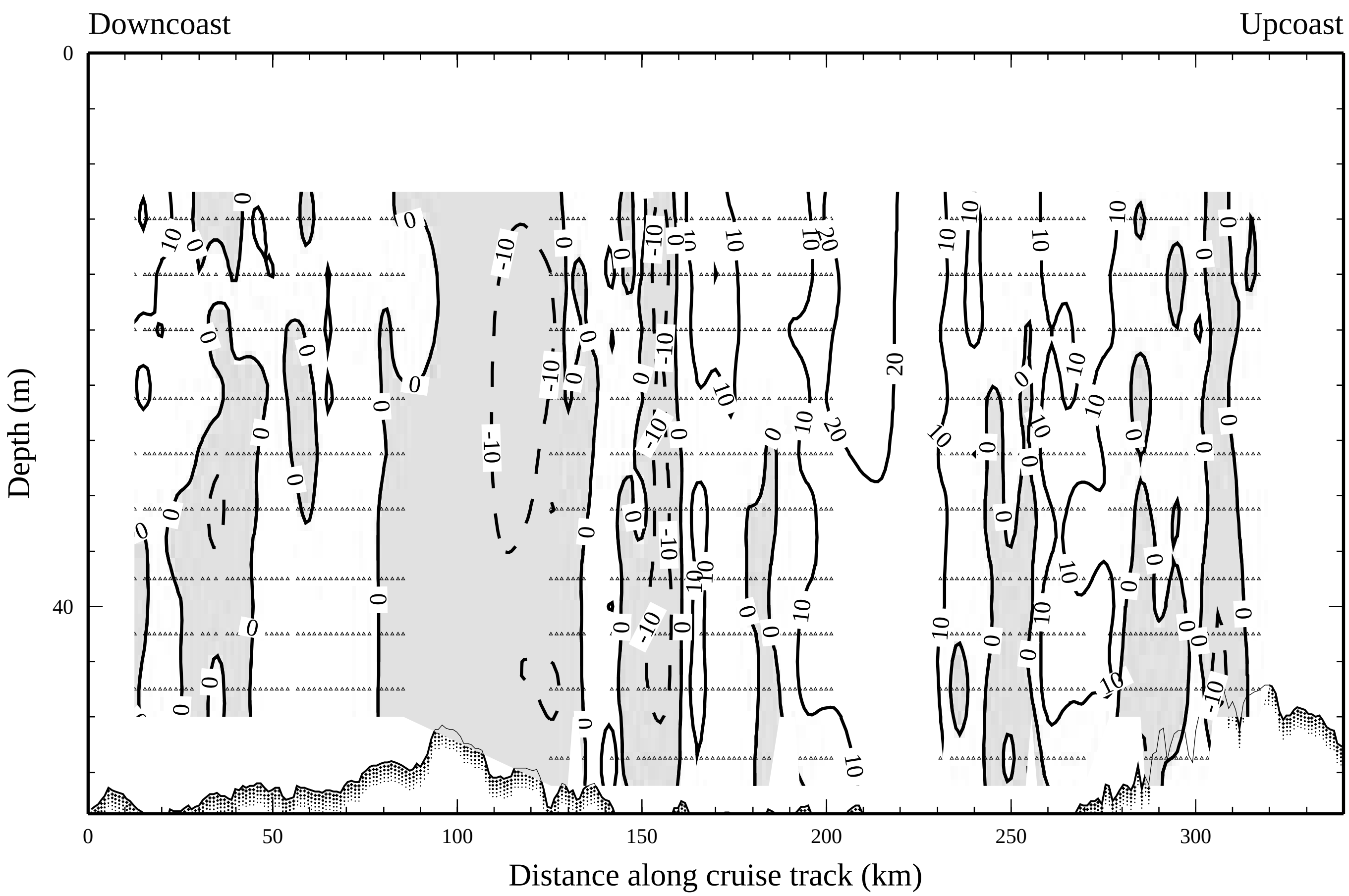

Figure 3.4.12. Vertical section of ADCP velocities (cm/sec) normal to transect 12 for cruise H03, November 1992. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

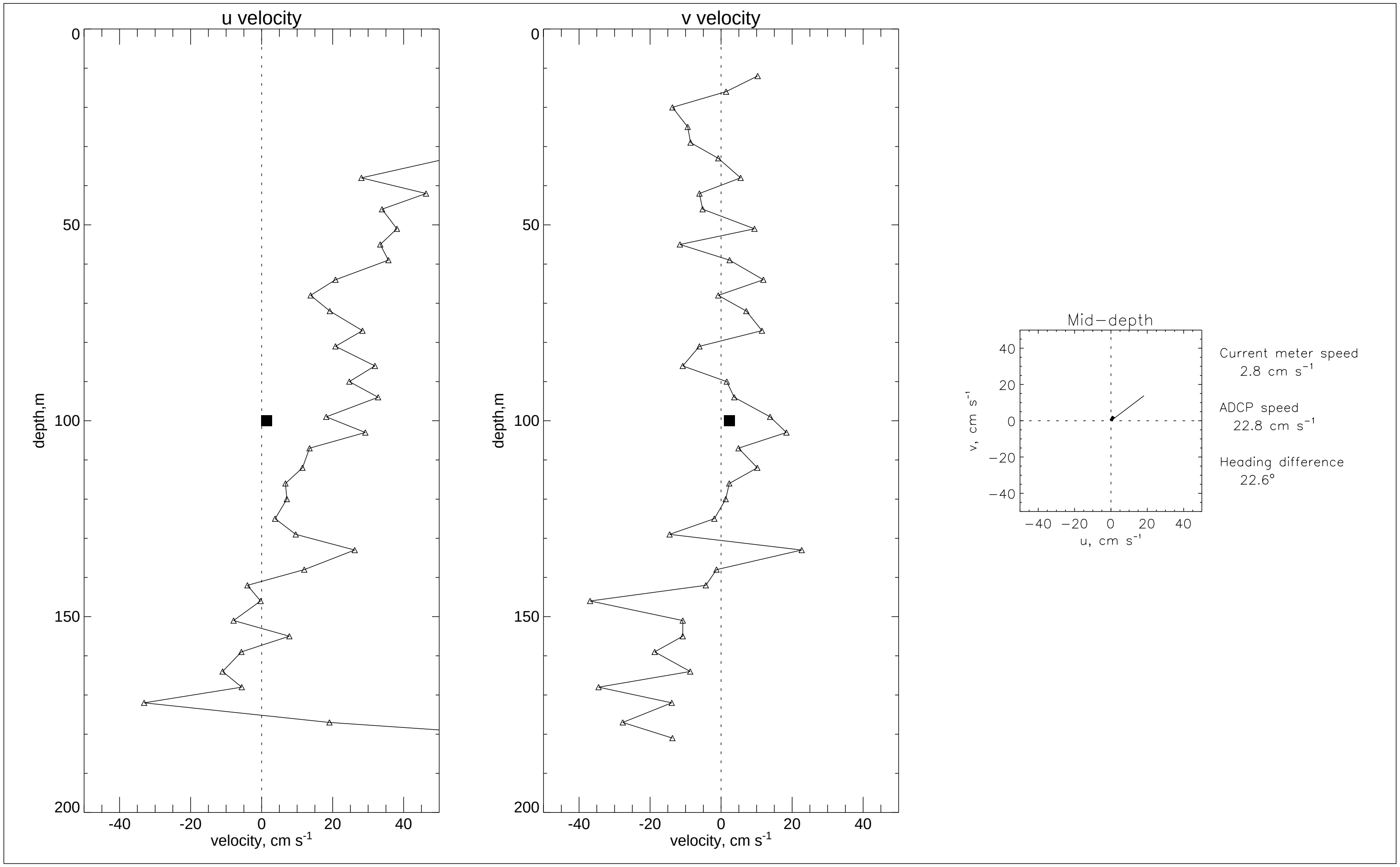

Figure 3.5.09. ADCP profile taken on 10 November 1992 at 1737 UTC (cruise H03) while passing by mooring CM09 at a distance o f 6.0 km. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 10 November 1992 at 1730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

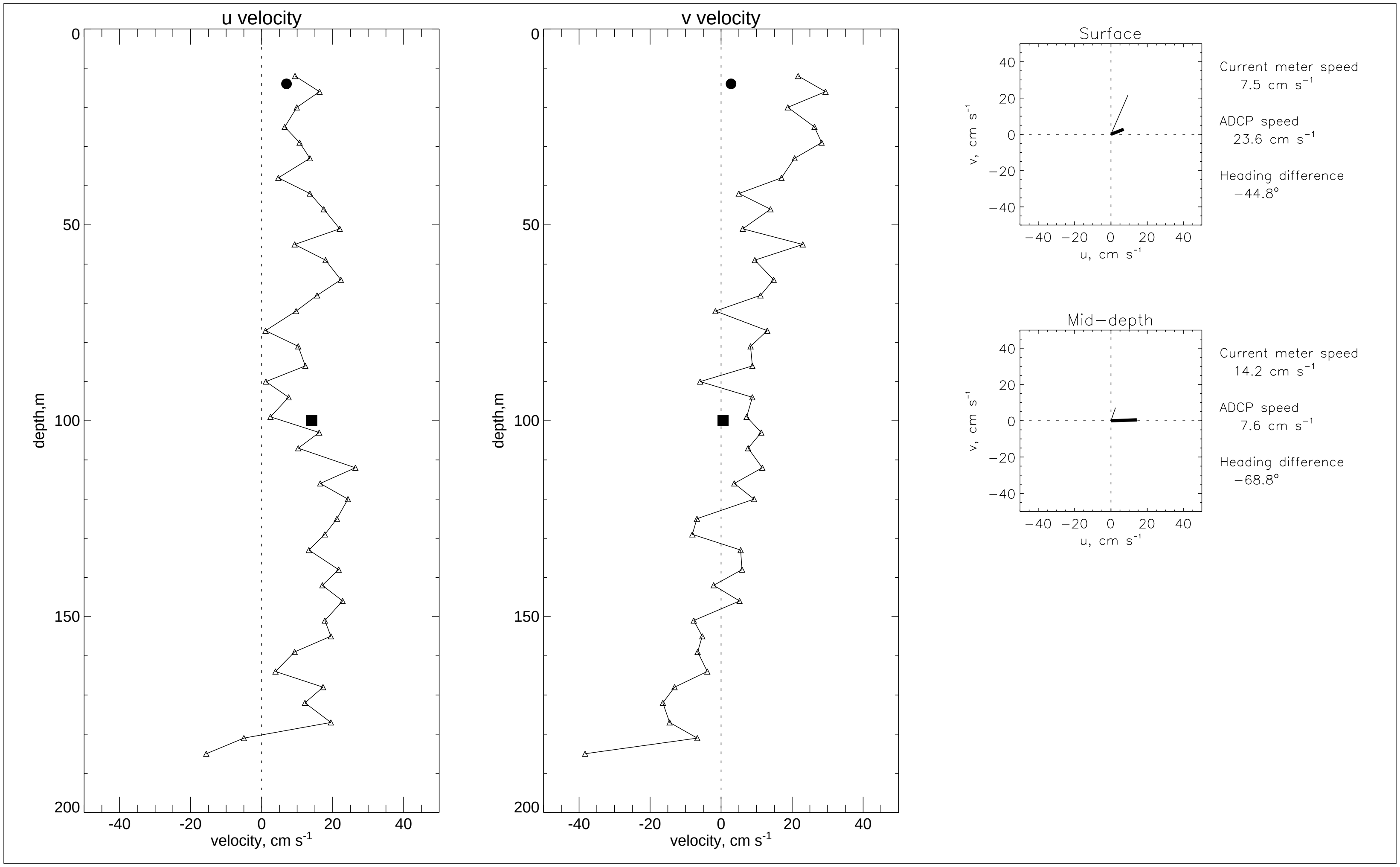

Figure 3.5.11. ADCP profile taken on 7 November 1992 at 1227 UTC (cruise H03) while passing by mooring CM11 at a distance of 2.3 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 7 November 1992 at 1230 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 7 November 1992 at 1230 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

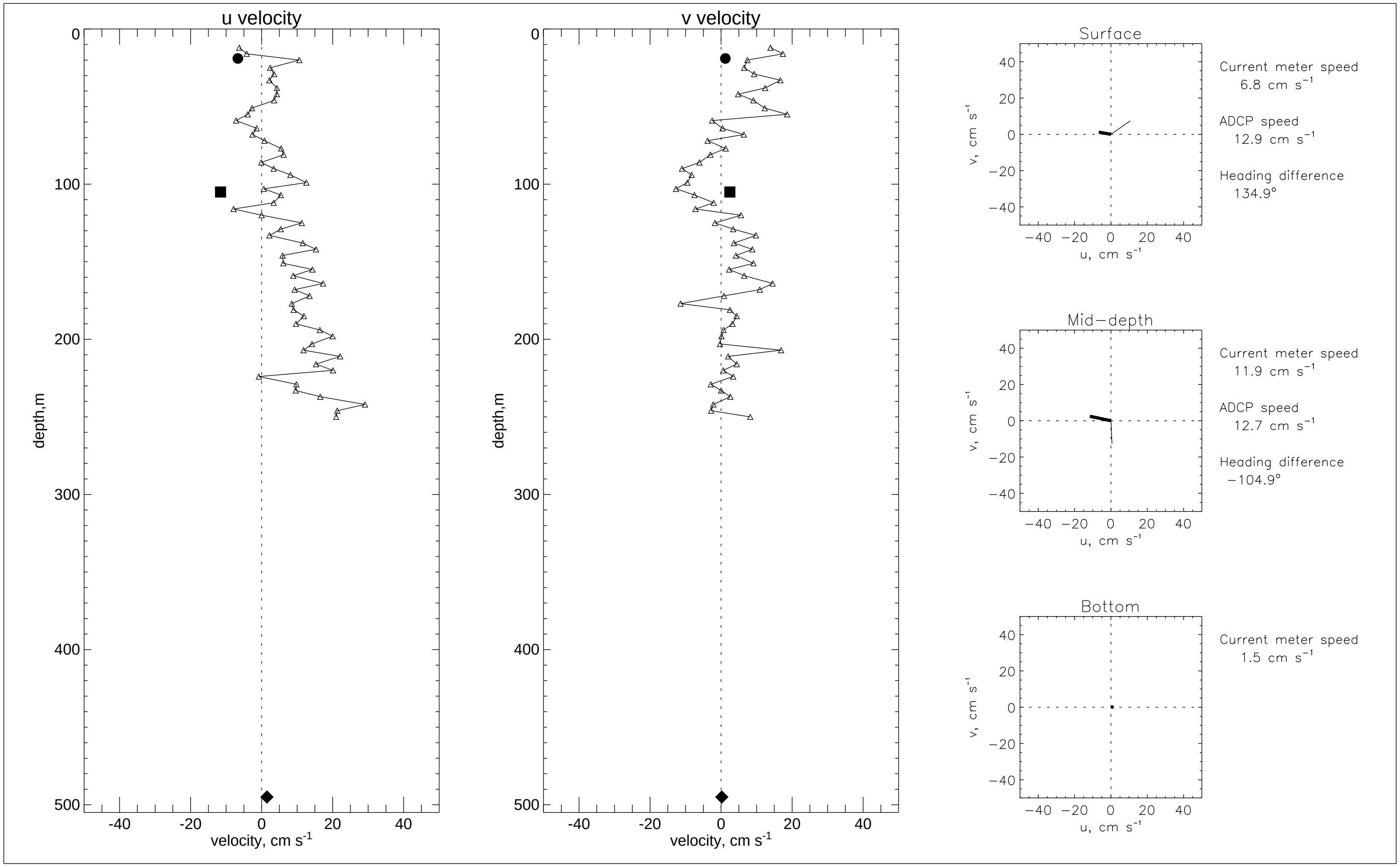

Figure 3.5.12. ADCP profile taken on 8 November 1992 at 1033 UTC (cruise H03) while passing by mooring CM12 at a distance of 0.3 km. Velocities for the surface meter (19 m) are marked with a circle and were recorded on 8 November 1992 at 1030 UTC. Velocities for the mid-depth meter (105 m) are marked with a square and were recorded on 8 November 1992 at 1030 UTC. Velocities for the bottom meter (495 m) are marked with a diamond and were recorded on 8 November 1992 at 1030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

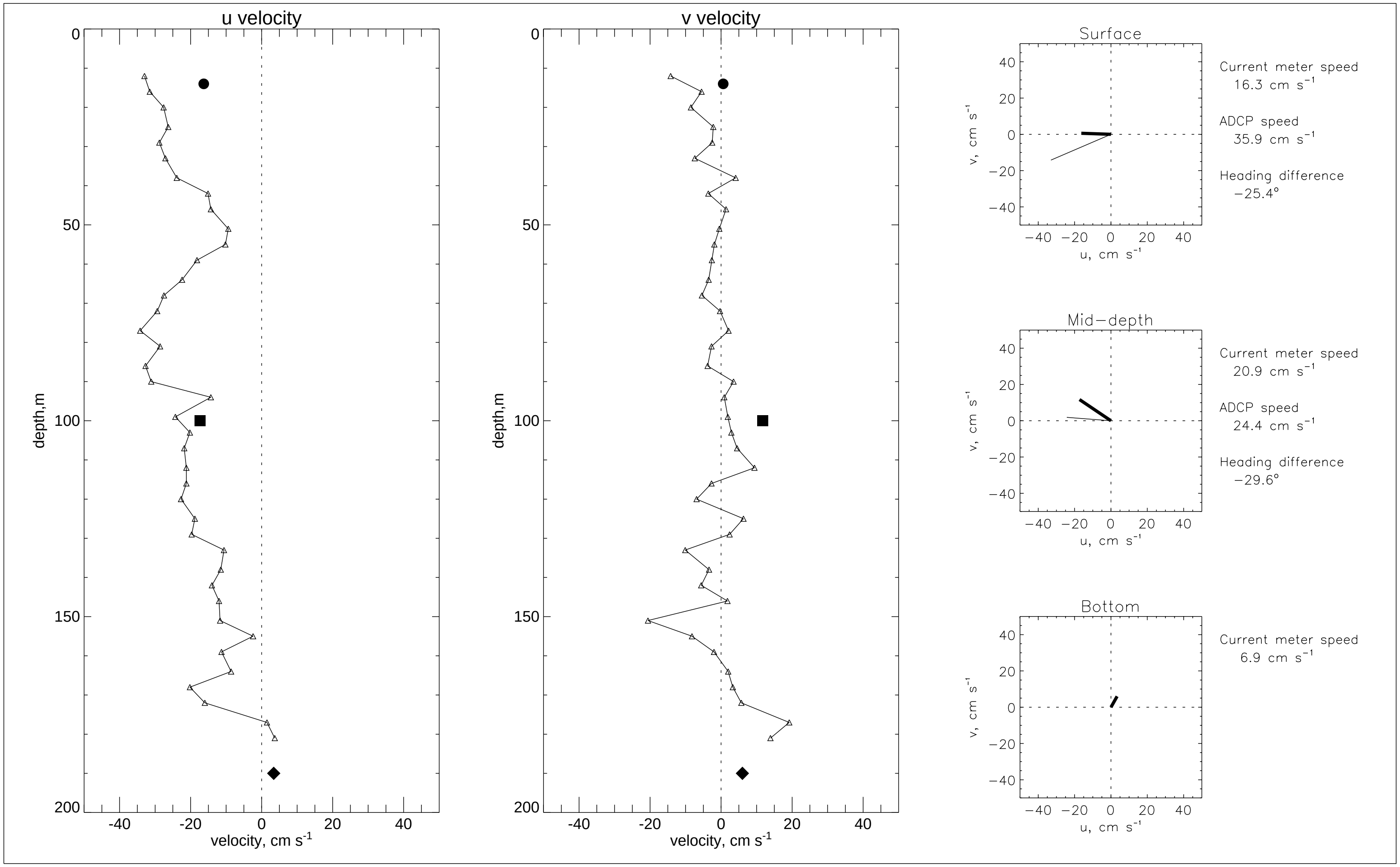

Figure 3.5.13. ADCP profile taken on 8 November 1992 at 1338 UTC (cruise H03) while passing by mooring CM13 at a distance of 0.5 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 8 November 1992 at 1330 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 8 November 1992 at 1330 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 8 November 1992 at 1330 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

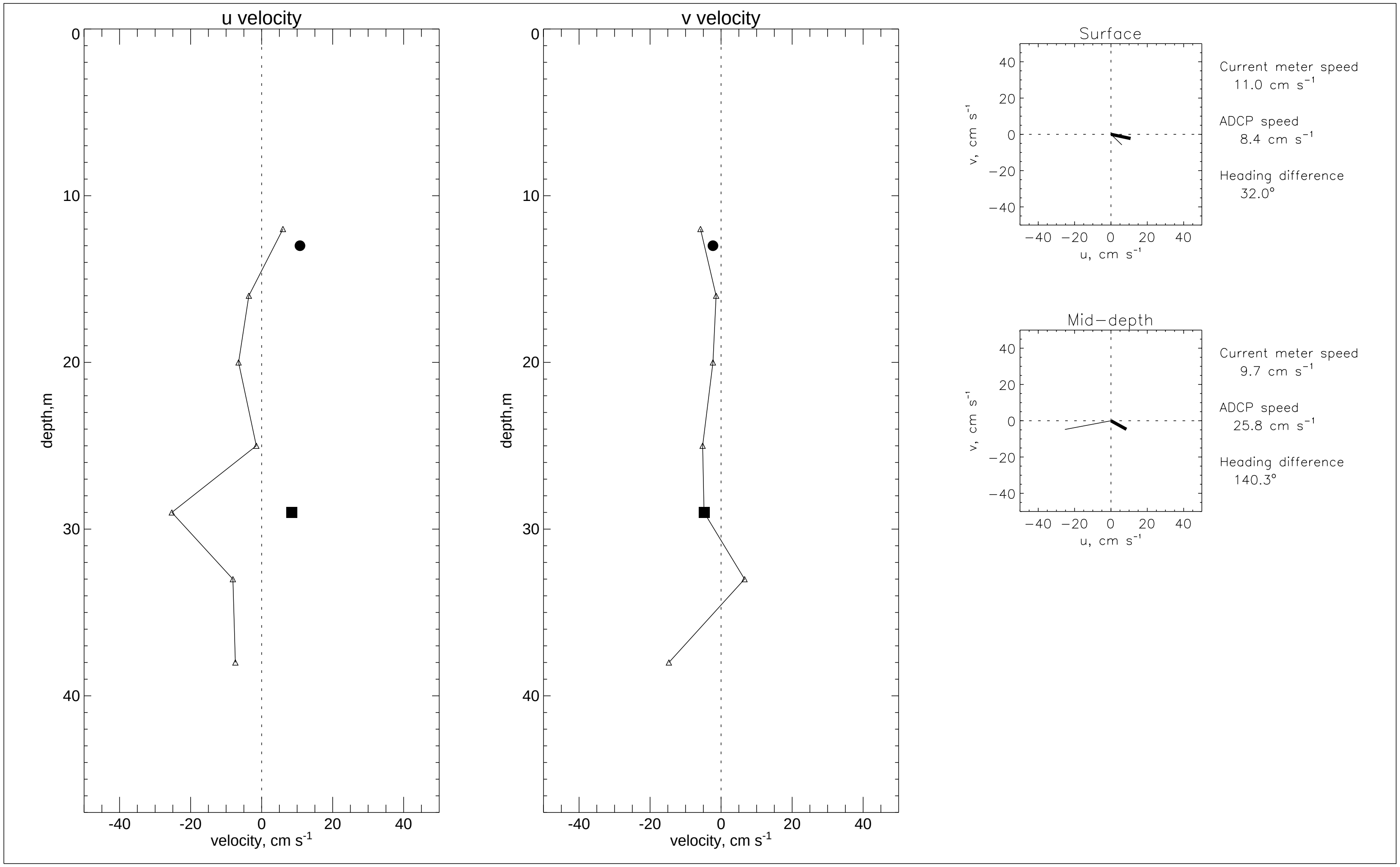

Figure 3.5.14. ADCP profile taken on 9 November 1992 at 0934 UTC (cruise H03) while passing by mooring CM14 at a distance of 9.5 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 9 November 1992 at 0930 UTC. Velocities for the mid-depth meter (29 m) are marked with a square and were recorded on 9 November 1992 at 0935 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

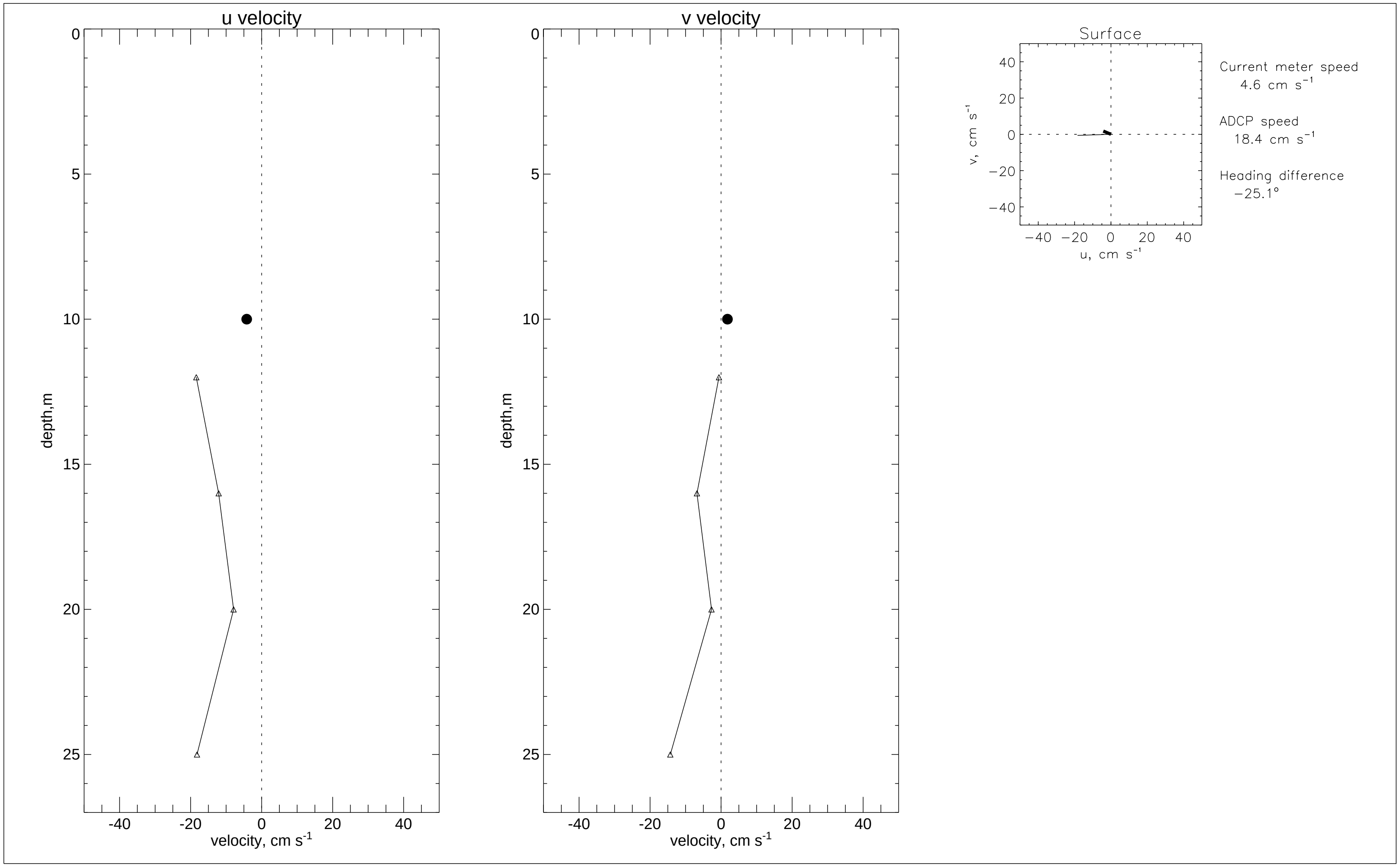

Figure 3.5.15. ADCP profile taken on 9 November 1992 at 0824 UTC (cruise H03) while passing by mooring CM15 at a distance of 1.1 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 9 November 1992 at 0830 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

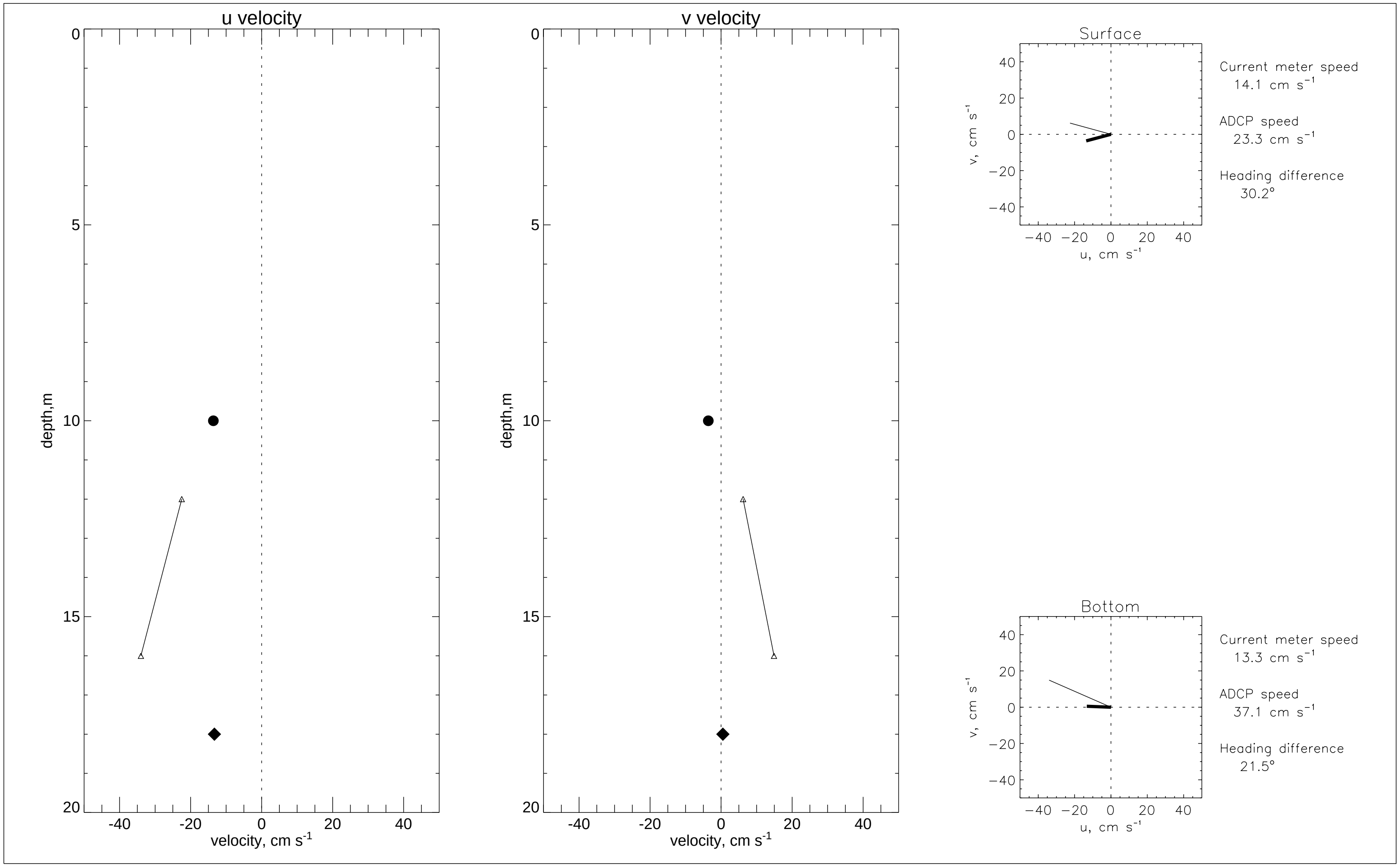

Figure 3.5.16. ADCP profile taken on 9 November 1992 at 0349 UTC (cruise H03) while passing by mooring CM16 at a distance of 3.3 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 9 November 1992 at 0400 UTC. Velocities for the bottom meter (18 m) are marked with a diamond and were recorded on 9 November 1992 at 0400 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

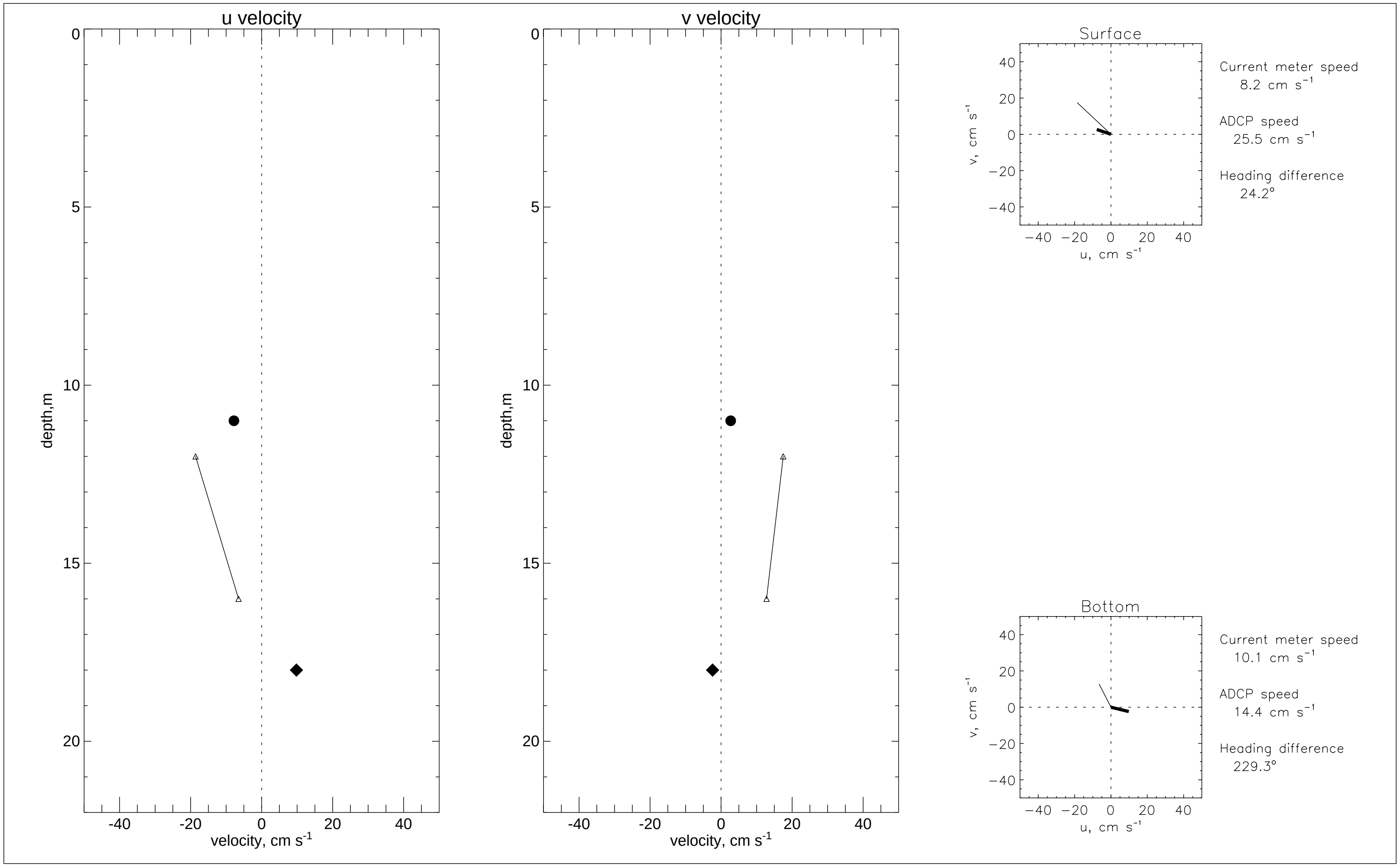

Figure 3.5.18. ADCP profile taken on 6 November 1992 at 1749 UTC (cruise H03) while passing by mooring CM18 at a distance of 4.3 km. Velocities for the surface meter (11 m) are marked with a circle and were recorded on 6 November 1992 at 1800 UTC. Velocities for the bottom meter (18 m) are marked with a diamond and were recorded on 6 November 1992 at 1750 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

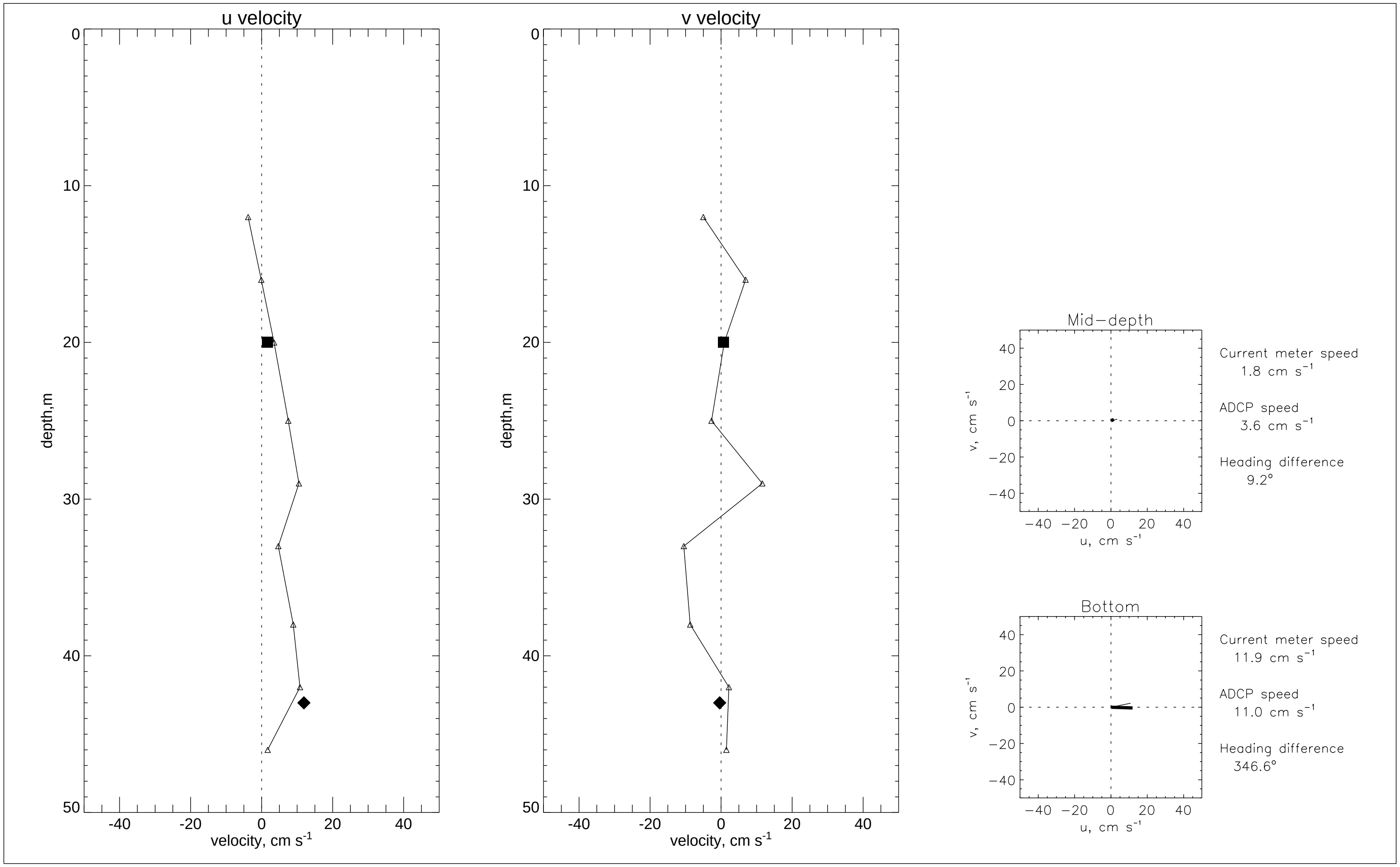

Figure 3.5.19. ADCP profile taken on 9 November 1992 at 2010 UTC (cruise H03) while passing by mooring CM19 at a distance of 3.2 km. Velocities for the mid-depth meter (20 m) are marked with a square and were recorded on 9 November 1992 at 2010 UTC. Velocities for the bottom meter (43 m) are marked with a diamond and were recorded on 9 November 1992 at 2010 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

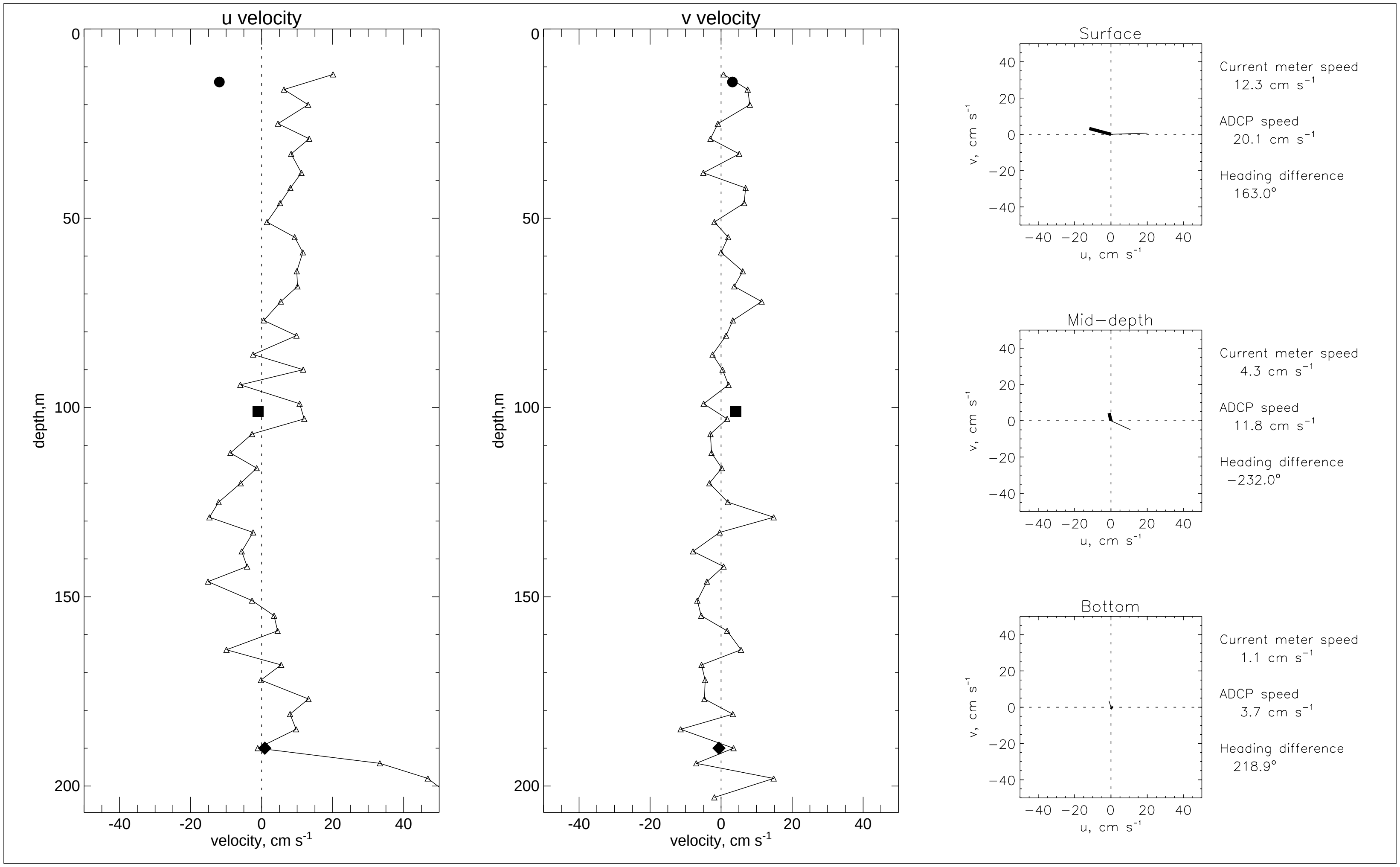

Figure 3.5.48. ADCP profile taken on 8 November 1992 at 0138 UTC (cruise H03) while passing by mooring CM48 at a distance of 0.8 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 8 November 1992 at 0130 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 8 November 1992 at 0130 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 8 November 1992 at 0130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

3.6 Cruise H04

3.6.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *Gyre*. The Vessel-Mount model ADCP was installed and the TRANSECT program was used during this survey. This was generally successful, although on 8 February at 0511 UTC and 11 February at 2130 GMT this software stuck at `checking Configuration and Data Path'. There were two other periods of downtime on 5 February at 2133 UTC and 9 February at 1508 UTC caused by an `on board parity error' caused by the computer. No significant problems with the ADCP were encountered. The QA/QC processing produced usable data. The parameter settings are shown in Table 11.

Table 11. Parameter settings (in meters) and the resulting sequence of bin depths on survey H04.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
4	4	4	12, 16, 20, 24, ...

3.6.2 Results

3.6.2.1 General Cruise Track

We show in Figure 4.1.1 a plan view of the general cruise track taken by the R/V *Gyre* during H04. The cruise covered the eastern LATEX shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 4.1.2 for which contoured profiles of normal velocity are presented in section 3.6.2.4. Figure 4.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 3.6.2.5.

3.6.2.2 Plan View of Stick Plot Velocity Vectors

Figure 4.2.1 shows the velocity from the surface bin centered at 12 m, Figure 4.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 4.2.3 shows the velocity from the bin centered at 100m below the surface.

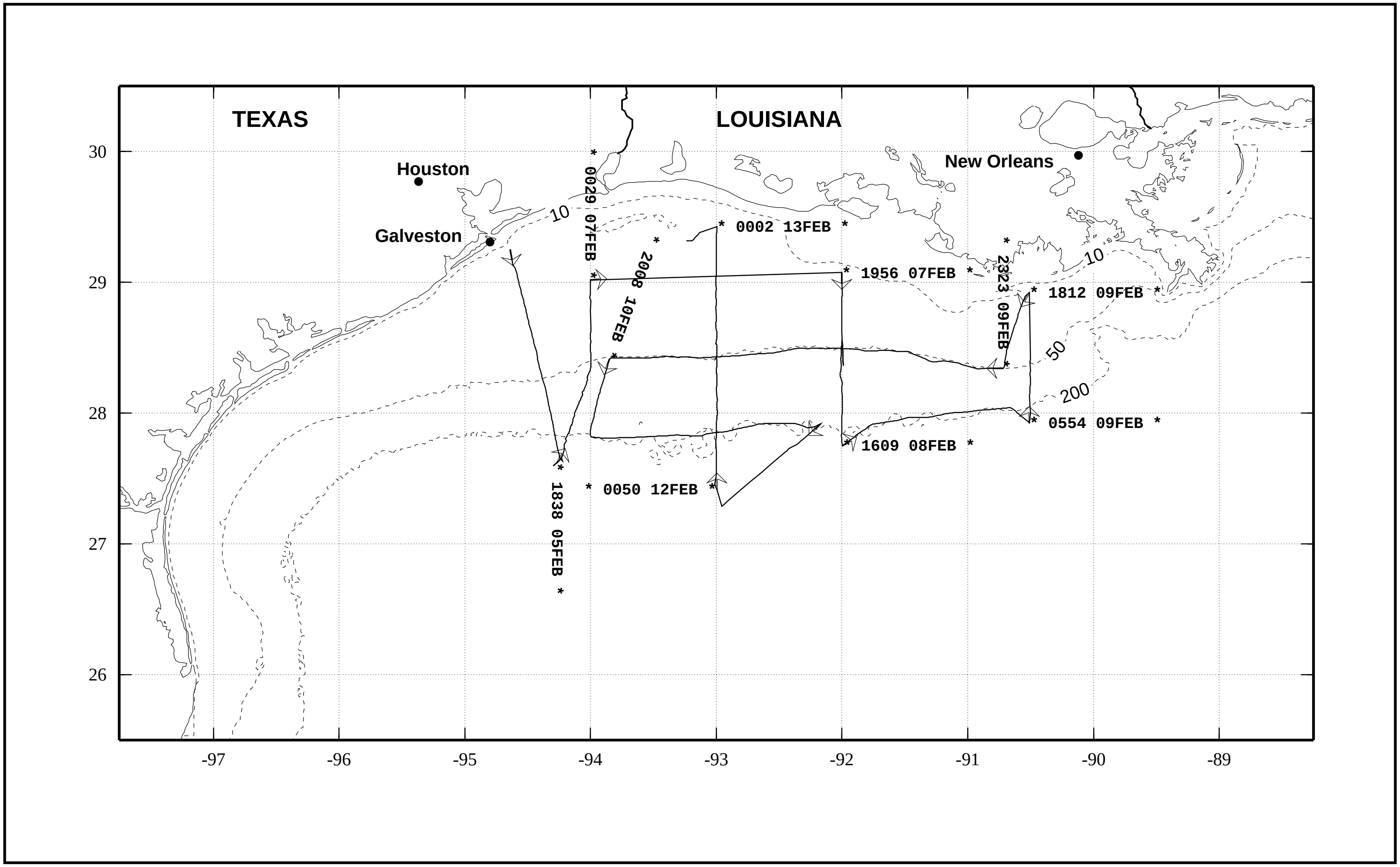

Figure 4.1.1. Cruise track for LATEX A cruise H04 in February 1993, showing times and directions.

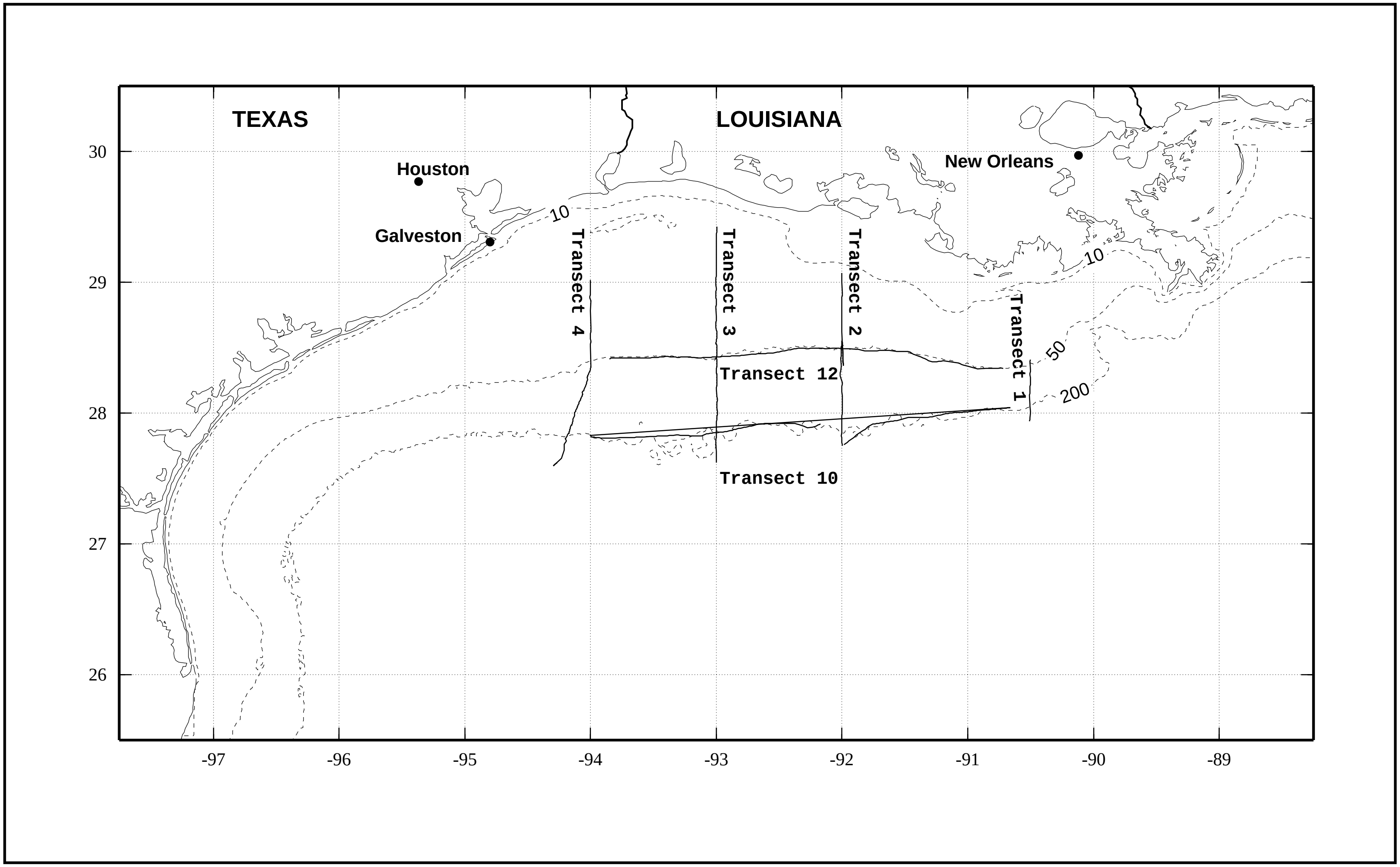

Figure 4.1.2. Cruise track for LATEX A cruise H04 in February 1993, showing individual labeled transects.

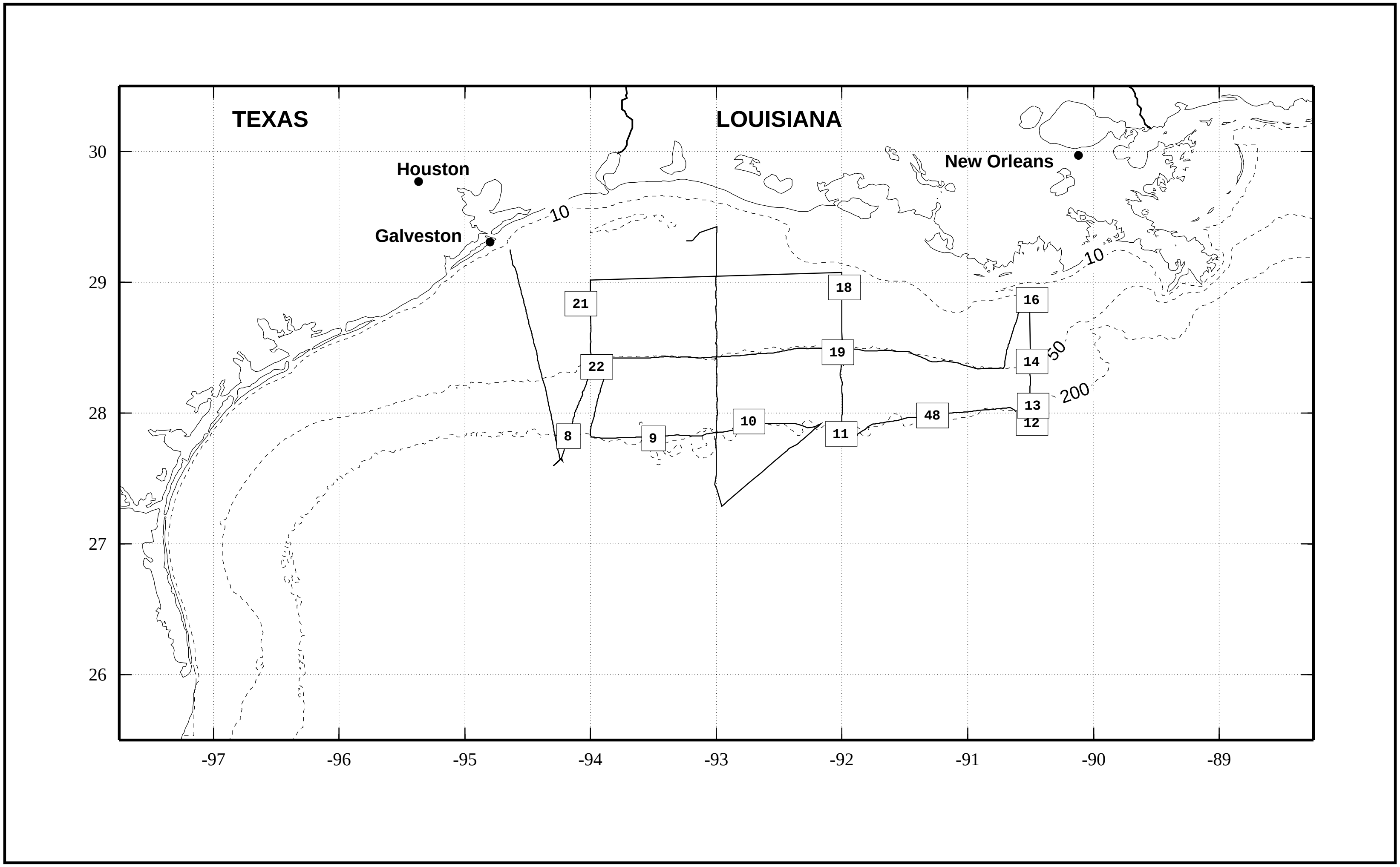

Figure 4.1.3. Cruise track for LATEX A cruise H04 in February 1993, showing current meter locations.

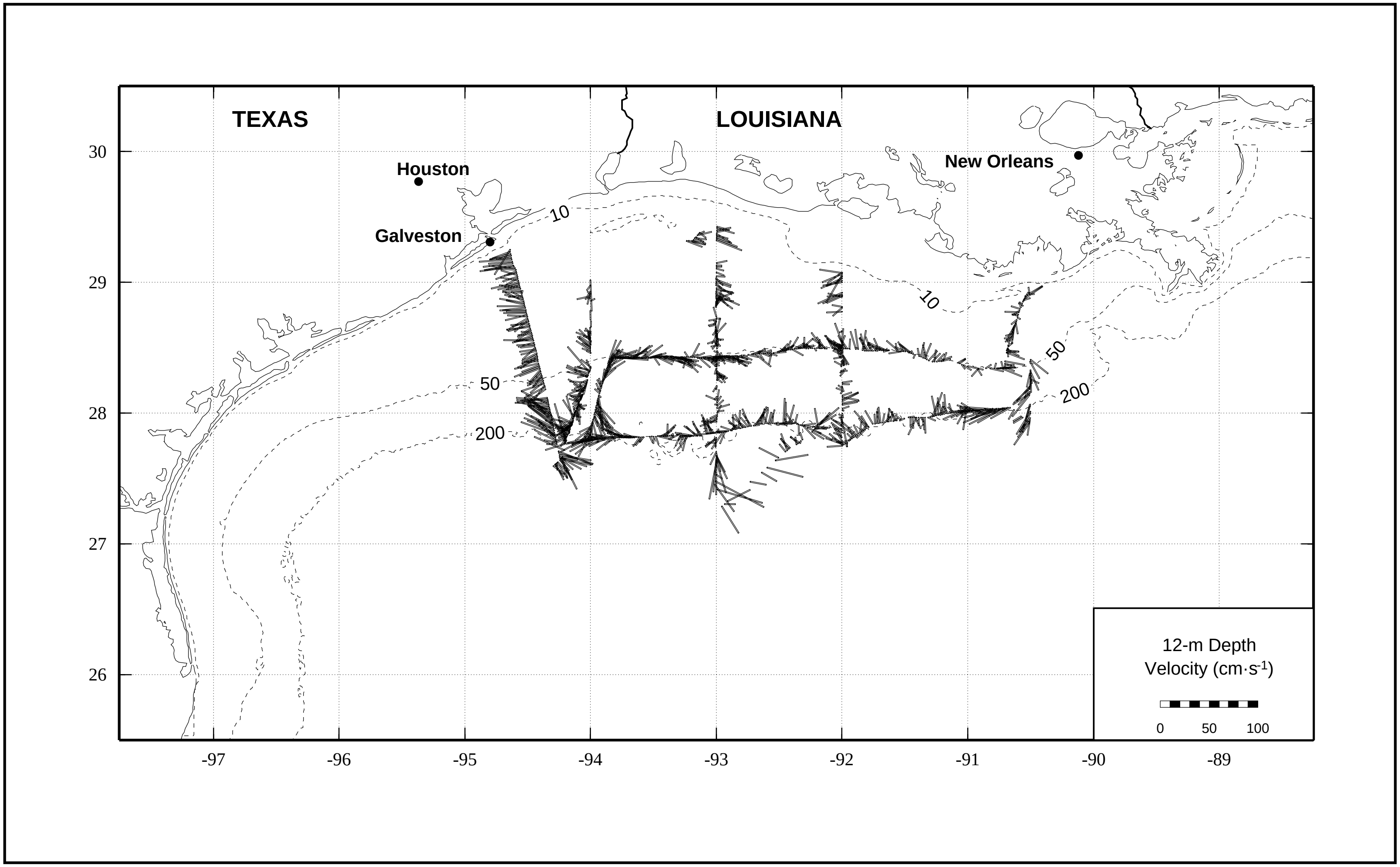

Figure 4.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H04 conducted in February 1993

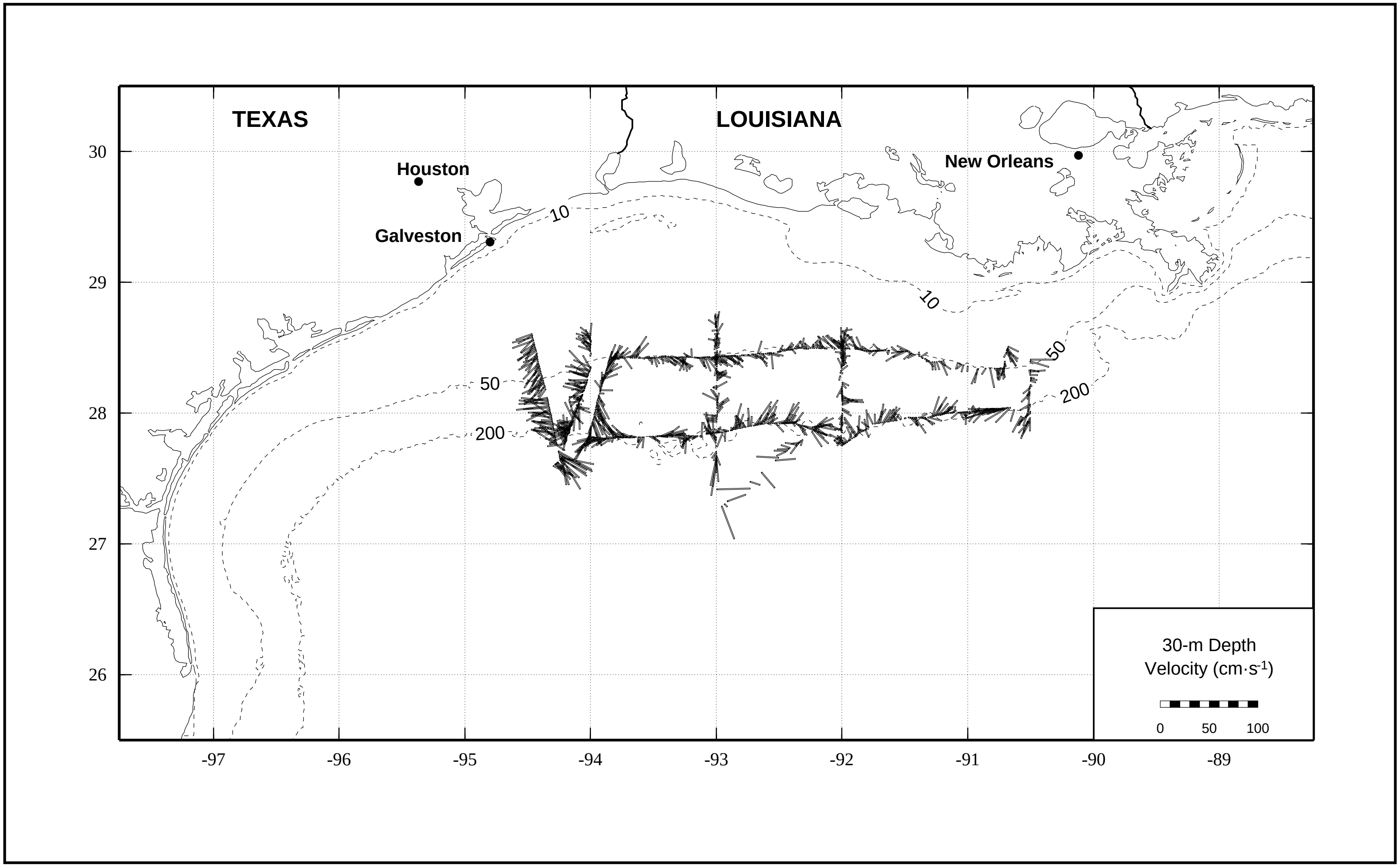

Figure 4.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H04 conducted in February 1993

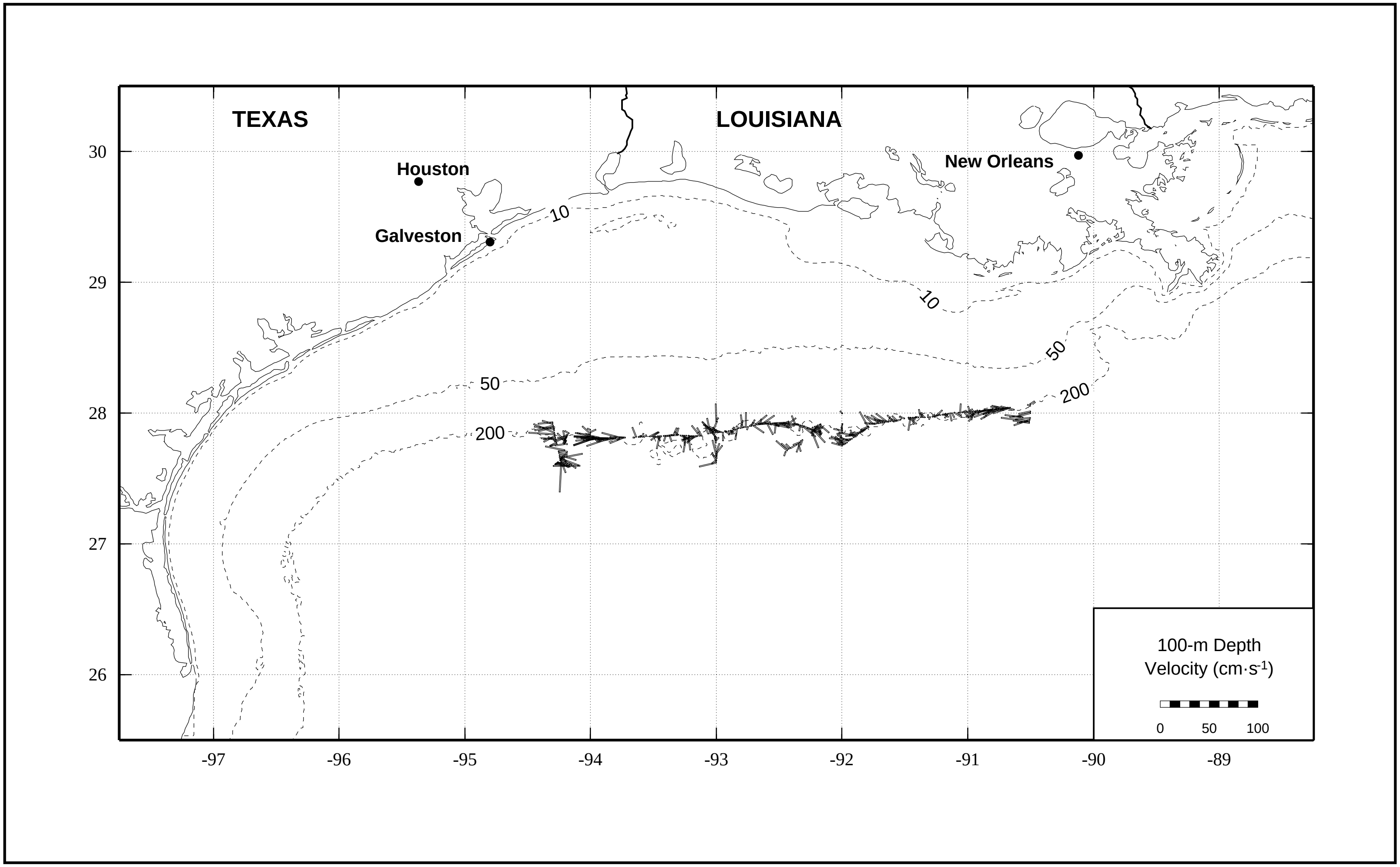

Figure 4.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H04 conducted in February 1993

3.6.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (GMT; Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 4.3.1 shows the velocity at the surface bin, Figure 4.3.2 shows the velocity 30 m below the surface, and Figure 4.3.3 shows the velocity 100 m below the surface.

3.6.2.4 Contoured Profiles of Normal Velocity

For across-shelf transects 1, 2, 3, and 4 we show the velocity normal to the transect. These comprise Figures 4.4.1, 4.4.2, 4.4.3, and 4.4.4. For along-shelf transect number 10, taken along the 200-m isobath, we show the normal velocity in Figure 4.4.10. For along-shelf transect number 12, taken along the 50-m isobath, we show the normal velocity in Figure 4.4.12. The transects are shown in Figure 4.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

3.6.2.5 Vertical Current Profiles

We show in Figures 4.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 4.1.3.

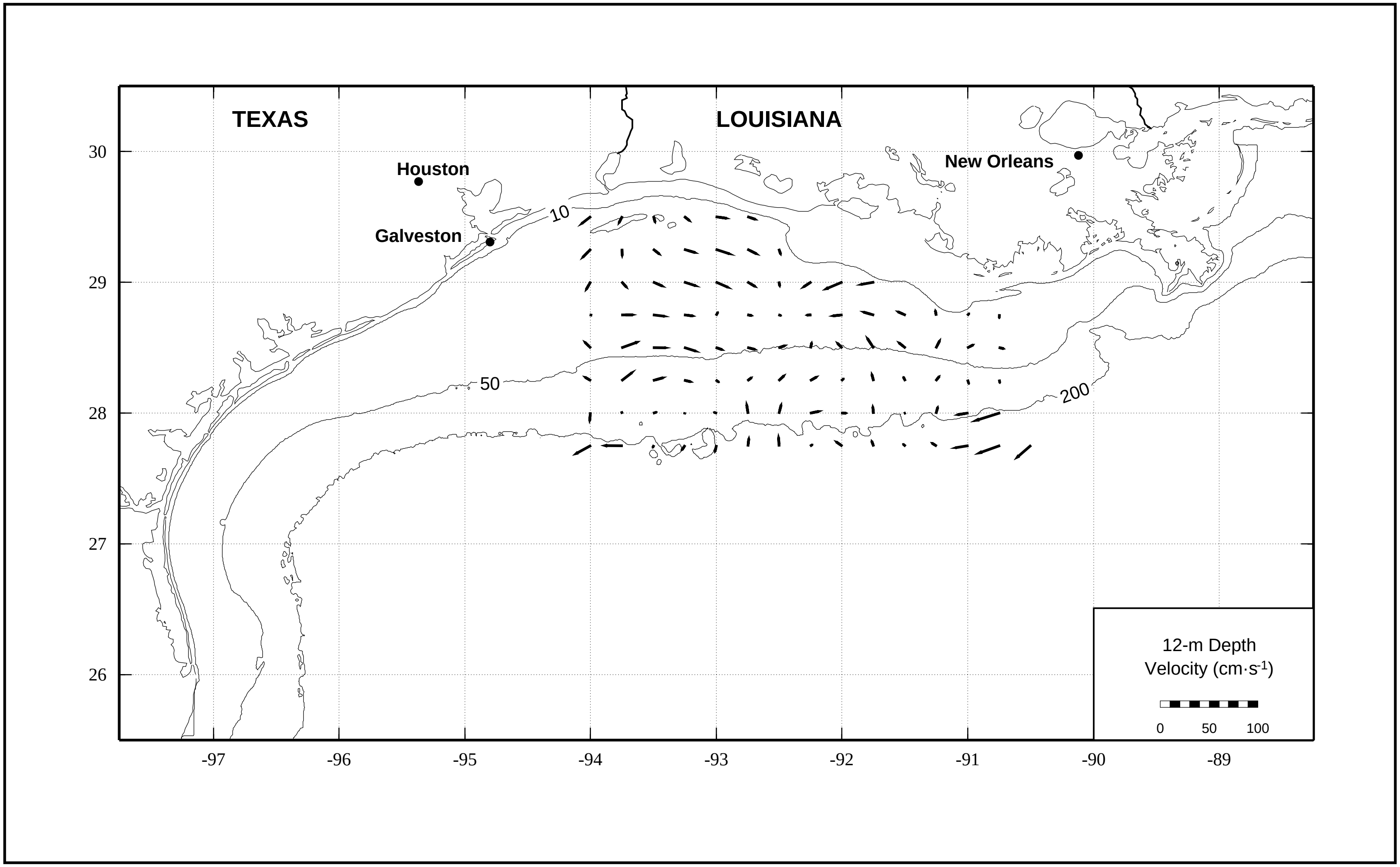

Figure 4.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H04 conducted in February 1993

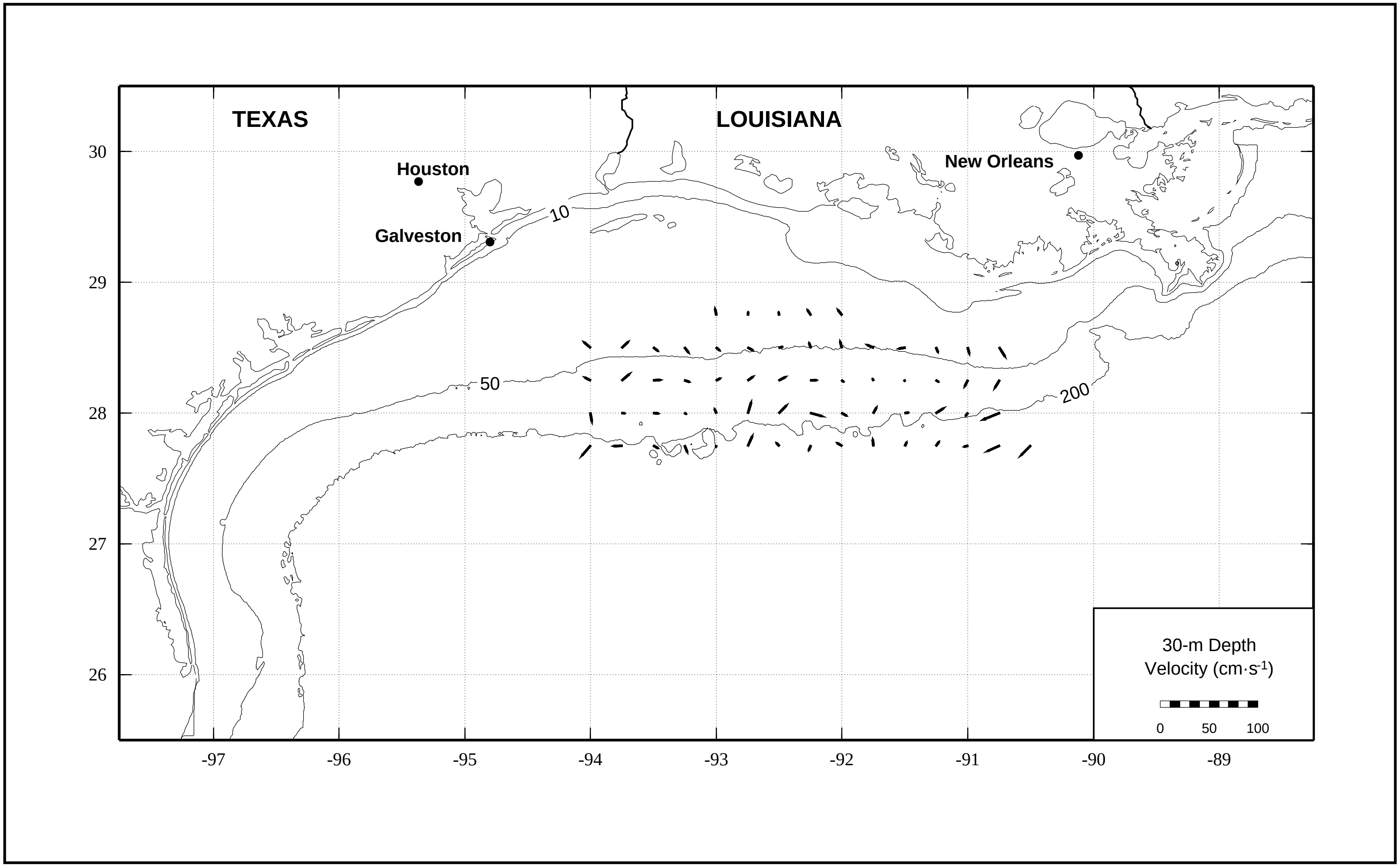

Figure 4.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H04 conducted in February 1993

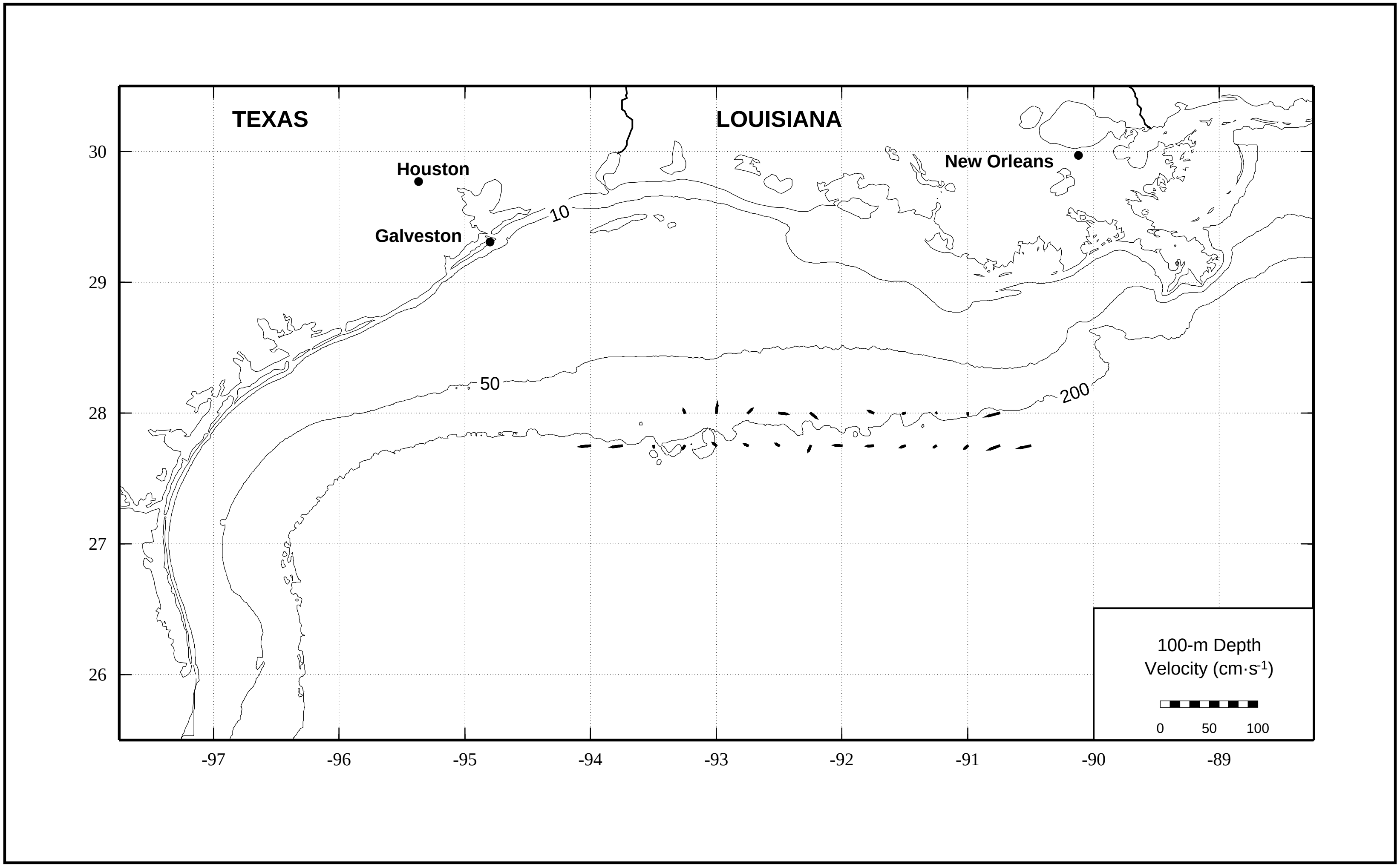

Figure 4.3.3. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H04 conducted in February 1993

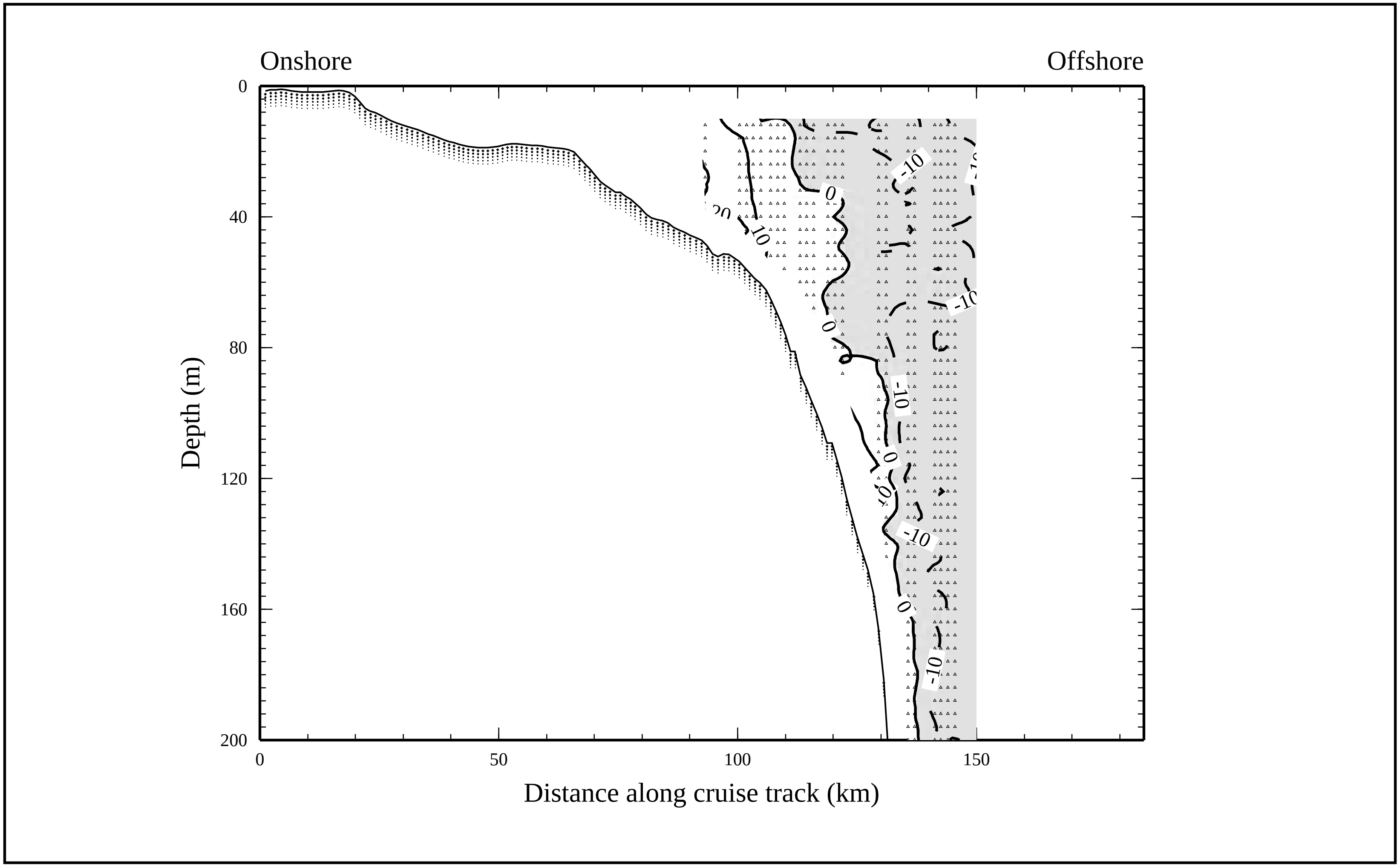

Figure 4.4.1. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 1 for cruise H04, February 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

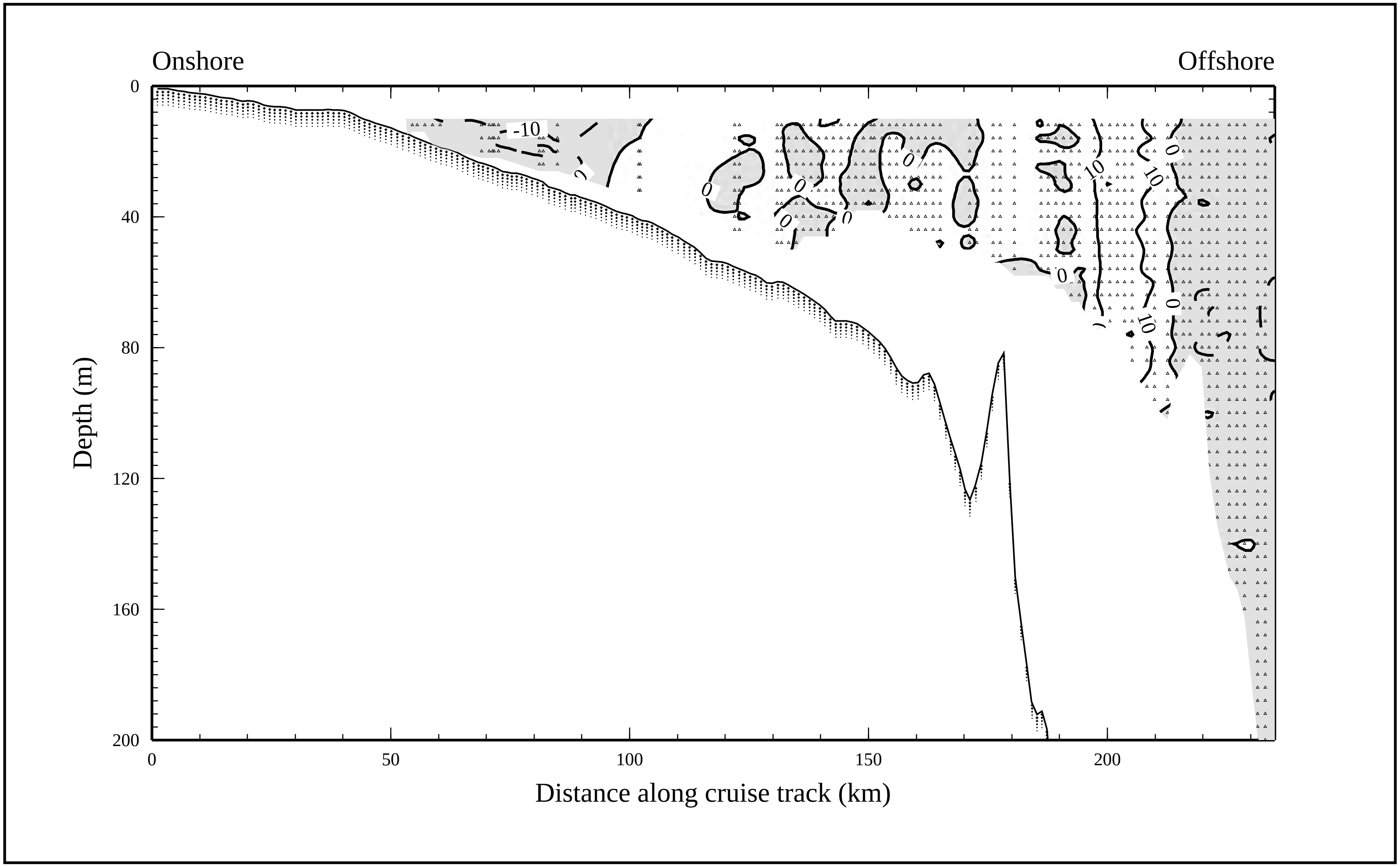

Figure 4.4.2. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 2 for cruise H04, February 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

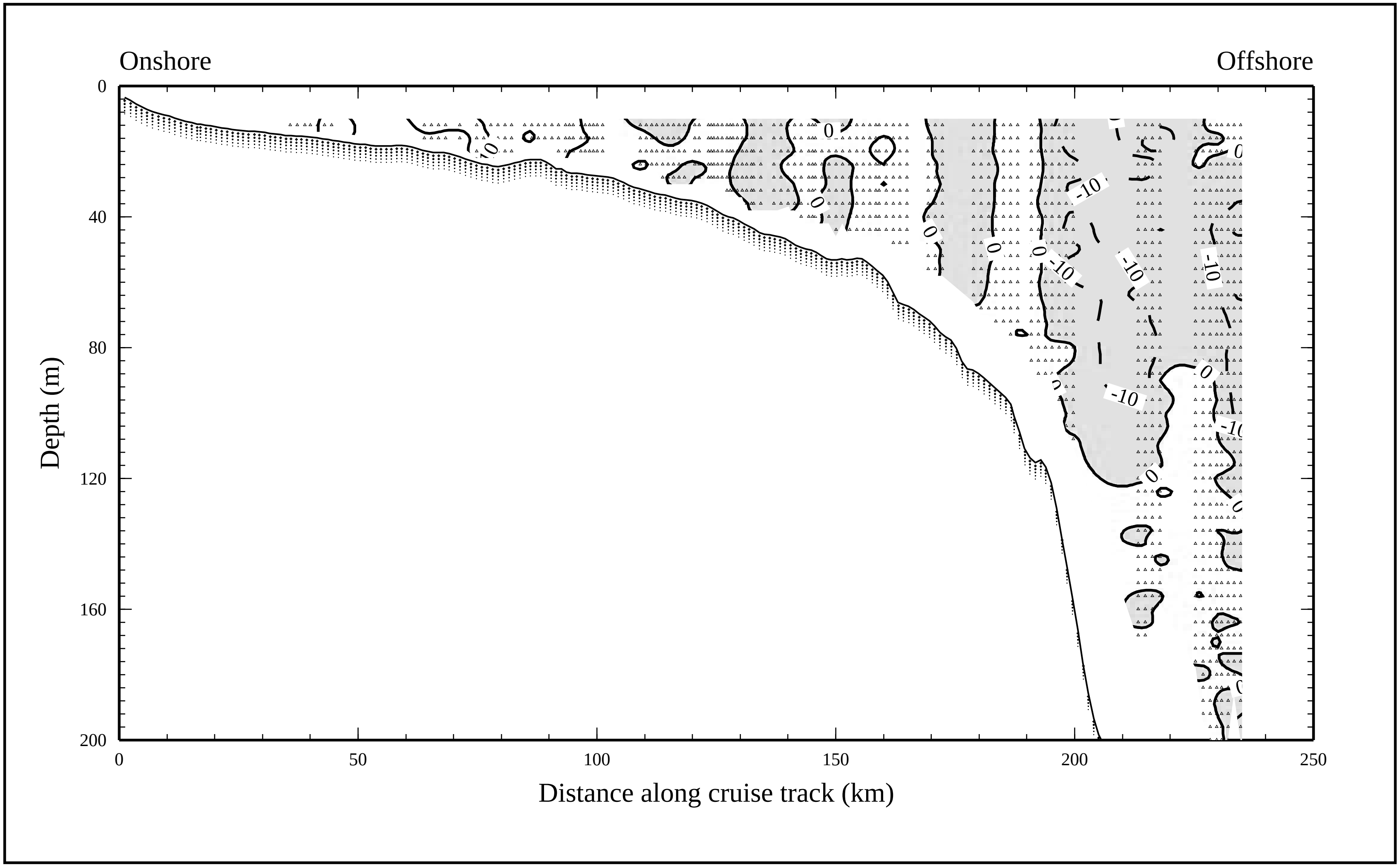

Figure 4.4.3. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 3 for cruise H04, February 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

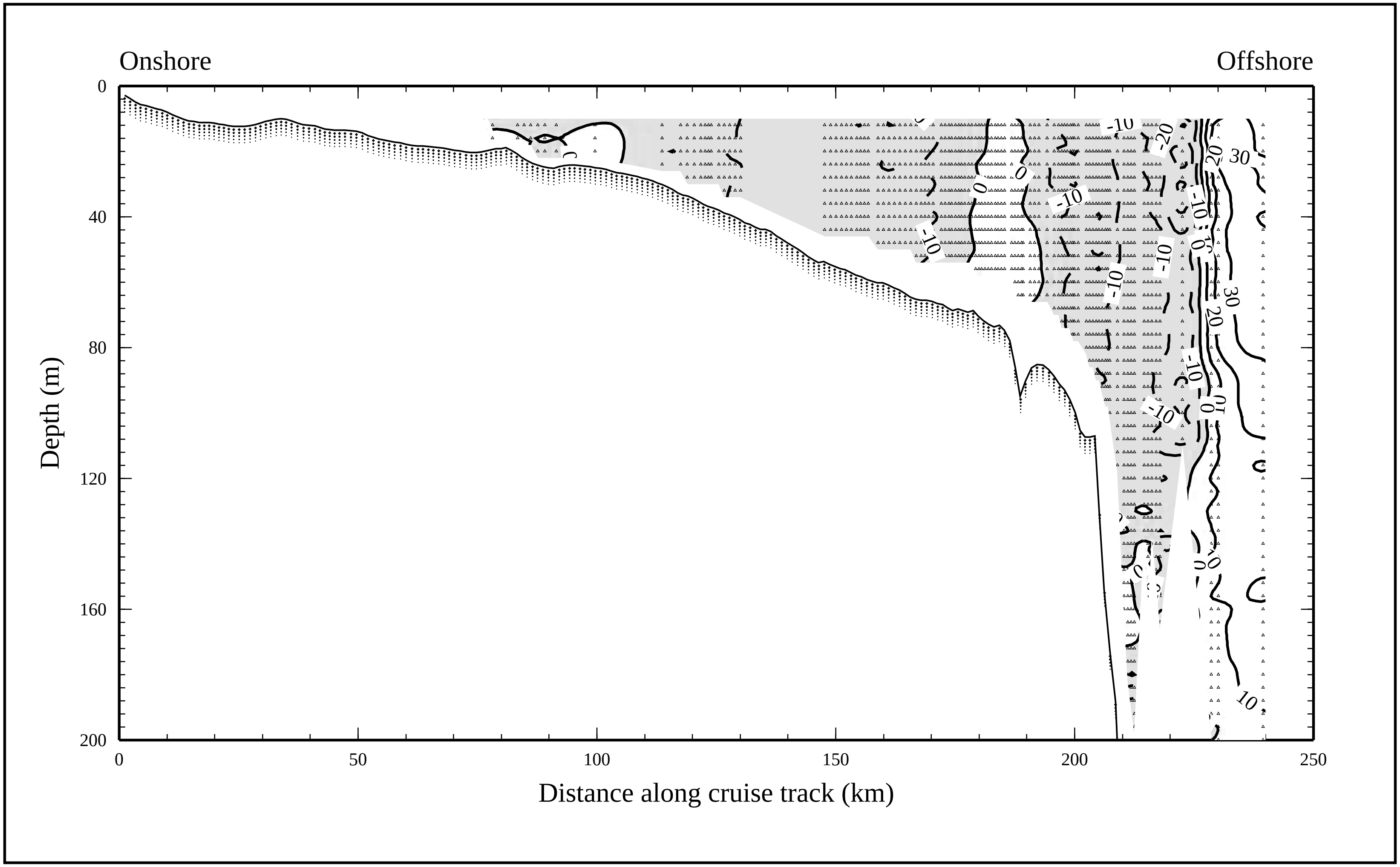

Figure 4.4.4. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 4 for cruise H04, February 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

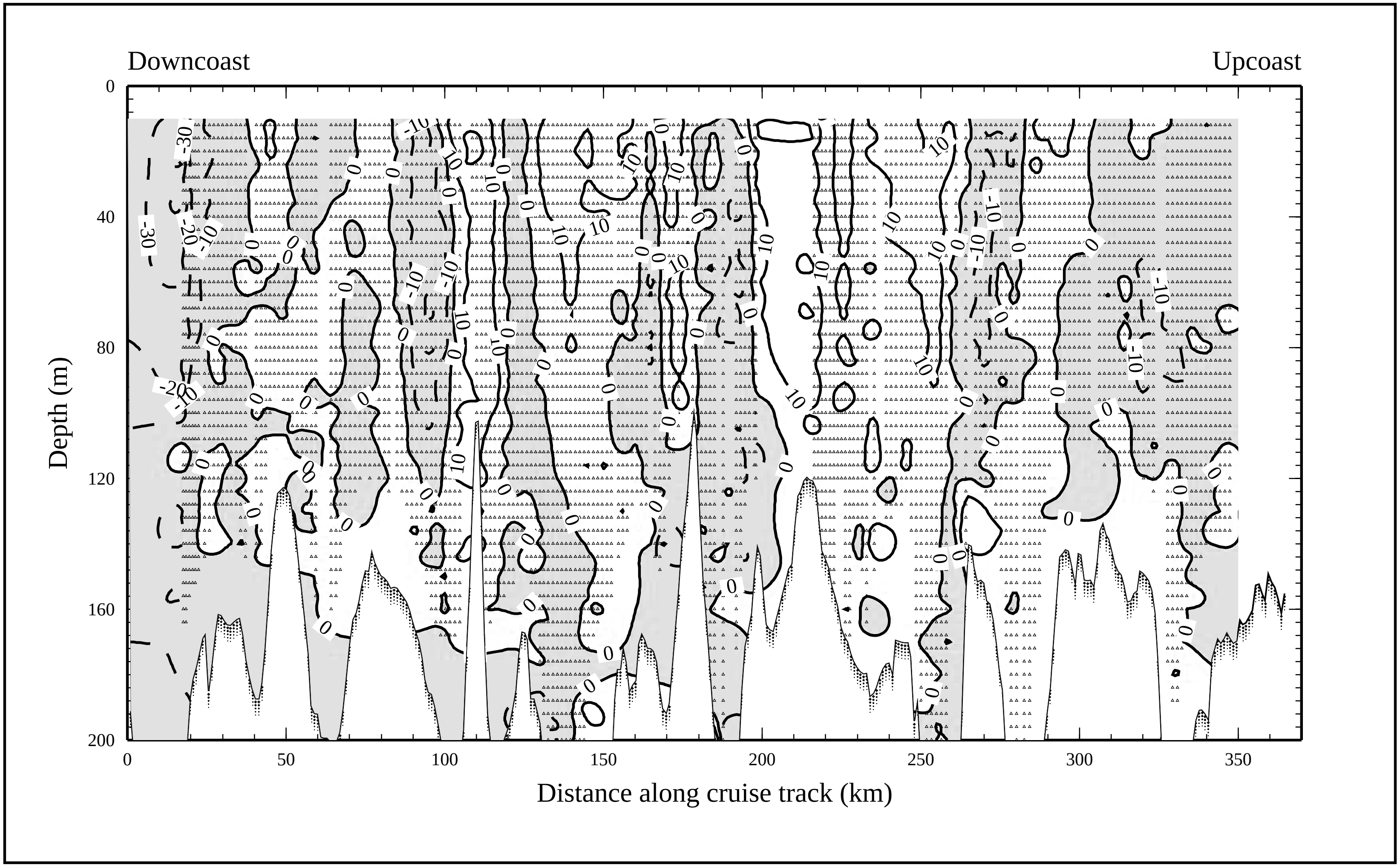

Figure 4.4.10. Vertical section of ADCP velocities (cm·s-1) normal to transect 10 for cruise H04, February 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

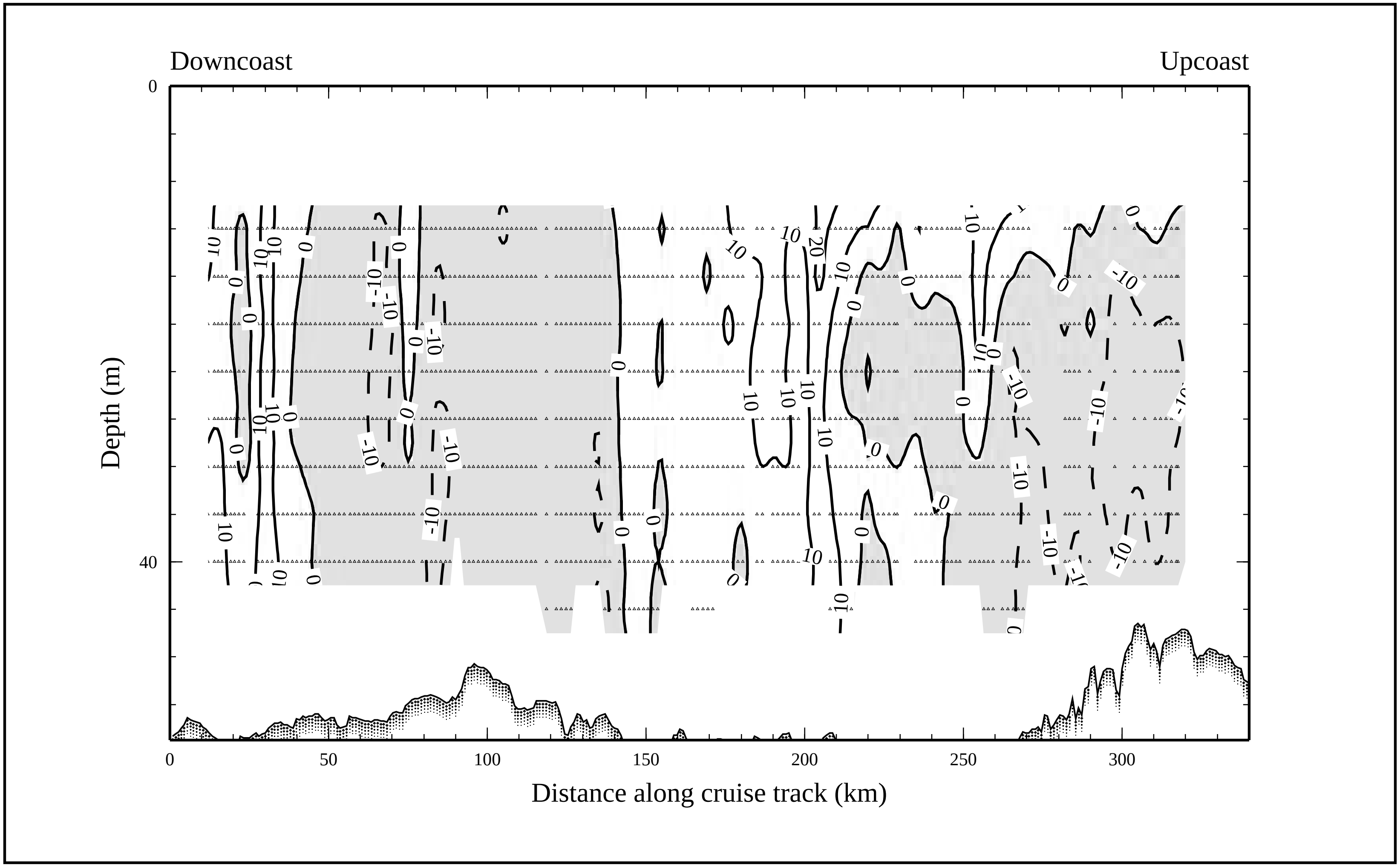

Figure 4.4.12. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 12 for cruise H04, February 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

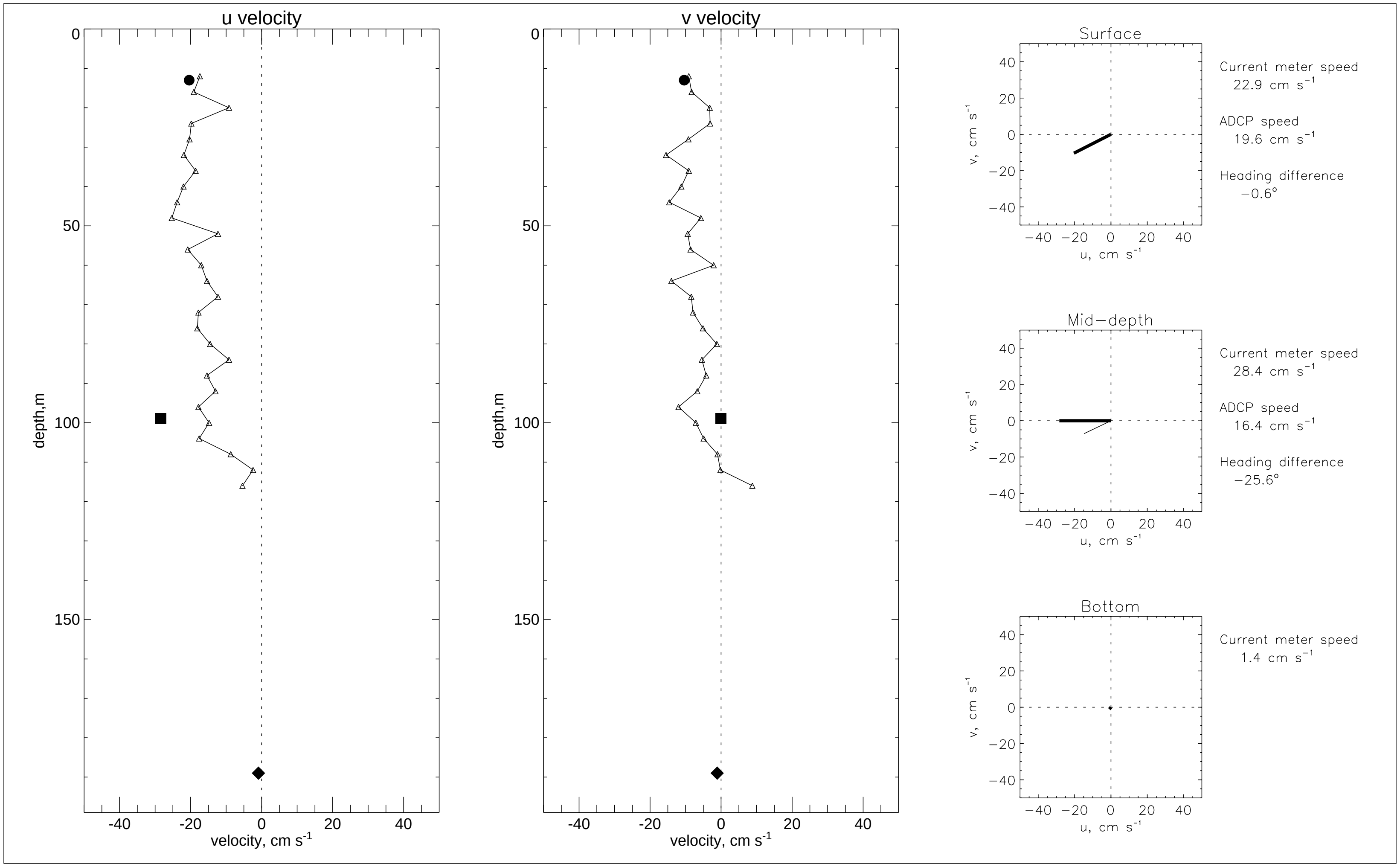

Figure 4.5.08. ADCP profile taken on 6 February 1993 at 0647 UTC (cruise H04) while passing by mooring CM08 at a distance of 0.7 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 6 February 1993 at 0700 UTC. Velocities for the mid-depth meter (99 m) are marked with a square and were recorded on 6 February 1993 at 0700 UTC. Velocities for the bottom meter (189 m) are marked with a diamond and were recorded on 6 February 1993 at 0700 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

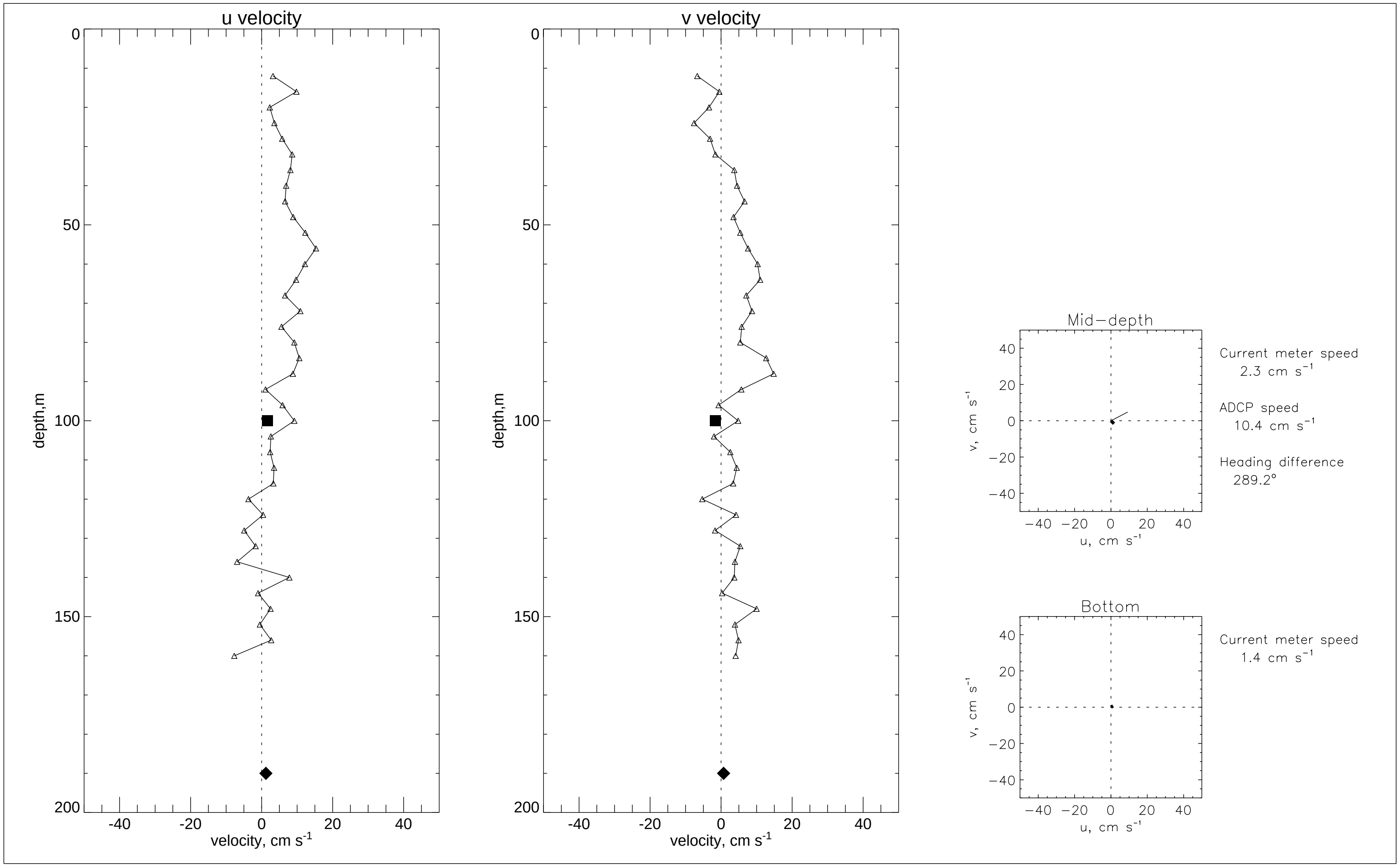

Figure 4.5.09. ADCP profile taken on 11 February 1993 at 0418 UTC (cruise H04) while passing by mooring CM09 at a distance o f 0.6 km. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 11 February 1993 at 0430 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 11 February 1993 at 0430 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

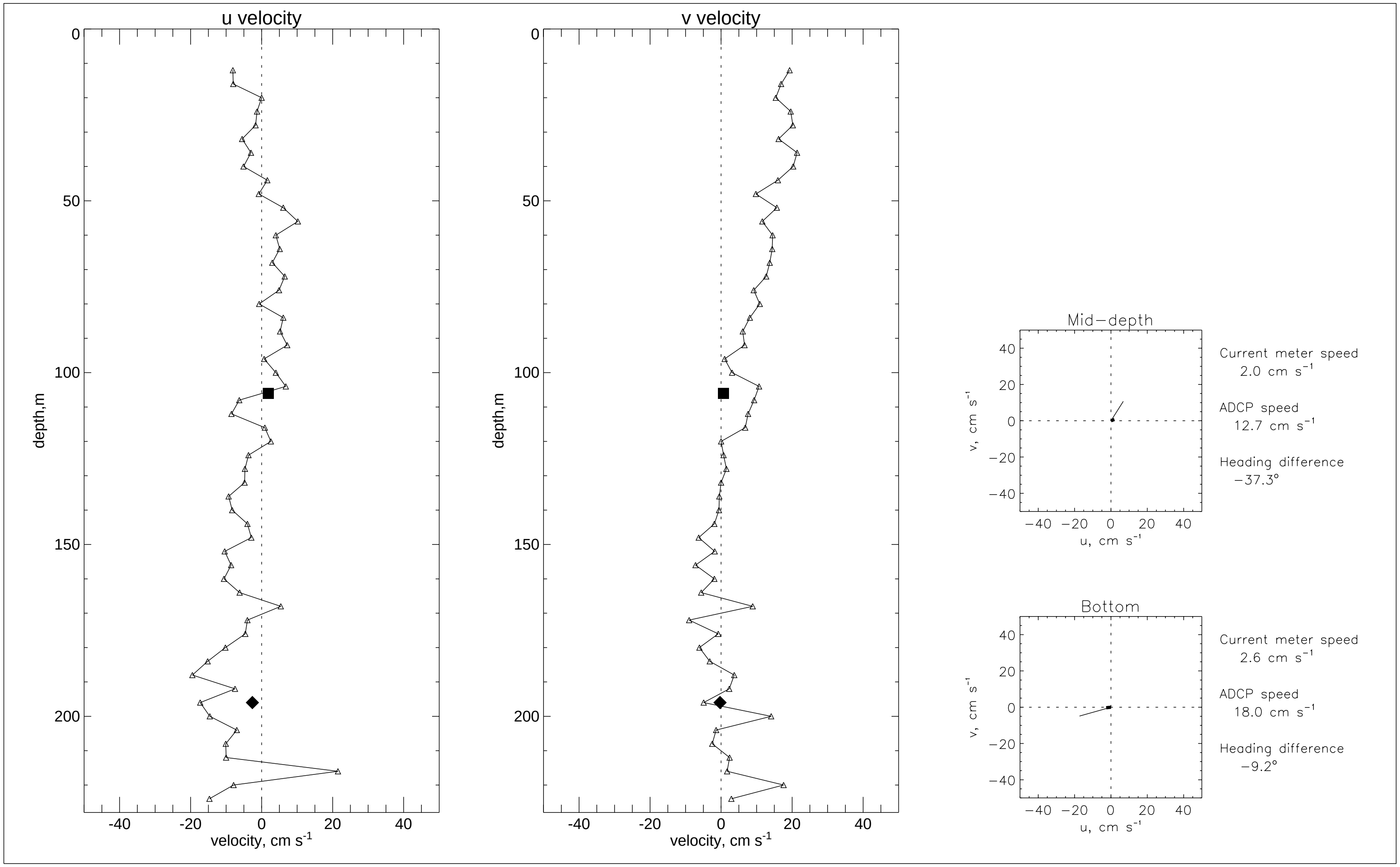

Figure 4.5.10. ADCP profile taken on 11 February 1993 at 1023 UTC (cruise H04) while passing by mooring CM10 at a distance o f 3.6 km. Velocities for the mid-depth meter (106 m) are marked with a square and were recorded on 11 February 1993 at 1030 UTC. Velocities for the bottom meter (196 m) are marked with a diamond and were recorded on 11 February 1993 at 1030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

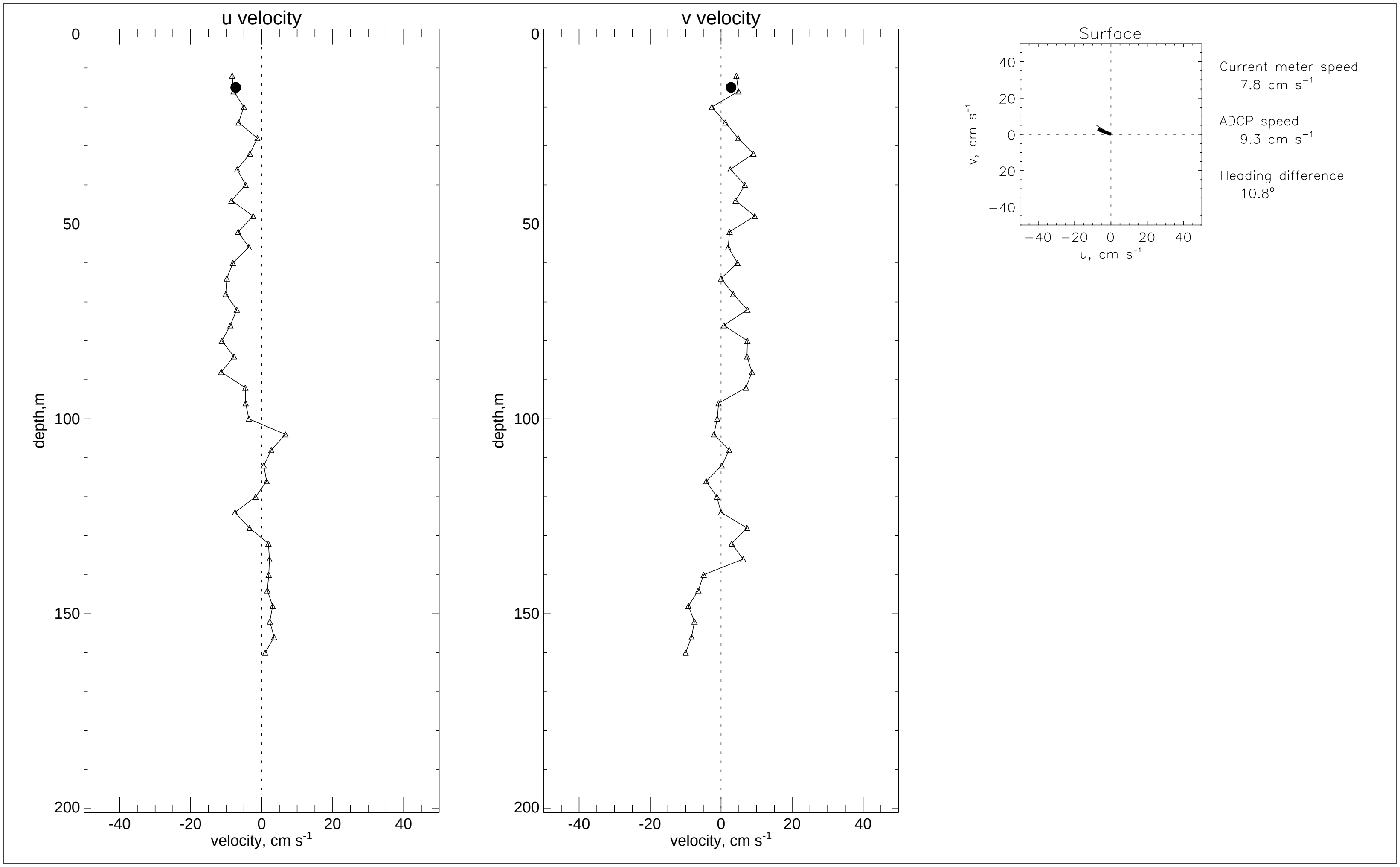

Figure 4.5.11. ADCP profile taken on 8 February 1993 at 1329 UTC (cruise H04) while passing by mooring CM11 at a distance of 1.0 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 8 February 1993 at 1330 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

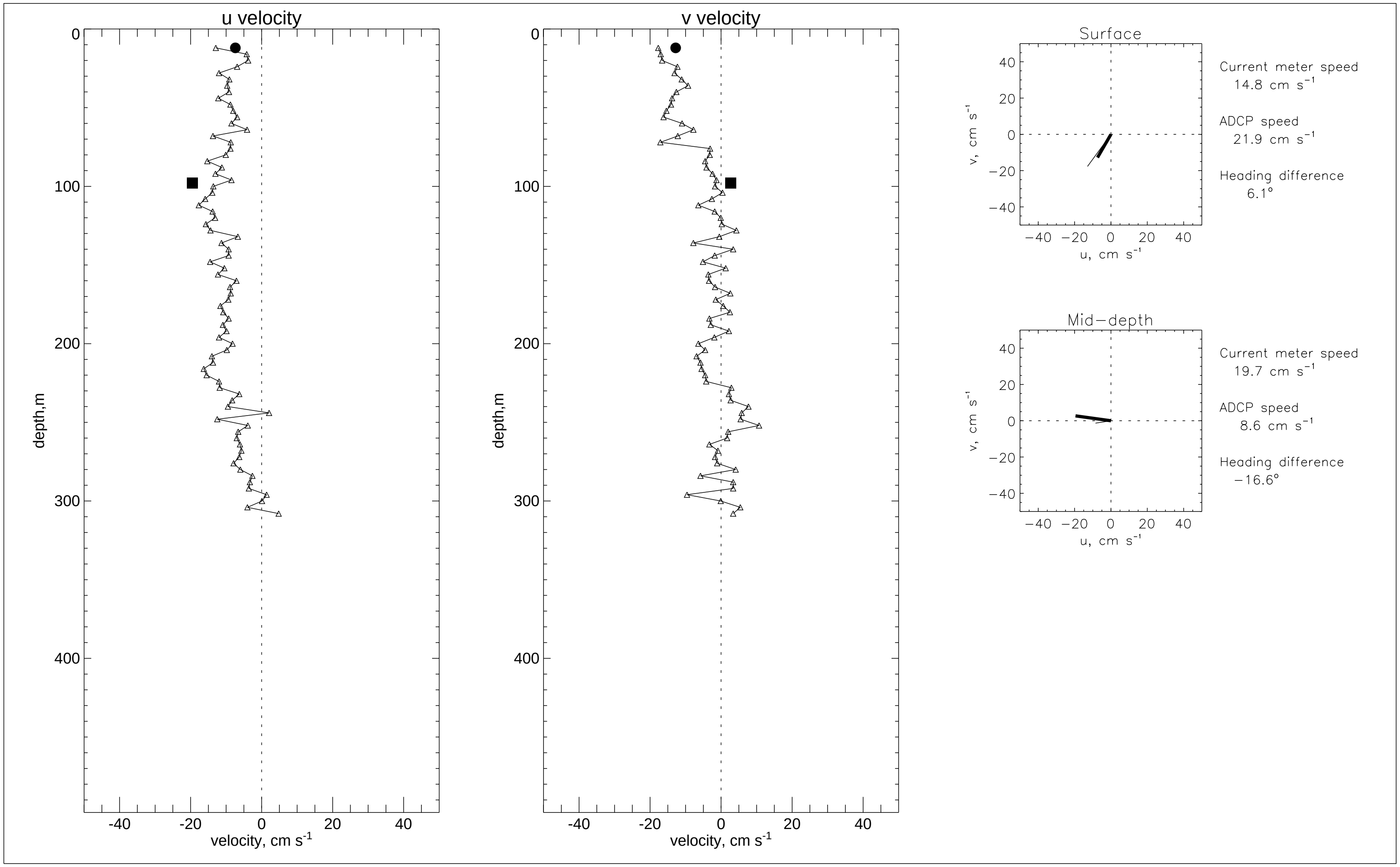

Figure 4.5.12. ADCP profile taken on 9 February 1993 at 0559 UTC (cruise H04) while passing by mooring CM12 at a distance of 1.7 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 9 February 1993 at 0600 UTC. Velocities for the mid-depth meter (98 m) are marked with a square and were recorded on 9 February 1993 at 0600 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

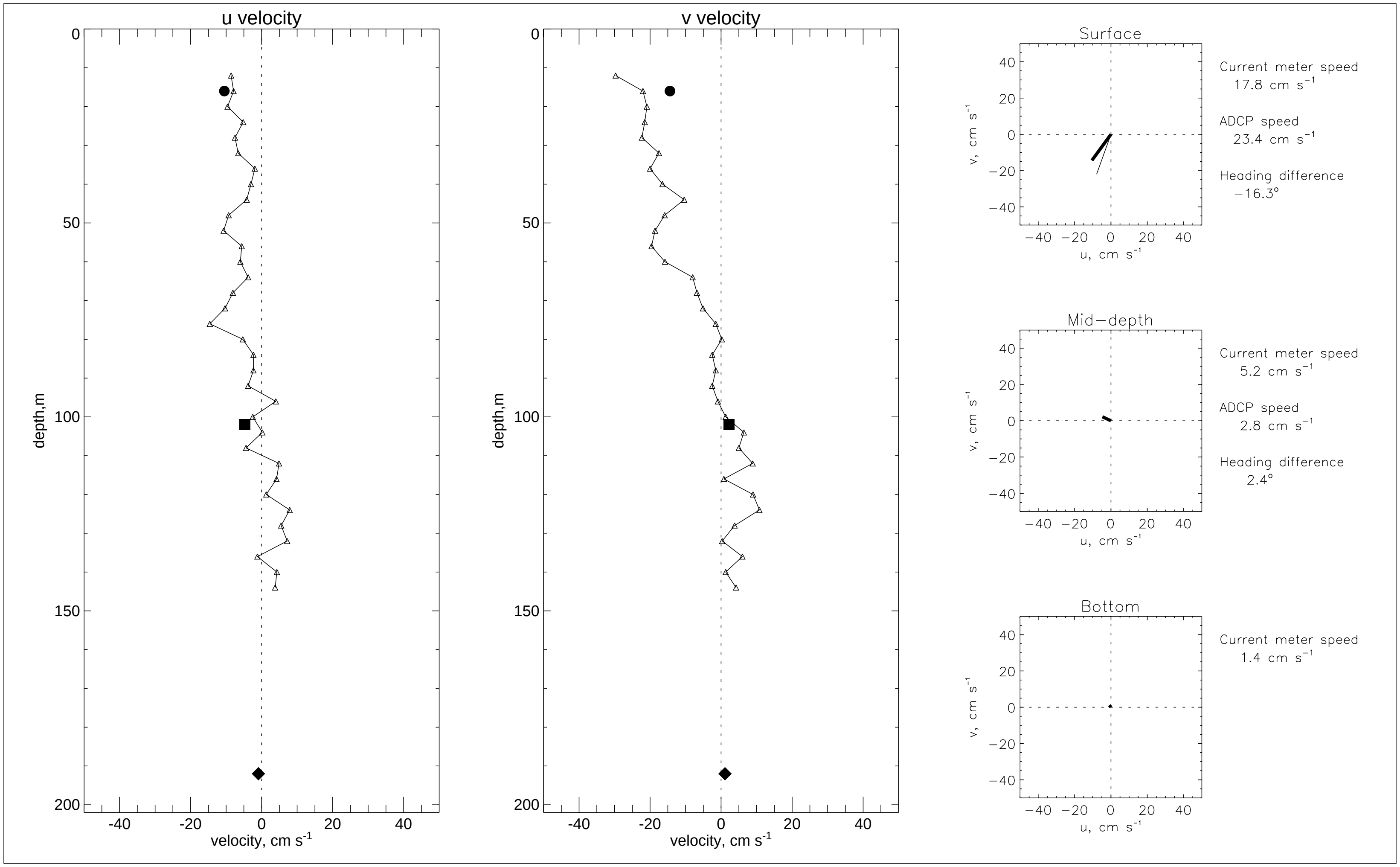

Figure 4.5.13. ADCP profile taken on 9 February 1993 at 0744 UTC (cruise H04) while passing by mooring CM13 at a distance of 1.8 km. Velocities for the surface meter (16 m) are marked with a circle and were recorded on 9 February 1993 at 0730 UTC. Velocities for the mid-depth meter (102 m) are marked with a square and were recorded on 9 February 1993 at 0730 UTC. Velocities for the bottom meter (192 m) are marked with a diamond and were recorded on 9 February 1993 at 0730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

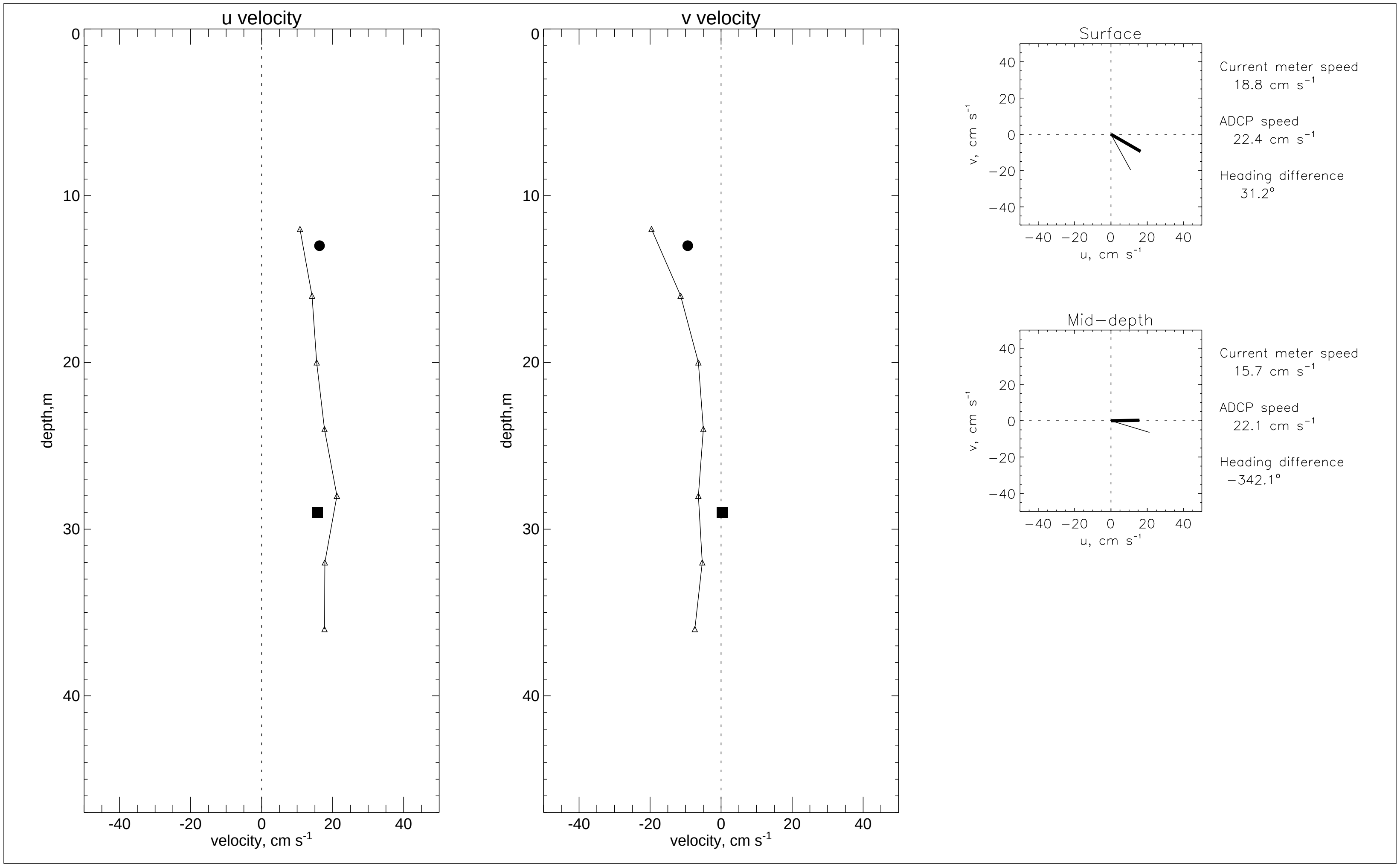

Figure 4.5.14. ADCP profile taken on 9 February 1993 at 1234 UTC (cruise H04) while passing by mooring CM14 at a distance of 1.1 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 9 February 1993 at 1230 UTC. Velocities for the mid-depth meter (29 m) are marked with a square and were recorded on 9 February 1993 at 1235 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

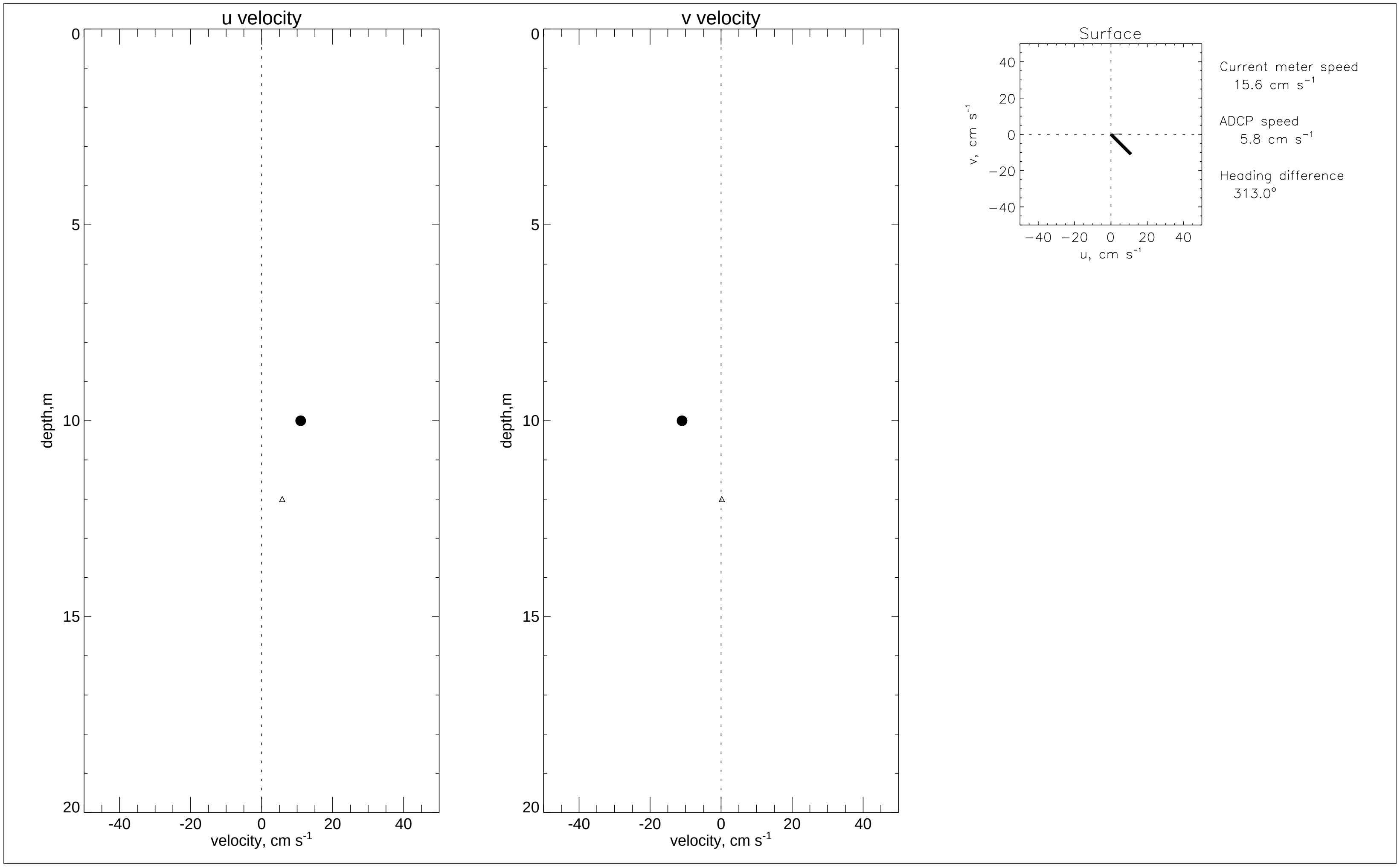

Figure 4.5.16. ADCP profile taken on 9 February 1993 at 1807 UTC (cruise H04) while passing by mooring CM16 at a distance of 4.5 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 9 February 1993 at 1800 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

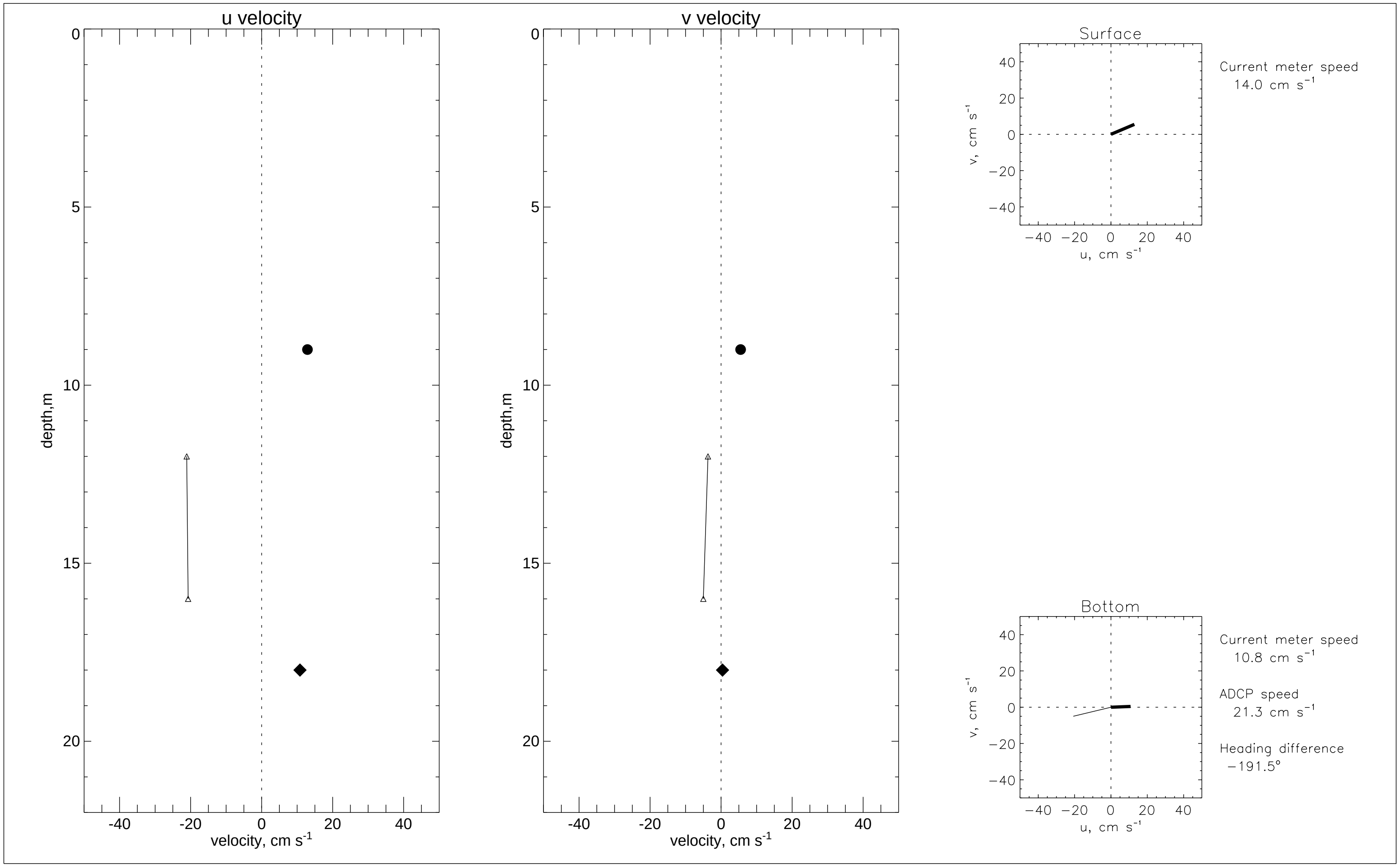

Figure 4.5.18. ADCP profile taken on 7 February 1993 at 2051 UTC (cruise H04) while passing by mooring CM18 at a distance of 3.9 km. Velocities for the surface meter (9 m) are marked with a circle and were recorded on 7 February 1993 at 2100 UTC. Velocities for the bottom meter (18 m) are marked with a diamond and were recorded on 7 February 1993 at 2050 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

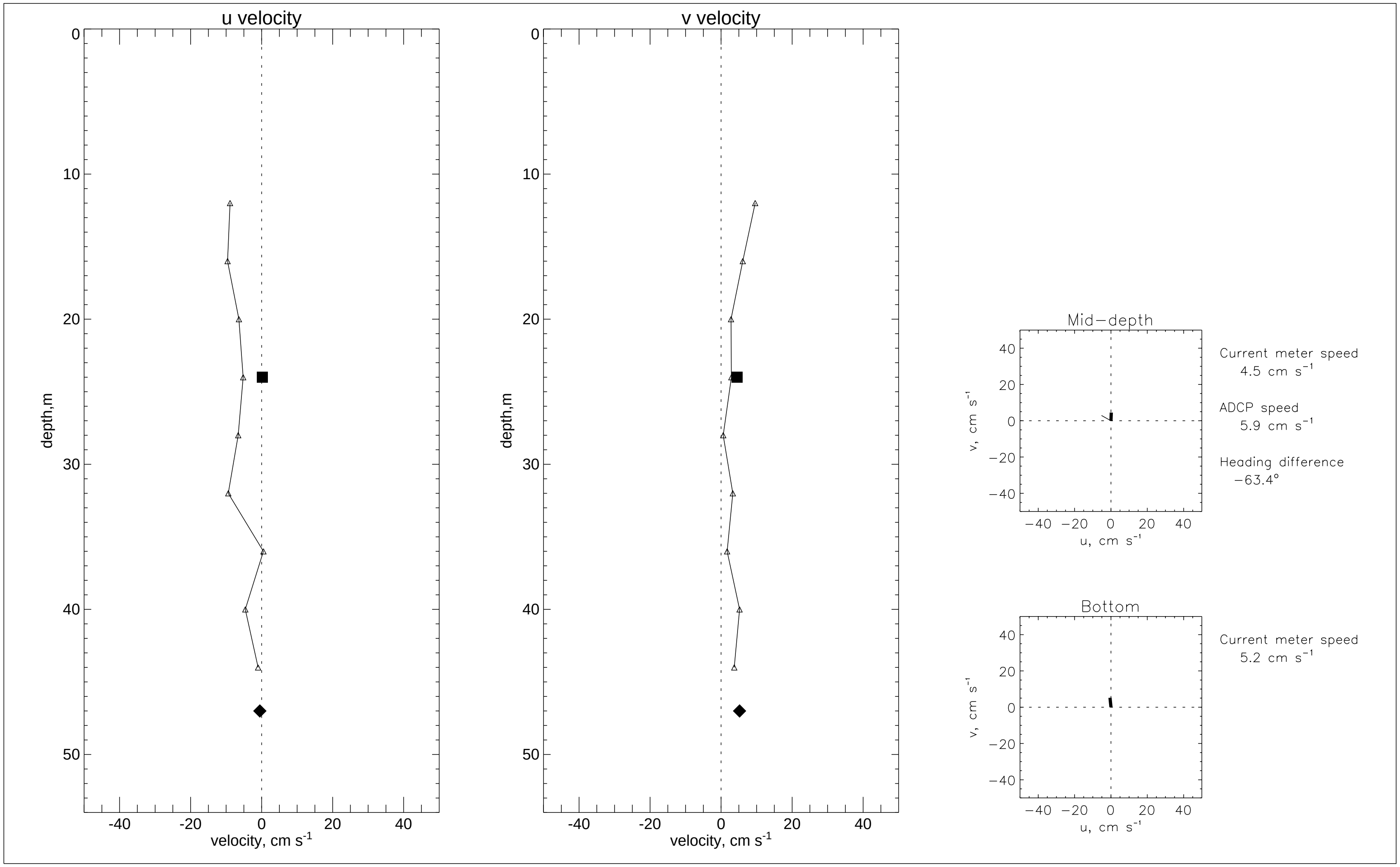

Figure 4.5.19. ADCP profile taken on 8 February 1993 at 0717 UTC (cruise H04) while passing by mooring CM19 at a distance of 2.7 km. Velocities for the mid-depth meter (24 m) are marked with a square and were recorded on 8 February 1993 at 0715 UTC. Velocities for the bottom meter (47 m) are marked with a diamond and were recorded on 8 February 1993 at 0715 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

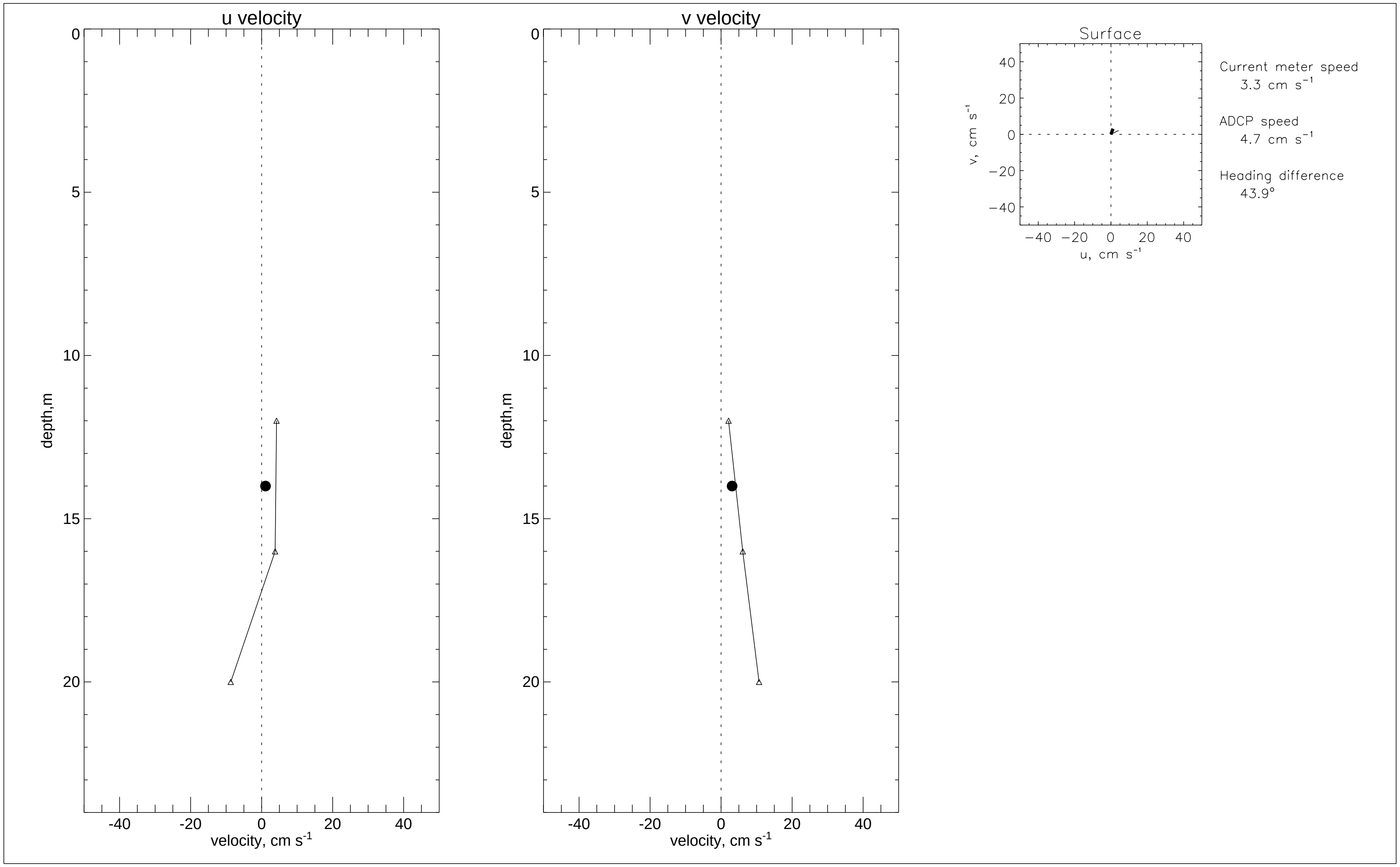

Figure 4.5.21. ADCP profile taken on 6 February 1993 at 2242 UTC (cruise H04) while passing by mooring CM21 at a distance of 8.1 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 6 February 1993 at 2230 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

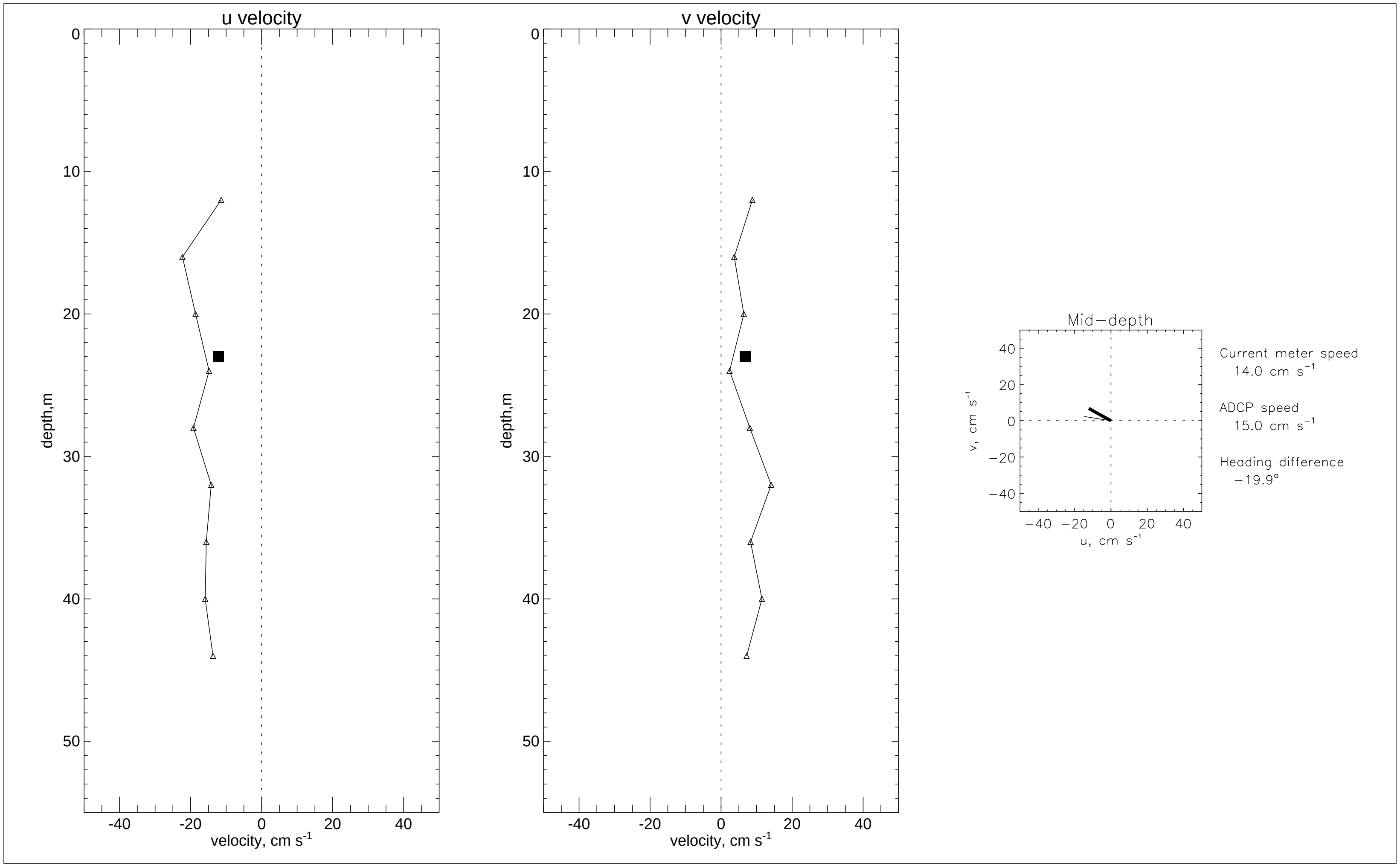

Figure 4.5.22. ADCP profile taken on 6 February 1993 at 1657 UTC (cruise H04) while passing by mooring CM22 at a distance of 4.0 km. Velocities for the mid-depth meter (23 m) are marked with a square and were recorded on 6 February 1993 at 1655 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

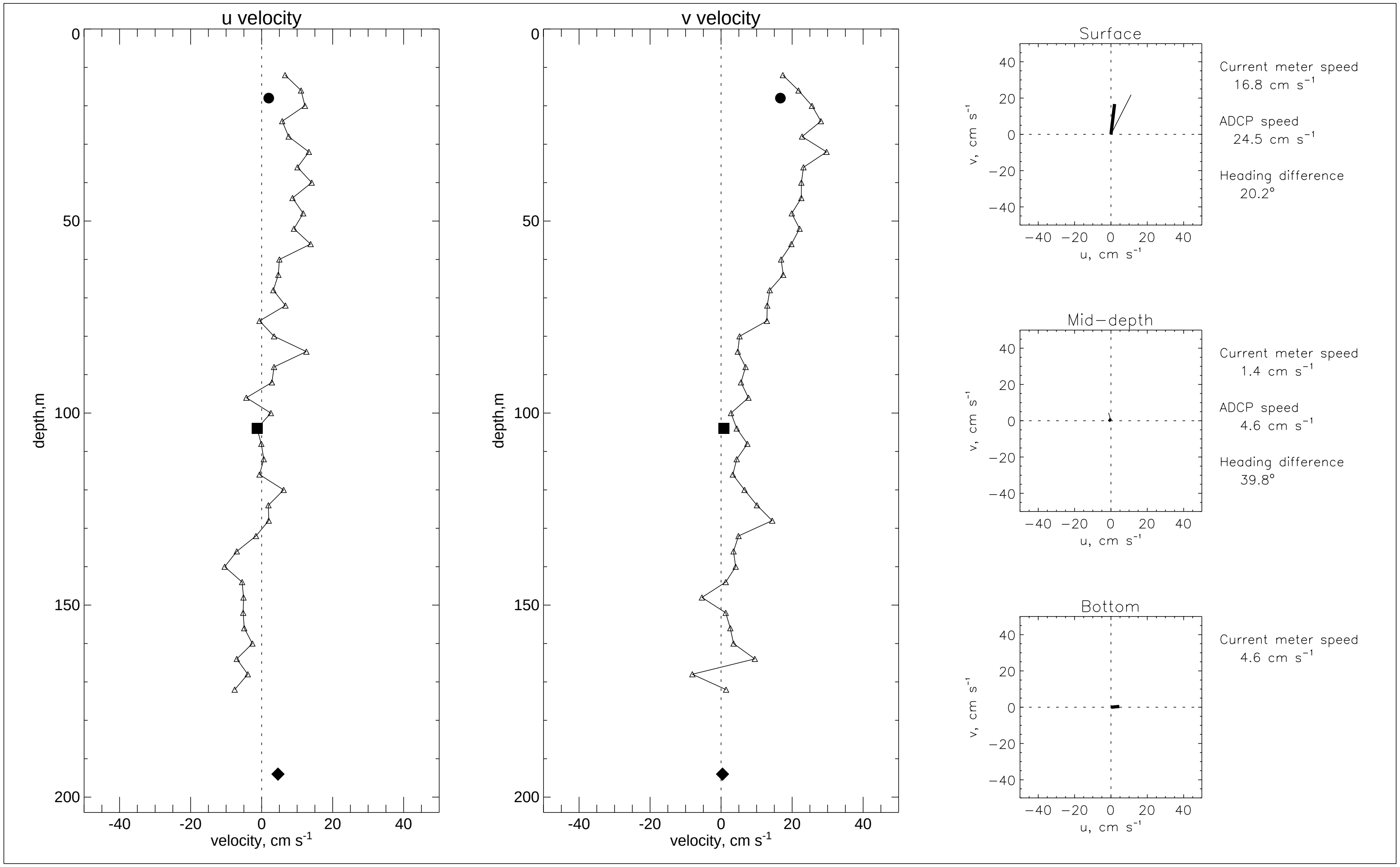

Figure 4.5.48. ADCP profile taken on 8 February 1993 at 2204 UTC (cruise H04) while passing by mooring CM48 at a distance of 1.1 km. Velocities for the surface meter (18 m) are marked with a circle and were recorded on 8 February 1993 at 2200 UTC. Velocities for the mid-depth meter (104 m) are marked with a square and were recorded on 8 February 1993 at 2200 UTC. Velocities for the bottom meter (194 m) are marked with a diamond and were recorded on 8 February 1993 at 2200 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

4 SECOND FIELD YEAR

4.1 Introduction

Underway ADCP surveys were made on all three hydrographic surveys during the second field year (April 1993 through March 1994). Dates are shown in Table 1 and mounting of the ADCP units is shown in Table 2. Continuous data were obtained along the tracks of the surveys, except during periods when instrument problems occurred or the system was shut off during long periods at a fixed location. All three surveys (H05, H06, and H07) were conducted aboard the R/V *J.W. Powell*. The configurations recorded for each ADCP cruise are shown in Table 12.

Table 12. ADCP configurations for H05, H06, and H07.

System Parameter	H05	H06	H07
Averaging interval (min)	5	5	5
Depth cell length (m)	4 (4.35)	4	4
Number of depth cells	100	100	100
Time between pings (sec)	1.75	0.67	0.67
Transmit pulse length (m)	4 (4.35)	4	4
Blank after transmit (m)	4 (4.35)	4	4
Navigation type	GPS	GPS	GPS
Data recorded	raw averaged navigation	raw averaged navigation	raw averaged navigation

4.2 Cruise H05

4.2.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *J.W. Powell*. The cruise covered the entire LATEX shelf. The Direct-Reading ADCP model was installed and the TRANSECT program was used during this survey. This was generally successful, although on 30 April, 3 May, and 7 May this software stuck at `checking Configuration and Data Path'. There were two other periods of down time occasioned by shipboard power failures on 8 May; each was less than an hour.

Several factors combined to significantly limit the vertical extent of the ADCP data collected during this cruise. The data suffered extensive contamination from flow-induced noise and bubbles most likely created by the high speeds of the vessel (the ship exceeded 9.5 knots much of the time). The contamination shows up as uniformly strong currents, typically seen in the depth bins below 50-75 m (e.g., see Figures 5.4.8 or 5.4.10). This contamination is serious enough to warrant rejecting the data set below that depth. However, as shown in section 2.4 the data in the upper water column are reliable. The parameter settings are shown in Table 13.

Table 13. Parameter settings (in meters) and the resulting sequence of bin depths on survey H05.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
3	4 (4.35)	4 (4.35)	11, 16, 20, 24, 29, 33, ...

The bin depth sequence is not an even multiple of 4. This is due to the fact that the electronic timing circuitry for the narrowband type ADCP model used during LATEX-A is fixed for a transducer head angle of 30°. Neither the ADCP's electronic circuitry nor the data collection software can be adjusted by the user if transducers with 20° heads are used, as were on this cruise. As simple consequence of trigonometry, a unit with 20° heads has a longer bin than the nominal value input by the operator. In this case, a 4 m `setting' results in 4.35 m for both the blank-beyond-transmit and the bin length. The first bin occurs at 11.7 m and every 4.35 m after that. In the post-processing step, the bin depth was truncated down to the nearest integer depth, resulting in the above sequence.

Additional QC processing is being considered to recover part of the data set. The aim of this processing will be to take advantage of the raw data collected by the TRANSECT software. Not all the pings in a five-minute average are contaminated; some are usable. By examining each of the pings individually using software designed by K. Leder, it may be possible to remove the contaminated pings from the five-minute average. Then the data set can be reprocessed. If this processing is successful, the data will be made available through the National Oceanographic Data Center and an addendum to this report will be issued.

4.2.2 Results

4.2.2.1 General Cruise Track

We show in Figure 5.1.1 a plan view of the general cruise track taken by the R/V *Powell* during H05. The cruise covered the entire shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 5.1.2 for which contoured profiles of normal velocity are presented in section 4.2.2.4. Figure 5.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 4.2.2.5.

4.2.2.2 Plan View of Stick Plot Velocity Vectors

Figure 5.2.1 shows the velocity from the surface bin centered at 11 m, Figure 5.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 5.2.3 shows the velocity from the bin centered at 100m below the surface.

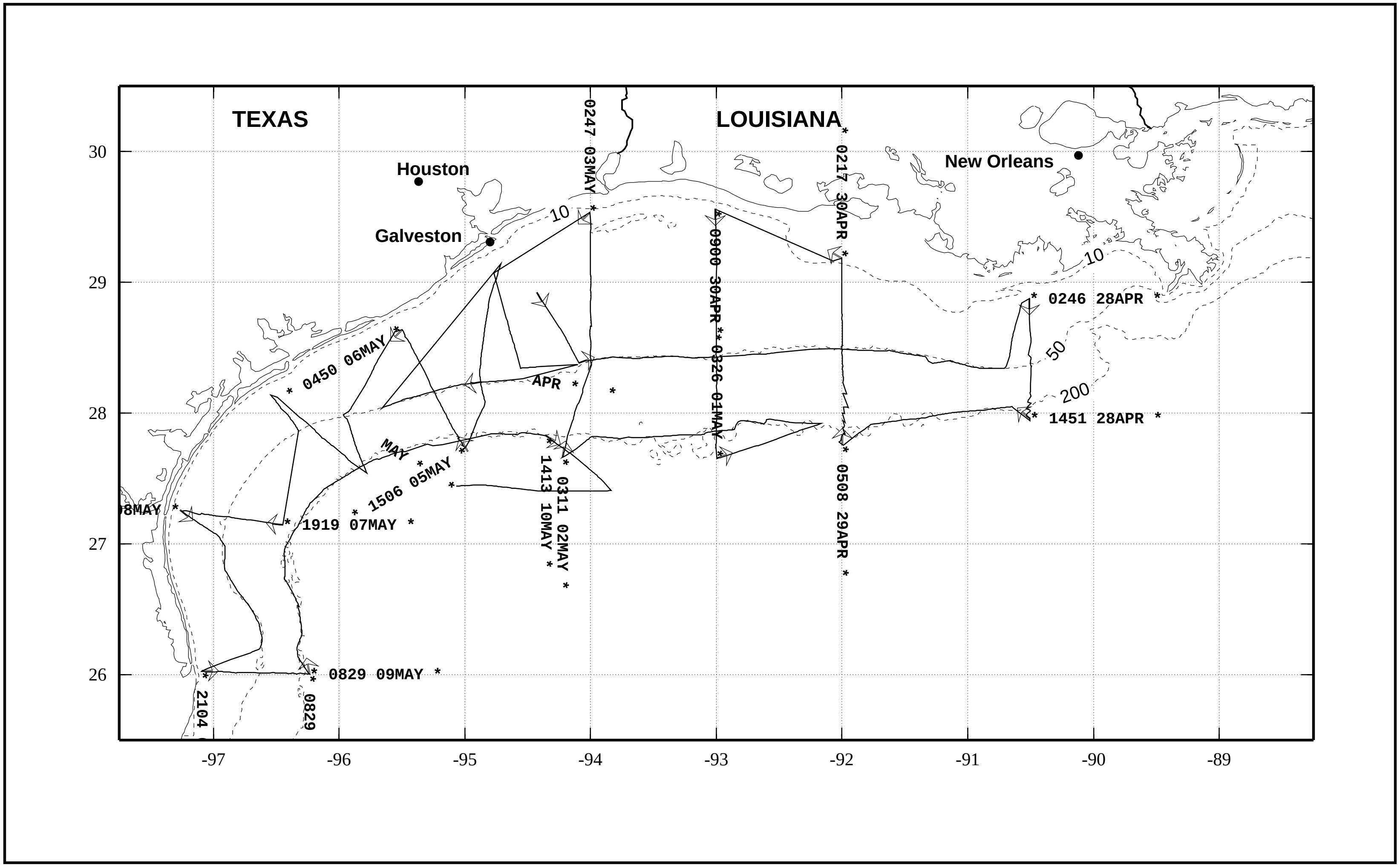

Figure 5.1.1 Cruise track taken during cruise H05, April 1993, showing times and directions.

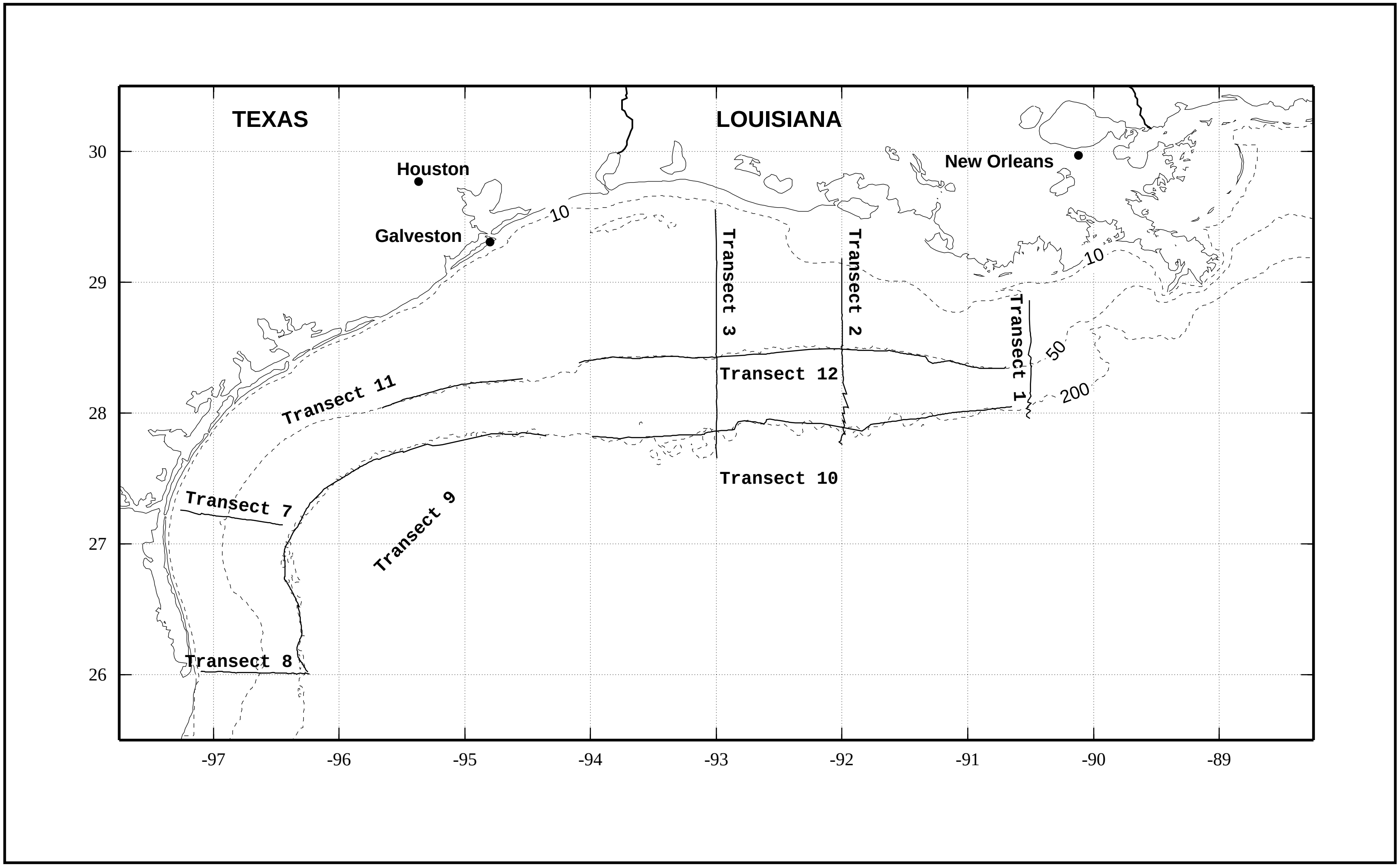

Figure 5.1.2 Cruise track taken during cruise H05, April 1993, showing individual labeled transects.

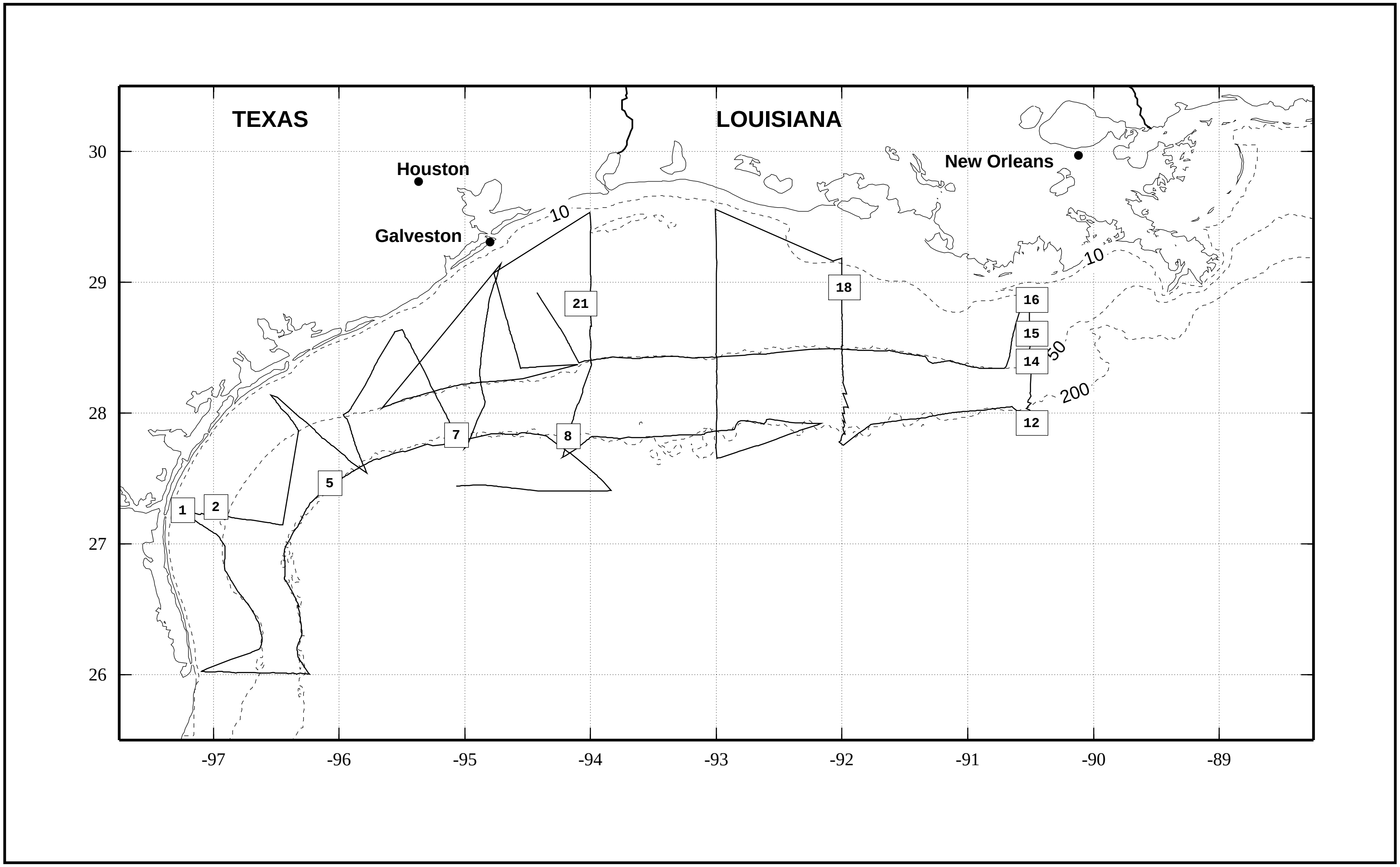

Figure 5.1.3 Cruise track taken during cruise H05, April 1993, showing current meter locations.

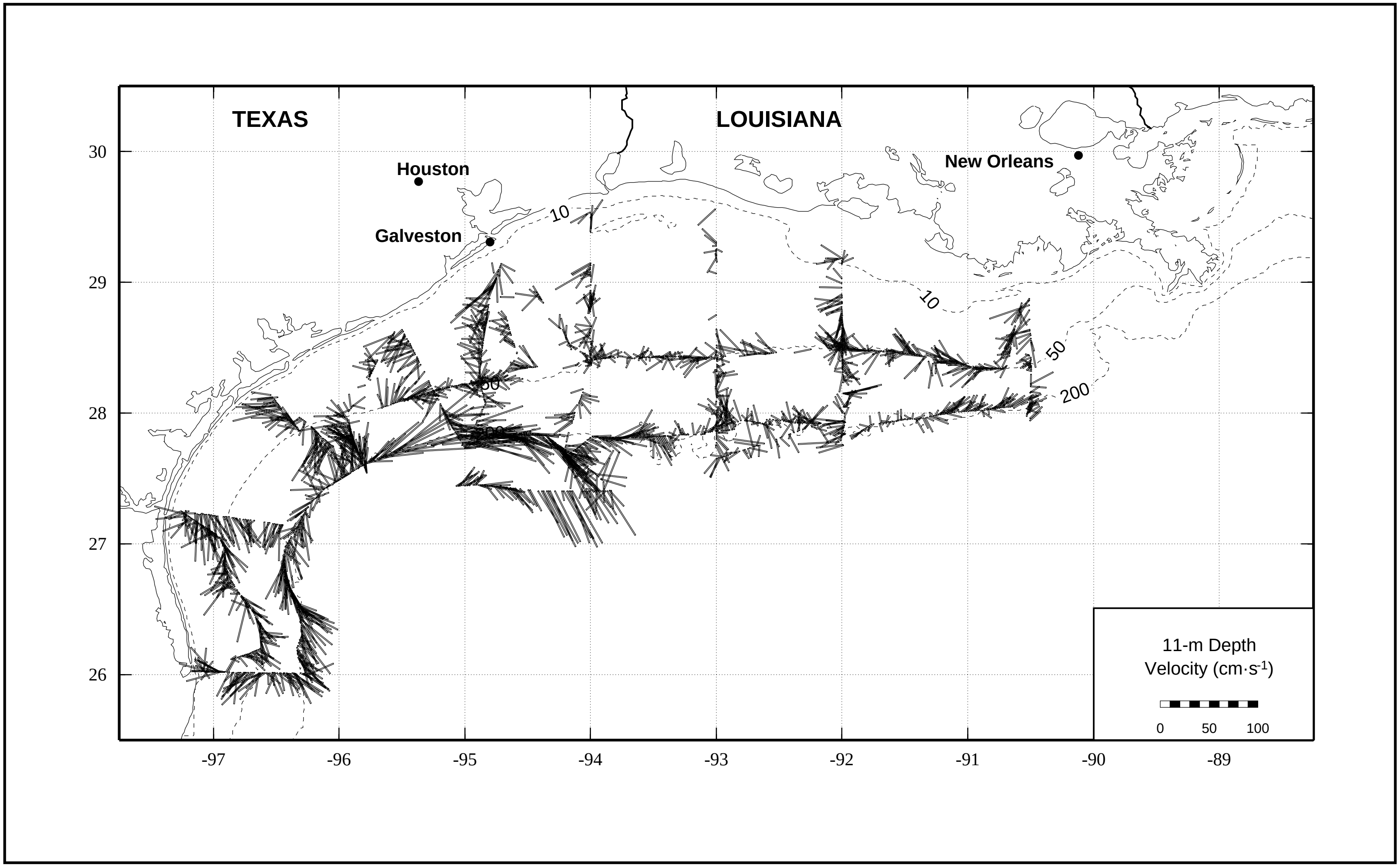

Figure 5.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 11 m depth. The data are from LATEX A cruise H05 conducted in April 1993

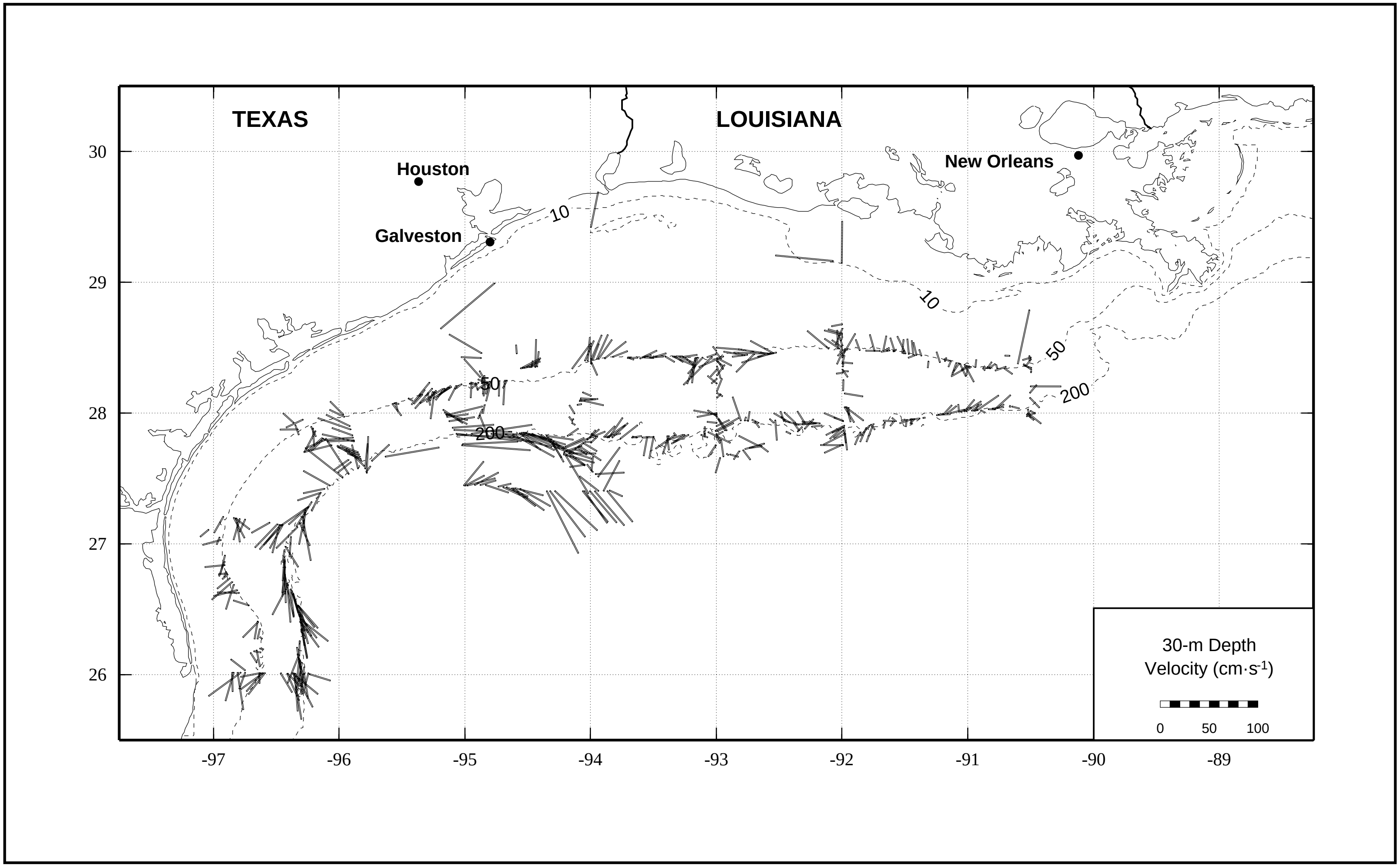

Figure 5.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H05 conducted in April 1993

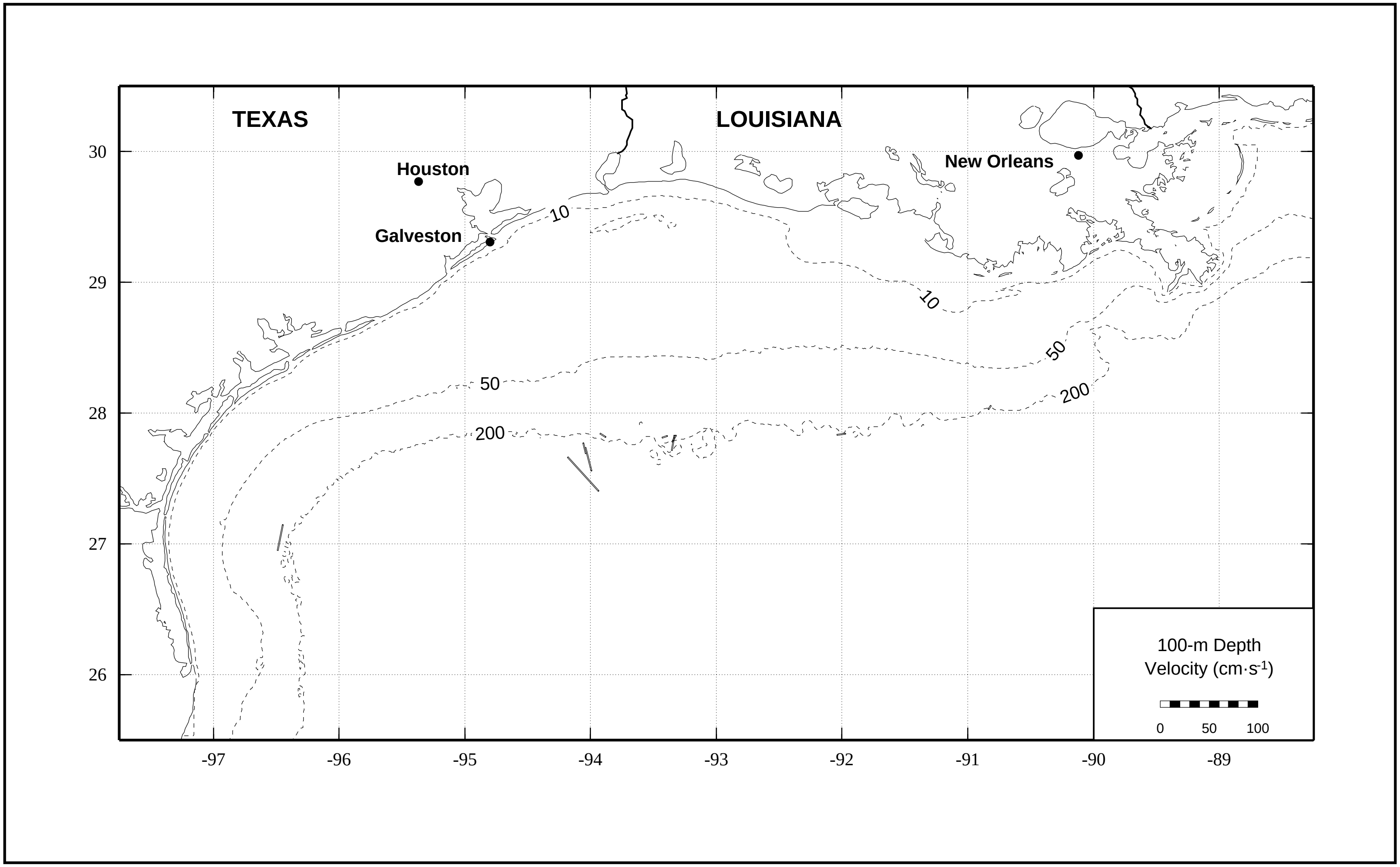

Figure 5.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H05 conducted in April 1993

4.2.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (GMT; Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 5.3.1 shows the velocity from the bin centered at 11 m, Figure 5.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 5.3.3 shows the velocity from the bin centered at 100 m below the surface.

4.2.2.4 Contoured Profiles of Normal Velocity

In Figures 5.4.1, 5.4.2, 5.4.3, 5.4.7, and 5.4.8 we show the velocity normal to across-shelf transects 1, 2, 3, 7, and 8, respectively. For the two along-shelf transects taken along the 200-m isobath, we show the normal velocity in Figure 5.4.9 and 5.4.10. For the two along-shelf transects taken along the 50-m isobath, we show the normal velocity in Figure 5.4.11 and 5.4.12. The transects are shown in Figure 5.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

4.2.2.5 Vertical Current Profiles

We show in Figures 5.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 5.1.3.

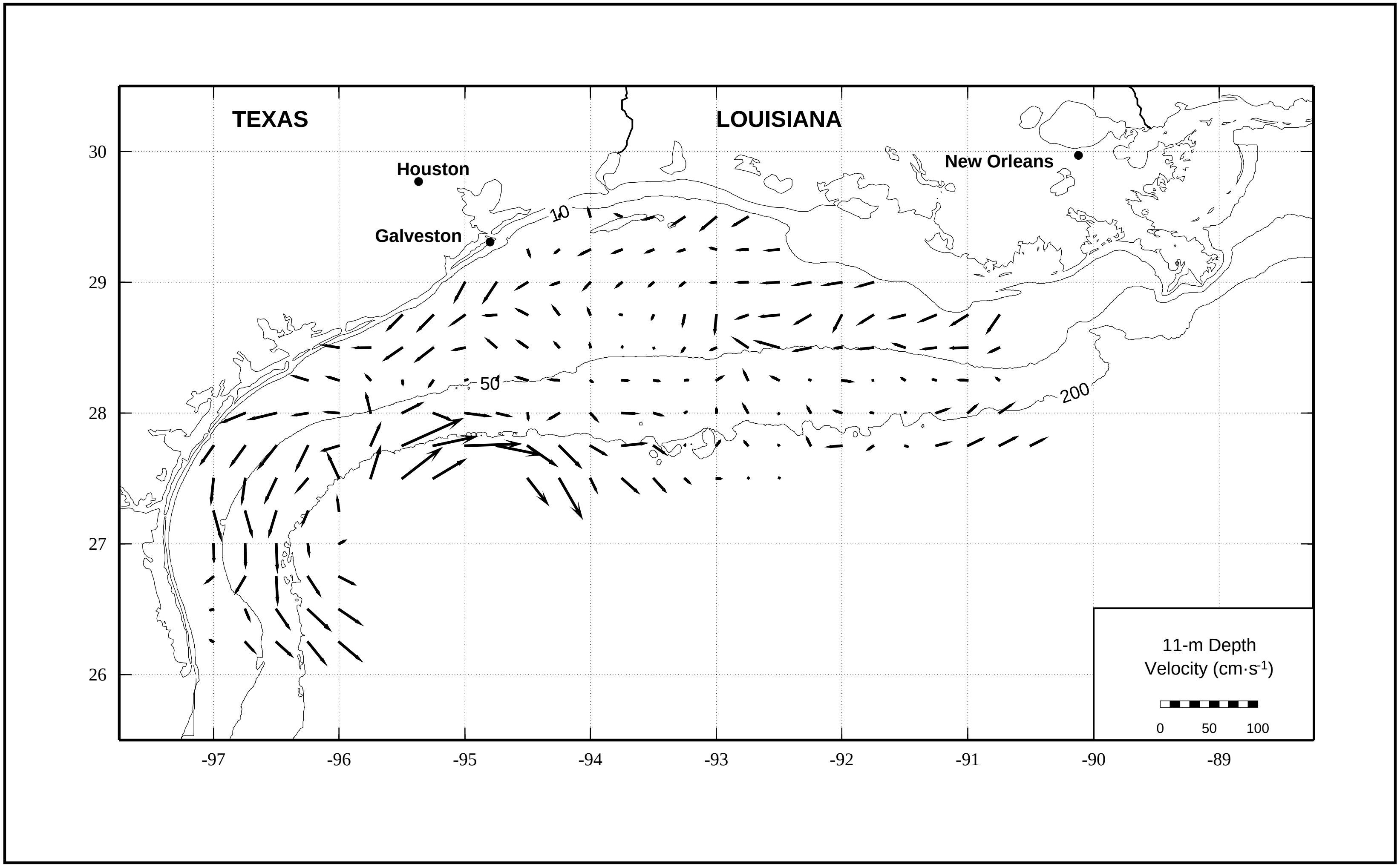

Figure 5.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 11 m depth. The data are from LATEX A cruise H05 conducted in April 1993

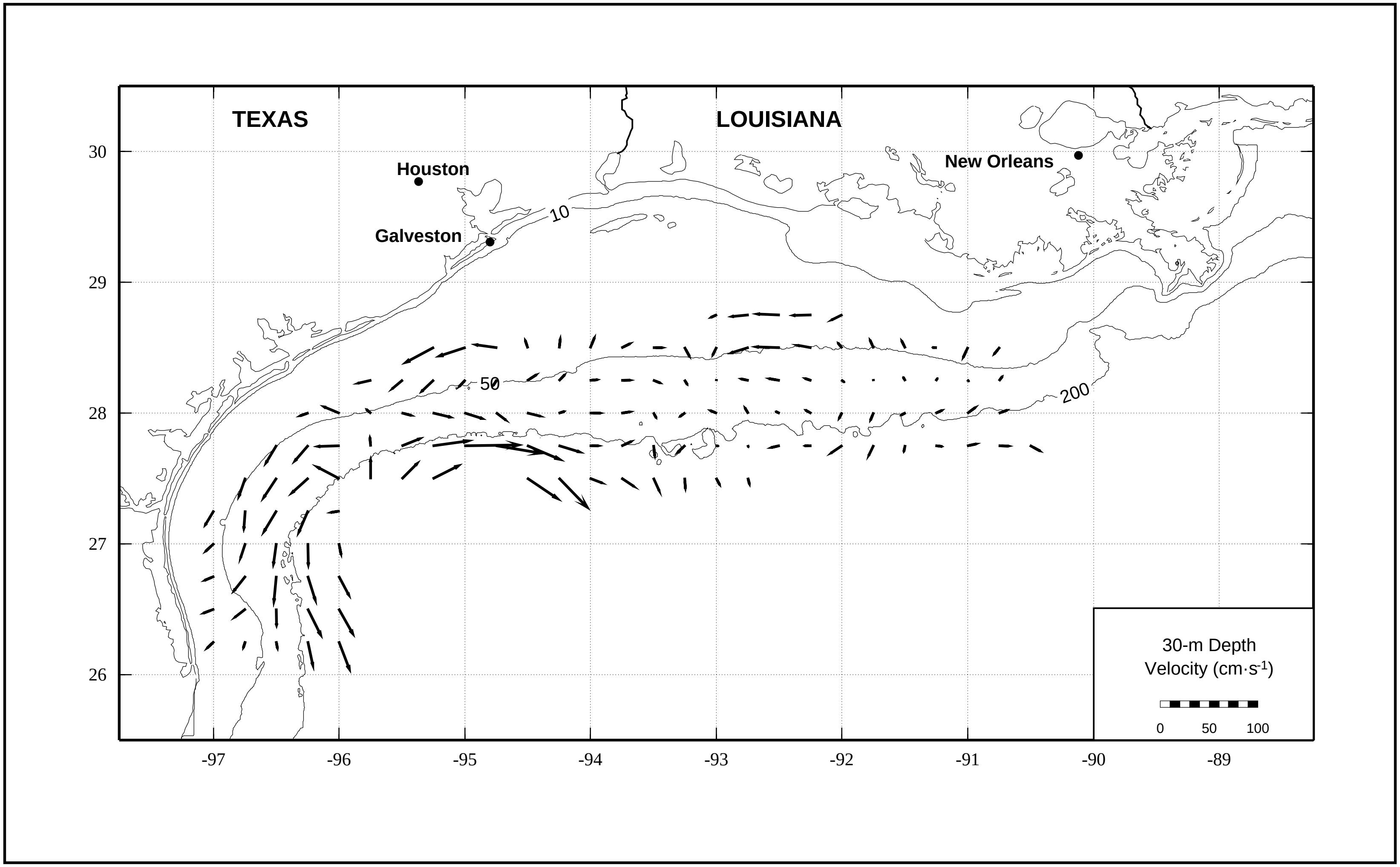

Figure 5.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H05 conducted in April 1993

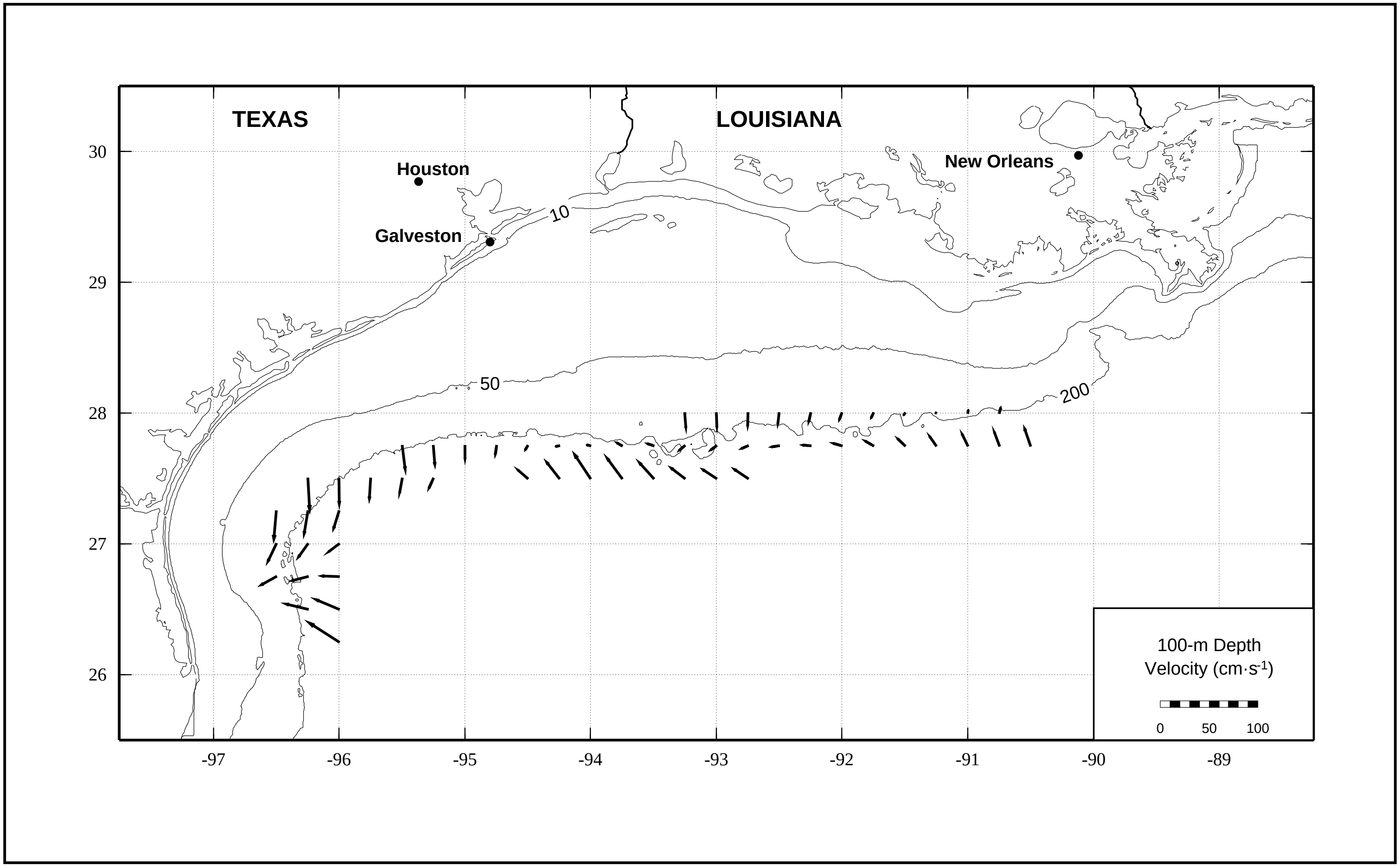

Figure 5.3.3. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H05 conducted in April 1993

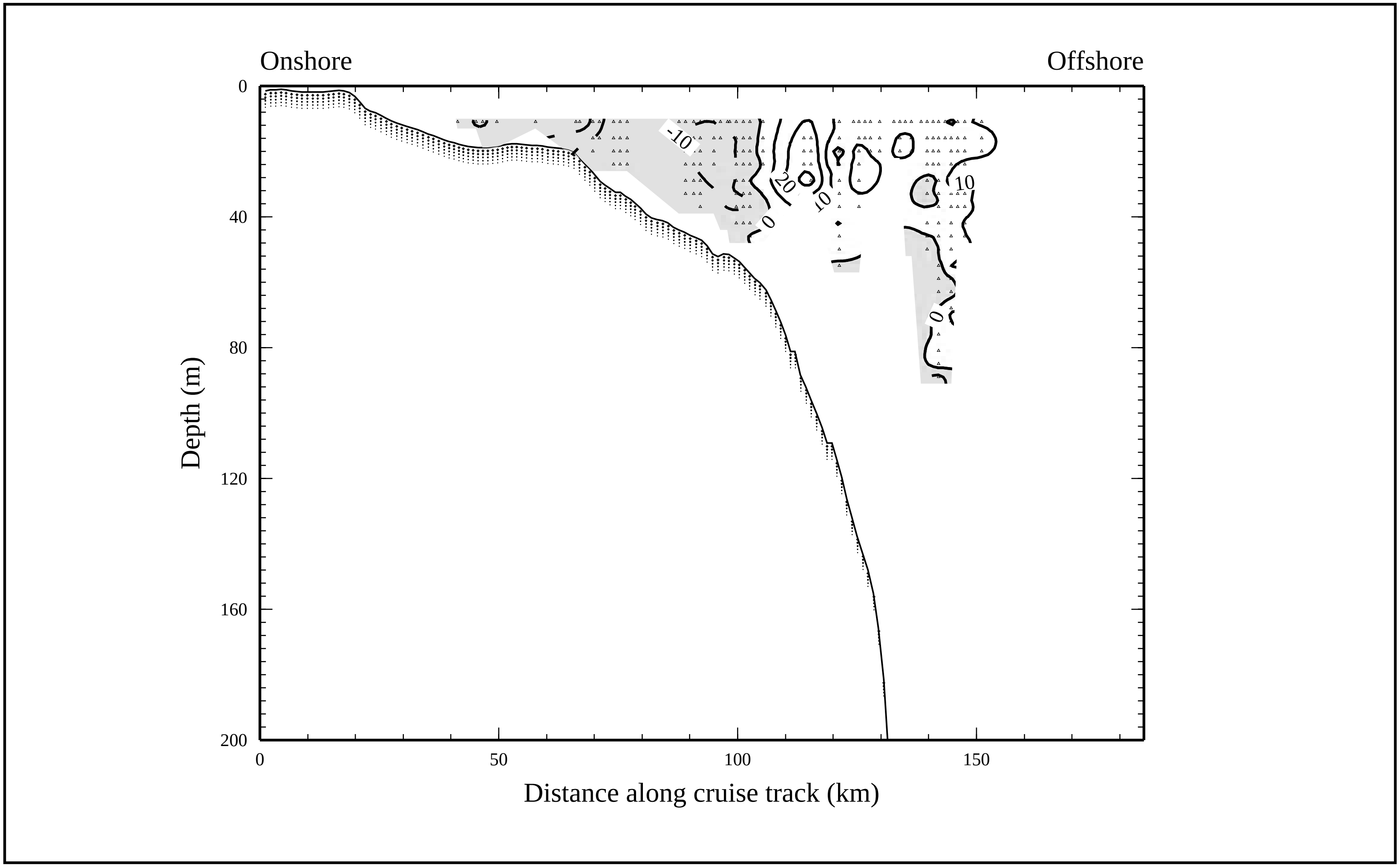

Figure 5.4.1. Vertical section of ADCP velocities (cm$^{\cdot-1}$) normal to transect 1 for cruise H05, April 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

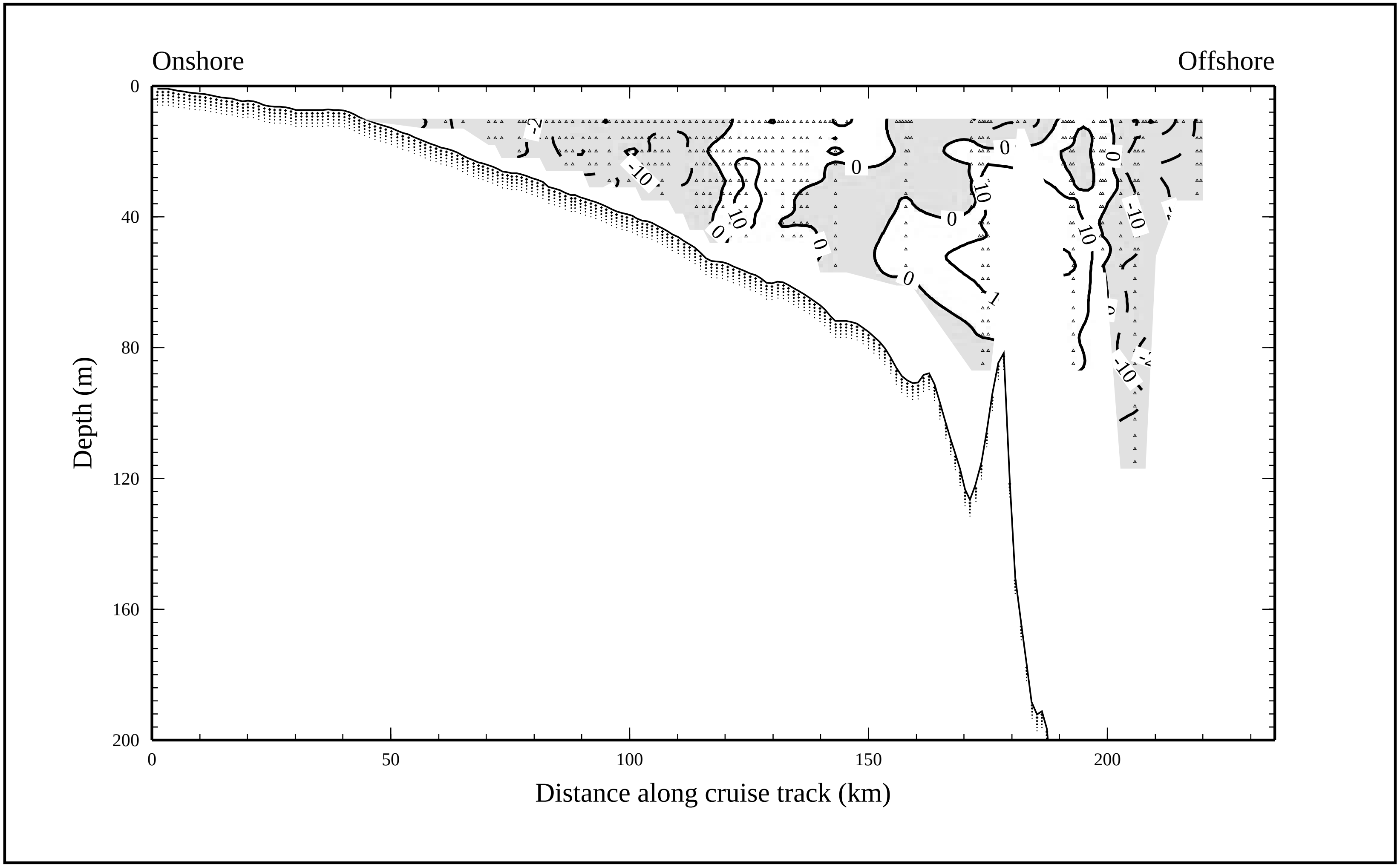

Figure 5.4.2. Vertical section of ADCP velocities (cm·$^{-1}$) normal to transect 2 for cruise H05, April 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

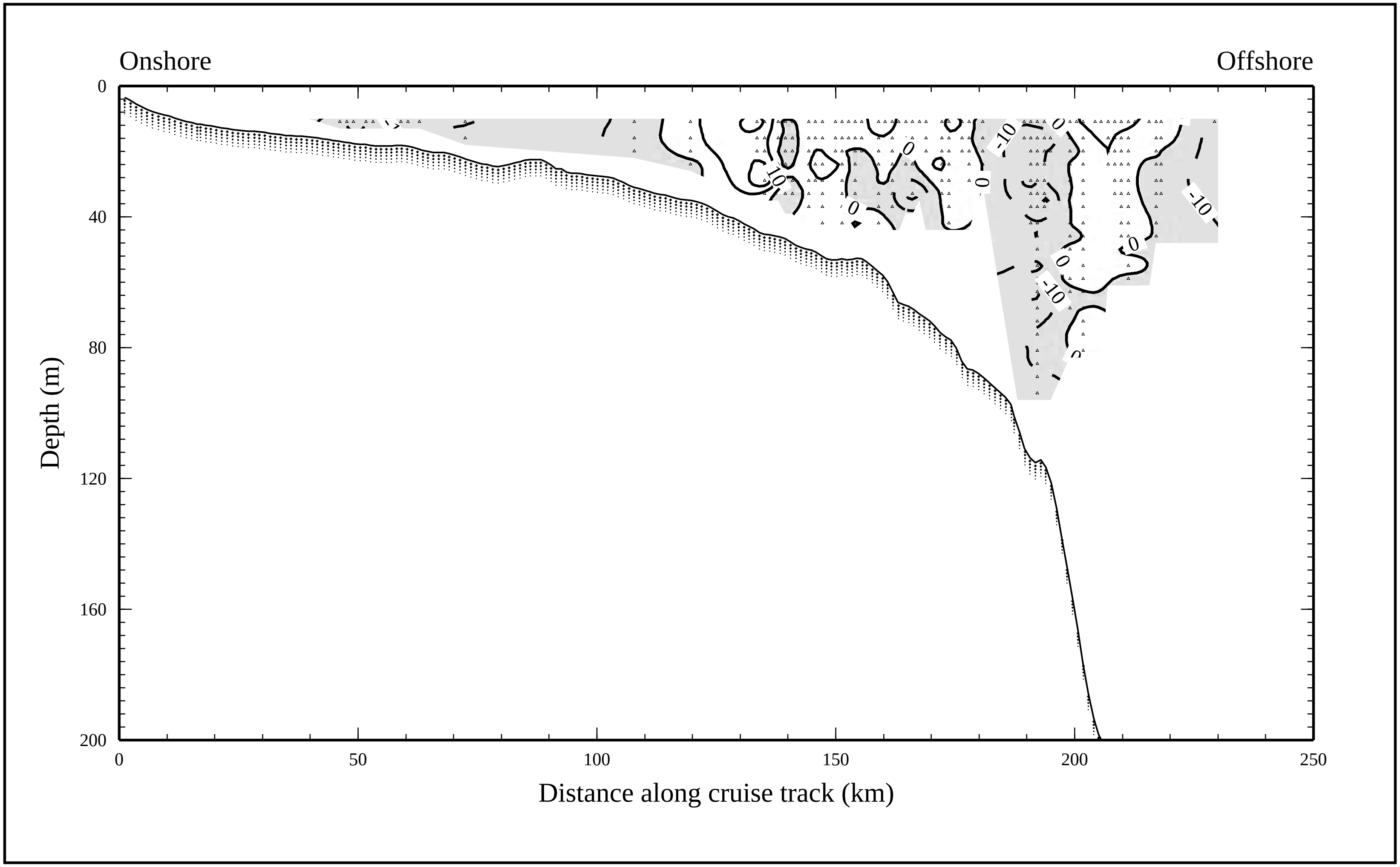

Figure 5.4.3. Vertical section of ADCP velocities (cm·$^{-1}$) normal to transect 3 for cruise H05, April 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

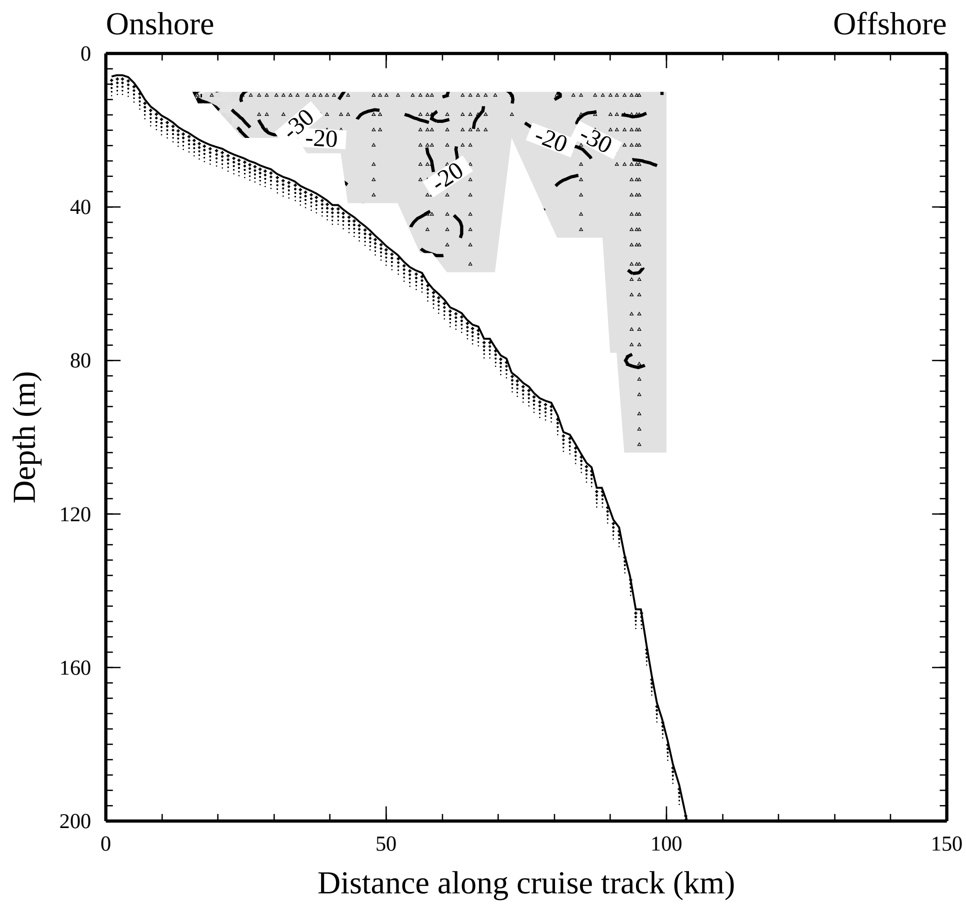

Figure 5.4.7. Vertical section of ADCP velocities (cm$\cdot^{-1}$) normal to transect 7 for cruise H05, April 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

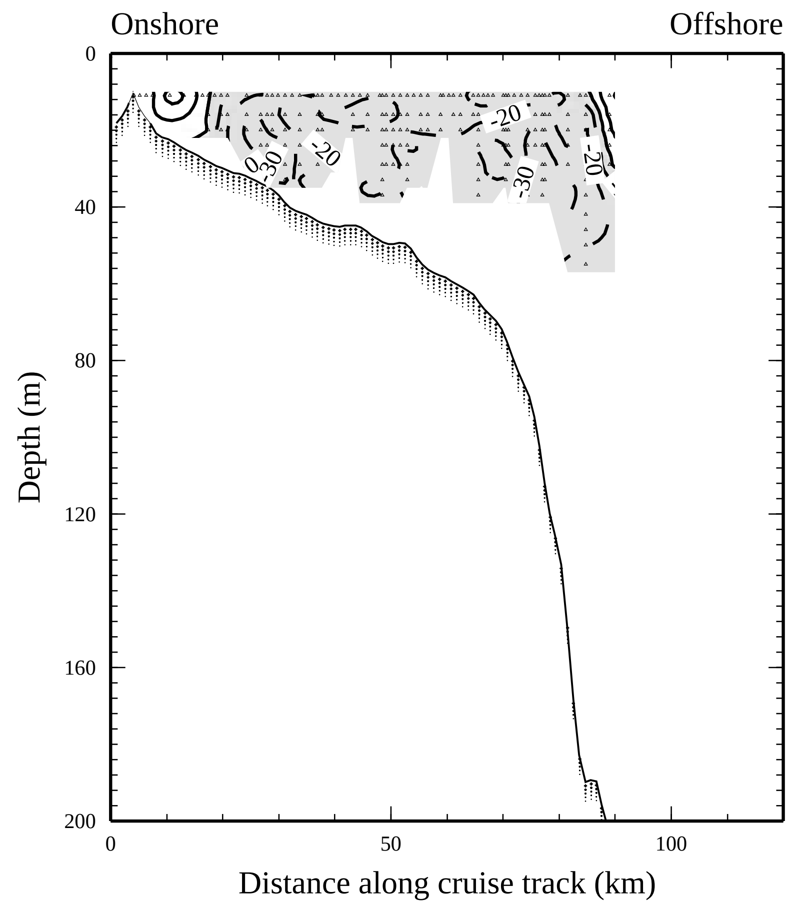

Figure 5.4.8. Vertical section of ADCP velocities ($cm \cdot^{-1}$) normal to transect 8 for cruise H05, April 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

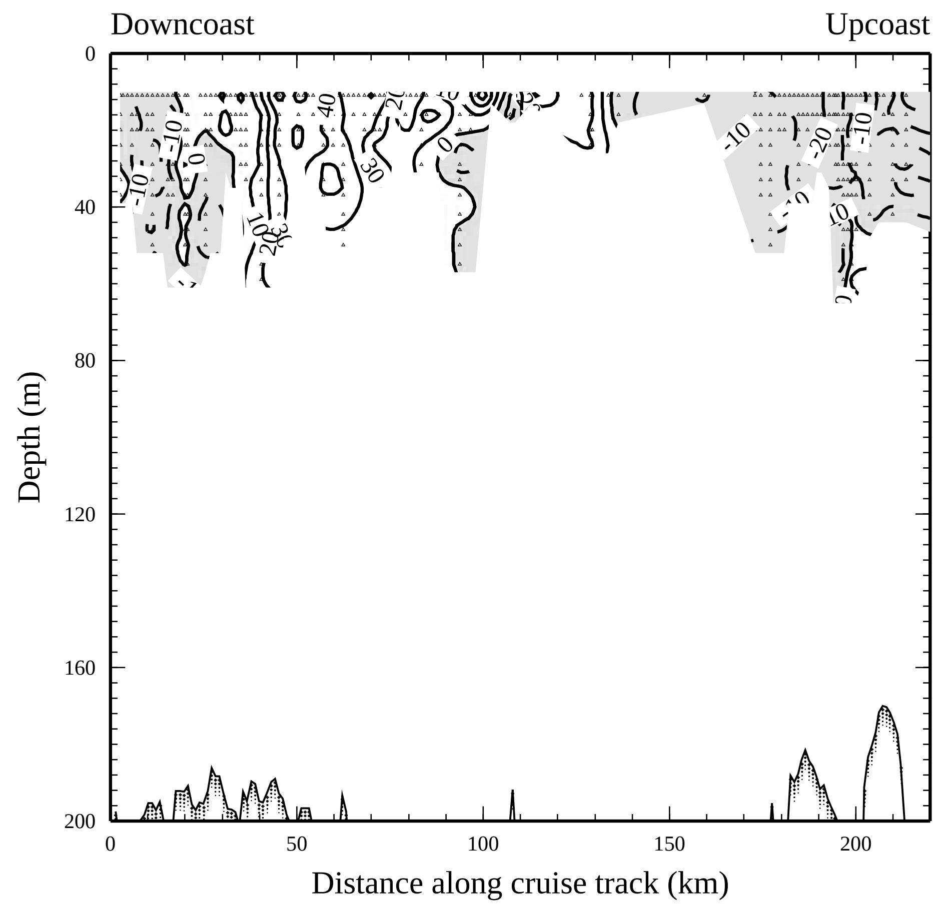

Figure 5.4.9. Vertical section of ADCP velocities (cm·$^{-1}$) normal to transect 9 for cruise H05, April 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

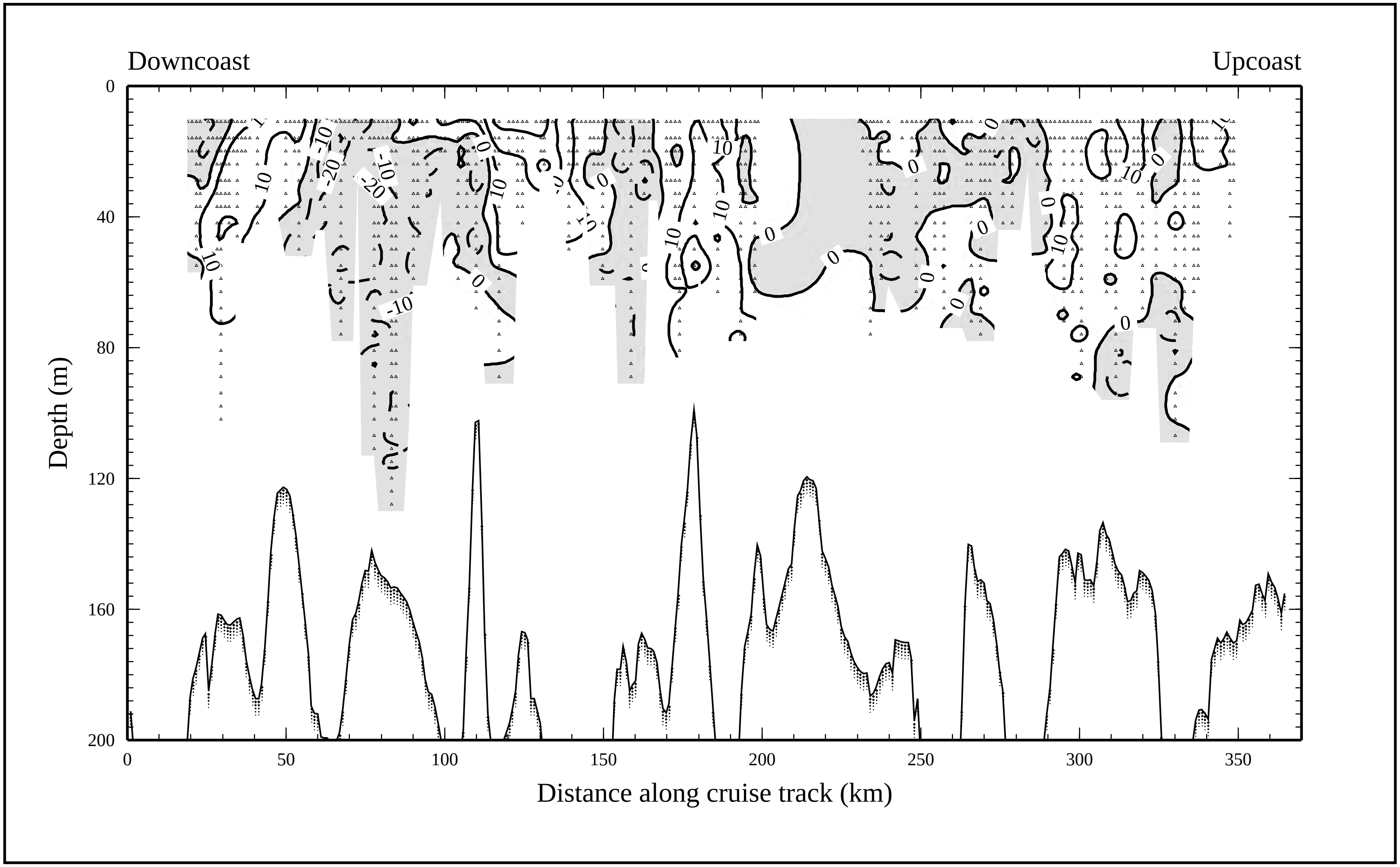

Figure 5.4.10. Vertical section of ADCP velocities (cm^{-1}) normal to transect 10 for cruise H05, April 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

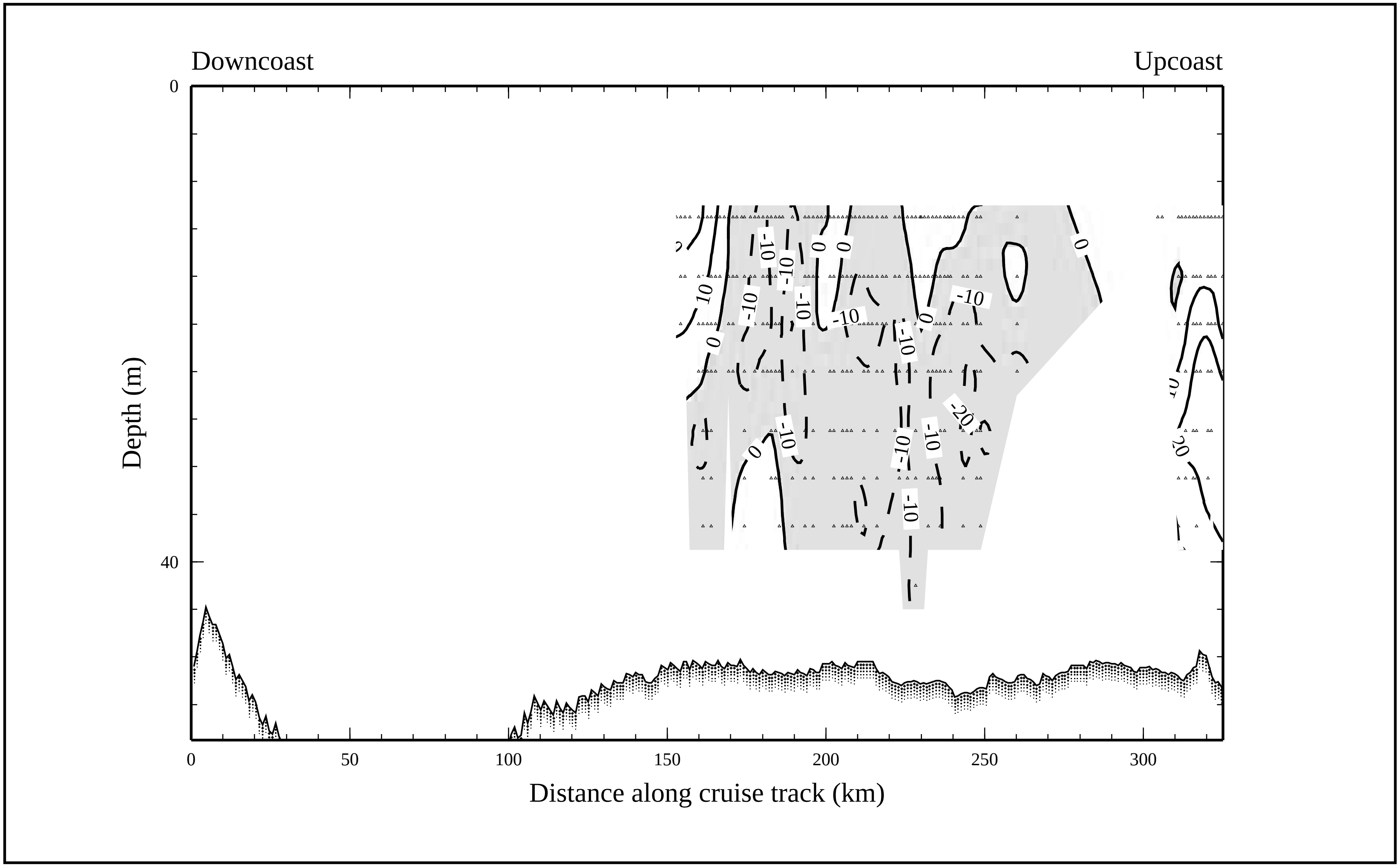

Figure 5.4.11. Vertical section of ADCP velocities (cm·$^{-1}$) normal to transect 11 for cruise H05, April 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

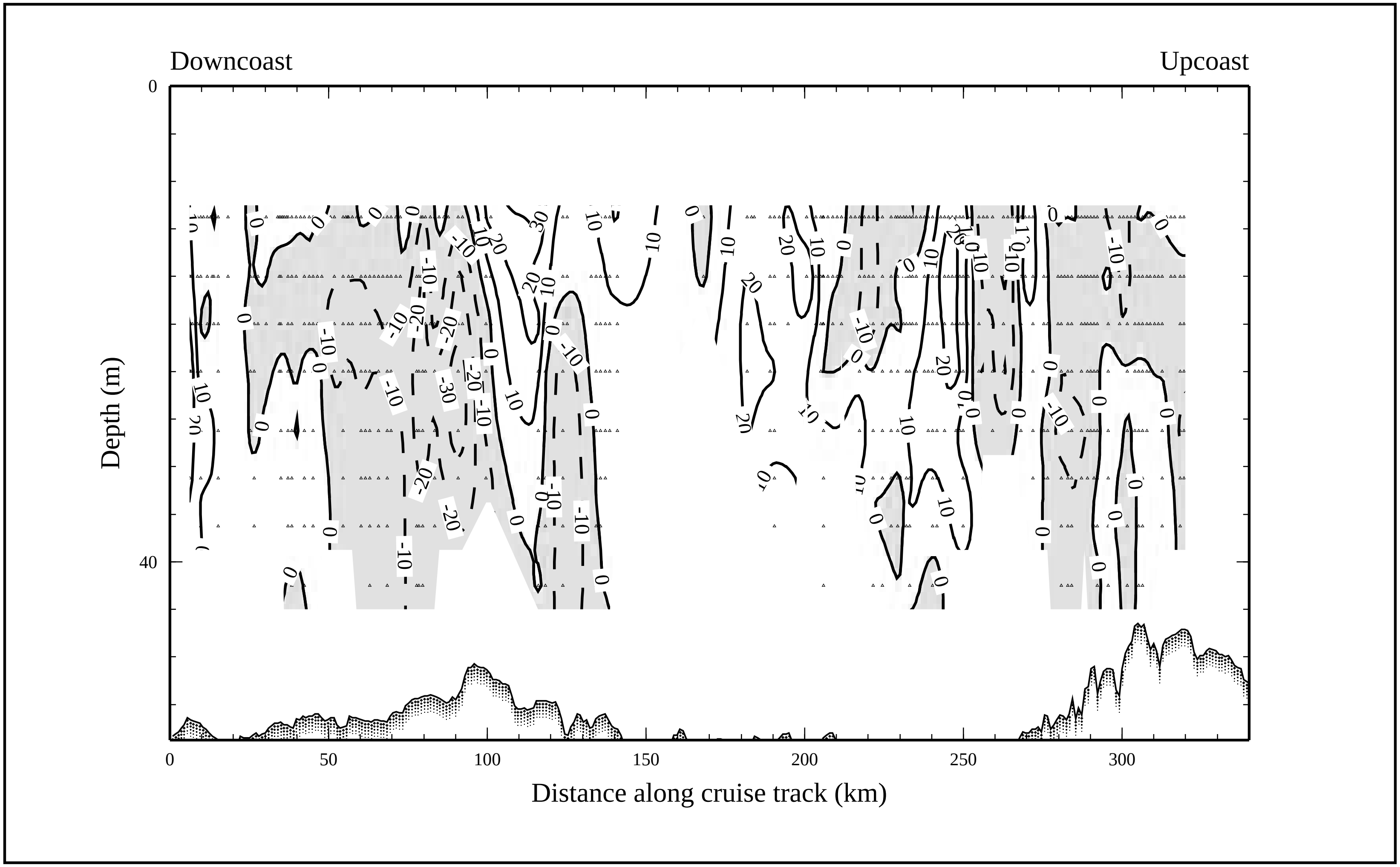

Figure 5.4.12. Vertical section of ADCP velocities (cm^{-1}) normal to transect 12 for cruise H05, April 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

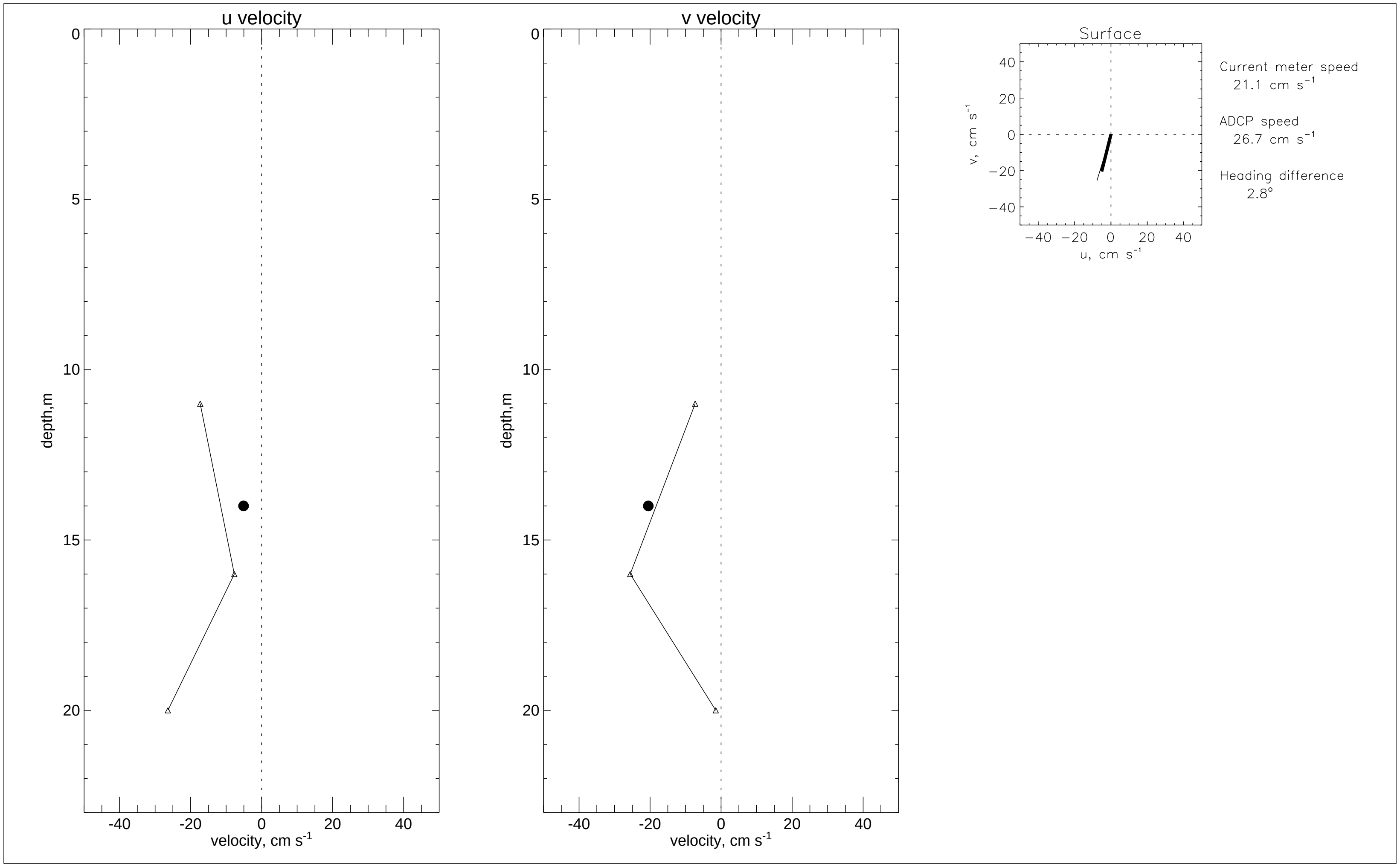

Figure 5.5.01. ADCP profile taken on 8 May 1993 at 0434 UTC (cruise H05) while passing by mooring CM01 at a distance of 1.1 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 8 May 1993 at 0430 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

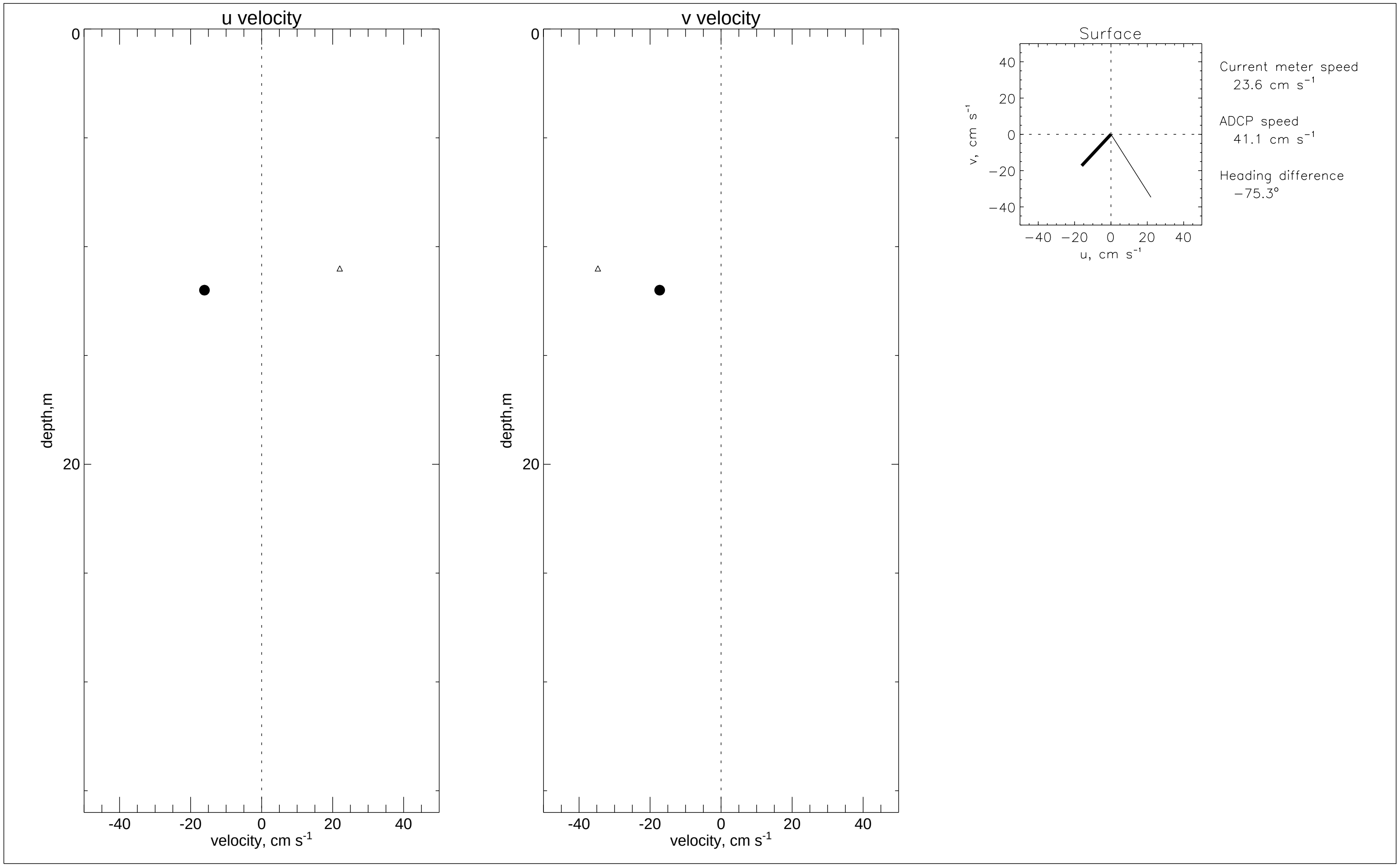

Figure 5.5.02. ADCP profile taken on 8 May 1993 at 0109 UTC (cruise H05) while passing by mooring CM02 at a distance of 6.8 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 8 May 1993 at 0100 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

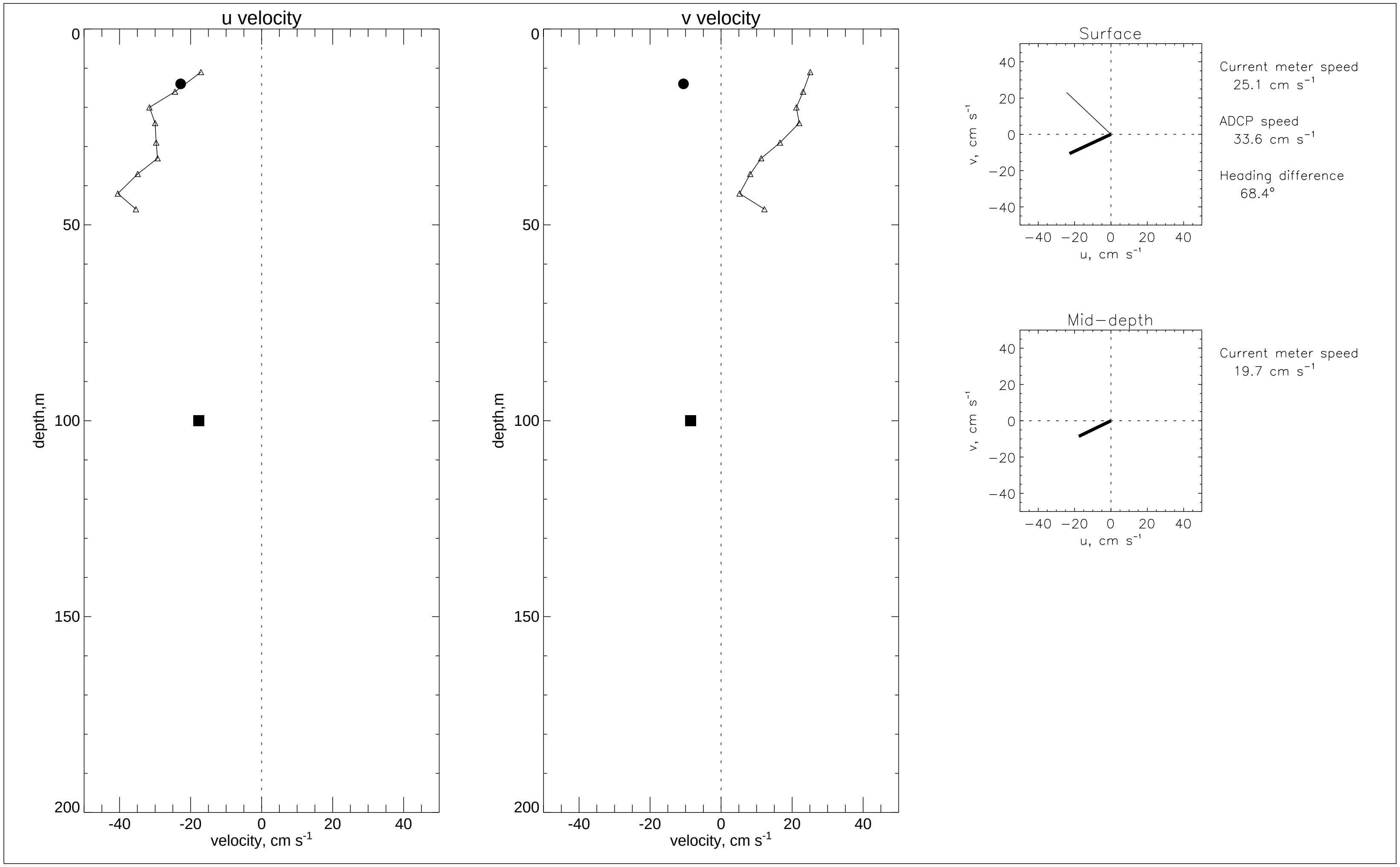

Figure 5.5.05. ADCP profile taken on 9 May 1993 at 2348 UTC (cruise H05) while passing by mooring CM05 at a distance of 1.8 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 10 May 1993 at 0000 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 10 May 1993 at 0000 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

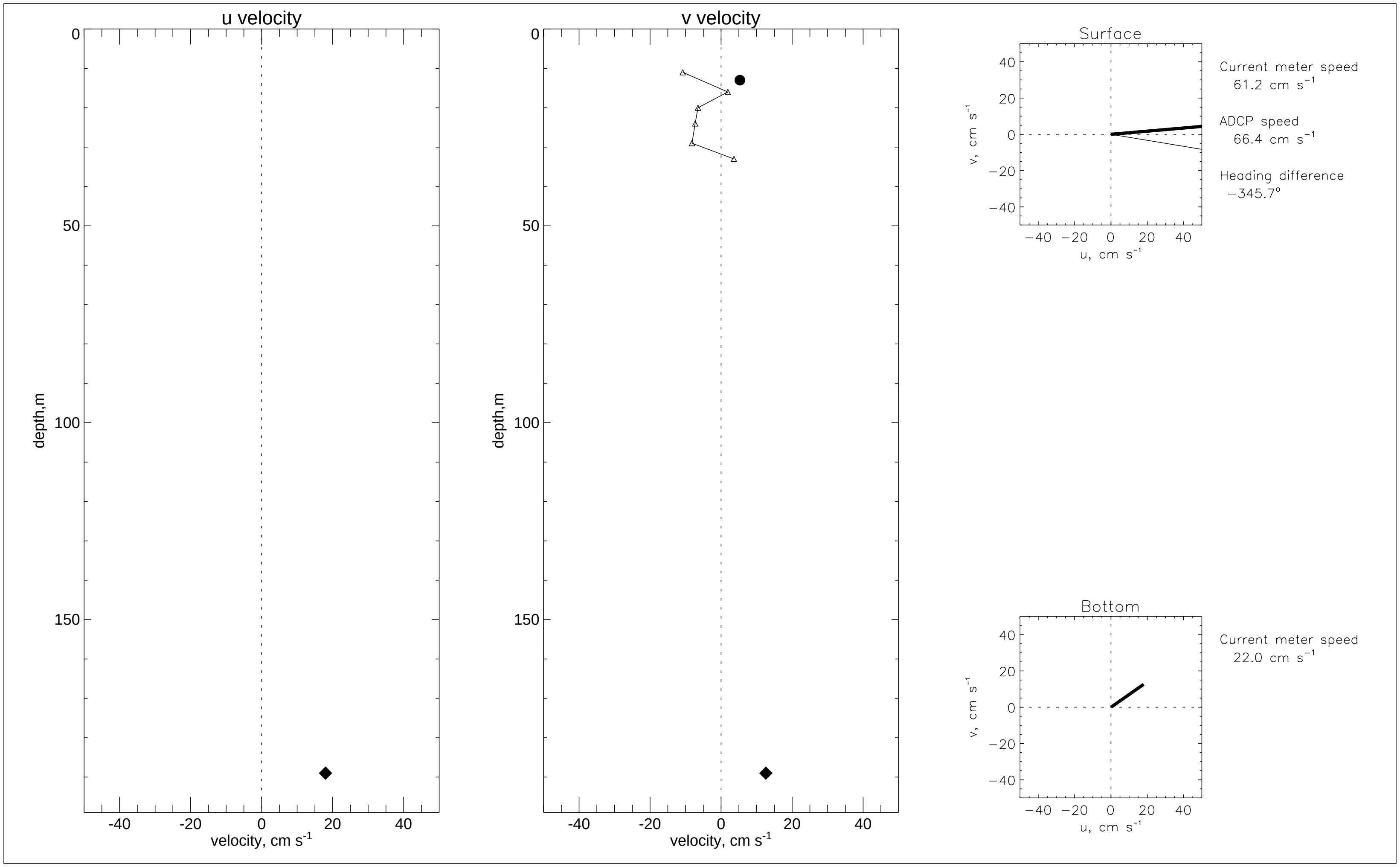

Figure 5.5.07. ADCP profile taken on 5 May 1993 at 1905 UTC (cruise H05) while passing by mooring CM07 at a distance of 0.7 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 5 May 1993 at 1900 UTC. Velocities for the bottom meter (189 m) are marked with a diamond and were recorded on 5 May 1993 at 1900 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

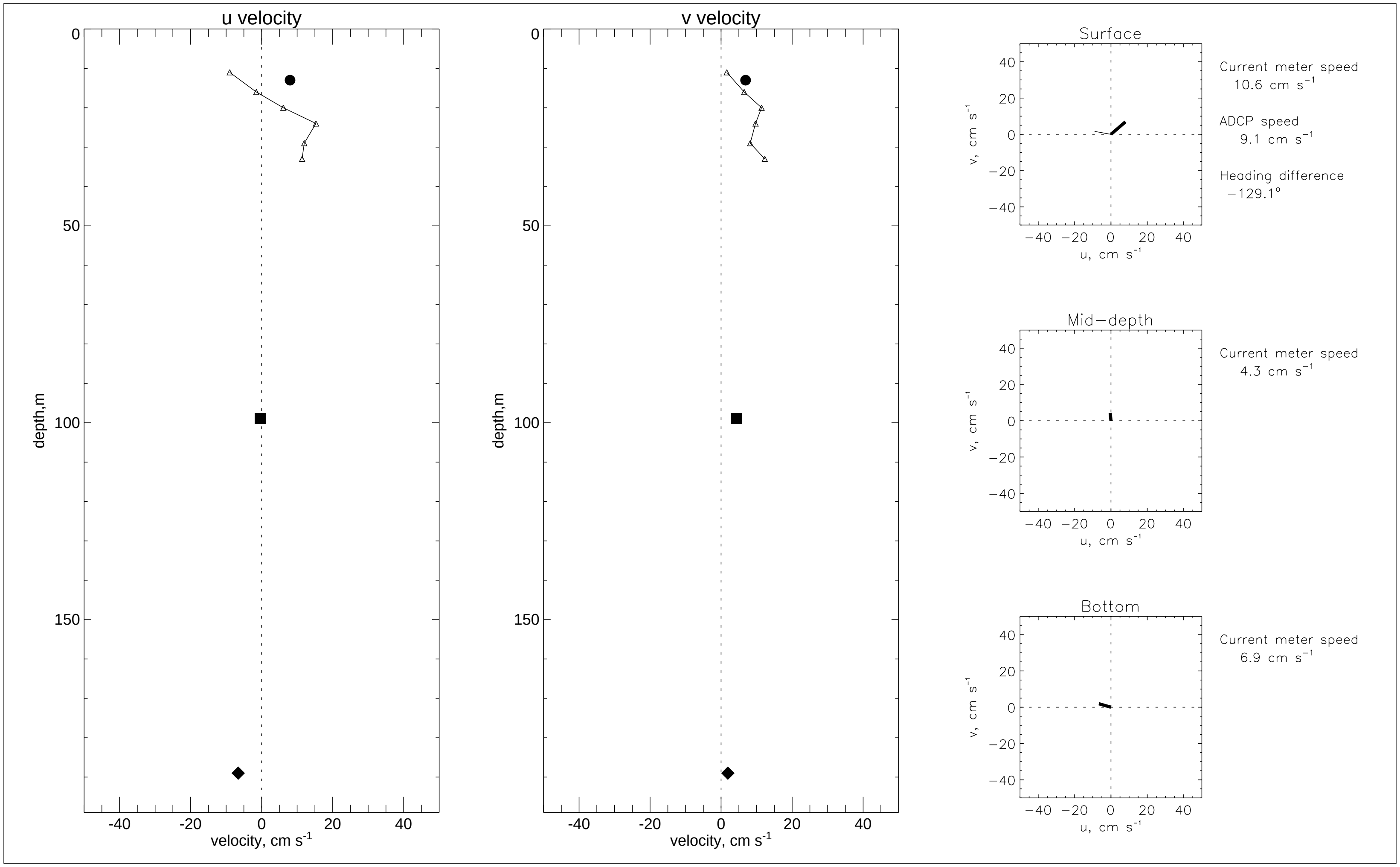

Figure 5.5.08. ADCP profile taken on 2 May 1993 at 0528 UTC (cruise H05) while passing by mooring CM08 at a distance of 0.5 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 2 May 1993 at 0530 UTC. Velocities for the mid-depth meter (99 m) are marked with a square and were recorded on 2 May 1993 at 0530 UTC. Velocities for the bottom meter (189 m) are marked with a diamond and were recorded on 2 May 1993 at 0530 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

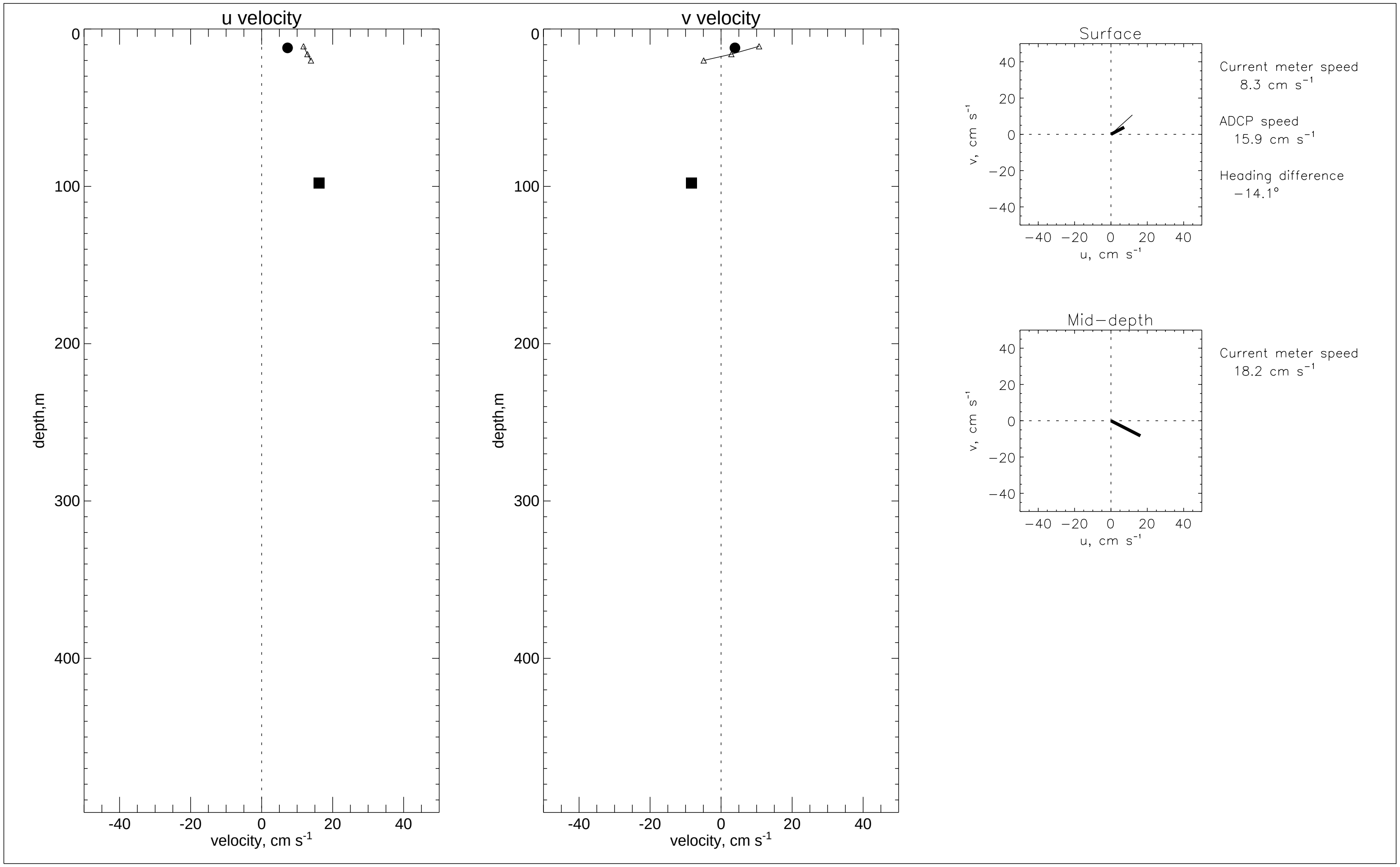

Figure 5.5.12. ADCP profile taken on 28 April 1993 at 1456 UTC (cruise H05) while passing by mooring CM12 at a distance of 1 .8 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 28 April 1993 at 1500 UTC. Velocities for the mid-depth meter (98 m) are marked with a square and were recorded on 28 April 1993 at 1500 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

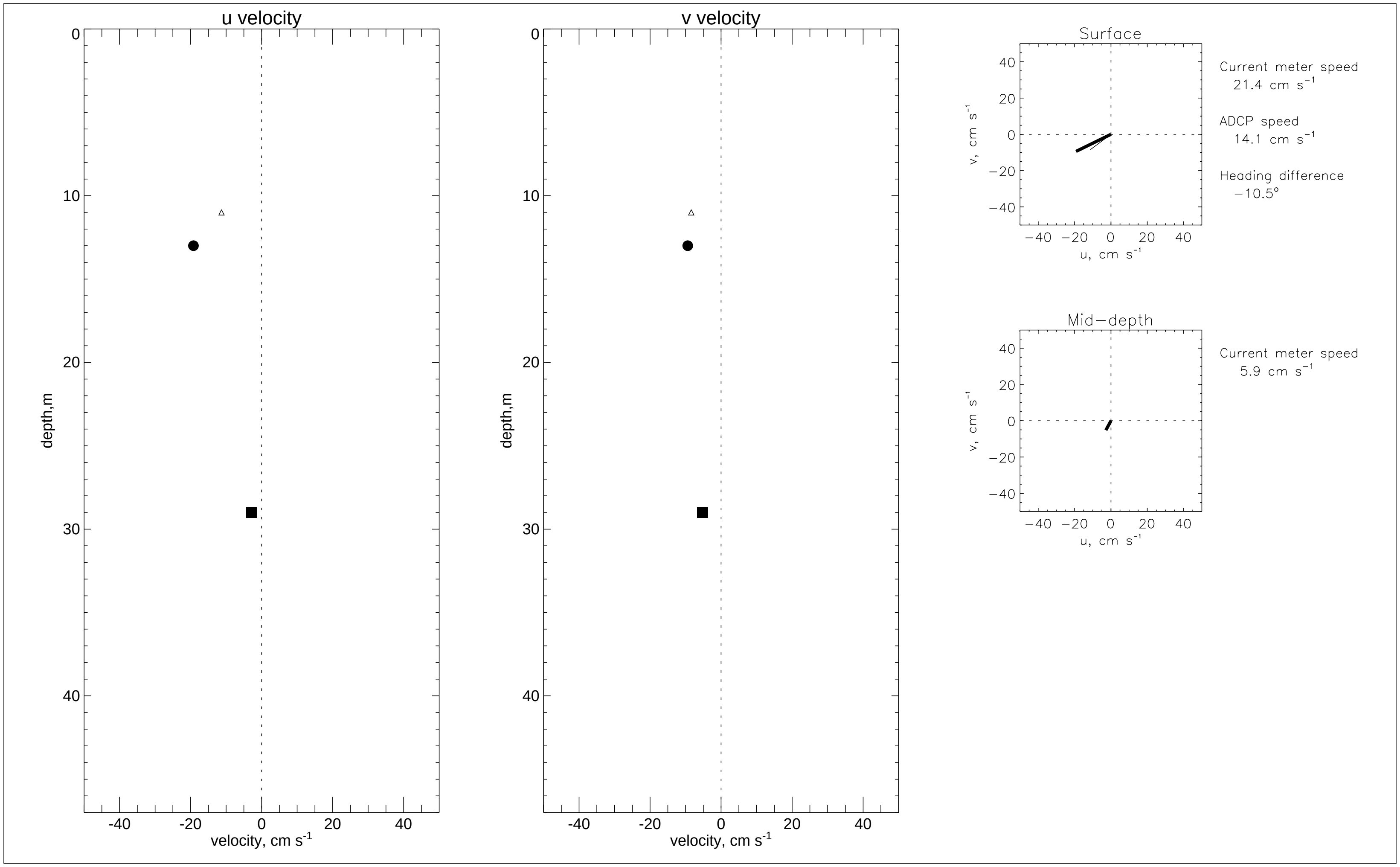

Figure 5.5.14. ADCP profile taken on 28 April 1993 at 0716 UTC (cruise H05) while passing by mooring CM14 at a distance of 0 .8 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 28 April 1993 at 0730 UTC. Velocities for the mid-depth meter (29 m) are marked with a square and were recorded on 28 April 1993 at 0715 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

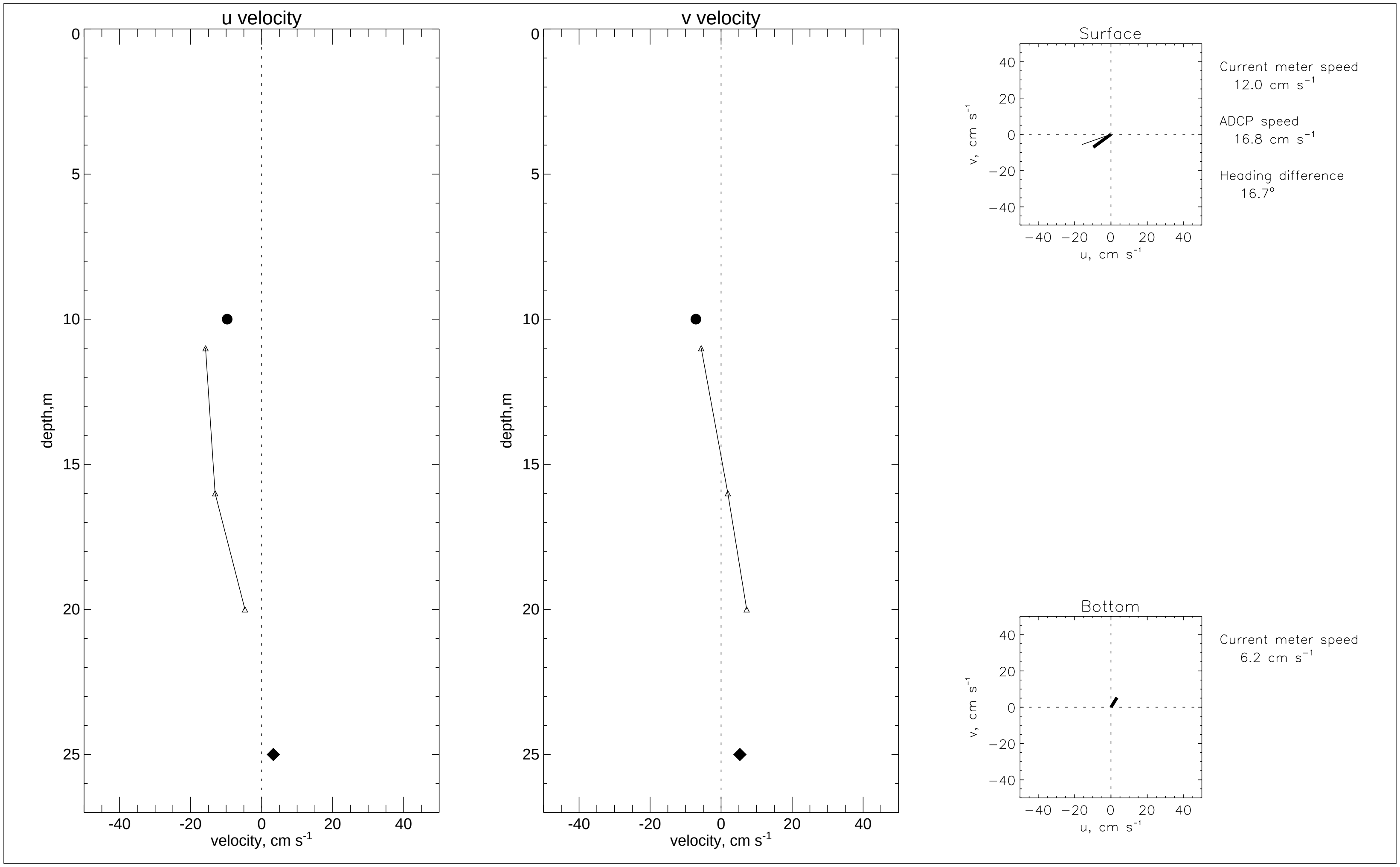

Figure 5.5.15. ADCP profile taken on 28 April 1993 at 0516 UTC (cruise H05) while passing by mooring CM15 at a distance of 1 .0 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 28 April 1993 at 0530 UTC. Velocities for the bottom meter (25 m) are marked with a diamond and were recorded on 28 April 1993 at 0515 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

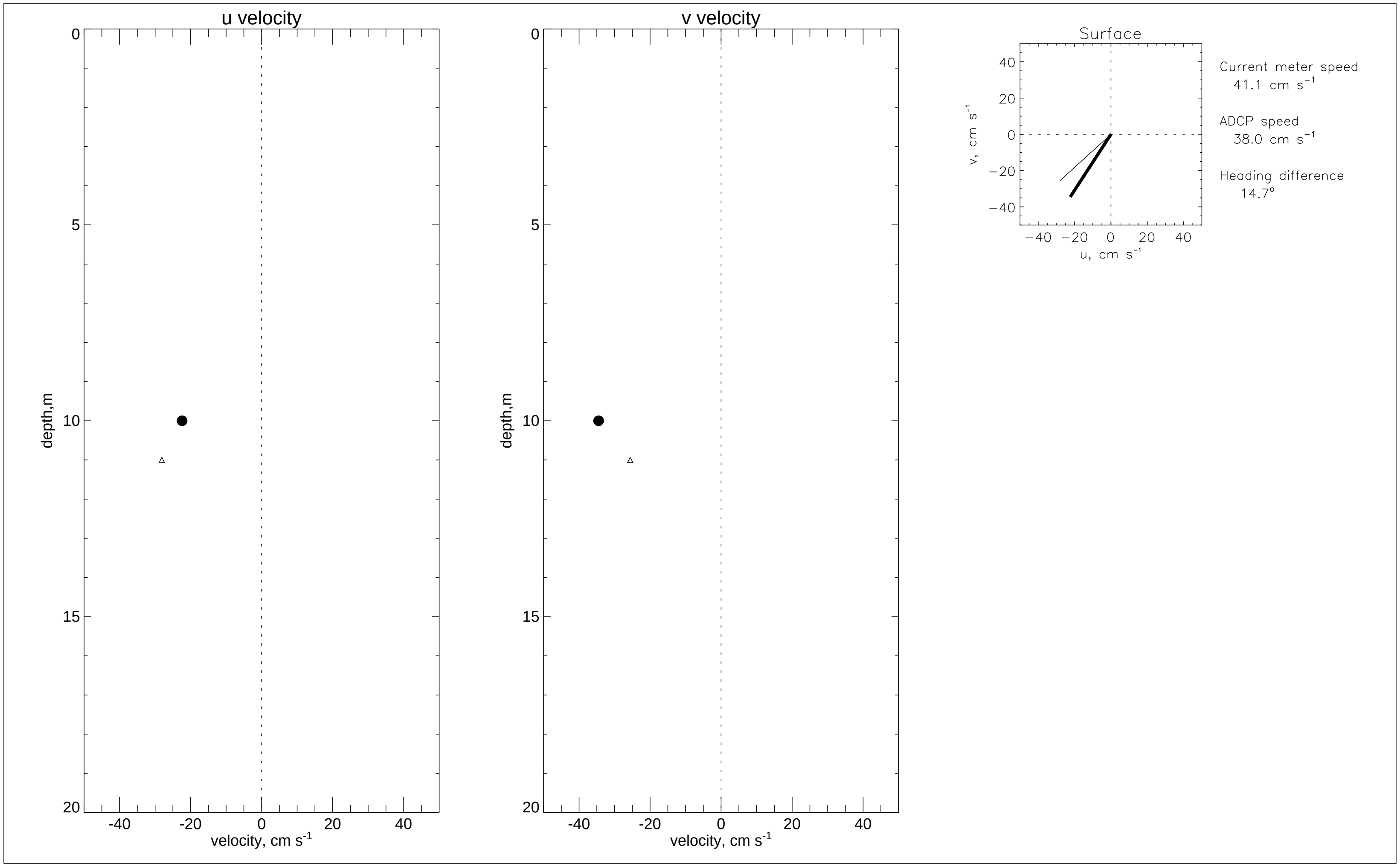

Figure 5.5.16. ADCP profile taken on 28 April 1993 at 0251 UTC (cruise H05) while passing by mooring CM16 at a distance of 2 .1 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 28 April 1993 at 0300 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

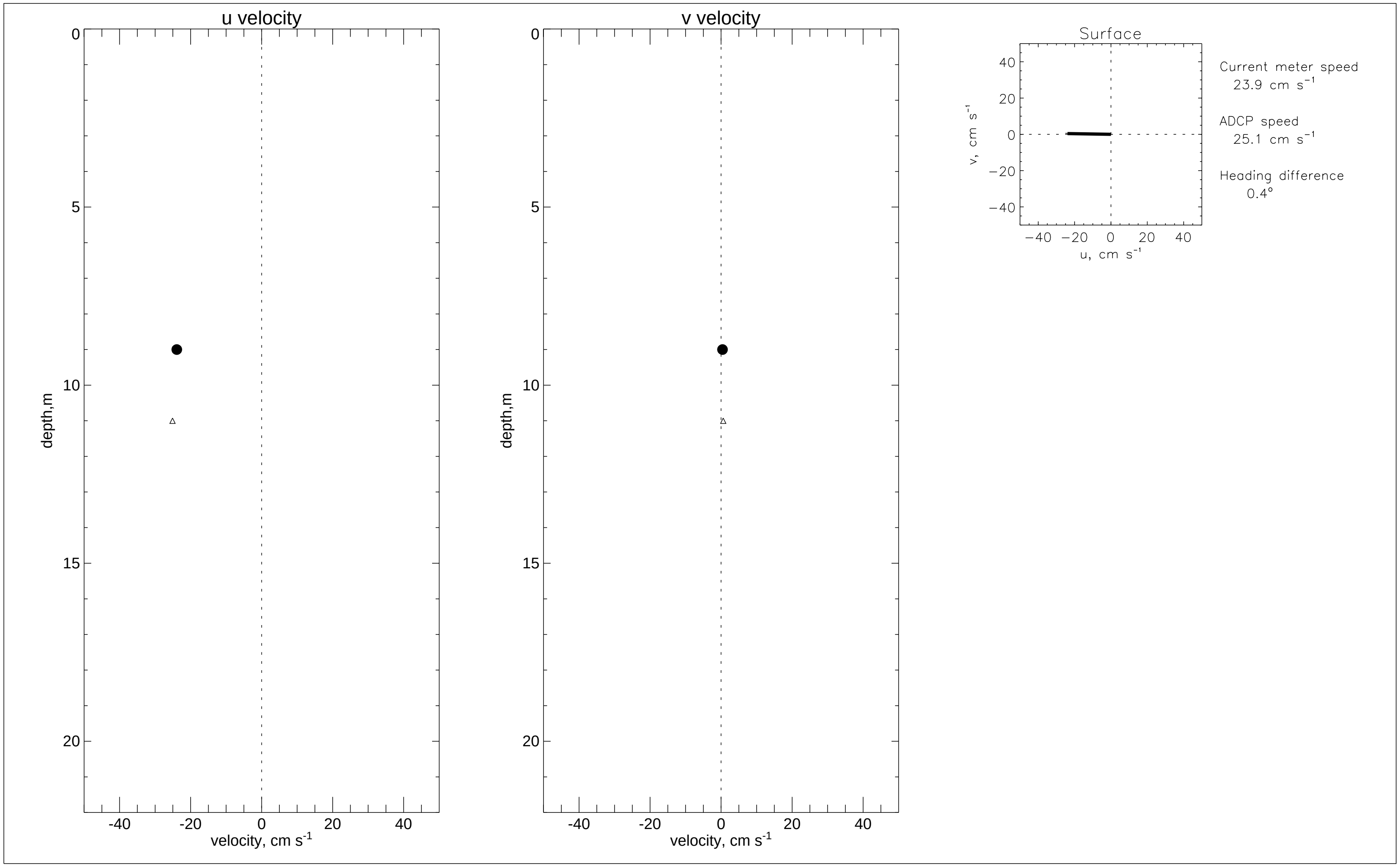

Figure 5.5.18. ADCP profile taken on 29 April 1993 at 2342 UTC (cruise H05) while passing by mooring CM18 at a distance of 1 .8 km. Velocities for the surface meter (9 m) are marked with a circle and were recorded on 29 April 1993 at 2330 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

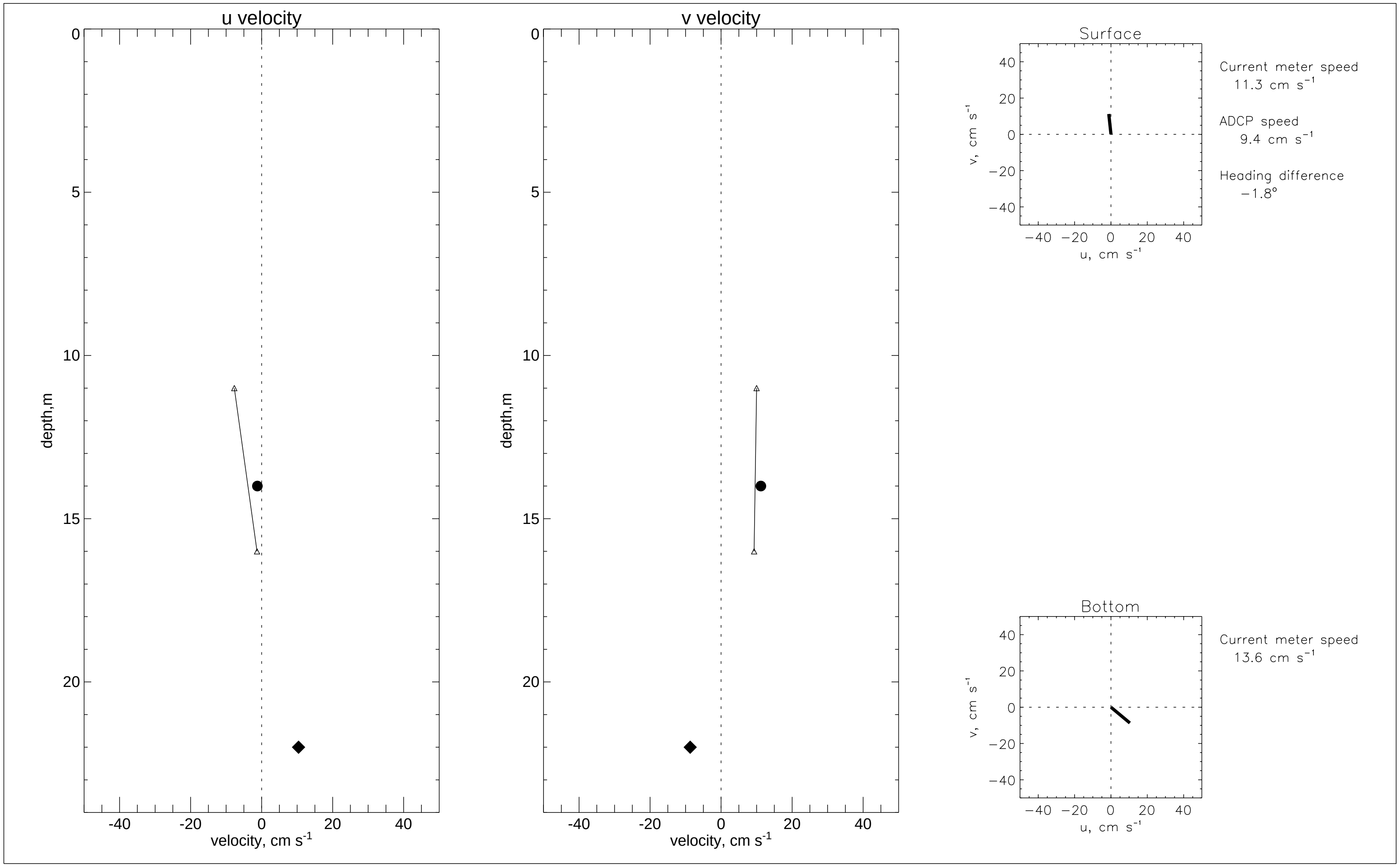

Figure 5.5.21. ADCP profile taken on 2 May 1993 at 1852 UTC (cruise H05) while passing by mooring CM21 at a distance of 7.8 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 2 May 1993 at 1900 UTC. Velocities for the bottom meter (22 m) are marked with a diamond and were recorded on 2 May 1993 at 1850 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

4.3 Cruise H06

4.3.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *J.W. Powell*. The cruise covered the entire LATEX shelf. The Vessel-Mount ADCP model was installed and the TRANSECT program was used during this survey. At the beginning of the cruise, the ADCP deck unit had difficulty receiving heading information from the gyrocompass on the R/V *Powell*. This was corrected by 15:57 UTC on July 26, 1993 and there were no difficulties with subsequent operation. Most parameter settings were unchanged from those of cruise H04; the time set between pings was changed to 0.67 seconds. The QA/QC processing produced usable data. The parameter settings are shown in Table 14.

Table 14. Parameter settings (in meters) and the resulting sequence of bin depths on survey H06.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
2	4	4	10, 14, 18, 22, ...

4.3.2 Results

4.3.2.1 General Cruise Track

We show in Figure 6.1.1 a plan view of the general cruise track taken by the R/V *Powell* during H06. The cruise covered the entire shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 6.1.2 for which contoured profiles of normal velocity are presented in section 4.3.2.4. Figure 6.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 4.3.2.5.

4.3.2.2 Plan View of Stick Plot Velocity Vectors

Figure 6.2.1 shows the velocity from the surface bin centered at 10 m, Figure 6.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 6.2.3 shows the velocity from the bin centered at 100m below the surface.

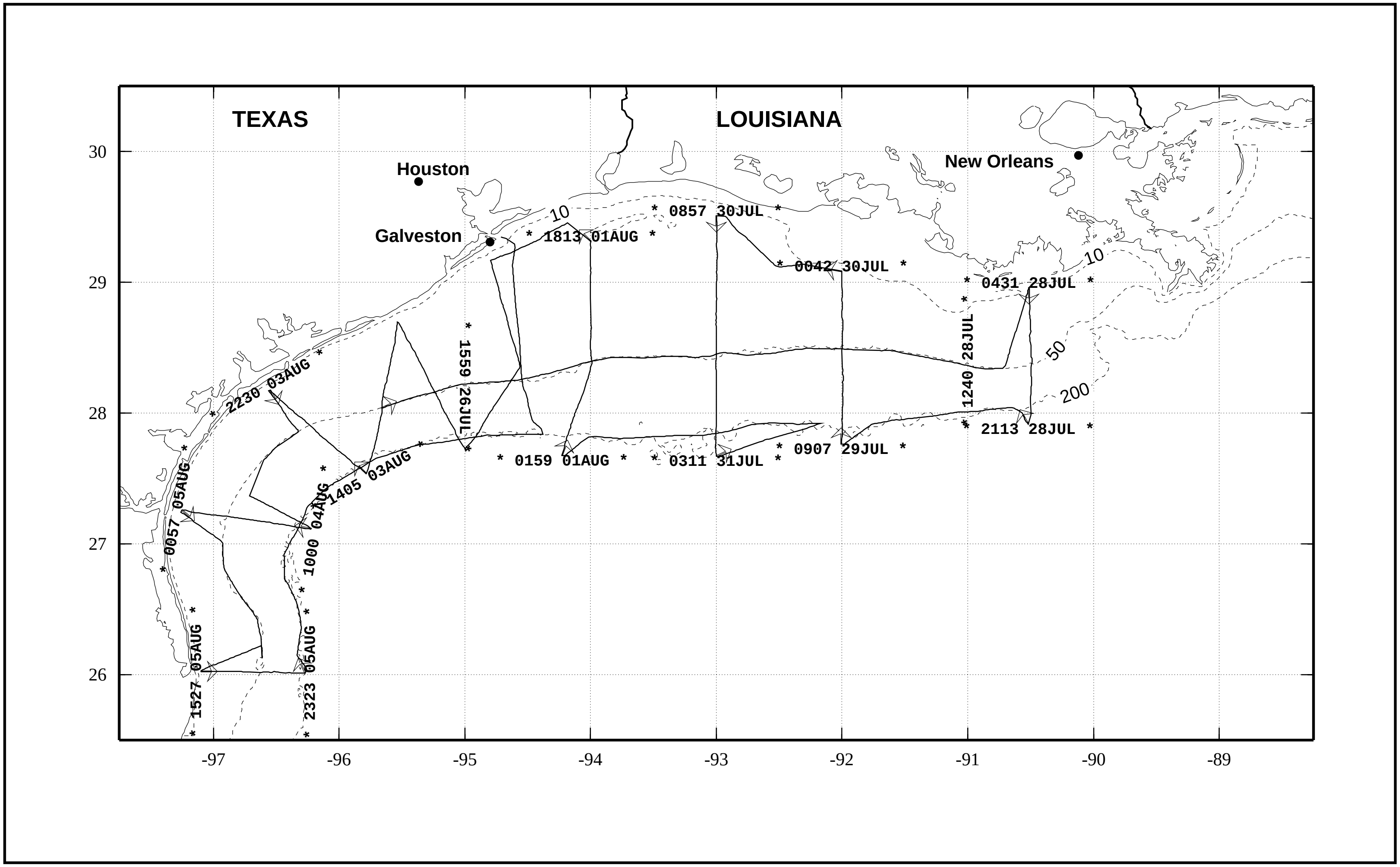

Figure 6.1.1. Cruise track taken during cruise H06, July 1993, showing times and directions.

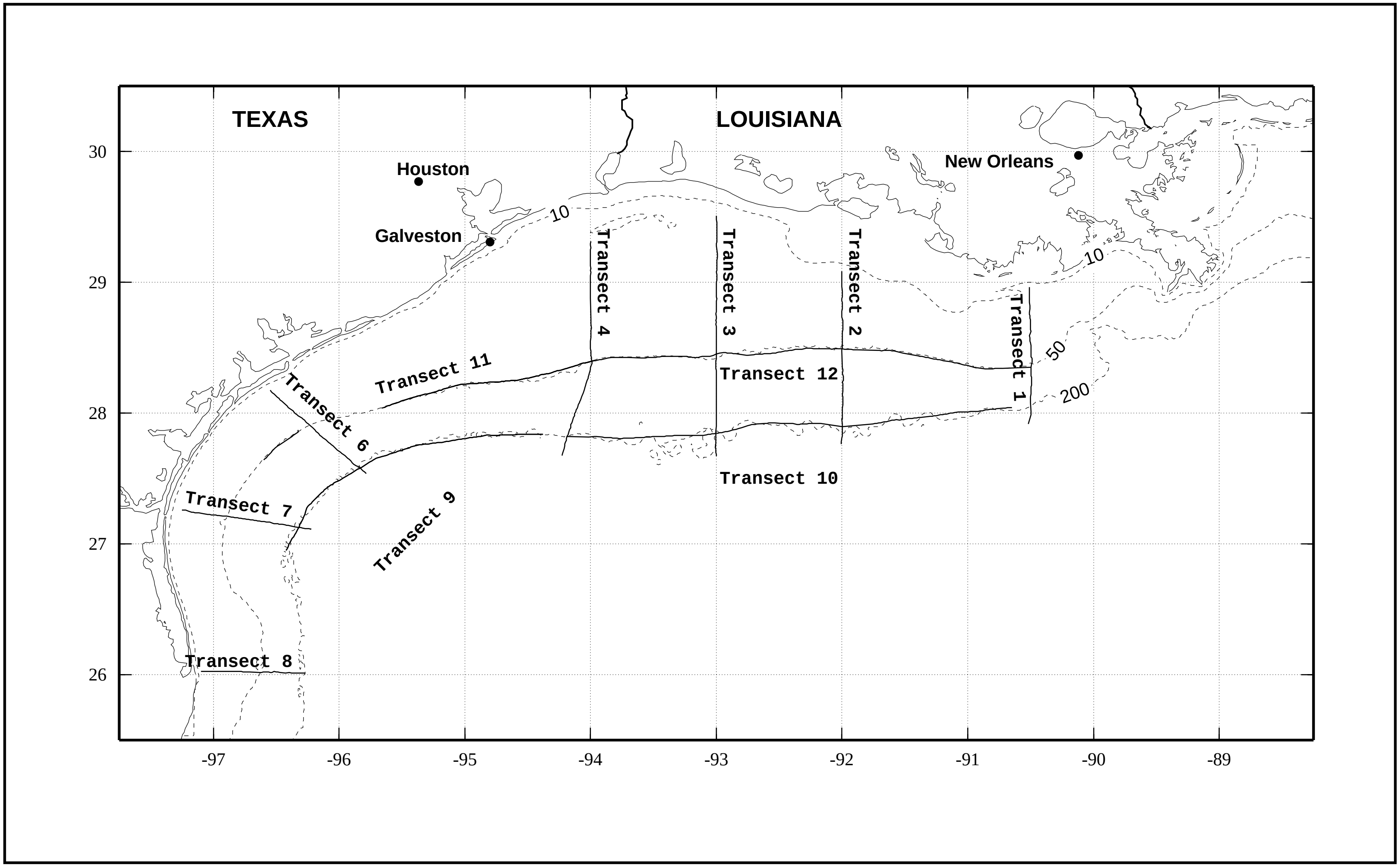

Figure 6.1.2. Cruise track taken during cruise H06, July 1993, showing individual labeled transects.

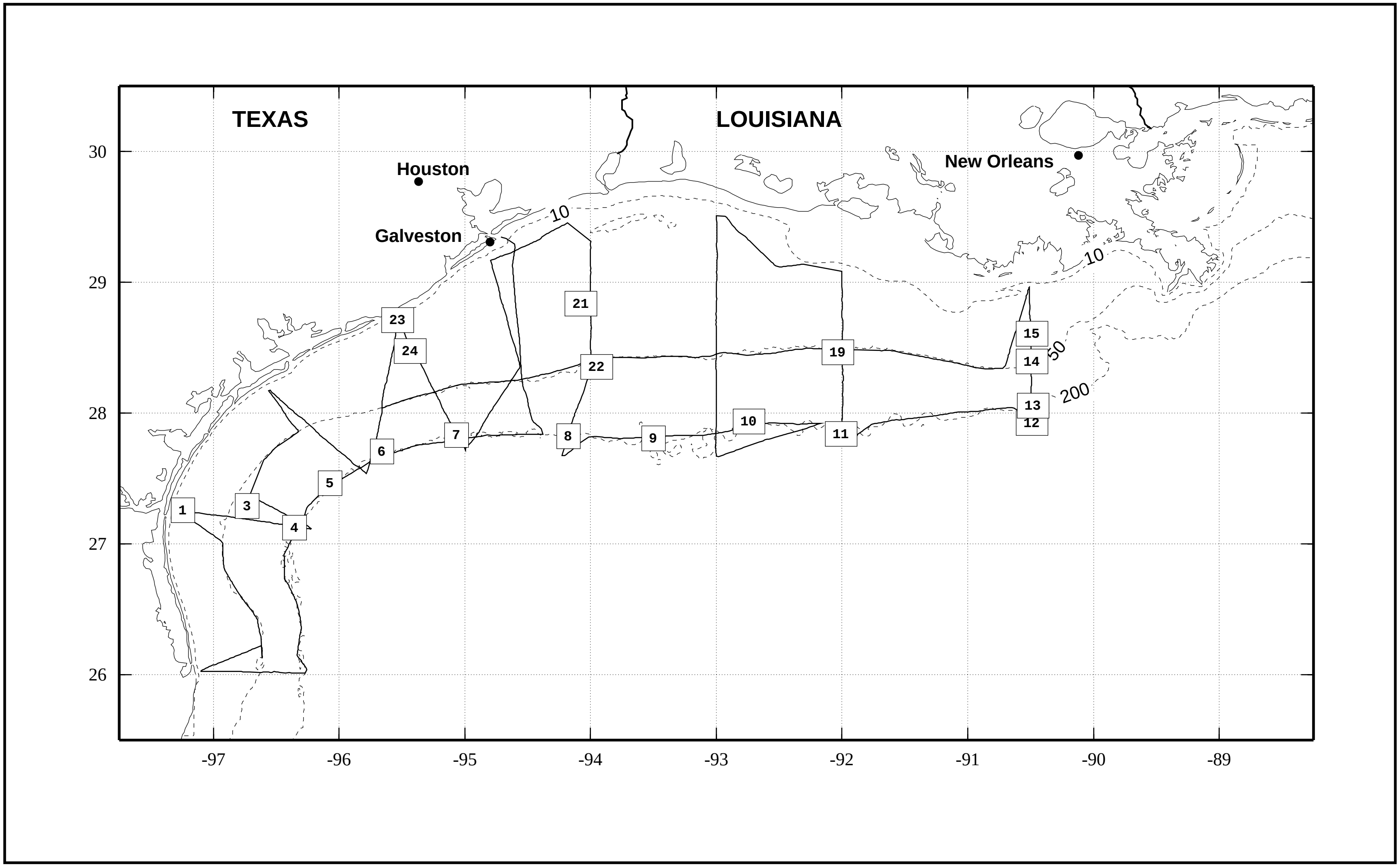

Figure 6.1.3. Cruise track taken during cruise H06, July 1993, showing current meter locations.

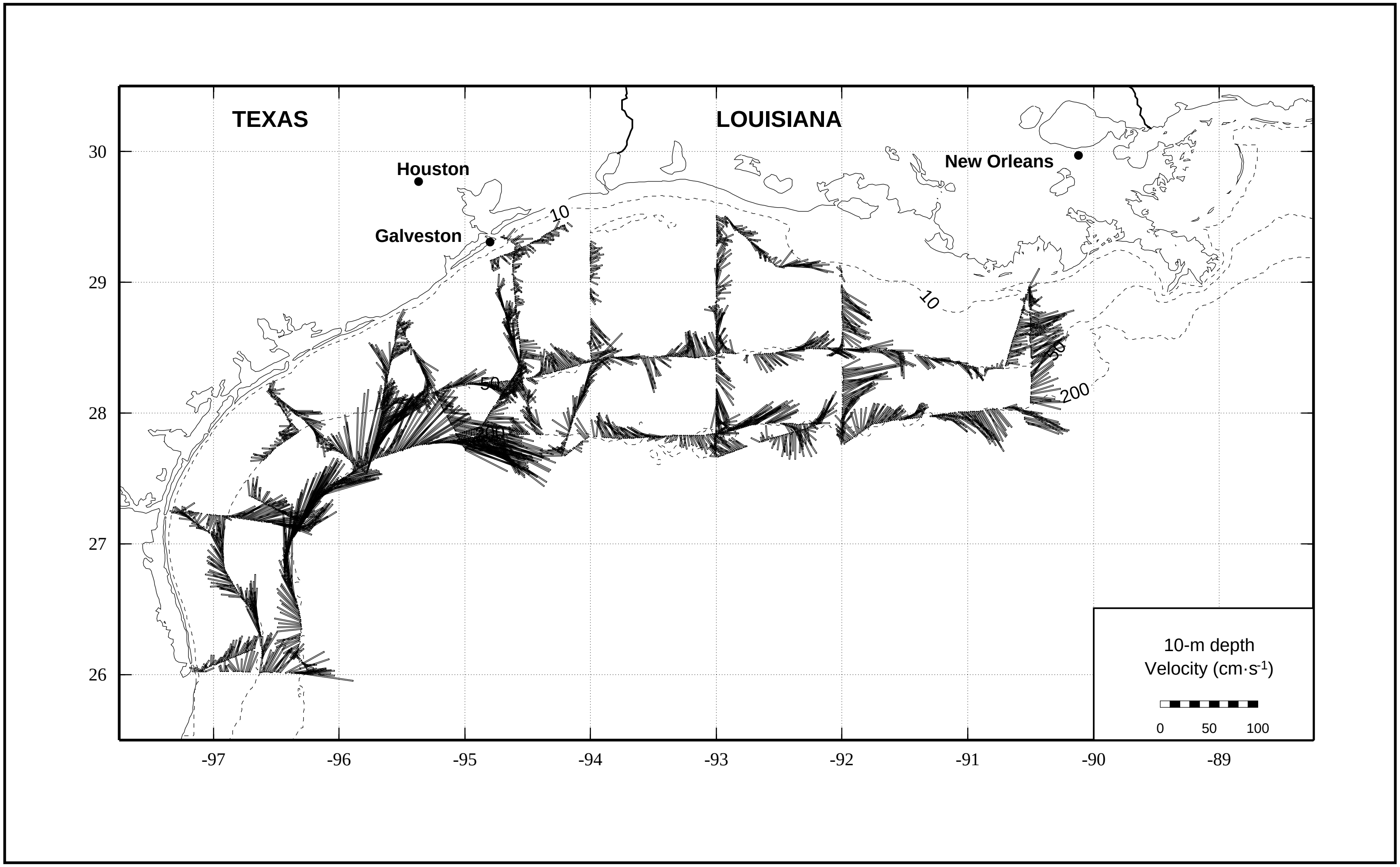

Figure 6.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 10 m depth. The data are from LATEX A cruise H06 conducted in July 1993

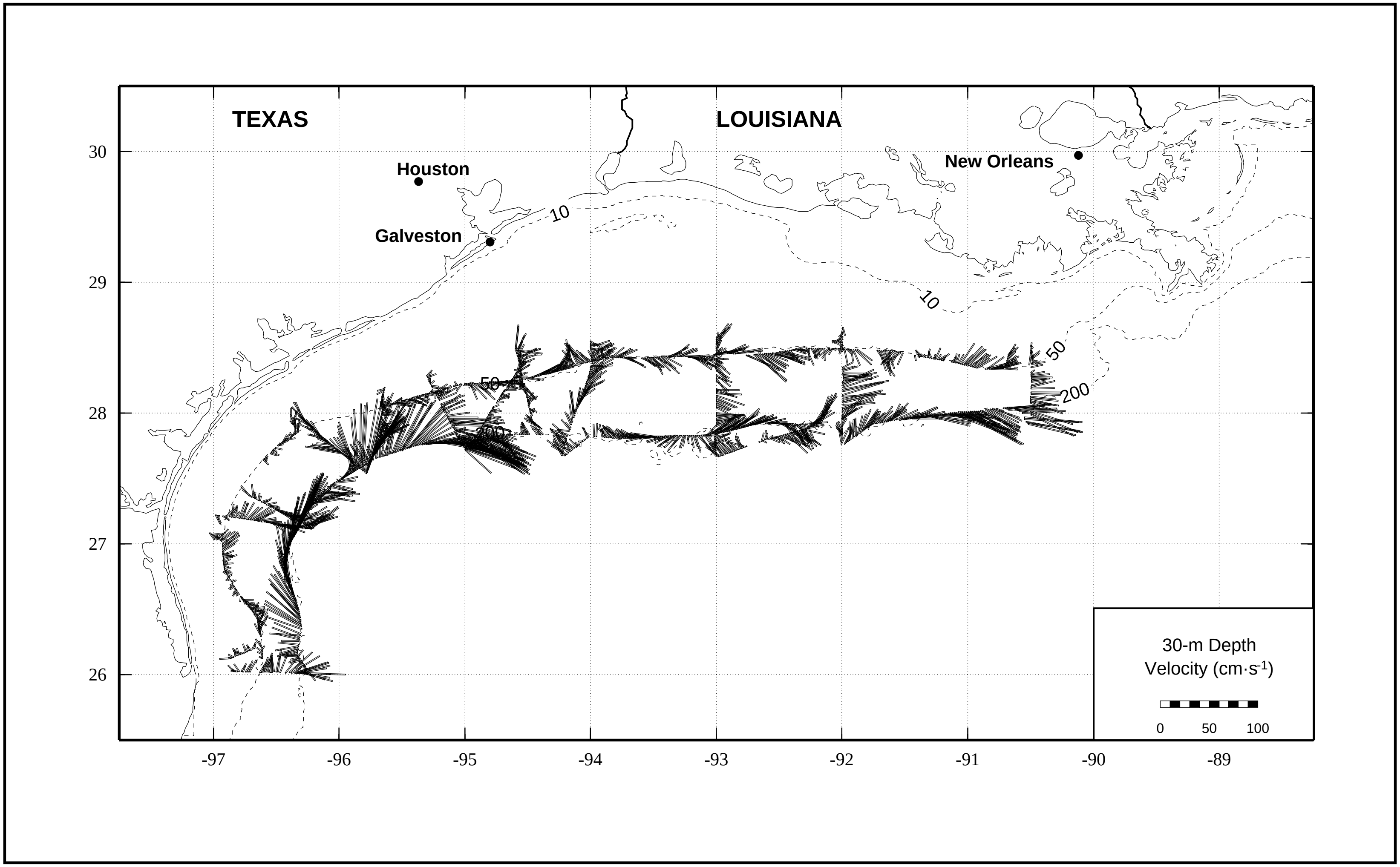

Figure 6.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H06 conducted in July 1993

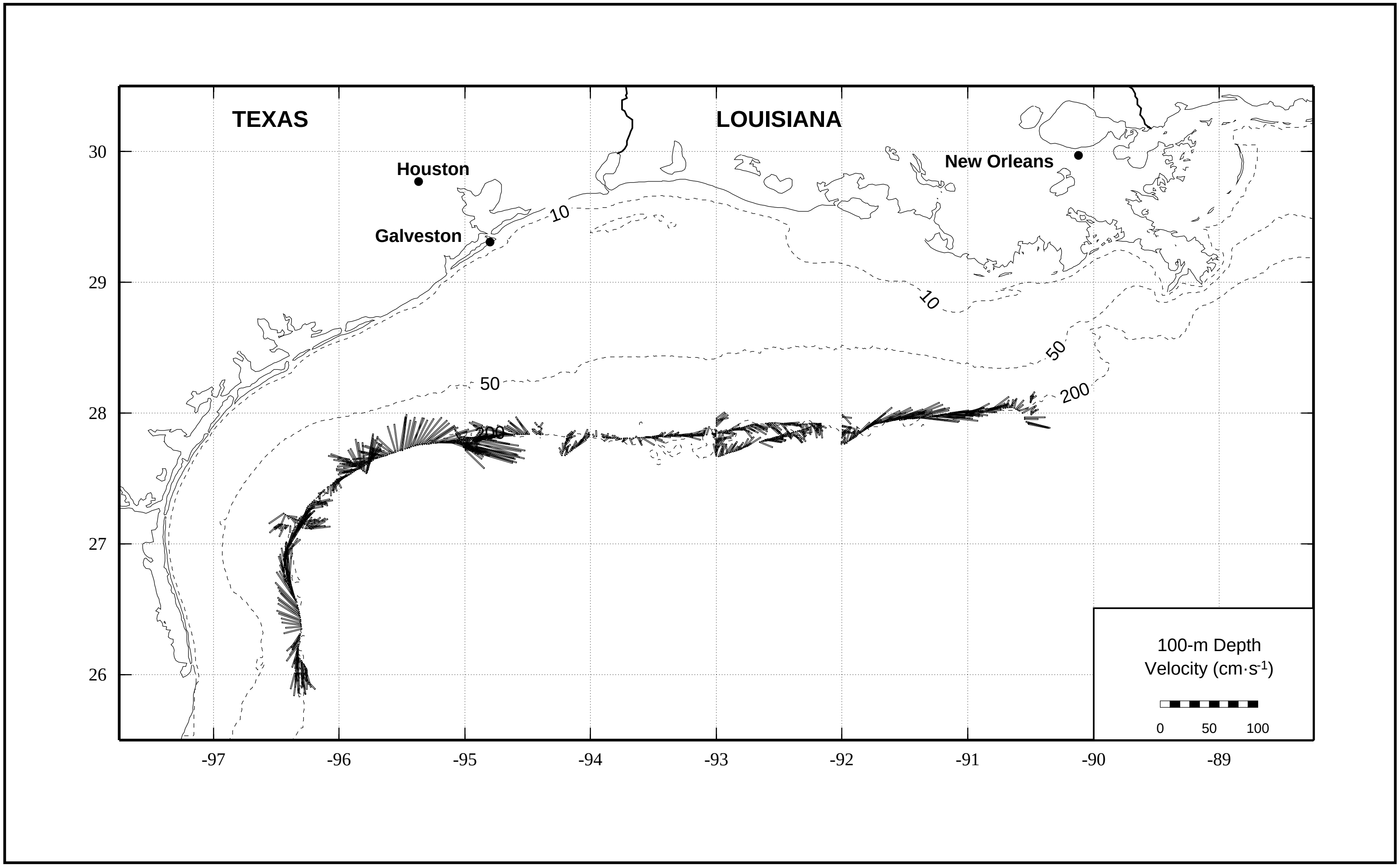

Figure 6.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H06 conducted in July 1993

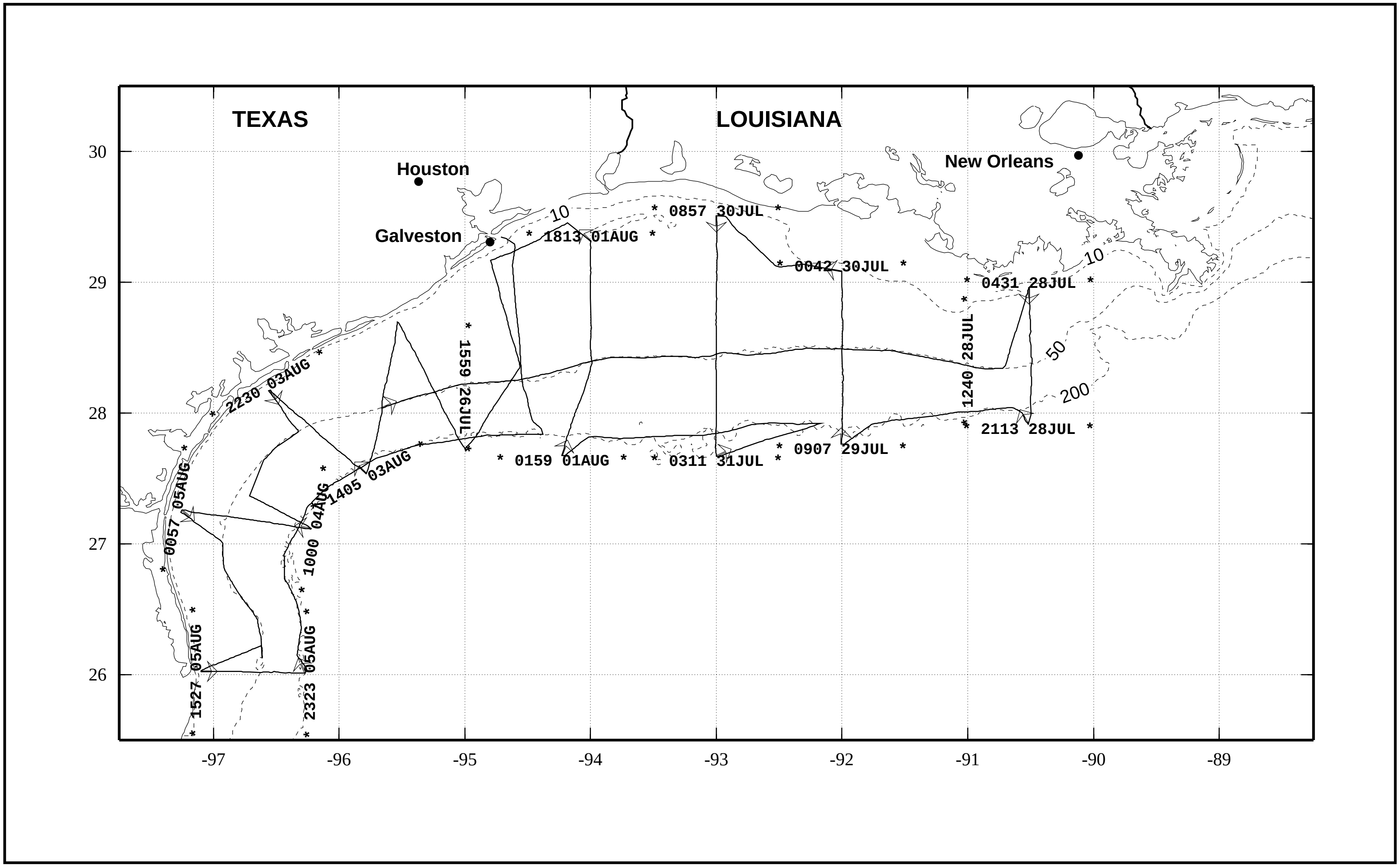

Figure 6.1.1. Cruise track taken during cruise H06, July 1993, showing times and directions.

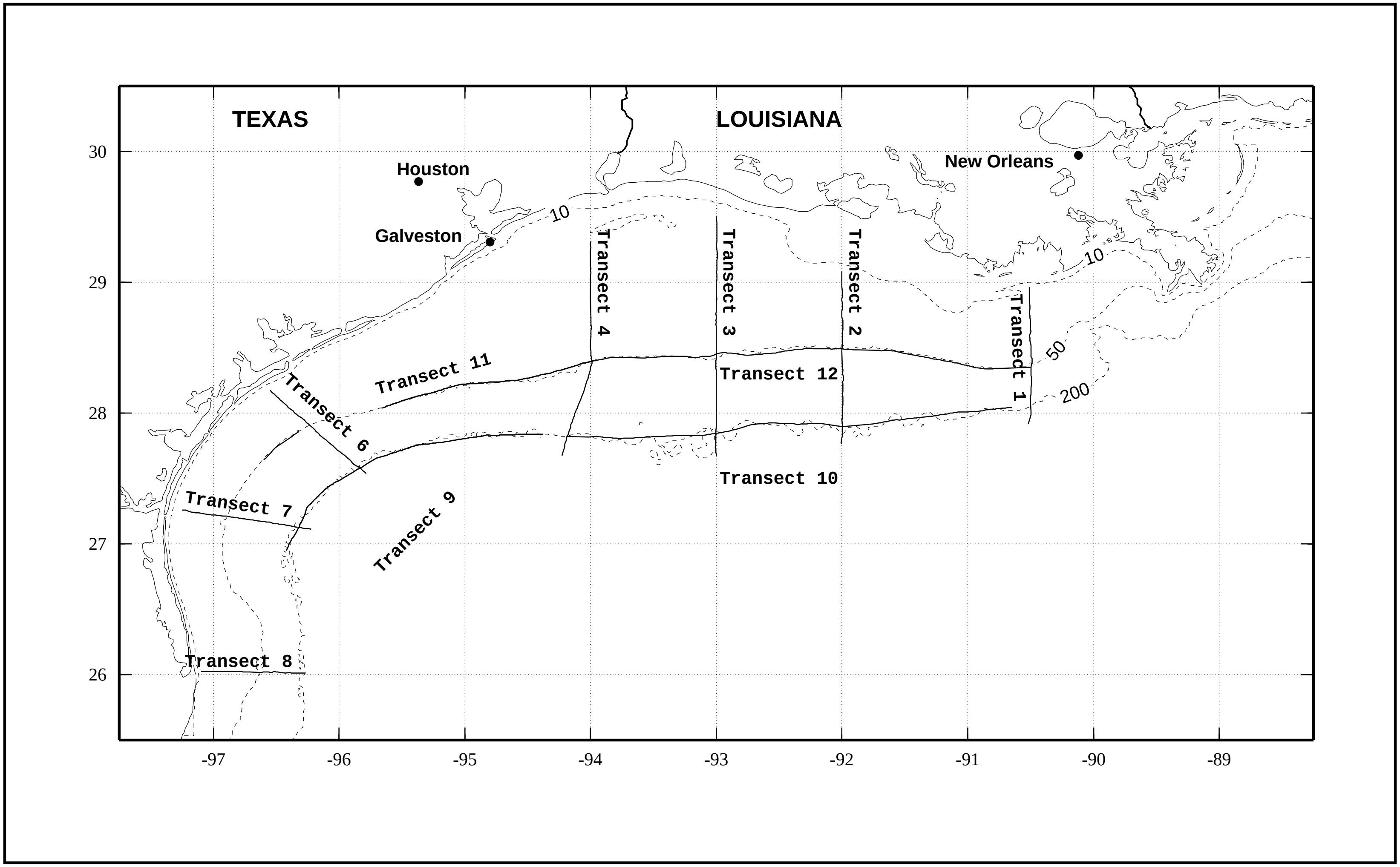

Figure 6.1.2. Cruise track taken during cruise H06, July 1993, showing individual labeled transects.

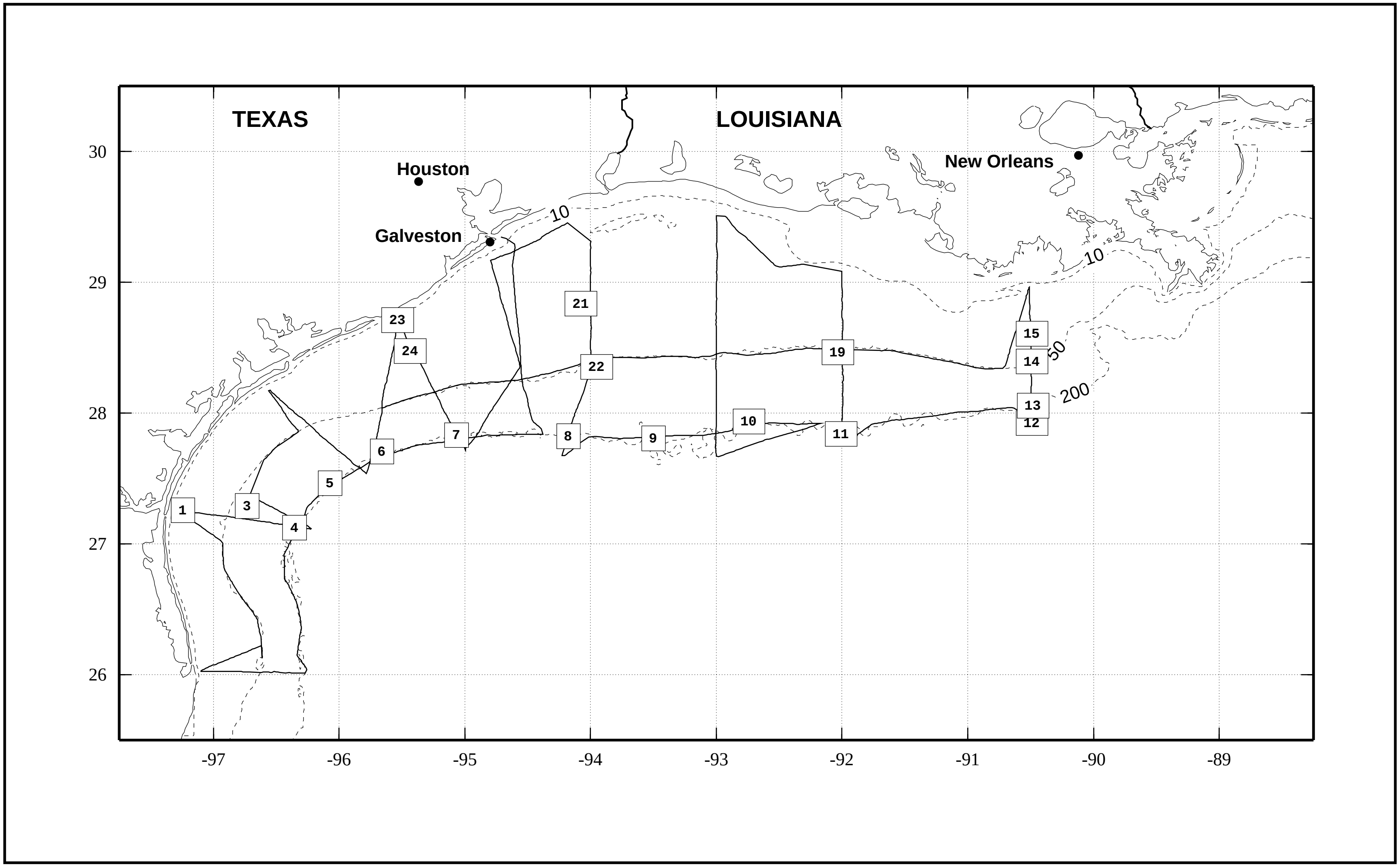

Figure 6.1.3. Cruise track taken during cruise H06, July 1993, showing current meter locations.

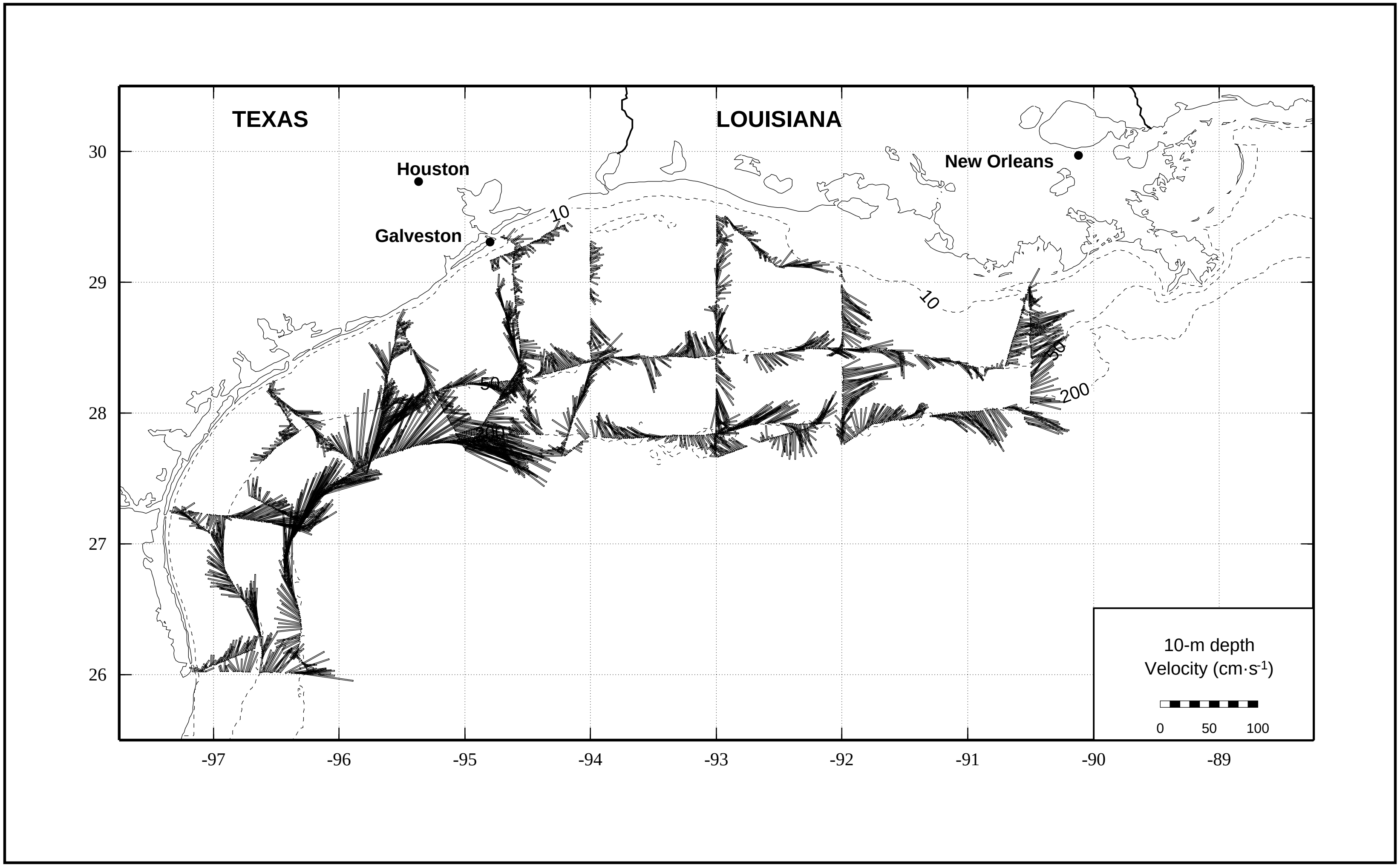

Figure 6.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 10 m depth. The data are from LATEX A cruise H06 conducted in July 1993

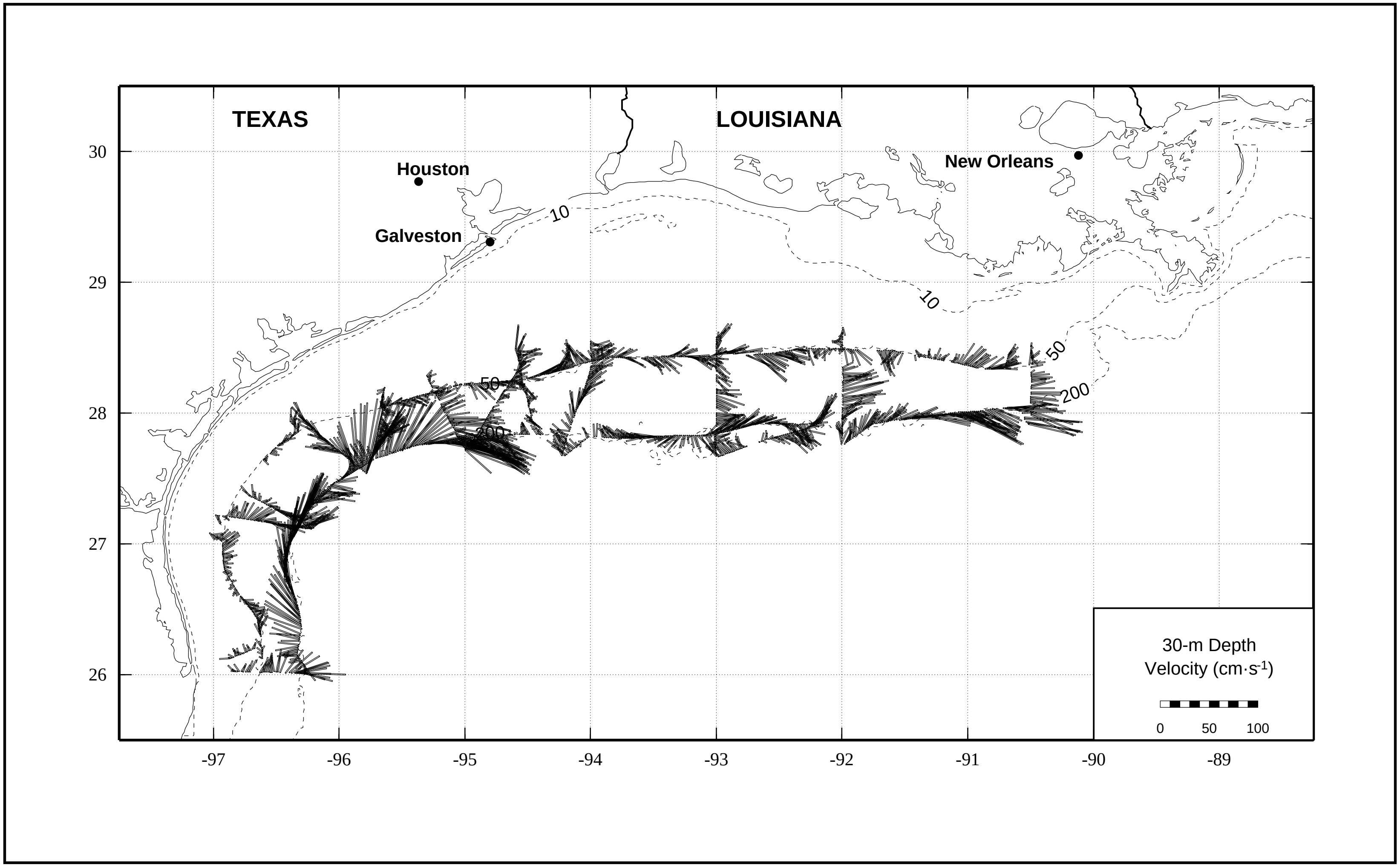

Figure 6.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H06 conducted in July 1993

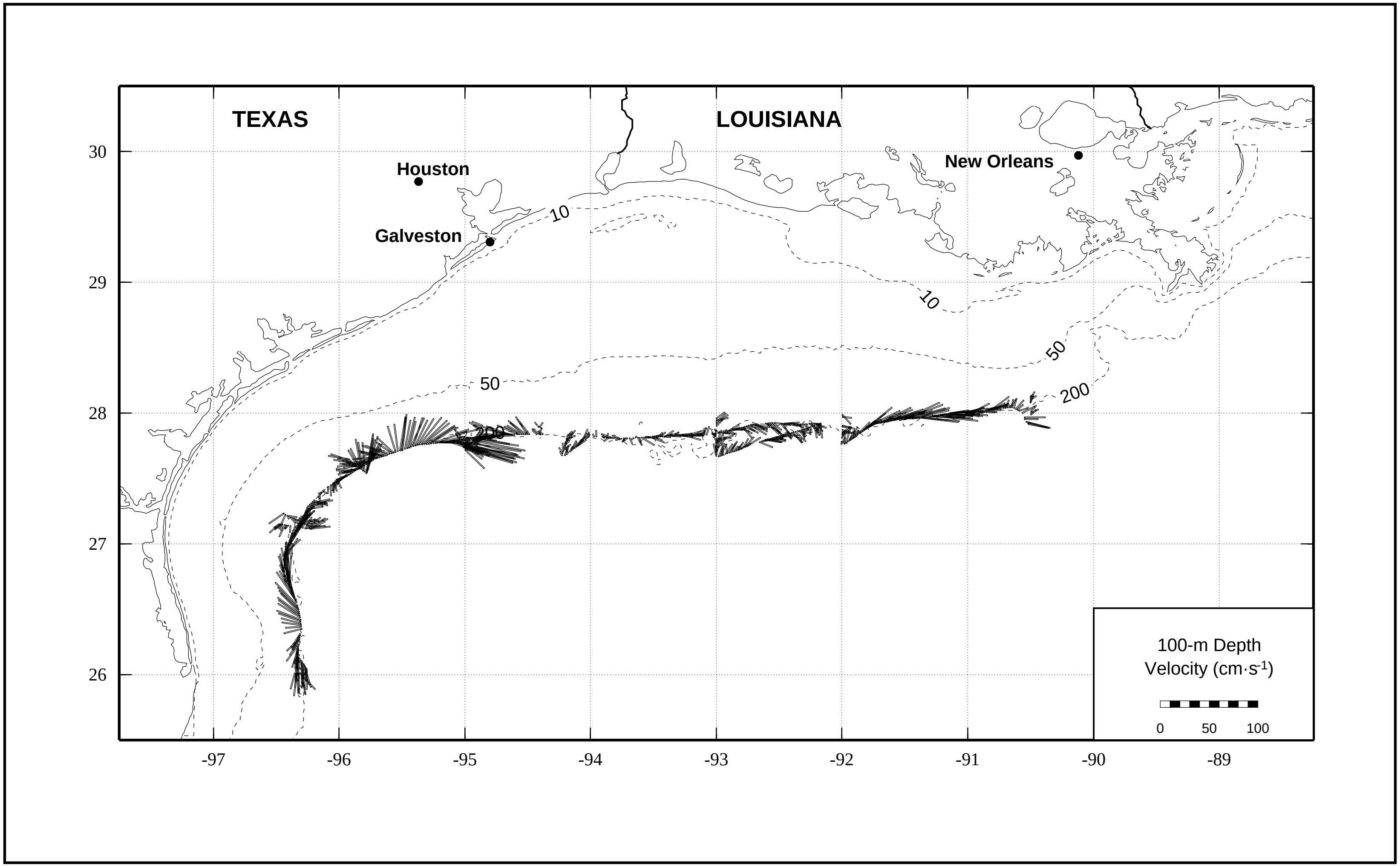

Figure 6.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H06 conducted in July 1993

4.3.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (GMT; Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 6.3.1 shows the velocity from the bin centered at 10 m, Figure 6.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 6.3.3 shows the velocity from the bin centered at 100 m below the surface.

4.3.2.4 Contoured Profiles of Normal Velocity

In Figures 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.4.6, 6.4.7, and 6.4.8 we show the velocity normal to across-shelf transects 1, 2, 3, 4, 6, 7, and 8, respectively. For the two along-shelf transects taken along the 200-m isobath, we show the normal velocity in Figure 6.4.9 and 6.4.10. For the two along-shelf transects taken along the 50-m isobath, we show the normal velocity in Figure 6.4.11 and 6.4.12. The transects are shown in Figure 6.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

4.3.2.5 Vertical Current Profiles

We show in Figures 6.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 6.1.3.

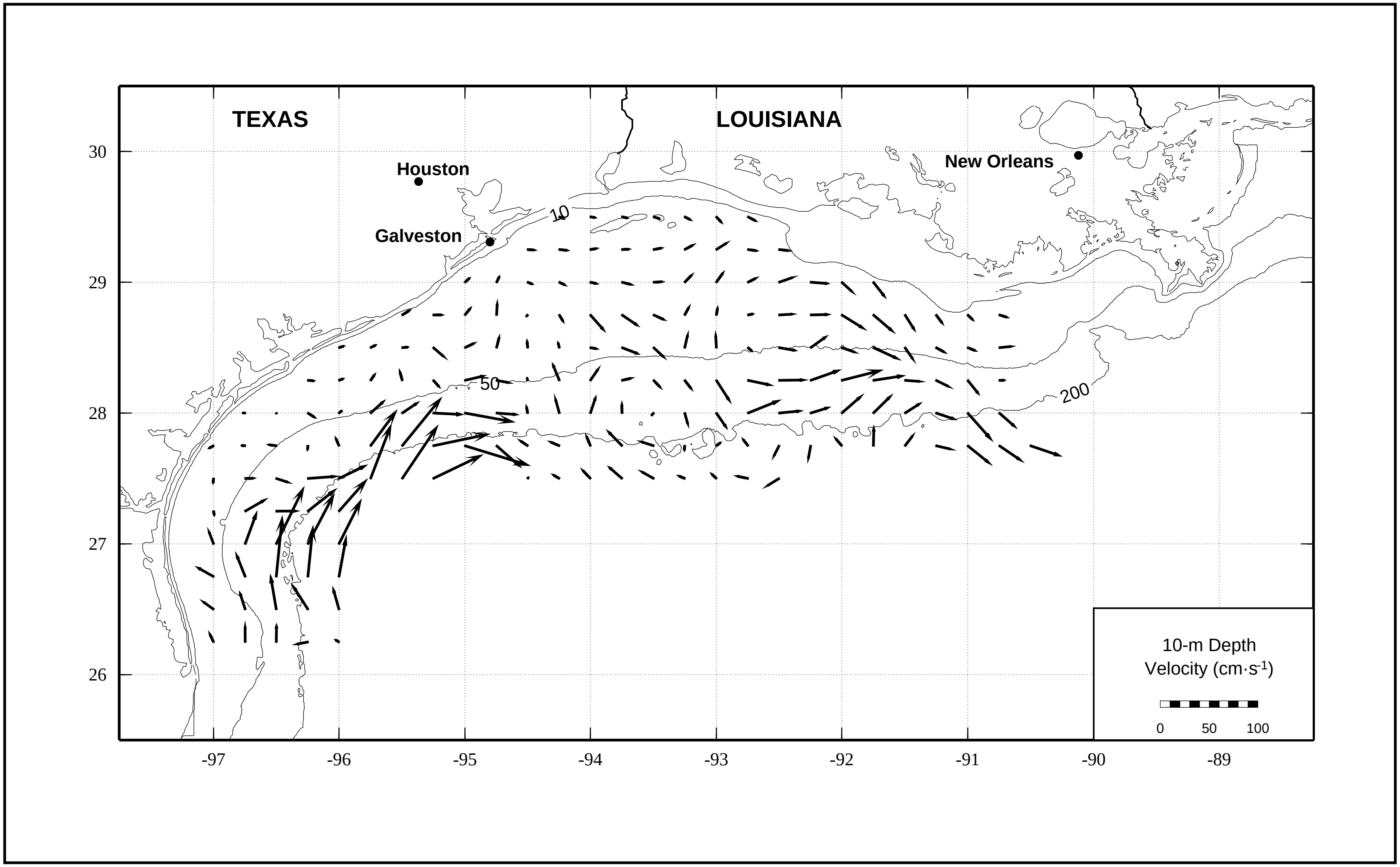

Figure 6.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 10 m depth. The data are from LATEX A cruise H06 conducted in July 1993

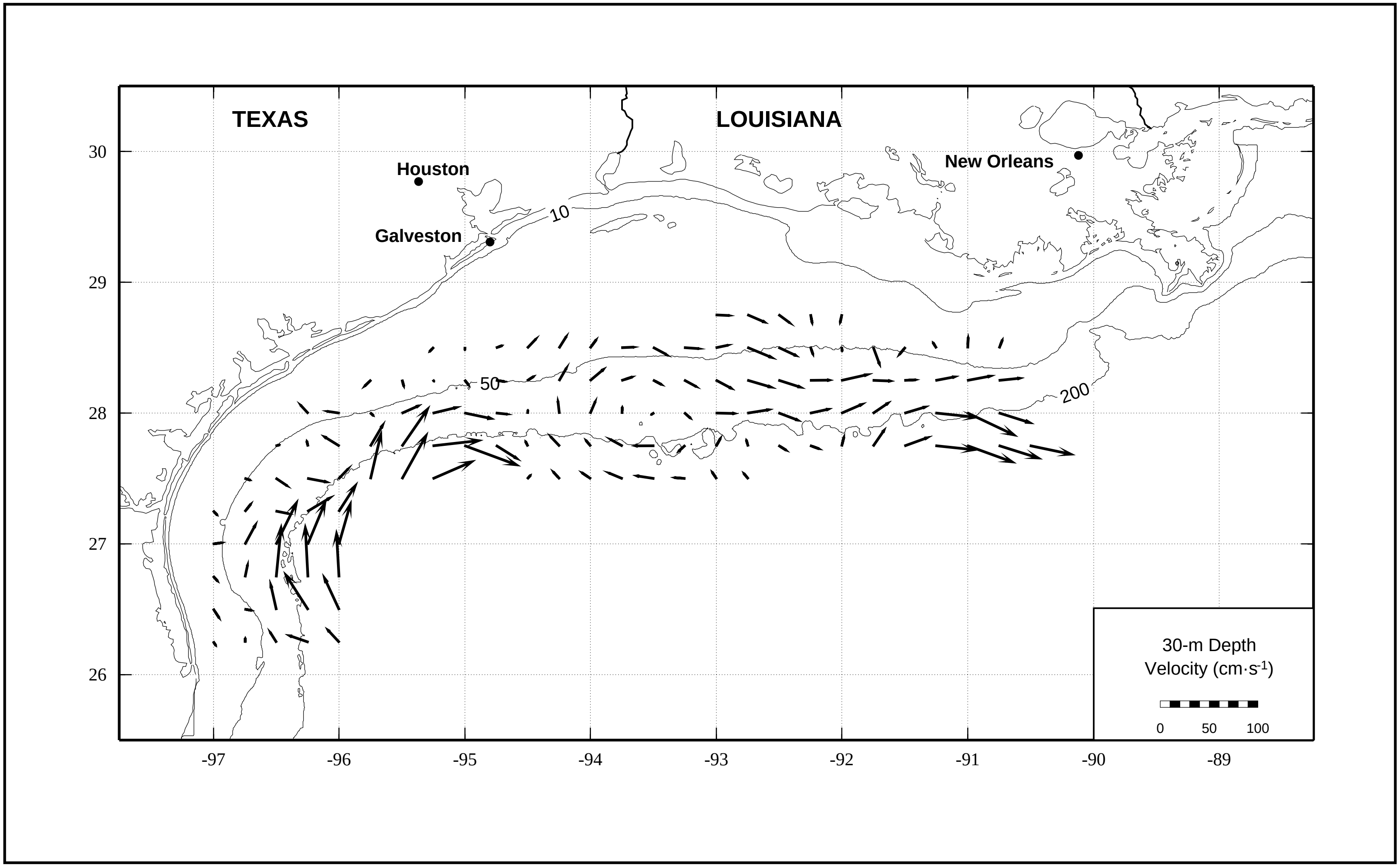

Figure 6.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H06 conducted in July 1993

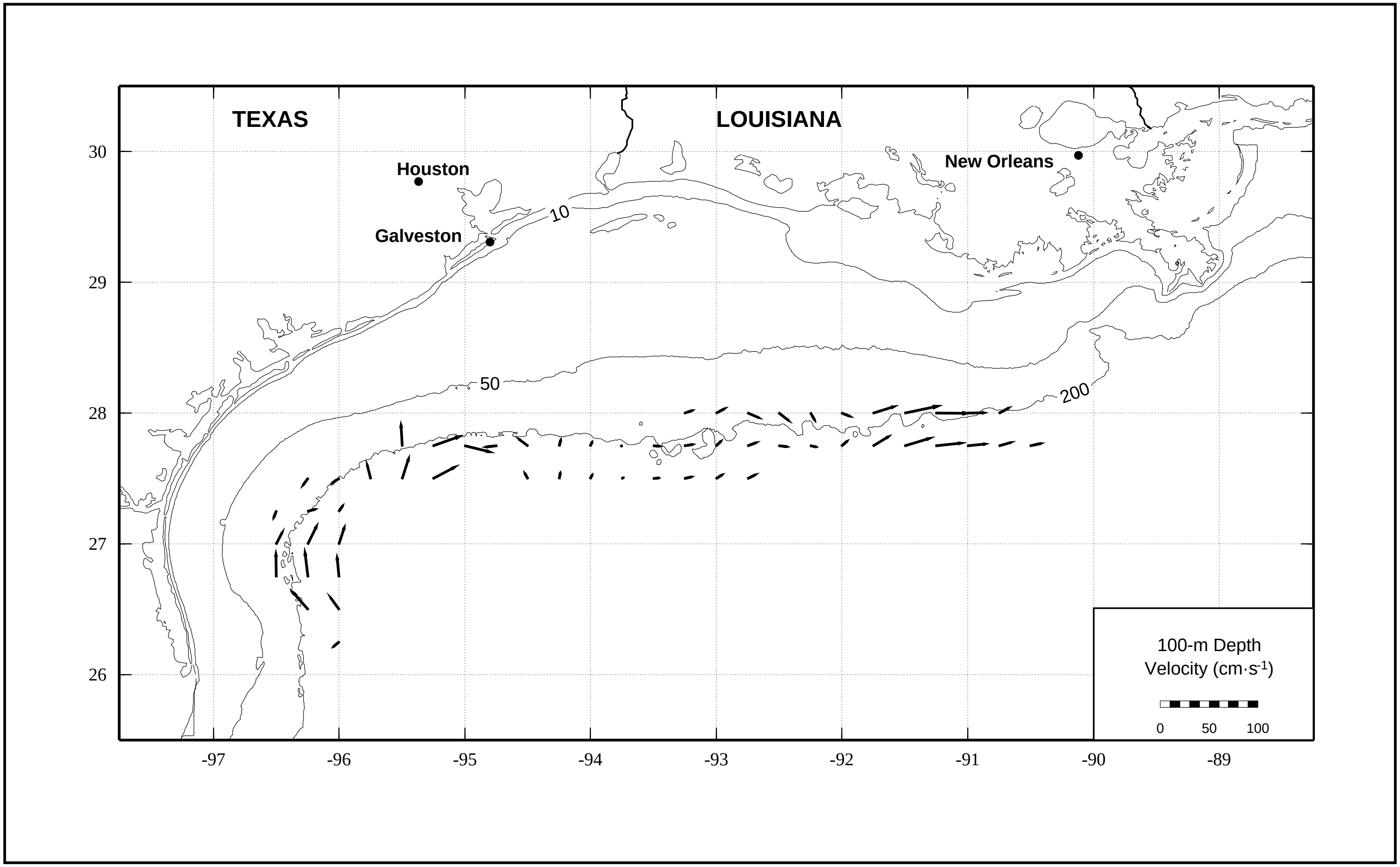

Figure 6.3.3. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H06 conducted in July 1993

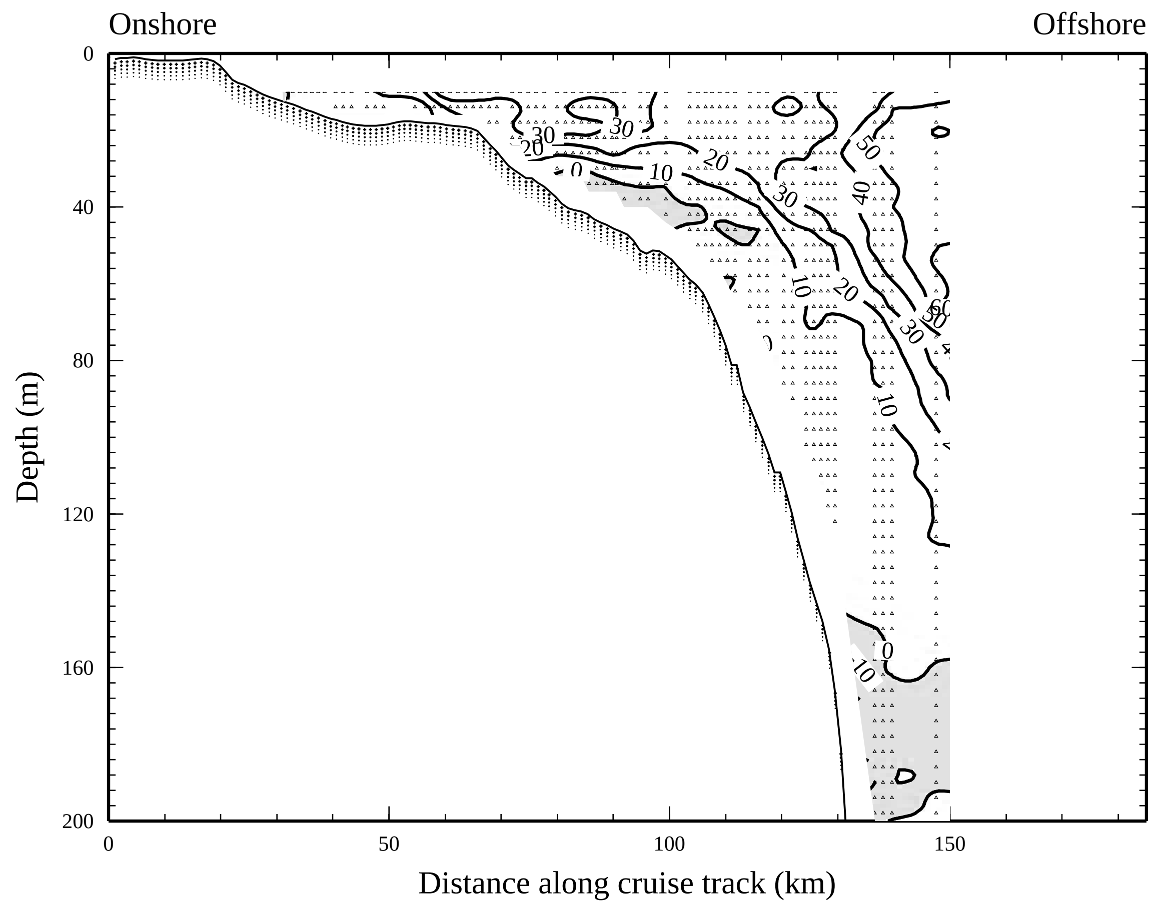

Figure 6.4.1. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 1 for cruise H06, July 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

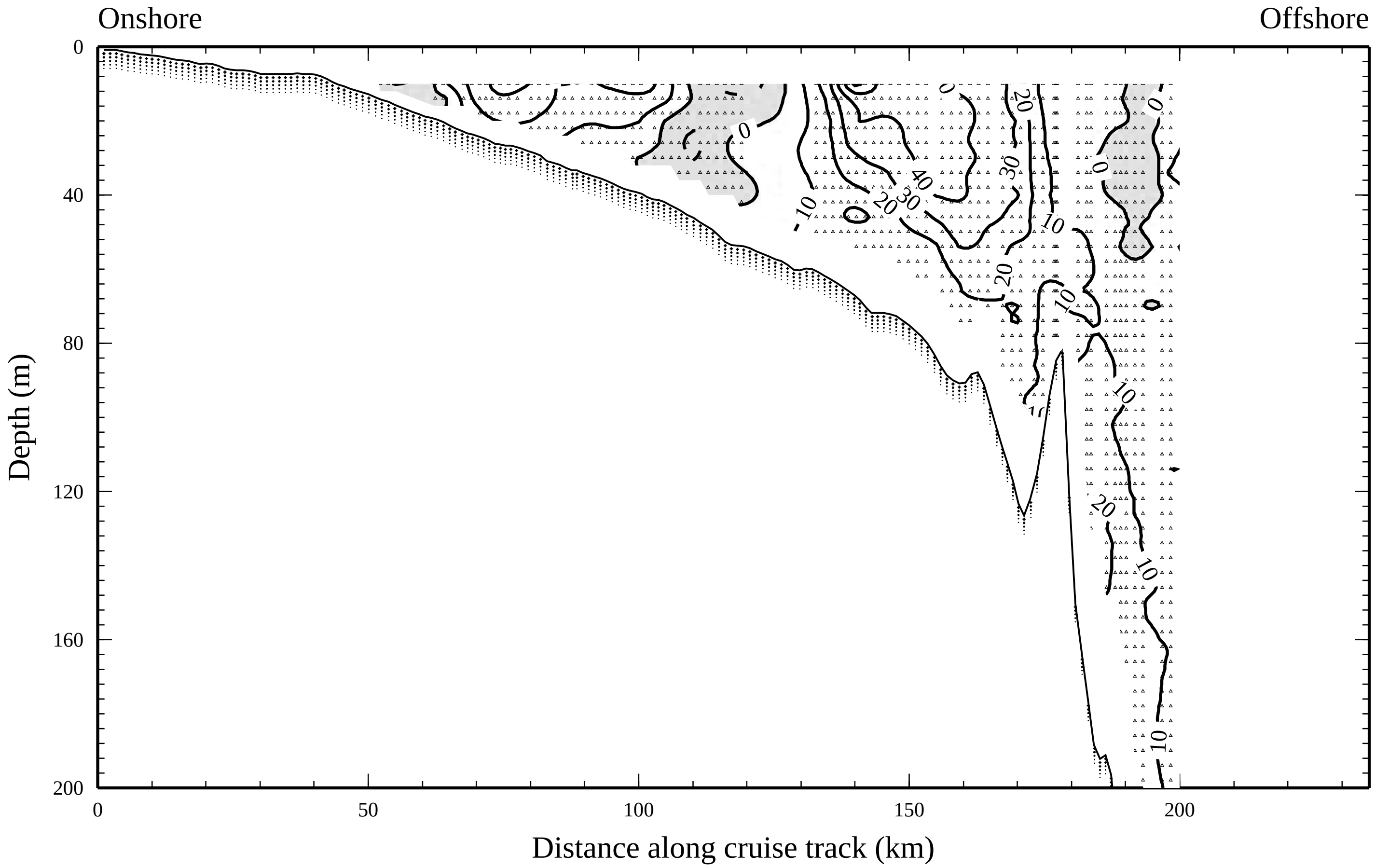

Figure 6.4.2. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 2 for cruise H06, July 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

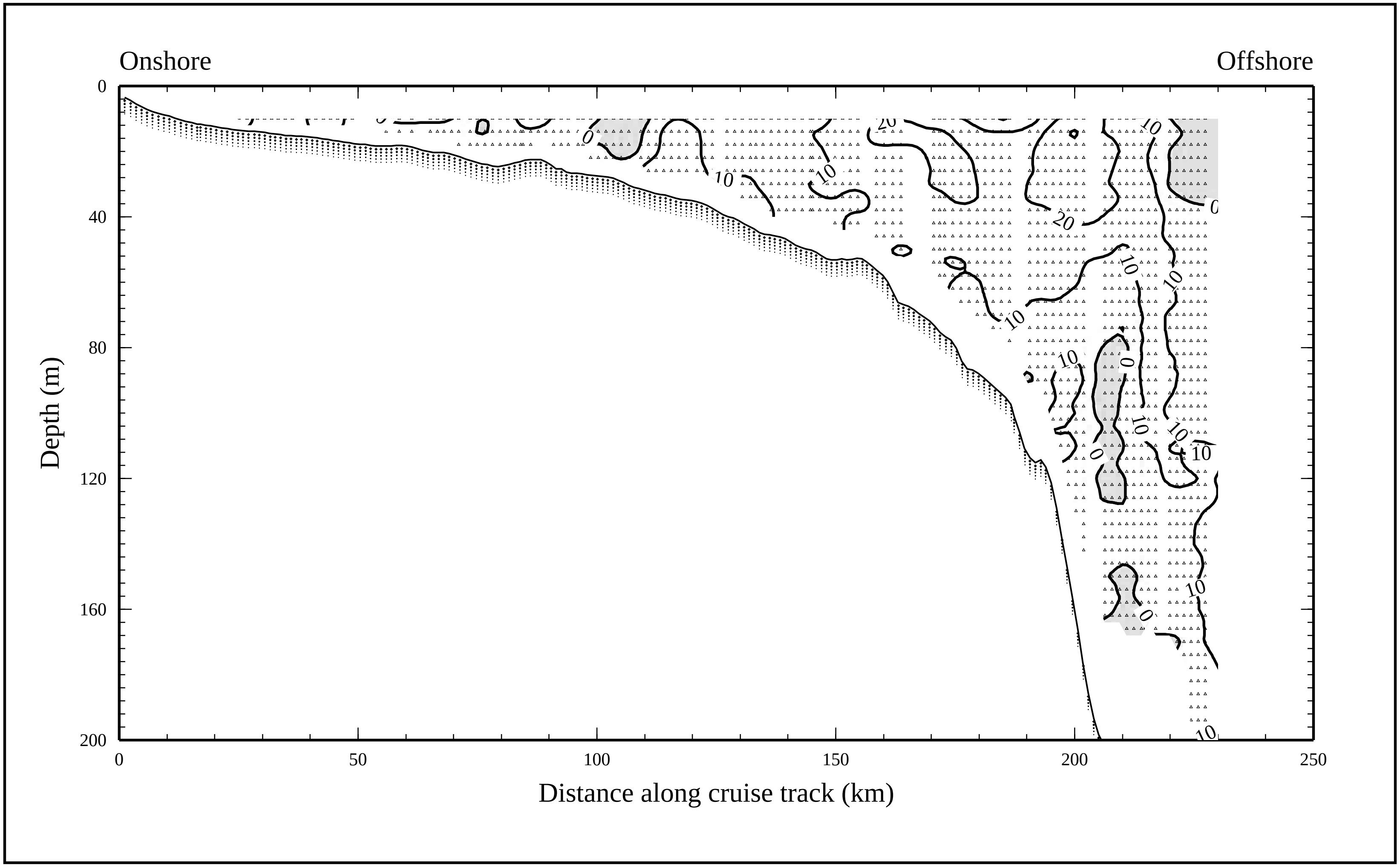

Figure 6.4.3. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 3 for cruise H06, July 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

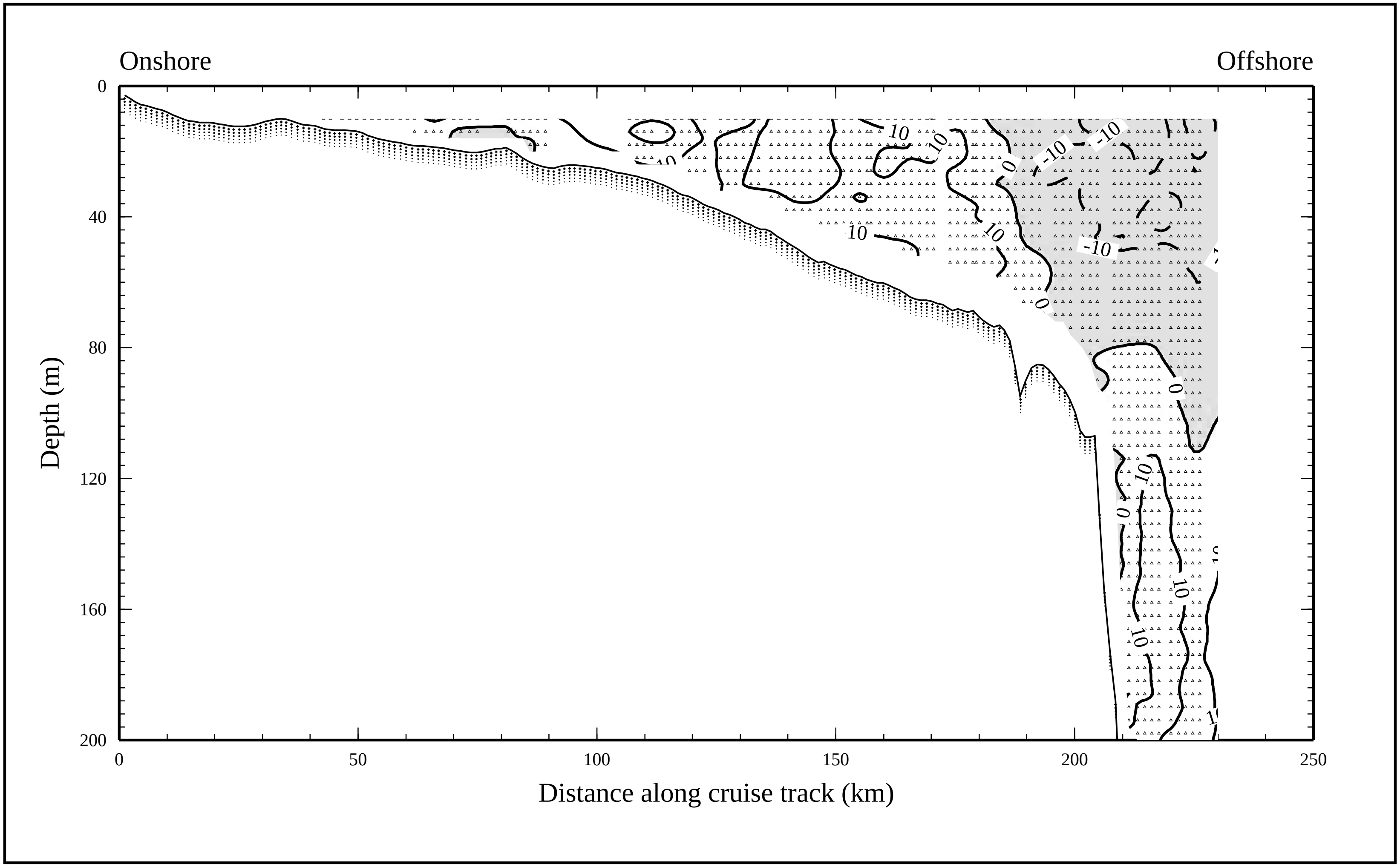

Figure 6.4.4. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 4 for cruise H06, July 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

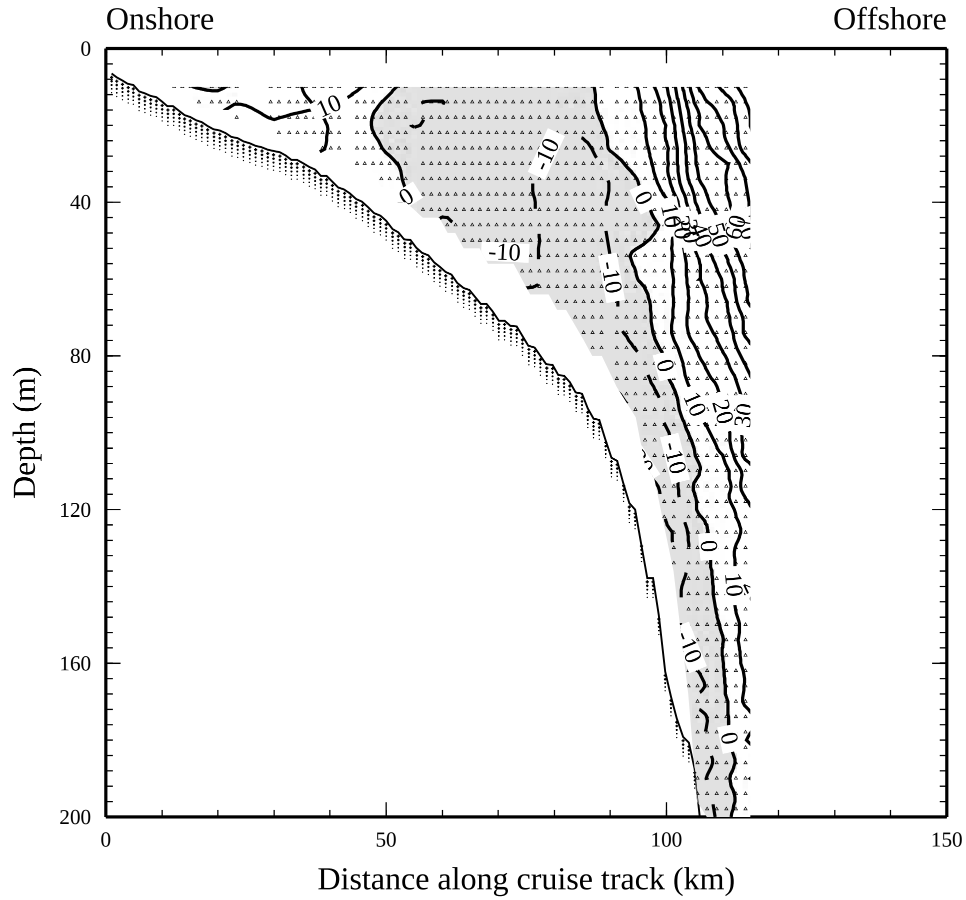

Figure 6.4.6. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 6 for cruise H06, July 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

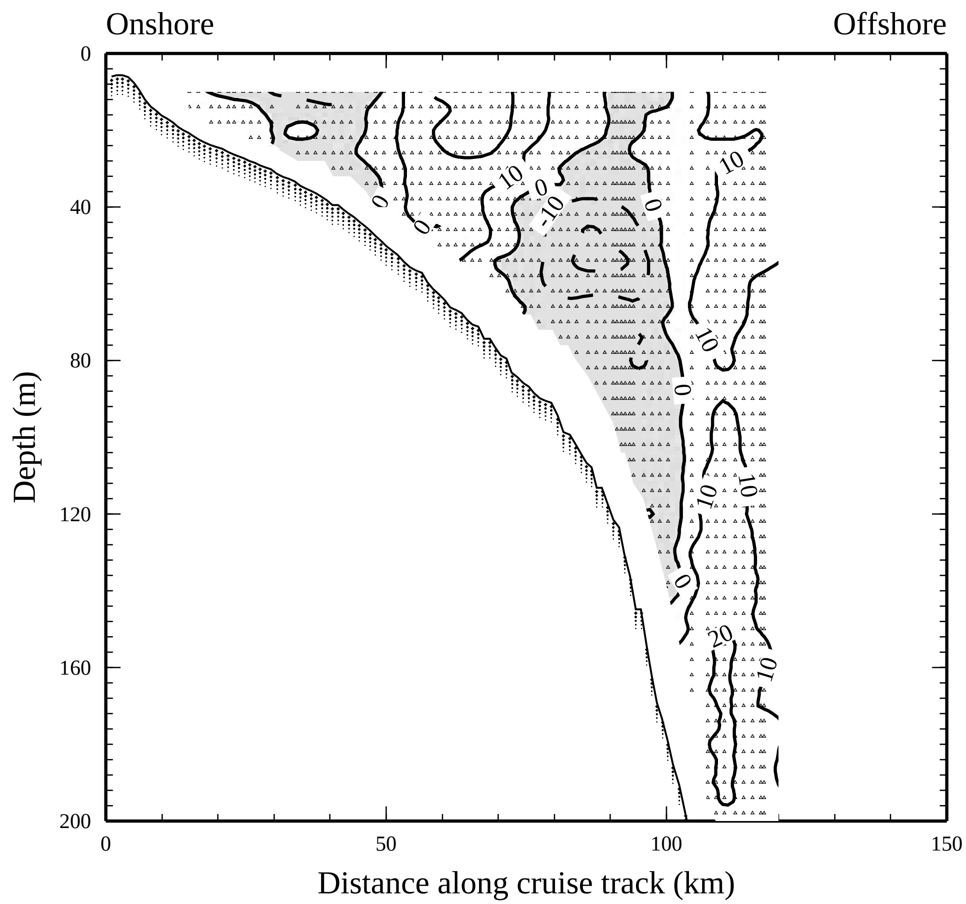

Figure 6.4.7. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 7 for cruise H06, July 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

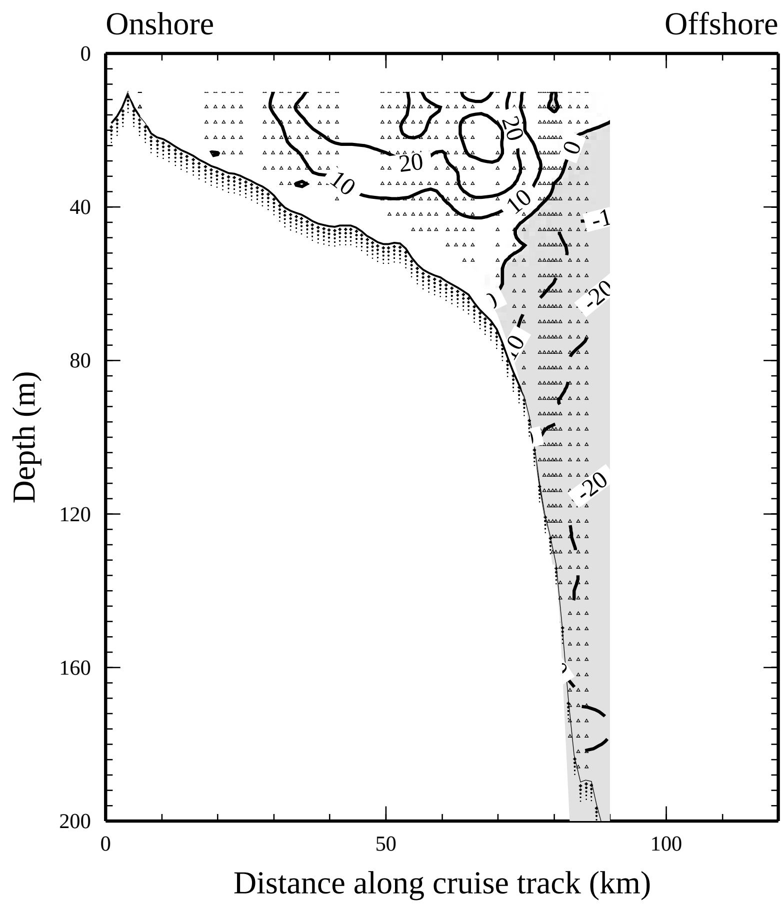

Figure 6.4.8. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 8 for cruise H06, July 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

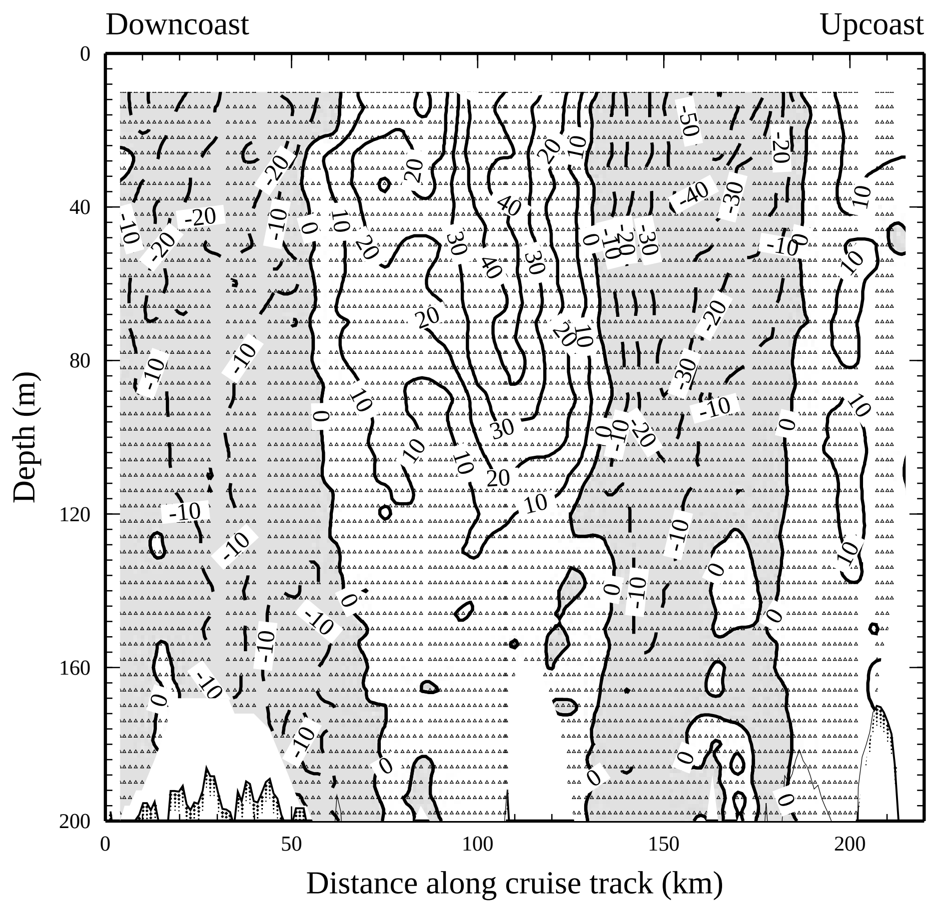

Figure 6.4.9. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 9 for cruise H06, July 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

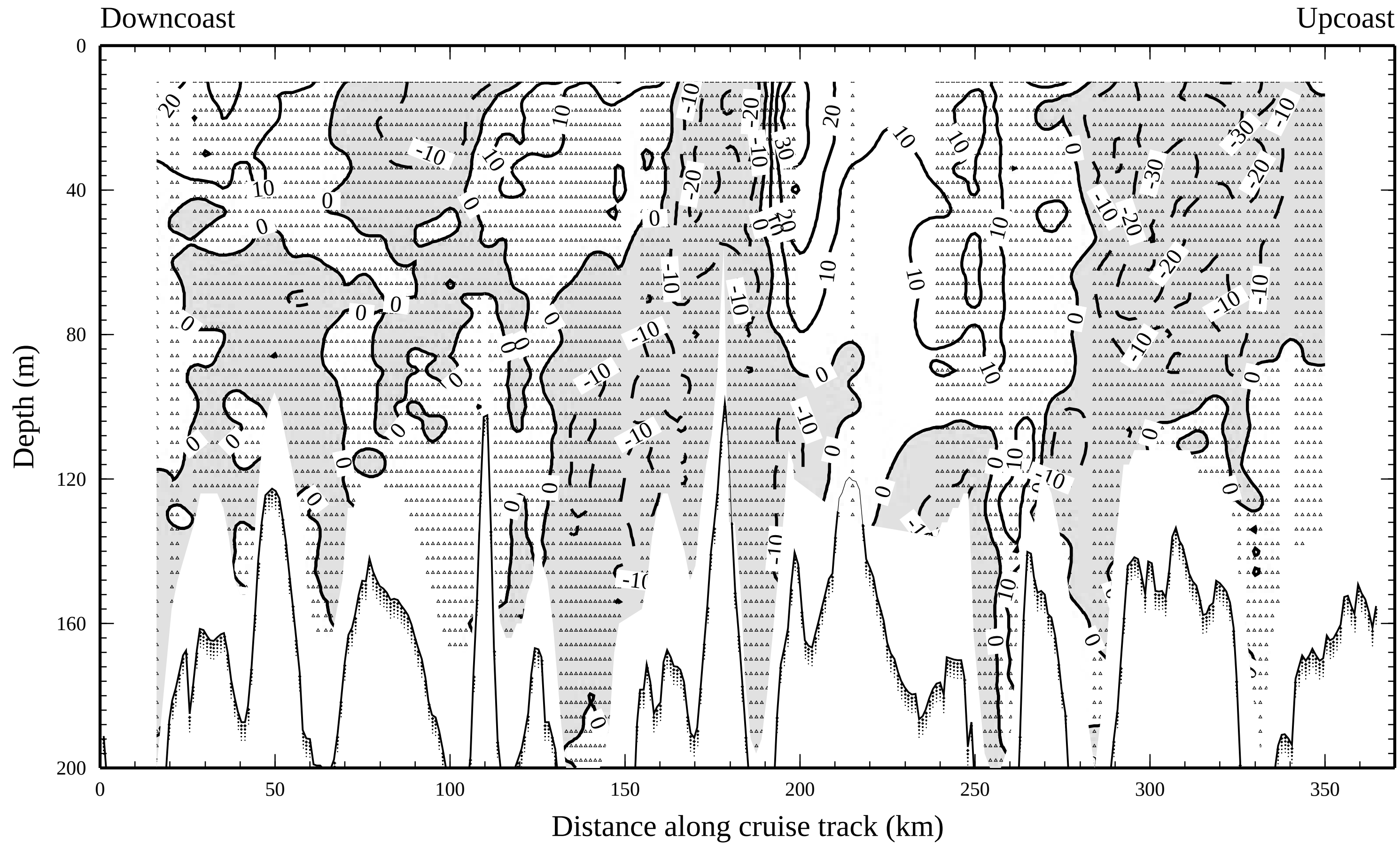

Figure 6.4.10. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 10 for cruise H06, July 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

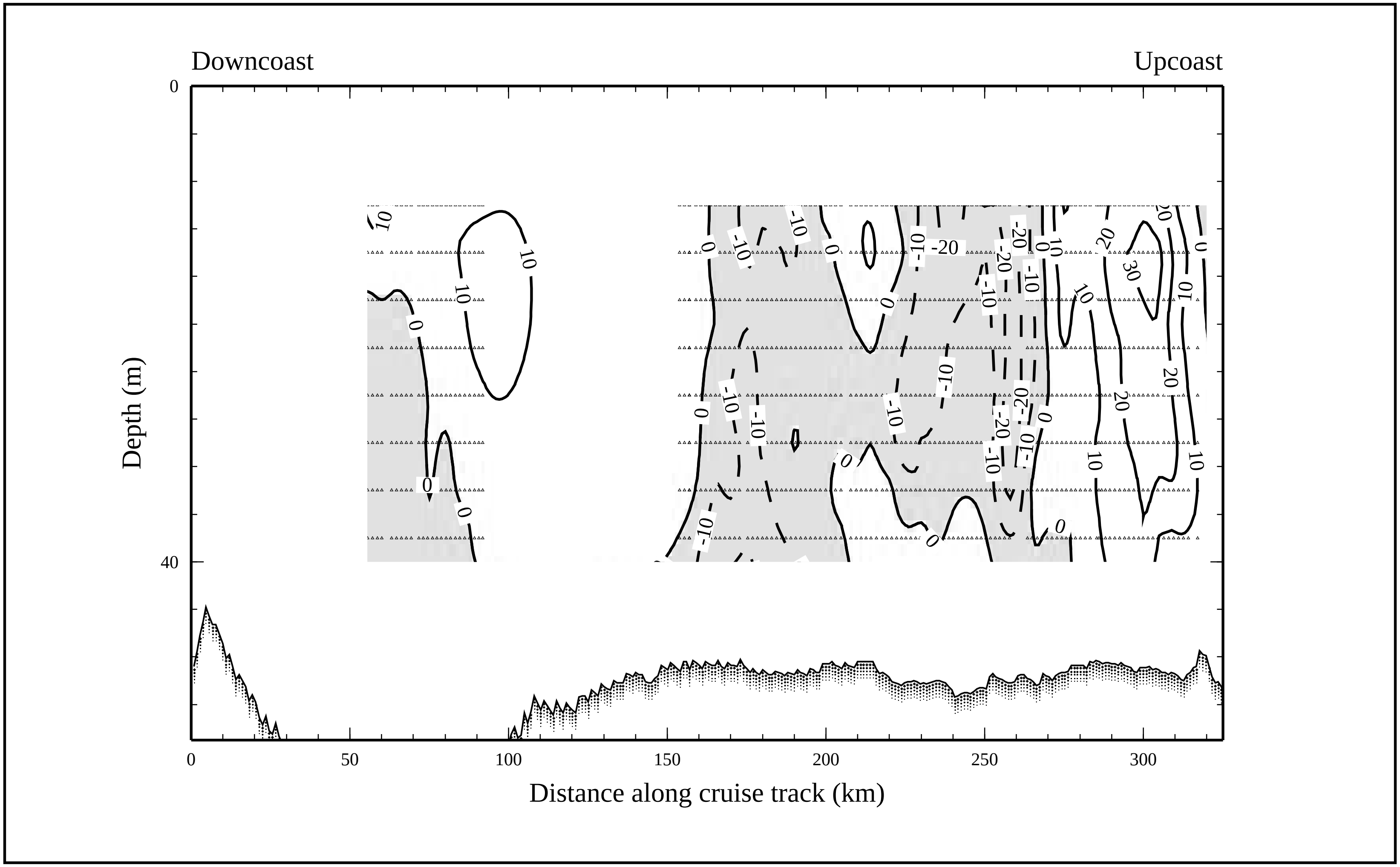

Figure 6.4.11. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 11 for cruise H06, July 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

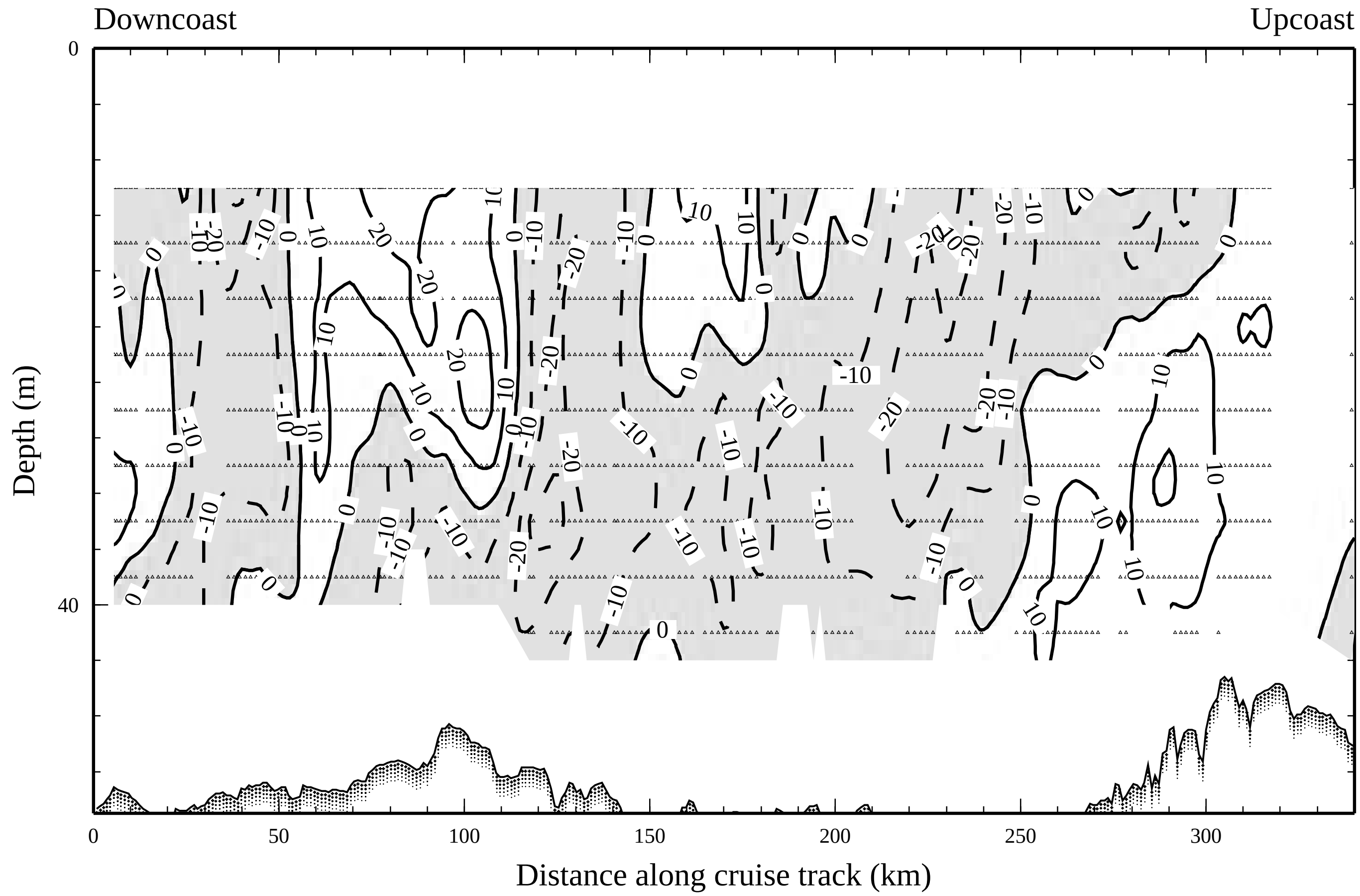

Figure 6.4.12. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 12 for cruise H06, July 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

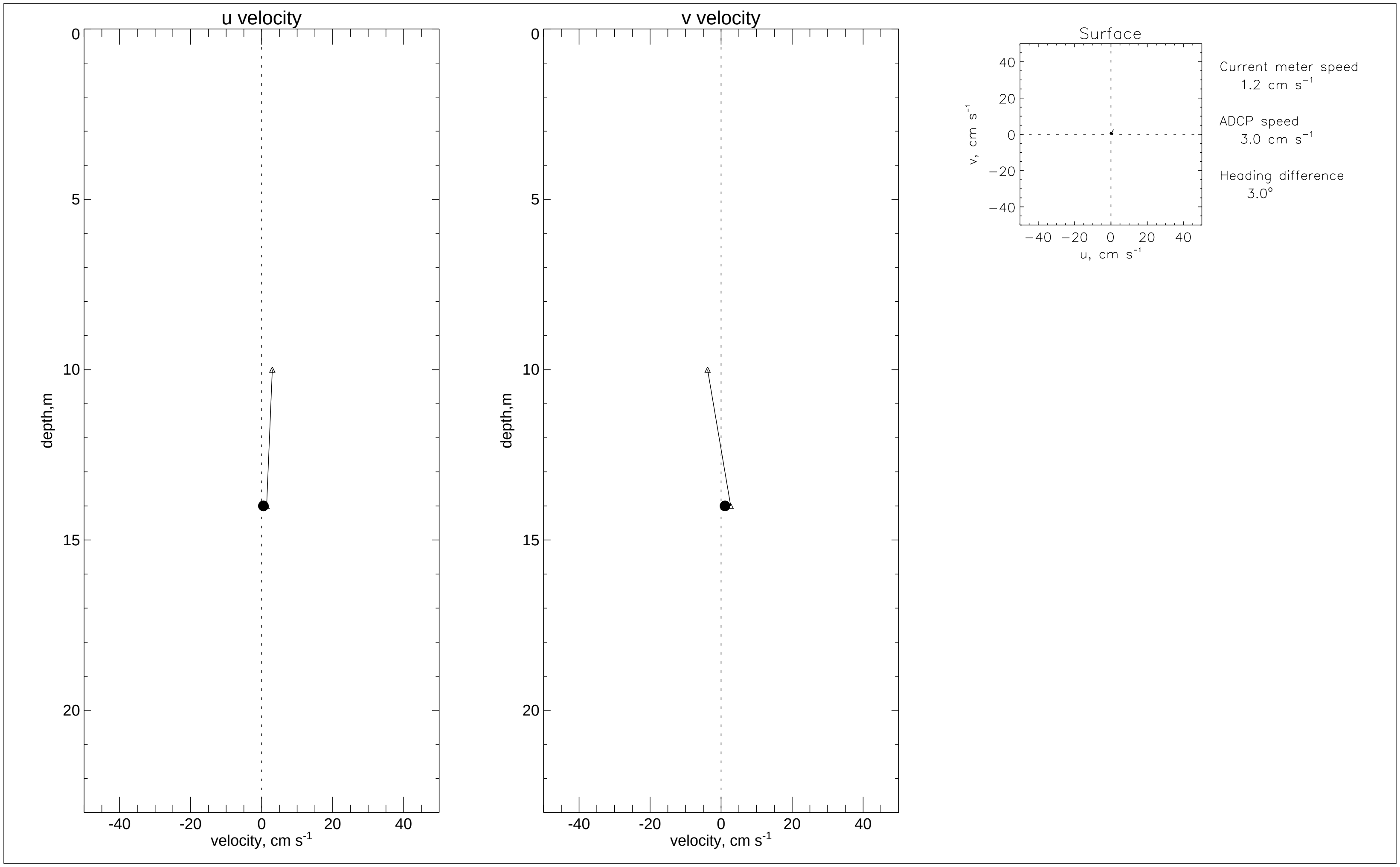

Figure 6.5.01. ADCP profile taken on 5 August 1993 at 0057 UTC (cruise H06) while passing by mooring CM01 at a distance of 0 .7 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 5 August 1993 at 0100 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

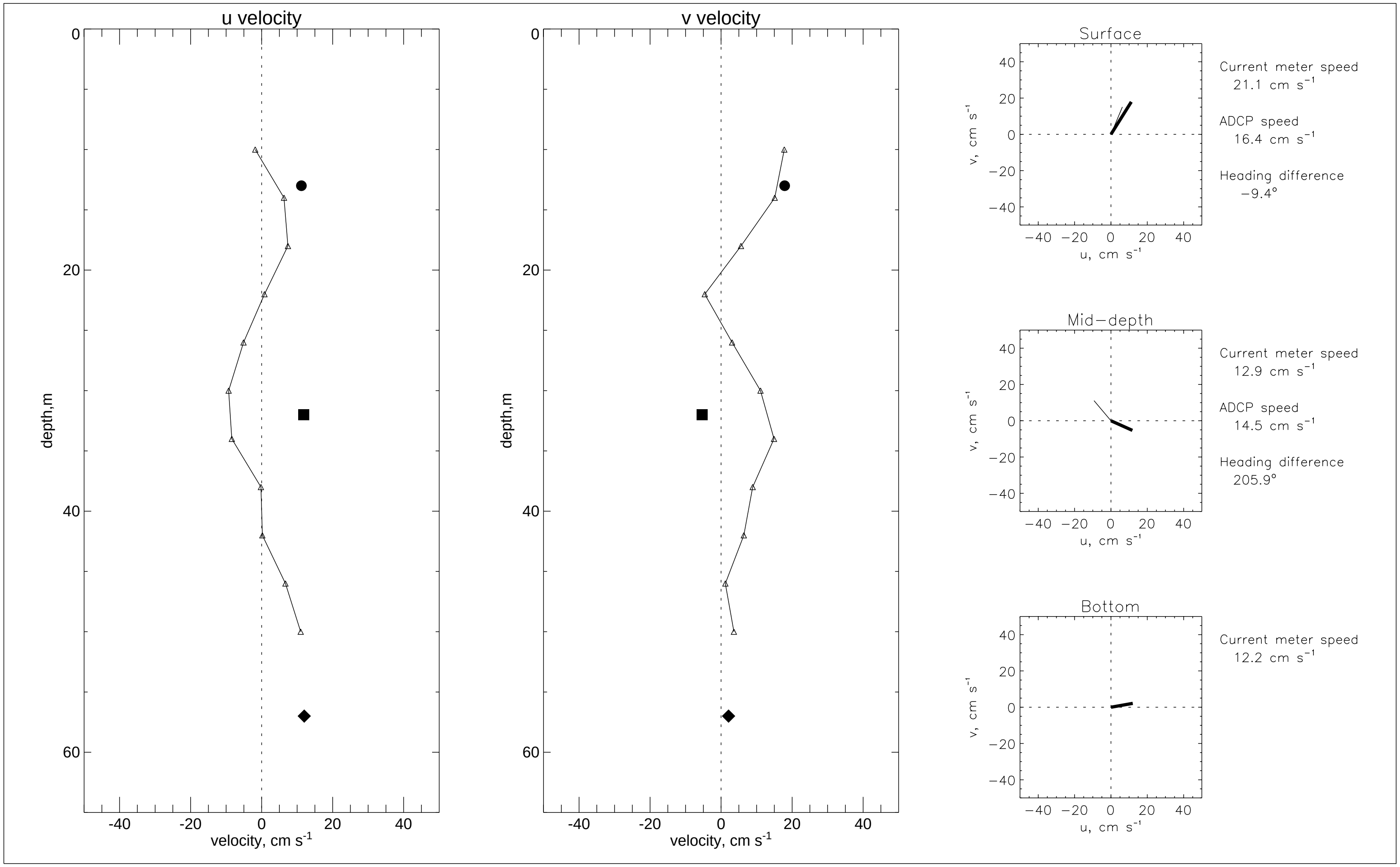

Figure 6.5.03. ADCP profile taken on 4 August 1993 at 0700 UTC (cruise H06) while passing by mooring CM03 at a distance of 8 .0 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 4 August 1993 at 0700 UTC. Velocities for the mid-depth meter (32 m) are marked with a square and were recorded on 4 August 1993 at 0700 UTC. Velocities for the bottom meter (57 m) are marked with a diamond and were recorded on 4 August 1993 at 0700 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

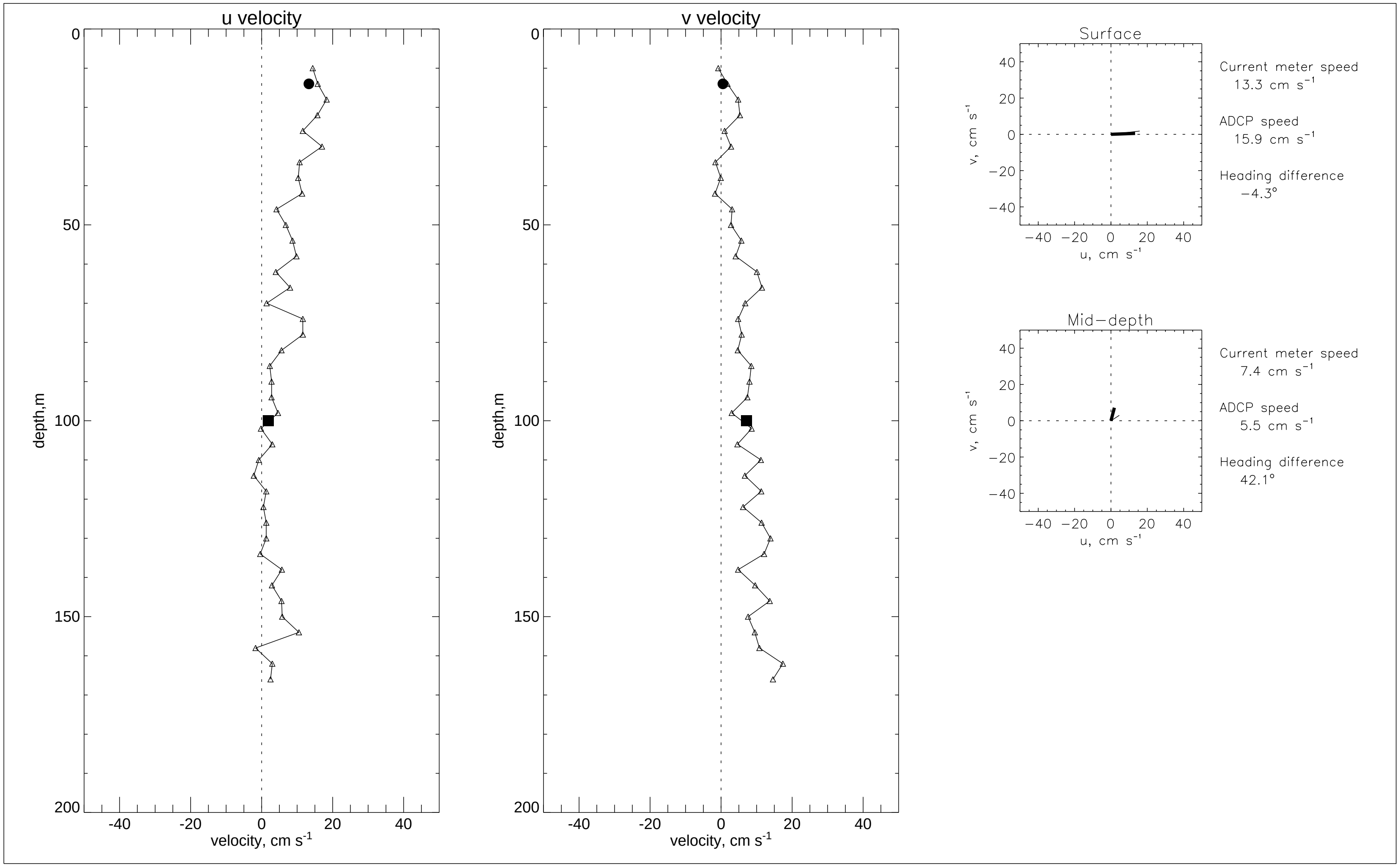

Figure 6.5.04. ADCP profile taken on 4 August 1993 at 1342 UTC (cruise H06) while passing by mooring CM04 at a distance of 1 .2 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 4 August 1993 at 1330 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 4 August 1993 at 1330 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

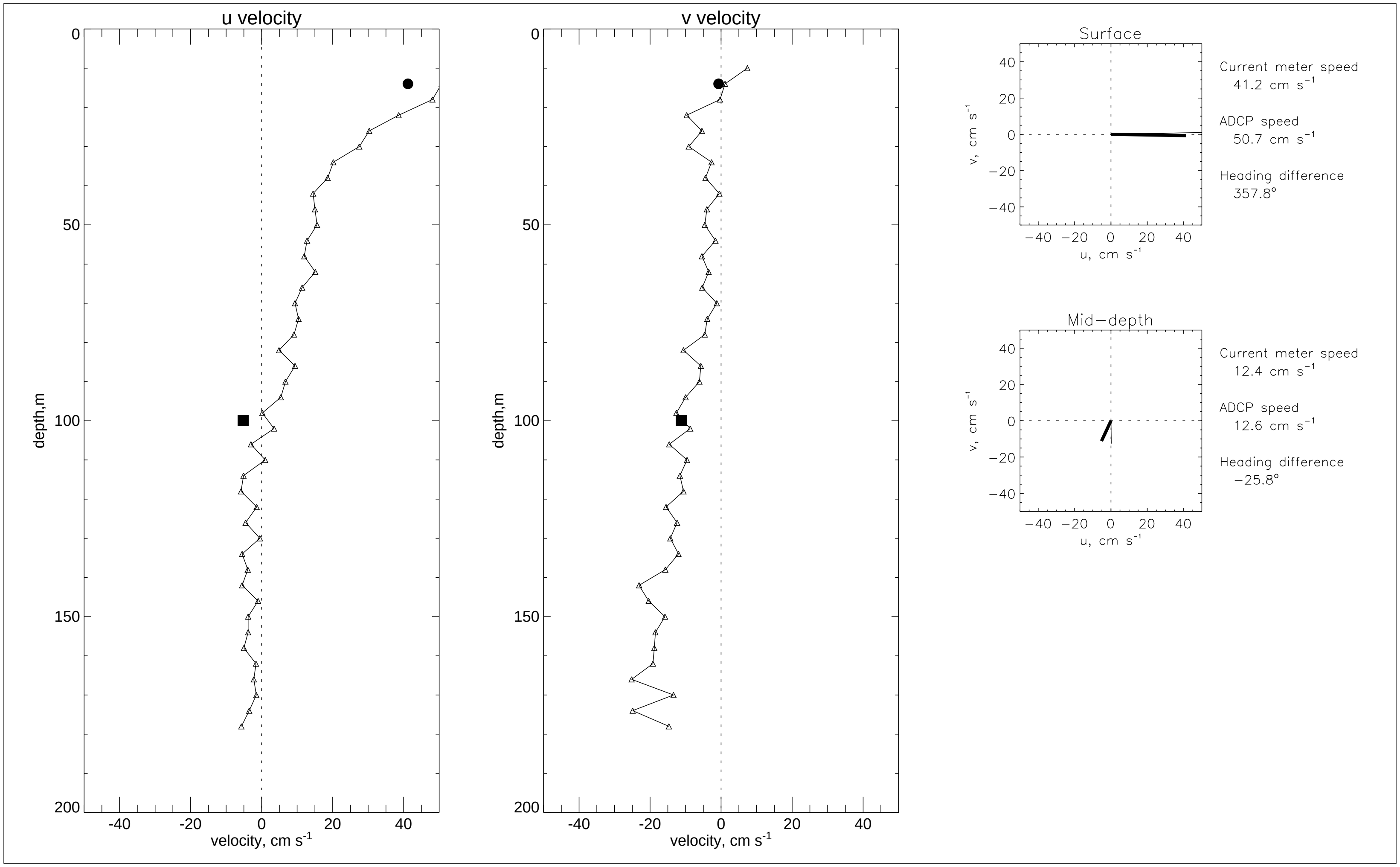

Figure 6.5.05. ADCP profile taken on 6 August 1993 at 1215 UTC (cruise H06) while passing by mooring CM05 at a distance of 1 .6 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 6 August 1993 at 1200 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 6 August 1993 at 1200 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

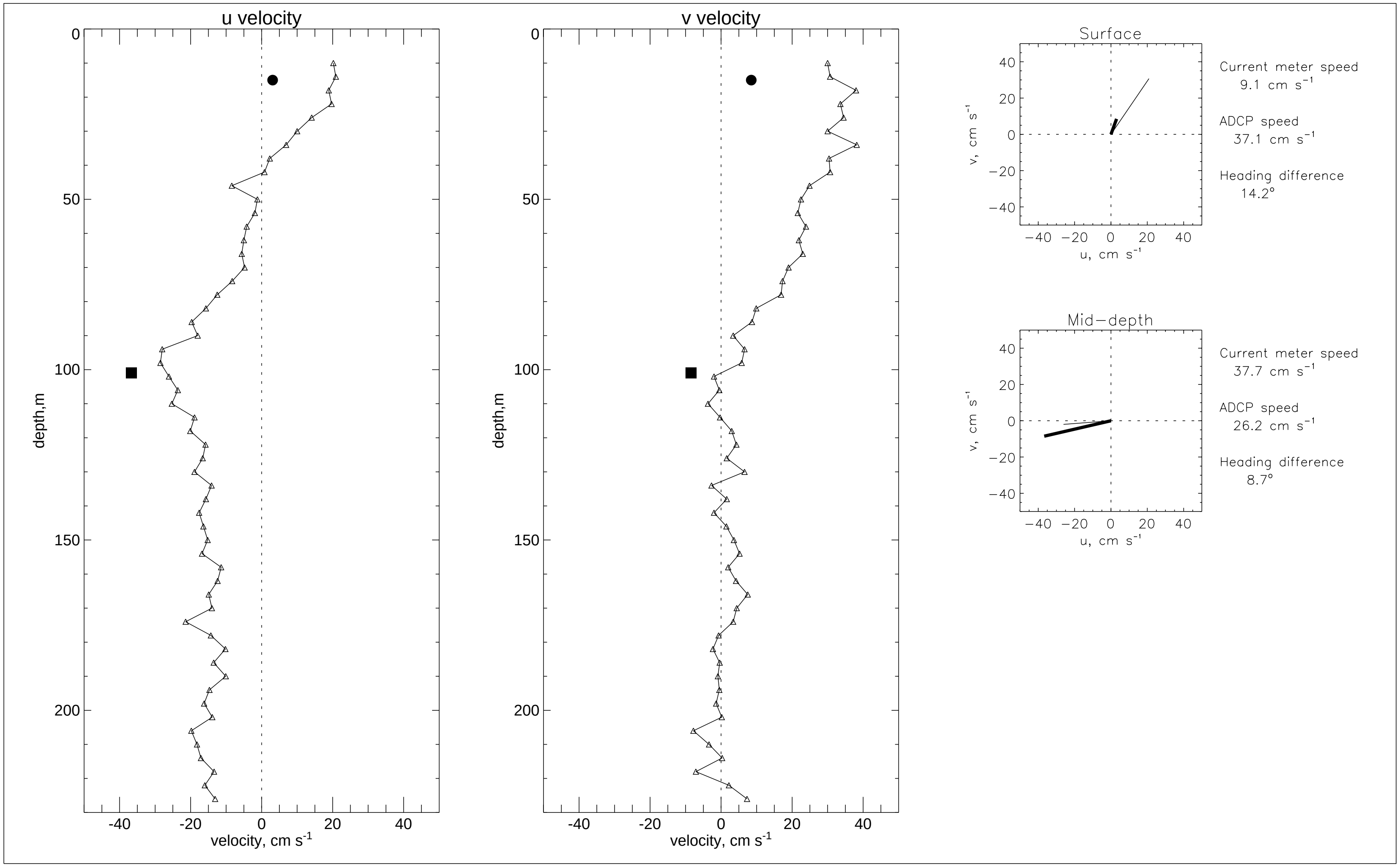

Figure 6.5.06. ADCP profile taken on 6 August 1993 at 1525 UTC (cruise H06) while passing by mooring CM06 at a distance of 4 .1 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 6 August 1993 at 1530 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 6 August 1993 at 1530 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

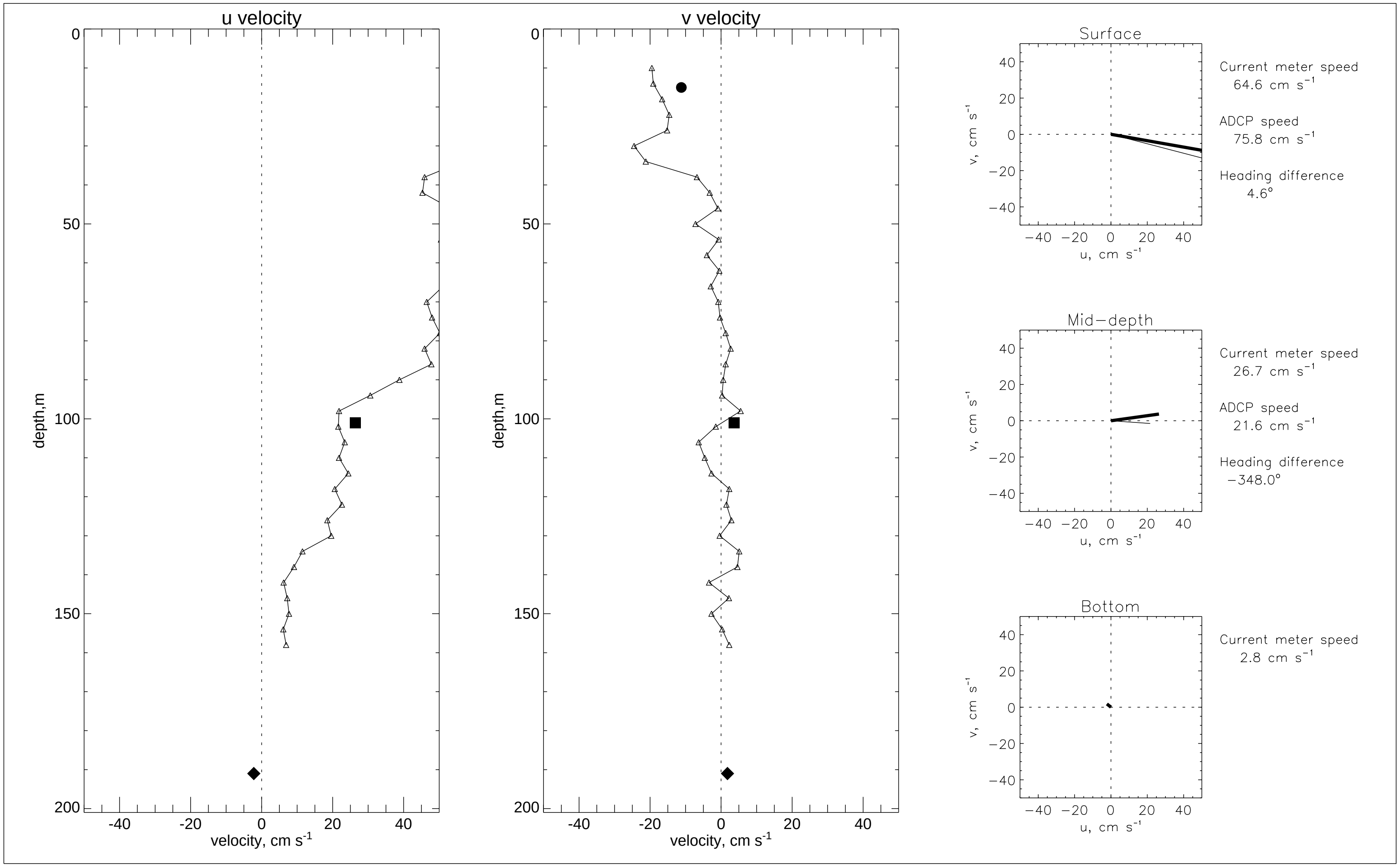

Figure 6.5.07. ADCP profile taken on 2 August 1993 at 1739 UTC (cruise H06) while passing by mooring CM07 at a distance of 0 .4 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 2 August 1993 at 1730 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 2 August 1993 at 1730 UTC. Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 2 August 1993 at 1730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

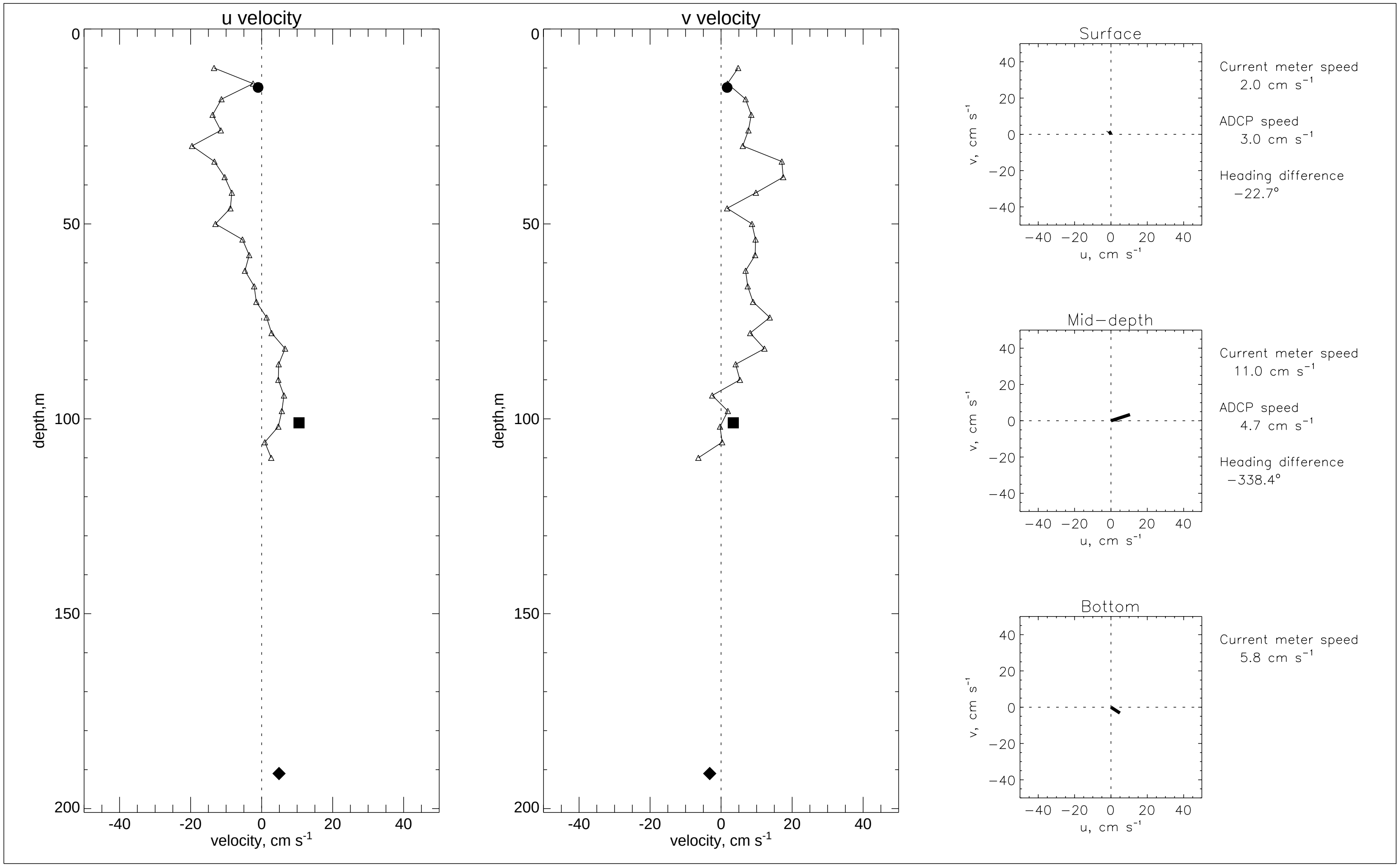

Figure 6.5.08. ADCP profile taken on 1 August 1993 at 0354 UTC (cruise H06) while passing by mooring CM08 at a distance of 0 .7 km.
Velocities for the surface meter (15 m) are marked with a circle and were recorded on 1 August 1993 at 0400 UTC.
Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 1 August 1993 at 0400 UTC.
Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 1 August 1993 at 0400 UTC.
The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

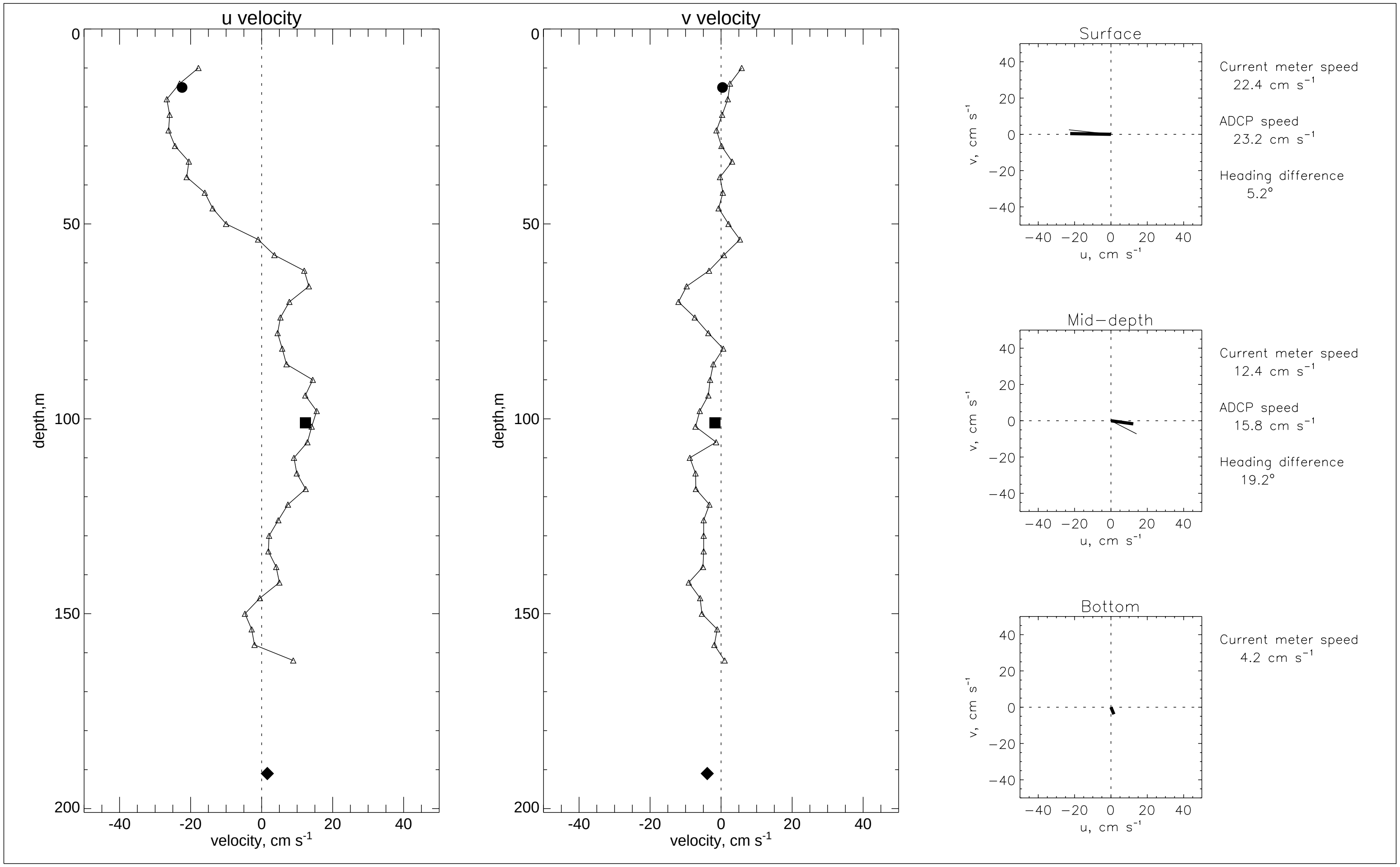

Figure 6.5.09. ADCP profile taken on 31 July 1993 at 1854 UTC (cruise H06) while passing by mooring CM09 at a distance of 0. 8 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 31 July 1993 at 1900 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 31 July 1993 at 1900 UTC. Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 31 July 1993 at 1900 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

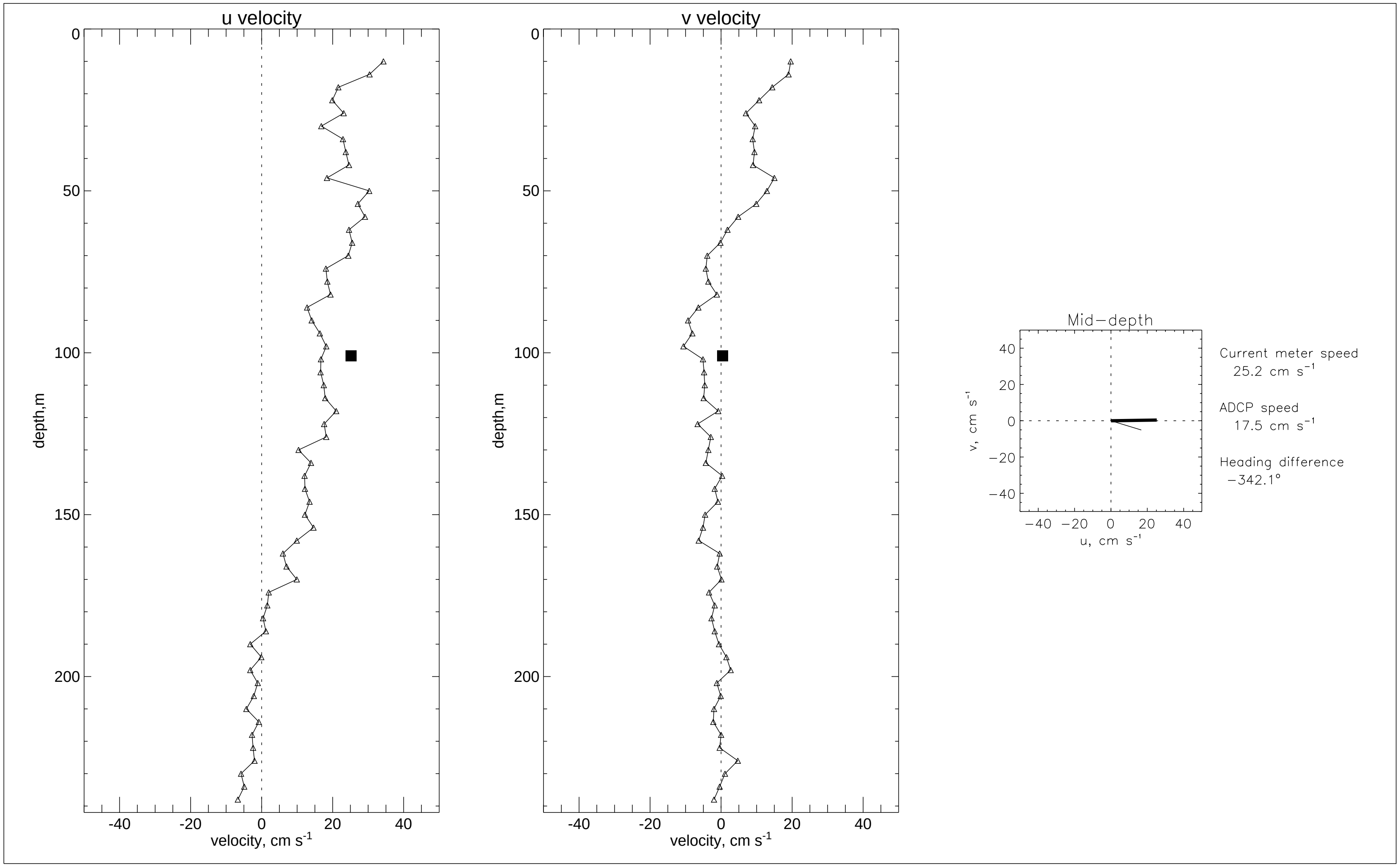

Figure 6.5.10. ADCP profile taken on 31 July 1993 at 1319 UTC (cruise H06) while passing by mooring CM10 at a distance of 2. 9 km. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 31 July 1993 at 1330 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

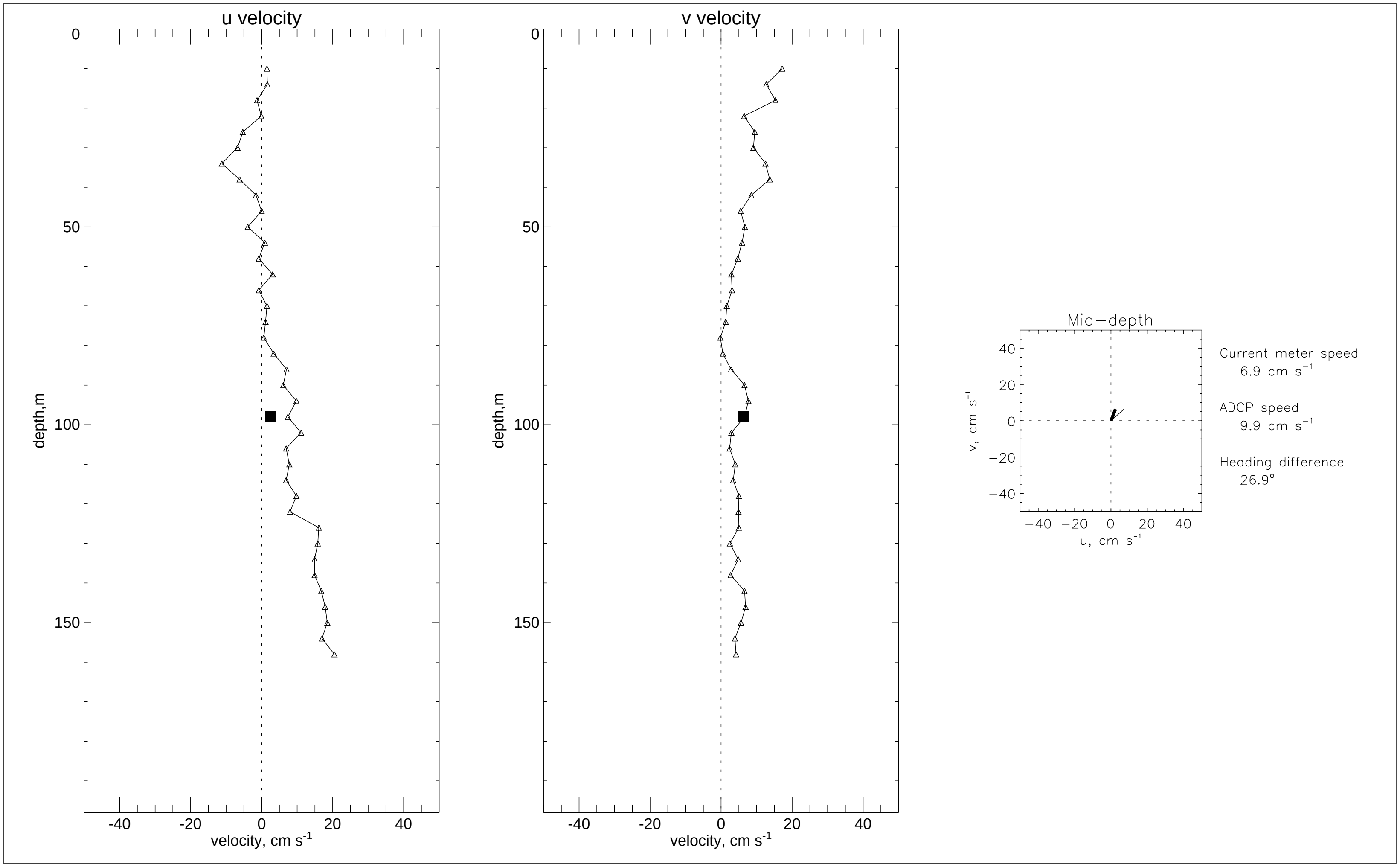

Figure 6.5.11. ADCP profile taken on 29 July 1993 at 1032 UTC (cruise H06) while passing by mooring CM11 at a distance of 0. 7 km. Velocities for the mid-depth meter (98 m) are marked with a square and were recorded on 29 July 1993 at 1030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

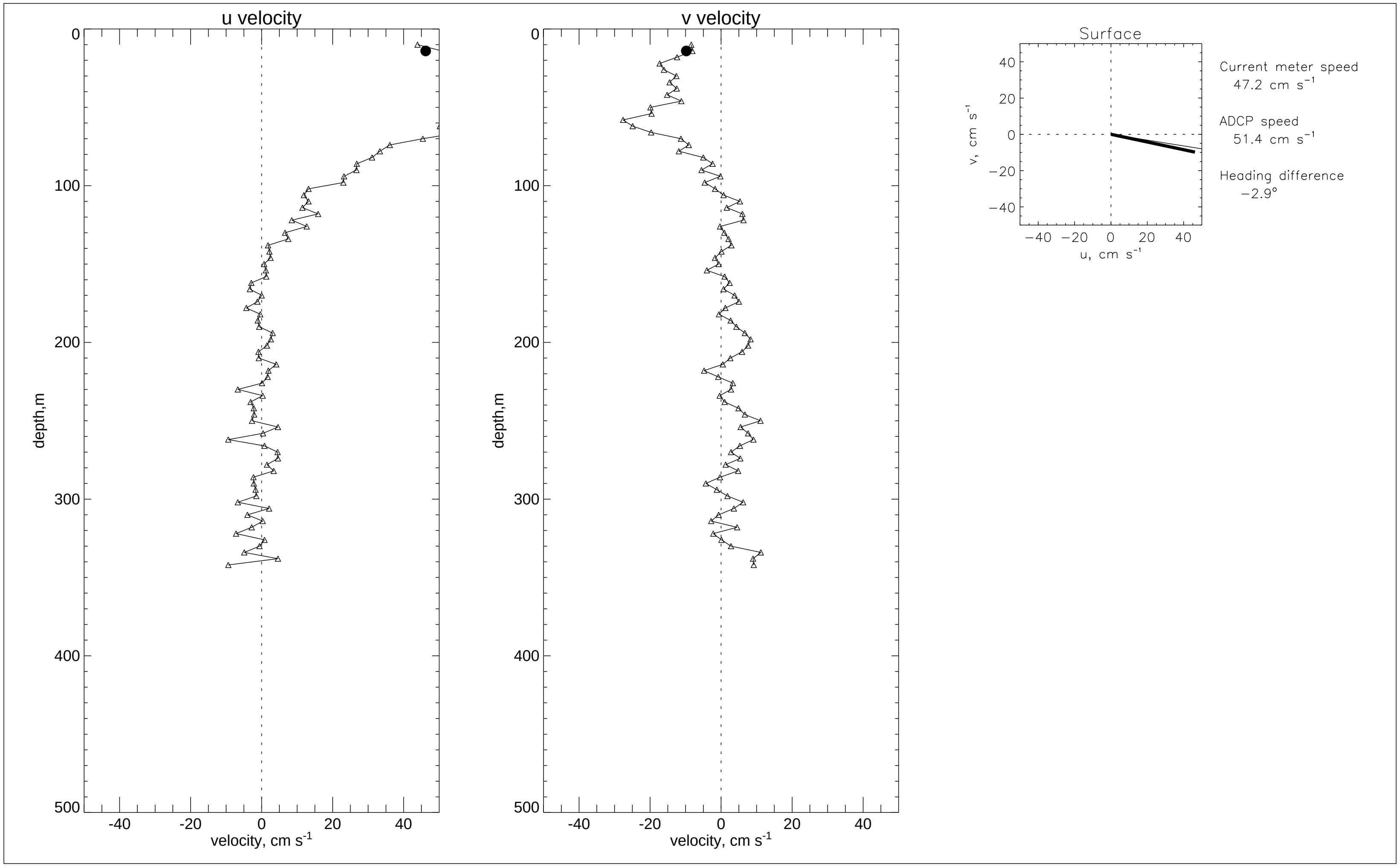

Figure 6.5.12. ADCP profile taken on 28 July 1993 at 2113 UTC (cruise H06) while passing by mooring CM12 at a distance of 2. 2 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 28 July 1993 at 2100 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

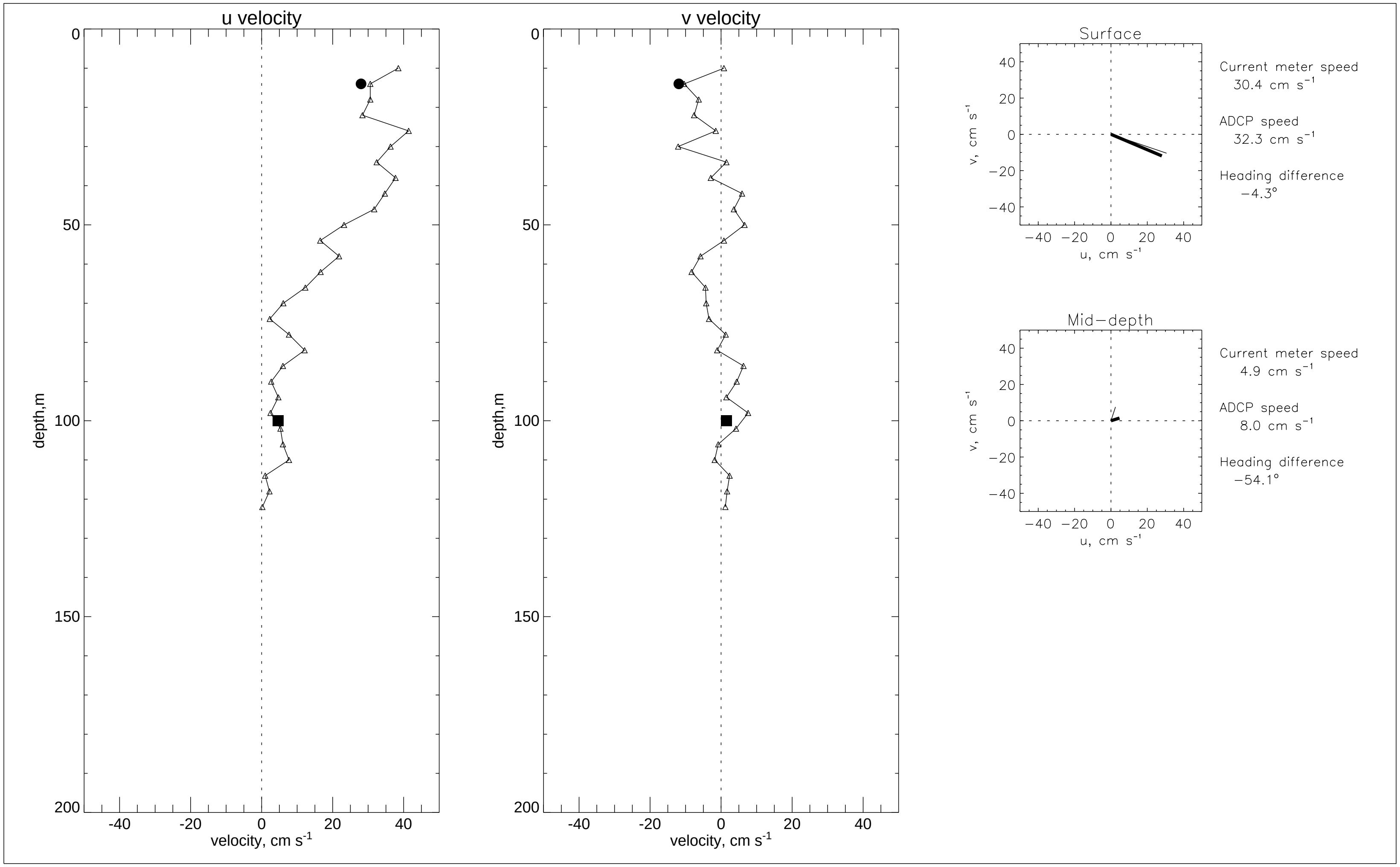

Figure 6.5.13. ADCP profile taken on 28 July 1993 at 1631 UTC (cruise H06) while passing by mooring CM13 at a distance of 2. 5 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 28 July 1993 at 1630 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 28 July 1993 at 1630 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

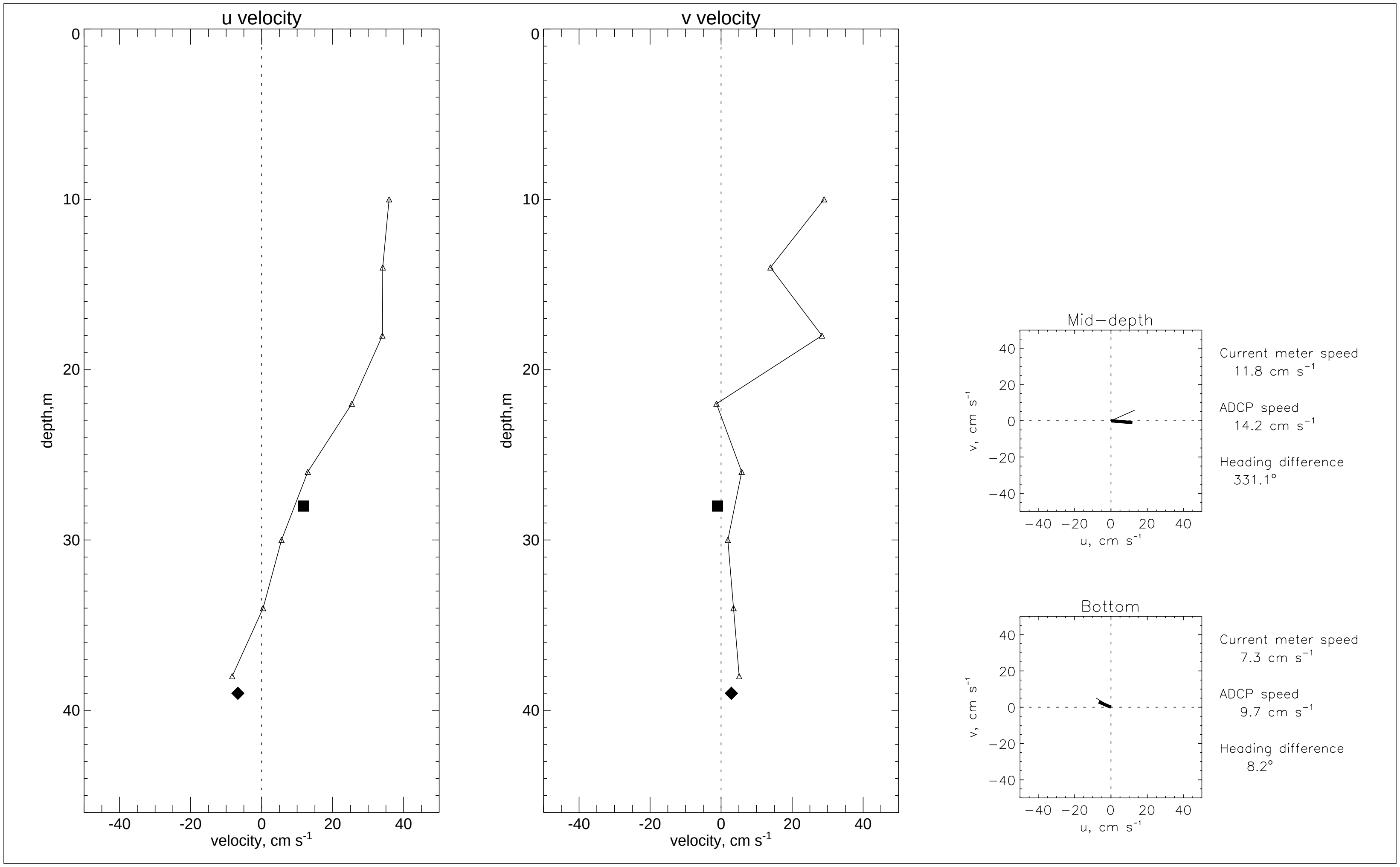

Figure 6.5.14. ADCP profile taken on 28 July 1993 at 1206 UTC (cruise H06) while passing by mooring CM14 at a distance of 0. 9 km. Velocities for the mid-depth meter (28 m) are marked with a square and were recorded on 28 July 1993 at 1205 UTC. Velocities for the bottom meter (39 m) are marked with a diamond and were recorded on 28 July 1993 at 1205 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

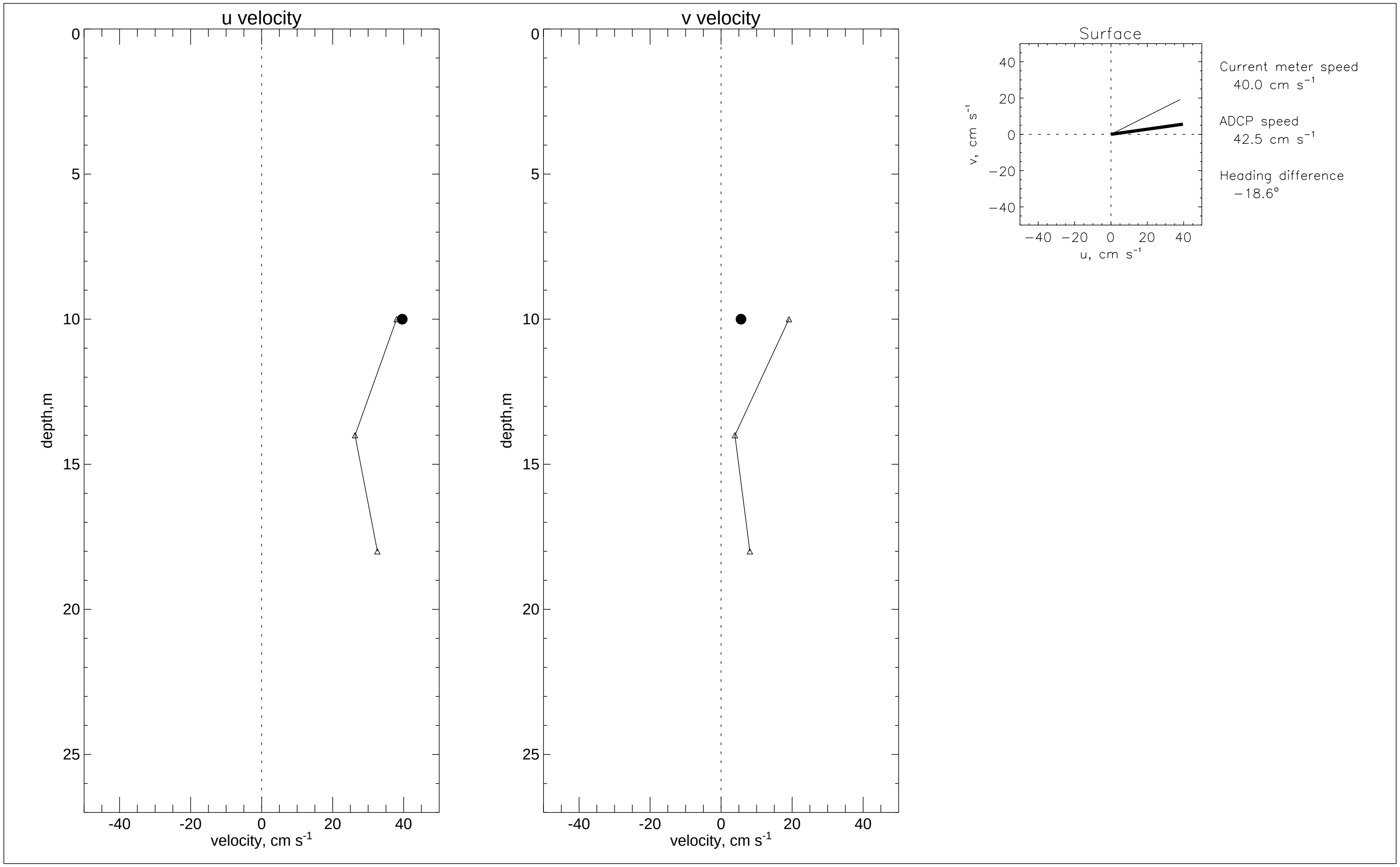

Figure 6.5.15. ADCP profile taken on 28 July 1993 at 0940 UTC (cruise H06) while passing by mooring CM15 at a distance of 1. 0 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 28 July 1993 at 0930 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

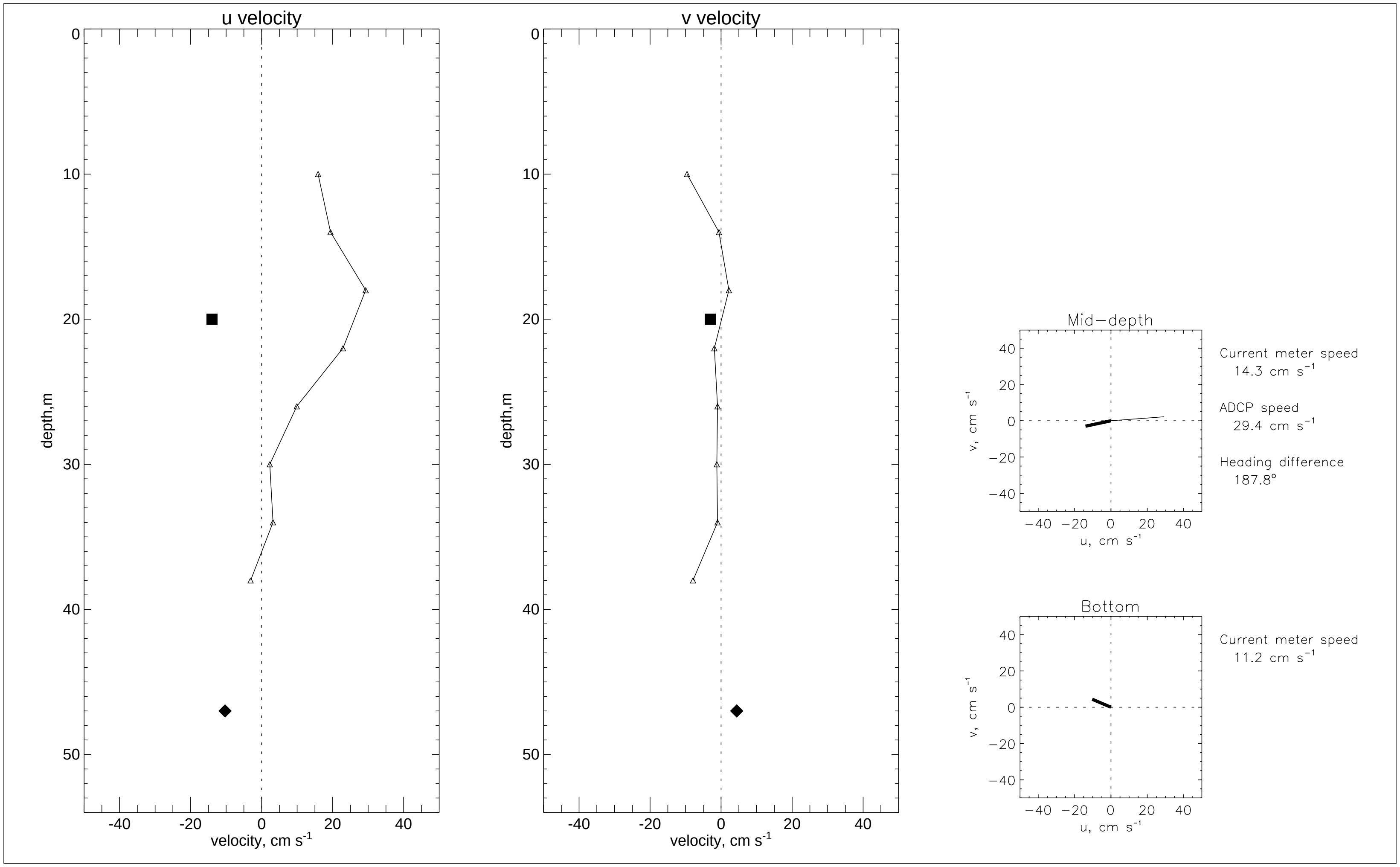

Figure 6.5.19. ADCP profile taken on 27 July 1993 at 1602 UTC (cruise H06) while passing by mooring CM19 at a distance of 2. 8 km. Velocities for the mid-depth meter (20 m) are marked with a square and were recorded on 27 July 1993 at 1600 UTC. Velocities for the bottom meter (47 m) are marked with a diamond and were recorded on 27 July 1993 at 1600 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

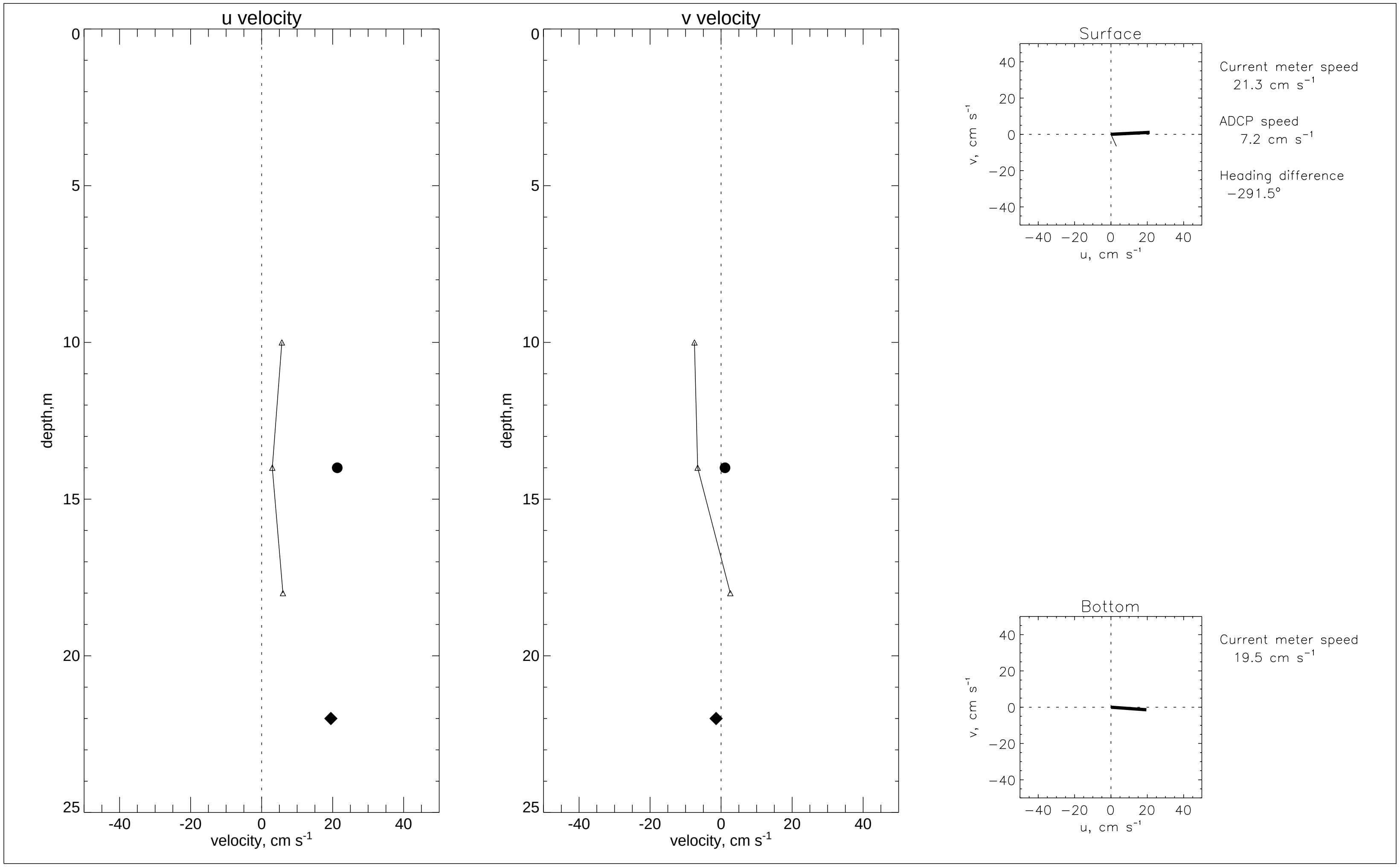

Figure 6.5.21. ADCP profile taken on 1 August 1993 at 1348 UTC (cruise H06) while passing by mooring CM21 at a distance of 8 .8 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 1 August 1993 at 1400 UTC. Velocities for the bottom meter (22 m) are marked with a diamond and were recorded on 1 August 1993 at 1350 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

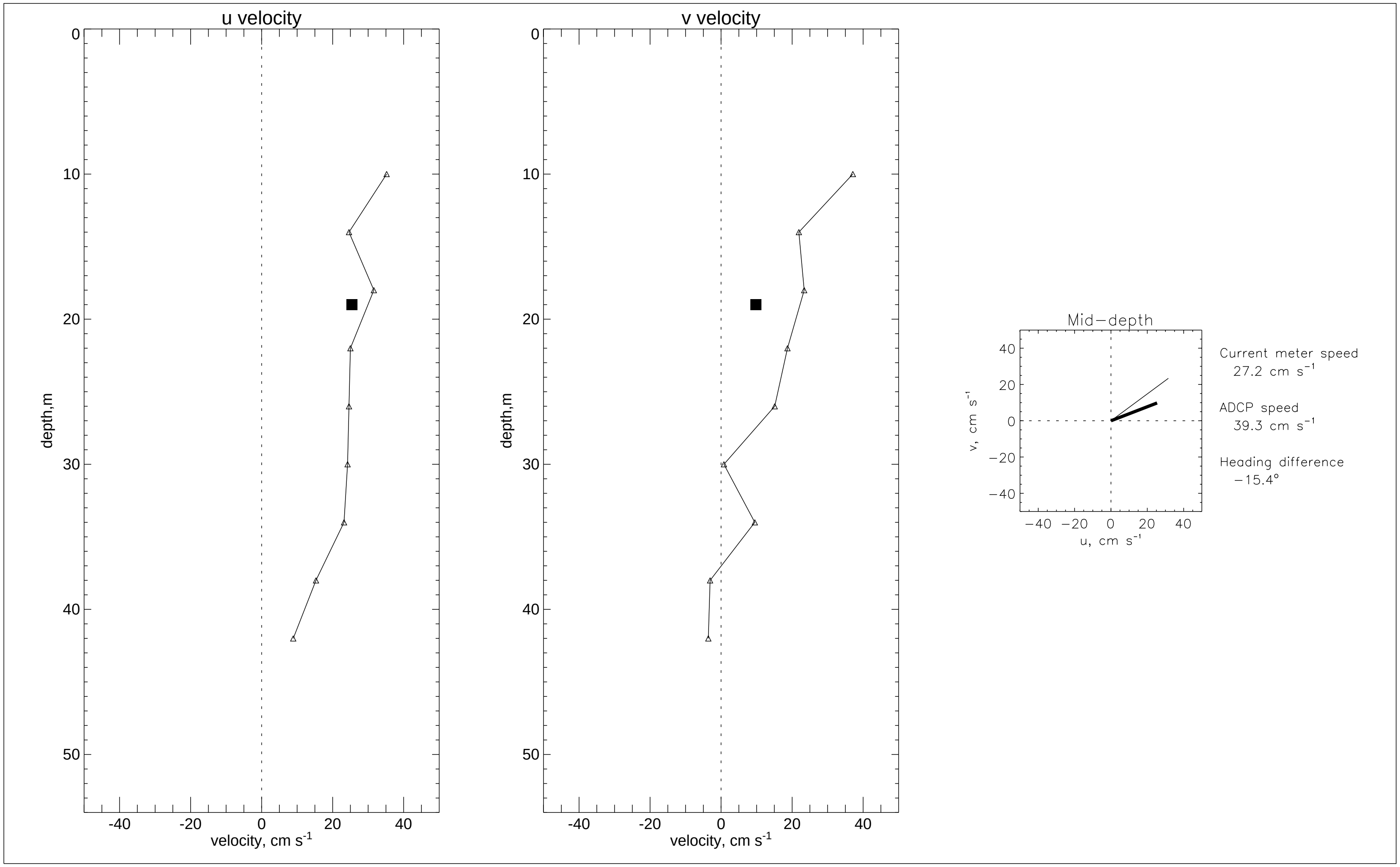

Figure 6.5.22. ADCP profile taken on 1 August 1993 at 0909 UTC (cruise H06) while passing by mooring CM22 at a distance of 3 .9 km. Velocities for the mid-depth meter (19 m) are marked with a square and were recorded on 1 August 1993 at 0910 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

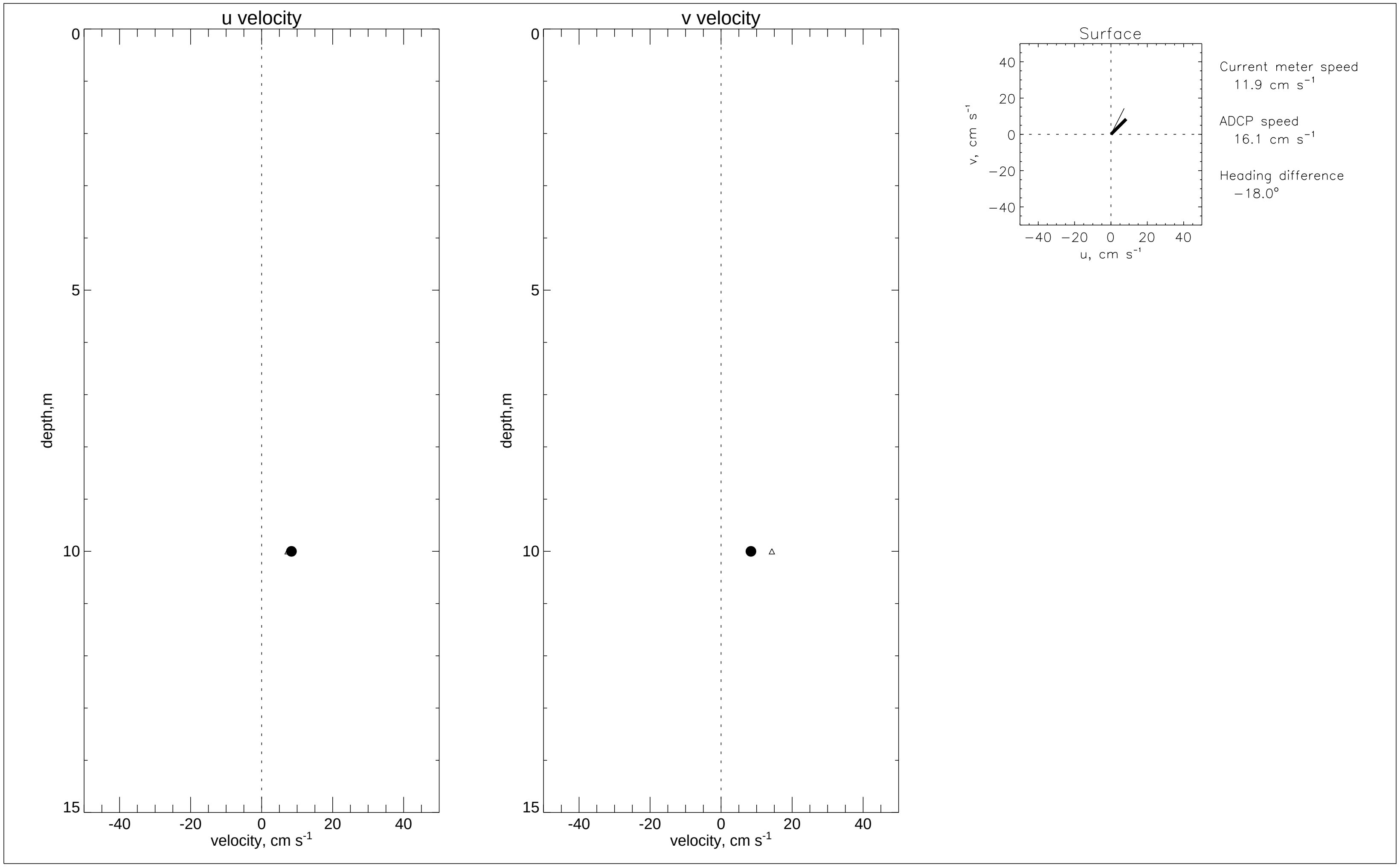

Figure 6.5.23. ADCP profile taken on 3 August 1993 at 0359 UTC (cruise H06) while passing by mooring CM23 at a distance of 1 .9 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 3 August 1993 at 0400 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

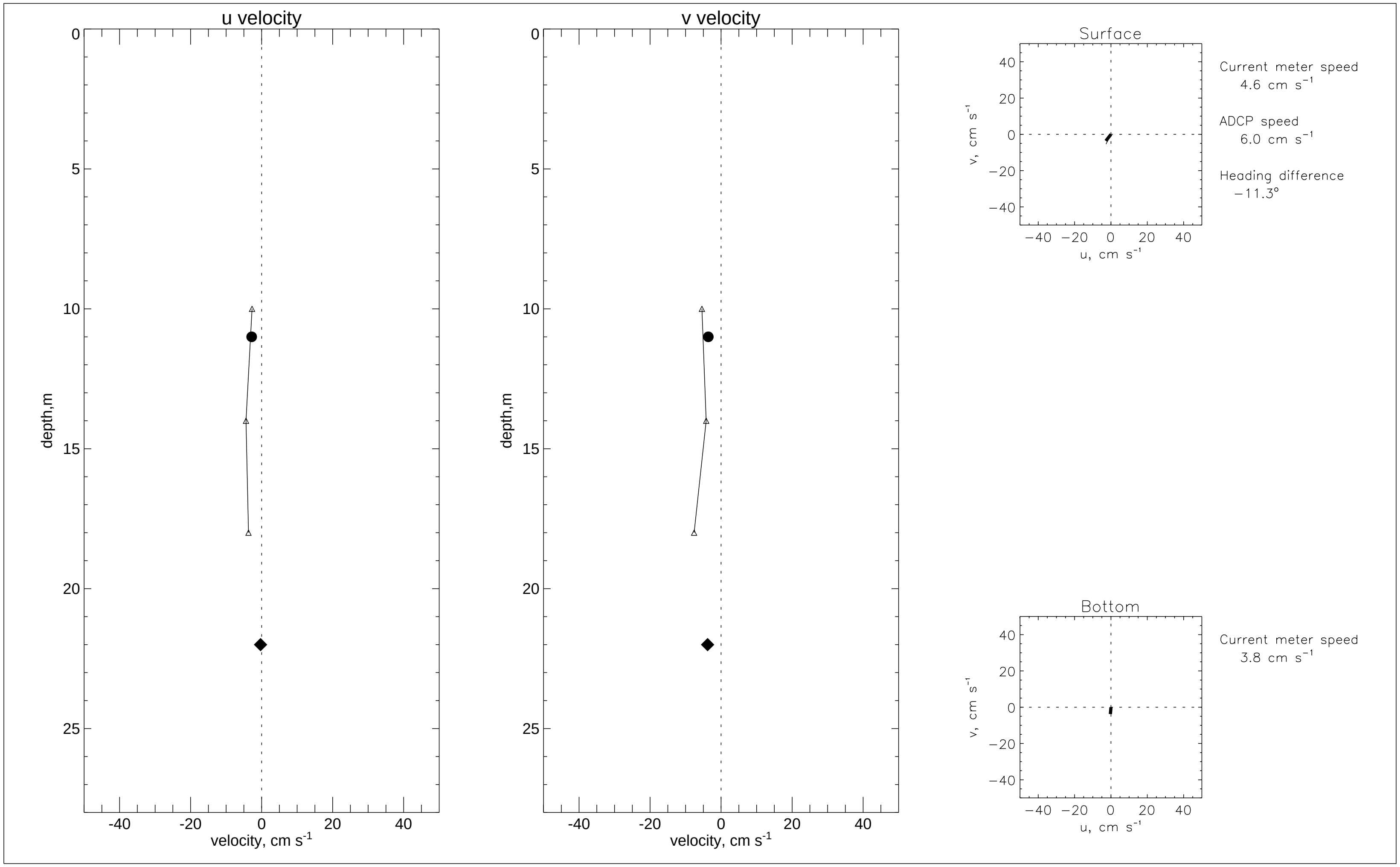

Figure 6.5.24. ADCP profile taken on 3 August 1993 at 0134 UTC (cruise H06) while passing by mooring CM24 at a distance of 4 .1 km. Velocities for the surface meter (11 m) are marked with a circle and were recorded on 3 August 1993 at 0130 UTC. Velocities for the bottom meter (22 m) are marked with a diamond and were recorded on 3 August 1993 at 0135 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

4.4 Cruise H07

4.4.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *J.W. Powell*. The Vessel-Mount model ADCP was installed and the TRANSECT program was used during this survey. Underway ADCP data were collected from 05:53 UTC on 7 November through 18:53 UTC on 14 November, from 09:30 UTC on 15 November through 12:30 UTC on 16 November, and from 09:56 UTC on 17 November through 05:52 UTC on 22 November. Gaps in data collection were occasioned by mid-cruise port stops. Except for data gaps when the computer hung up (for 8 hours on 11 November and 1.5 hours on 20 November), there were no major problems in data collection. The QA/QC processing produced usable data. The parameter settings are shown in Table 15.

Table 15. Parameter settings (in meters) and the resulting sequence of bin depths on survey H07.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
2	4	4	10, 14, 18, 22, ...

4.4.2 Results

4.4.2.1 General Cruise Track

We show in Figure 7.1.1 a plan view of the general cruise track taken by the R/V *Powell* during H07. The cruise covered the entire LATEX shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 7.1.2 for which contoured profiles of normal velocity are presented in section 4.4.2.4. Figure 7.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 4.4.2.5.

4.4.2.2 Plan View of Stick Plot Velocity Vectors

Figure 7.2.1 shows the velocity from the surface bin centered at 10 m, Figure 7.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 7.2.3 shows the velocity from the bin centered at 100m below the surface.

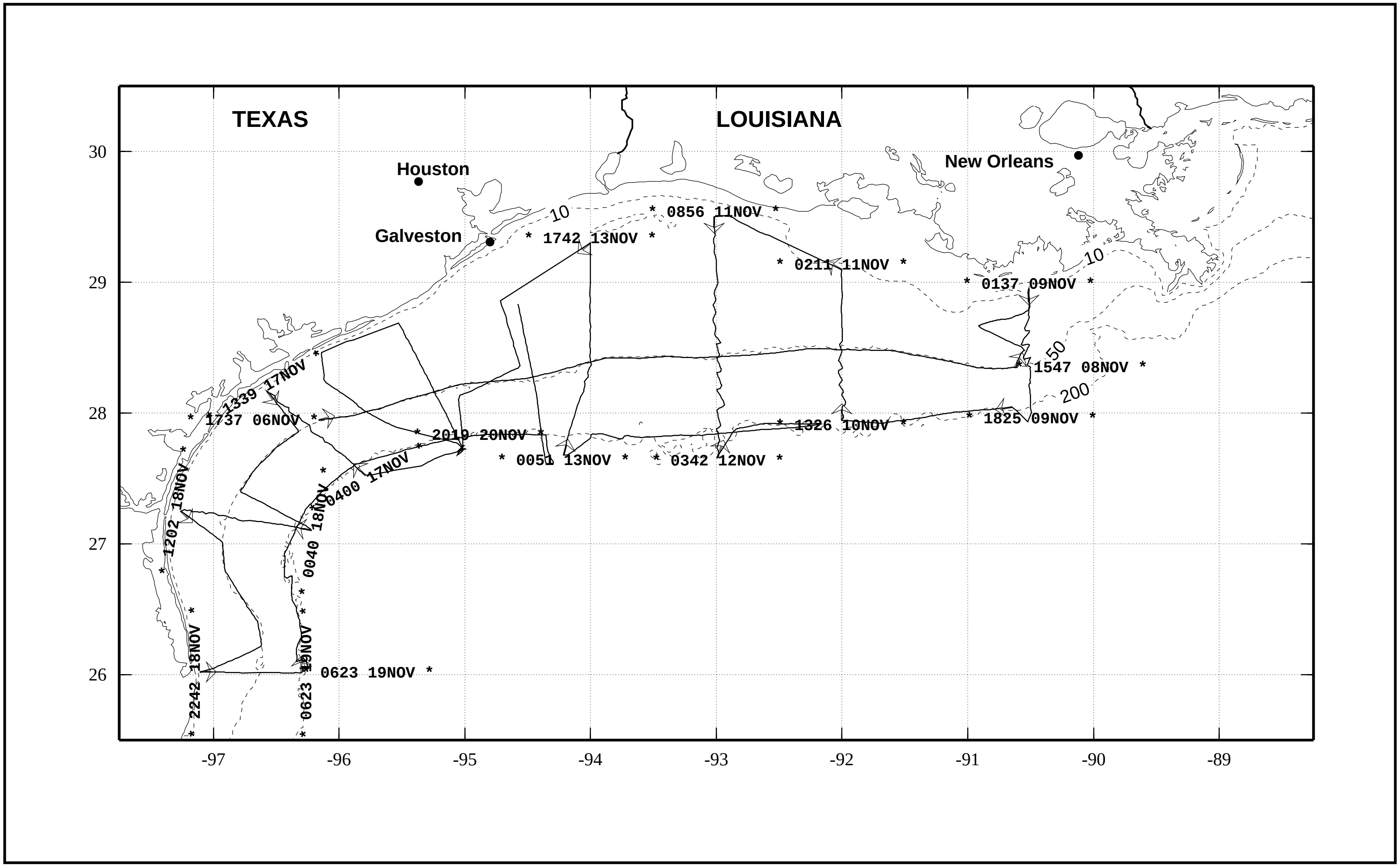

Figure 7.1.1. Cruise track for LATEX A cruise H07 in November 1993, showing times and directions.

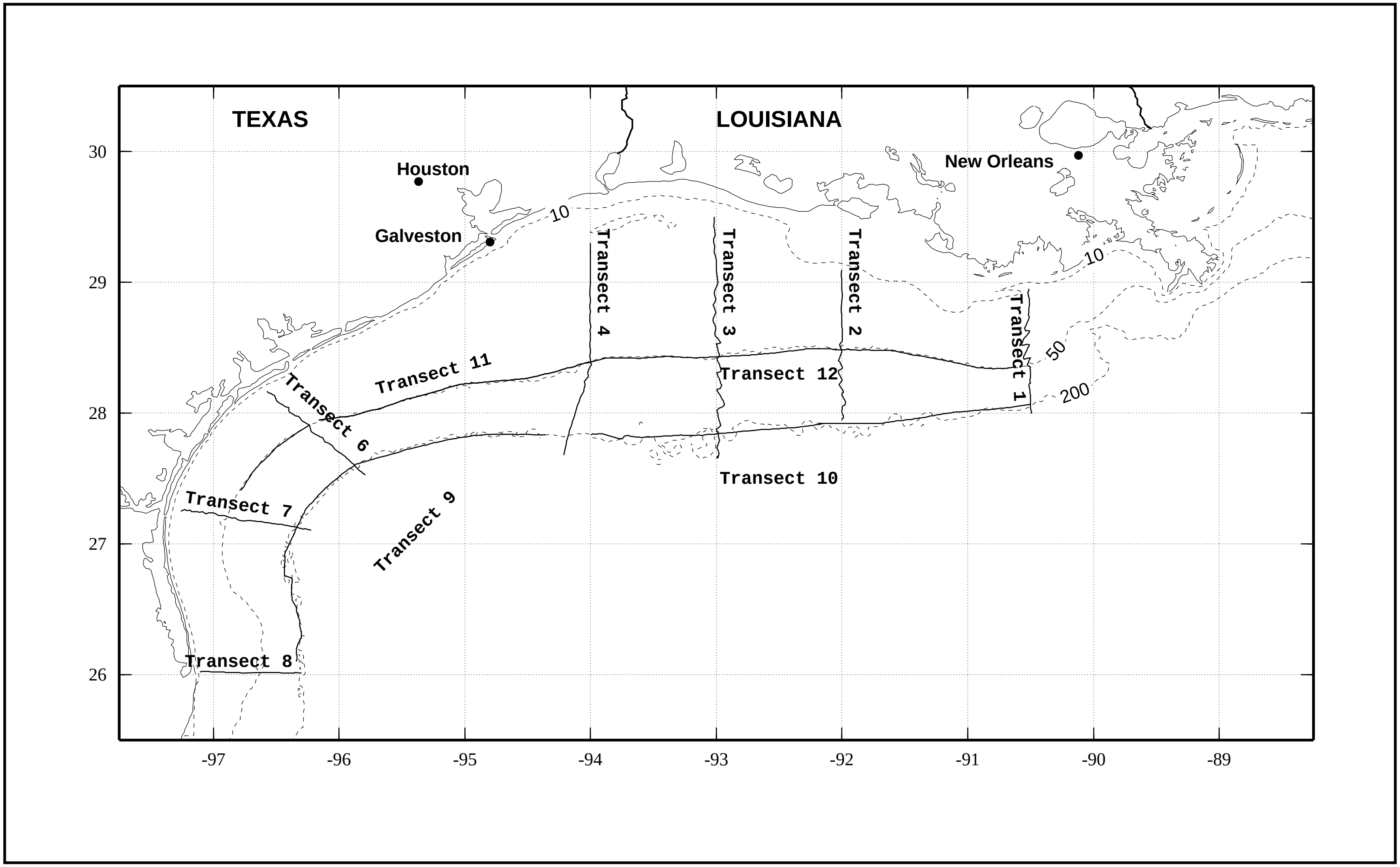

Figure 7.1.2. Cruise track for LATEX A cruise H07 in November 1993, showing individual labeled transects.

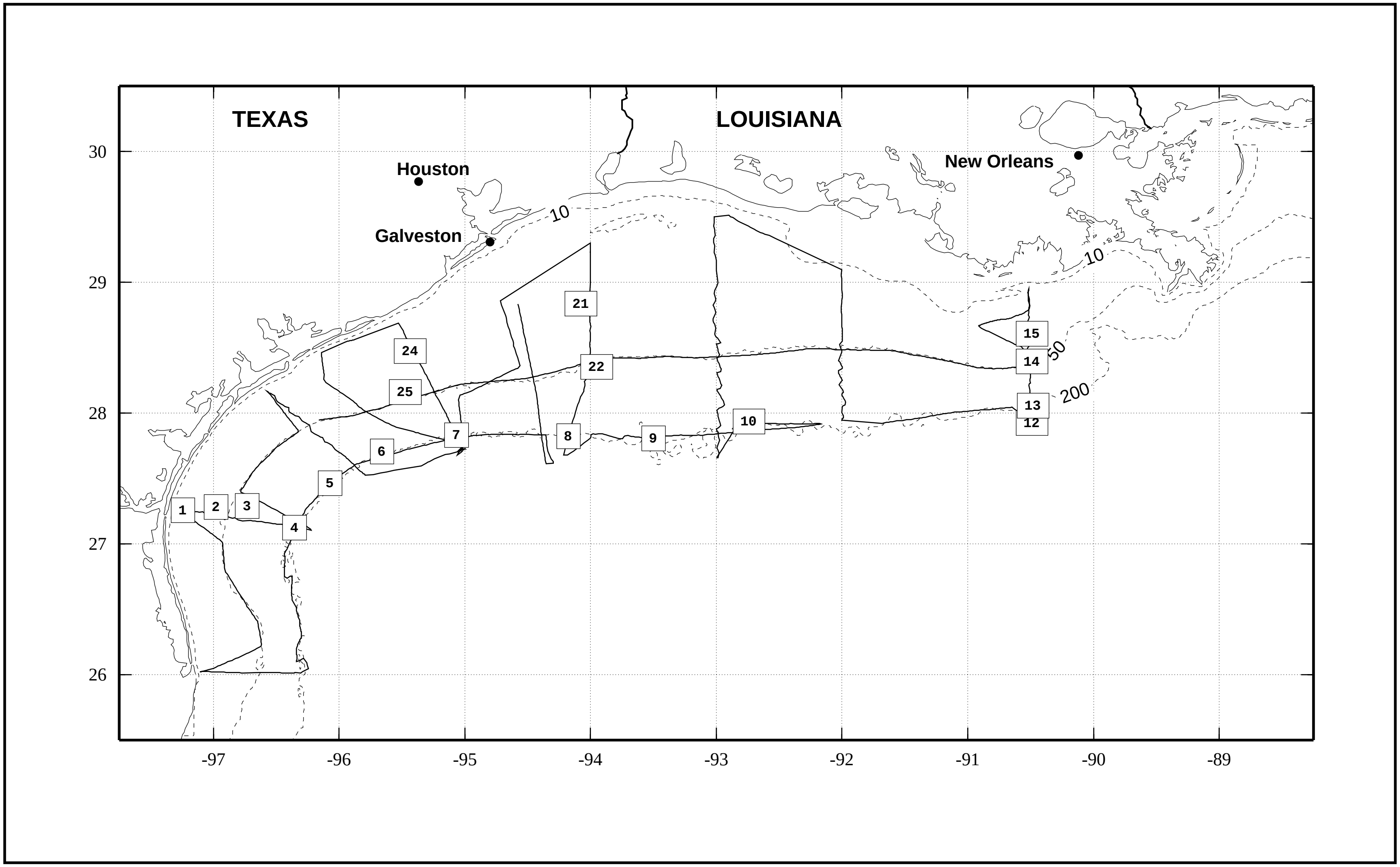

Figure 7.1.3. Cruise track for LATEX A cruise H07 in November 1993, showing current meter locations.

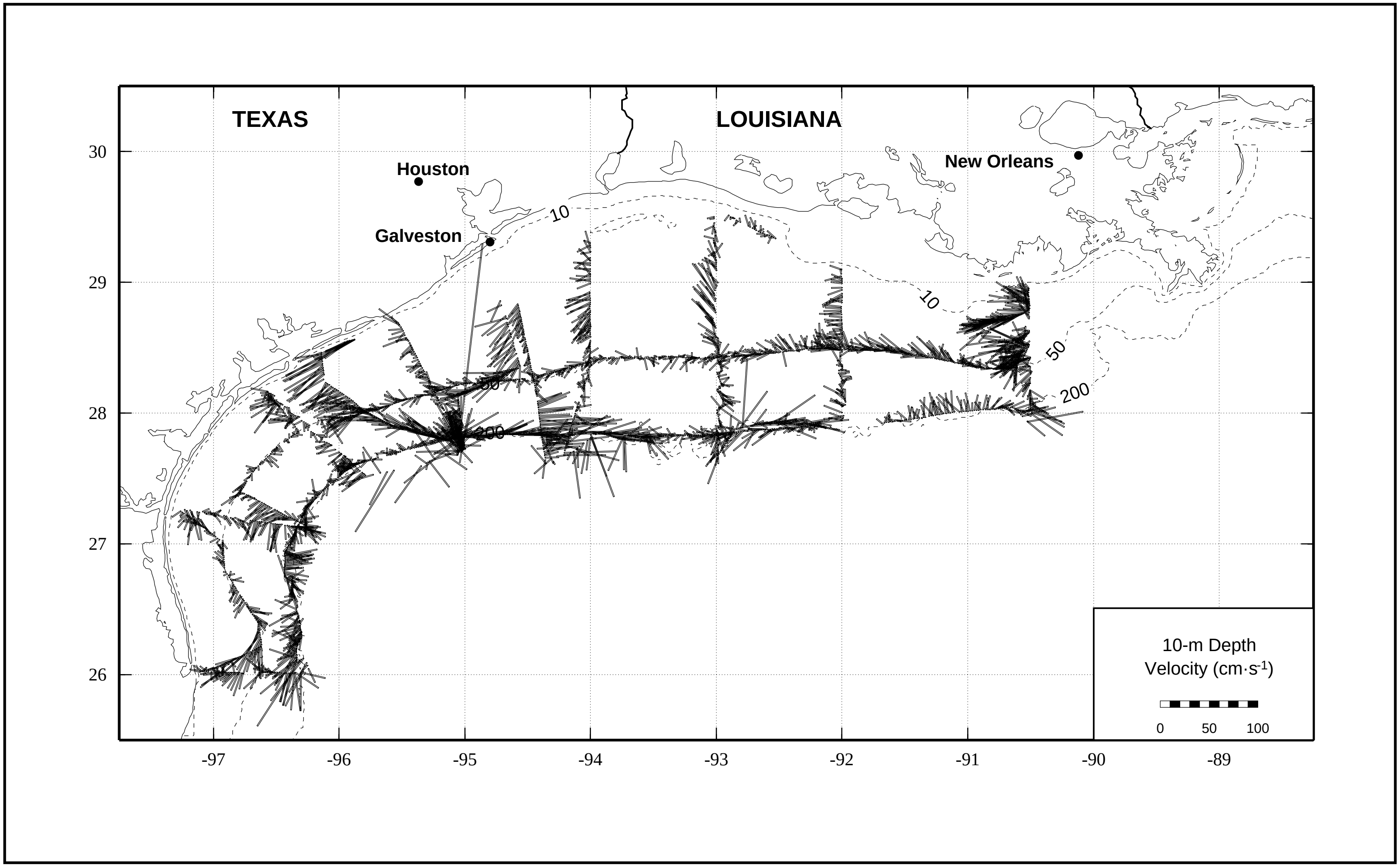

Figure 7.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 10 m depth. The data are from LATEX A cruise H07 conducted in November 1993

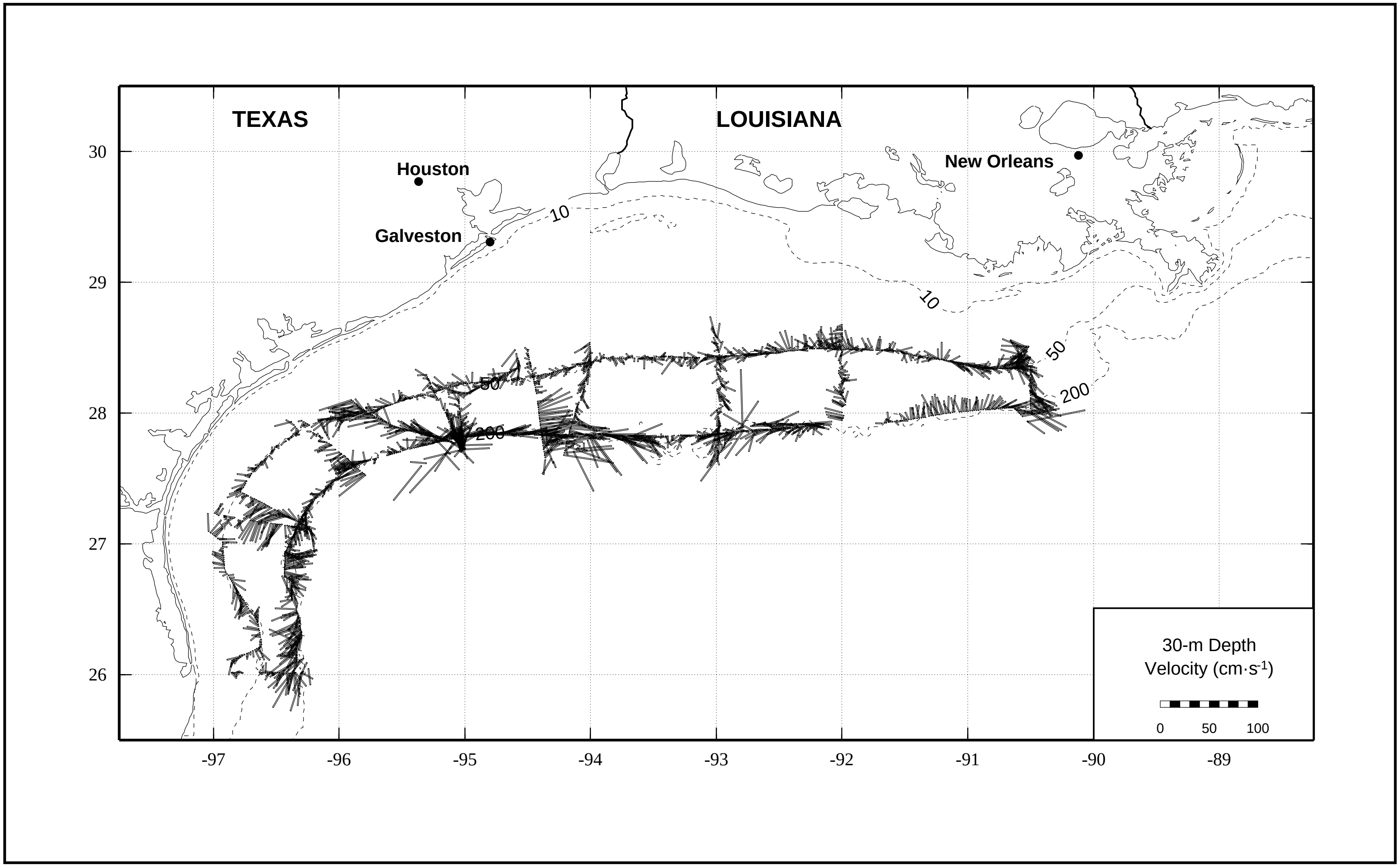

Figure 7.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H07 conducted in November 1993

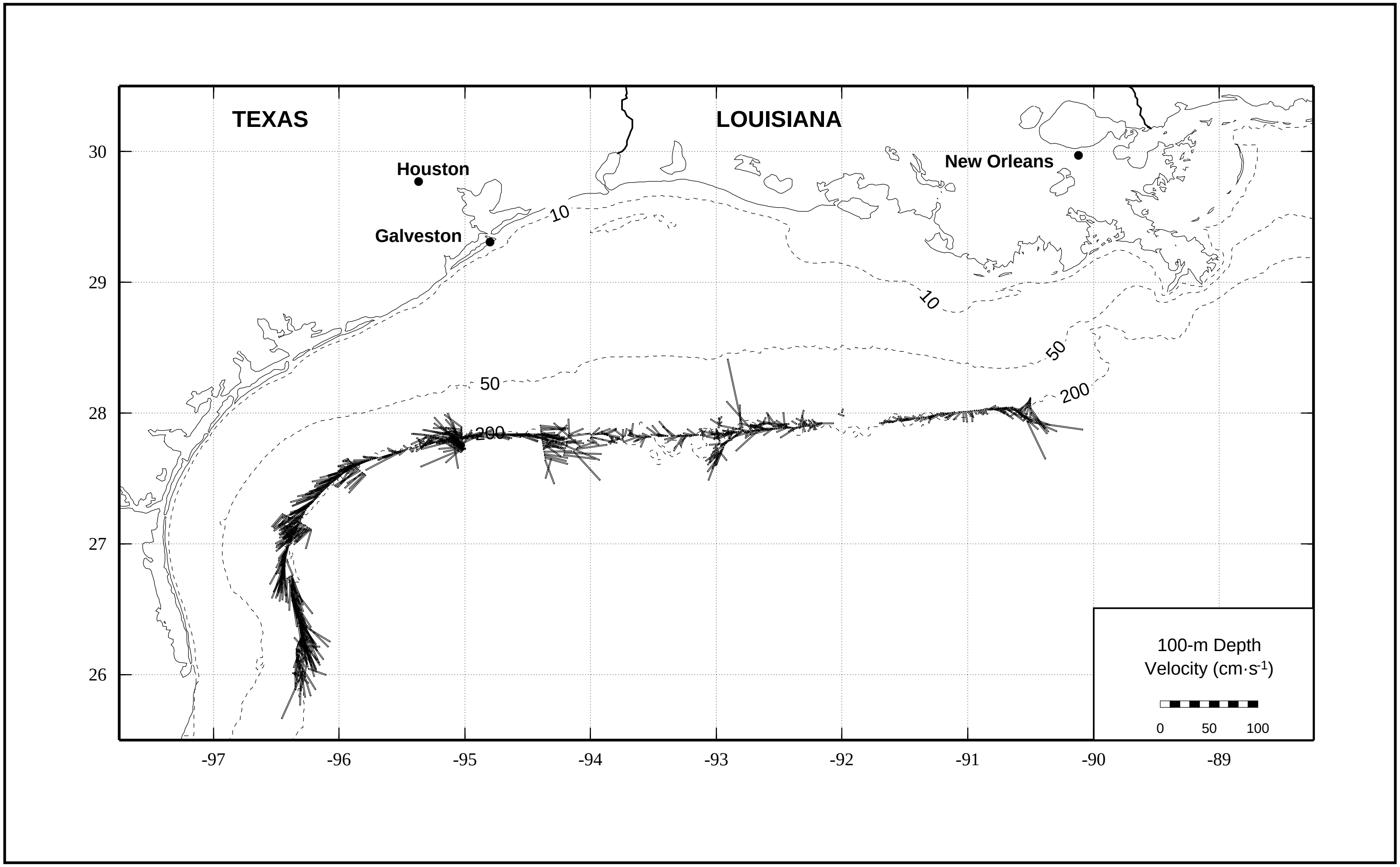

Figure 7.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H07 conducted in November 1993

4.4.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (GMT; Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 7.3.1 shows the velocity from the bin centered at 10 m, Figure 7.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 7.3.3 shows the velocity from the bin centered at 100 m below the surface.

4.4.2.4 Contoured Profiles of Normal Velocity

In Figures 7.4.1, 7.4.2, 7.4.3, 7.4.4, 7.4.6, 7.4.7, and 7.4.8 we show the velocity normal to across-shelf transects 1, 2, 3, 4, 6, 7, and 8, respectively. For the two along-shelf transects taken along the 200-m isobath, we show the normal velocity in Figures 7.4.9 and 7.4.10. For the two along-shelf transects taken along the 50-m isobath, we show the normal velocity in Figures 7.4.11 and 7.4.12. The transects are shown in Figure 7.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

4.4.2.5 Vertical Current Profiles

We show in Figures 7.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 7.1.3.

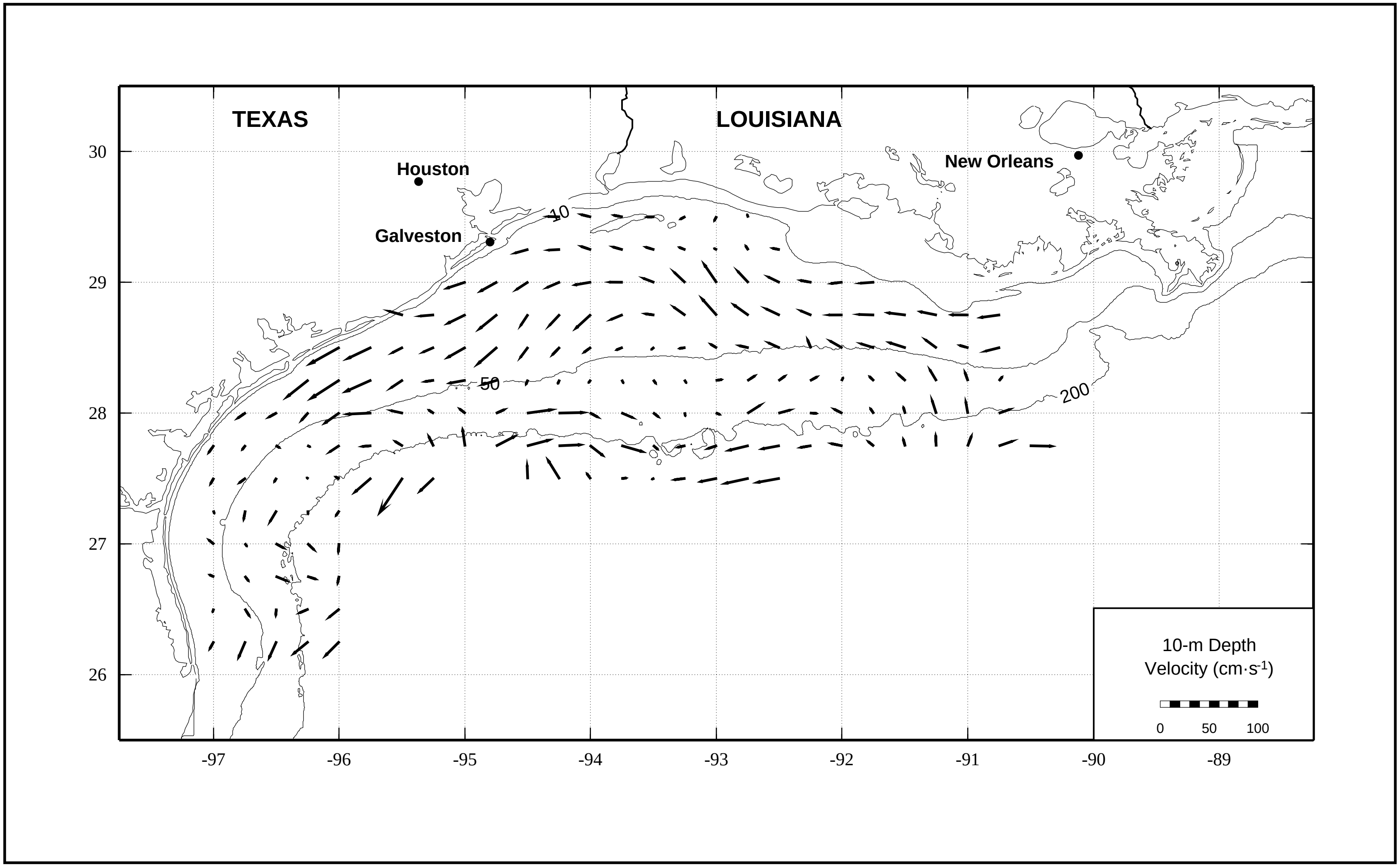

Figure 7.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 10 m depth. The data are from LATEX A cruise H07 conducted in November 1993

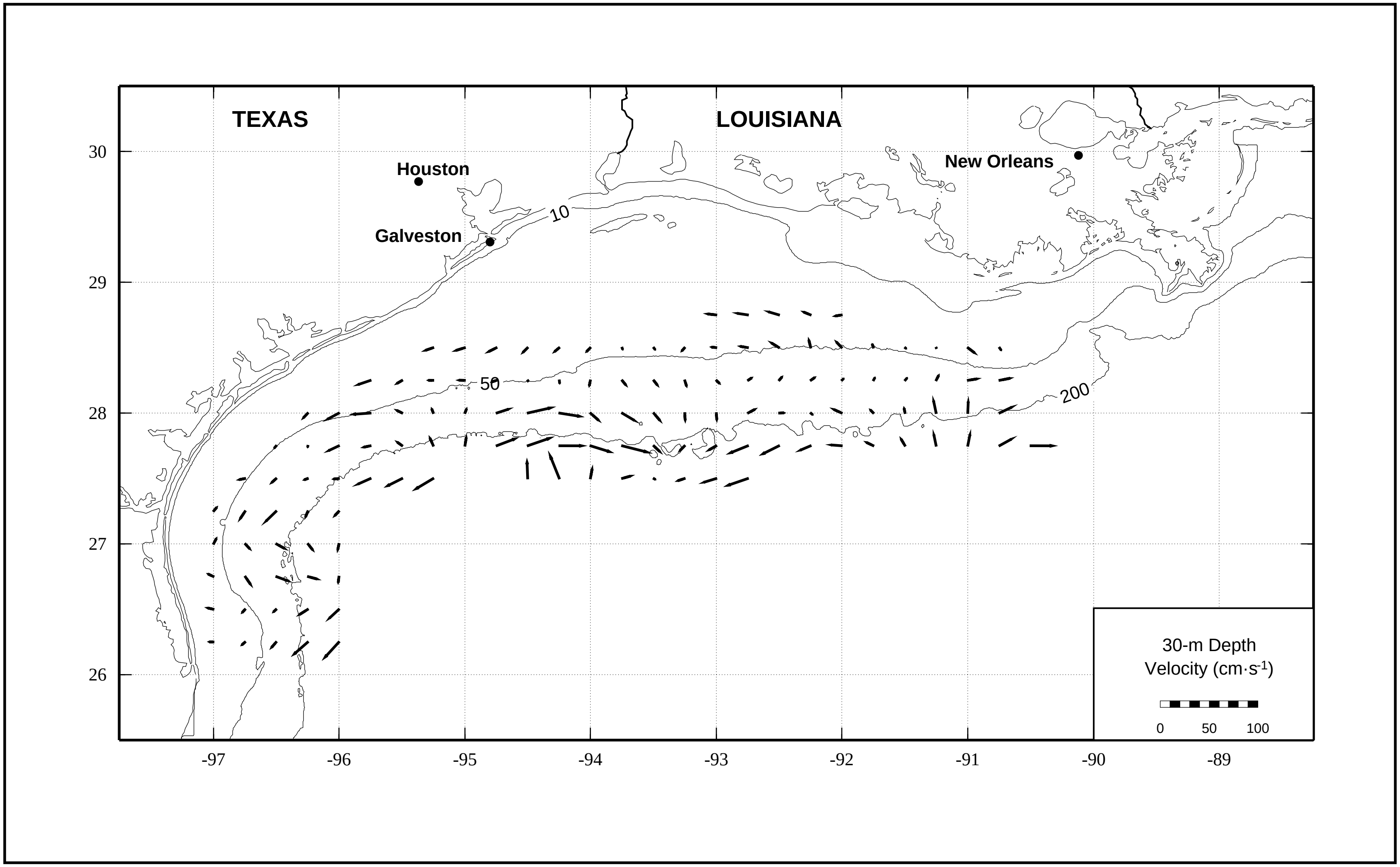

Figure 7.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H07 conducted in November 1993

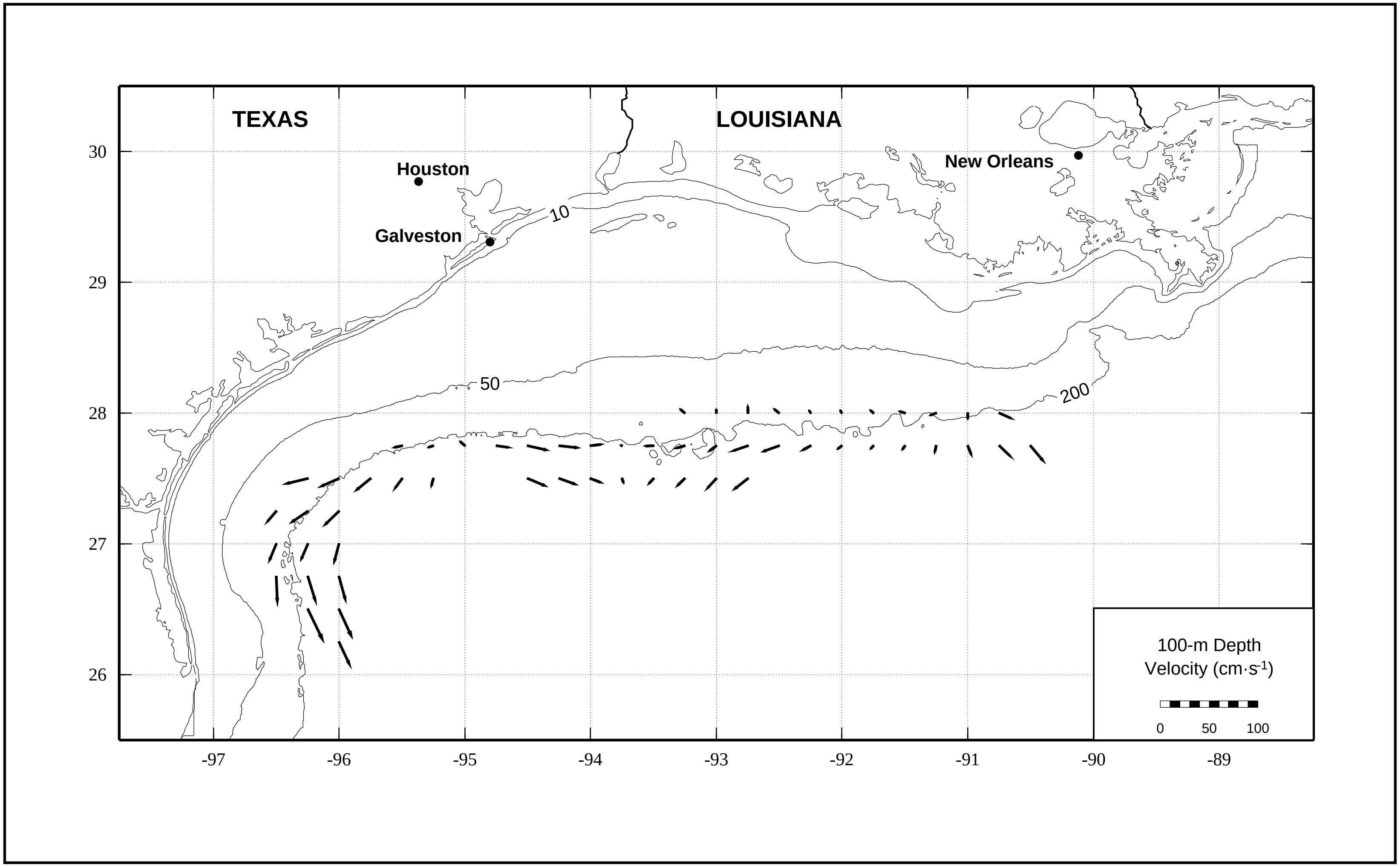

Figure 7.3.3. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H07 conducted in November 1993

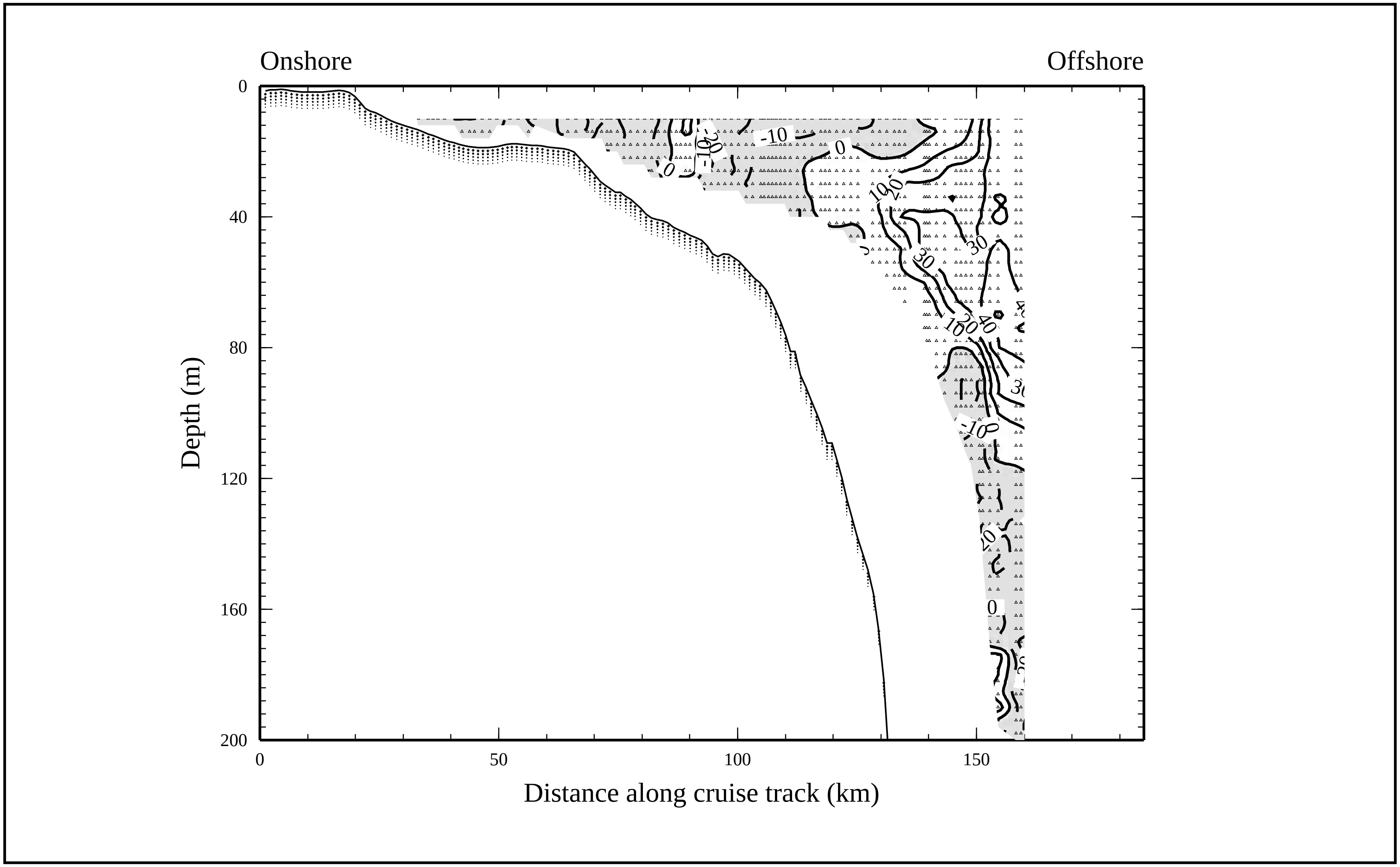

Figure 7.4.1. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 1 for cruise H07, November 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

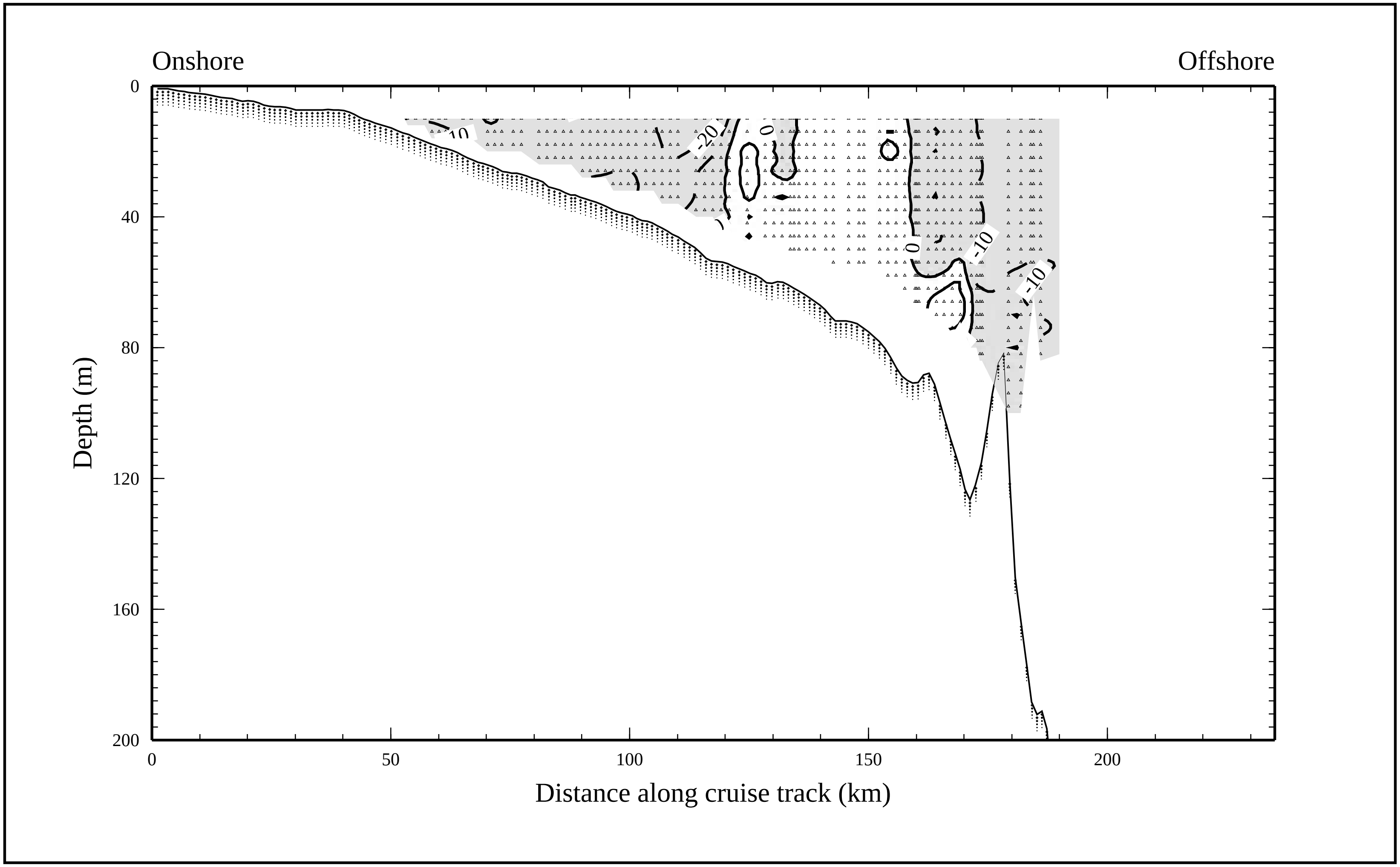

Figure 7.4.2. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 2 for cruise H07, November 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

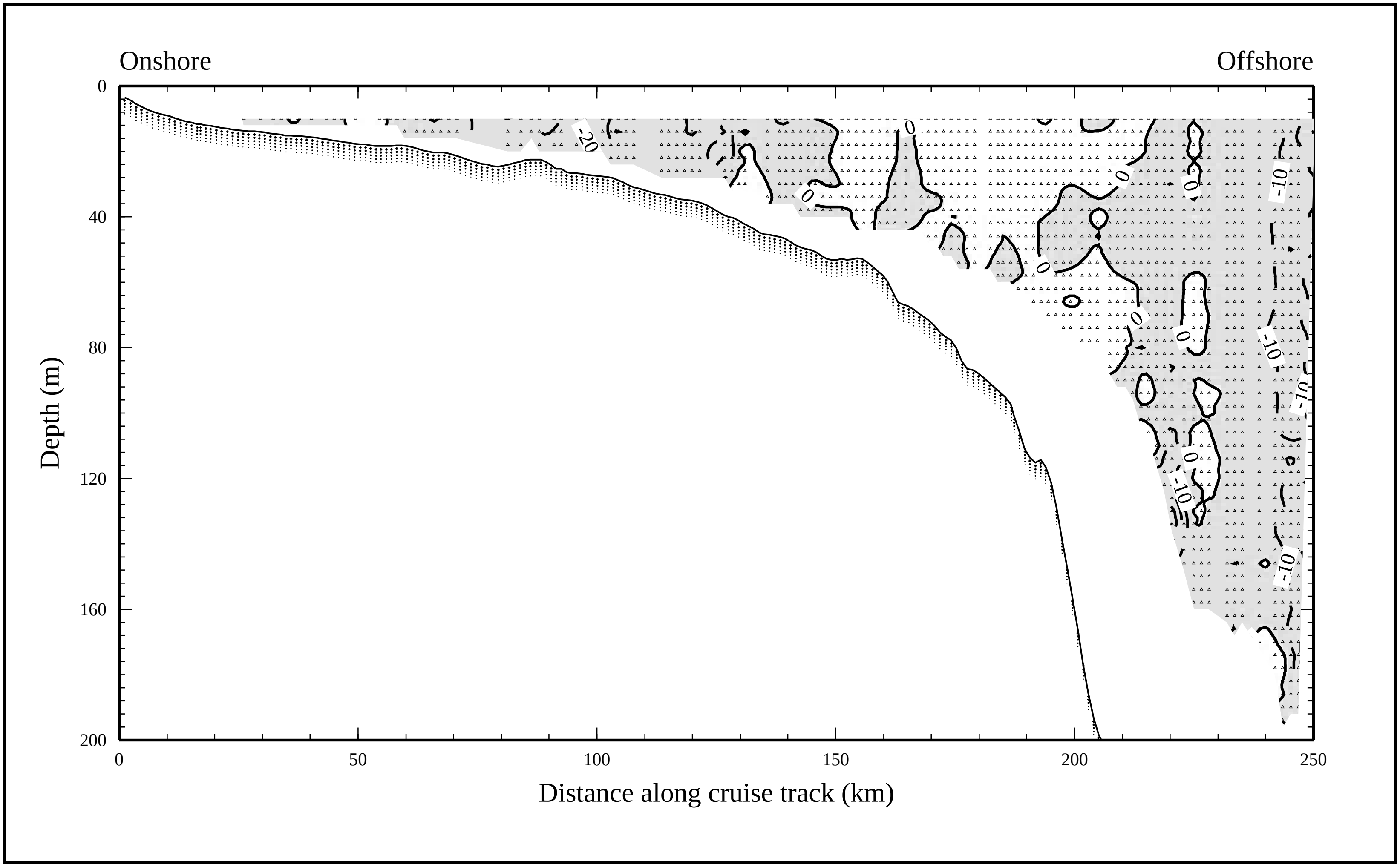

Figure 7.4.3. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 3 for cruise H07, November 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

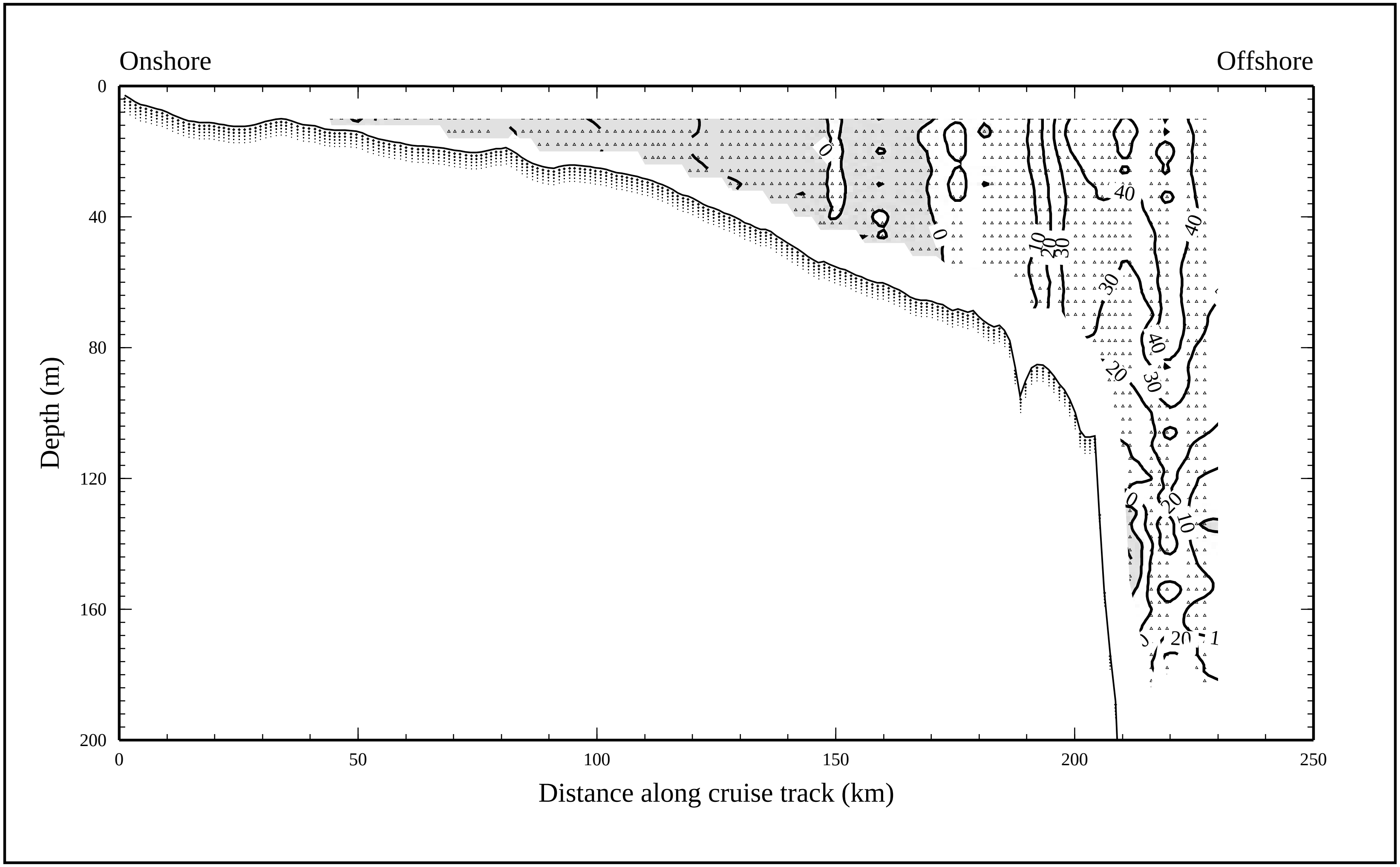

Figure 7.4.4. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 4 for cruise H07, November 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

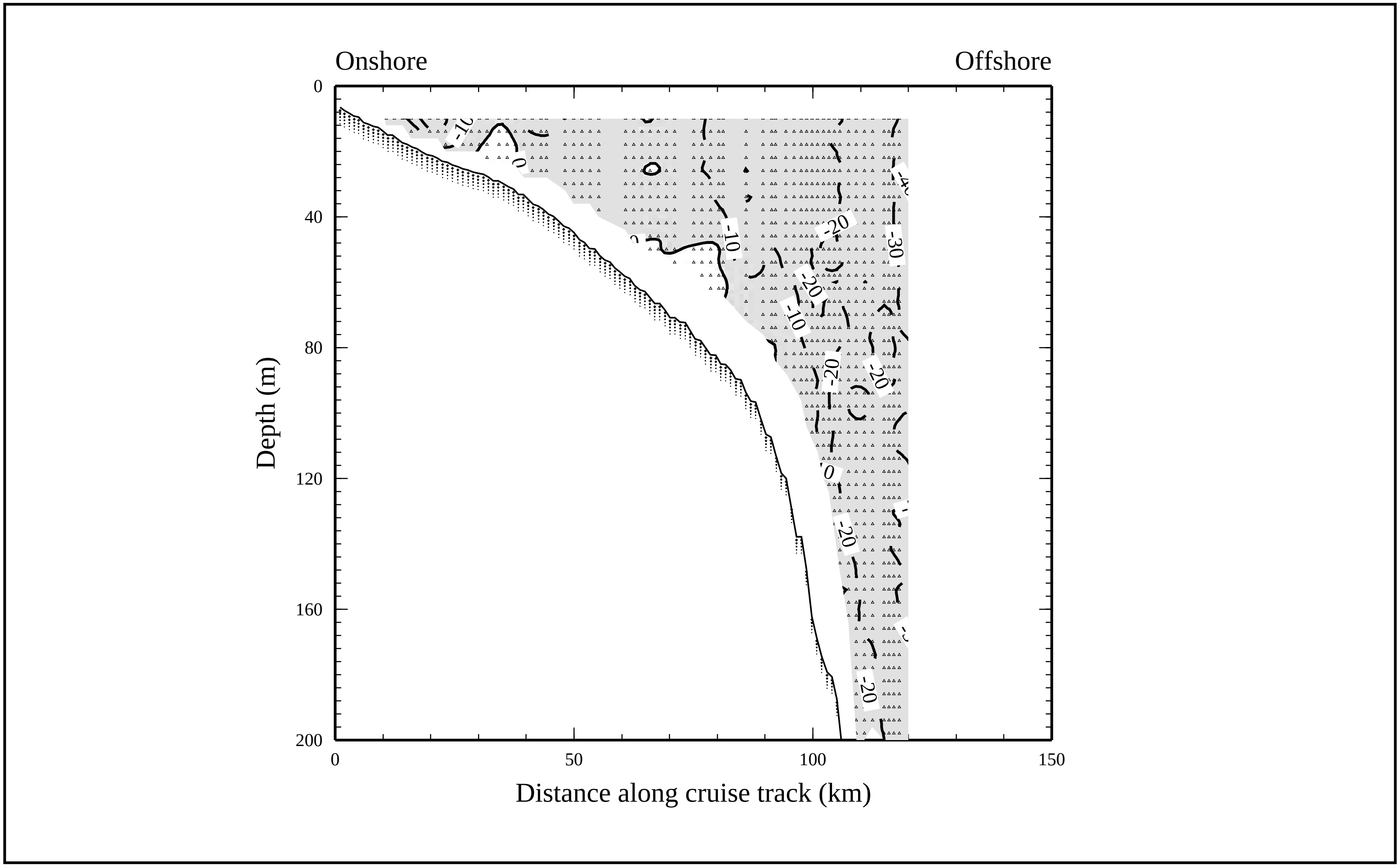

Figure 7.4.6. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 6 for cruise H07, November 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

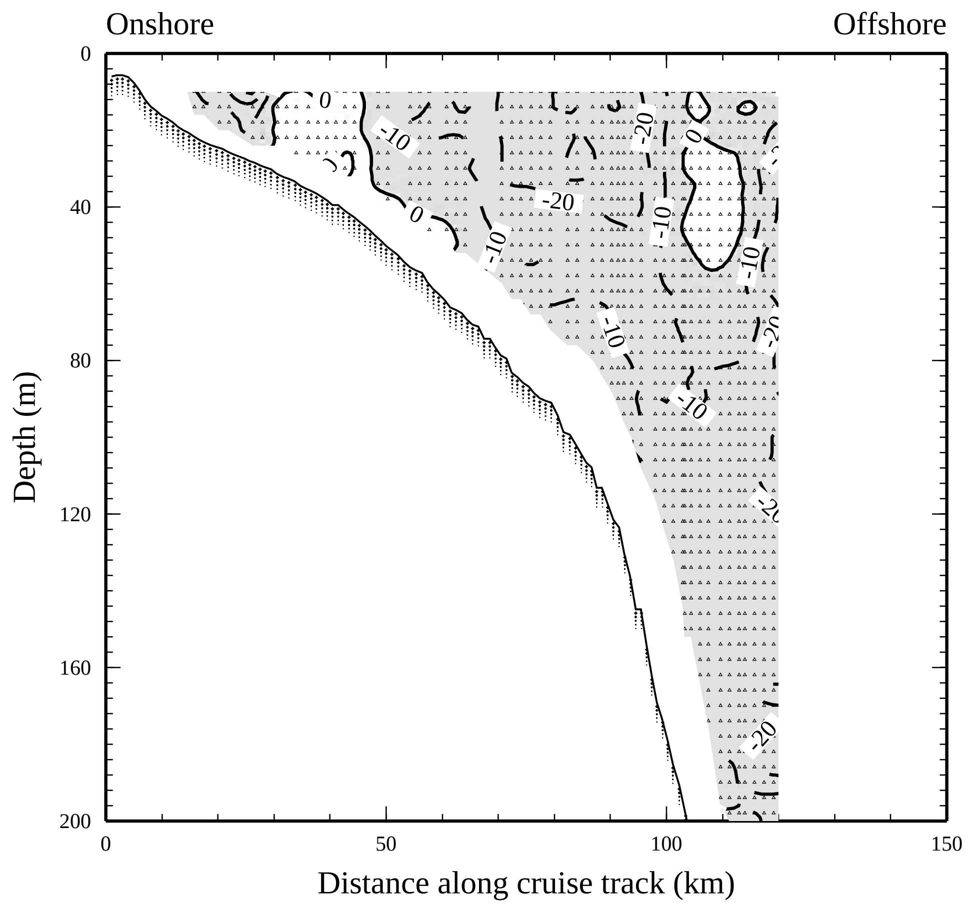

Figure 7.4.7. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 7 for cruise H07, November 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

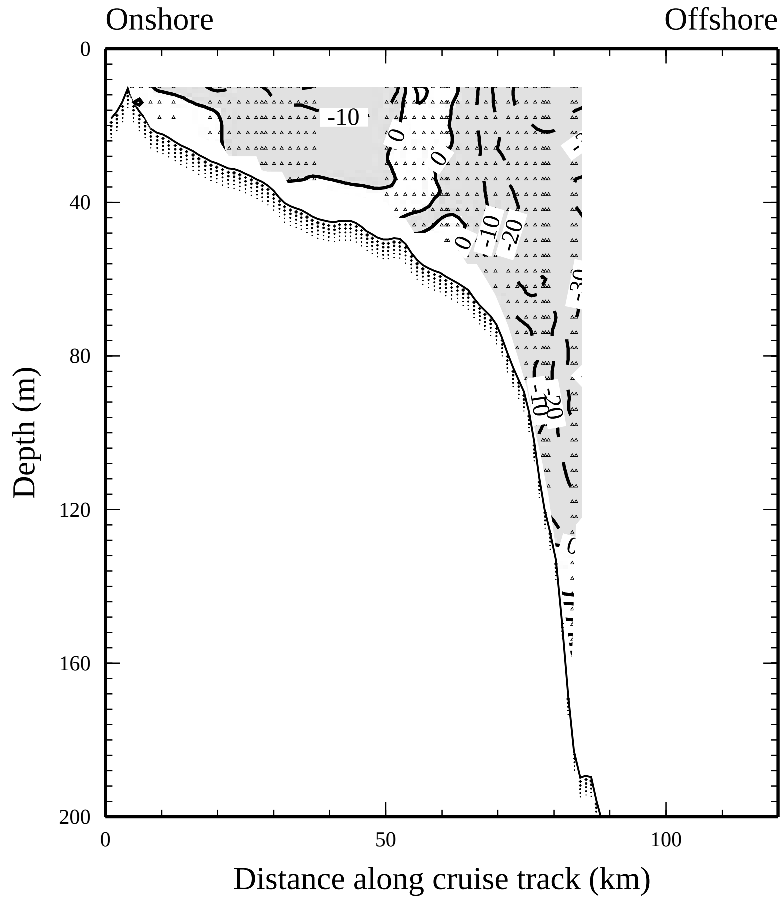

Figure 7.4.8. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 8 for cruise H07, November 1993. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

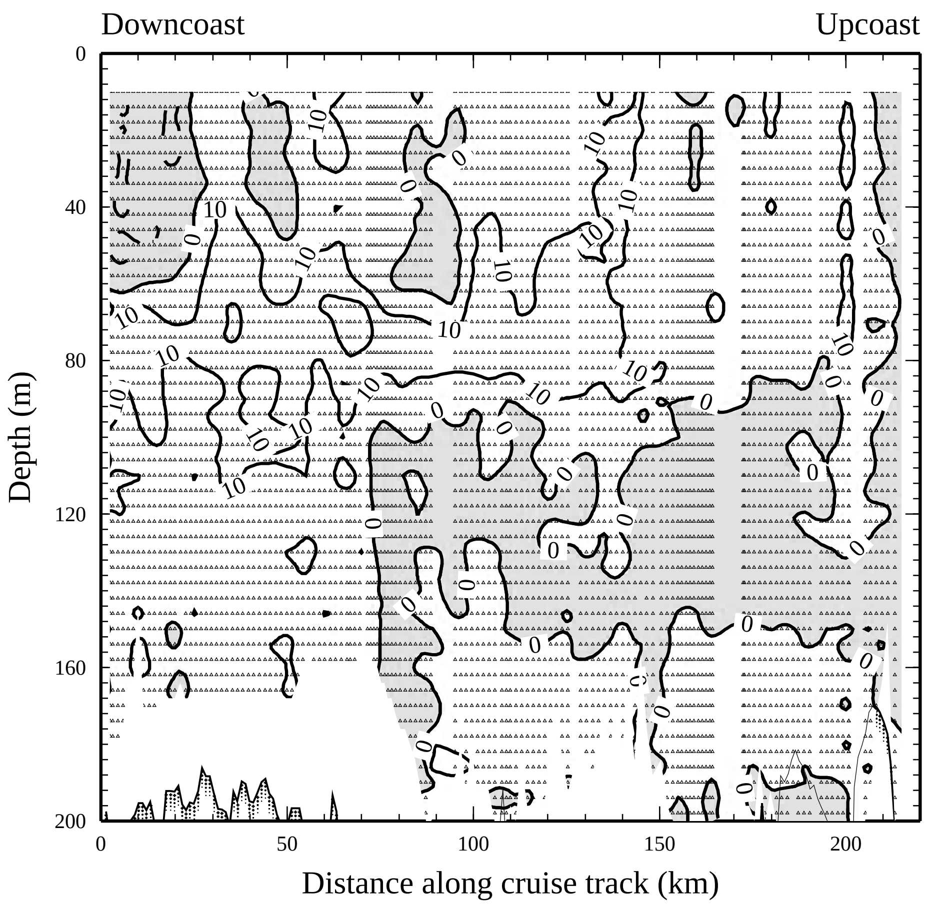

Figure 7.4.9. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 9 for cruise H07, November 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

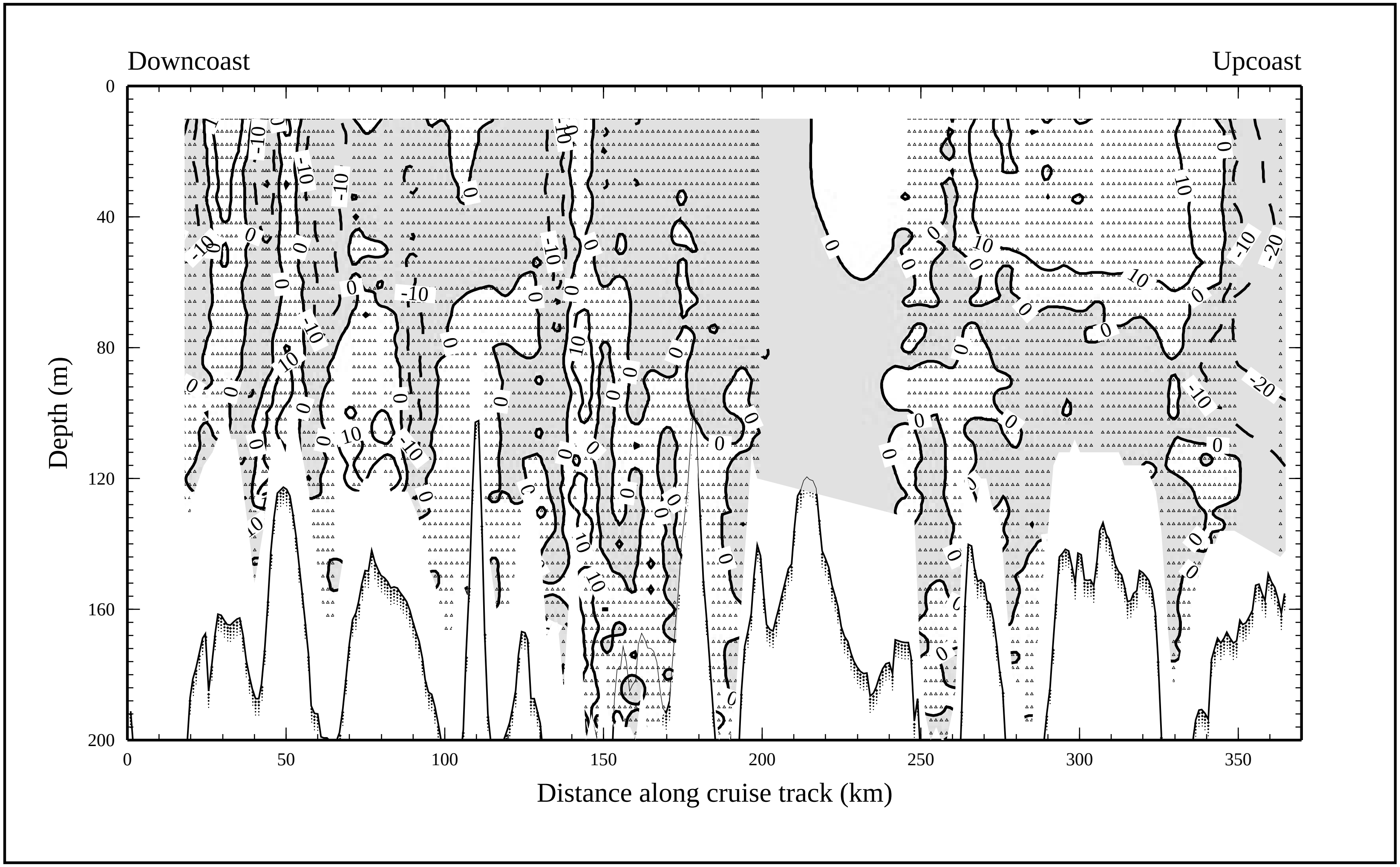

Figure 7.4.10. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 10 for cruise H07, November 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

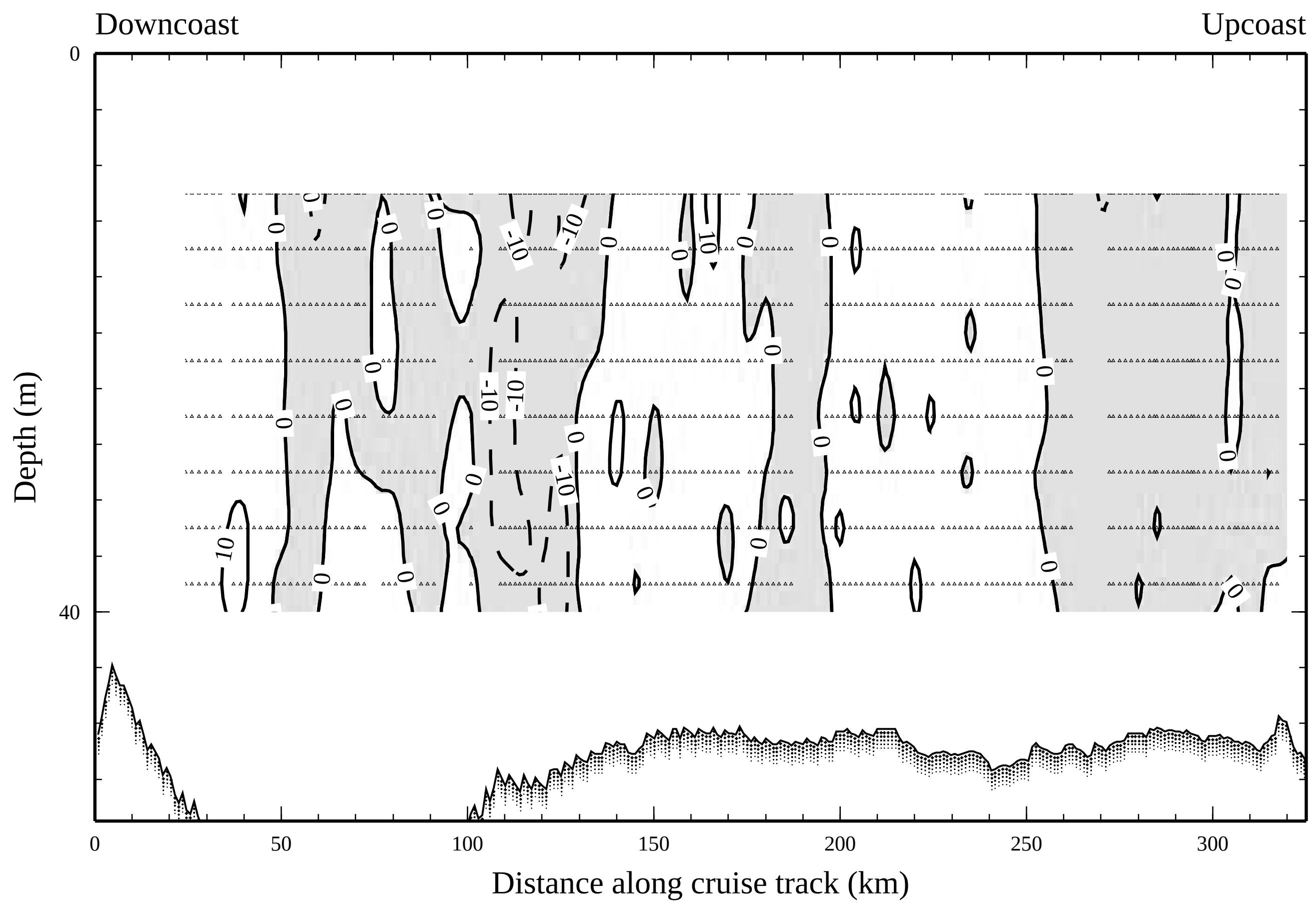

Figure 7.4.11. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 11 for cruise H07, November 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

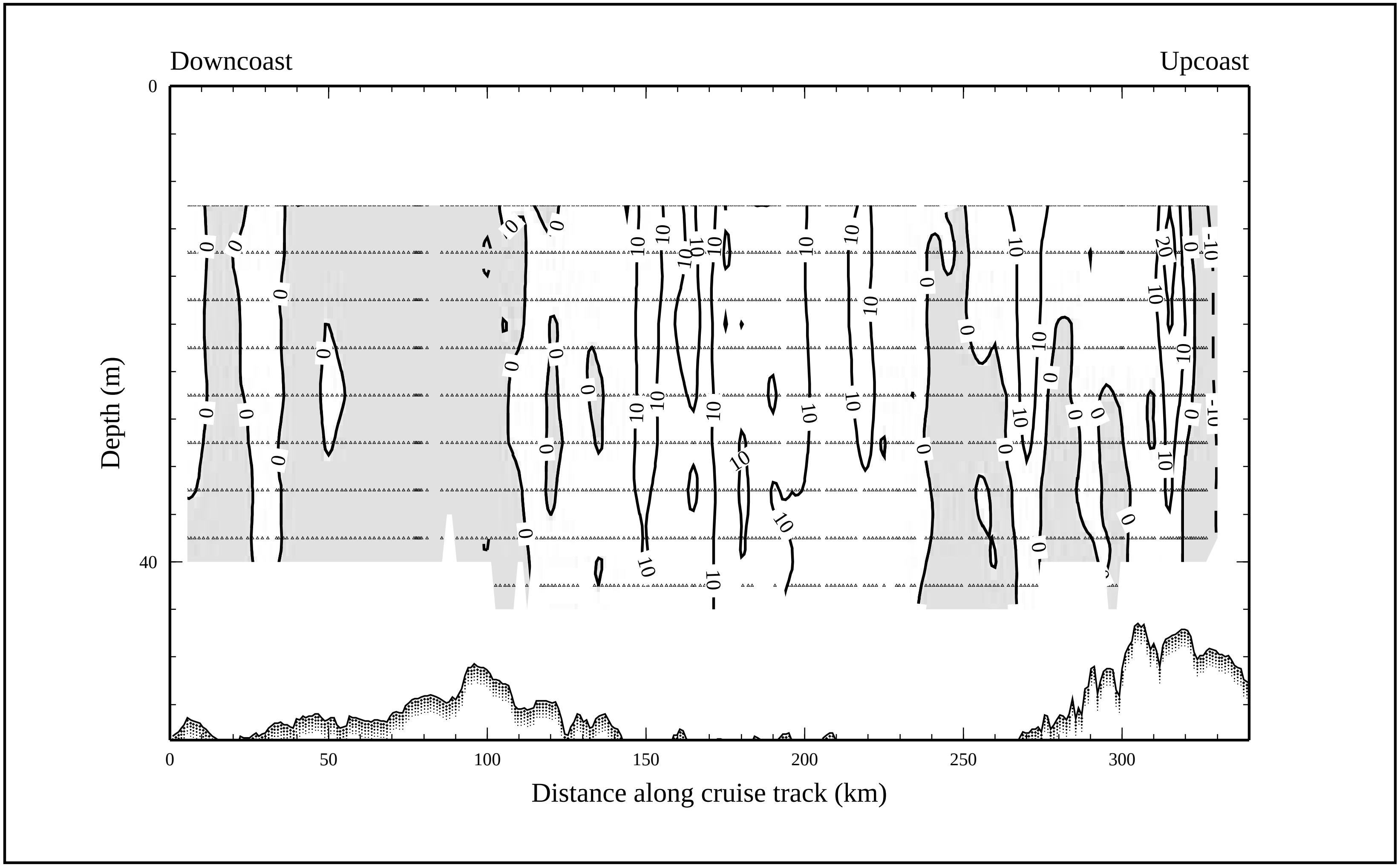

Figure 7.4.12. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 12 for cruise H07, November 1993. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

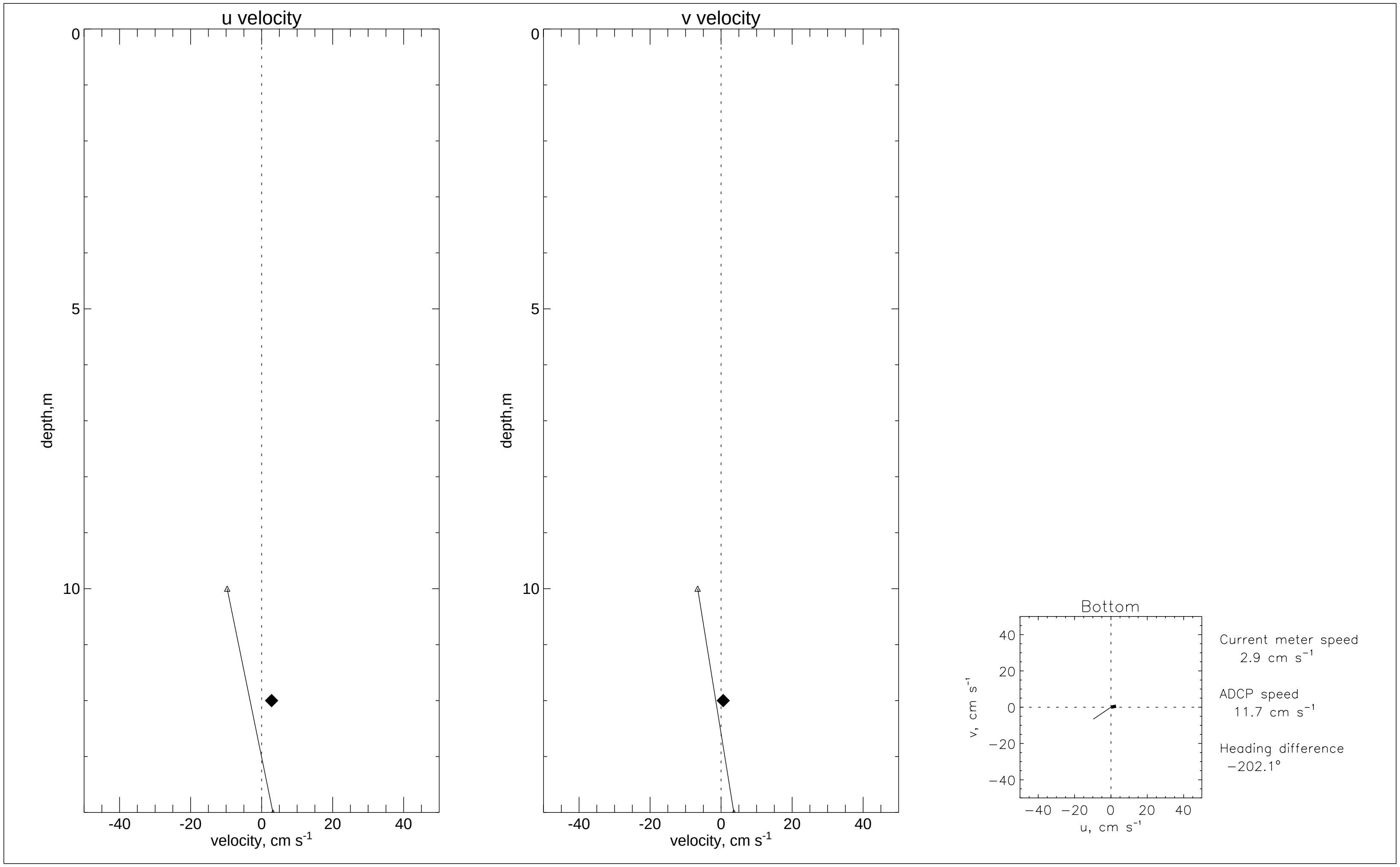

Figure 7.5.01. ADCP profile taken on 18 November 1993 at 1202 UTC (cruise H07) while passing by mooring CM01 at a distance o f 8.4 km. Velocities for the bottom meter (12 m) are marked with a diamond and were recorded on 18 November 1993 at 1200 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

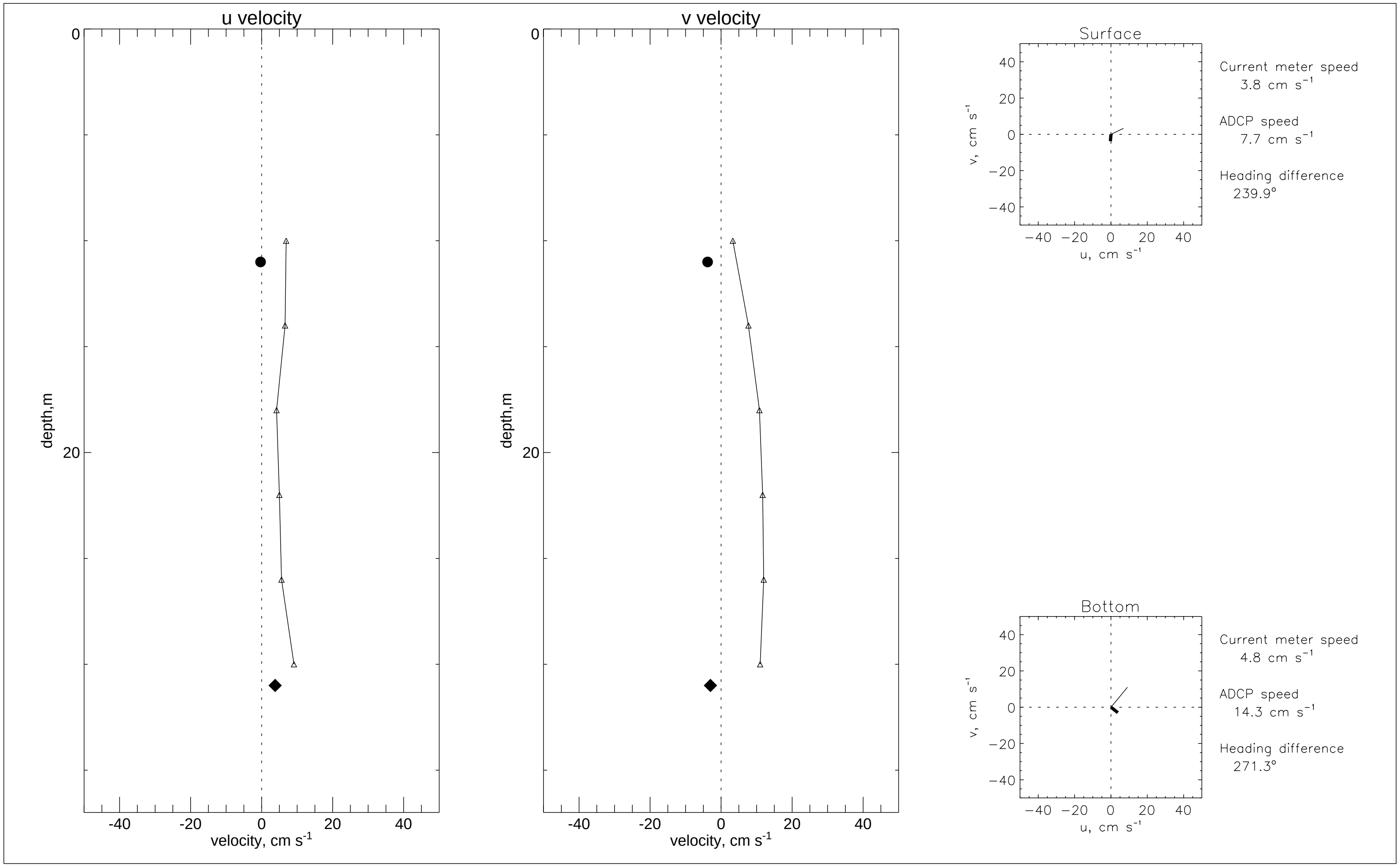

Figure 7.5.02. ADCP profile taken on 18 November 1993 at 0902 UTC (cruise H07) while passing by mooring CM02 at a distance o f 5.3 km. Velocities for the surface meter (11 m) are marked with a circle and were recorded on 18 November 1993 at 0900 UTC. Velocities for the bottom meter (31 m) are marked with a diamond and were recorded on 18 November 1993 at 0900 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

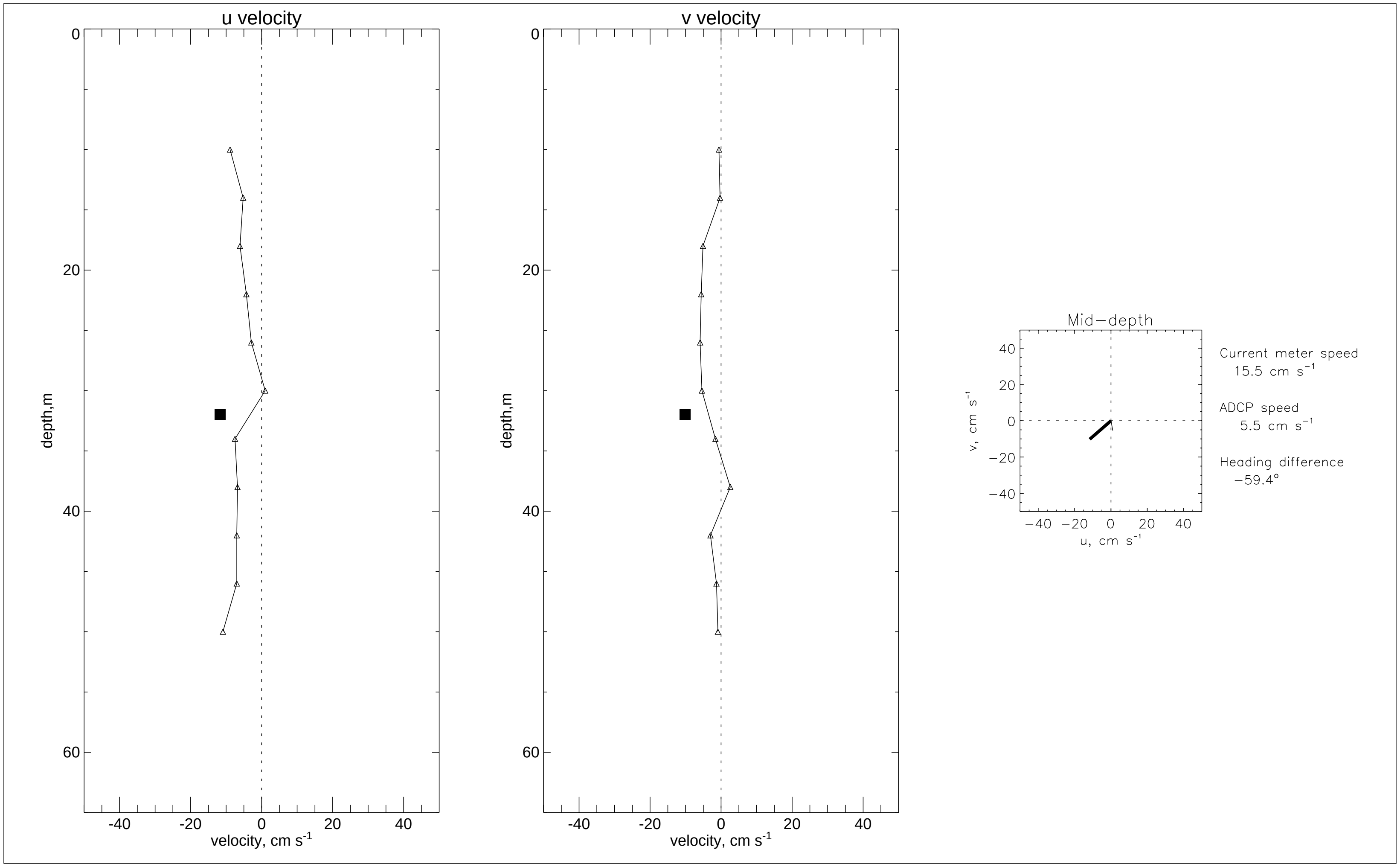

Figure 7.5.03. ADCP profile taken on 17 November 1993 at 2114 UTC (cruise H07) while passing by mooring CM03 at a distance o f 7.5 km. Velocities for the mid-depth meter (32 m) are marked with a square and were recorded on 17 November 1993 at 2115 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

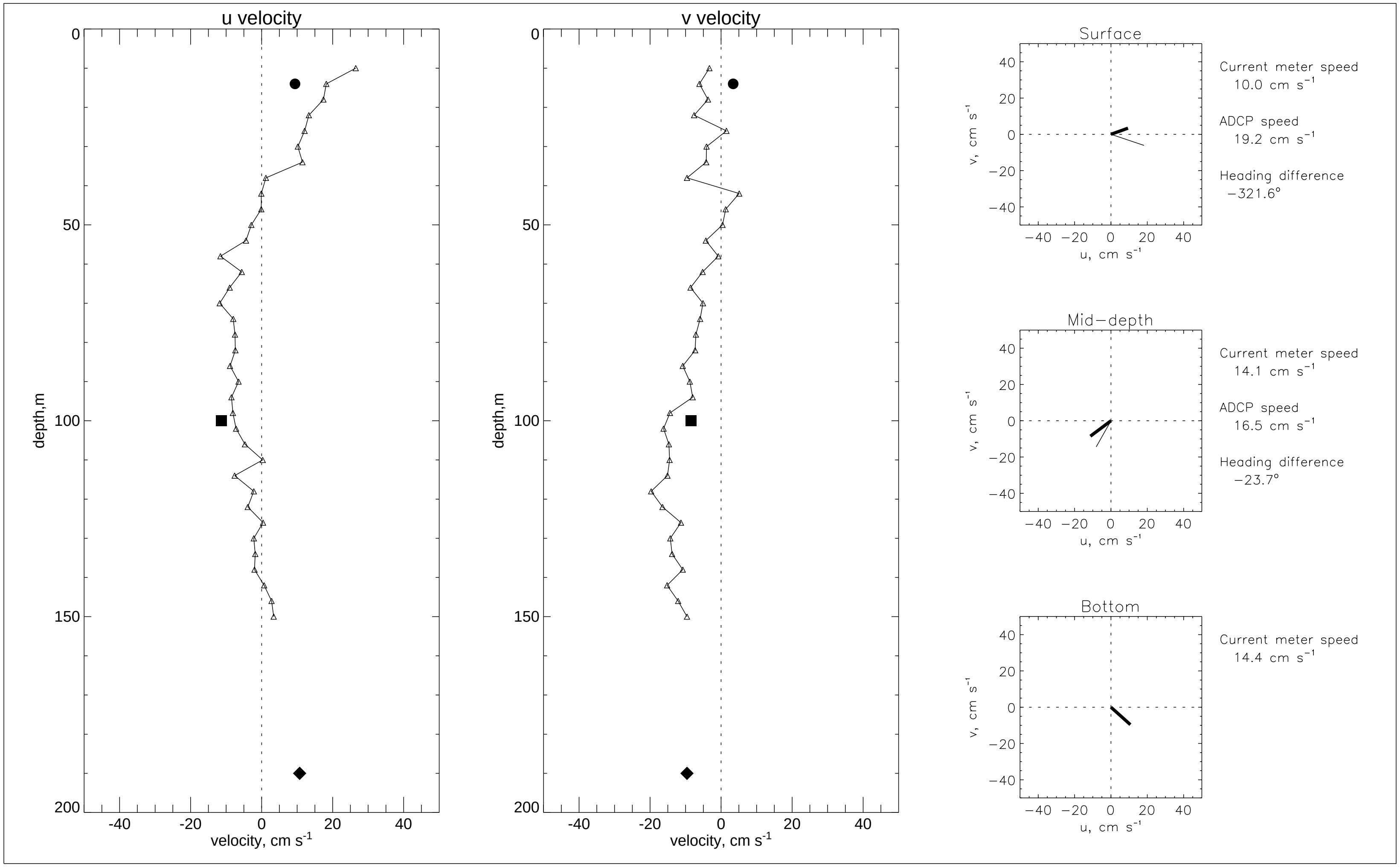

Figure 7.5.04. ADCP profile taken on 18 November 1993 at 0222 UTC (cruise H07) while passing by mooring CM04 at a distance o f 0.8 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 18 November 1993 at 0230 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 18 November 1993 at 0230 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 18 November 1993 at 0230 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

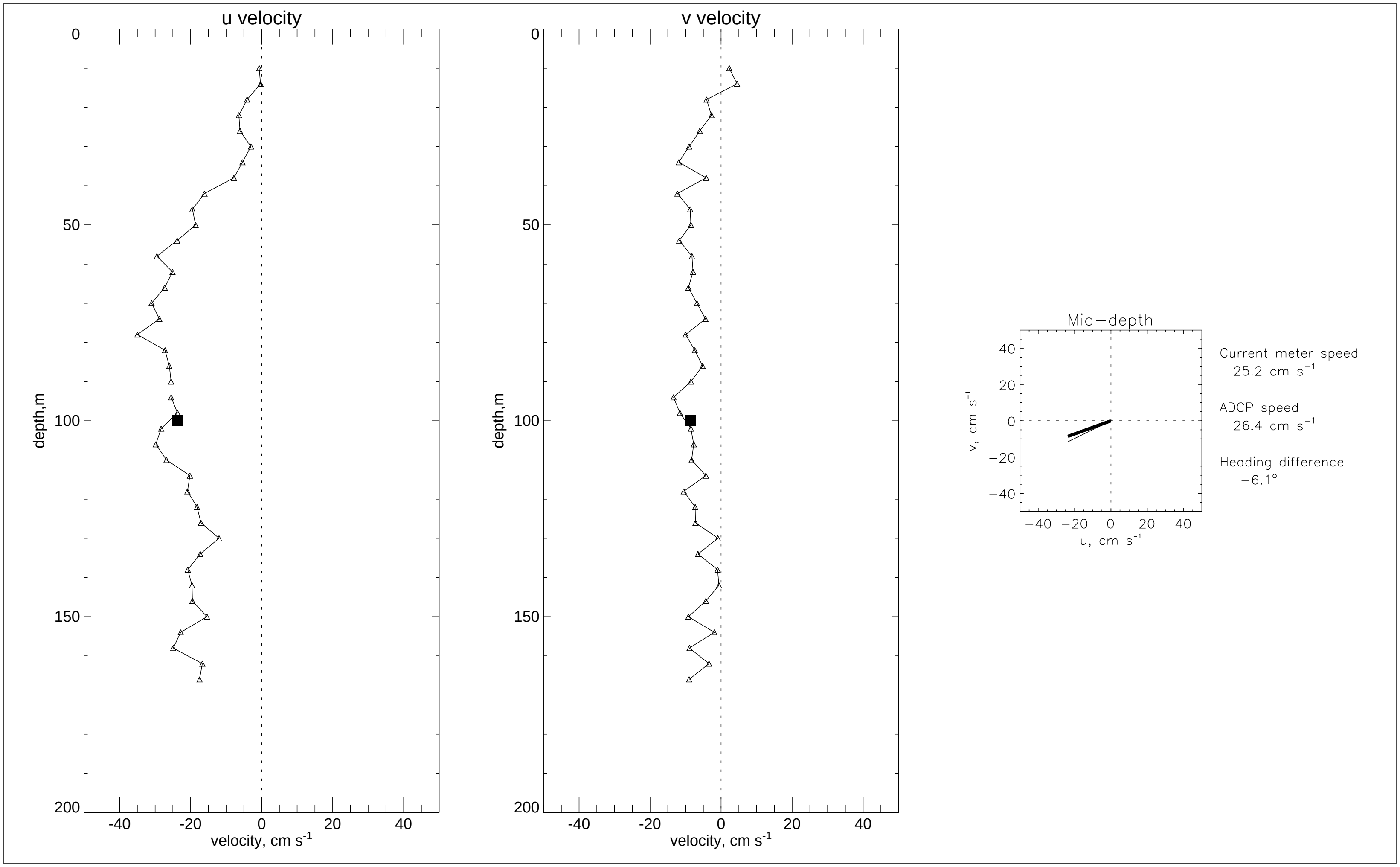

Figure 7.5.05. ADCP profile taken on 20 November 1993 at 0537 UTC (cruise H07) while passing by mooring CM05 at a distance o f 0.4 km. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 20 November 1993 at 0530 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

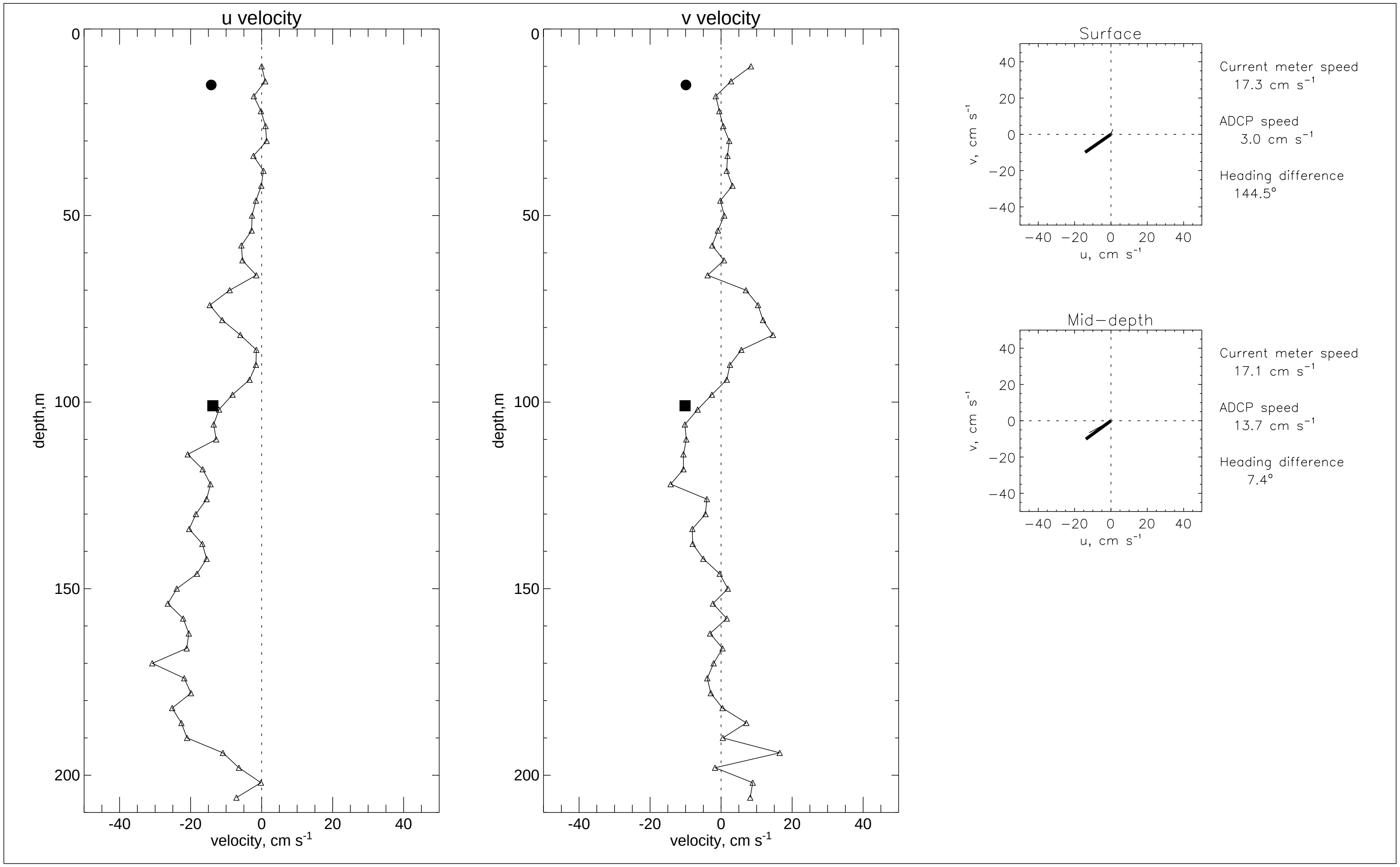

Figure 7.5.06. ADCP profile taken on 20 November 1993 at 1017 UTC (cruise H07) while passing by mooring CM06 at a distance o f 5.2 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 20 November 1993 at 1030 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 20 November 1993 at 1030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

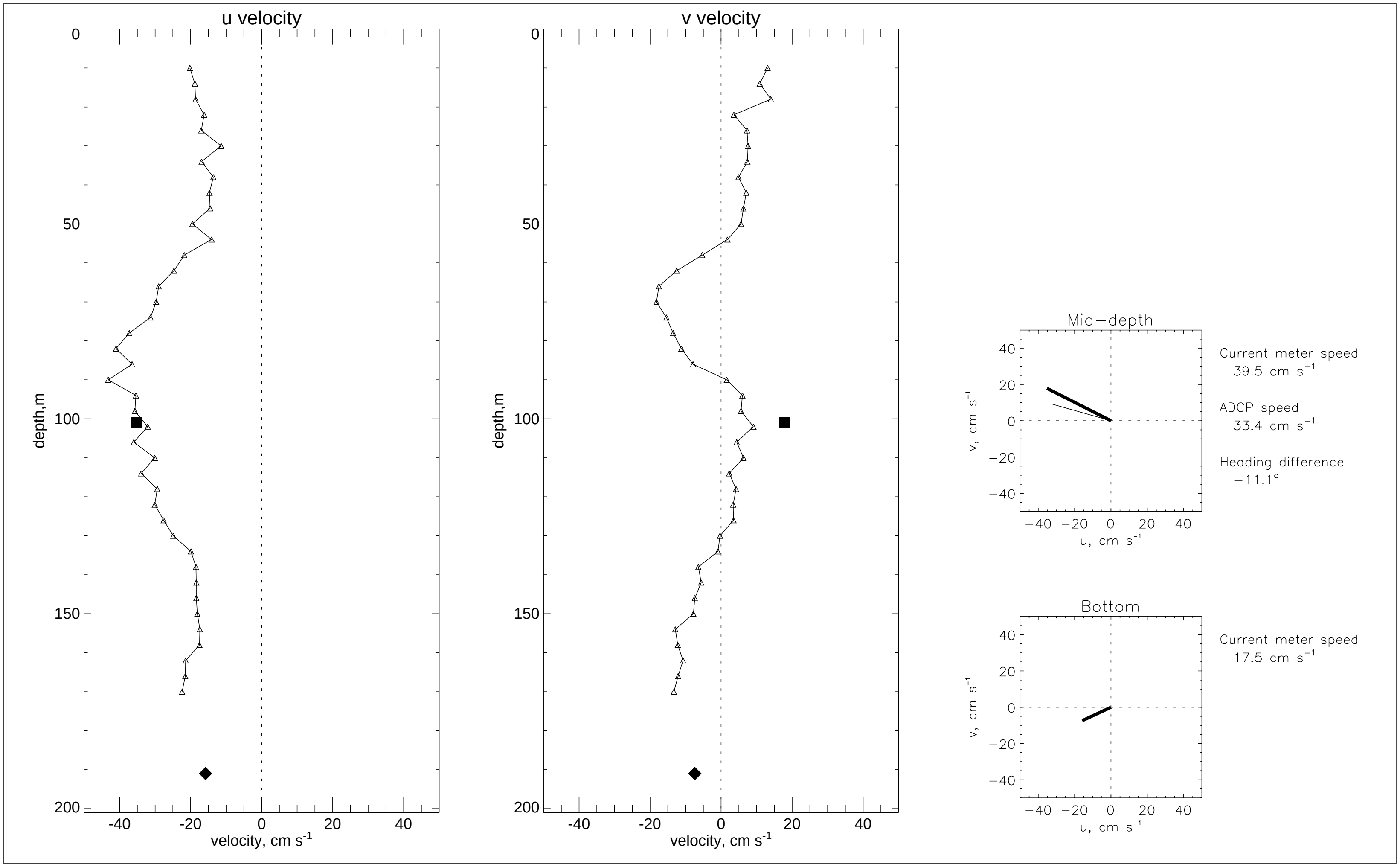

Figure 7.5.07. ADCP profile taken on 16 November 1993 at 2033 UTC (cruise H07) while passing by mooring CM07 at a distance o f 1.2 km. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 16 November 1993 at 2030 UTC. Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 16 November 1993 at 2030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

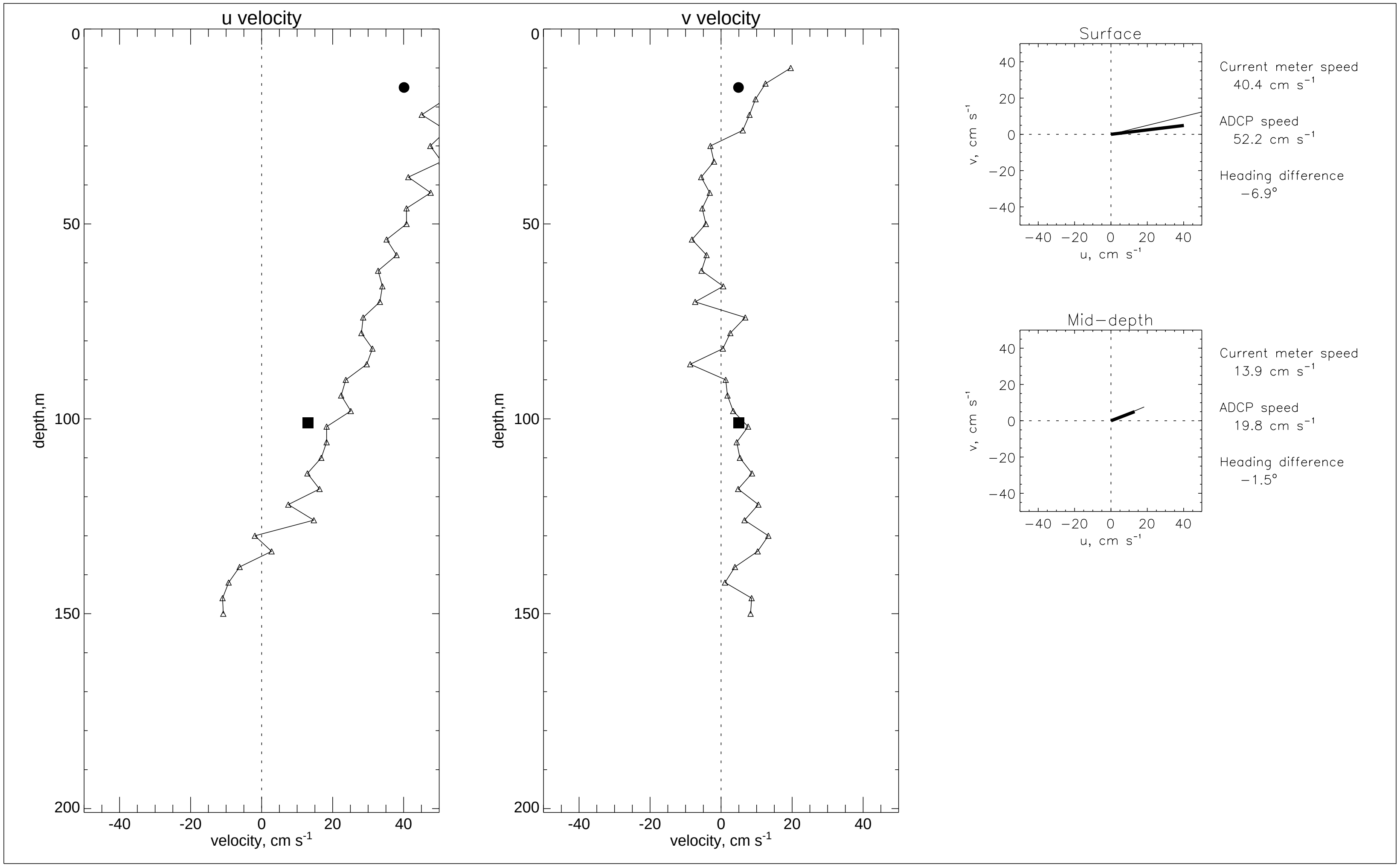

Figure 7.5.08. ADCP profile taken on 13 November 1993 at 0246 UTC (cruise H07) while passing by mooring CM08 at a distance o f 0.6 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 13 November 1993 at 0300 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 13 November 1993 at 0300 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

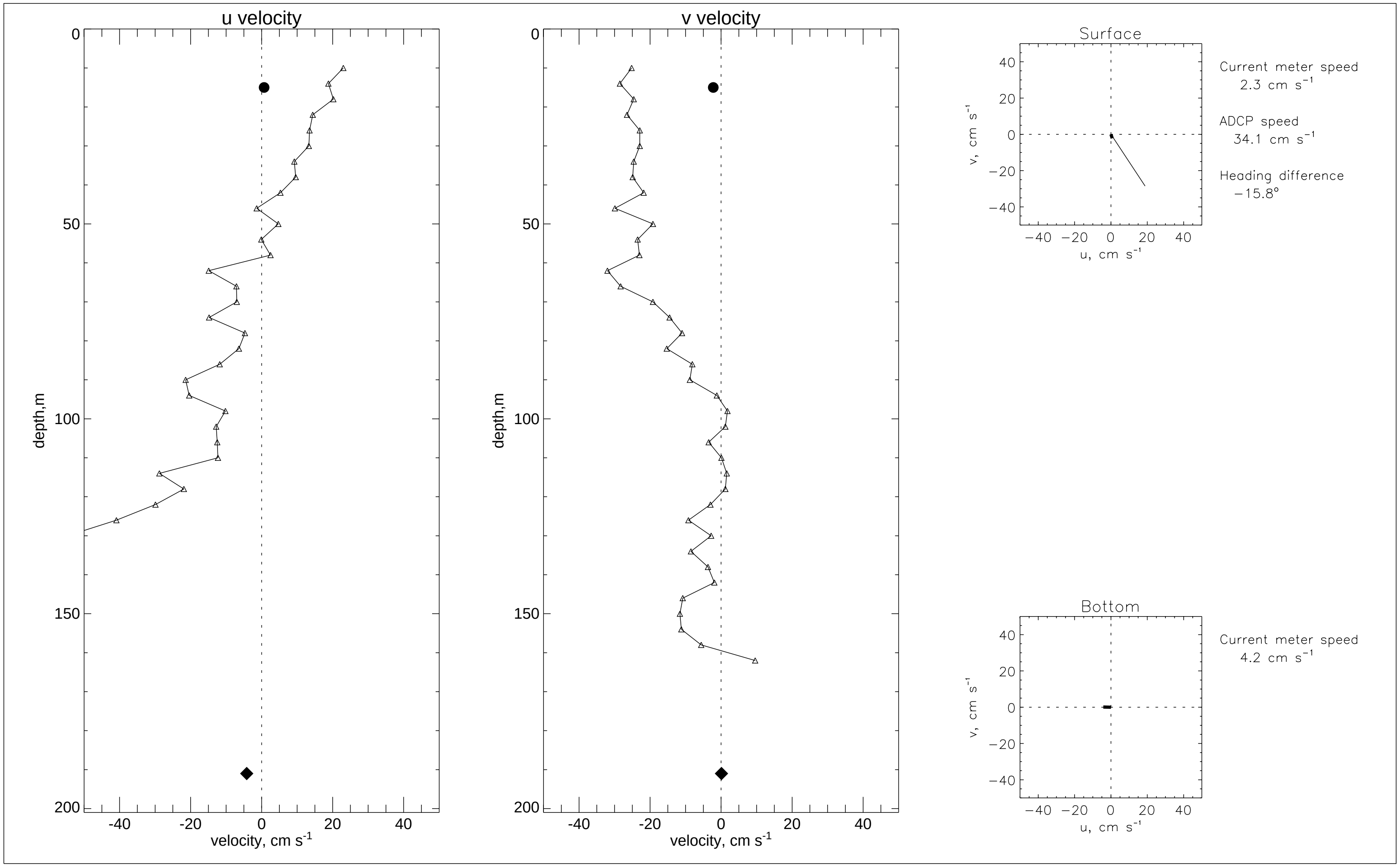

Figure 7.5.09. ADCP profile taken on 12 November 1993 at 1803 UTC (cruise H07) while passing by mooring CM09 at a distance o f 0.8 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 12 November 1993 at 1800 UTC. Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 12 November 1993 at 1800 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

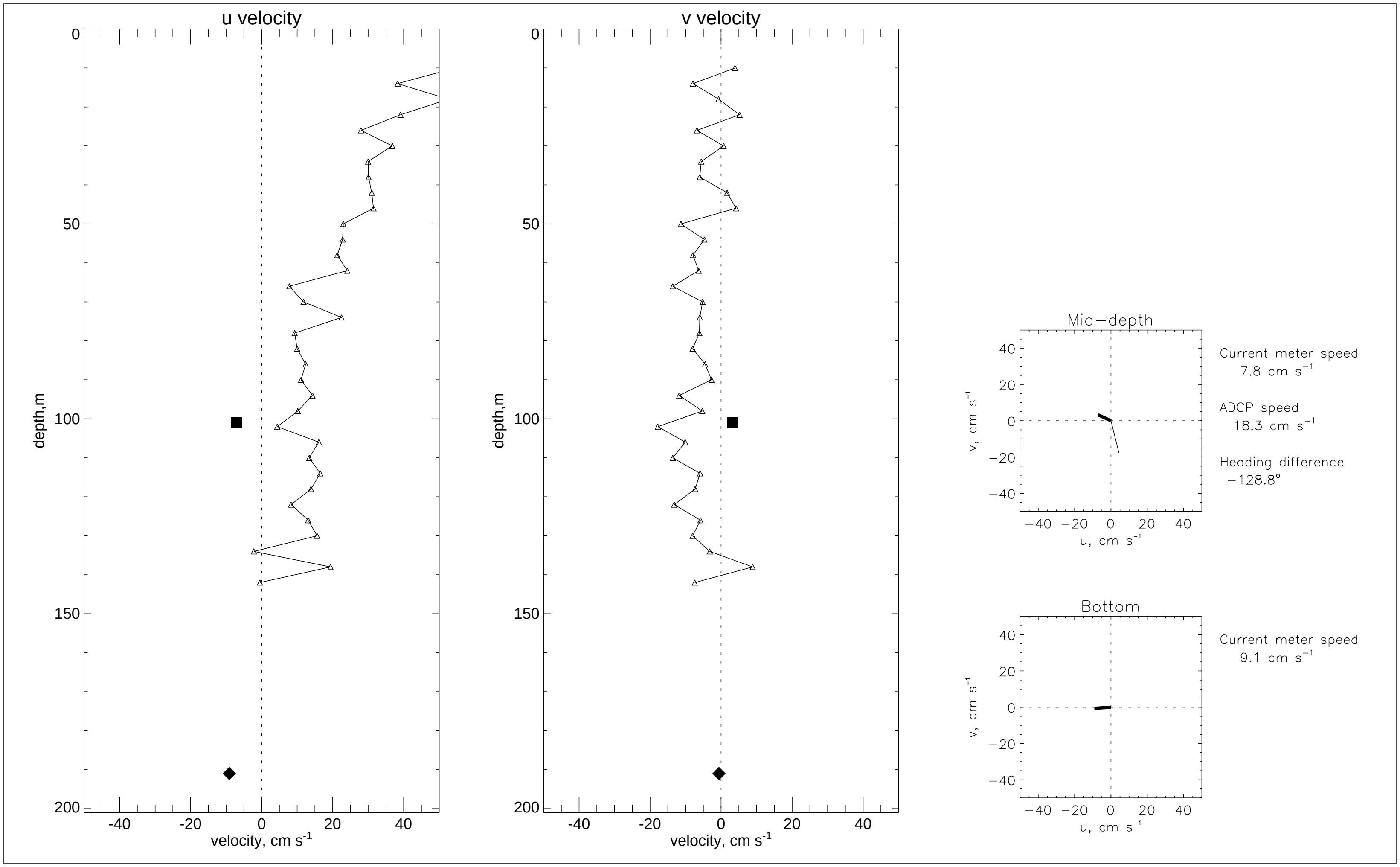

Figure 7.5.10. ADCP profile taken on 12 November 1993 at 0607 UTC (cruise H07) while passing by mooring CM10 at a distance o f 3.6 km. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 12 November 1993 at 0600 UTC. Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 12 November 1993 at 0600 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

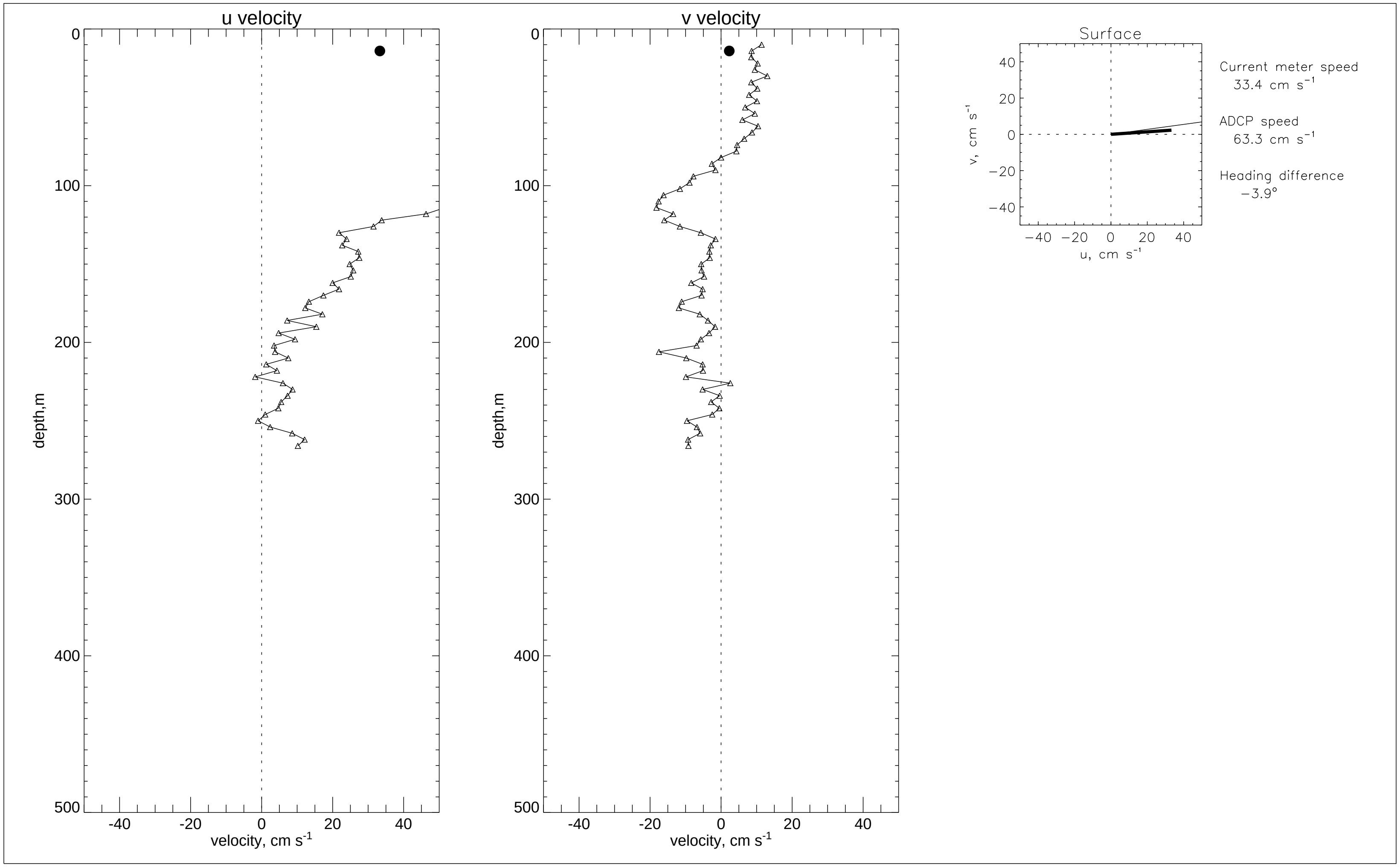

Figure 7.5.12. ADCP profile taken on 9 November 1993 at 2045 UTC (cruise H07) while passing by mooring CM12 at a distance of 2.5 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 9 November 1993 at 2030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

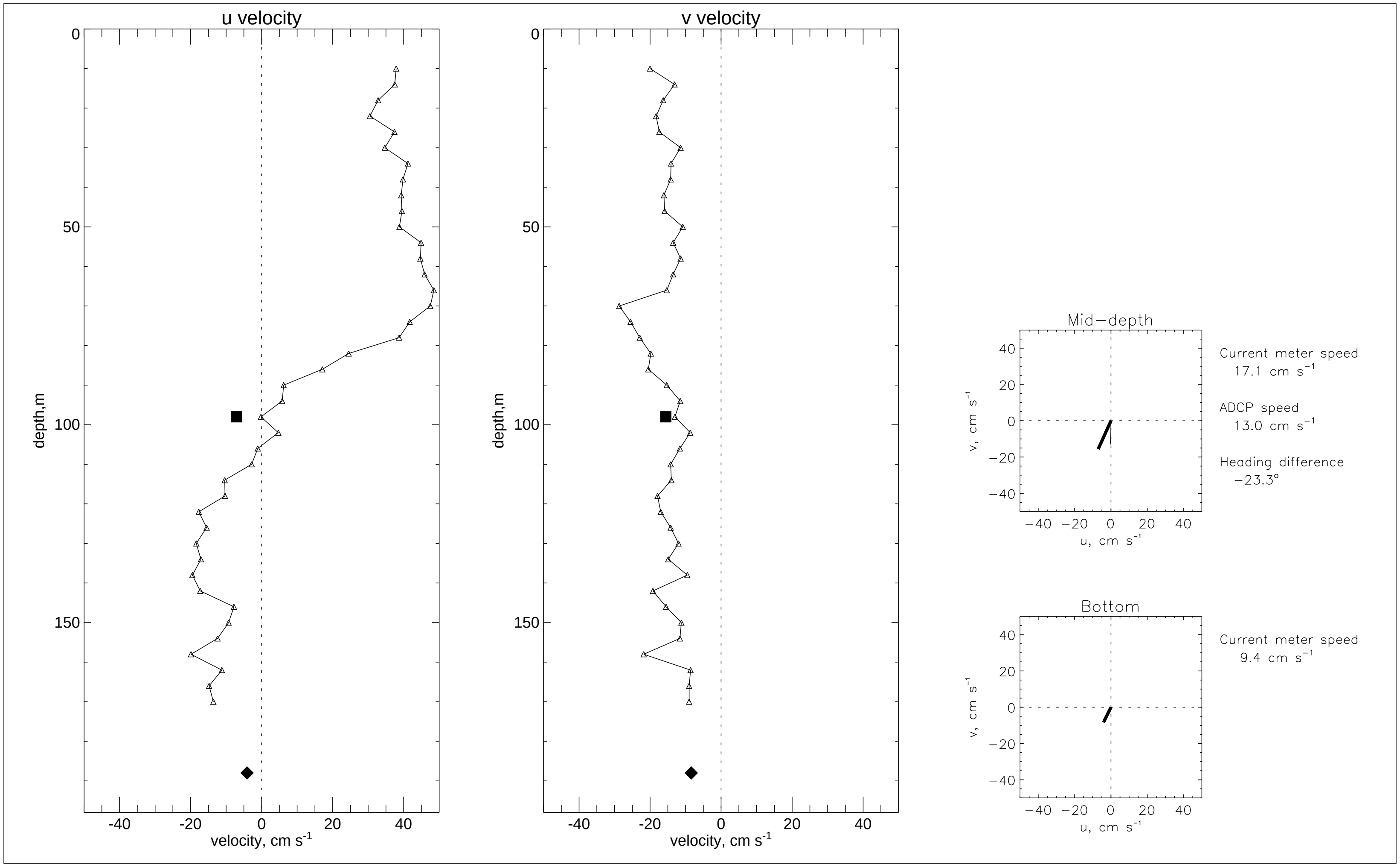

Figure 7.5.13. ADCP profile taken on 9 November 1993 at 1725 UTC (cruise H07) while passing by mooring CM13 at a distance of 1.7 km. Velocities for the mid-depth meter (98 m) are marked with a square and were recorded on 9 November 1993 at 1730 UTC. Velocities for the bottom meter (188 m) are marked with a diamond and were recorded on 9 November 1993 at 1730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

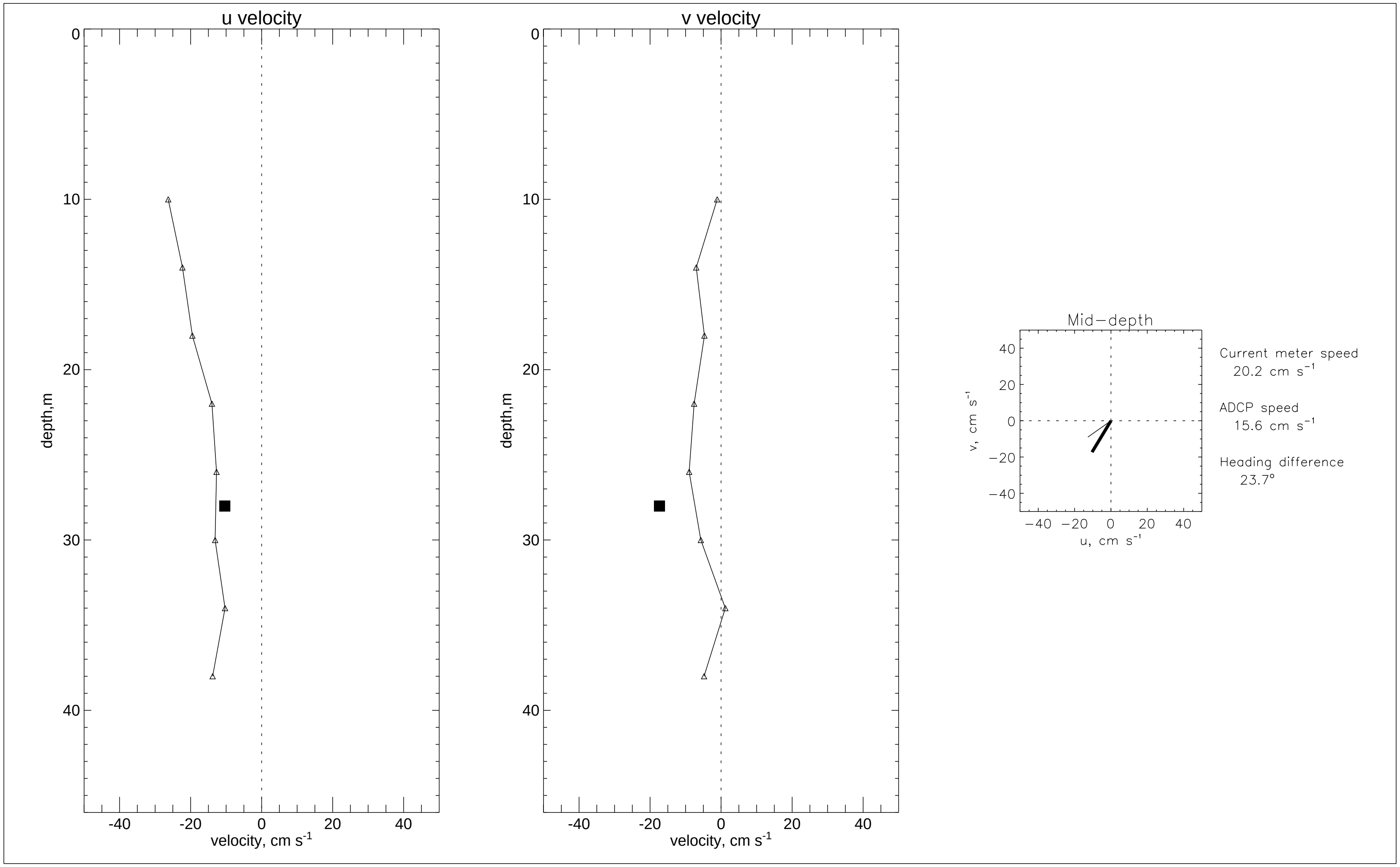

Figure 7.5.14. ADCP profile taken on 9 November 1993 at 1106 UTC (cruise H07) while passing by mooring CM14 at a distance of 1.9 km. Velocities for the mid-depth meter (28 m) are marked with a square and were recorded on 9 November 1993 at 1105 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

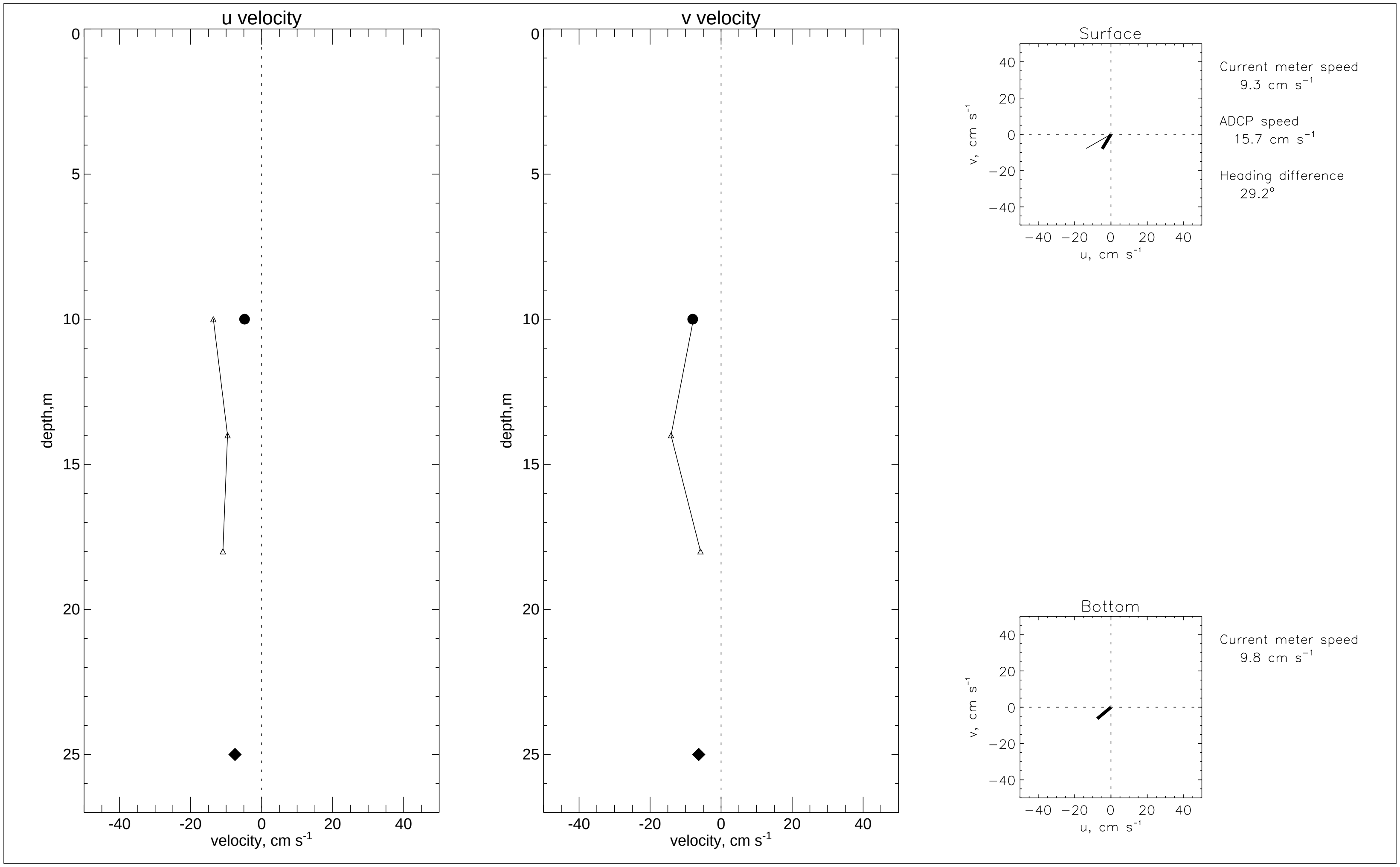

Figure 7.5.15. ADCP profile taken on 9 November 1993 at 0656 UTC (cruise H07) while passing by mooring CM15 at a distance of 2.3 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 9 November 1993 at 0700 UTC. Velocities for the bottom meter (25 m) are marked with a diamond and were recorded on 9 November 1993 at 0655 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

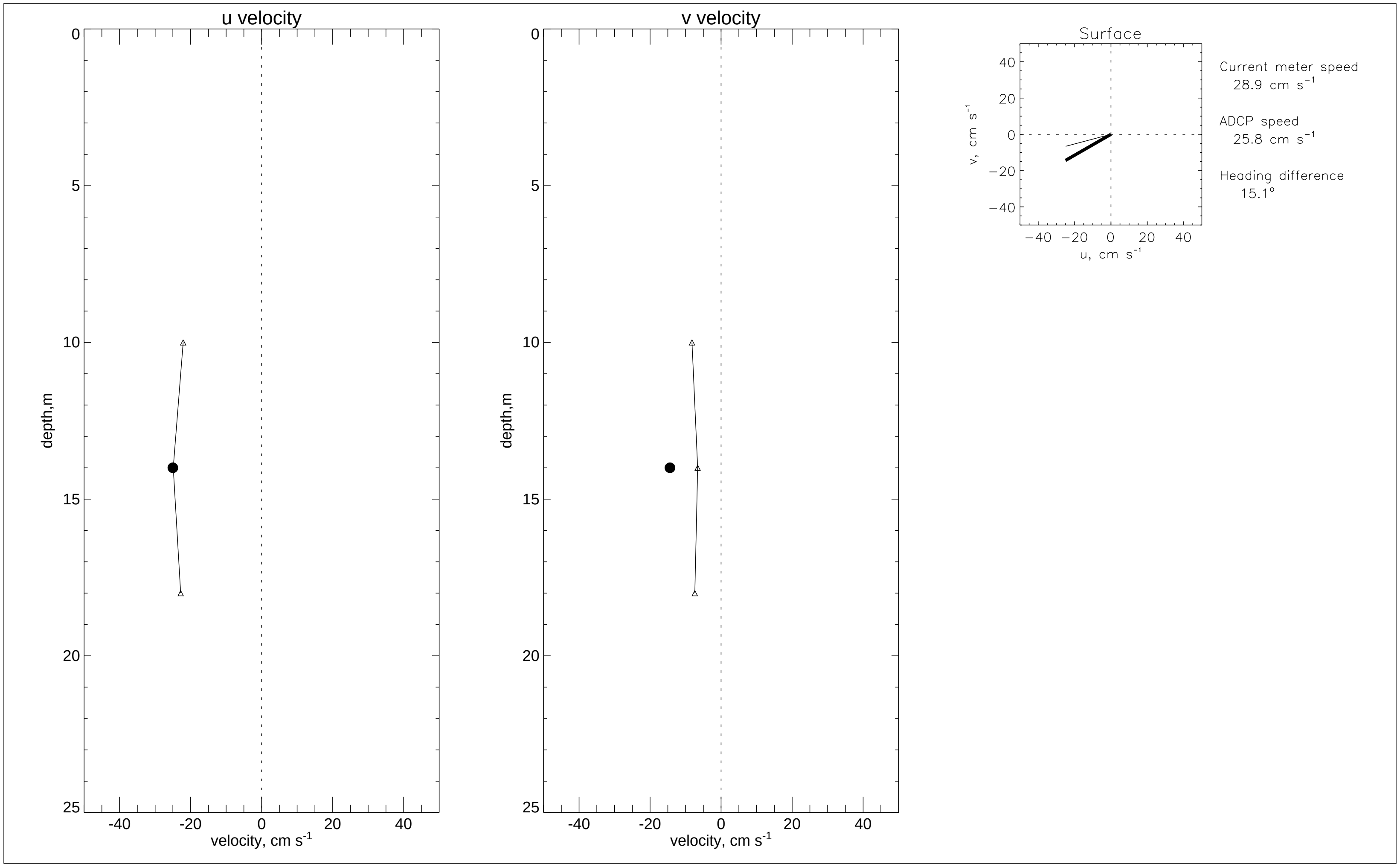

Figure 7.5.21. ADCP profile taken on 13 November 1993 at 1256 UTC (cruise H07) while passing by mooring CM21 at a distance o f 7.3 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 13 November 1993 at 1300 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

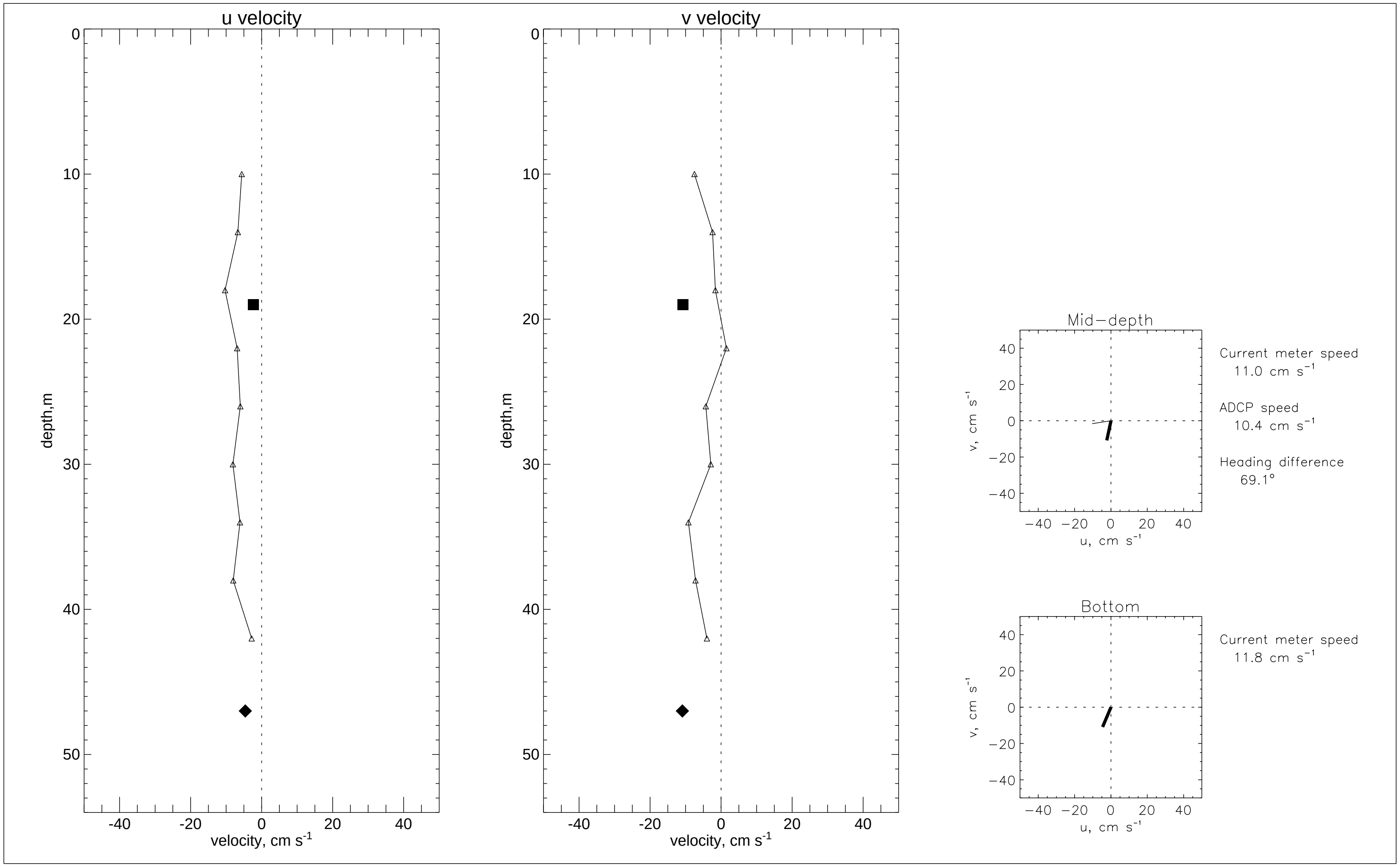

Figure 7.5.22. ADCP profile taken on 13 November 1993 at 0851 UTC (cruise H07) while passing by mooring CM22 at a distance o f 4.0 km. Velocities for the mid-depth meter (19 m) are marked with a square and were recorded on 13 November 1993 at 0900 UTC. Velocities for the bottom meter (47 m) are marked with a diamond and were recorded on 13 November 1993 at 0850 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

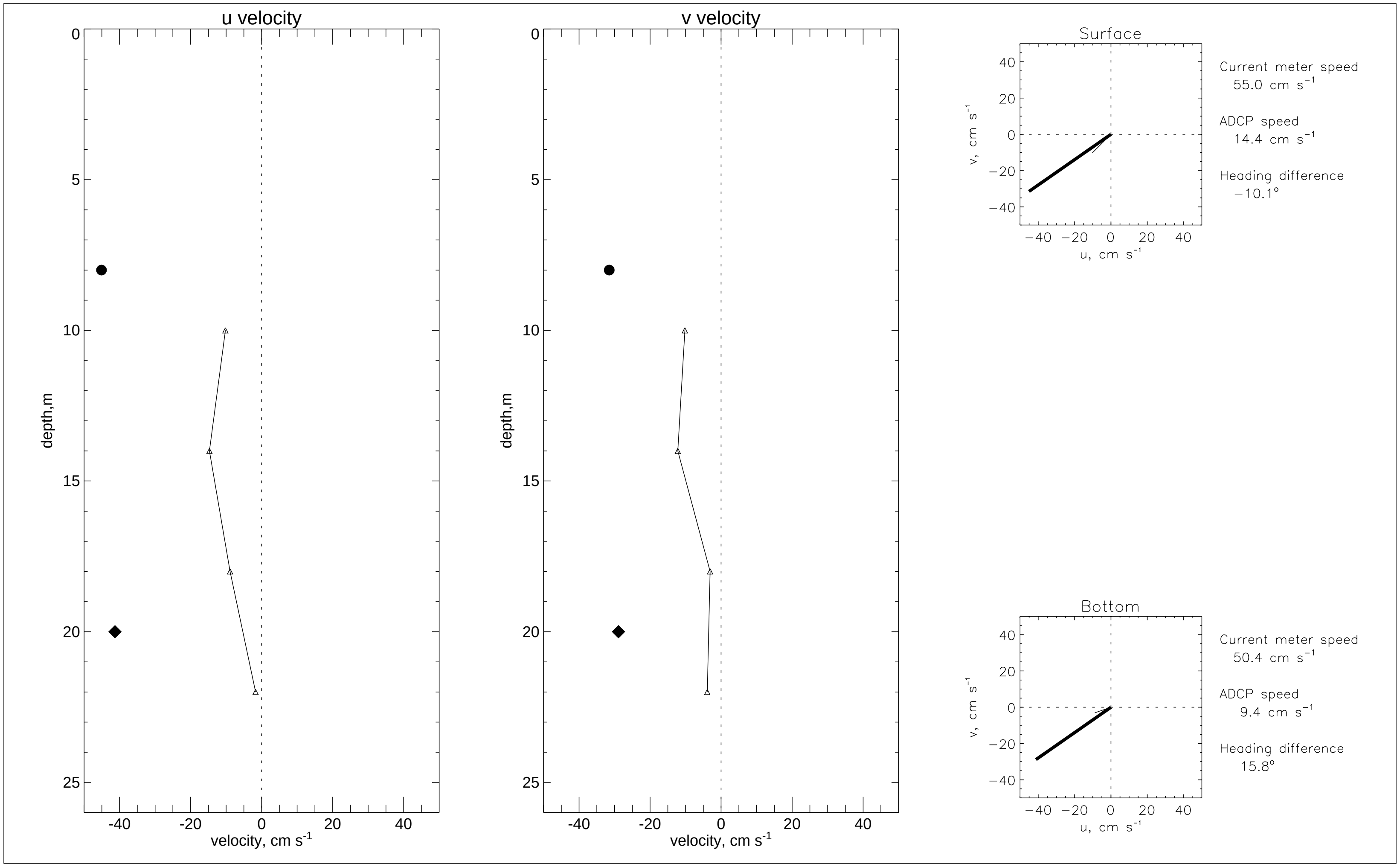

Figure 7.5.24. ADCP profile taken on 16 November 1993 at 1241 UTC (cruise H07) while passing by mooring CM24 at a distance o f 4.1 km. Velocities for the surface meter (8 m) are marked with a circle and were recorded on 16 November 1993 at 1230 UTC. Velocities for the bottom meter (20 m) are marked with a diamond and were recorded on 16 November 1993 at 1240 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

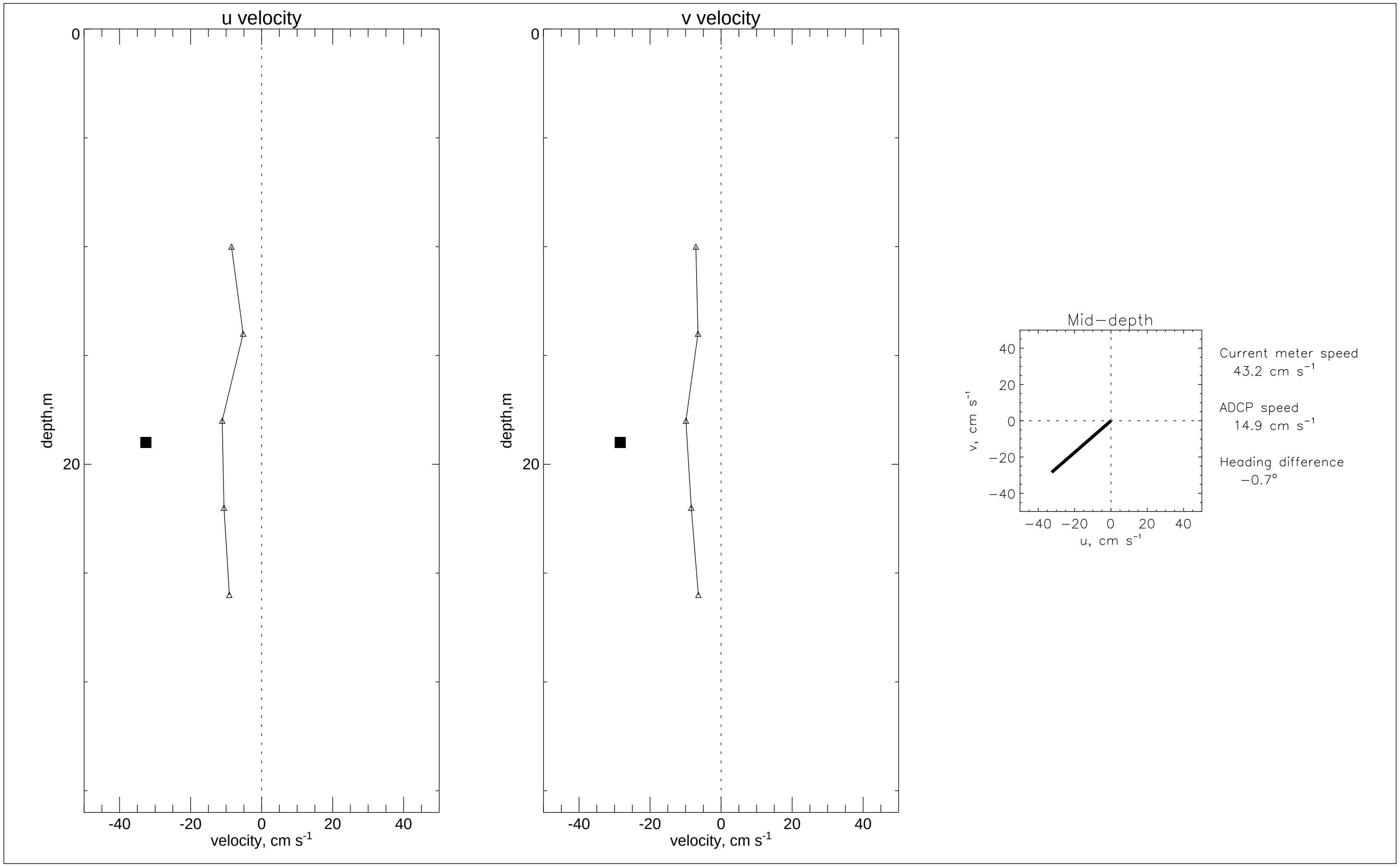

Figure 7.5.25. ADCP profile taken on 16 November 1993 at 1451 UTC (cruise H07) while passing by mooring CM25 at a distance o f 2.9 km. Velocities for the mid-depth meter (19 m) are marked with a square and were recorded on 16 November 1993 at 1450 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

5 THIRD FIELD YEAR

5.1 Introduction

Underway ADCP surveys were made on all three hydrographic surveys during the third and final field year (April 1994 through December 1994). Dates are shown in Table 1 and mounting of the ADCP units is shown in Table 2. Continuous data were obtained along the tracks of the surveys, except during periods when instrument problems occurred or the system was shut off during long periods at a fixed location. Two surveys (H08 and H10) were conducted aboard the R/V *Gyre*; one survey (H09) was conducted aboard the R/V *J.W. Powell*. The configurations recorded for each ADCP cruise are shown in Table 16.

Table 16. ADCP configurations for H08, H09, and H10.

System Parameter	H08	H09	H10
Averaging interval (min)	5	5	5
Depth cell length (m)	4	4	4
Number of depth cells	100	100	100
Time between pings (sec)	0.67	0.67	0.67
Transmit pulse length (m)	4	4	4
Blank after transmit (m)	4	4	4
Navigation type	DGPS	DGPS	DGPS
Data recorded	Raw data averaged data navigation	Raw data averaged data navigation	Raw data averaged data navigation

A departure from the previous methods of QA/QC processing procedures occurred in the handling of profiles collected on the continental slope. A comparison was made of the estimates of ship velocity obtained from bottom tracking (BT) and from DGPS. They agreed very well over the continental shelf to depths of 200 m, but over the continental slope the DGPS estimates were substantially better than those obtained from BT. For the H08, H09 and H10, ADCP data sets, BT was used inshore of the 100-m isobath, and DGPS was used seaward of it. Although the cruise track followed the 200-m isobath, the 100-m isobath was selected because the ship could not follow the 200-m line exactly. Had the 200-m isobath been selected, the reference would have oscillated between BT and DGPS.

5.2 Cruise H08

5.2.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *Gyre*. The Vessel-Mount model ADCP was installed and the TRANSECT program was used during this survey. The weather during cruise H08 was good, and, more importantly, the *Gyre*'s maximum speed was about eight knots because of hull barnacles. The slower than normal speed contributed to high quality ADCP data. Except for data gaps when the computer hung up (26 April, 28 April, 30 April, 2 May, 3 May, and 5 May), there were no major problems in data collection. The QA/QC processing produced usable data. The parameter settings are shown in Table 17.

Table 17. Parameter settings (in meters) and the resulting sequence of bin depths on survey H08.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
4	4	4	12, 16, 20, 24, ...

5.2.2 Results

5.2.2.1 General Cruise Track

We show in Figure 8.1.1 a plan view of the general cruise track taken by the R/V *Gyre* during H08. The cruise covered the entire LATEX shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 8.1.2 for which contoured profiles of normal velocity are presented in section 5.2.2.4. Figure 8.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 5.2.2.5.

5.2.2.2 Plan View of Stick Plot Velocity Vectors

Figure 8.2.1 shows the velocity from the surface bin centered at 12 m, Figure 8.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 8.2.3 shows the velocity from the bin centered at 100m below the surface.

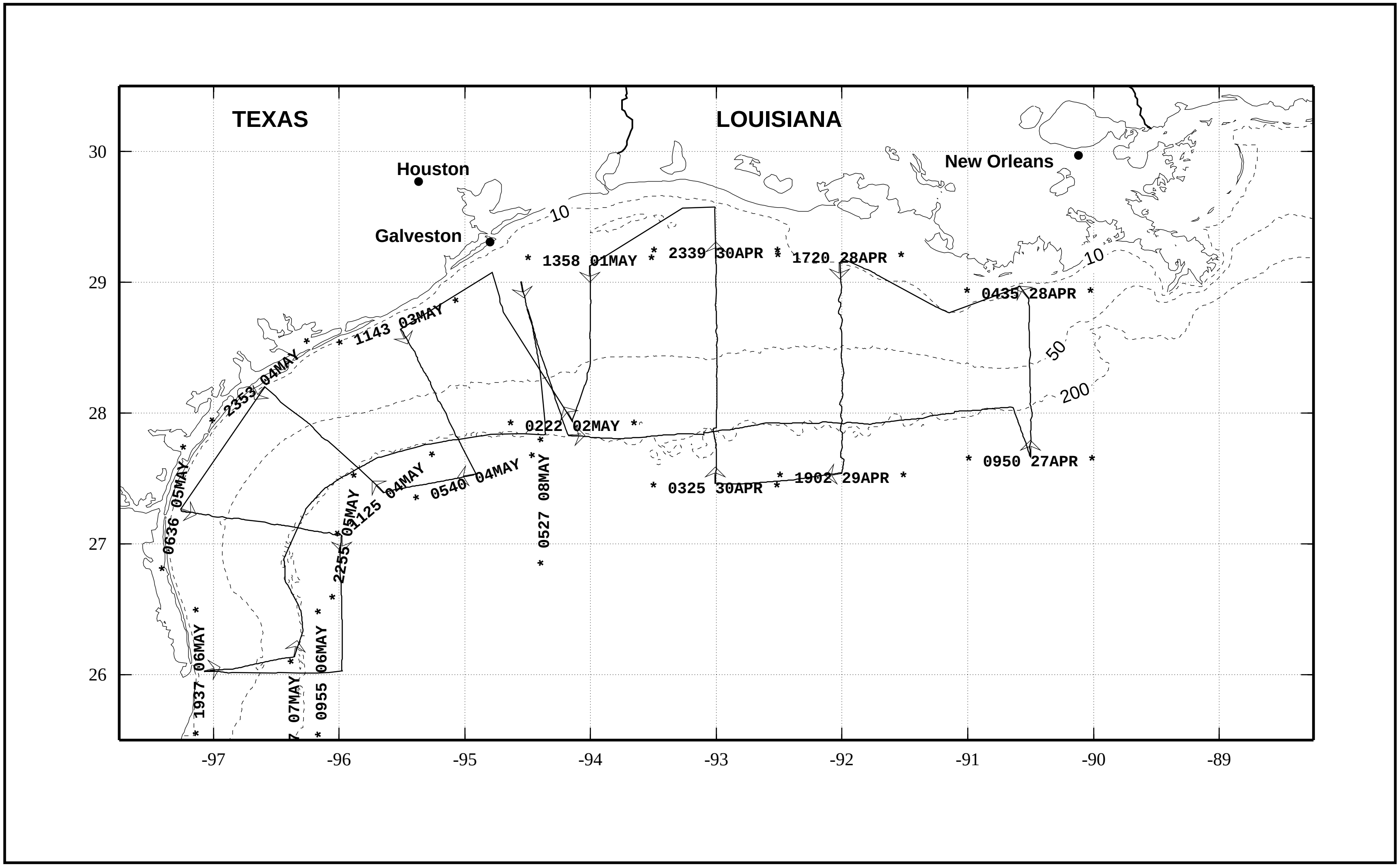

Figure 8.1.1. Cruise track on LATEX A cruise H08 in April 1994, showing times and directions.

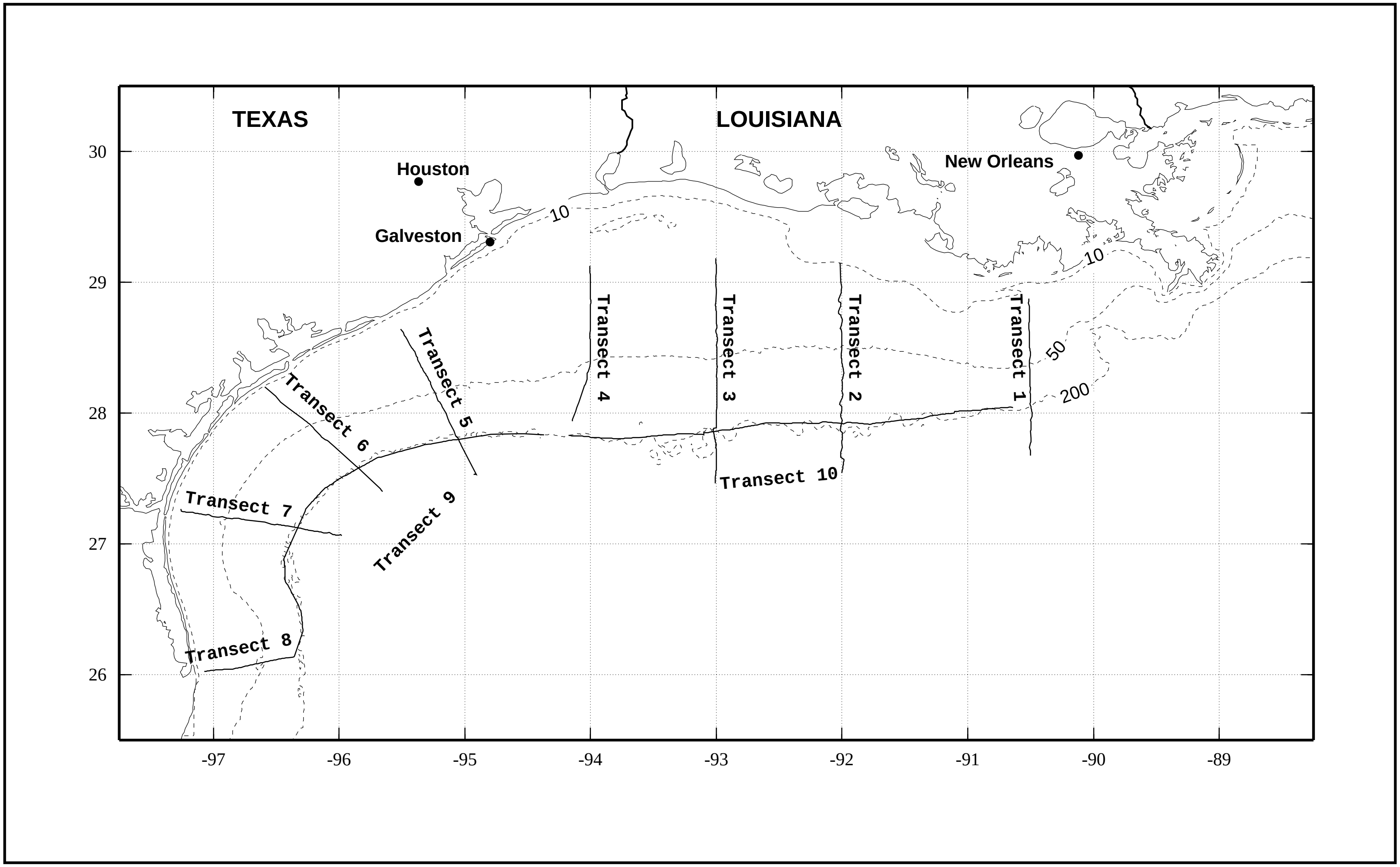

Figure 8.1.2. Cruise track on LATEX A cruise H08 in April 1994, showing individual labeled transects.

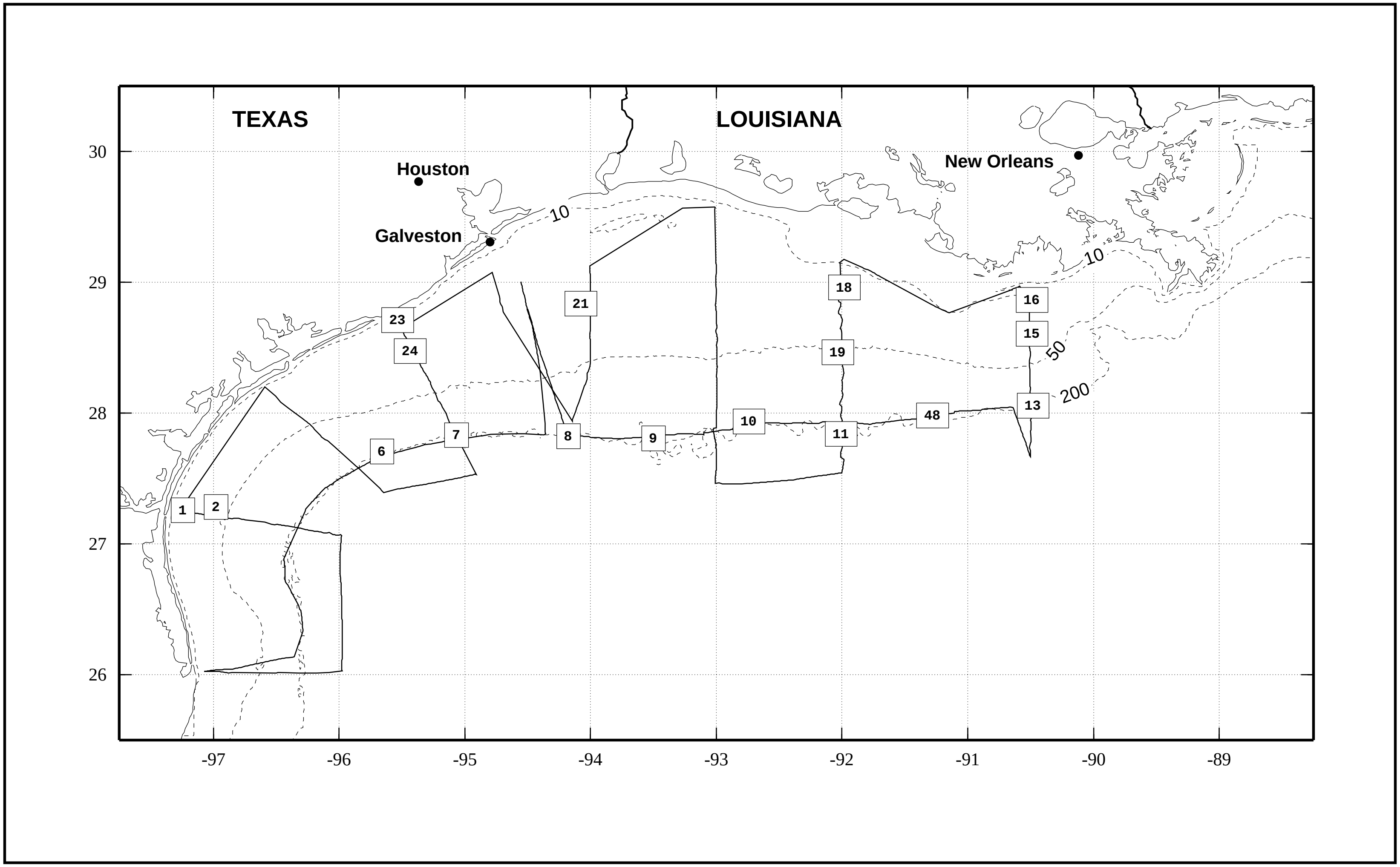

Figure 8.1.3. Cruise track on LATEX A cruise H08 in April 1994, showing current meter locations.

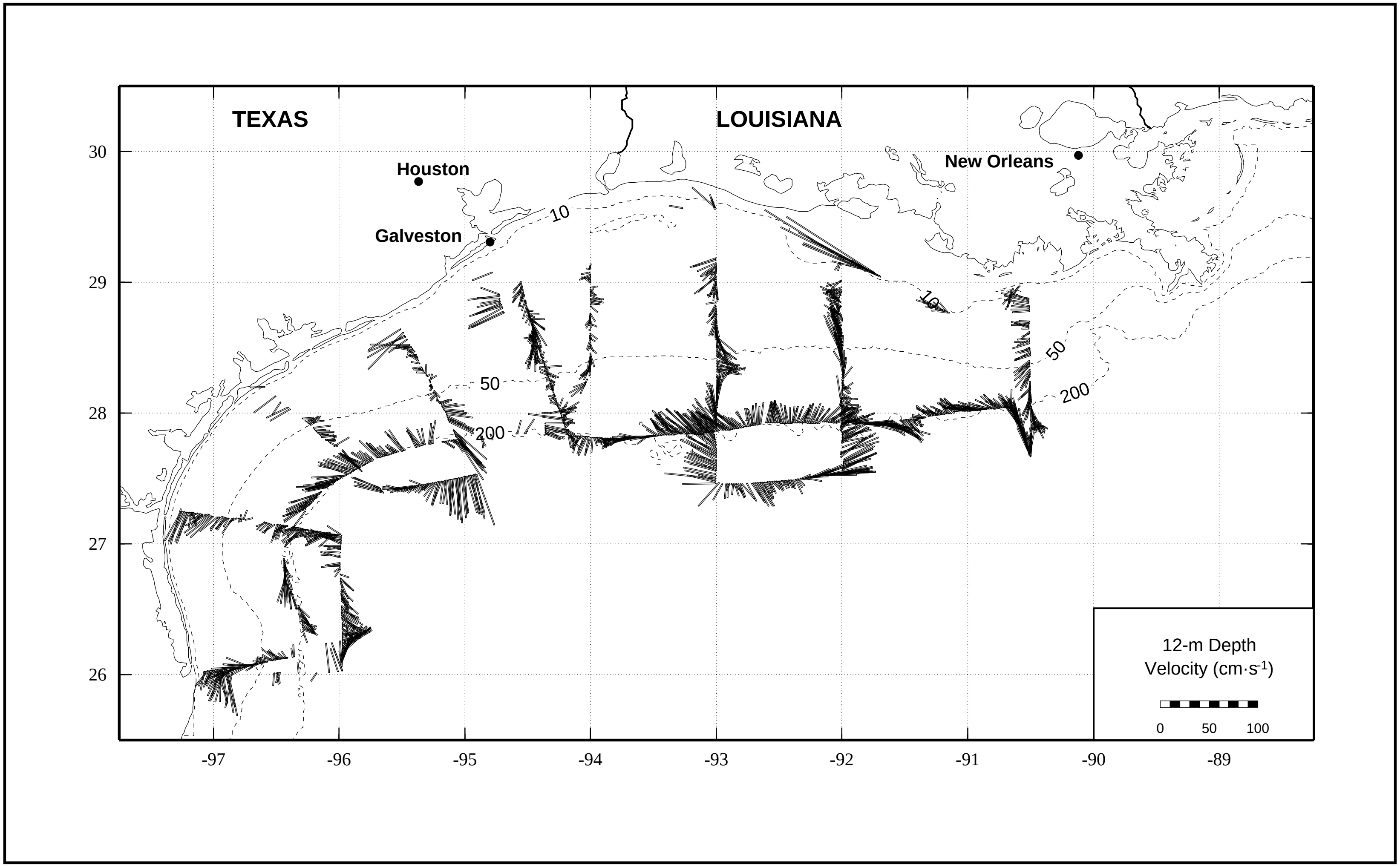

Figure 8.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H08 conducted in April 1994

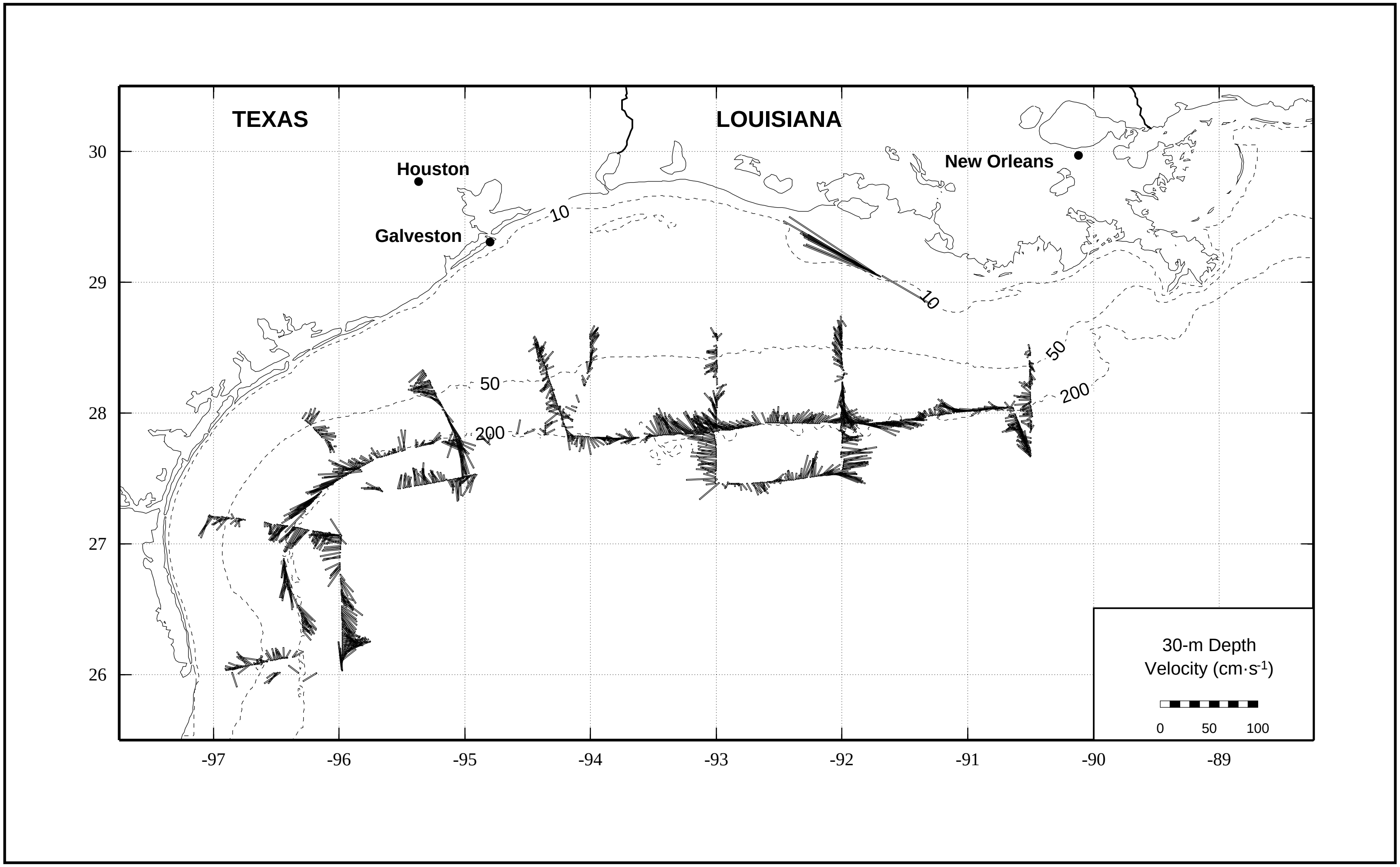

Figure 8.2.2 Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H08 conducted in April 1994

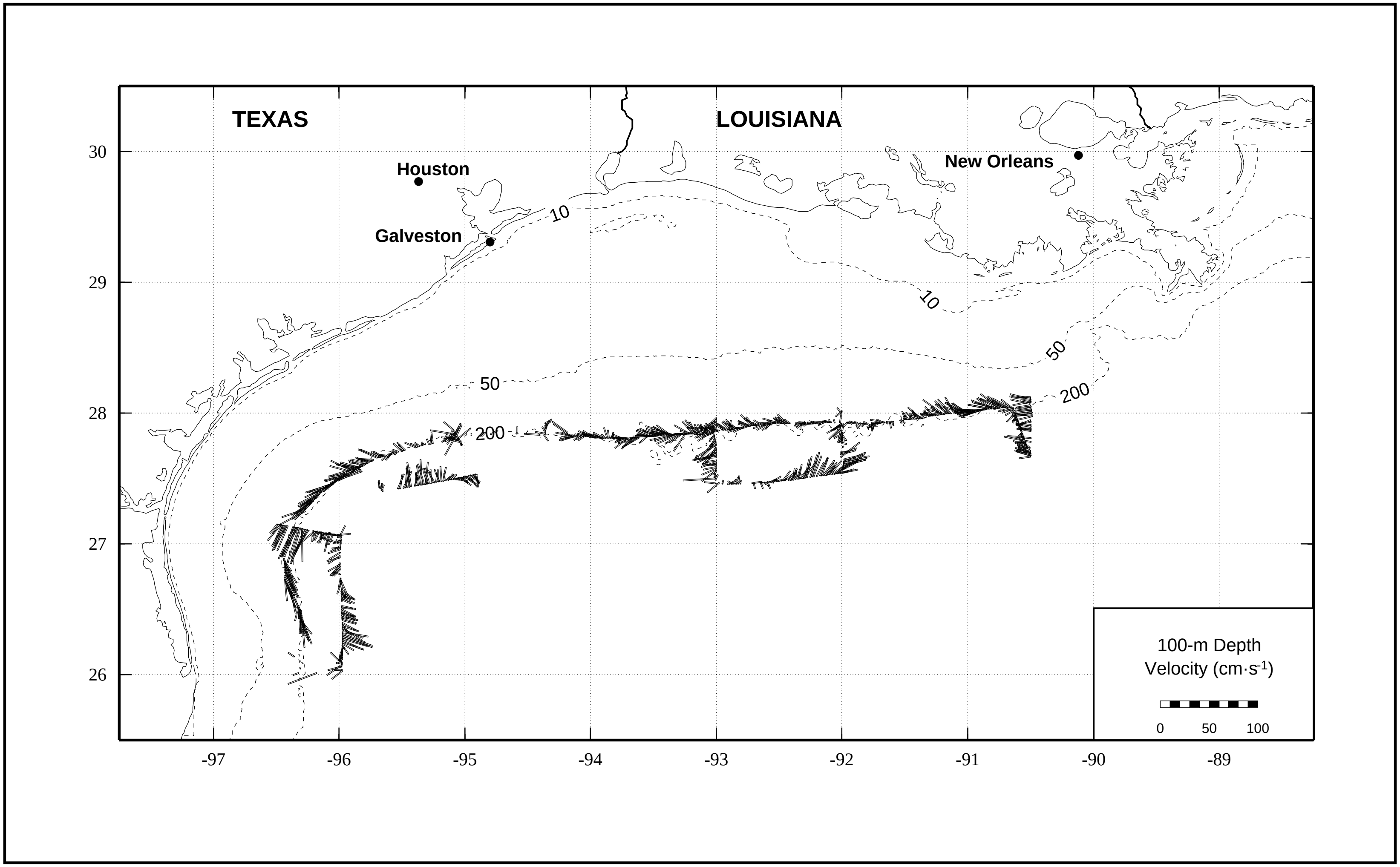

Figure 8.2.3. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H08 conducted in April 1994

5.2.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 8.3.1 shows the velocity from the bin centered at 12 m, Figure 8.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 8.3.3 shows the velocity from the bin centered at 100 m below the surface.

5.2.2.4 Contoured Profiles of Normal Velocity

In Figures 8.4.1, 8.4.2, 8.4.3, 8.4.4, 8.4.5, 8.4.6, 8.4.7, and 8.4.8 we show the velocity normal to across-shelf transects 1, 2, 3, 4, 5, 6, 7, and 8, respectively. For along-shelf transect number 9 taken along the 200-m isobath, we show the normal velocity in Figure 8.4.9. For along-shelf transect number 10 taken along the 200-m isobath, we show the normal velocity in Figure 8.4.10. The transects are shown in Figure 8.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

5.2.2.5 Vertical Current Profiles

We show in Figures 8.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 8.1.3.

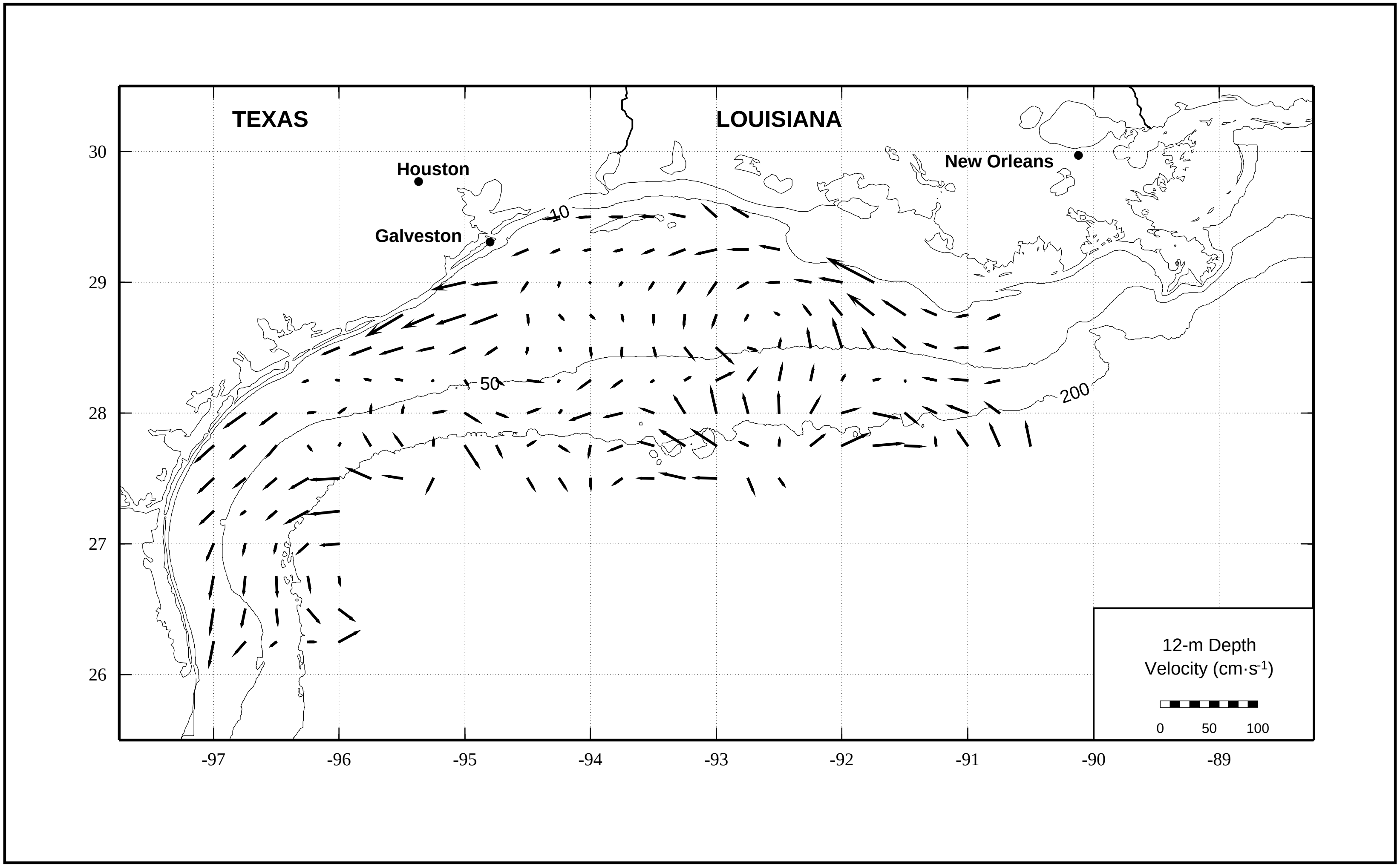

Figure 8.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H08 conducted in April 1994

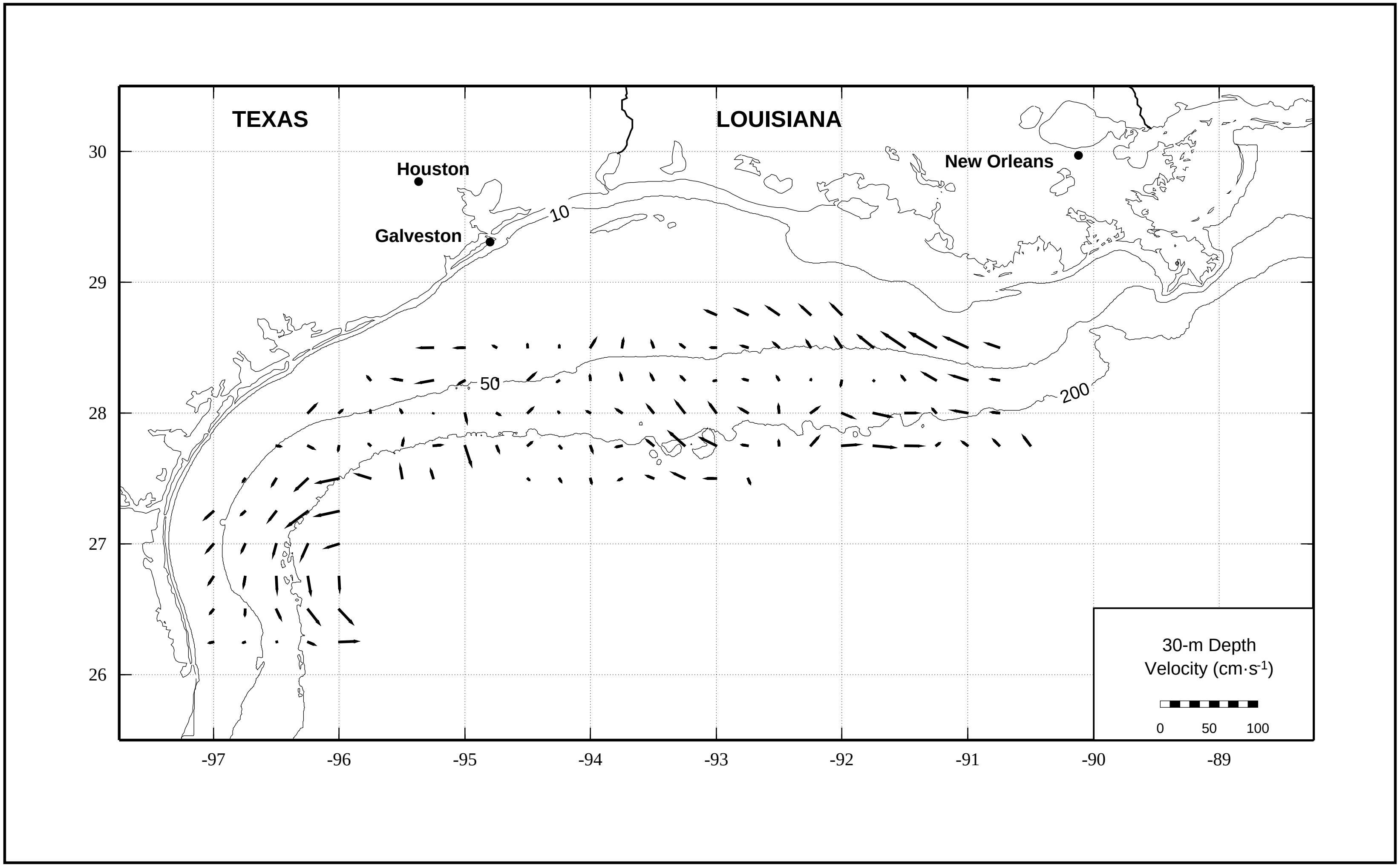

Figure 8.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H08 conducted in April 1994

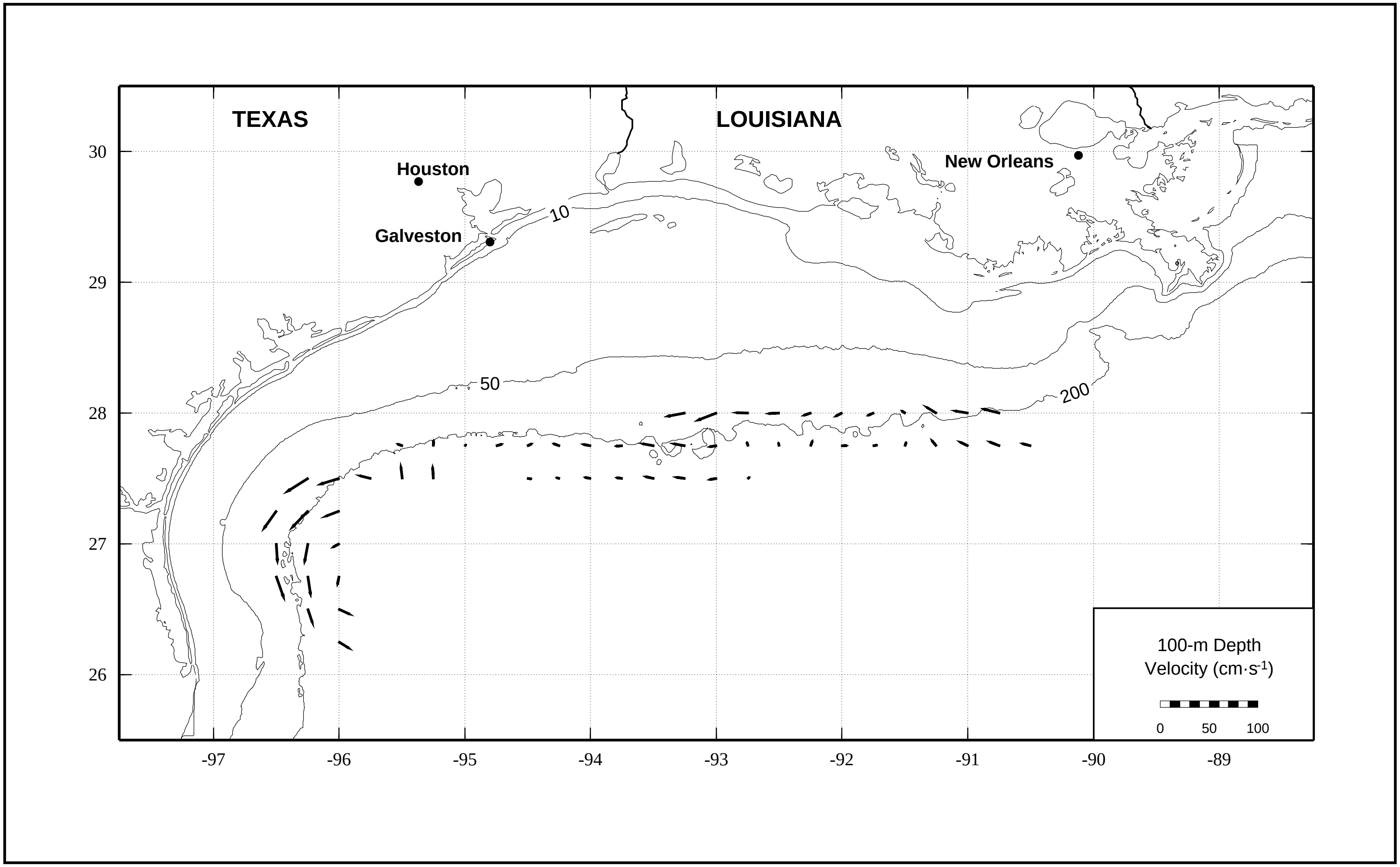

Figure 8.3.3. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H08 conducted in April 1994

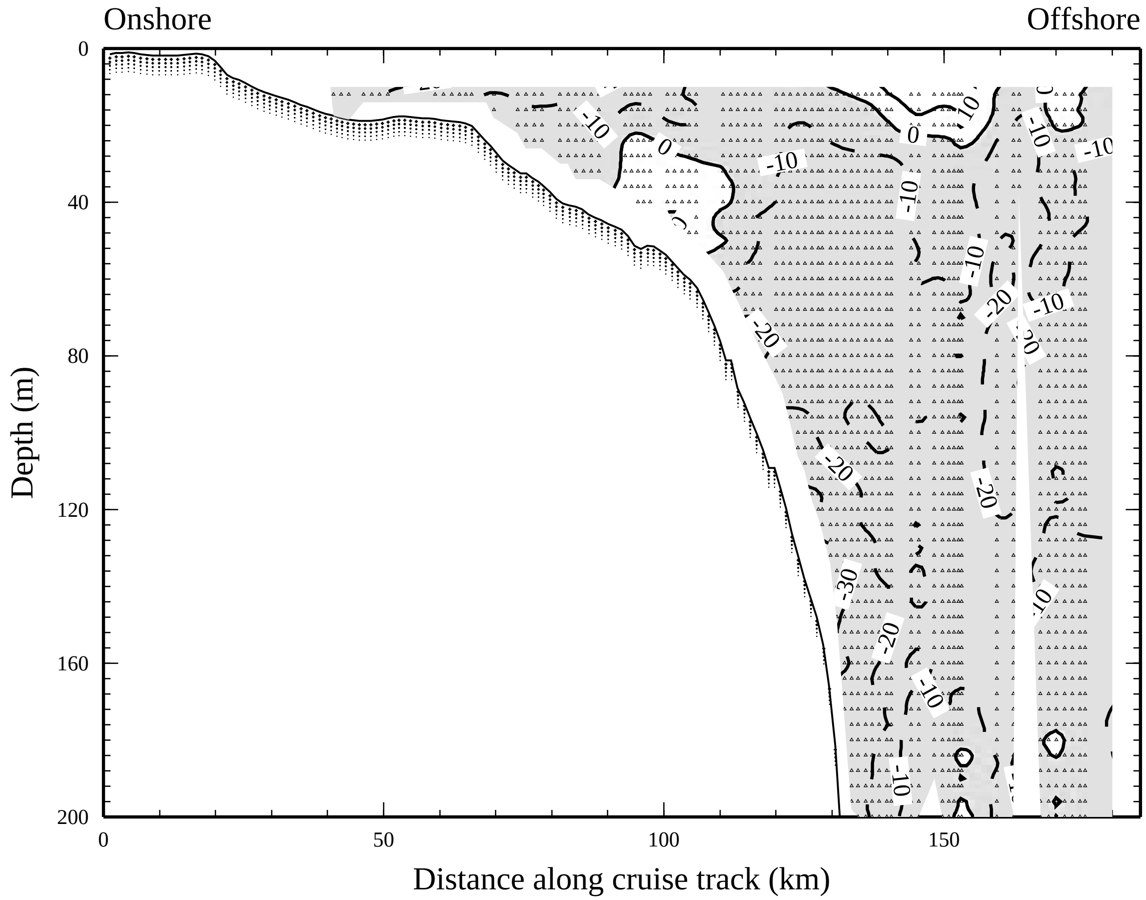

Figure 8.4.1. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 1 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

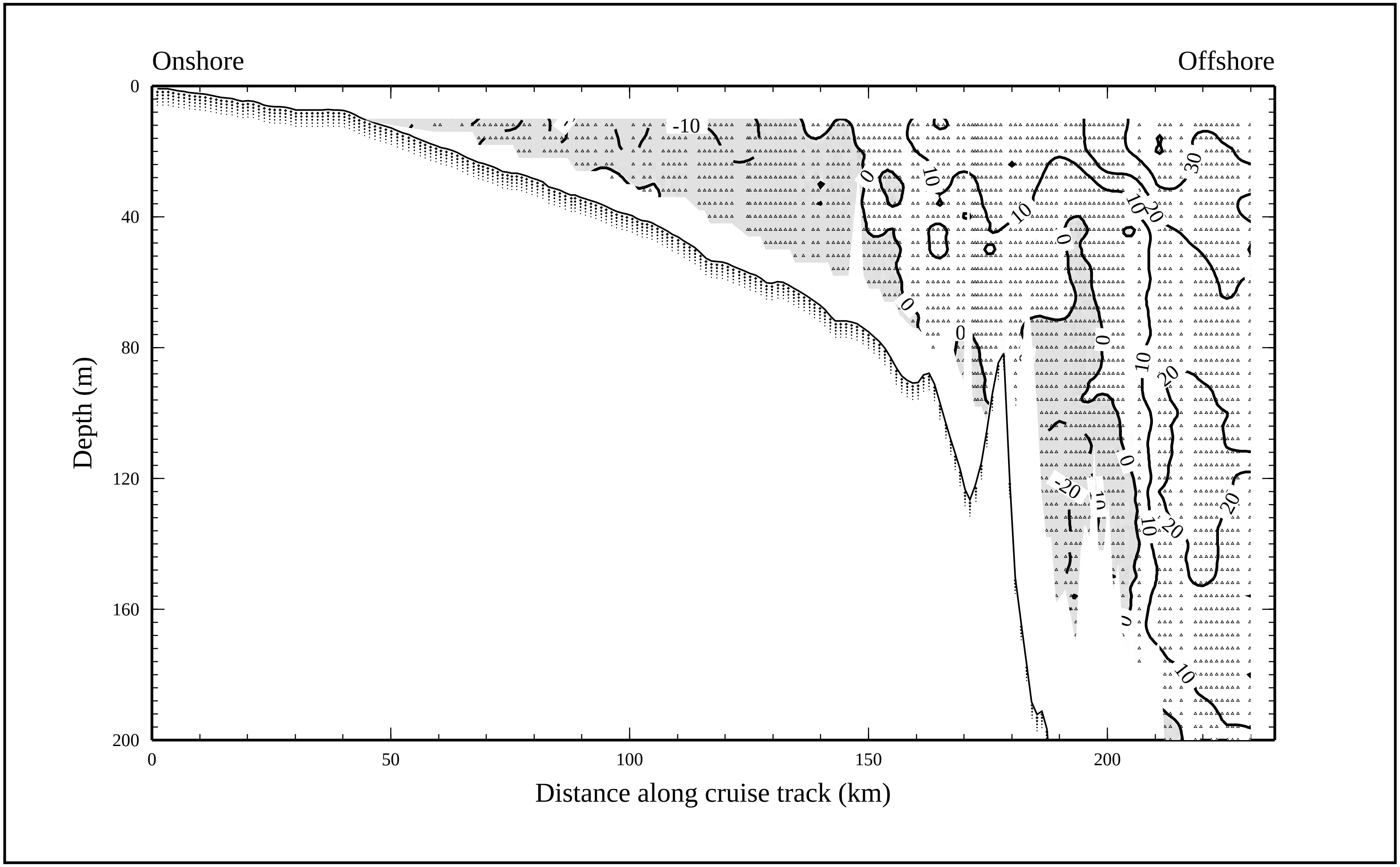

Figure 8.4.2. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 2 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

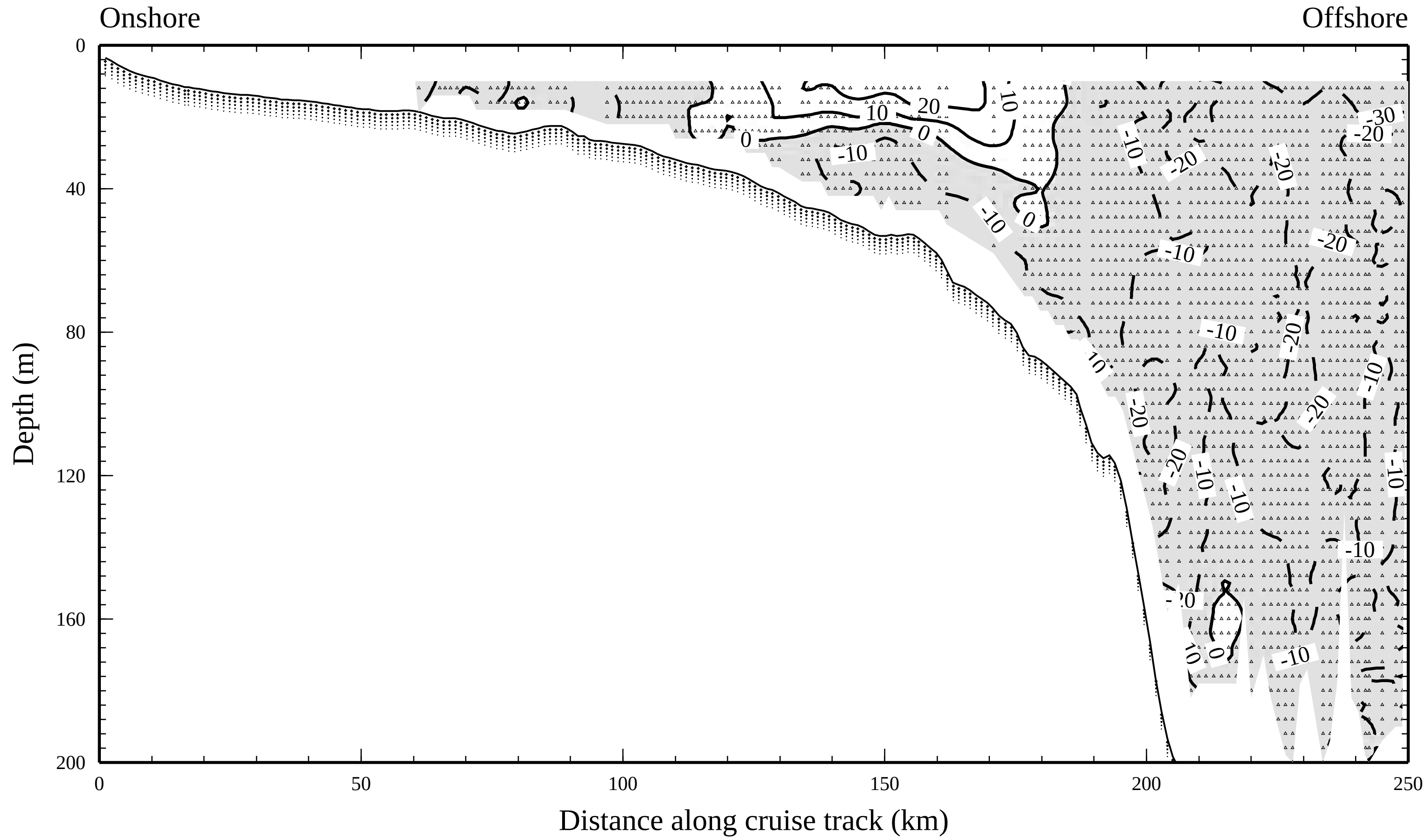

Figure 8.4.3. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 3 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

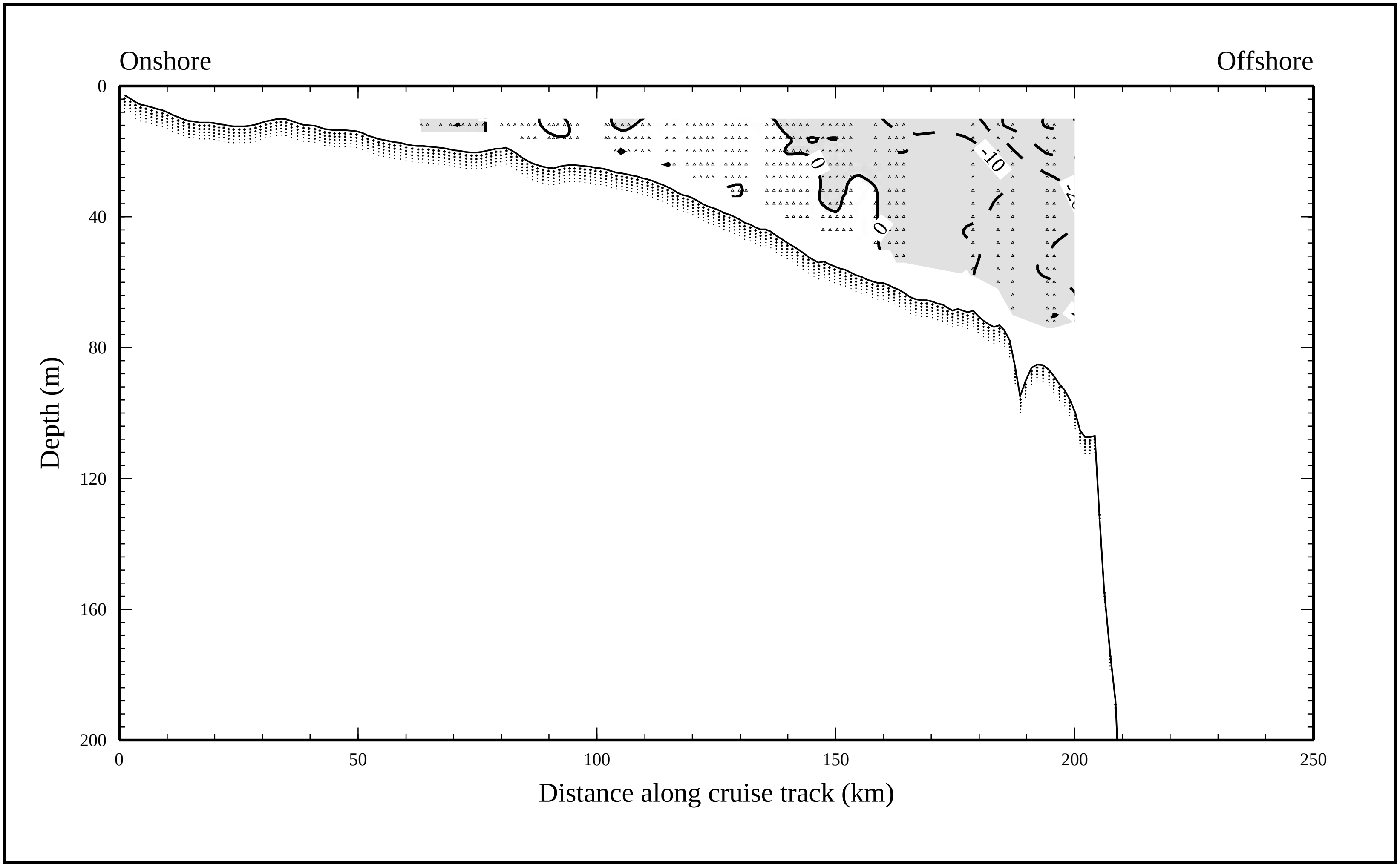

Figure 8.4.4. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 4 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

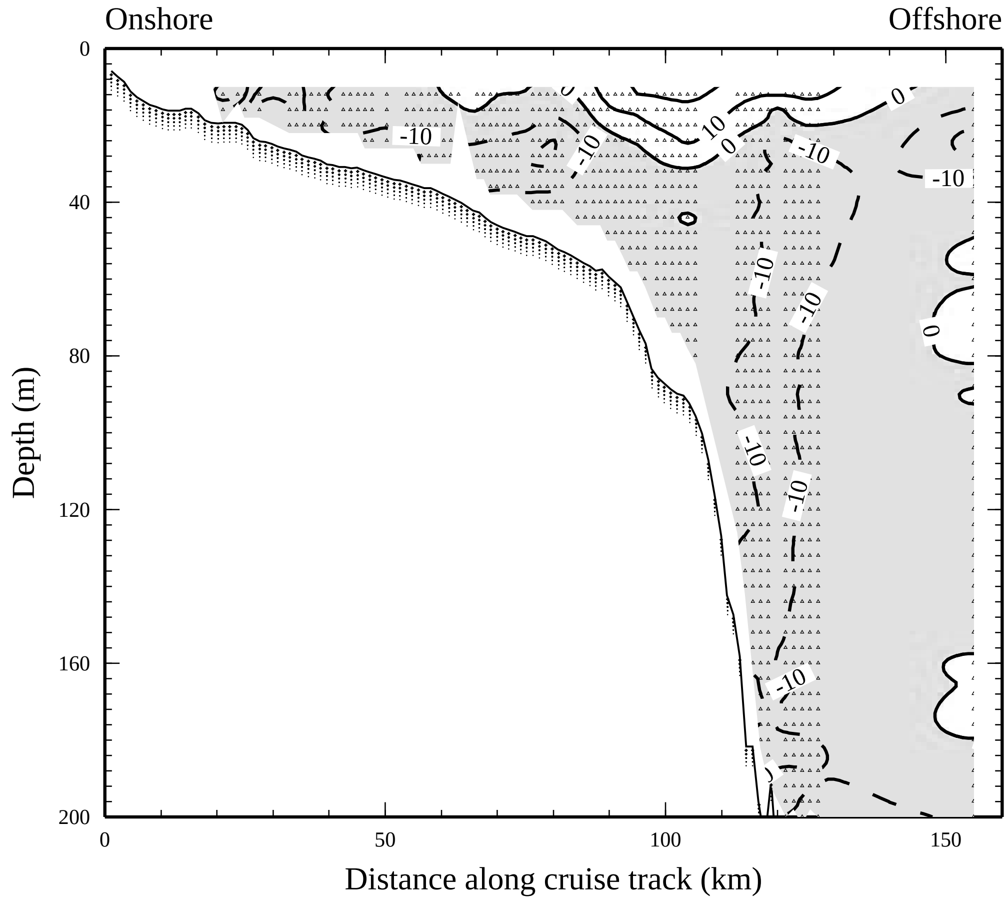

Figure 8.4.5. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 5 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

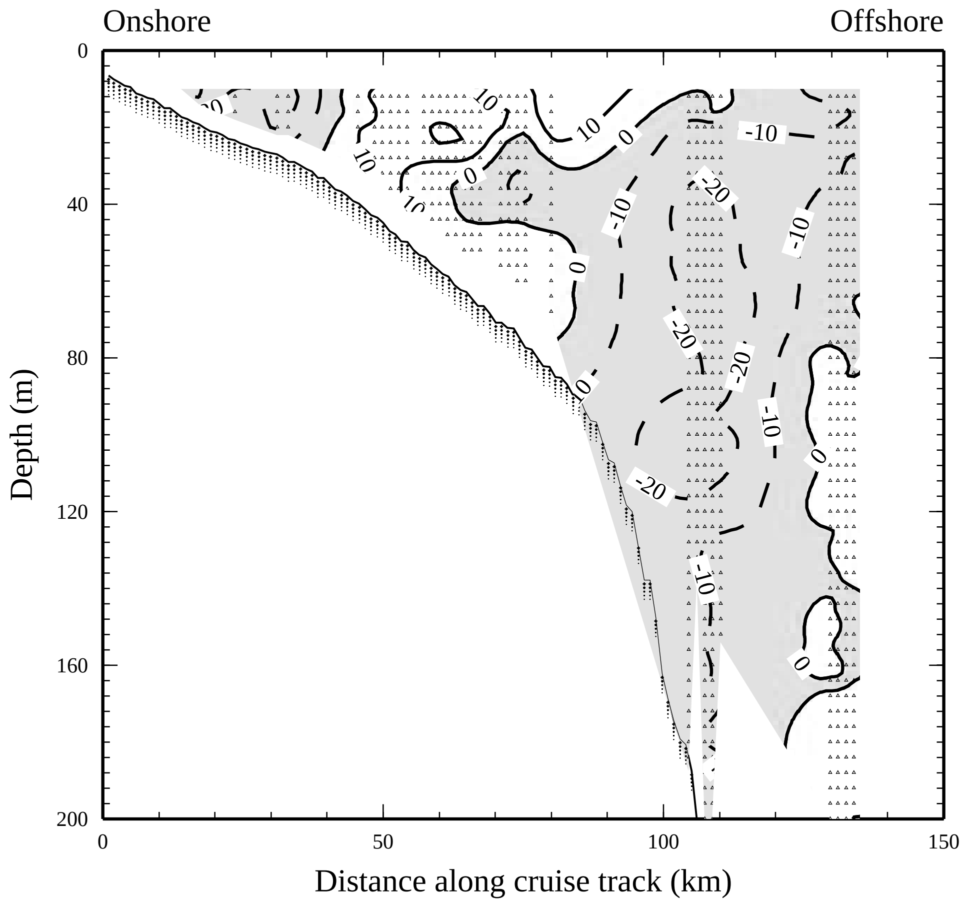

Figure 8.4.6. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 6 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

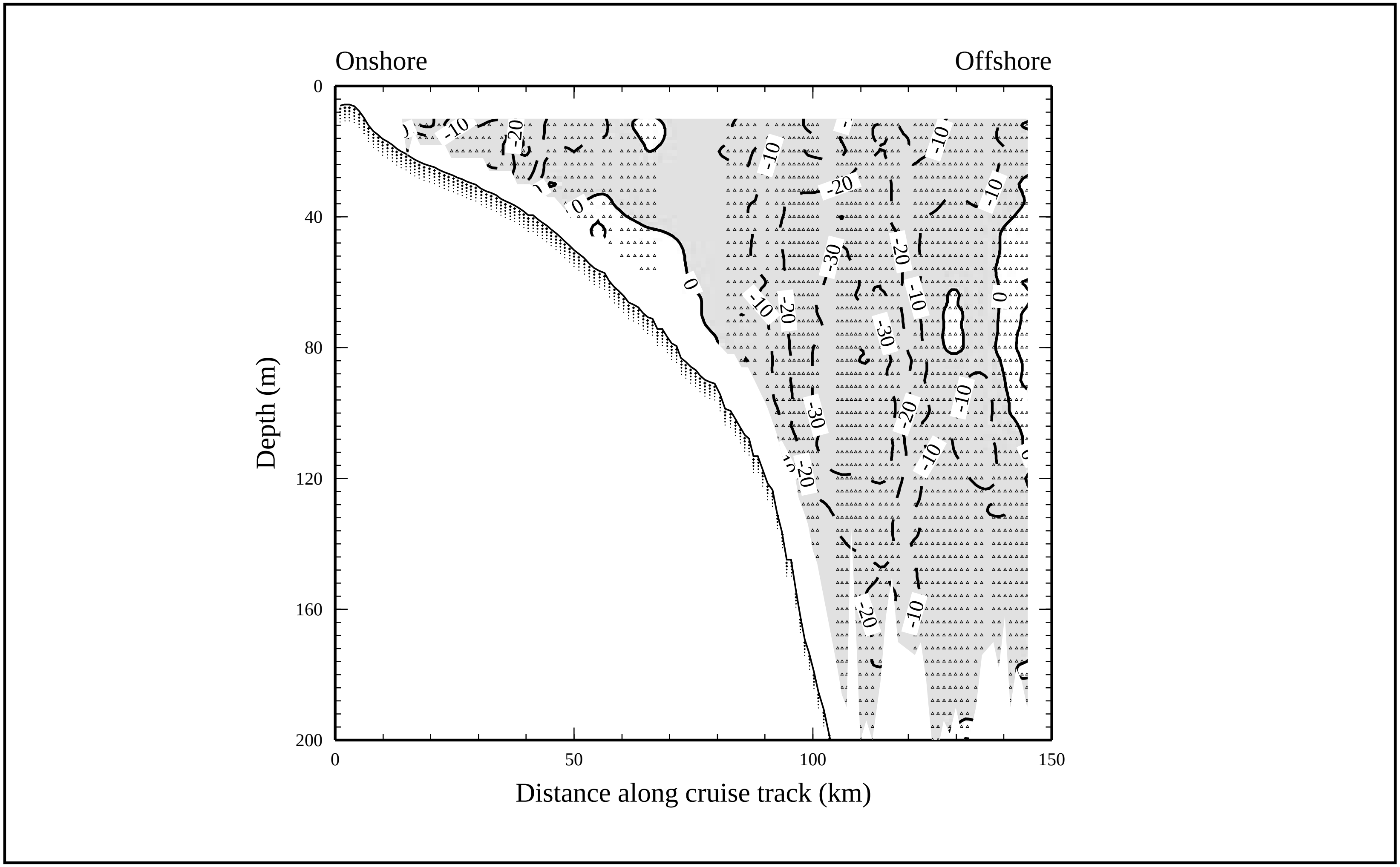

Figure 8.4.7. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 7 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

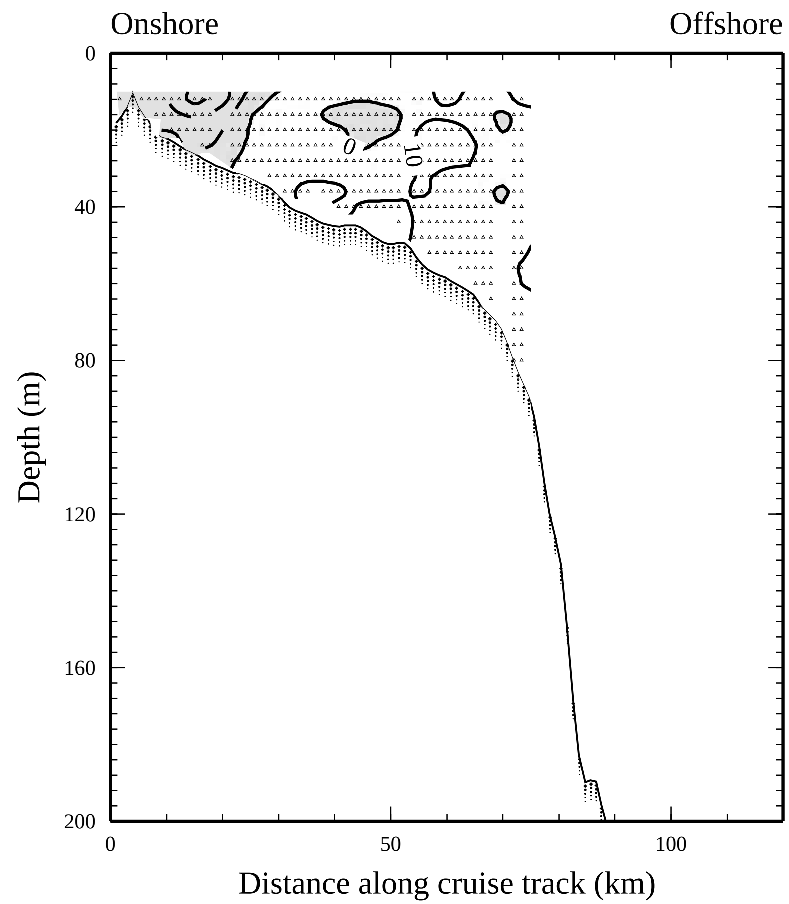

Figure 8.4.8. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 8 for cruise H08, April 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

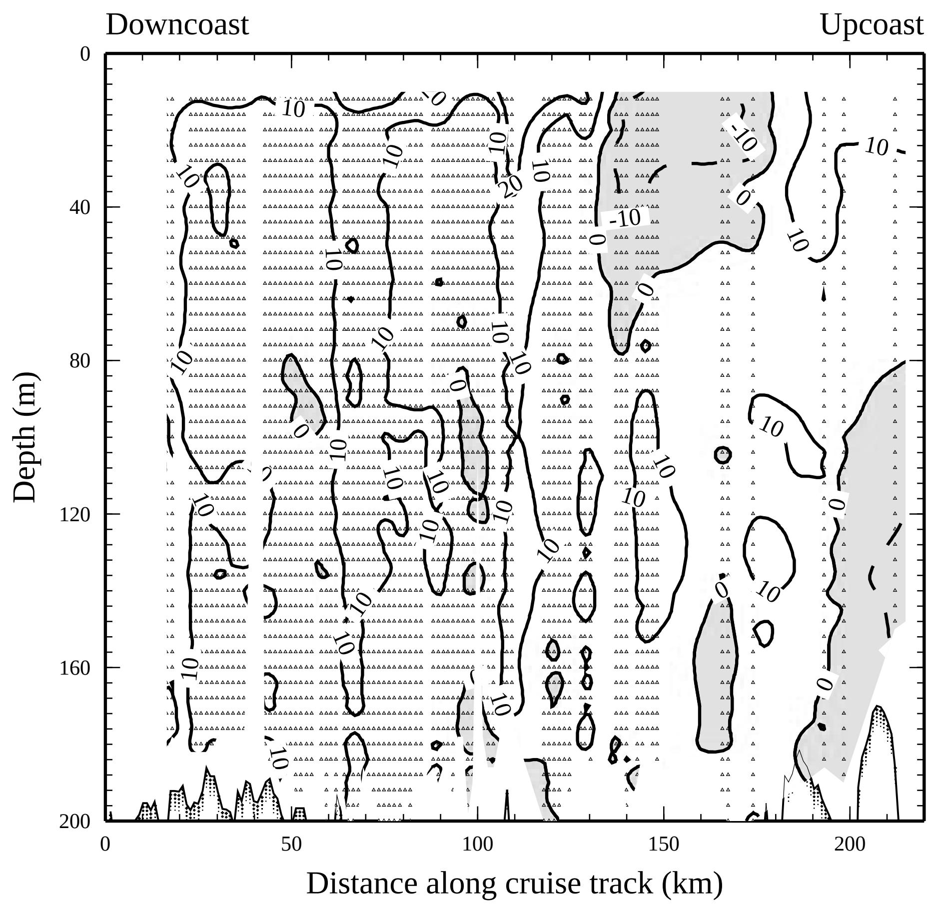

Figure 8.4.9. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 9 for cruise H08, April 1994. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

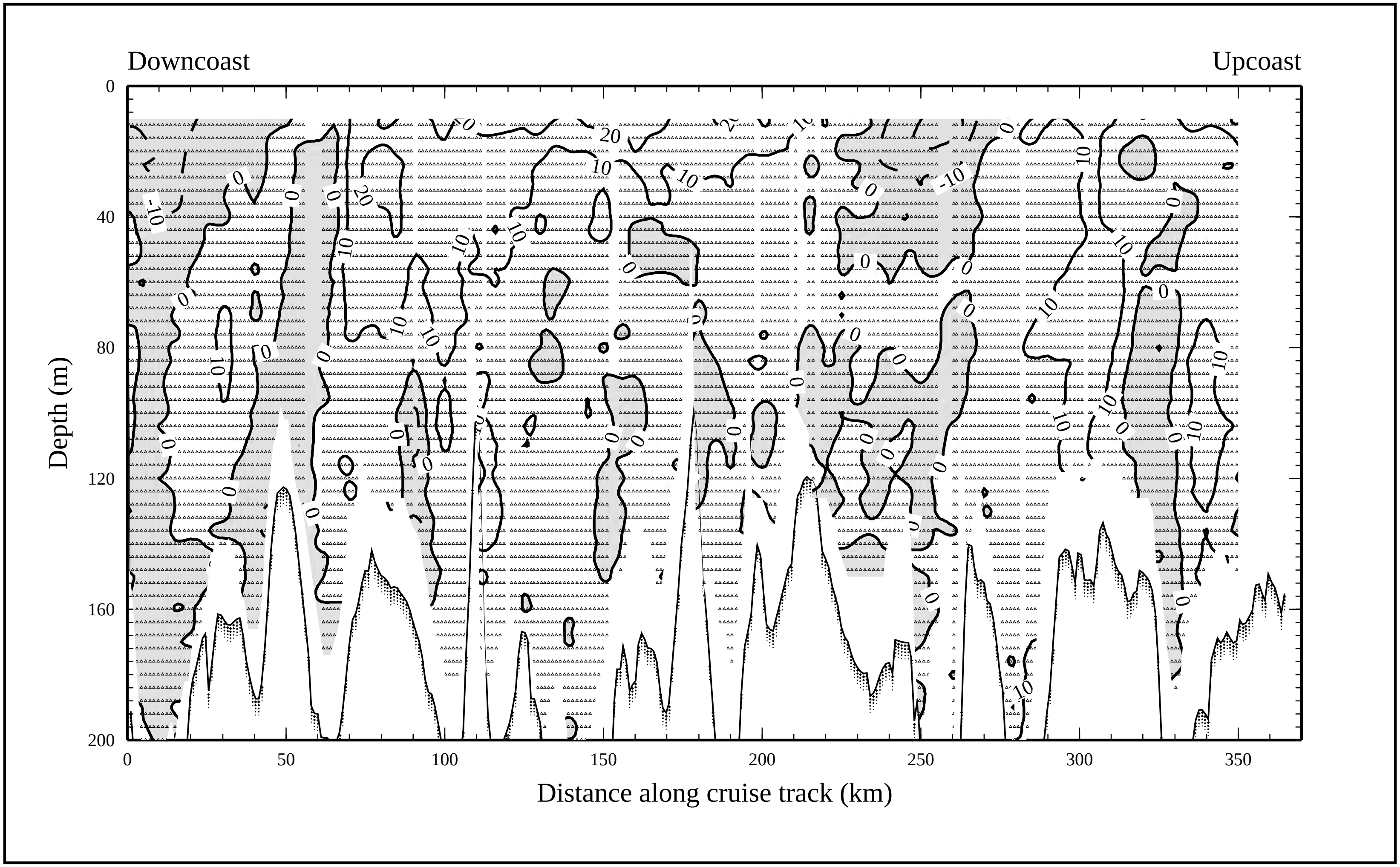

Figure 8.4.10. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 10 for cruise H08, April 1994. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

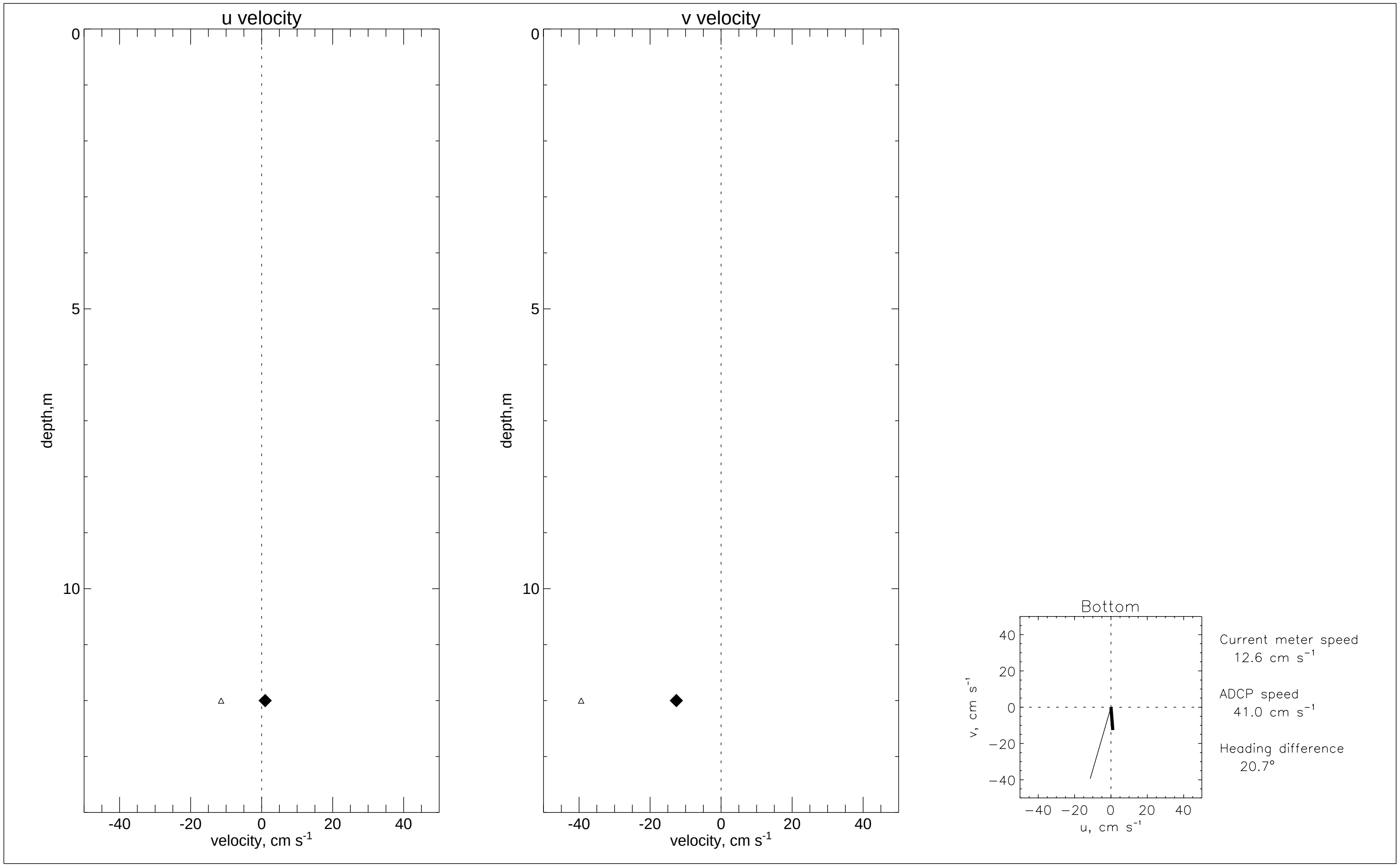

Figure 8.5.01. ADCP profile taken on 4 May 1994 at 1136 UTC (cruise H08) while passing by mooring CM01 at a distance of 7.3 km. Velocities for the bottom meter (12 m) are marked with a diamond and were recorded on 4 May 1994 at 1130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

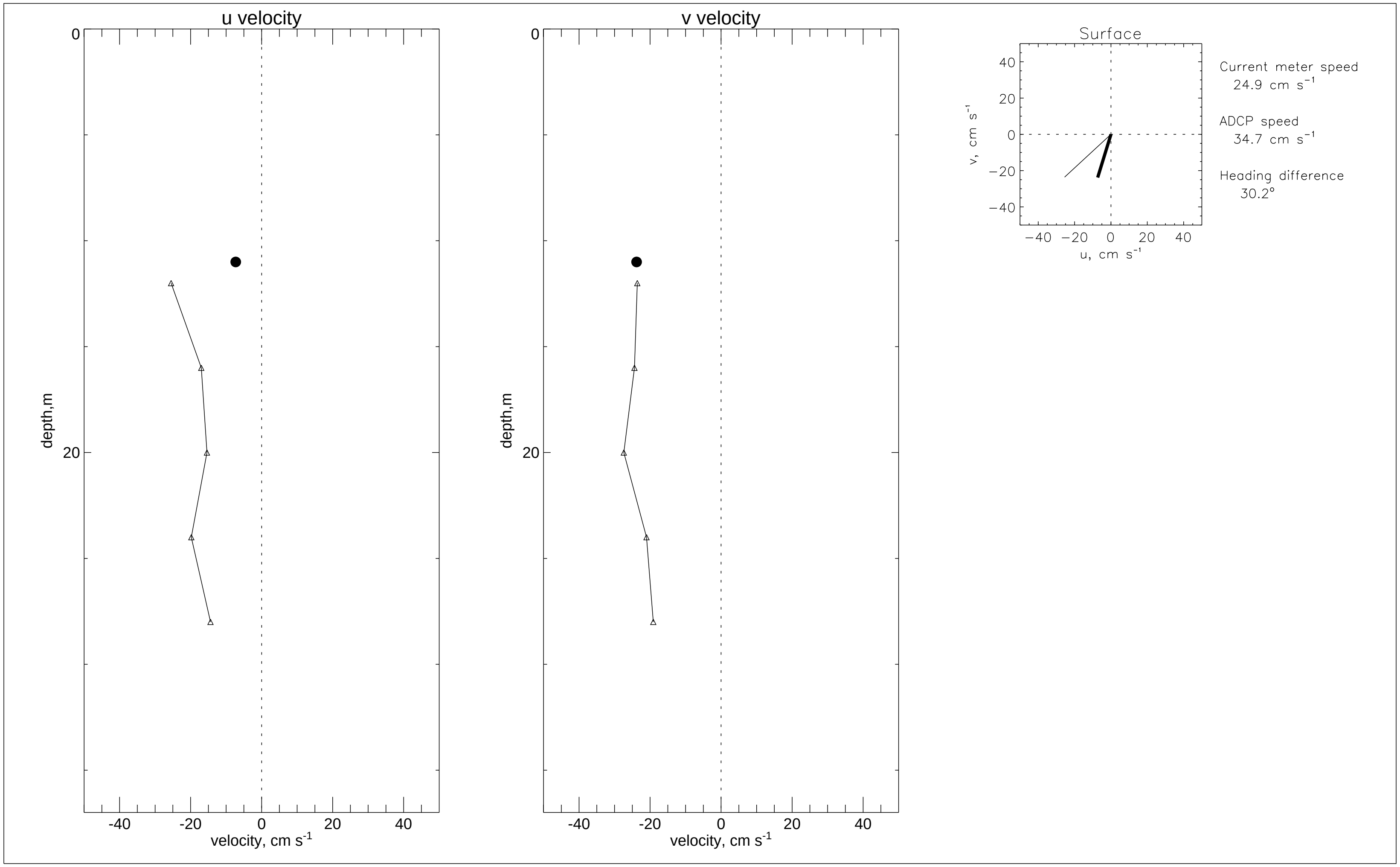

Figure 8.5.02. ADCP profile taken on 4 May 1994 at 1426 UTC (cruise H08) while passing by mooring CM02 at a distance of 7.7 km. Velocities for the surface meter (11 m) are marked with a circle and were recorded on 4 May 1994 at 1430 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

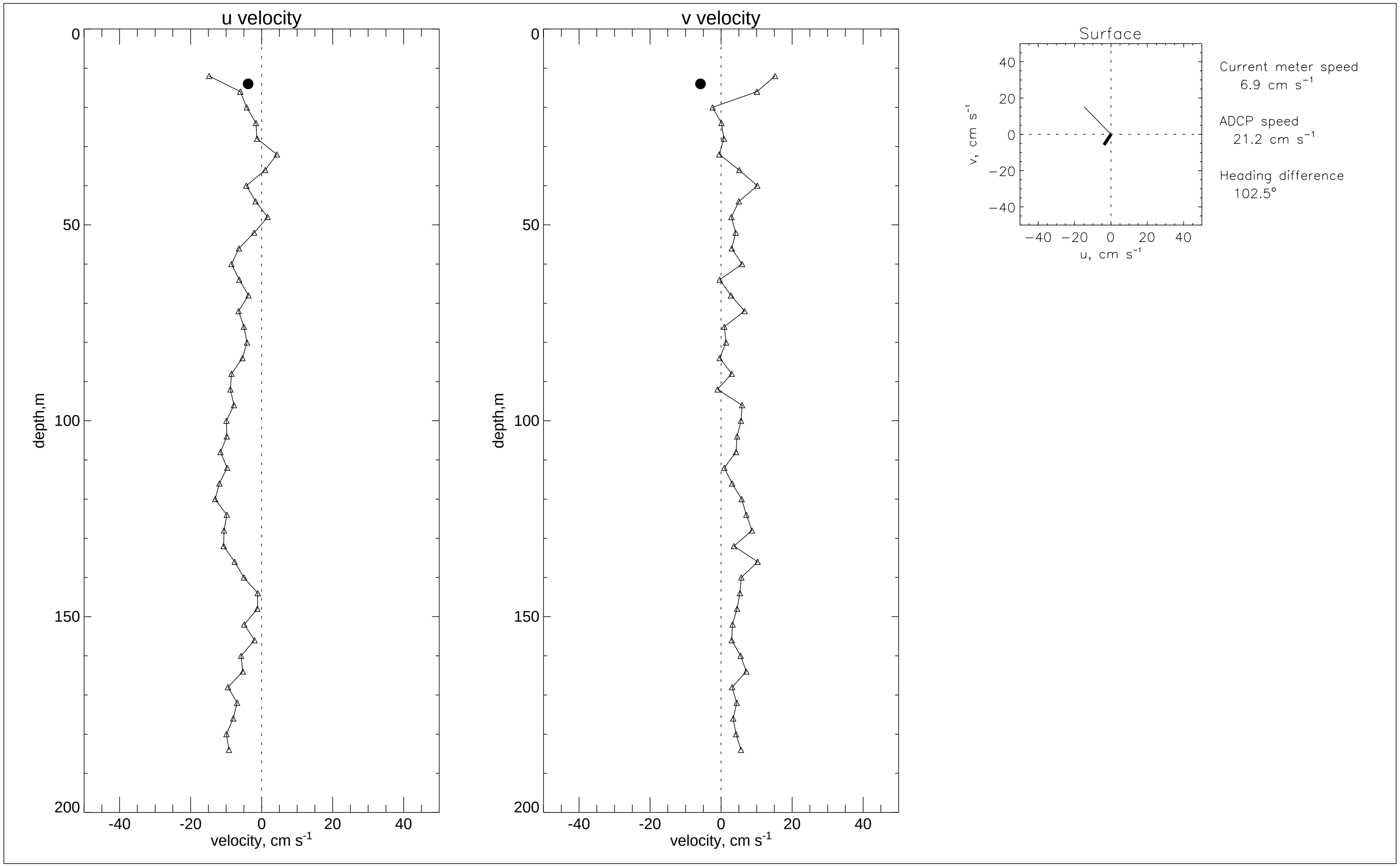

Figure 8.5.06. ADCP profile taken on 7 May 1994 at 0007 UTC (cruise H08) while passing by mooring CM06 at a distance of 4.2 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 7 May 1994 at 0000 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

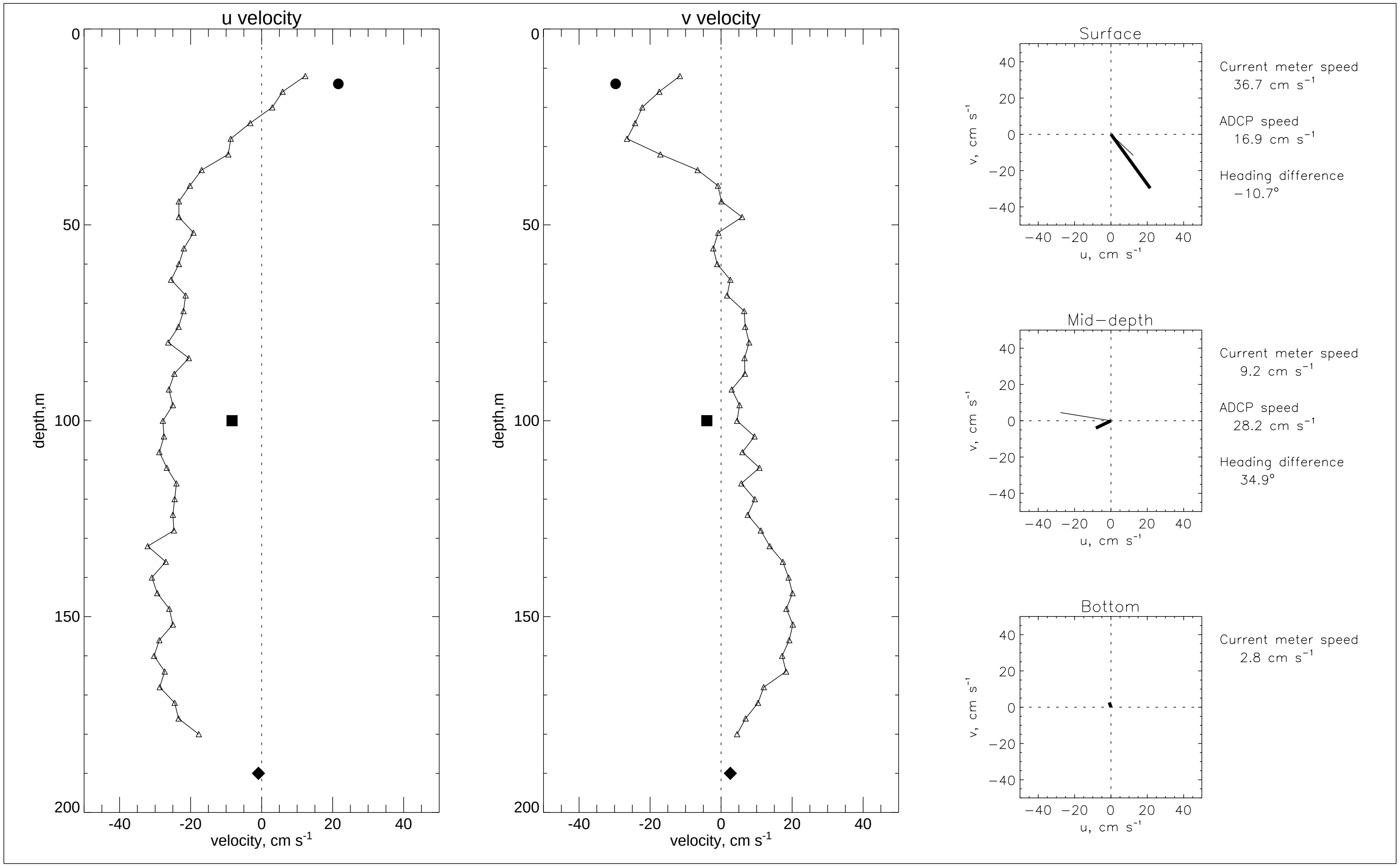

Figure 8.5.07. ADCP profile taken on 3 May 1994 at 0307 UTC (cruise H08) while passing by mooring CM07 at a distance of 0.9 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 3 May 1994 at 0300 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 3 May 1994 at 0300 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 3 May 1994 at 0300 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

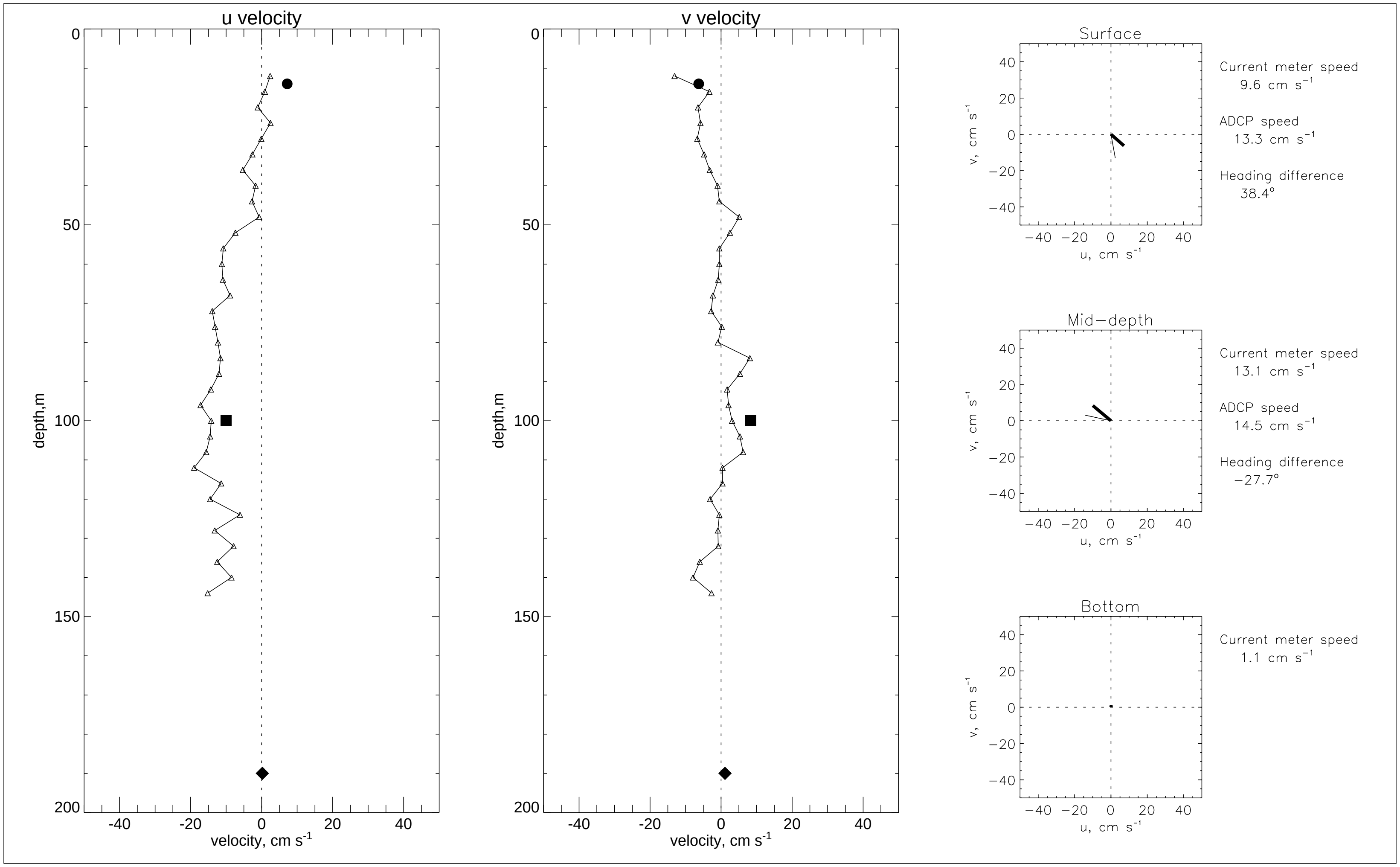

Figure 8.5.08. ADCP profile taken on 24 April 1994 at 1913 UTC (cruise H08) while passing by mooring CM08 at a distance of 0 .4 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 24 April 1994 at 1900 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 24 April 1994 at 1900 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 24 April 1994 at 1900 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

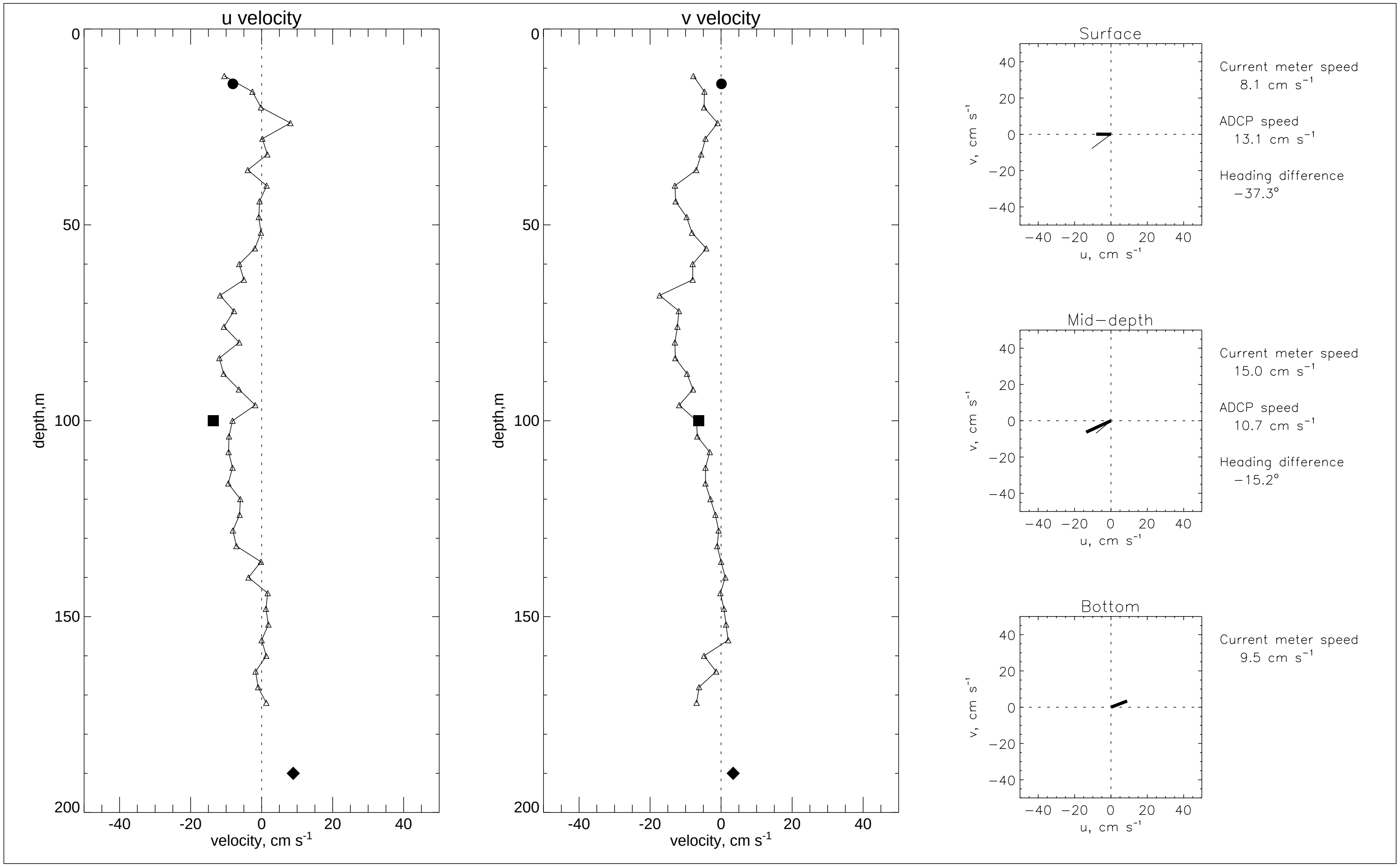

Figure 8.5.09. ADCP profile taken on 25 April 1994 at 0120 UTC (cruise H08) while passing by mooring CM09 at a distance of 0 .7 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 25 April 1994 at 0130 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 25 April 1994 at 0130 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 25 April 1994 at 0130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

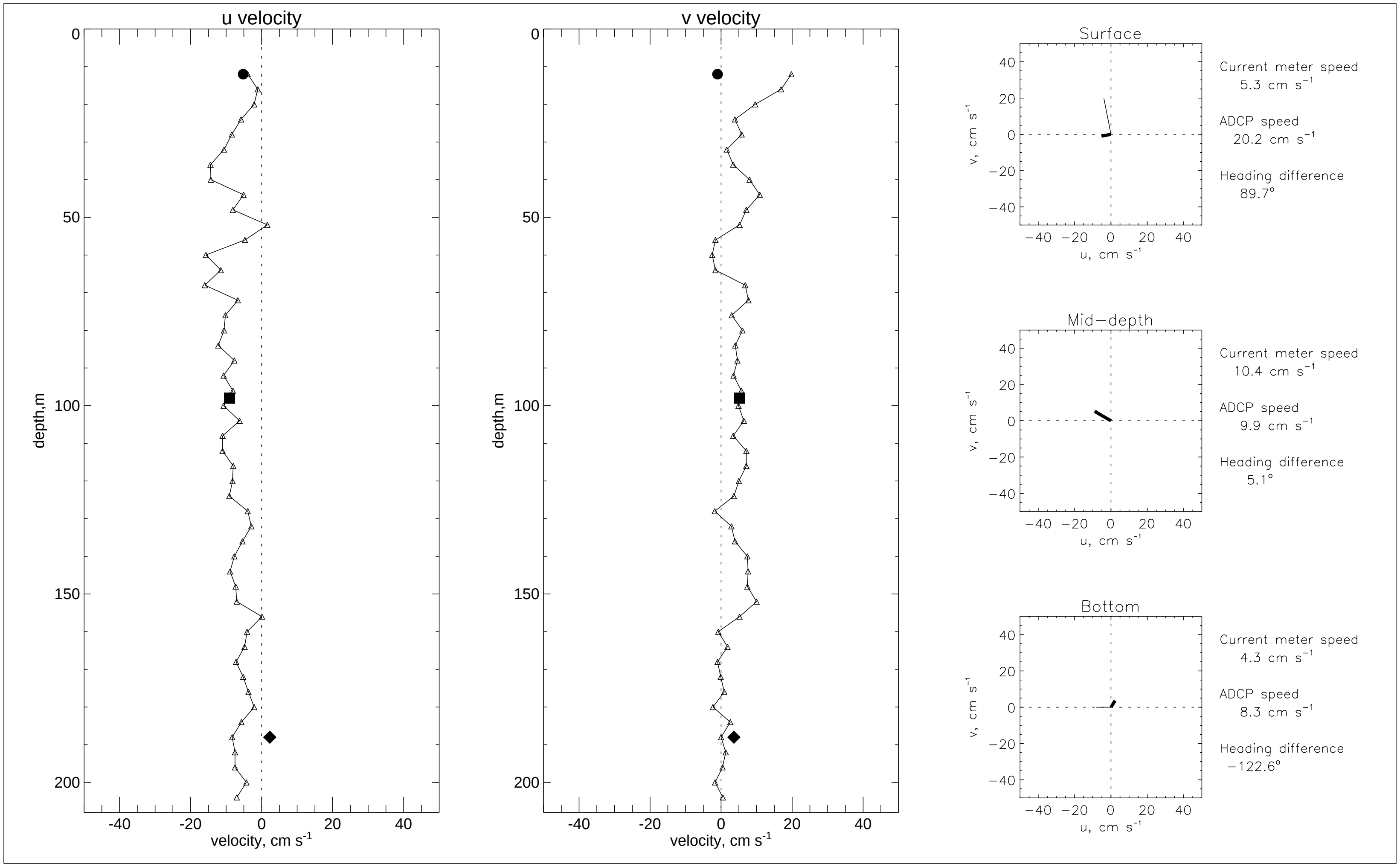

Figure 8.5.10. ADCP profile taken on 25 April 1994 at 1100 UTC (cruise H08) while passing by mooring CM10 at a distance of 3 .7 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 25 April 1994 at 1100 UTC. Velocities for the mid-depth meter (98 m) are marked with a square and were recorded on 25 April 1994 at 1100 UTC. Velocities for the bottom meter (188 m) are marked with a diamond and were recorded on 25 April 1994 at 1100 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

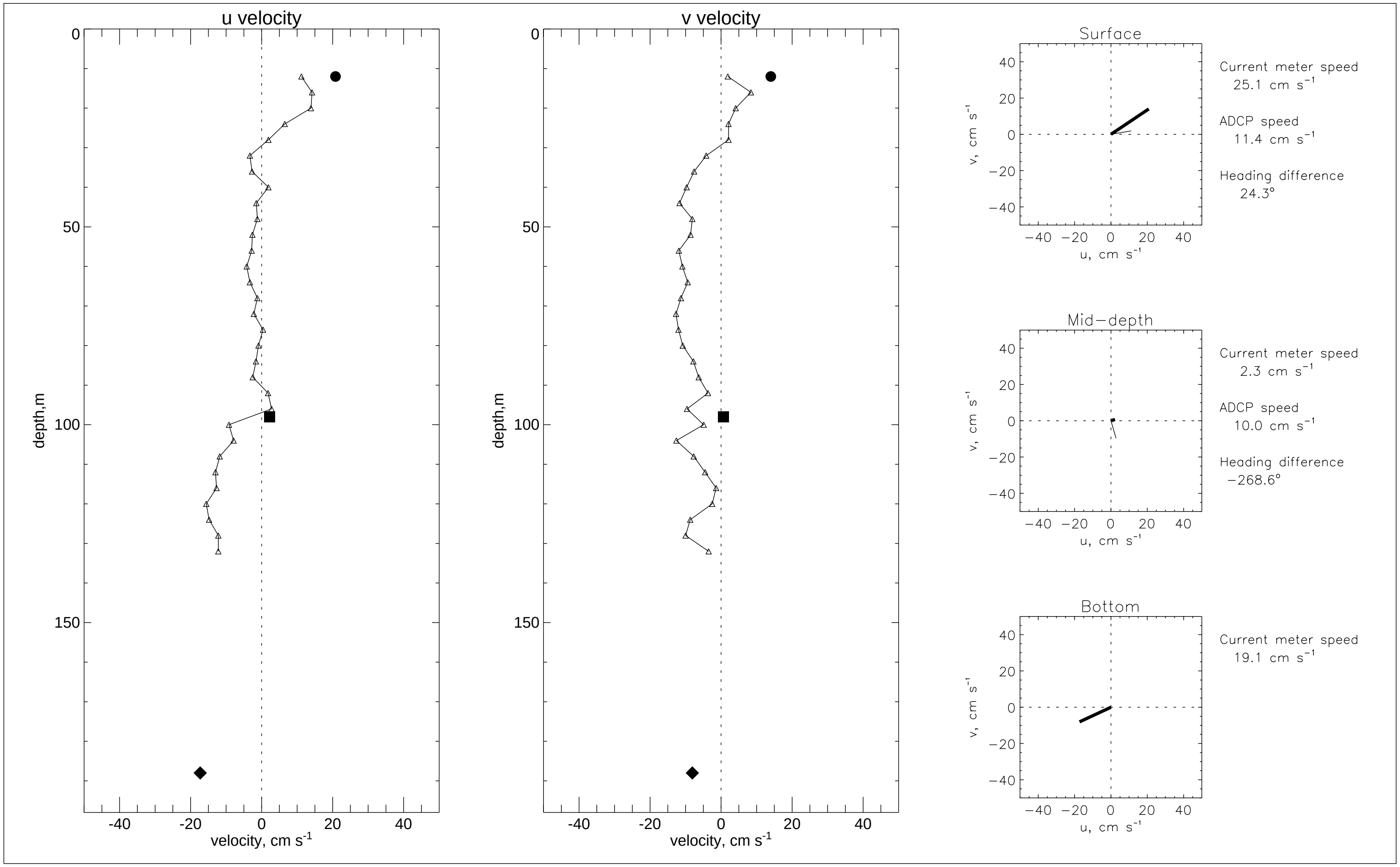

Figure 8.5.11. ADCP profile taken on 28 April 1994 at 1727 UTC (cruise H08) while passing by mooring CM11 at a distance of 0 .6 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 28 April 1994 at 1730 UTC. Velocities for the mid-depth meter (98 m) are marked with a square and were recorded on 28 April 1994 at 1730 UTC. Velocities for the bottom meter (188 m) are marked with a diamond and were recorded on 28 April 1994 at 1730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

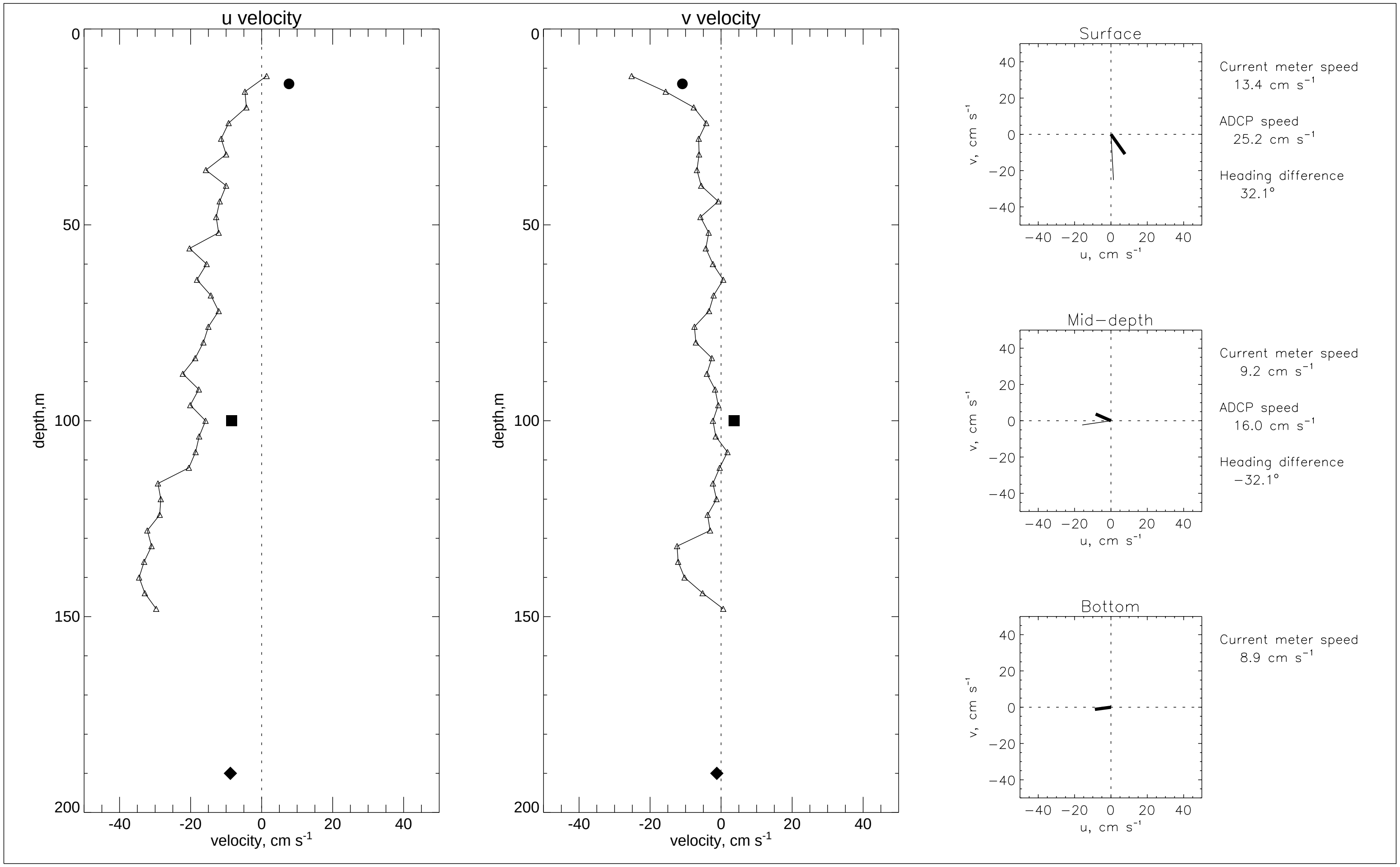

Figure 8.5.13. ADCP profile taken on 26 April 1994 at 2220 UTC (cruise H08) while passing by mooring CM13 at a distance of 1 .3 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 26 April 1994 at 2230 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 26 April 1994 at 2230 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 26 April 1994 at 2230 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

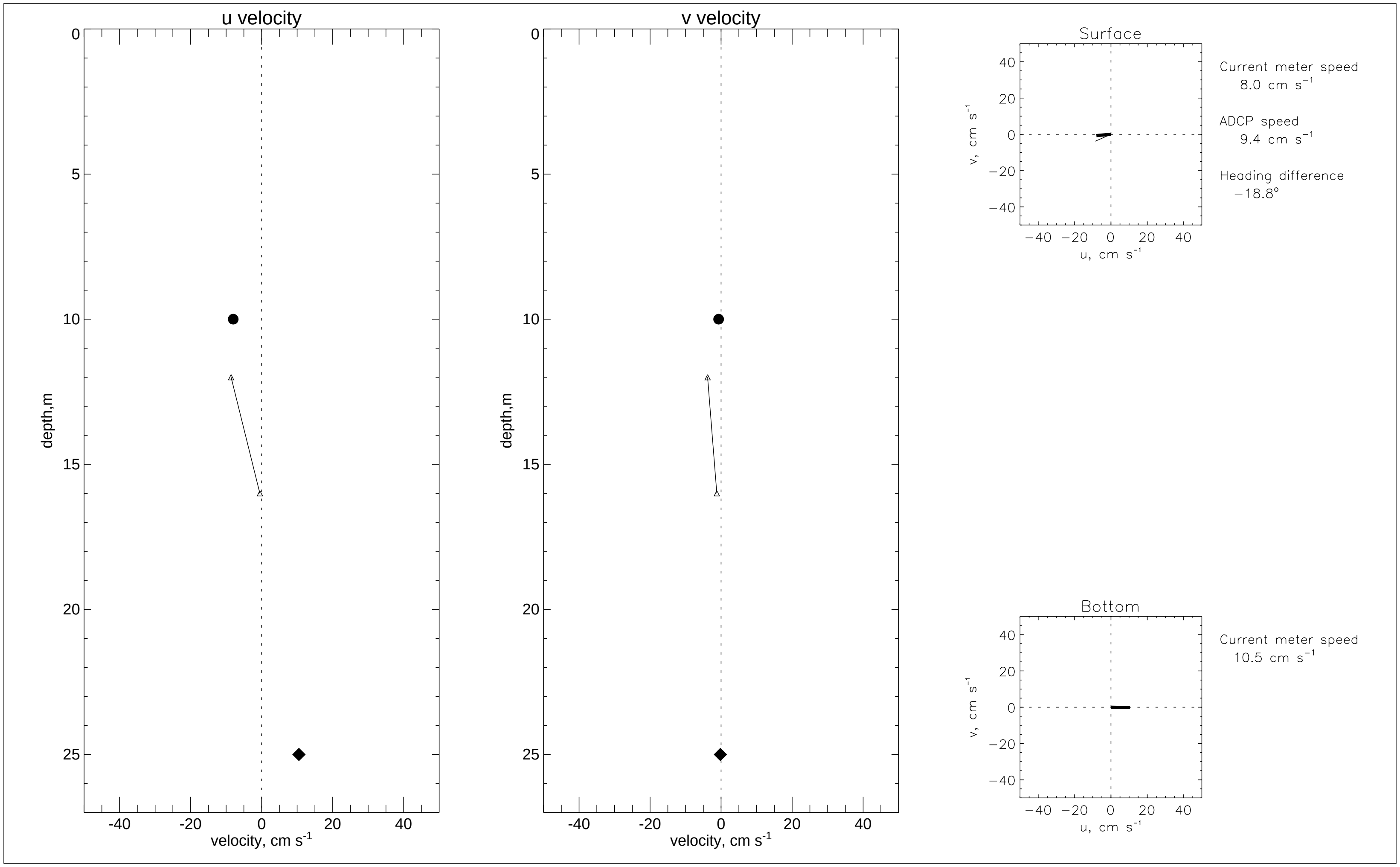

Figure 8.5.15. ADCP profile taken on 27 April 1994 at 0620 UTC (cruise H08) while passing by mooring CM15 at a distance of 2 .0 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 27 April 1994 at 0630 UTC. Velocities for the bottom meter (25 m) are marked with a diamond and were recorded on 27 April 1994 at 0620 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

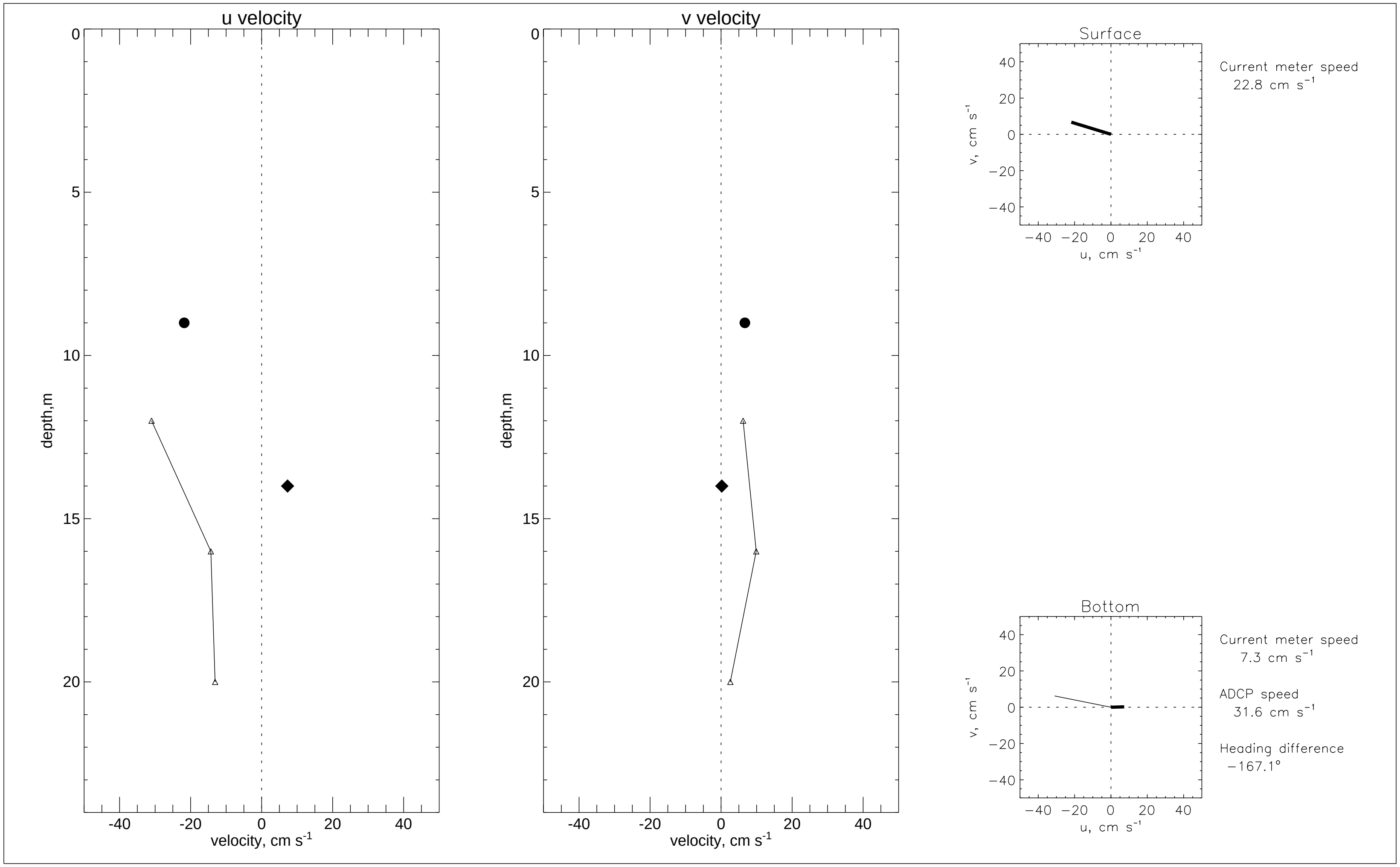

Figure 8.5.16. ADCP profile taken on 27 April 1994 at 0935 UTC (cruise H08) while passing by mooring CM16 at a distance of 9 .8 km. Velocities for the surface meter (9 m) are marked with a circle and were recorded on 27 April 1994 at 0930 UTC. Velocities for the bottom meter (14 m) are marked with a diamond and were recorded on 27 April 1994 at 0930 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

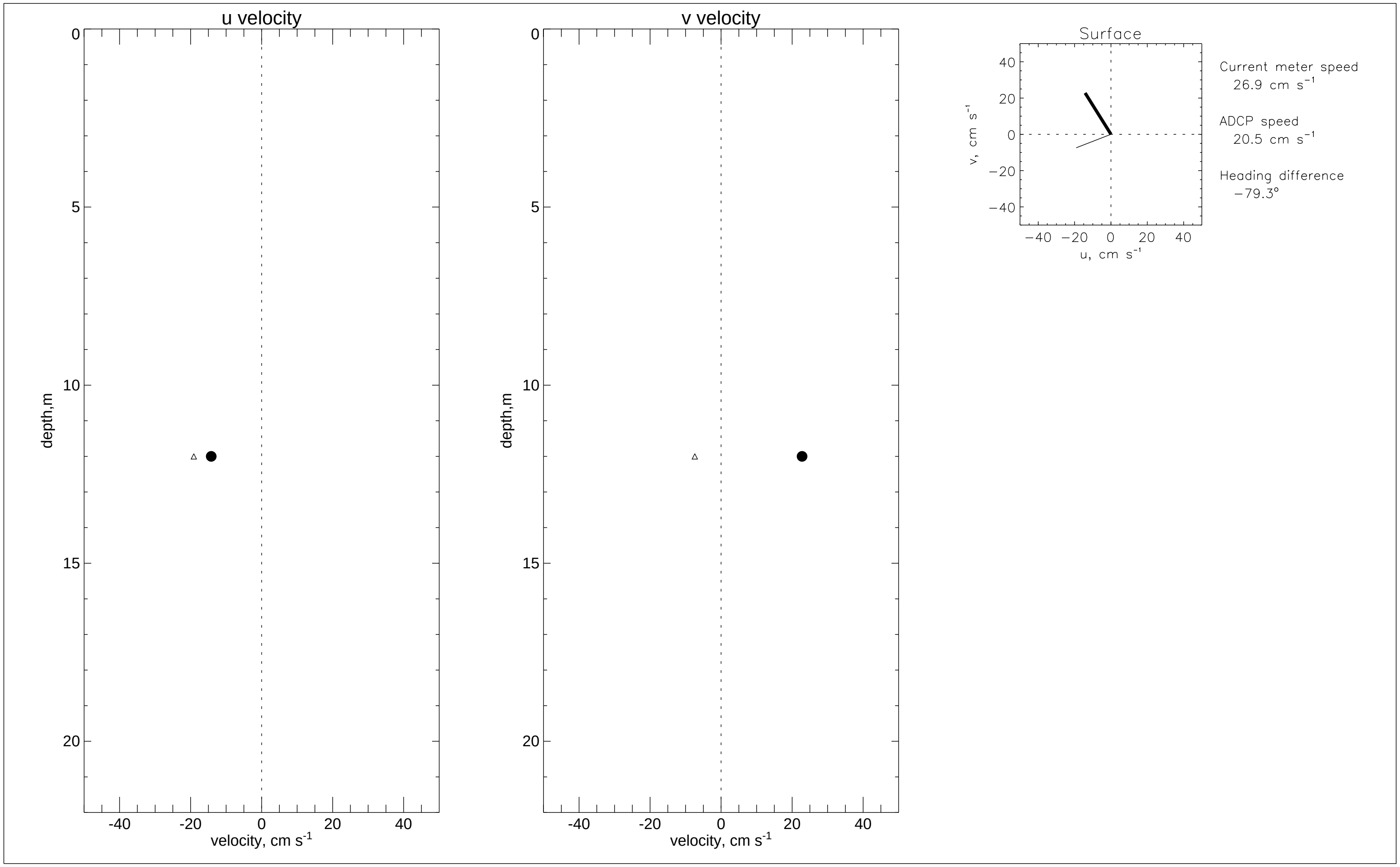

Figure 8.5.18. ADCP profile taken on 28 April 1994 at 0055 UTC (cruise H08) while passing by mooring CM18 at a distance of 2 .0 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 28 April 1994 at 0055 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

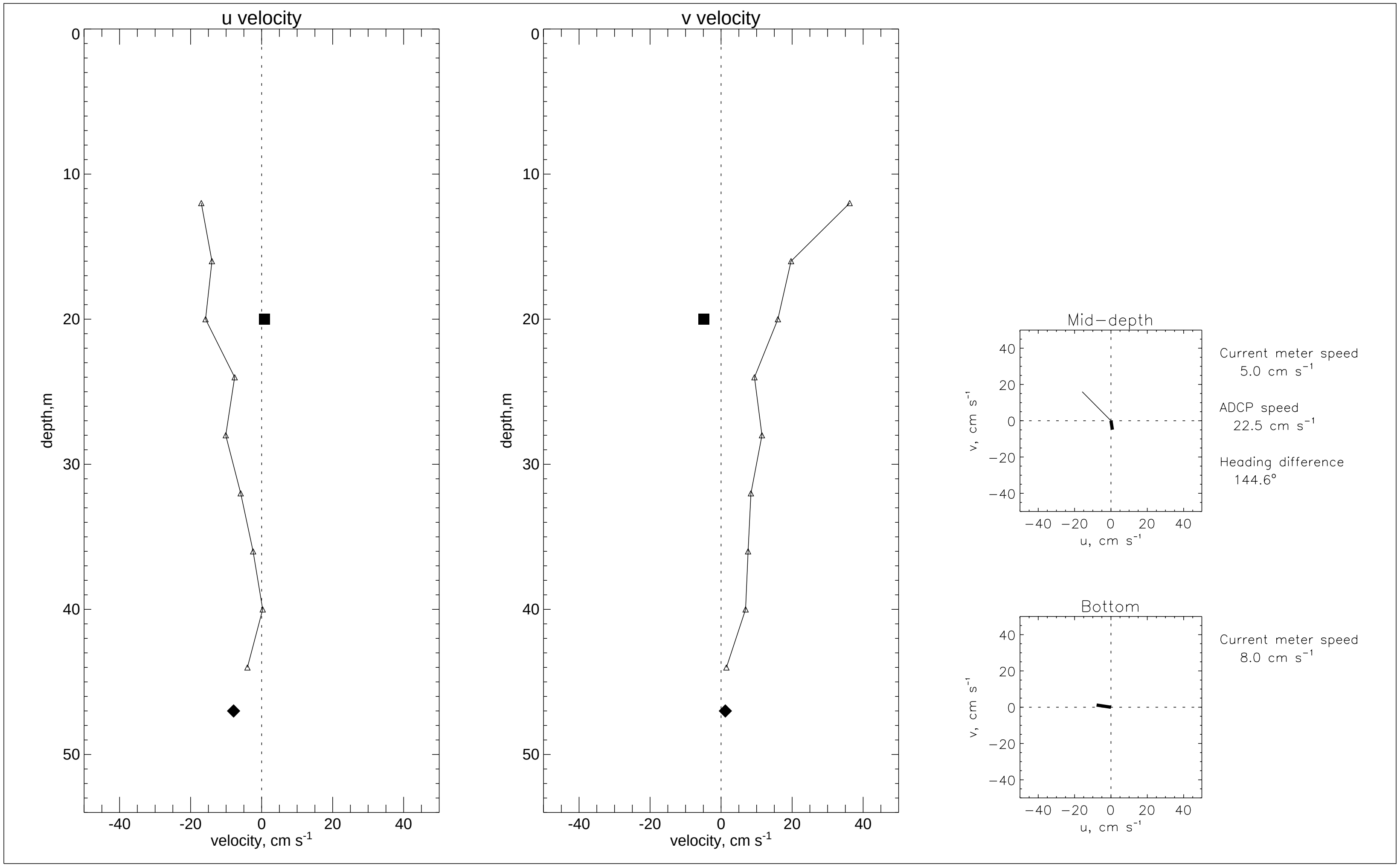

Figure 8.5.19. ADCP profile taken on 28 April 1994 at 0732 UTC (cruise H08) while passing by mooring CM19 at a distance of 3 .2 km. Velocities for the mid-depth meter (20 m) are marked with a square and were recorded on 28 April 1994 at 0730 UTC. Velocities for the bottom meter (47 m) are marked with a diamond and were recorded on 28 April 1994 at 0730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

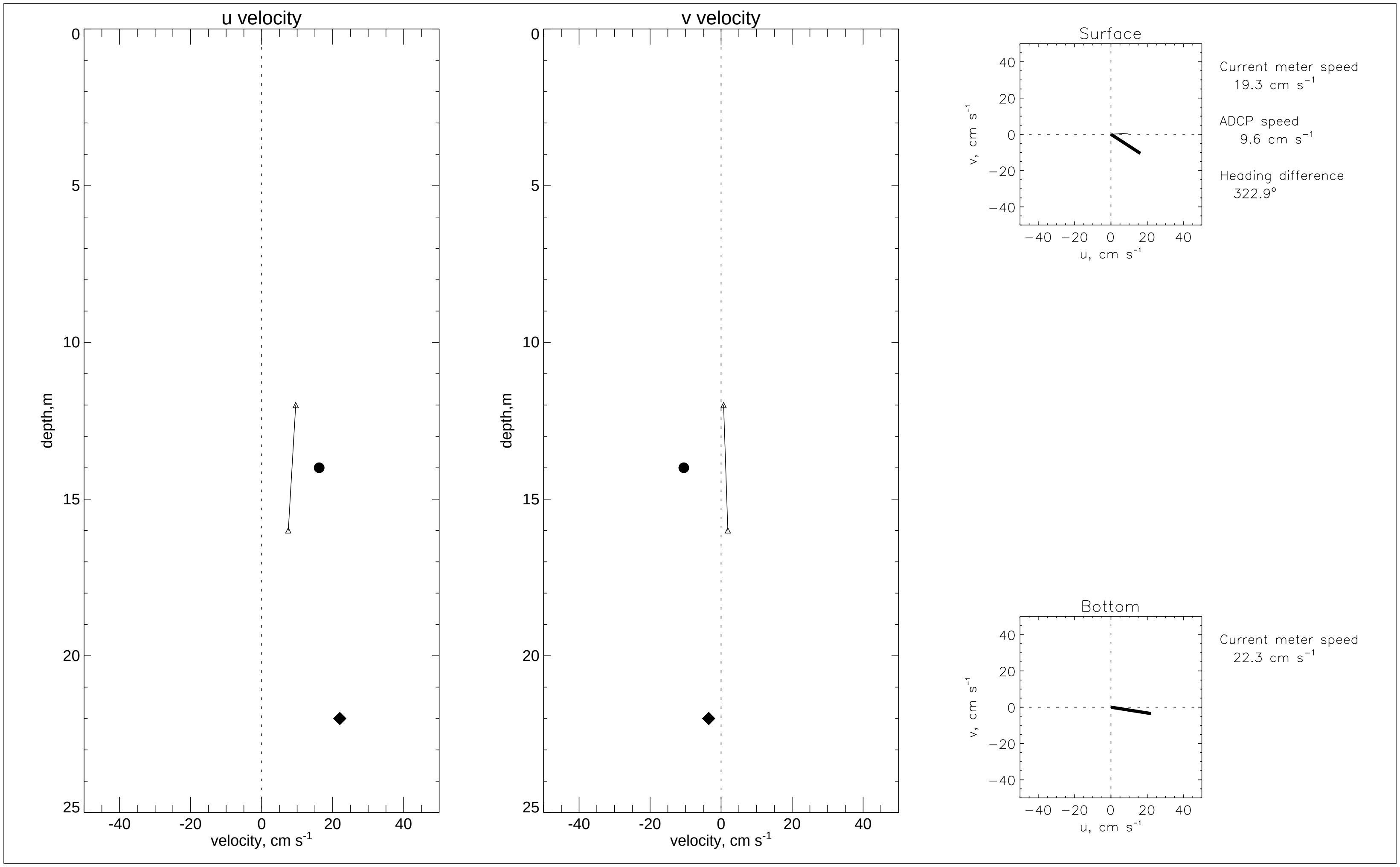

Figure 8.5.21. ADCP profile taken on 30 April 1994 at 2143 UTC (cruise H08) while passing by mooring CM21 at a distance of 7 .9 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 30 April 1994 at 2130 UTC. Velocities for the bottom meter (22 m) are marked with a diamond and were recorded on 30 April 1994 at 2145 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

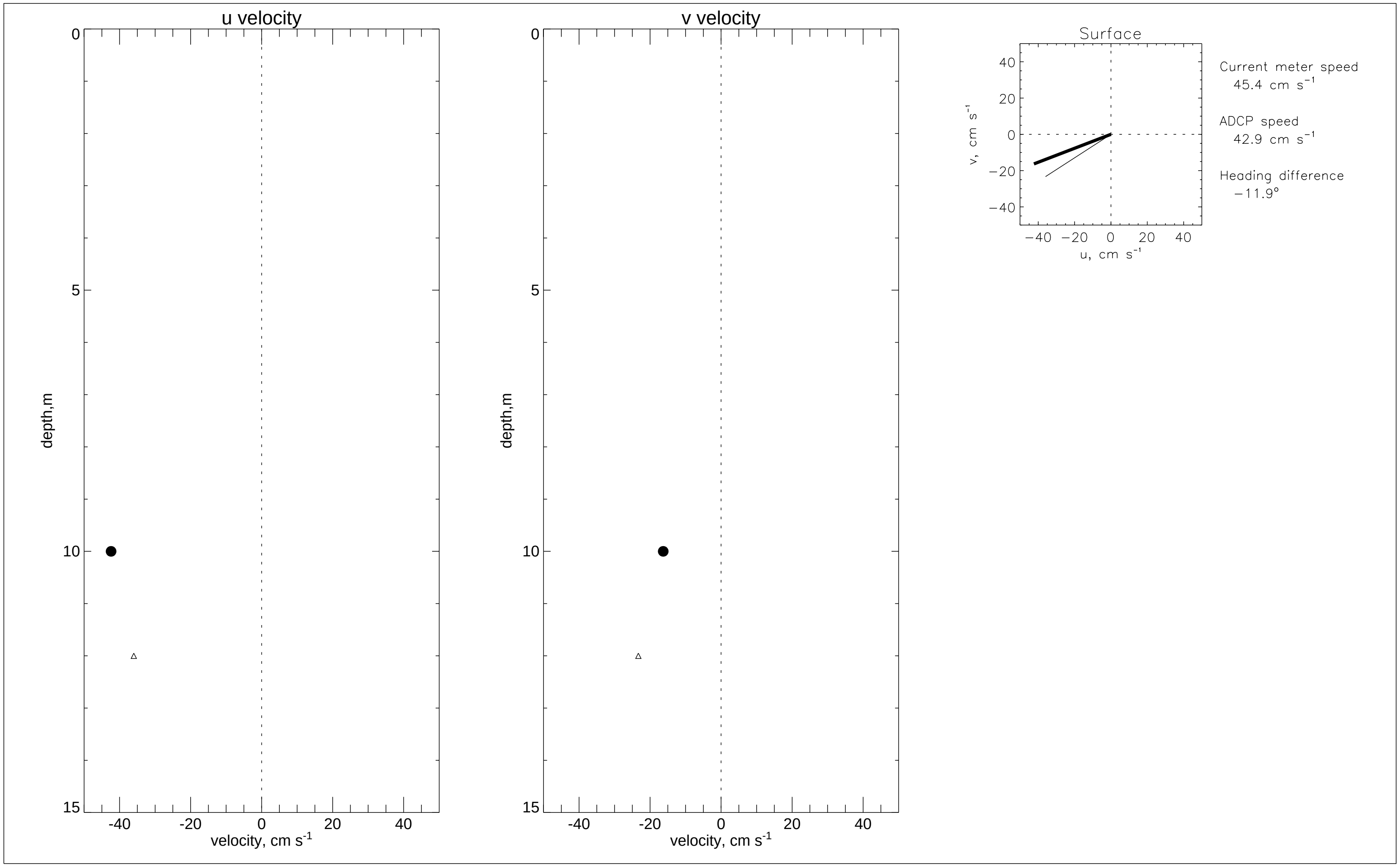

Figure 8.5.23. ADCP profile taken on 2 May 1994 at 1643 UTC (cruise H08) while passing by mooring CM23 at a distance of 7.4 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 2 May 1994 at 1630 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

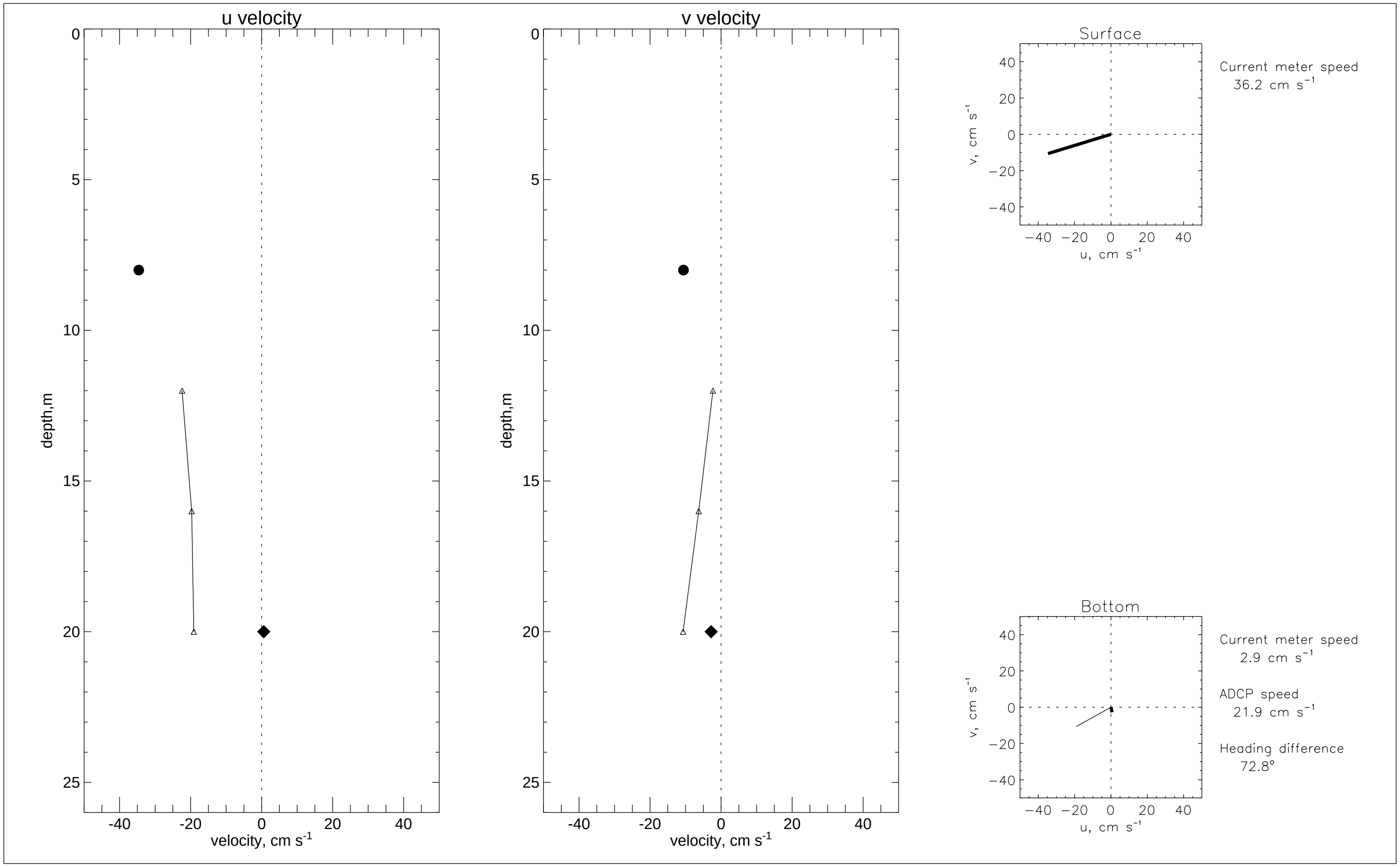

Figure 8.5.24. ADCP profile taken on 2 May 1994 at 1833 UTC (cruise H08) while passing by mooring CM24 at a distance of 4.6 km. Velocities for the surface meter (8 m) are marked with a circle and were recorded on 2 May 1994 at 1830 UTC. Velocities for the bottom meter (20 m) are marked with a diamond and were recorded on 2 May 1994 at 1835 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

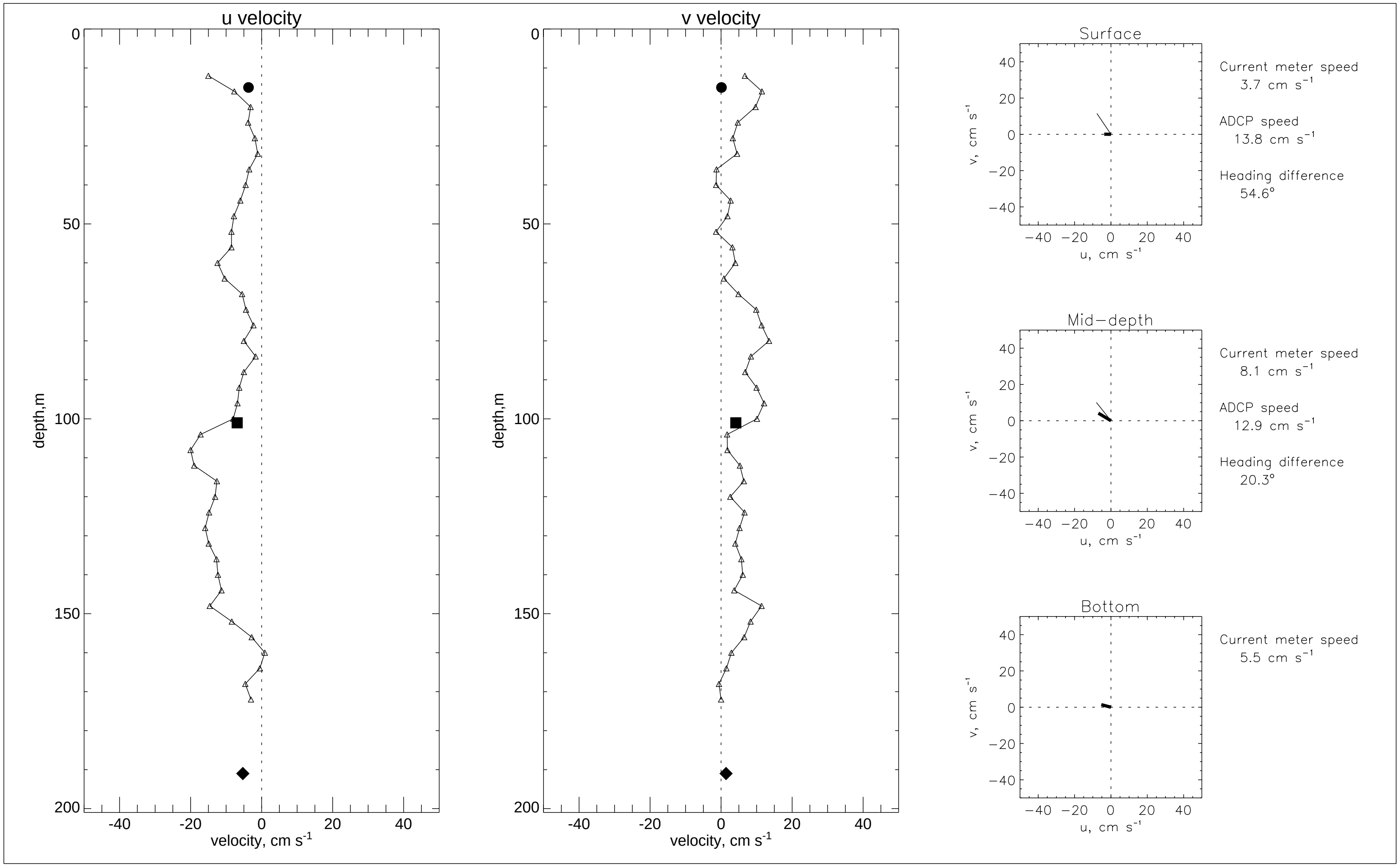

Figure 8.5.48. ADCP profile taken on 26 April 1994 at 0250 UTC (cruise H08) while passing by mooring CM48 at a distance of 0 .4 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 26 April 1994 at 0300 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 26 April 1994 at 0300 UTC. Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 26 April 1994 at 0300 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

5.3 Cruise H09

5.3.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *J.W. Powell*. The Vessel-Mount model ADCP was installed and the TRANSECT program was used during this survey. The computer hung up five times over the course of the cruise on 28 July, 31 July, 1 August, and twice on 5 August. The ship exceeded ten knots much of the time, the seas were rough, and it rained almost continuously. The data suffered contamination from flow-induced noise and bubbles created most likely by the high speeds of the vessel. The contamination shows up as uniformly strong currents seen in all the bins. However the ADCP-Current Meter Statistical Comparison of section 2.4 indicates that in spite of these problems, the data set is reliable. The parameter settings are shown in Table 18.

Table 18. Parameter settings (in meters) and the resulting sequence of bin depths on survey H09.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
2	4	4	10, 14, 18, 22, ...

Additional QC processing is being considered to recover part of the data set. The aim of this processing will be to take advantage of the raw data collected by the TRANSECT software. Not all the pings in a five-minute average are contaminated; some are usable. By examining each of the pings individually using software designed by K. Leder, it may be possible to remove the contaminated pings from the five-minute average. Then the data set can be reprocessed. If this processing is successful, the data will be made available through the National Oceanographic Data Center and an addendum to this report will be issued.

5.3.2 Results

5.3.2.1 General Cruise Track

We show in Figure 9.1.1 a plan view of the general cruise track taken by the R/V *Powell* during H09. The cruise covered the entire LATEX shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 9.1.2 for which contoured profiles of normal velocity are presented in section 5.3.2.4. Figure 9.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 5.3.2.5.

5.3.2.2 Plan View of Stick Plot Velocity Vectors

Figure 9.2.1 shows the velocity from the surface bin centered at 10 m, Figure 9.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 9.2.3 shows the velocity from the bin centered at 100m below the surface.

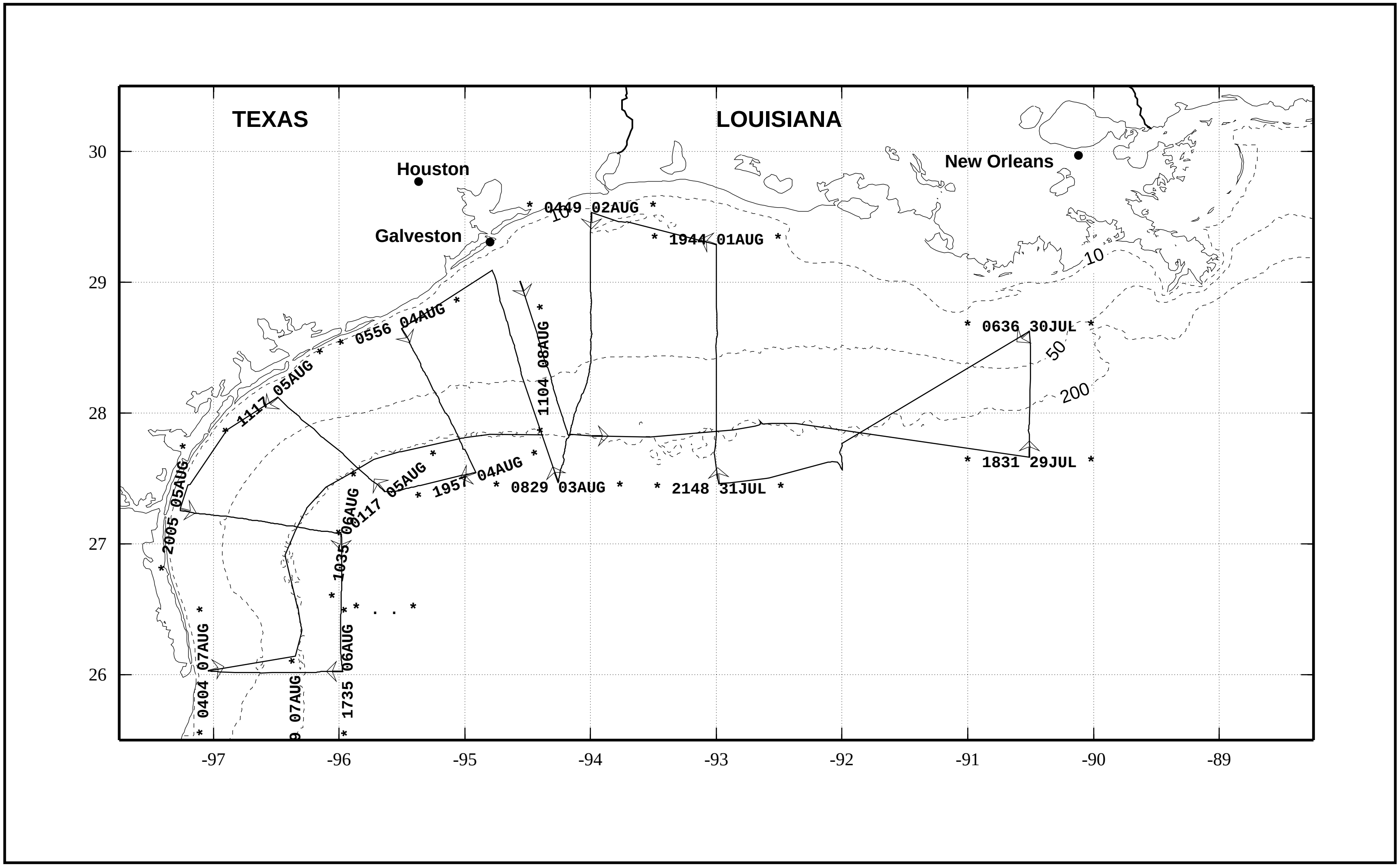

Figure 9.1.1 Cruise track for LATEX A cruise H09 in July 1994, showing times and directions.

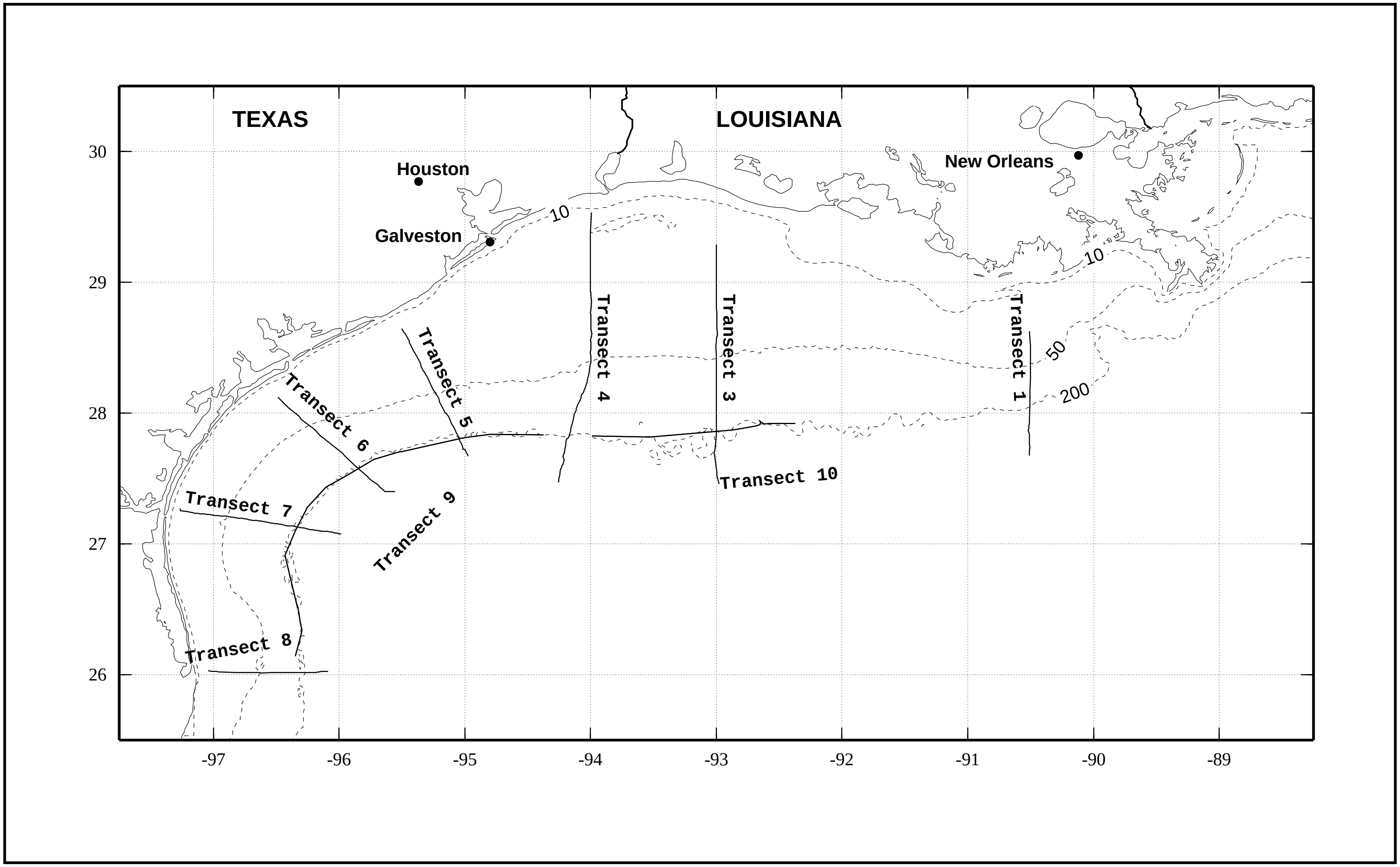

Figure 9.1.2 Cruise track for LATEX A cruise H09 in July 1994, showing individual labeled transects.

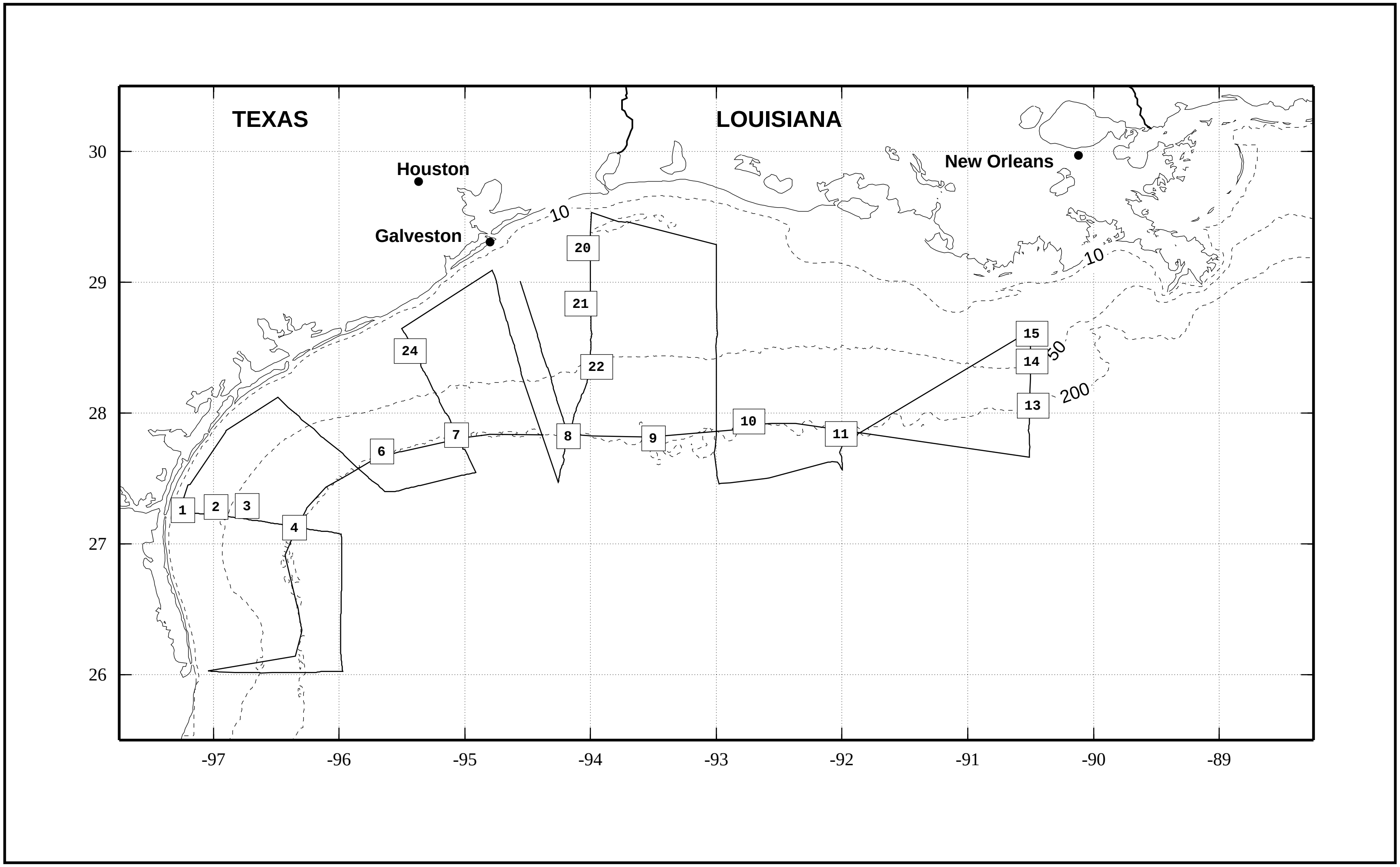

Figure 9.1.3 Cruise track for LATEX A cruise H09 in July 1994, showing current meter locations.

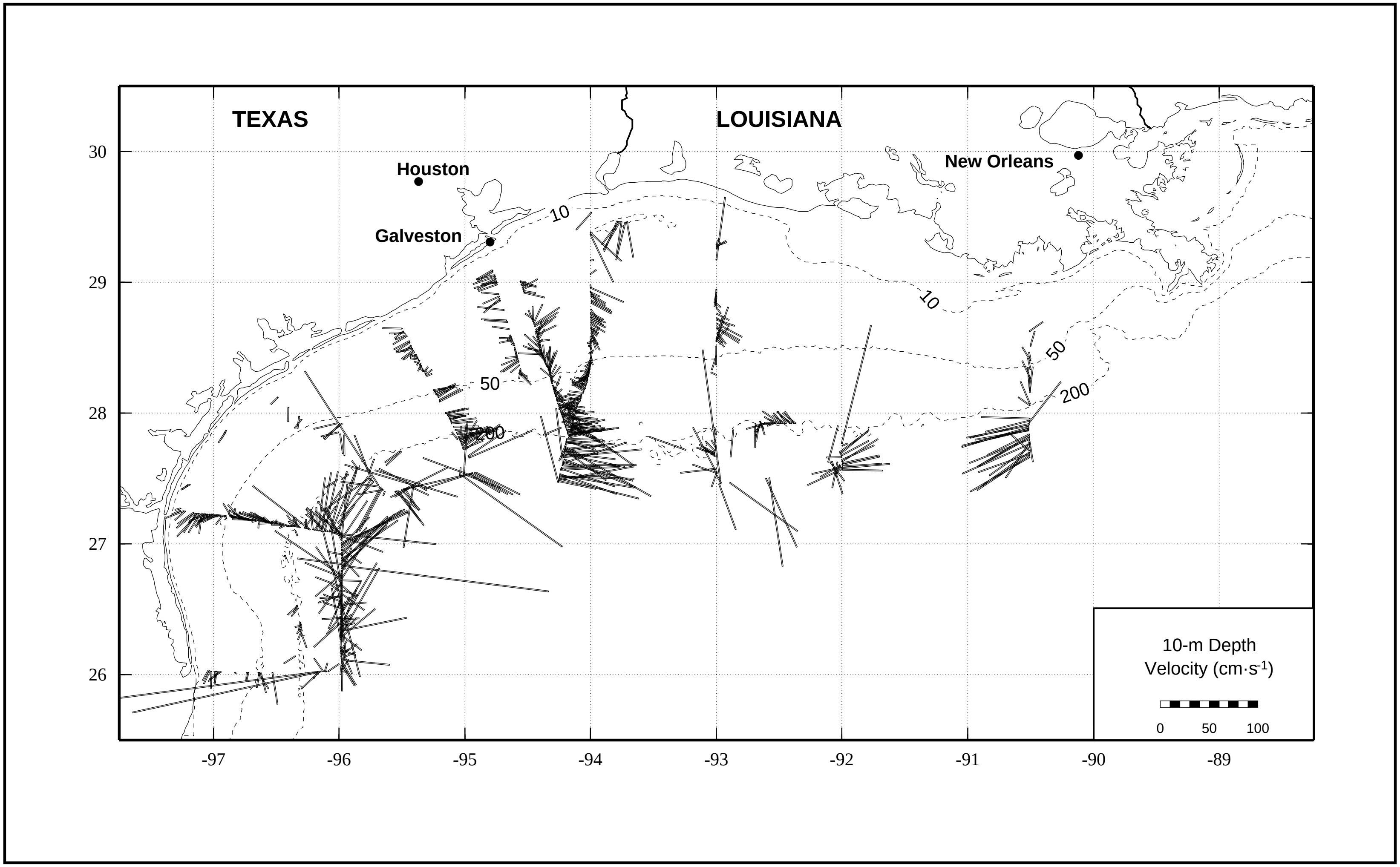

Figure 9.2.1 Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 10 m depth. The data are from LATEX A cruise H09 conducted in July 1994

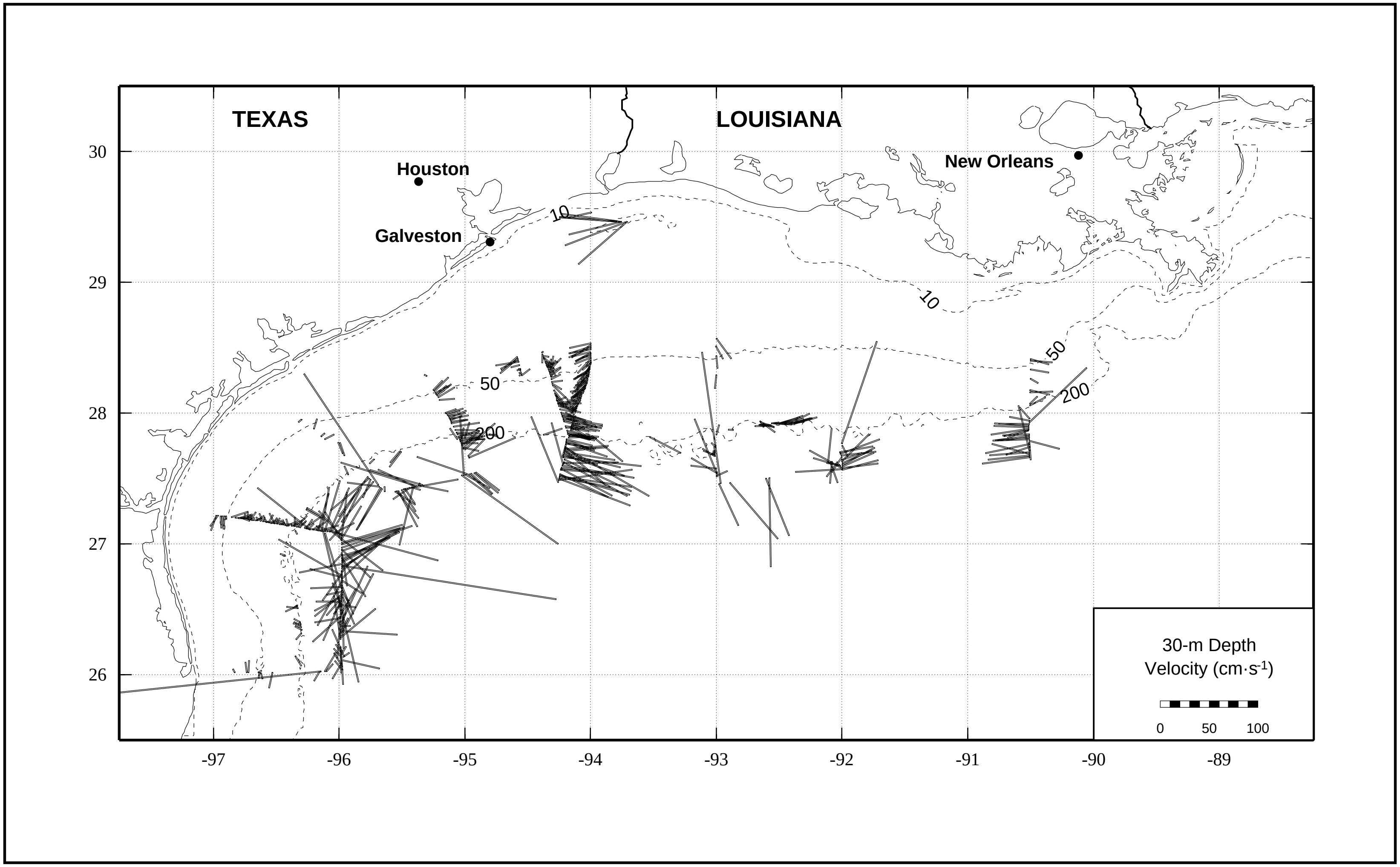

Figure 9.2.2 Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H09 conducted in July 1994

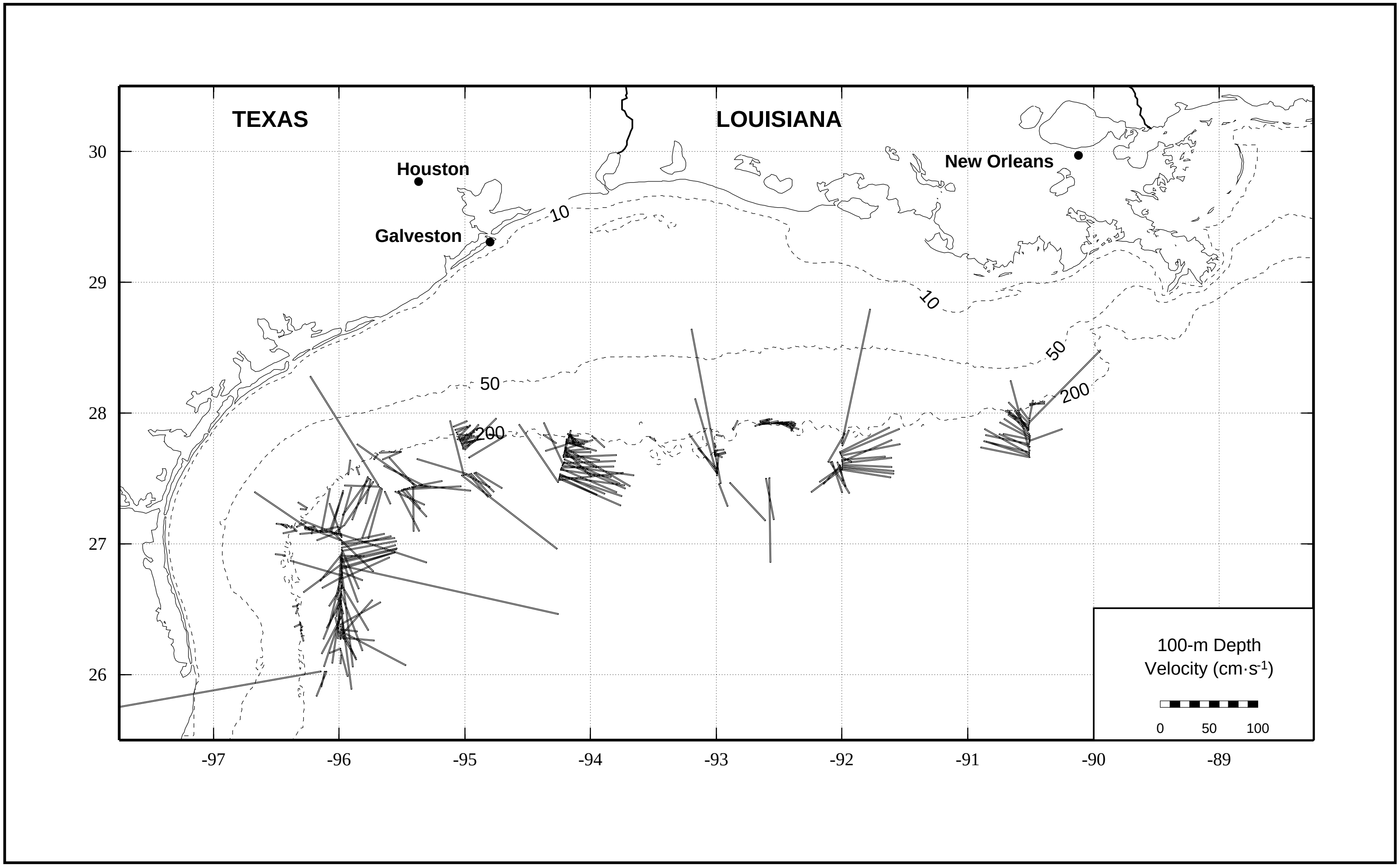

Figure 9.2.3 Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H09 conducted in July 1994

5.3.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 9.3.1 shows the velocity from the bin centered at 10 m, Figure 9.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 9.3.3 shows the velocity from the bin centered at 100 m below the surface.

5.3.2.4 Contoured Profiles of Normal Velocity

In Figures 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.4.5, 9.4.6, 9.4.7, and 9.4.8 we show the velocity normal to across-shelf transects 1, 2, 3, 4, 5, 6, 7, and 8, respectively. For along-shelf transect number 9 taken along the 200-m isobath, we show the normal velocity in Figure 9.4.9. For along-shelf transect number 10 taken along the 200-m isobath, we show the normal velocity in Figure 9.4.10. The transects are shown in Figure 9.1.2. Upcoast is defined as towards Louisiana and downcoast as towards Mexico. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

5.3.2.5 Vertical Current Profiles

We show in Figures 9.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 9.1.3.

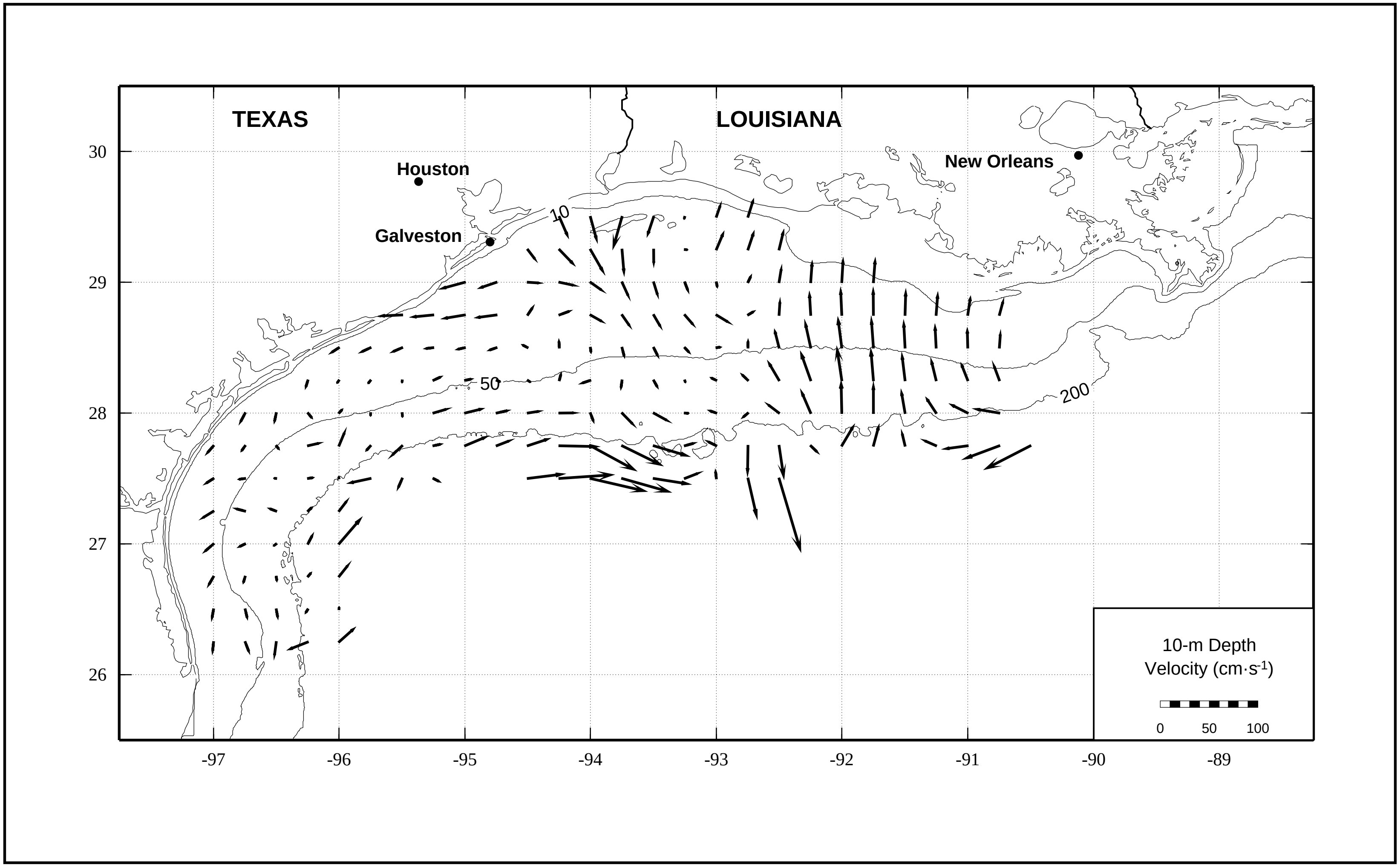

Figure 9.3.1 Objectively analyzed ADCP currents measured at the 4-m bin centered at the 10 m depth. The data are from LATEX A cruise H09 conducted in July 1994

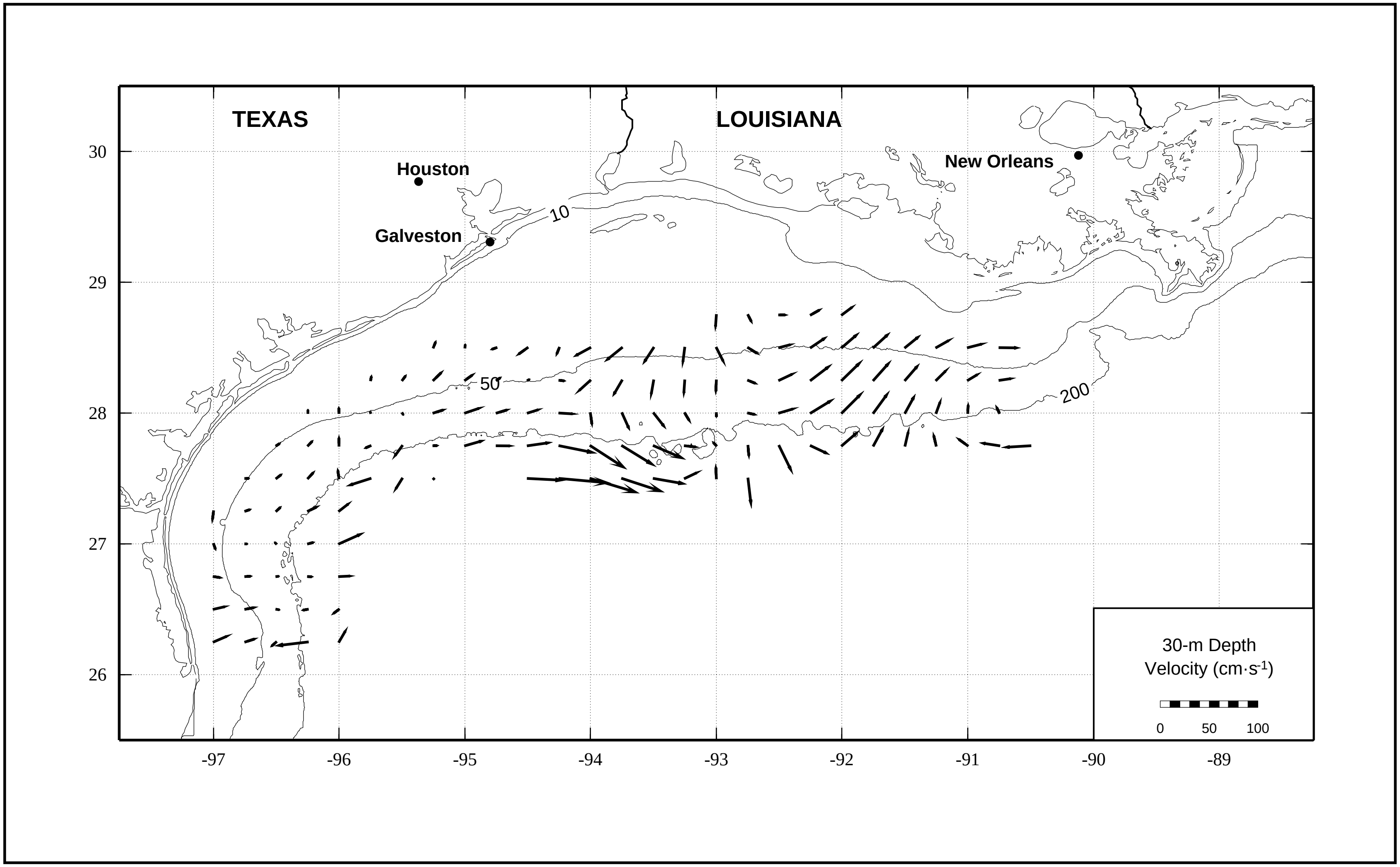

Figure 9.3.2 Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H09 conducted in July 1994

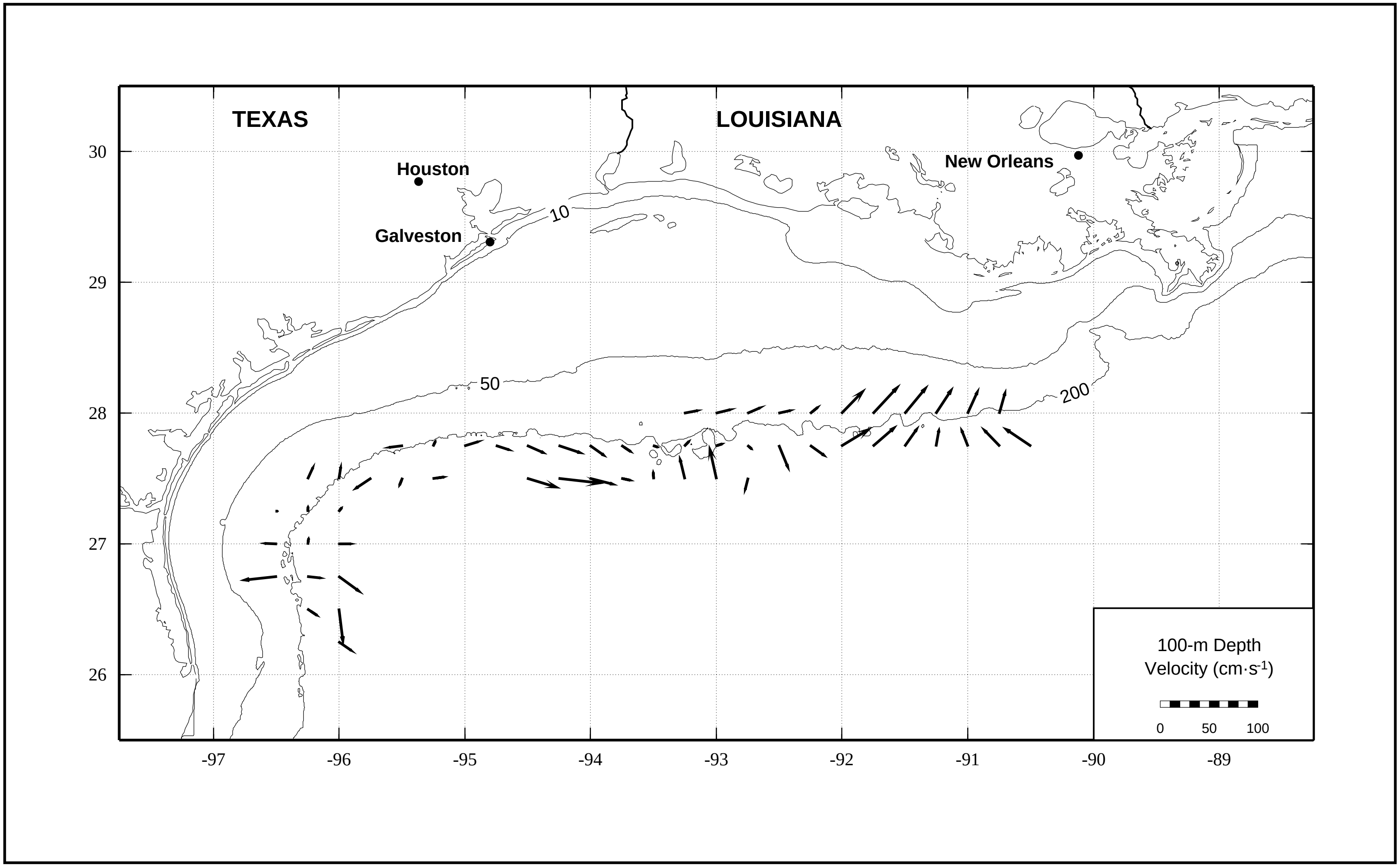

Figure 9.3.3 Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 100 m depth. The data are from LATEX A cruise H09 conducted in July 1994

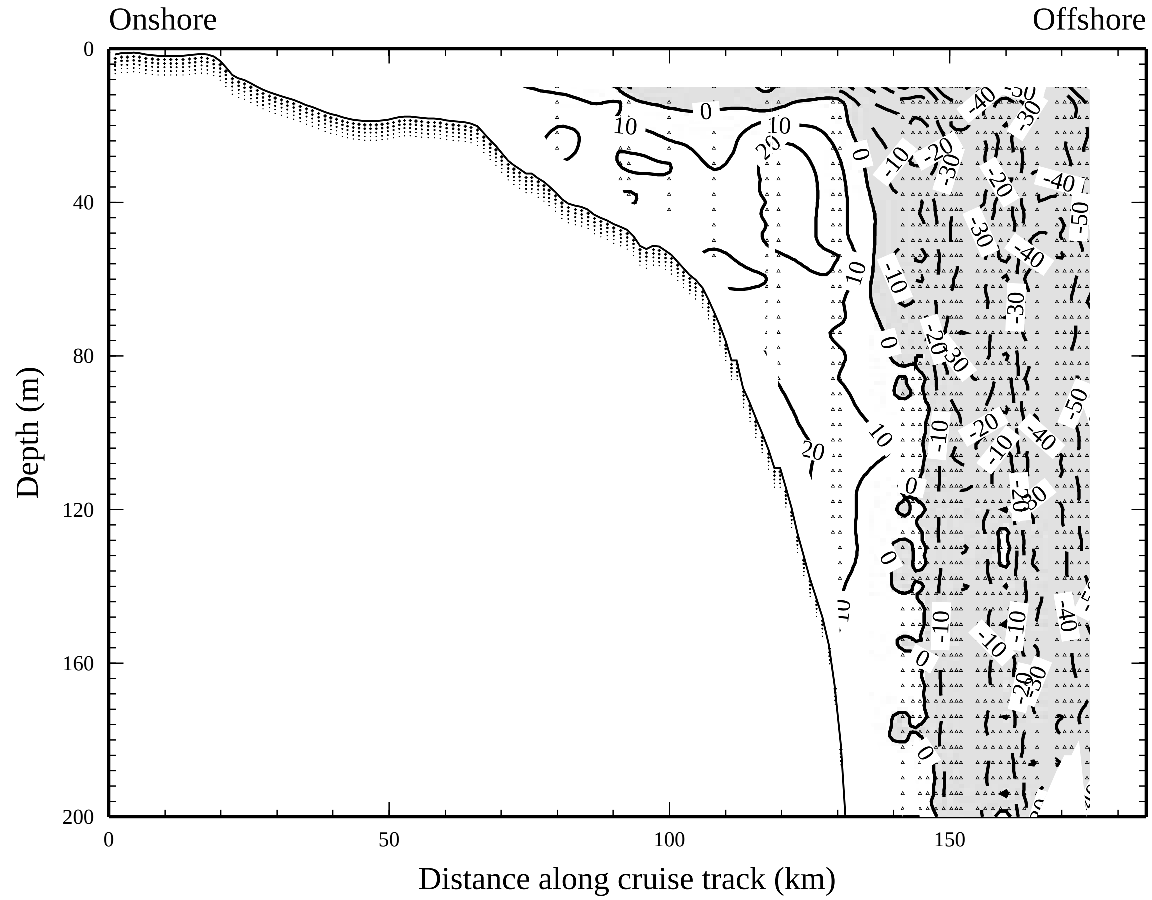

Figure 9.4.1. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 1 for cruise H09, July 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

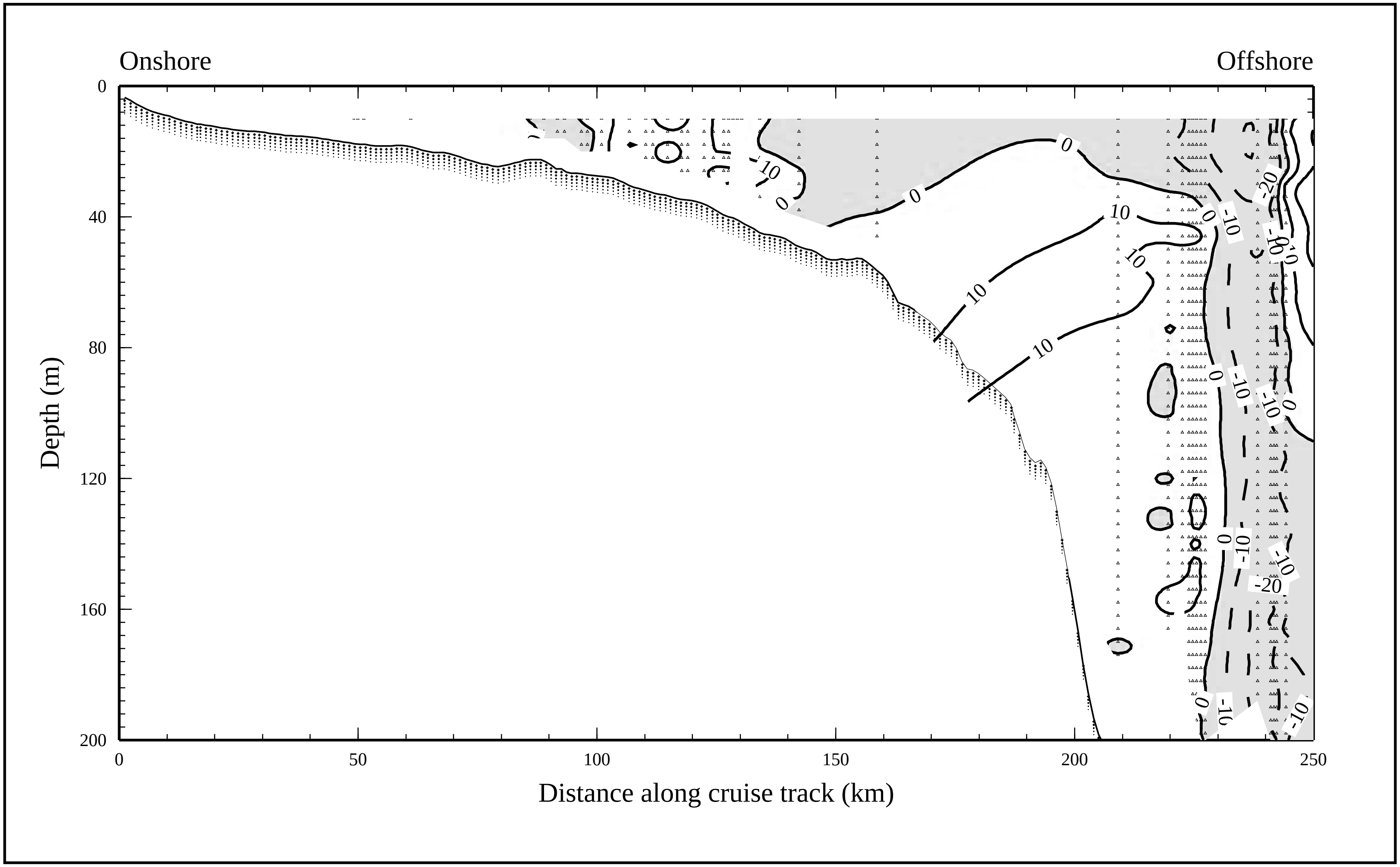

Figure 9.4.3. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 3 for cruise H09, July 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

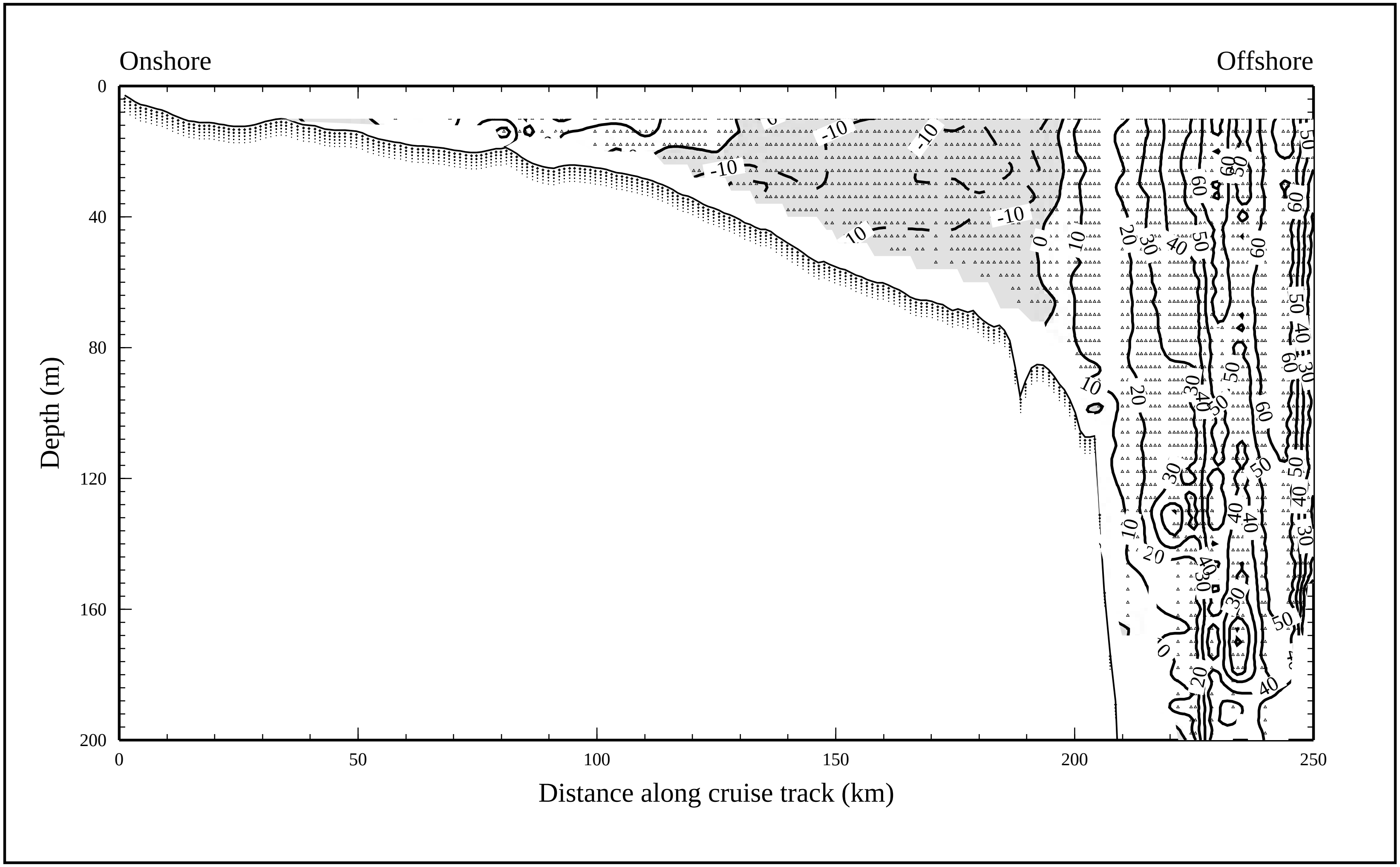

Figure 9.4.4. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 4 for cruise H09, July 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

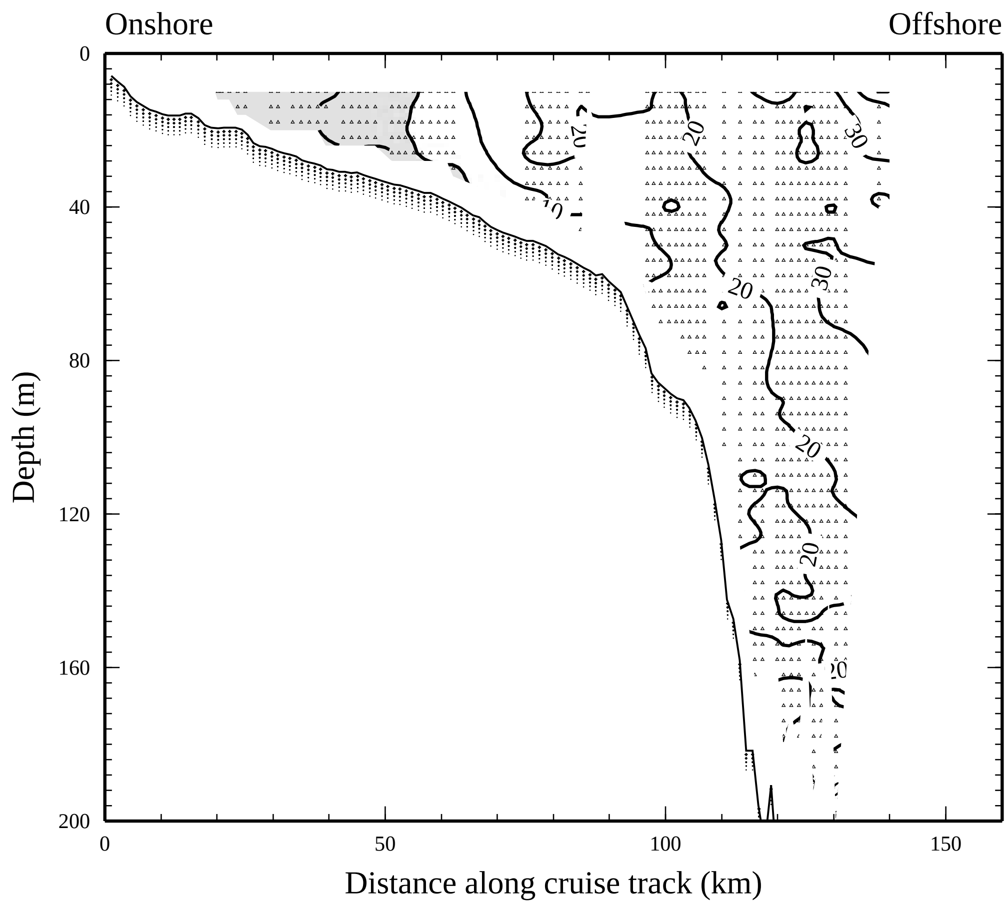

Figure 9.4.5. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 5 for cruise H09, July 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

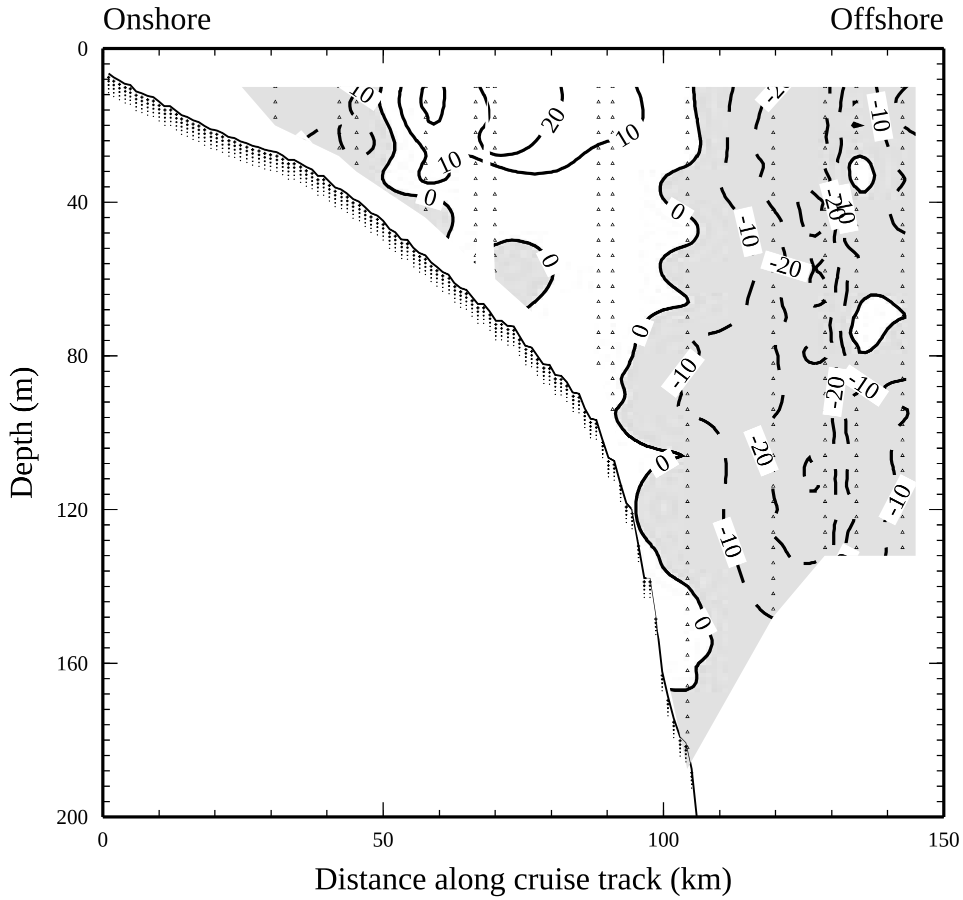

Figure 9.4.6. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 6 for cruise H09, July 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

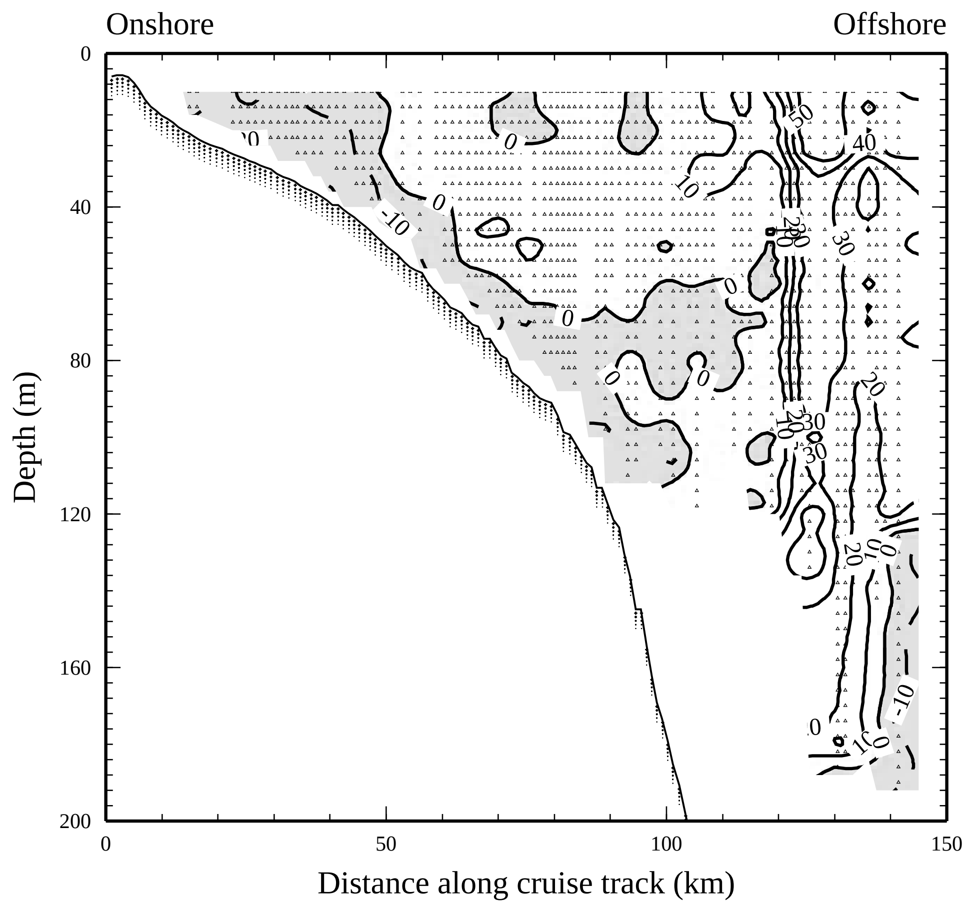

Figure 9.4.7. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 7 for cruise H09, July 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

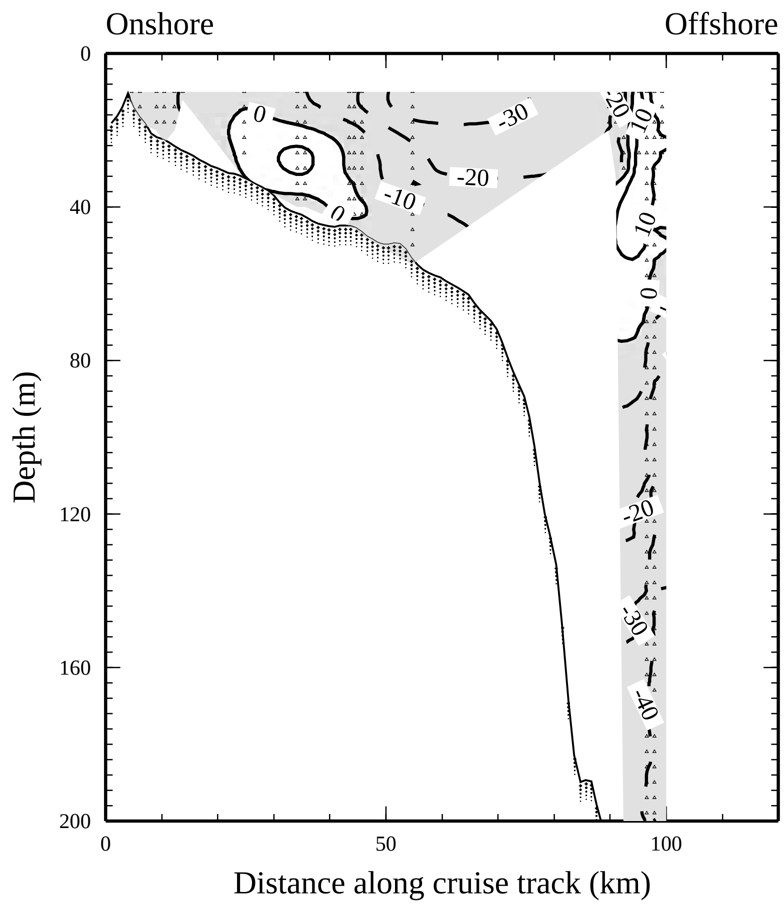

Figure 9.4.8. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 8 for cruise H09, July 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

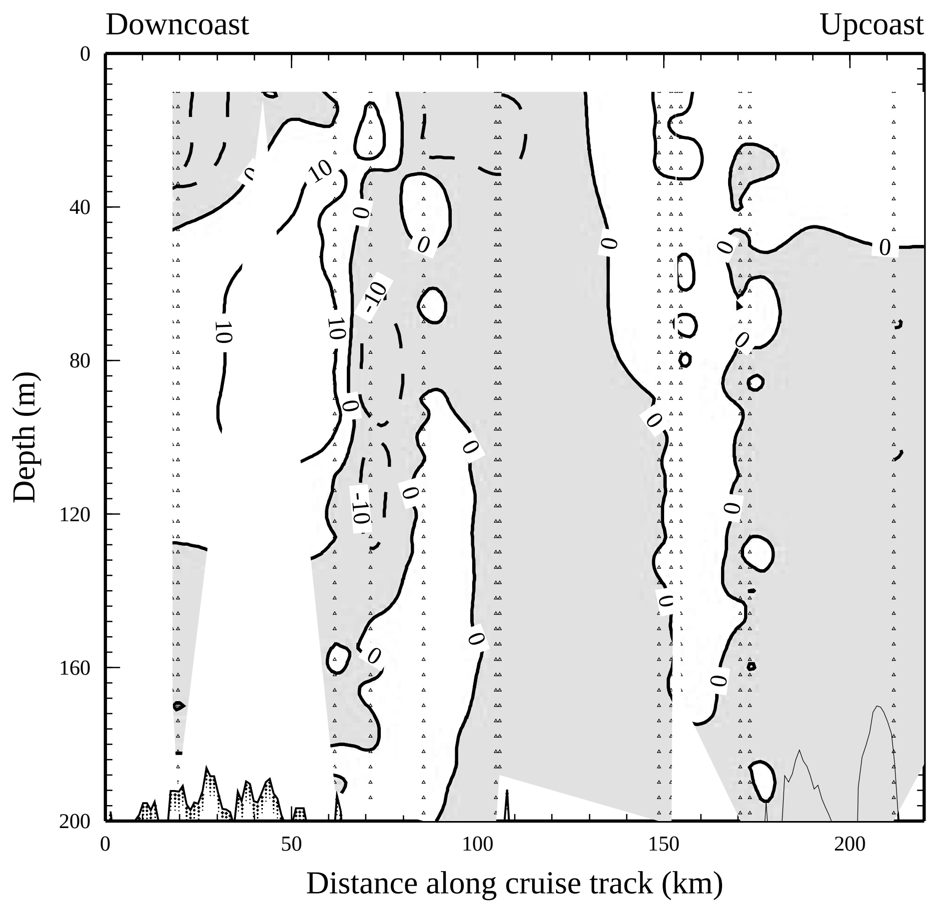

Figure 9.4.9. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 9 for cruise H09, July 1994. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

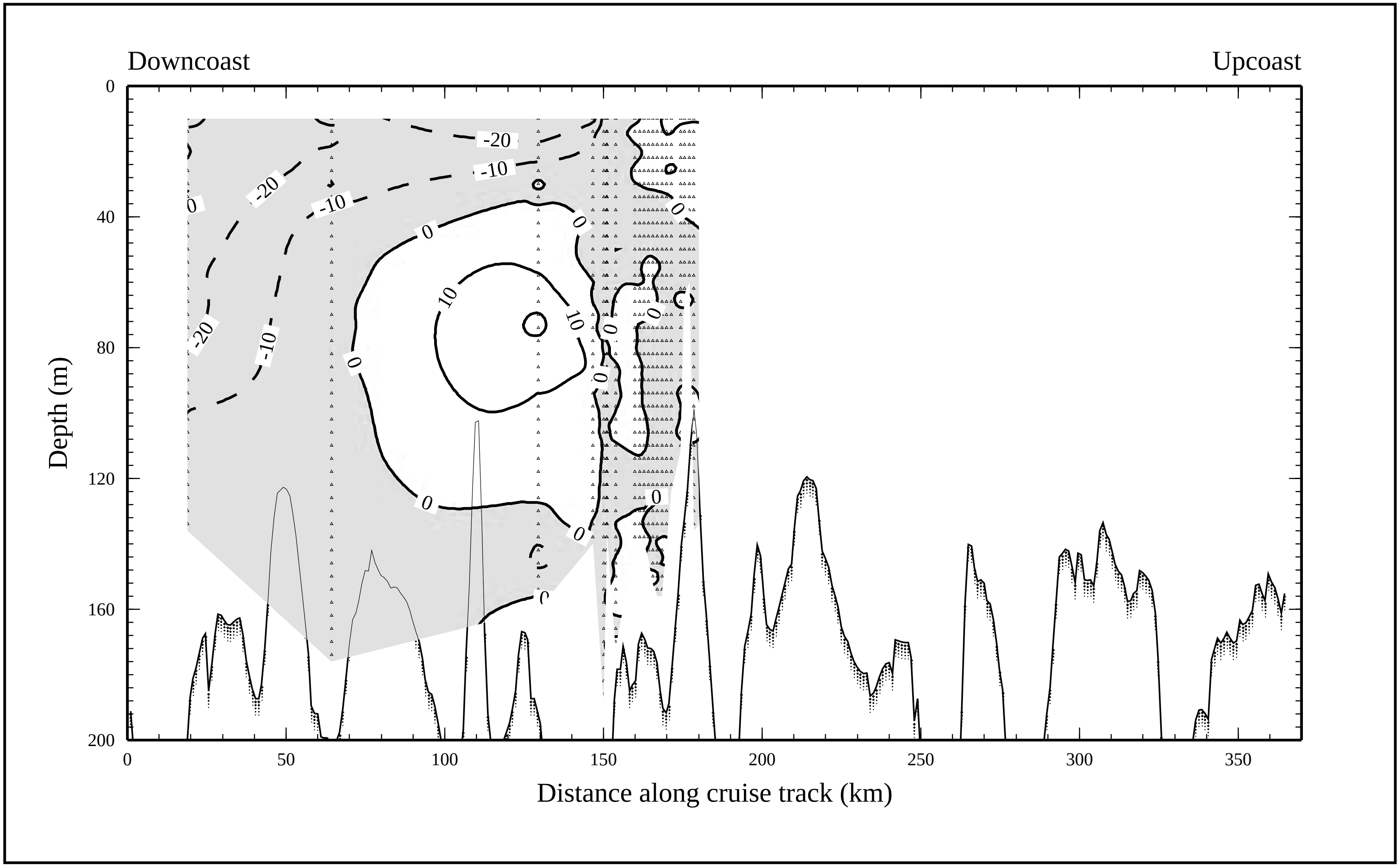

Figure 9.4.10. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 10 for cruise H09, July 1994. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

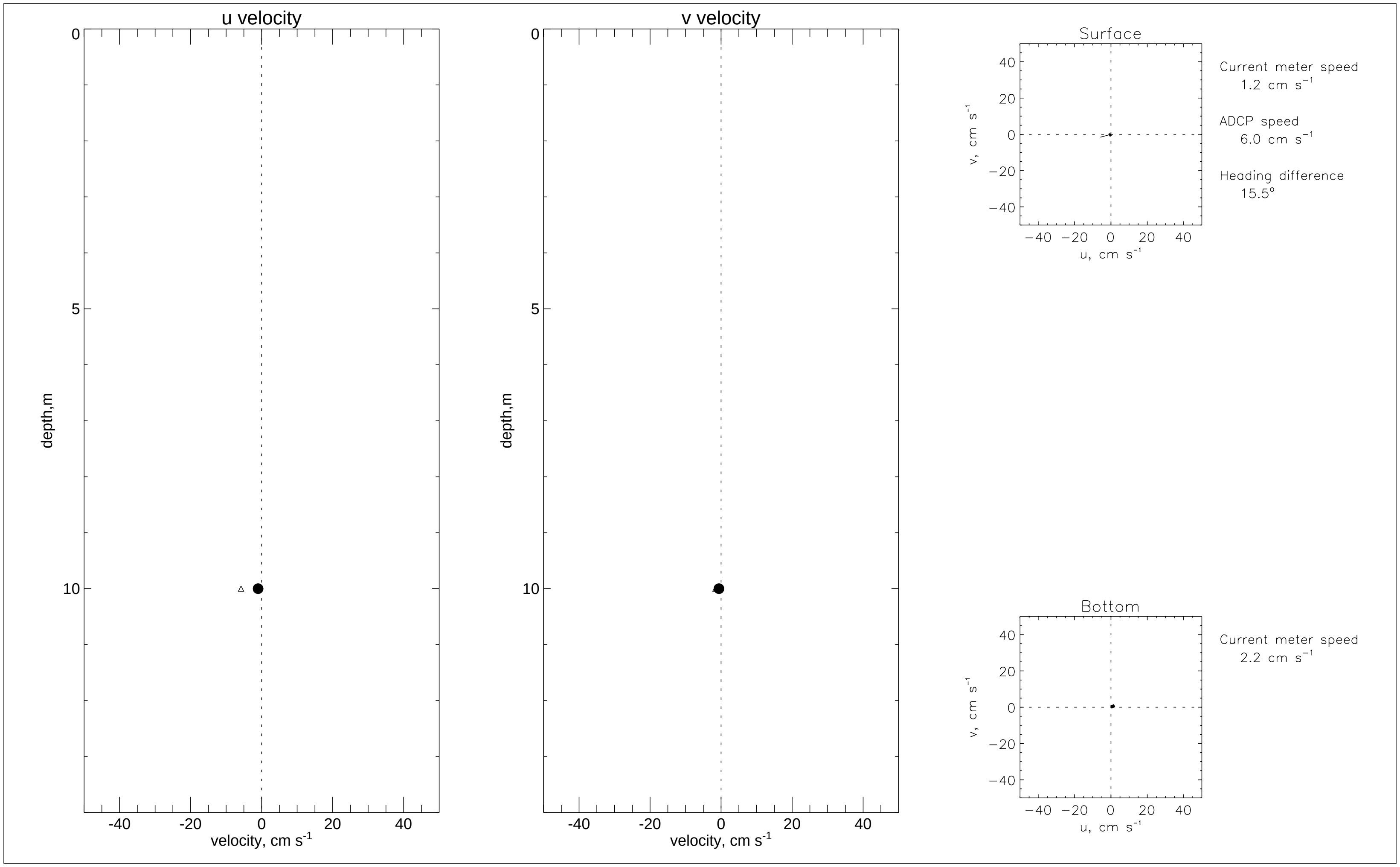

Figure 9.5.01. ADCP profile taken on 5 August 1994 at 0105 UTC (cruise H09) while passing by mooring CM01 at a distance of 6 .8 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 5 August 1994 at 0100 UTC. Velocities for the bottom meter (-99 m) are marked with a diamond and were recorded on 5 August 1994 at 0100 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

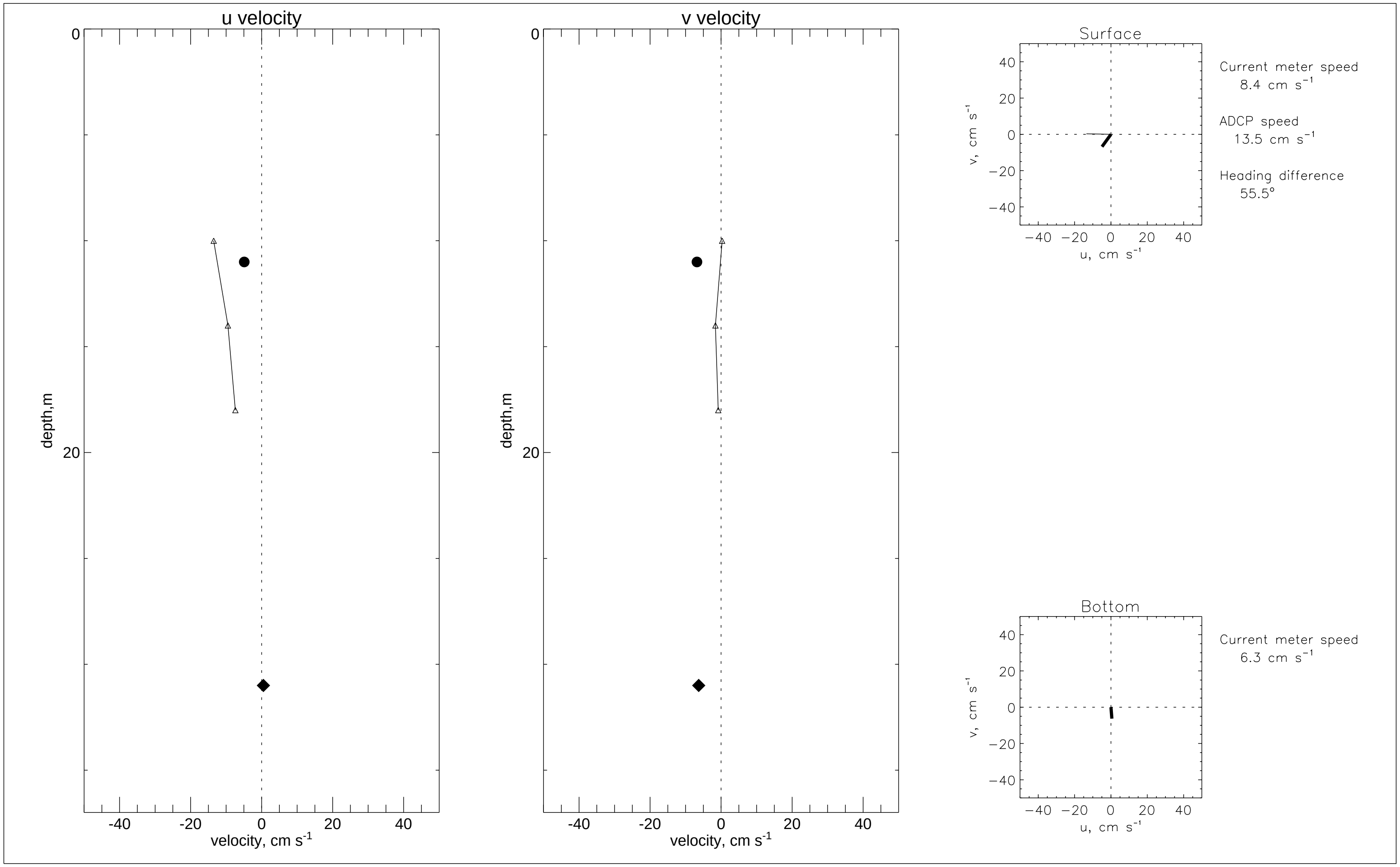

Figure 9.5.02. ADCP profile taken on 5 August 1994 at 0400 UTC (cruise H09) while passing by mooring CM02 at a distance of 6 .6 km. Velocities for the surface meter (11 m) are marked with a circle and were recorded on 5 August 1994 at 0400 UTC. Velocities for the bottom meter (31 m) are marked with a diamond and were recorded on 5 August 1994 at 0400 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

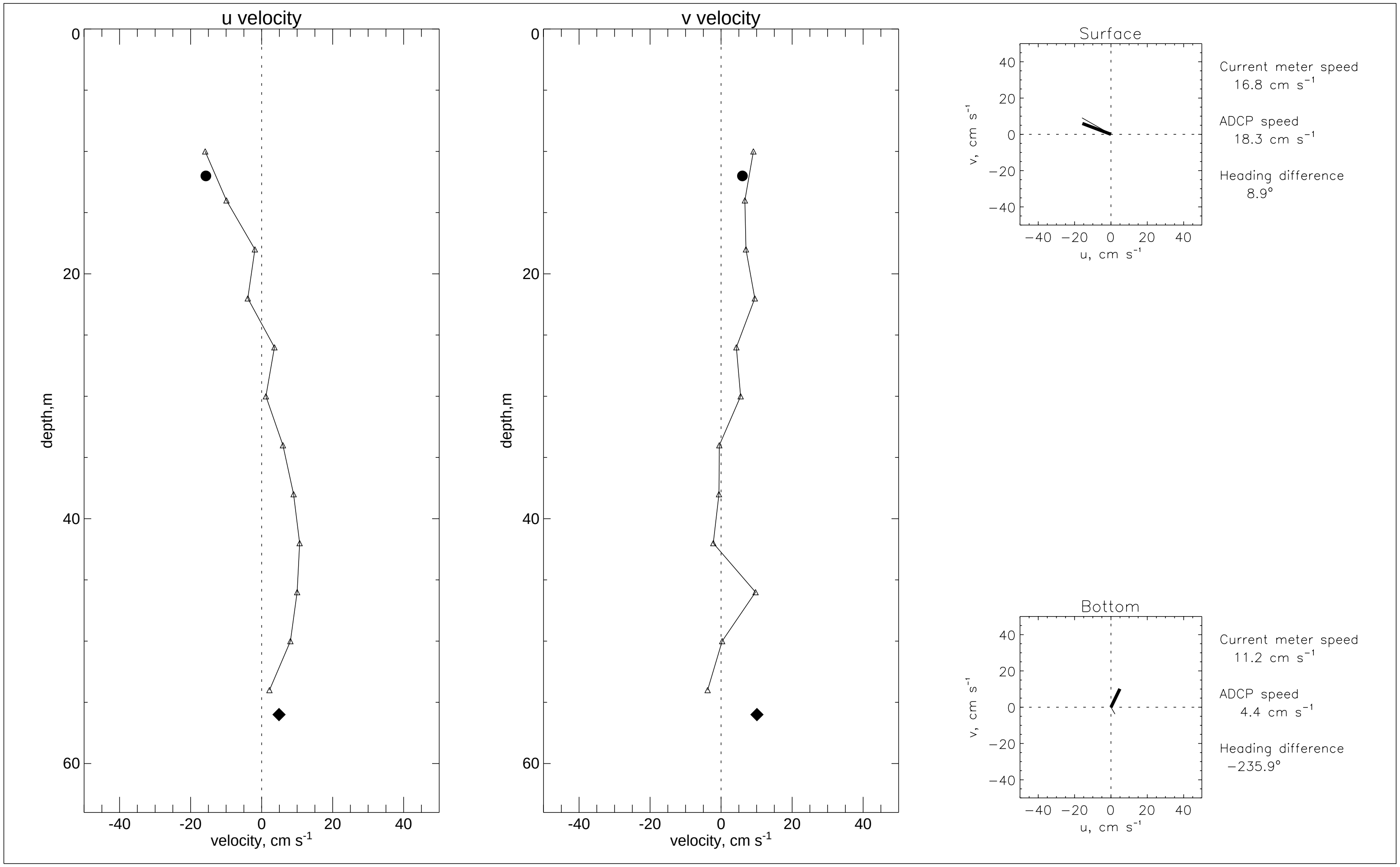

Figure 9.5.03. ADCP profile taken on 5 August 1994 at 0610 UTC (cruise H09) while passing by mooring CM03 at a distance of 9 .7 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 5 August 1994 at 0600 UTC. Velocities for the bottom meter (56 m) are marked with a diamond and were recorded on 5 August 1994 at 0600 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

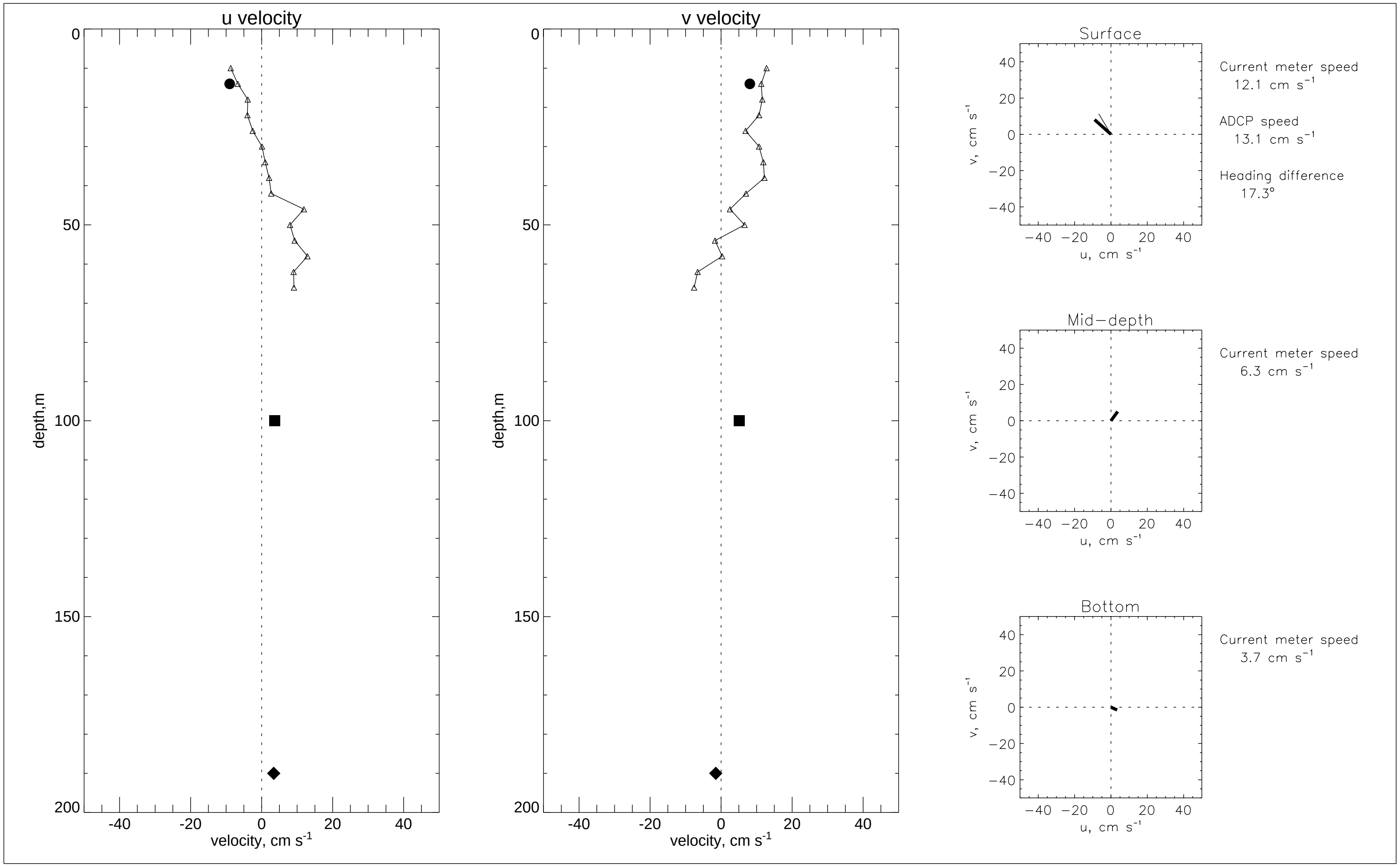

Figure 9.5.04. ADCP profile taken on 5 August 1994 at 1030 UTC (cruise H09) while passing by mooring CM04 at a distance of 0 .8 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 5 August 1994 at 1030 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 5 August 1994 at 1030 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 5 August 1994 at 1030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

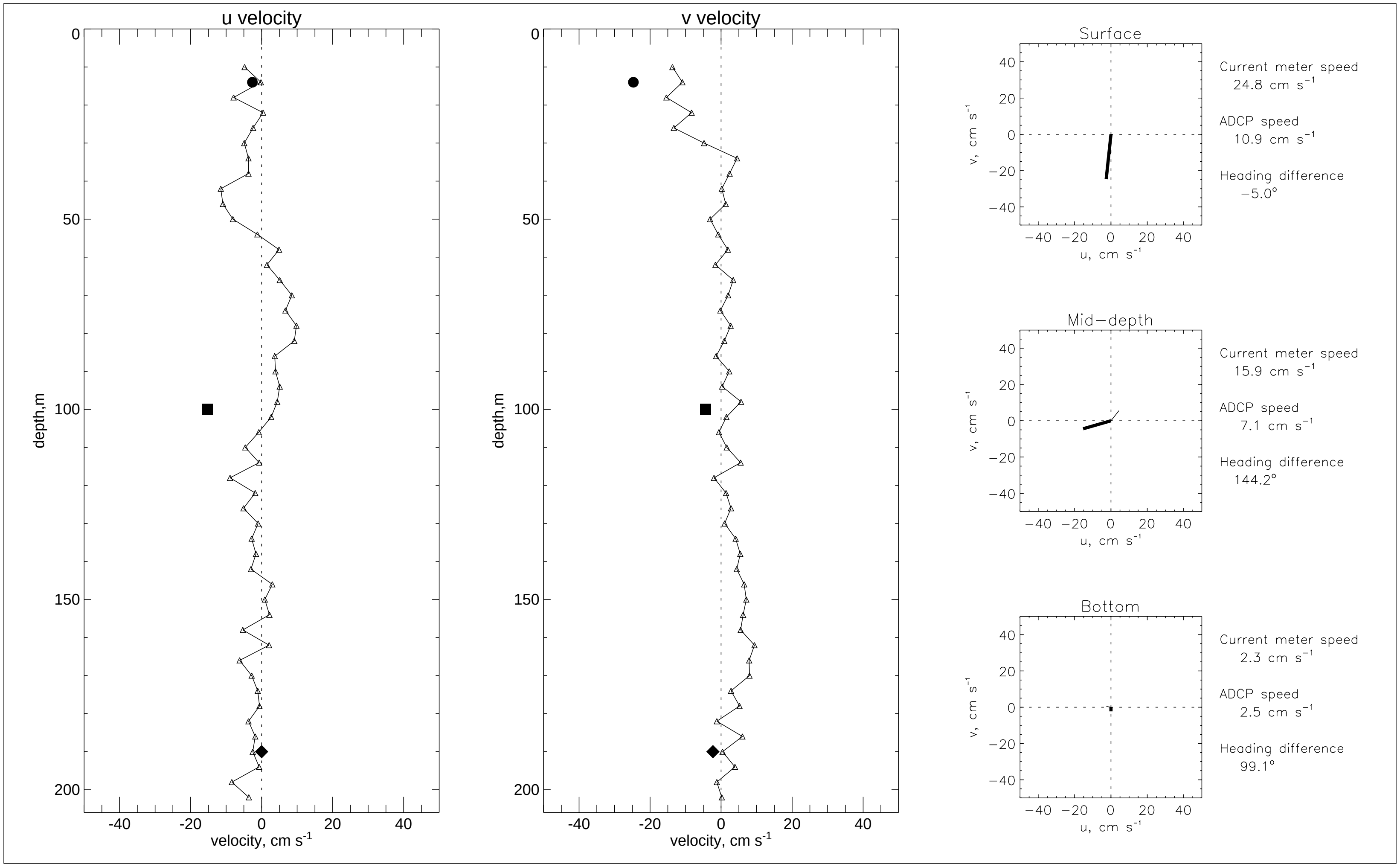

Figure 9.5.06. ADCP profile taken on 7 August 1994 at 0554 UTC (cruise H09) while passing by mooring CM06 at a distance of 8 .5 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 7 August 1994 at 0600 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 7 August 1994 at 0600 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 7 August 1994 at 0600 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

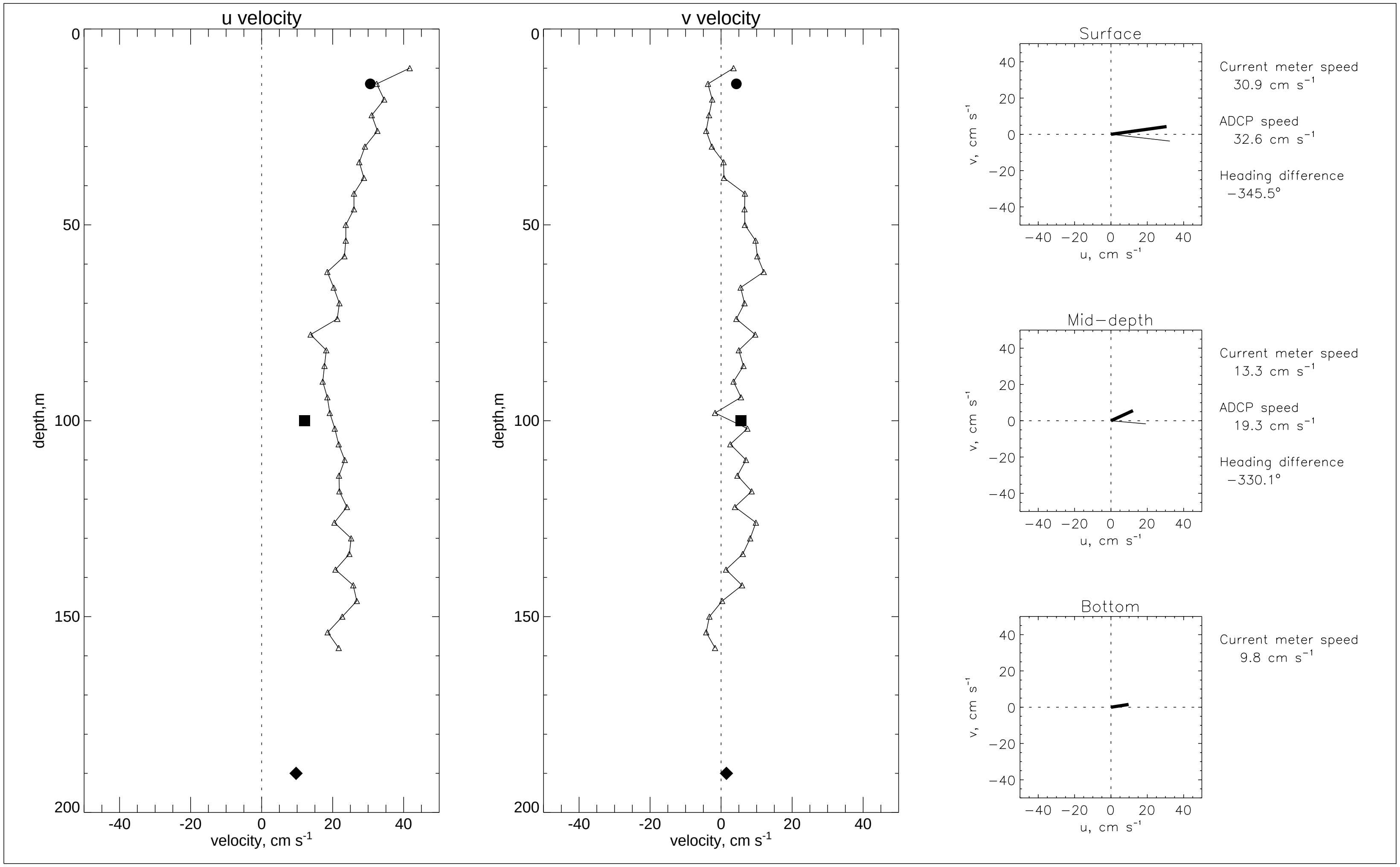

Figure 9.5.07. ADCP profile taken on 3 August 1994 at 1931 UTC (cruise H09) while passing by mooring CM07 at a distance of 0 .6 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 3 August 1994 at 1930 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 3 August 1994 at 1930 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 3 August 1994 at 1930 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

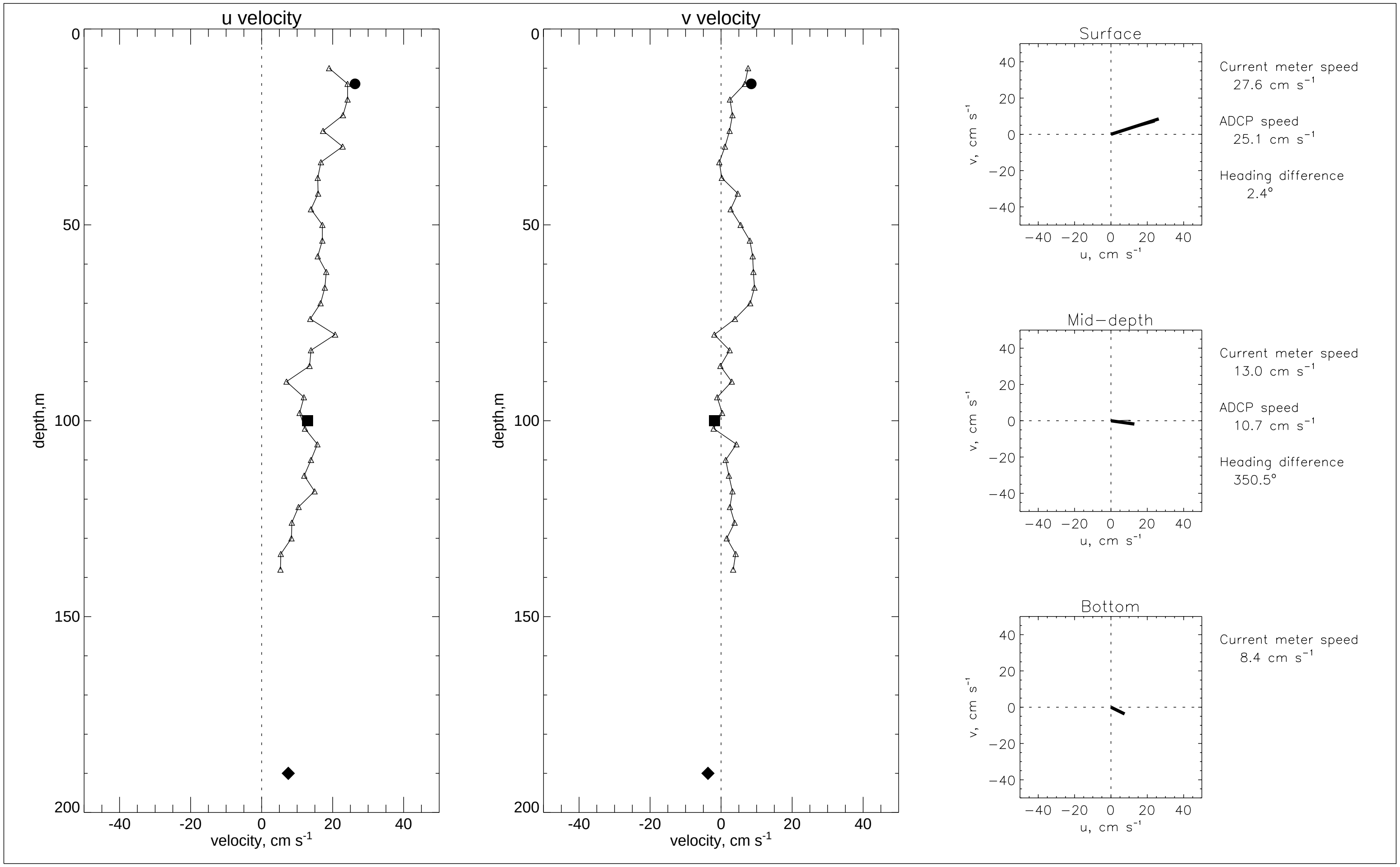

Figure 9.5.08. ADCP profile taken on 2 August 1994 at 0439 UTC (cruise H09) while passing by mooring CM08 at a distance of 0 .6 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 2 August 1994 at 0430 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 2 August 1994 at 0430 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 2 August 1994 at 0430 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

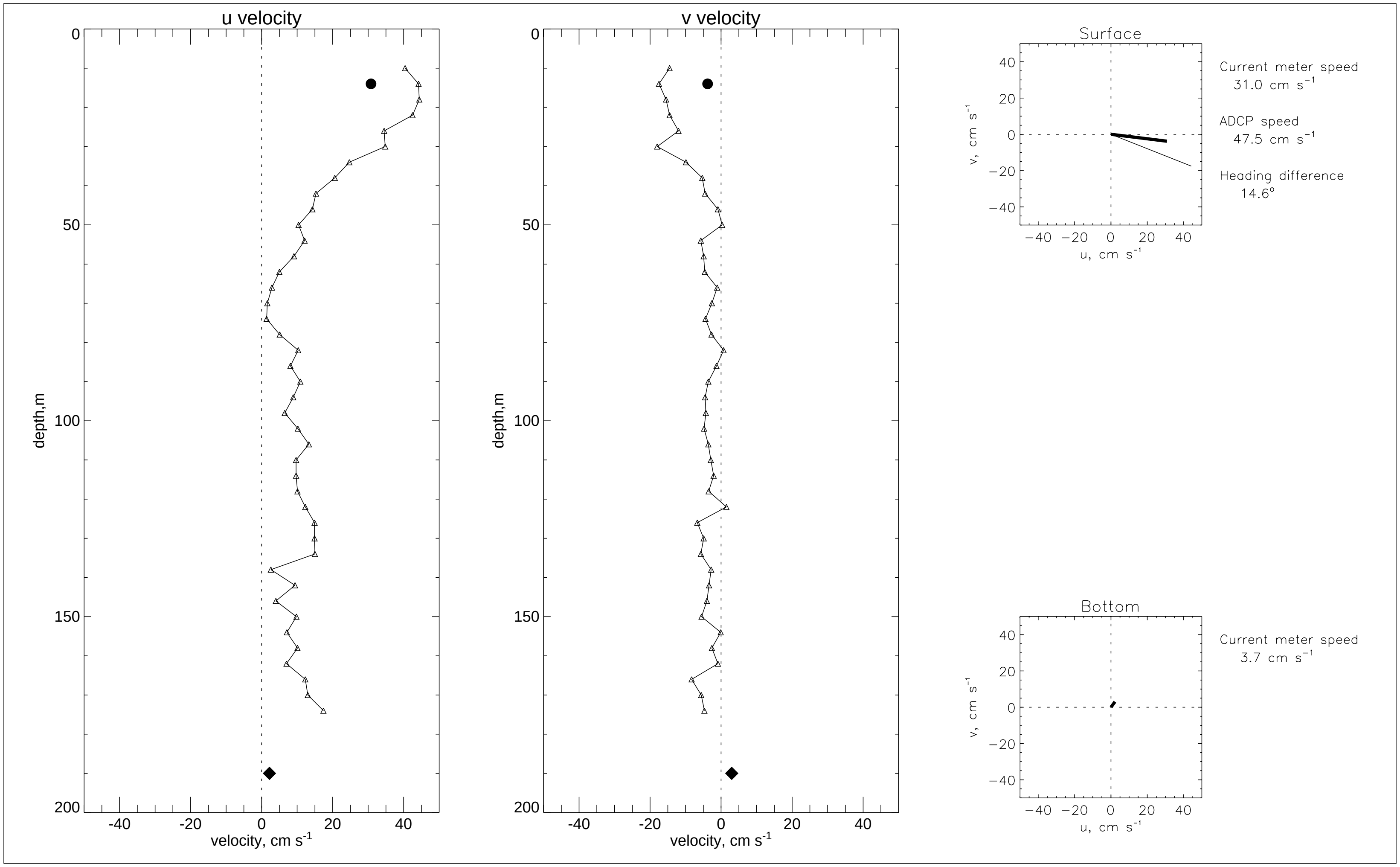

Figure 9.5.09. ADCP profile taken on 27 July 1994 at 2021 UTC (cruise H09) while passing by mooring CM09 at a distance of 2. 0 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 27 July 1994 at 2030 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 27 July 1994 at 2030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

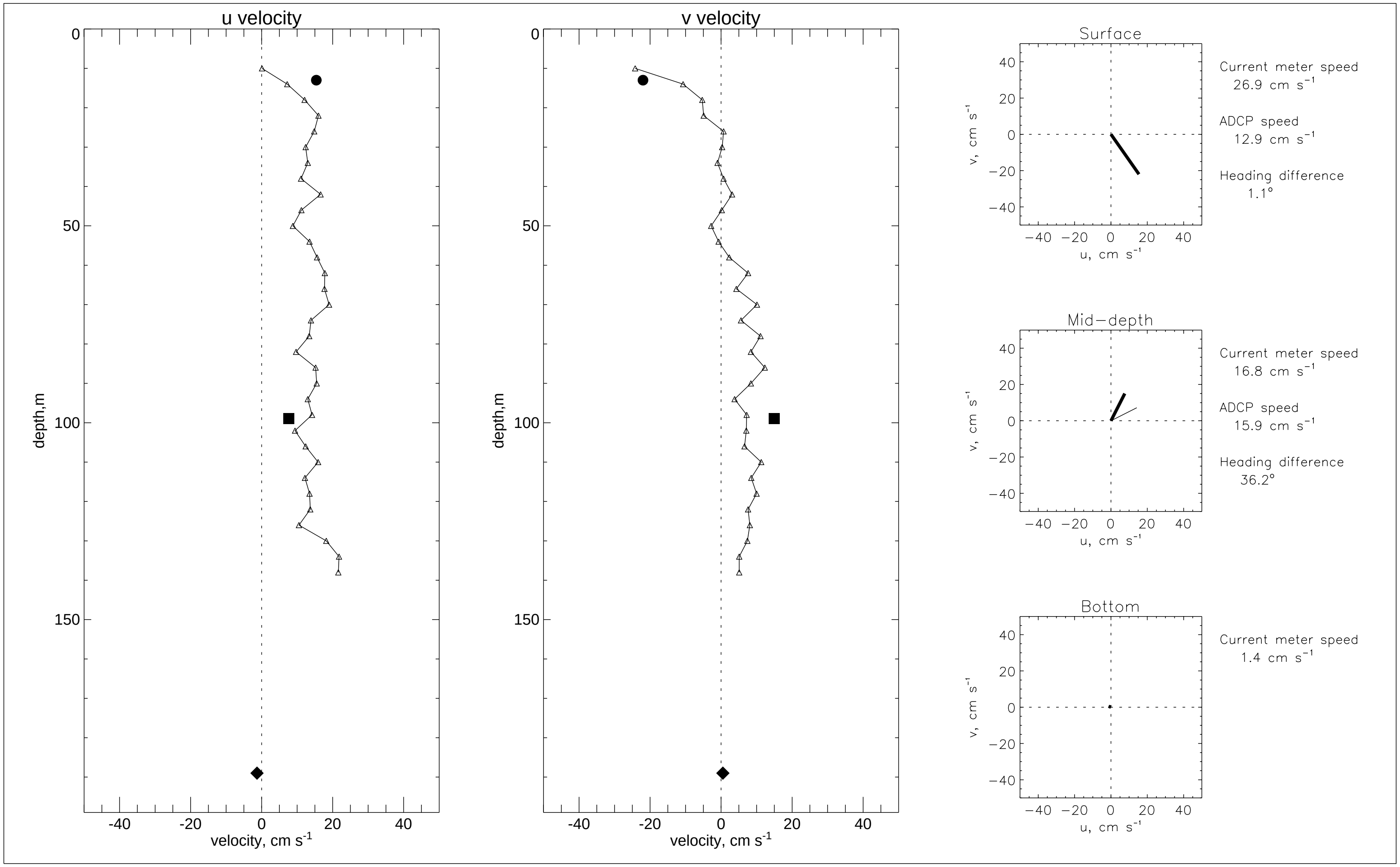

Figure 9.5.10. ADCP profile taken on 28 July 1994 at 0230 UTC (cruise H09) while passing by mooring CM10 at a distance of 6. 1 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 28 July 1994 at 0230 UTC. Velocities for the mid-depth meter (99 m) are marked with a square and were recorded on 28 July 1994 at 0230 UTC. Velocities for the bottom meter (189 m) are marked with a diamond and were recorded on 28 July 1994 at 0230 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

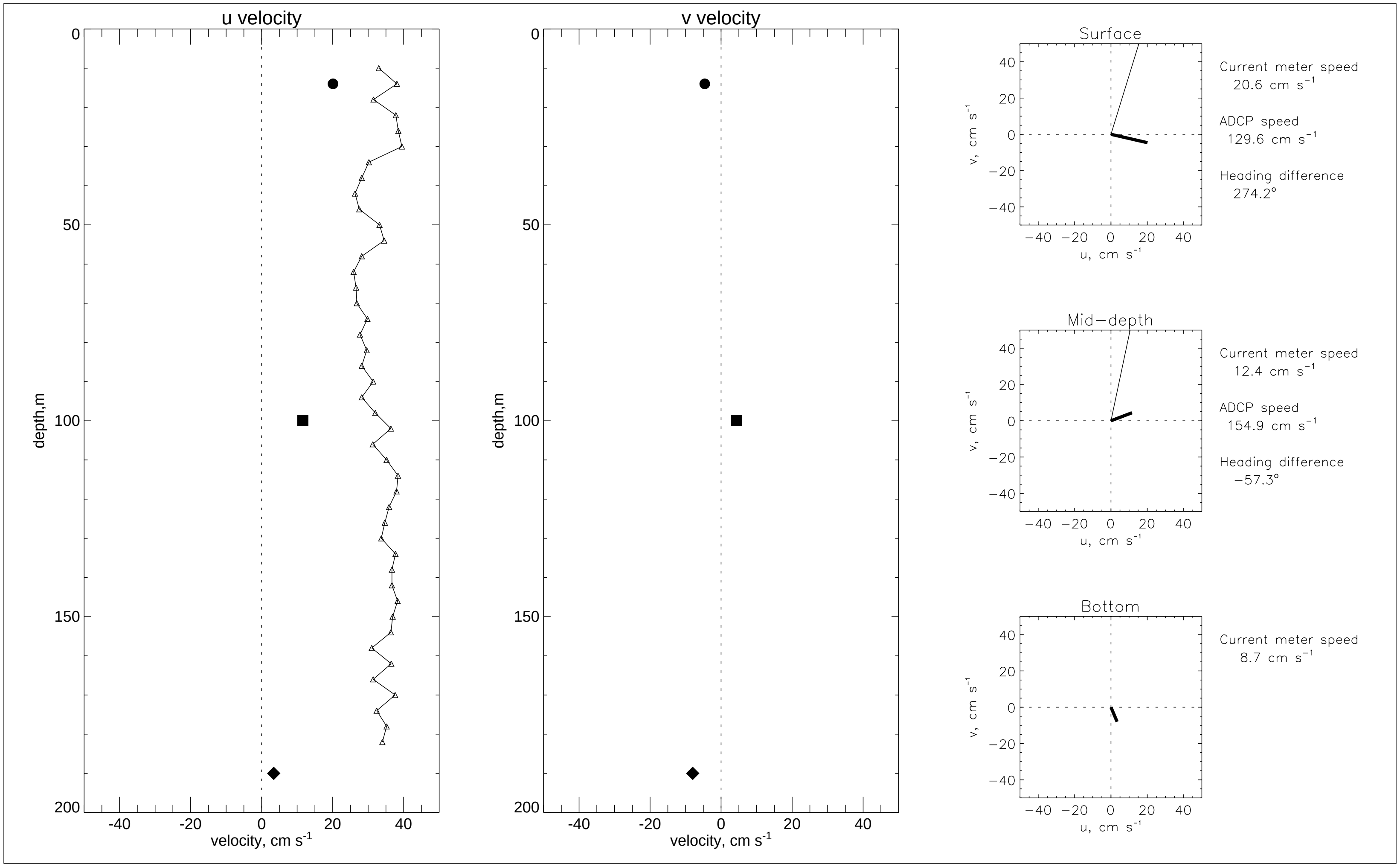

Figure 9.5.11. ADCP profile taken on 30 July 1994 at 1624 UTC (cruise H09) while passing by mooring CM11 at a distance of 7. 6 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 30 July 1994 at 1630 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 30 July 1994 at 1630 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 30 July 1994 at 1630 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

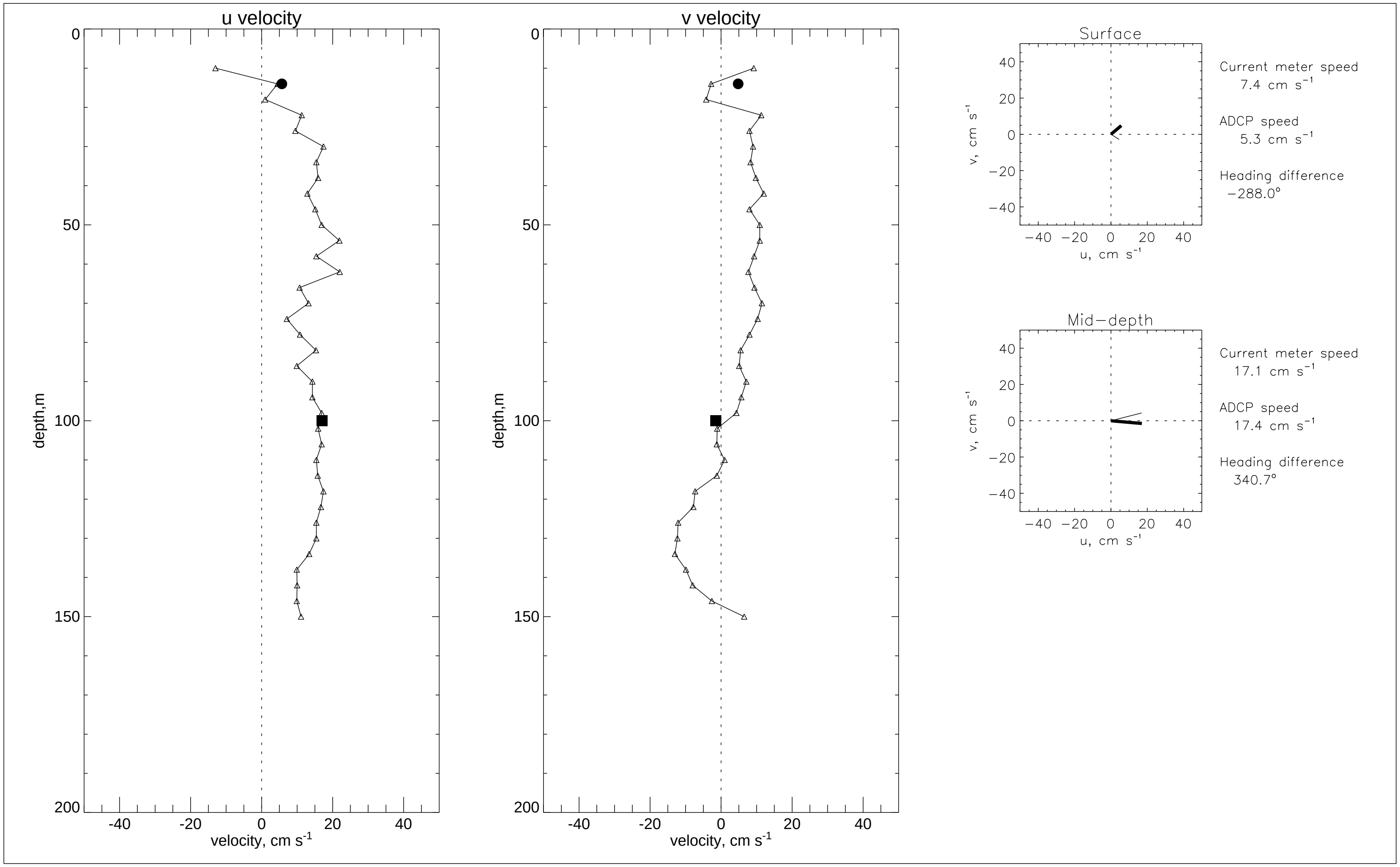

Figure 9.5.13. ADCP profile taken on 29 July 1994 at 0611 UTC (cruise H09) while passing by mooring CM13 at a distance of 1. 8 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 29 July 1994 at 0600 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 29 July 1994 at 0600 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

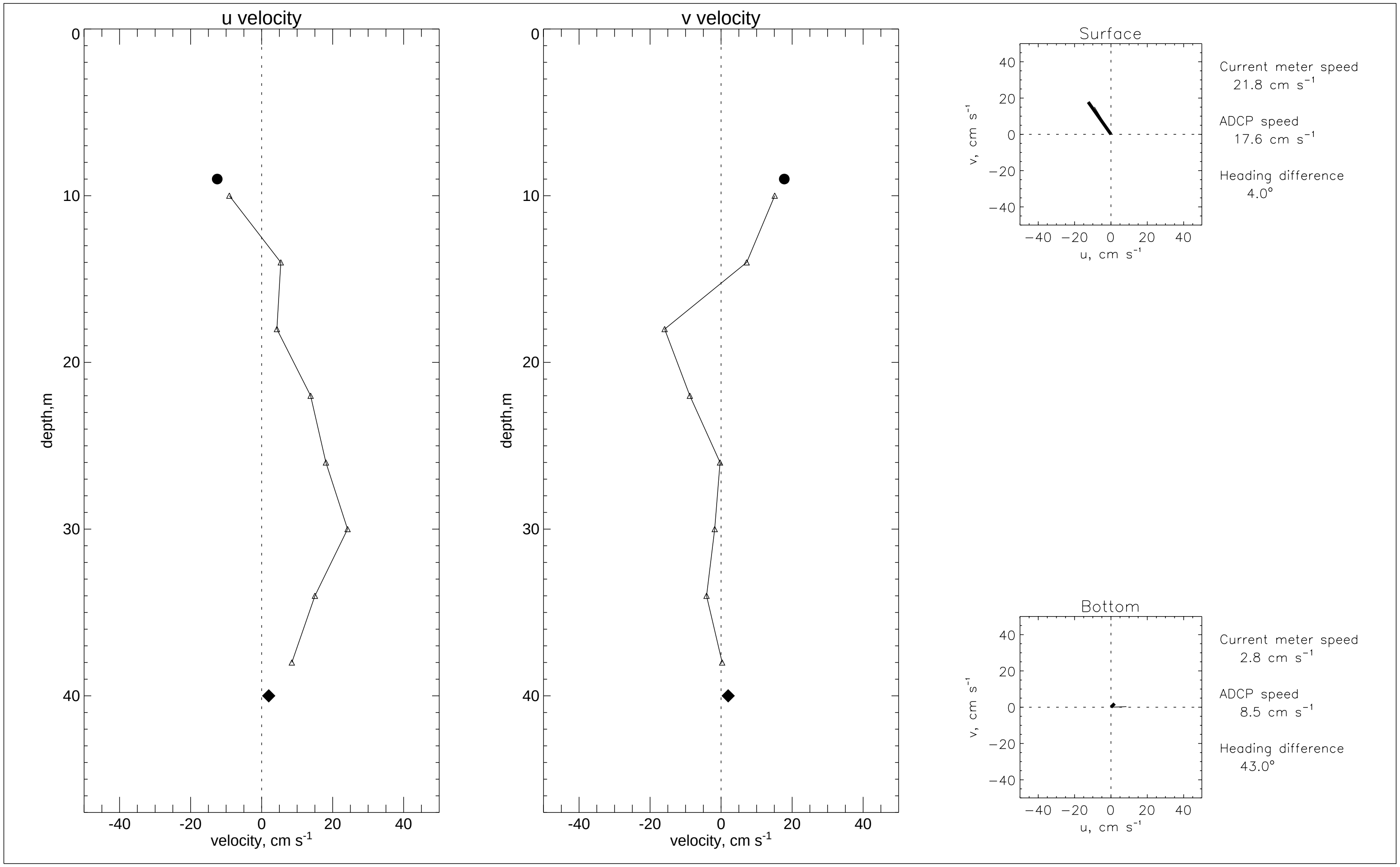

Figure 9.5.14. ADCP profile taken on 29 July 1994 at 0941 UTC (cruise H09) while passing by mooring CM14 at a distance of 1. 0 km. Velocities for the surface meter (9 m) are marked with a circle and were recorded on 29 July 1994 at 0930 UTC. Velocities for the bottom meter (40 m) are marked with a diamond and were recorded on 29 July 1994 at 0940 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

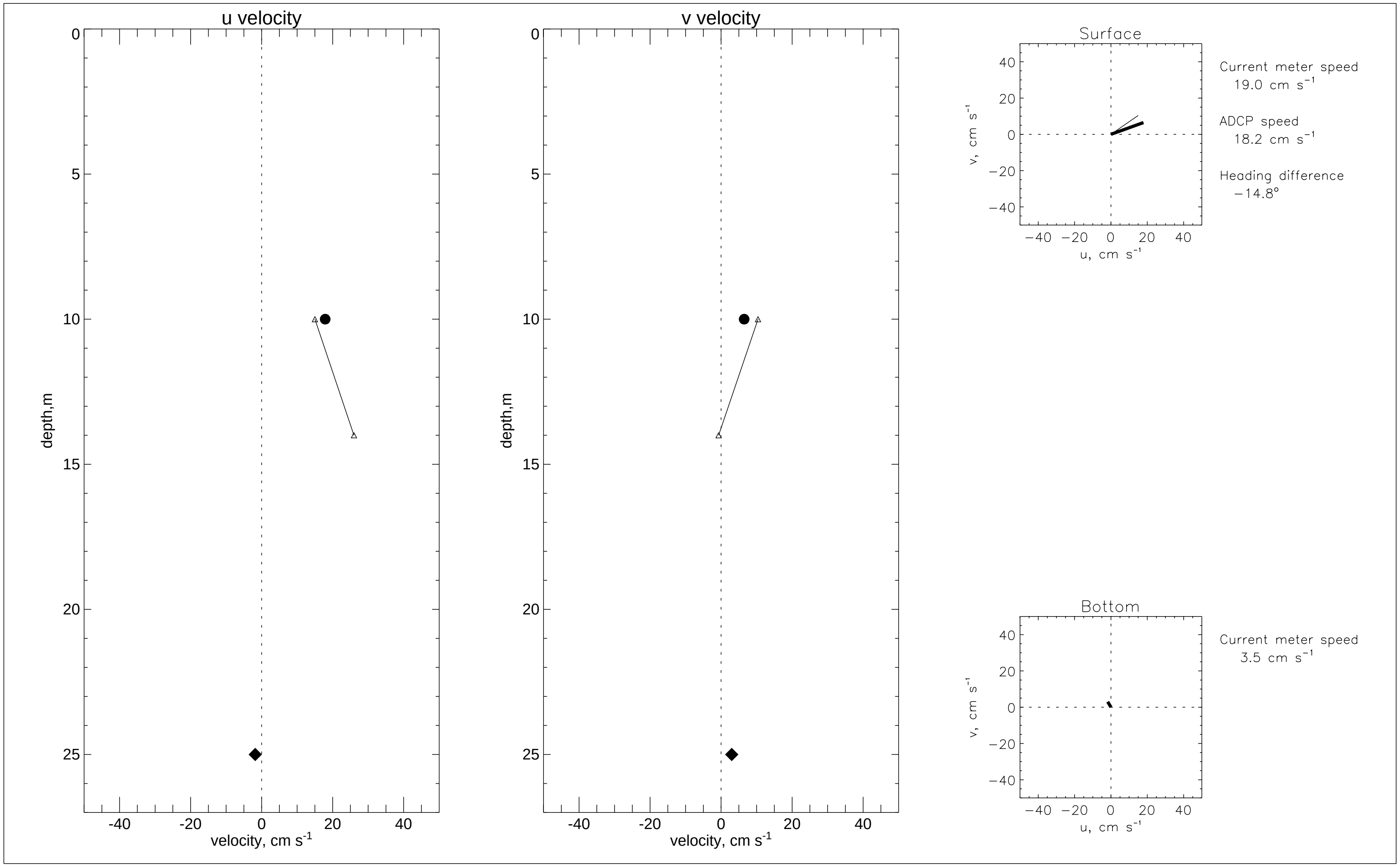

Figure 9.5.15. ADCP profile taken on 29 July 1994 at 1136 UTC (cruise H09) while passing by mooring CM15 at a distance of 2. 1 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 29 July 1994 at 1130 UTC. Velocities for the bottom meter (25 m) are marked with a diamond and were recorded on 29 July 1994 at 1135 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

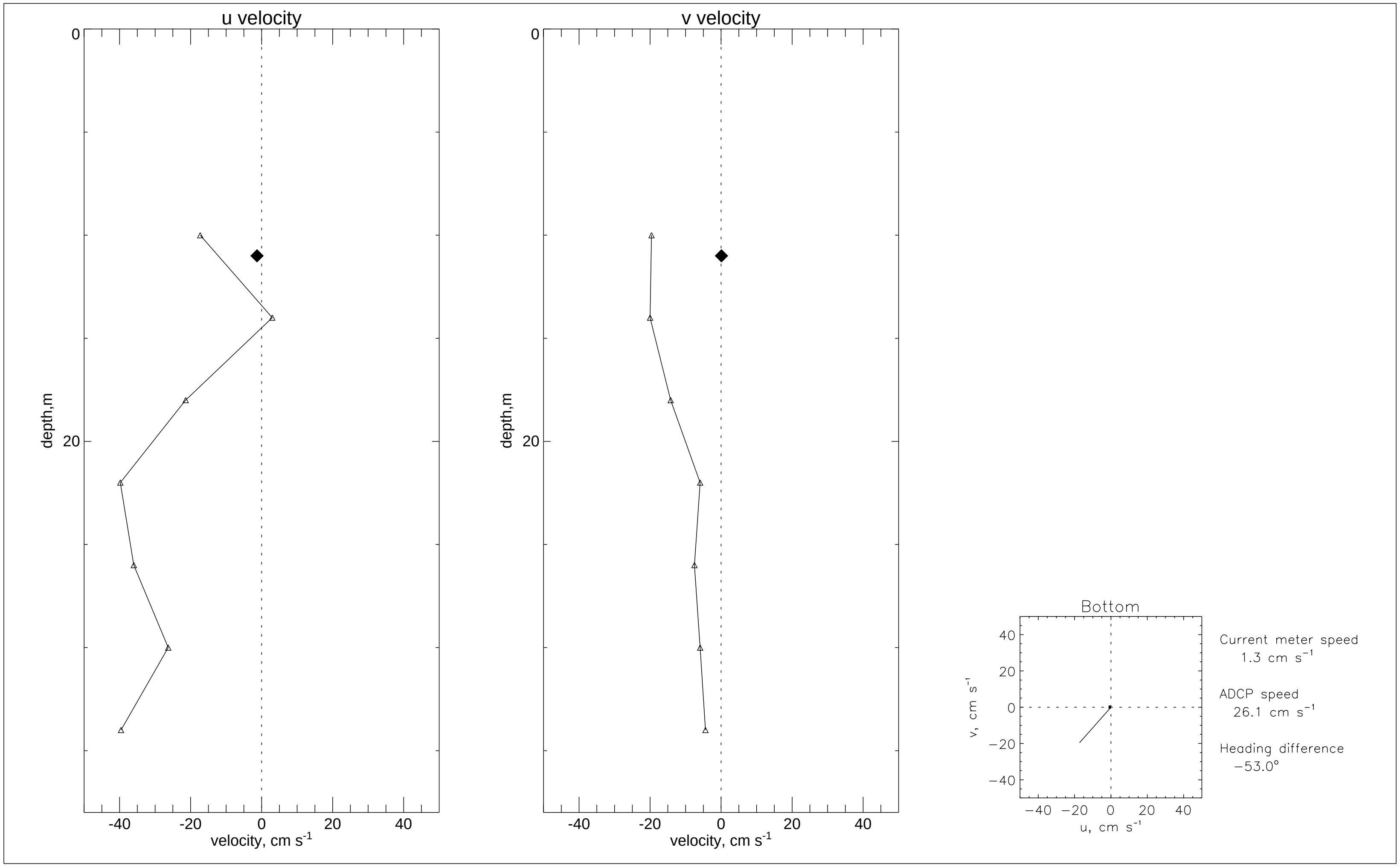

Figure 9.5.20. ADCP profile taken on 1 August 1994 at 0949 UTC (cruise H09) while passing by mooring CM20 at a distance of 4 .1 km. Velocities for the bottom meter (11 m) are marked with a diamond and were recorded on 1 August 1994 at 1000 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

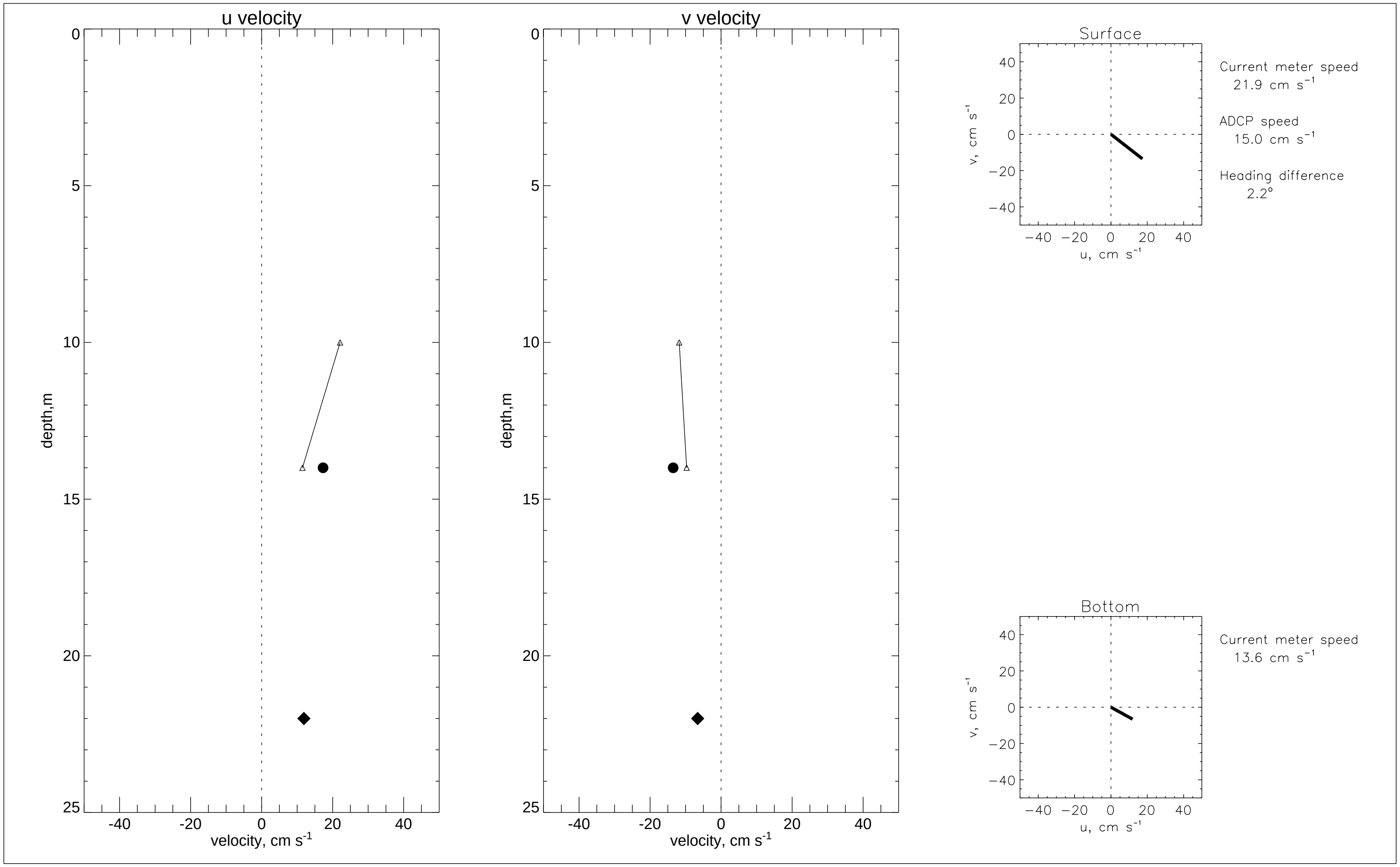

Figure 9.5.21. ADCP profile taken on 1 August 1994 at 1644 UTC (cruise H09) while passing by mooring CM21 at a distance of 8 .5 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 1 August 1994 at 1630 UTC. Velocities for the bottom meter (22 m) are marked with a diamond and were recorded on 1 August 1994 at 1645 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

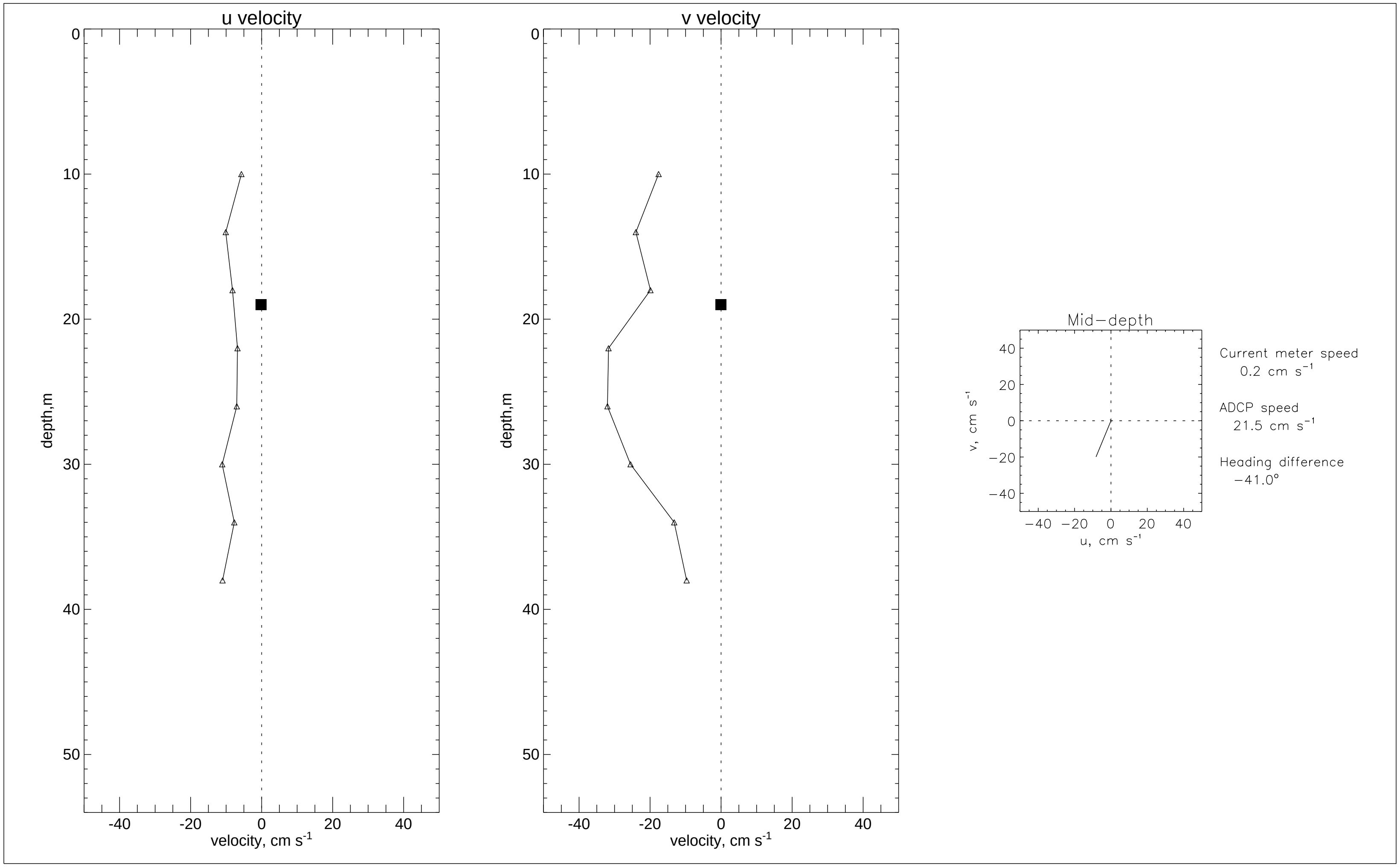

Figure 9.5.22. ADCP profile taken on 1 August 1994 at 2129 UTC (cruise H09) while passing by mooring CM22 at a distance of 4 .6 km. Velocities for the mid-depth meter (19 m) are marked with a square and were recorded on 1 August 1994 at 2130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

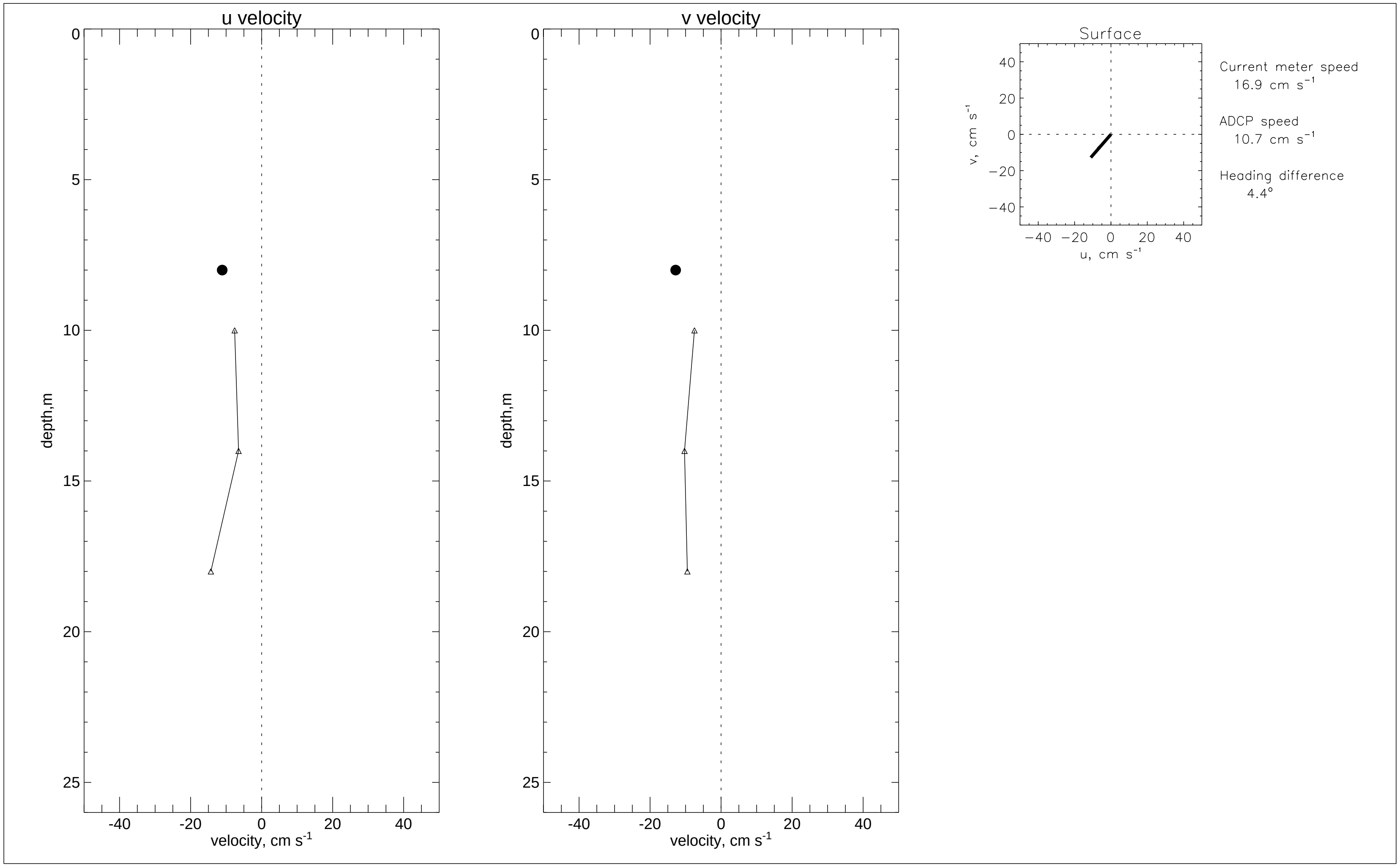

Figure 9.5.24. ADCP profile taken on 3 August 1994 at 1216 UTC (cruise H09) while passing by mooring CM24 at a distance of 4 .2 km. Velocities for the surface meter (8 m) are marked with a circle and were recorded on 3 August 1994 at 1230 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

5.4 Cruise H10

5.4.1 Specific Quality Control Issues

This survey was conducted aboard the R/V *Gyre*. The Vessel-Mount model ADCP was installed and the TRANSECT program was used during this survey. The weather the during cruise was good, the hull was clean, and the ship made speeds of 9-10 knots. The quality of the ADCP data set was, surprisingly, good. The QA/QC processing produced usable data. The parameter settings are shown in Table 19.

Table 19. Parameter settings (in meters) and the resulting sequence of bin depths on survey H10.

Transducer Depth	Blank-Beyond-Transmit	Bin Length	Bin Depth Sequence
4	4	4	12, 16, 20, 24, ...

5.4.2 Results

5.4.2.1 General Cruise Track

We show in Figure 10.1.1 a plan view of the general cruise track taken by the R/V *Gyre* during H10. The cruise covered the entire LATEX shelf. Because the data collection was not synoptic, we show selected time indices and the direction of travel. We show specifically labeled transects in Figure 10.1.2 for which contoured profiles of normal velocity are presented in section 5.4.2.4. Figure 10.1.3 shows the locations of current meters relative to the cruise tracks for which vertical current profiles are presented in section 5.4.2.5.

5.4.2.2 Plan View of Stick Plot Velocity Vectors

Figure 10.2.1 shows the velocity from the surface bin centered at 12 m, Figure 10.2.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 10.2.3 shows the velocity from the bin centered at 100m below the surface.

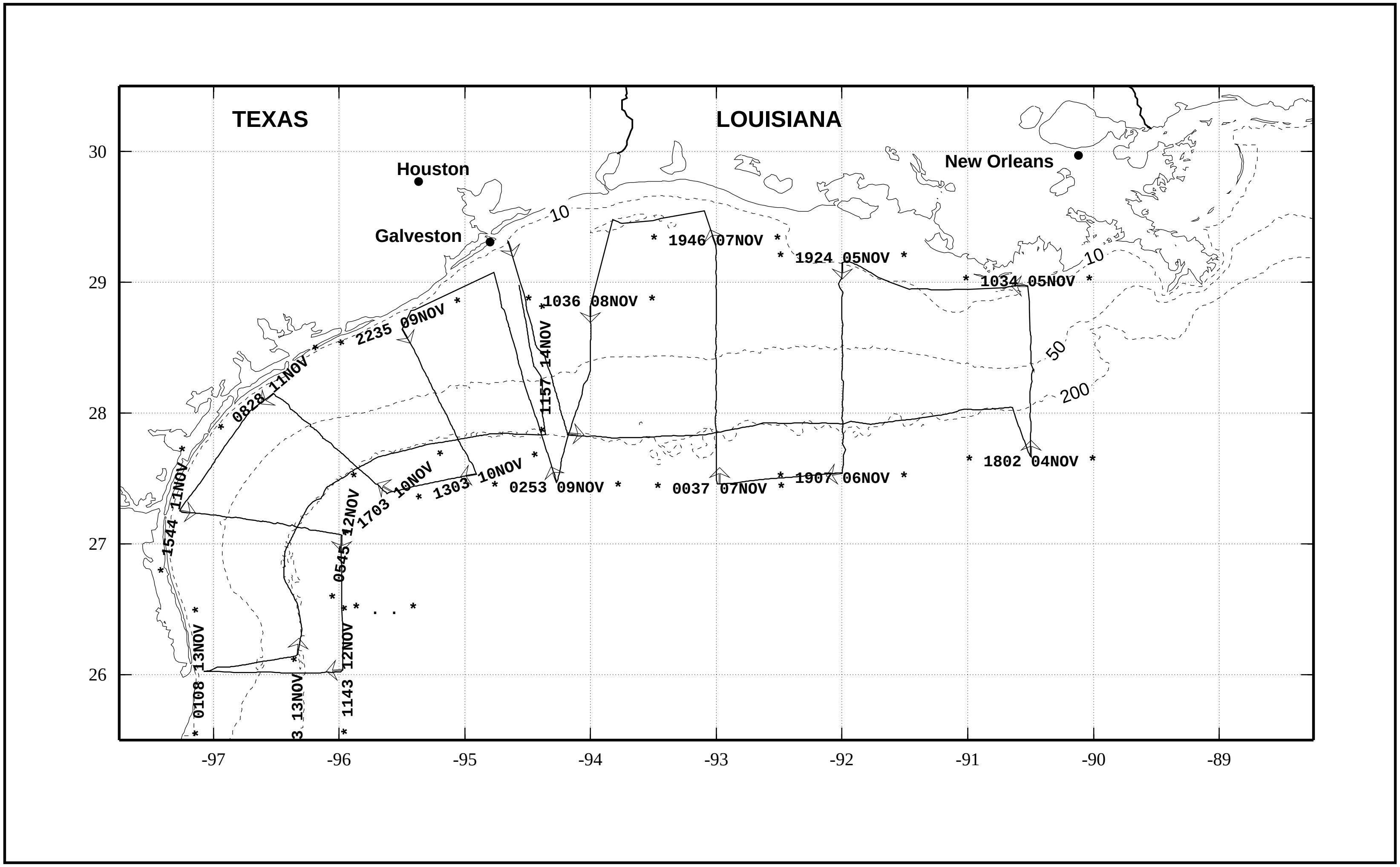

Figure 10.1.1. Cruise track on LATEX A cruise H10 in November 1994, showing times and directions.

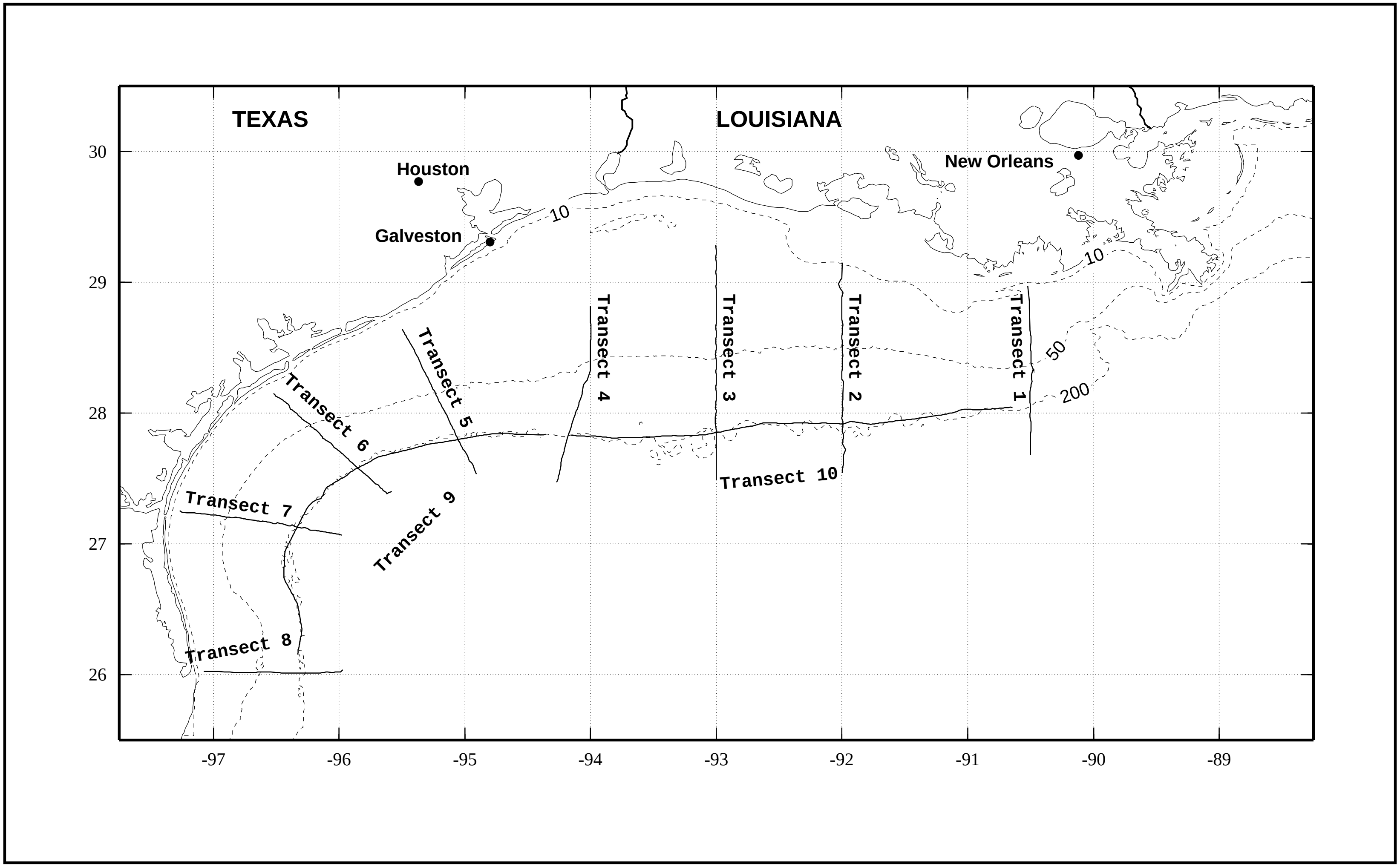

Figure 10.1.2. Cruise track on LATEX A cruise H10 in November 1994, showing individual labeled transects.

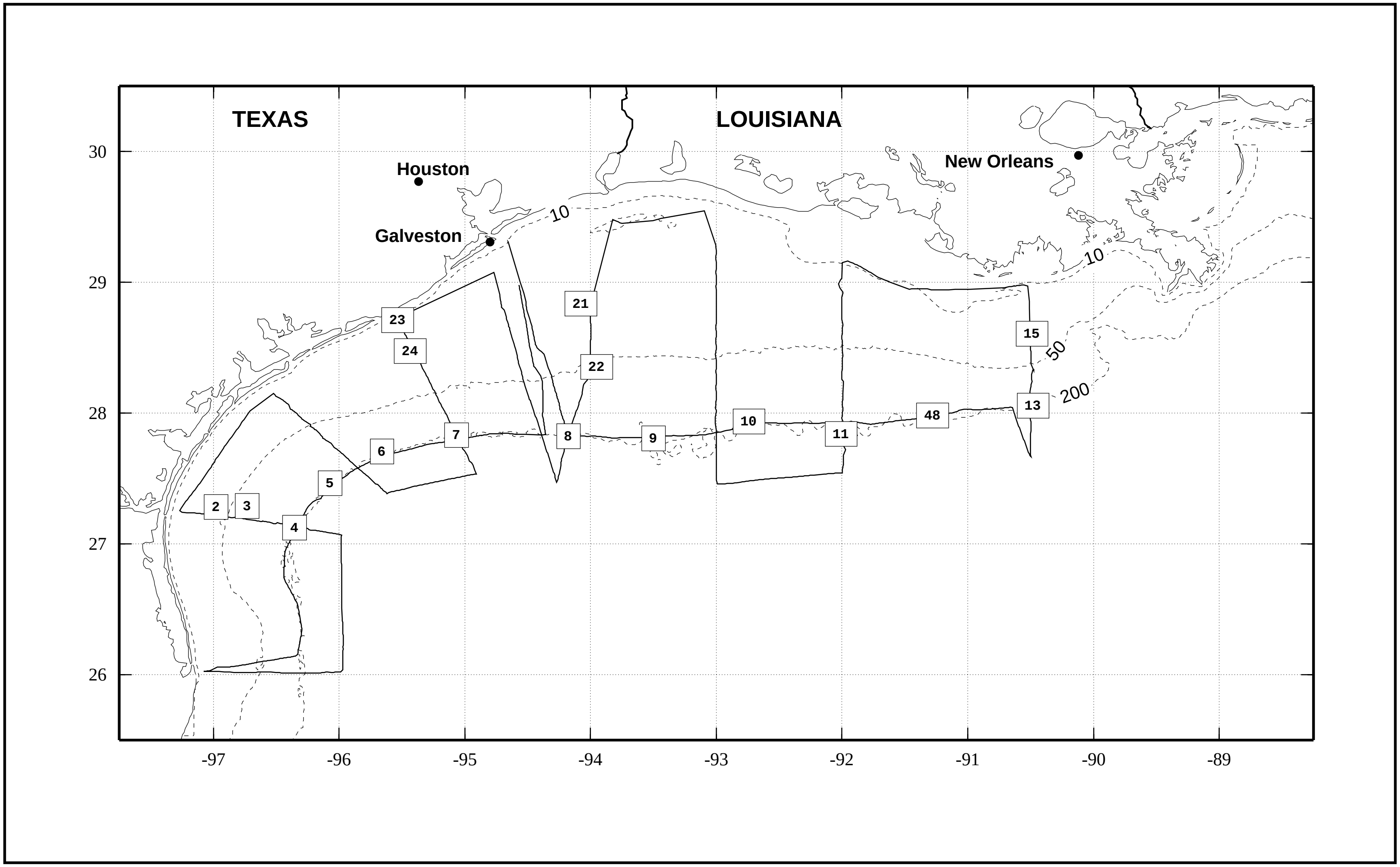

Figure 10.1.3. Cruise track on LATEX A cruise H10 in November 1994, showing current meter locations.

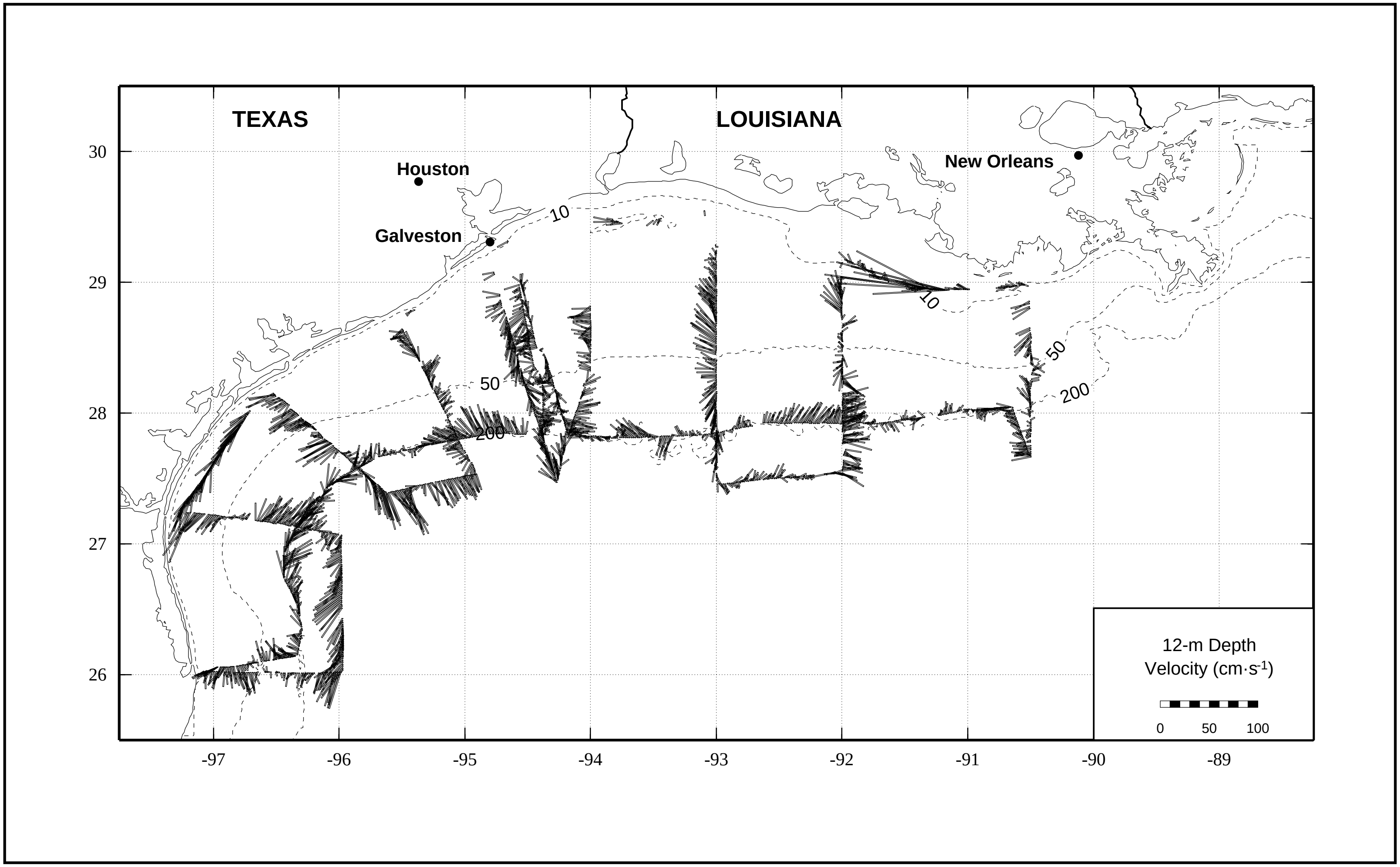

Figure 10.2.1. Stick-vector plot of ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H10 conducted in November 1994

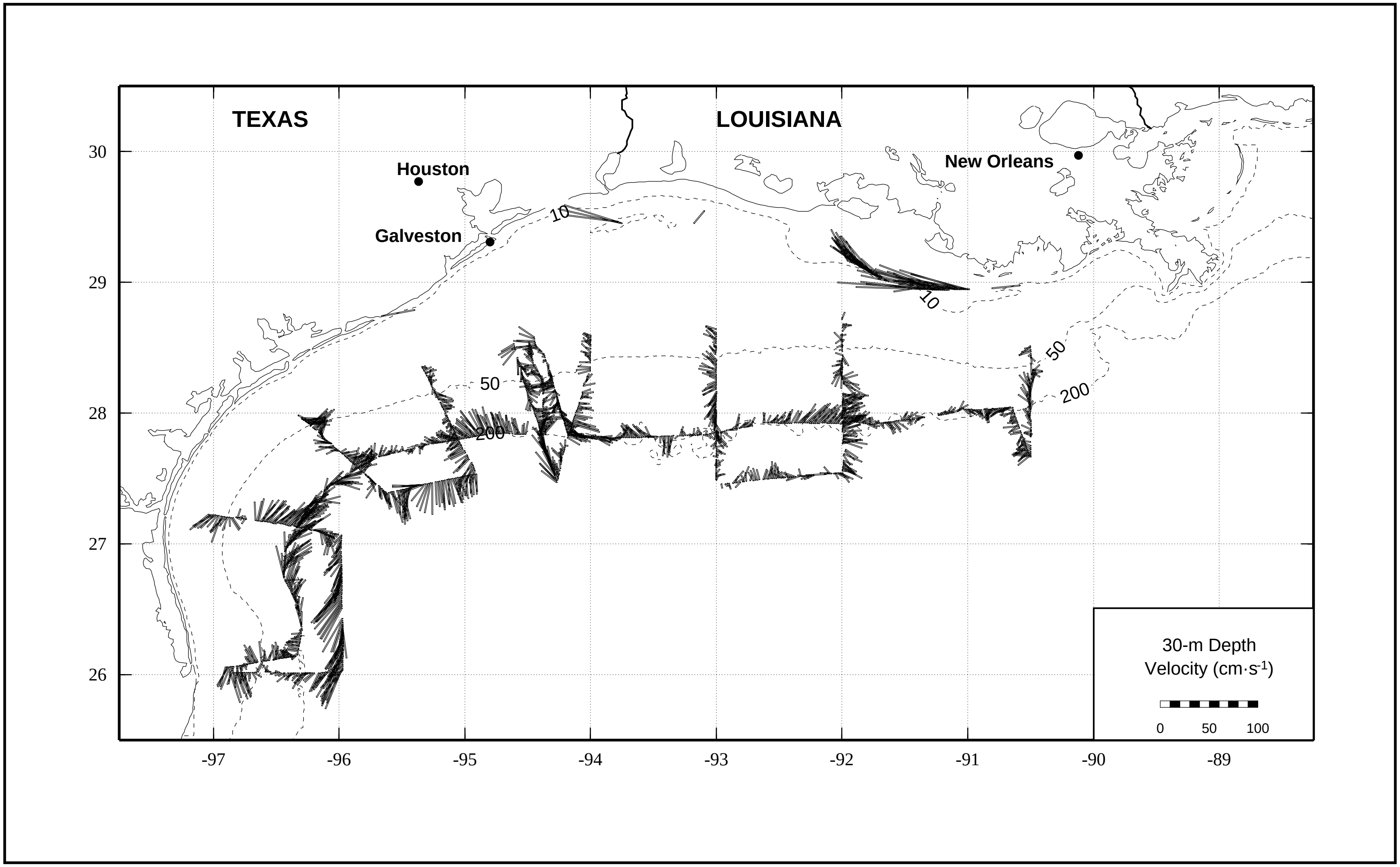

Figure 10.2.2. Stick-vector plot of ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H10 conducted in November 1994

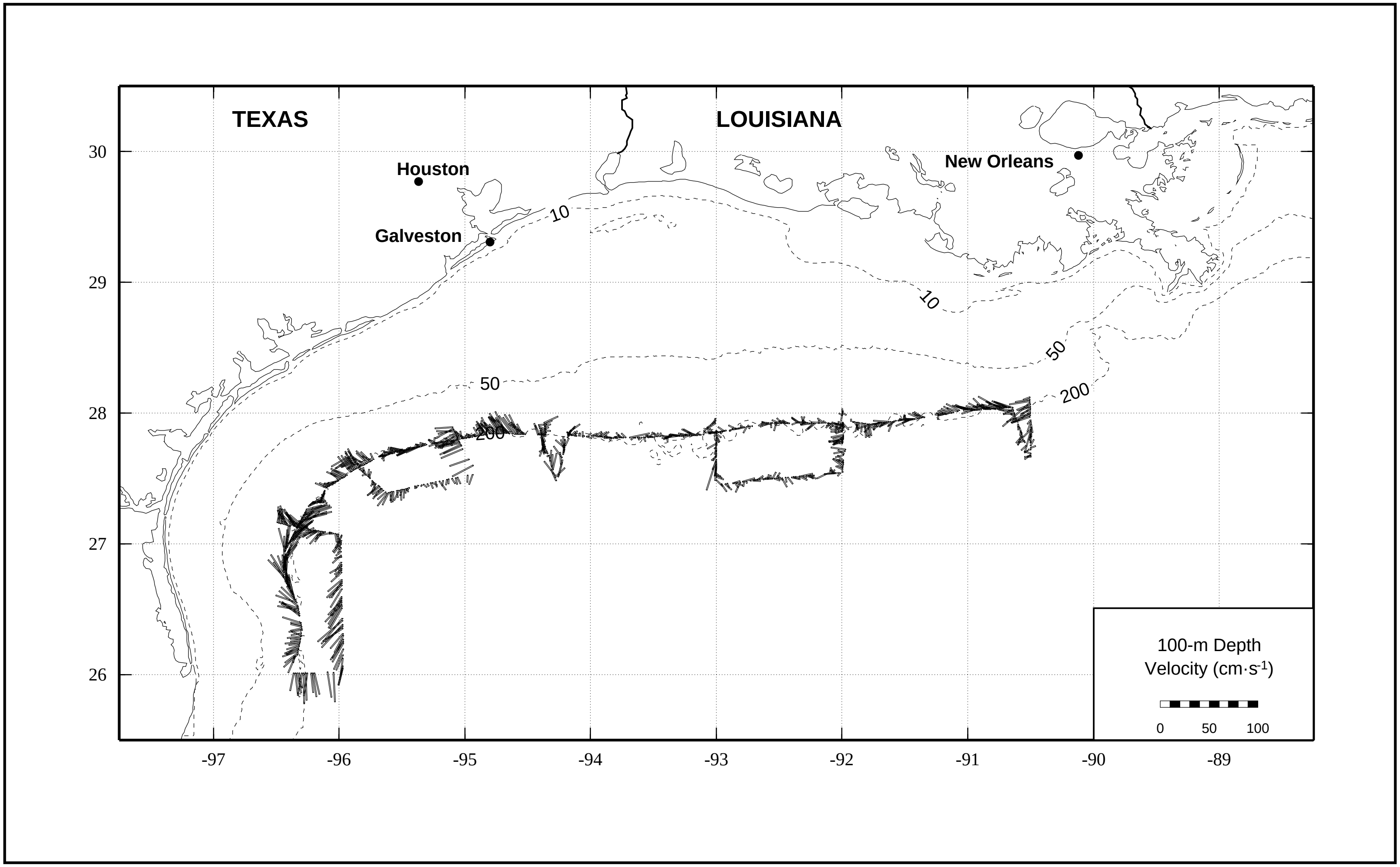

Figure 10.2.3. Stick-vector plot of ADCP currents measured at approximately the 100 m depth. The data are from LATEX A cruise H10 conducted in November 1994

5.4.2.3 Plan View of Objectively Analyzed Velocity Vectors

We used Generic Mapping Tool (GMT; Wessel and Smith, 1993) to objectively analyze the ADCP current vectors shown as stick plots in the above figures to a regular quarter-degree grid. Figure 10.3.1 shows the velocity from the bin centered at 12 m, Figure 10.3.2 shows the velocity from the bin centered at 30 m below the surface, and Figure 10.3.3 shows the velocity from the bin centered at 100 m below the surface.

5.4.2.4 Contoured Profiles of Normal Velocity

In Figures 10.4.1 through 10.4.8 we show the velocity normal to transects 1 through 8, respectively. For along-shelf transect number 9 taken along the 200-m isobath, we show the normal velocity in Figure 10.4.9. The transects are shown in Figure 10.1.2. Upcoast is defined as directed from Mexico toward Louisiana. The depth of the bottom was interpolated from a 0.01° by 0.01° bathymetric data set prepared by Dynalysis of Princeton (Herring, personal communication) for the LATEX project. It consists of a composite of NOS casts, DBDB5 1/12° gridded data, and Texas A&M University 1/8° gridded data.

5.4.2.5 Vertical Current Profiles

We show in Figures 10.5.*z*, where *z* is the current meter number, the ADCP-determined velocities and the u and v velocity from the nearest current meter, where u is the east/west velocity (toward the east is positive) and v is the north/south velocity (toward the north is positive). If the distance of closest approach between the ADCP profile and the current meter was greater than 10 km or if the time difference was greater than 30 minutes, then the results are not shown. The positions of the current meters relative to the cruise tracks are shown in Figure 10.1.3.

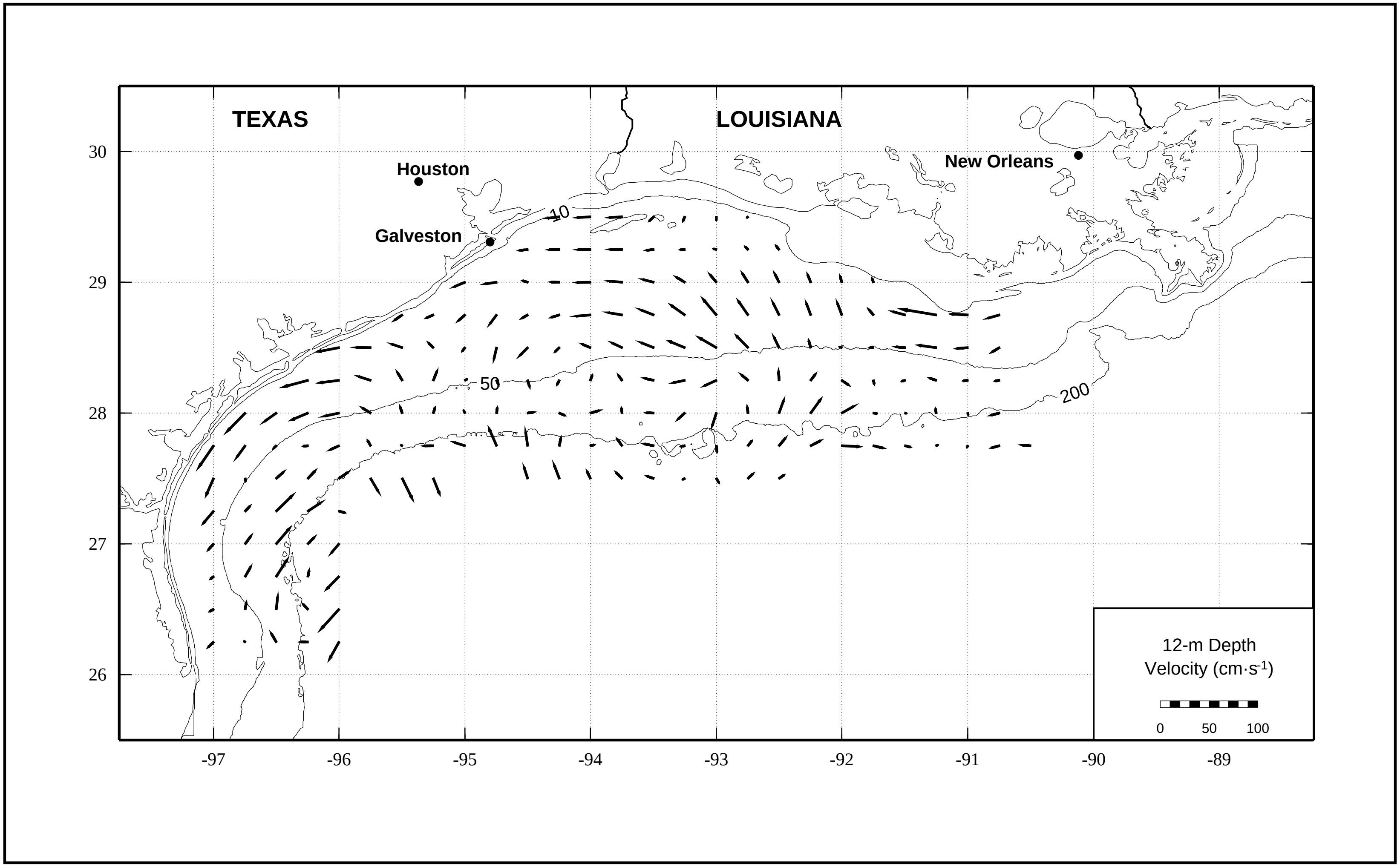

Figure 10.3.1. Objectively analyzed ADCP currents measured at the 4-m bin centered at the 12 m depth. The data are from LATEX A cruise H10 conducted in November 1994

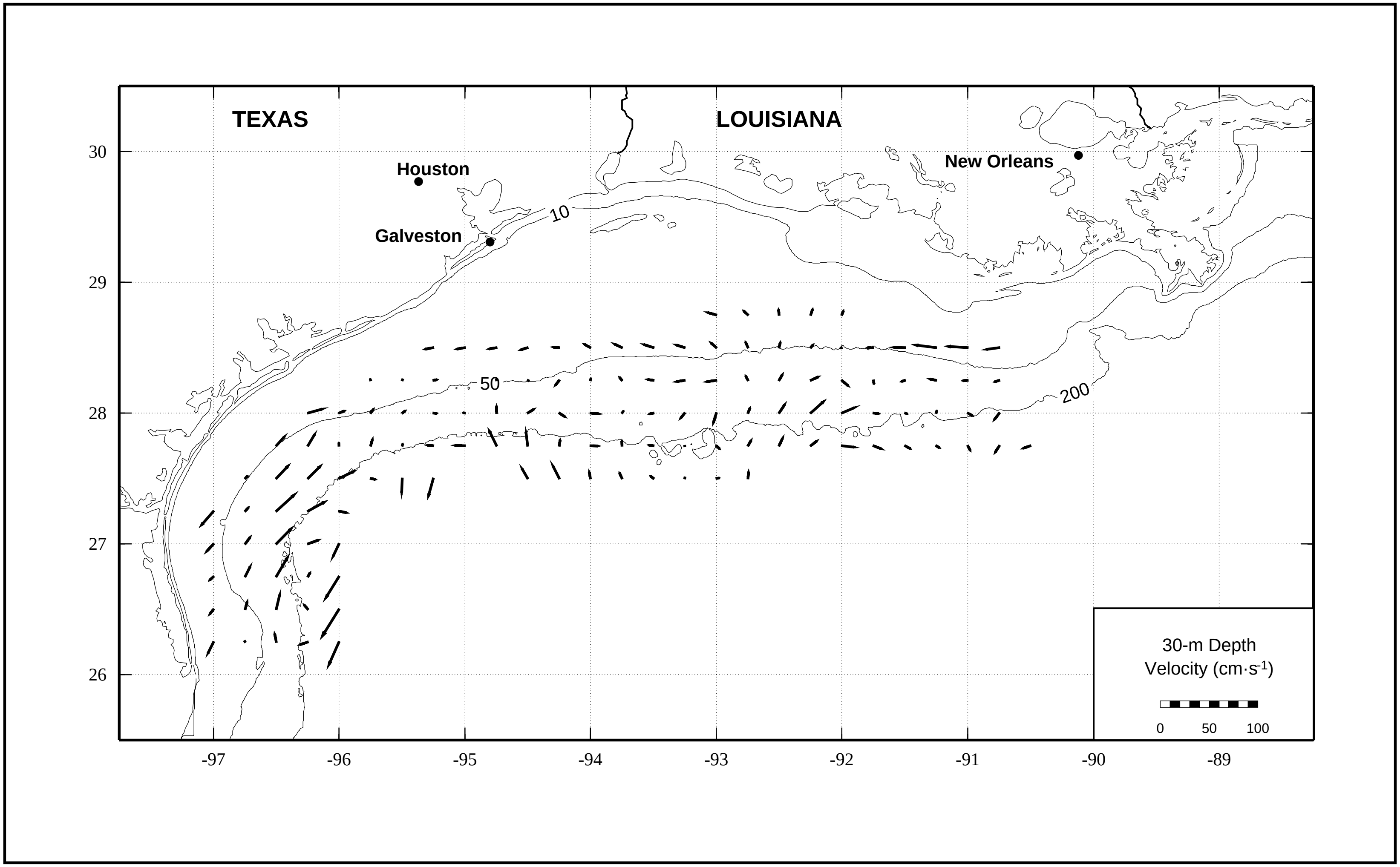

Figure 10.3.2. Objectively analyzed ADCP currents measured at the 4-m bin centered at approximately the 30 m depth. The data are from LATEX A cruise H10 conducted in November 1994

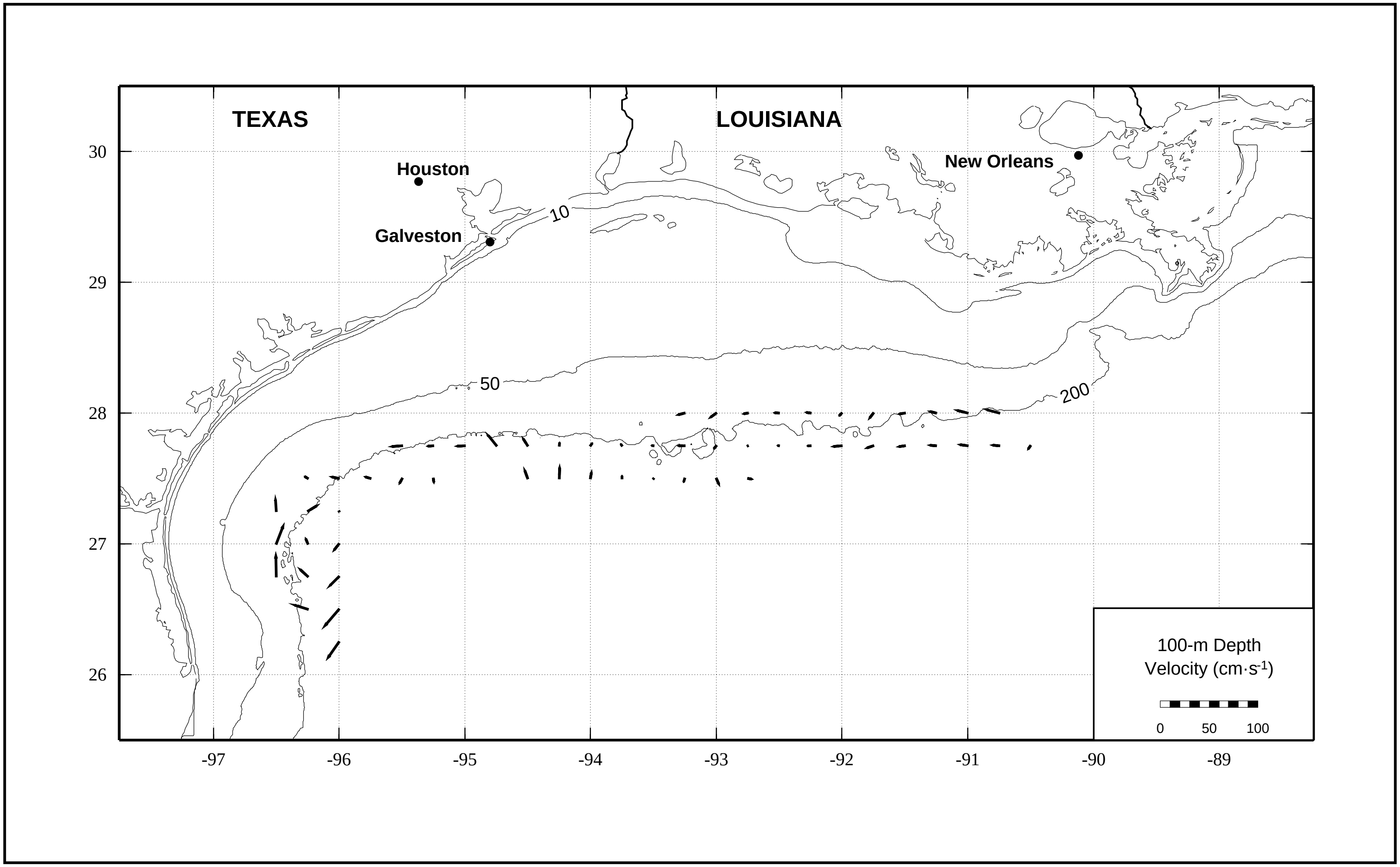

Figure 10.3.3. Objectively analyzed ADCP currents measured at approximately the 100 m depth. The data are from LATEX A cruise H10 conducted in November 1994

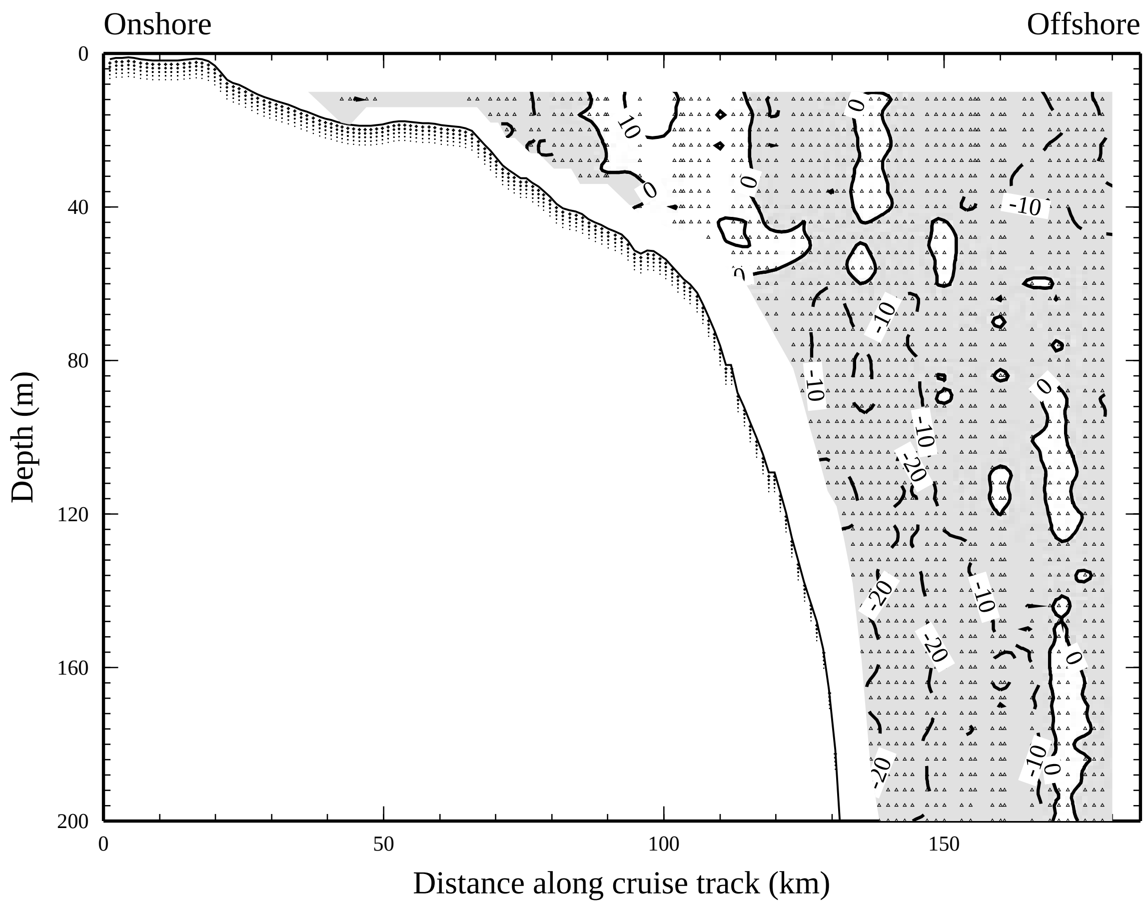

Figure 10.4.1. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 1 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

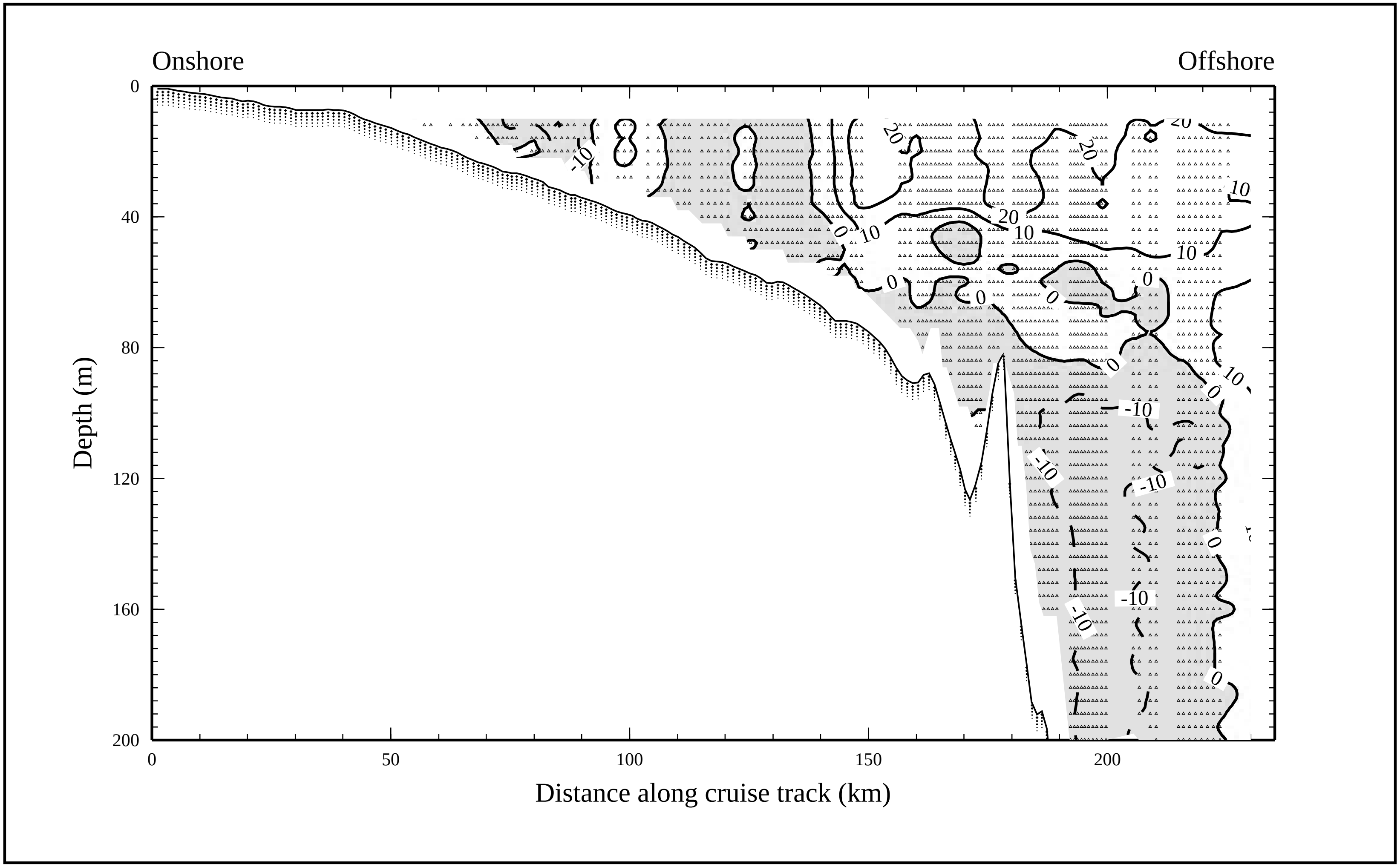

Figure 10.4.2. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 2 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

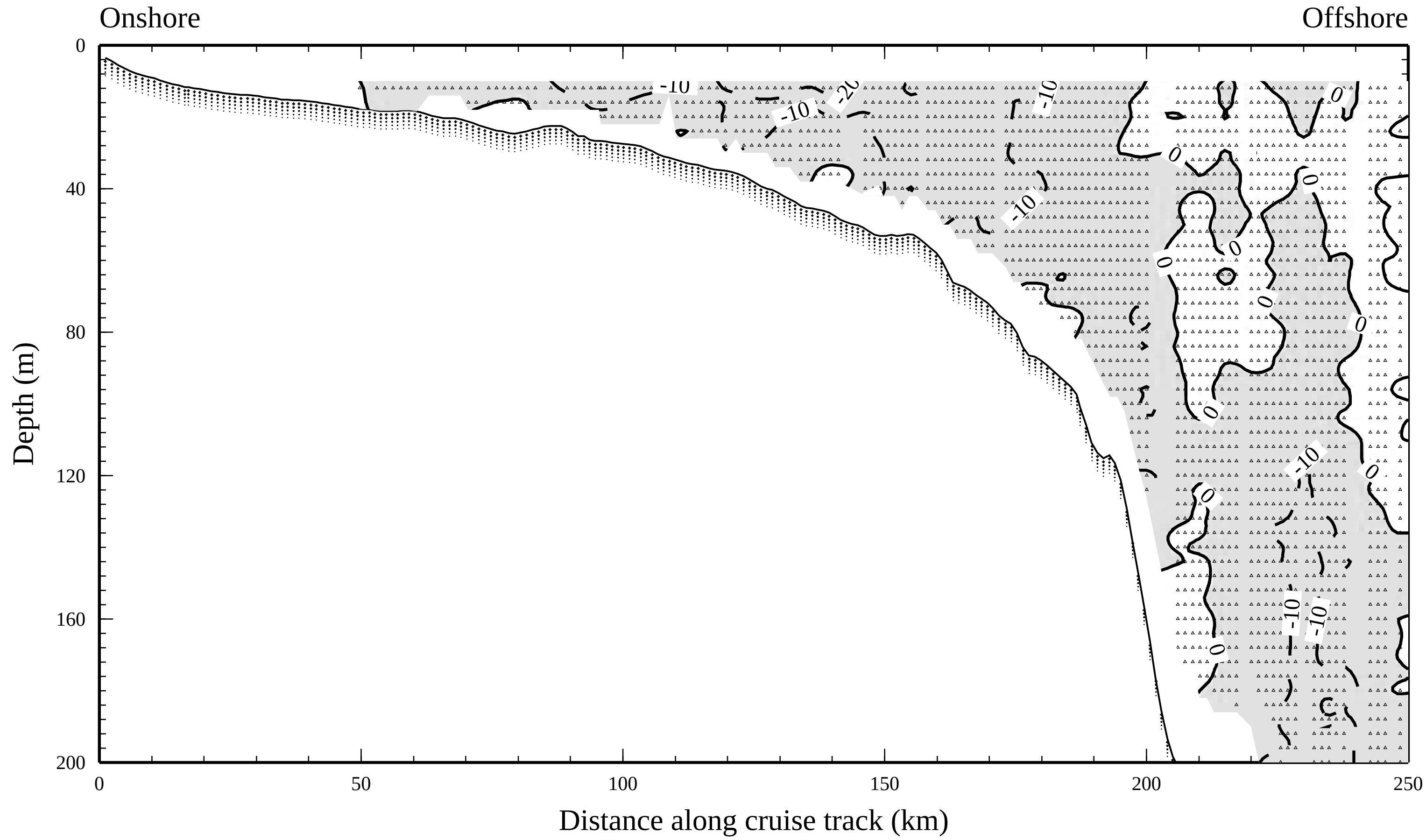

Figure 10.4.3. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 3 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

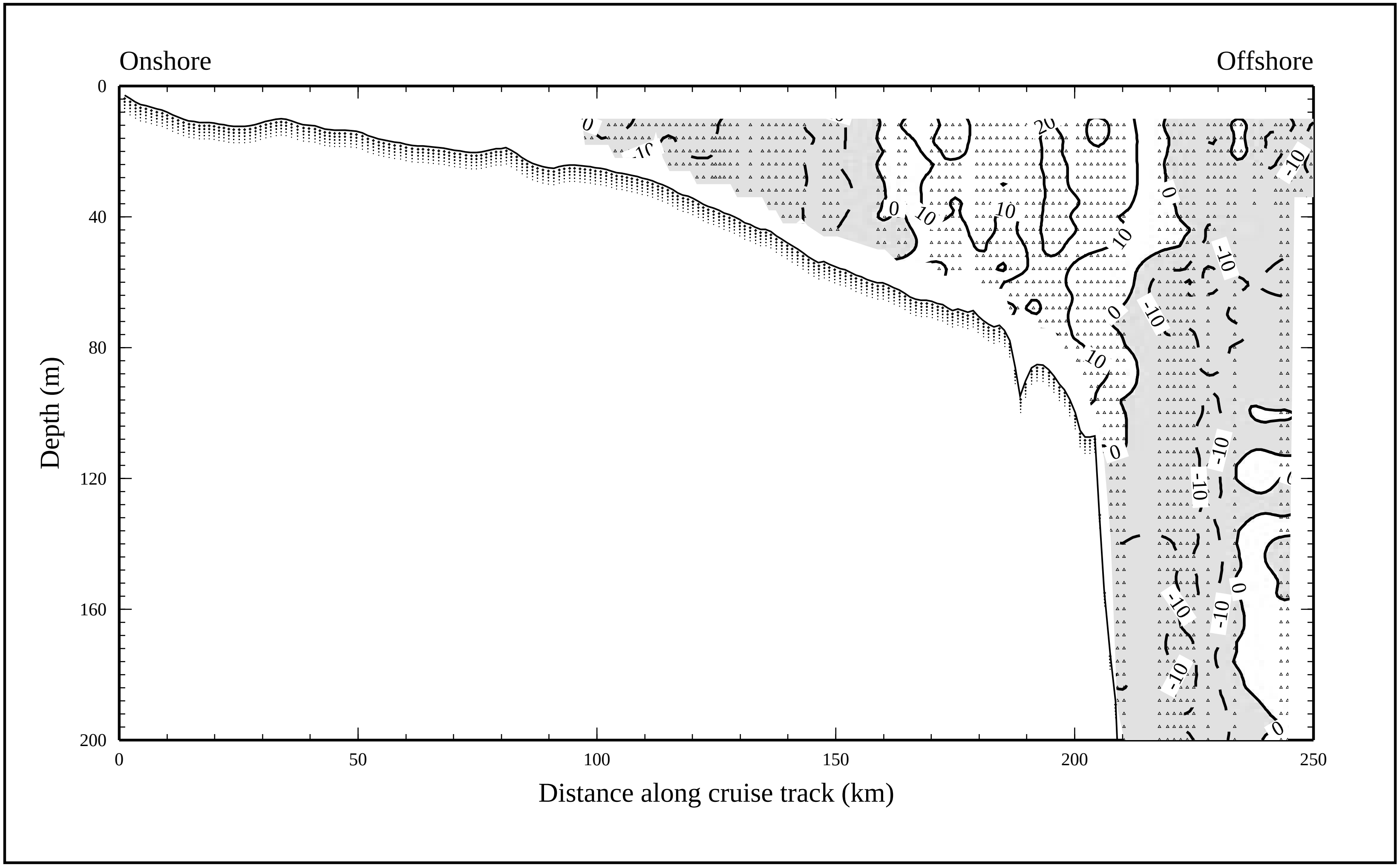

Figure 10.4.4. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 4 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

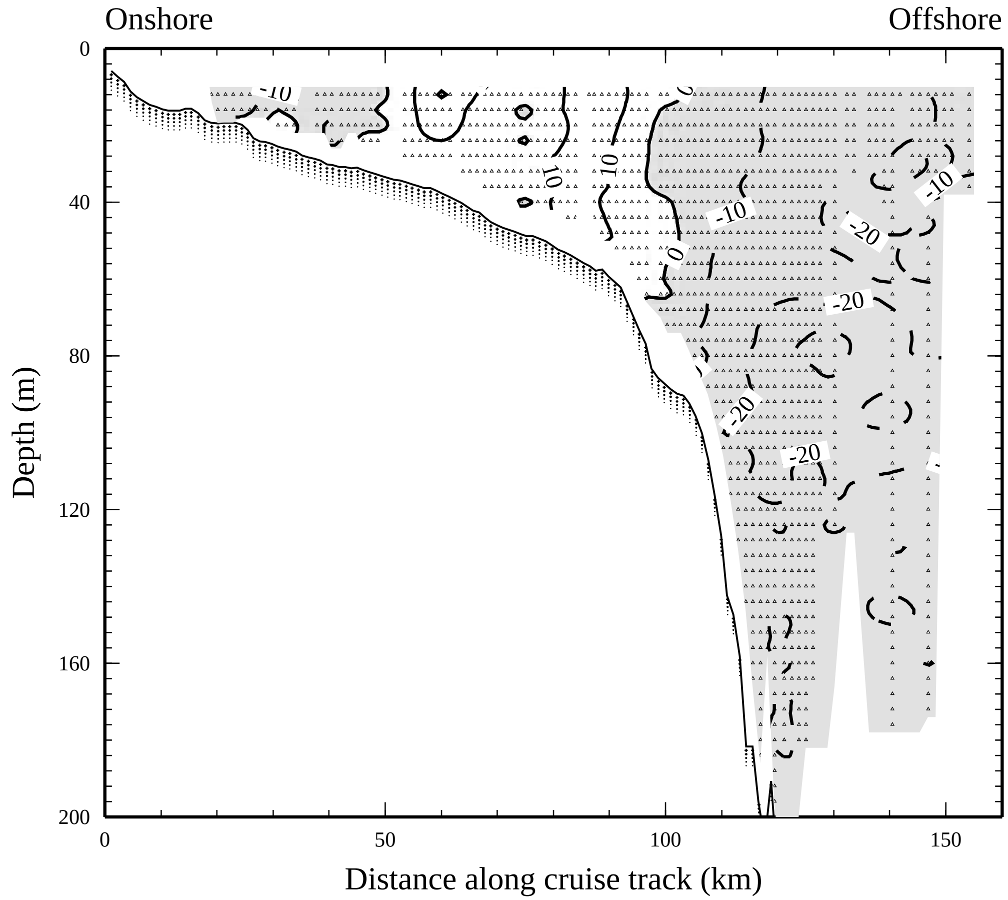

Figure 10.4.5. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 5 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

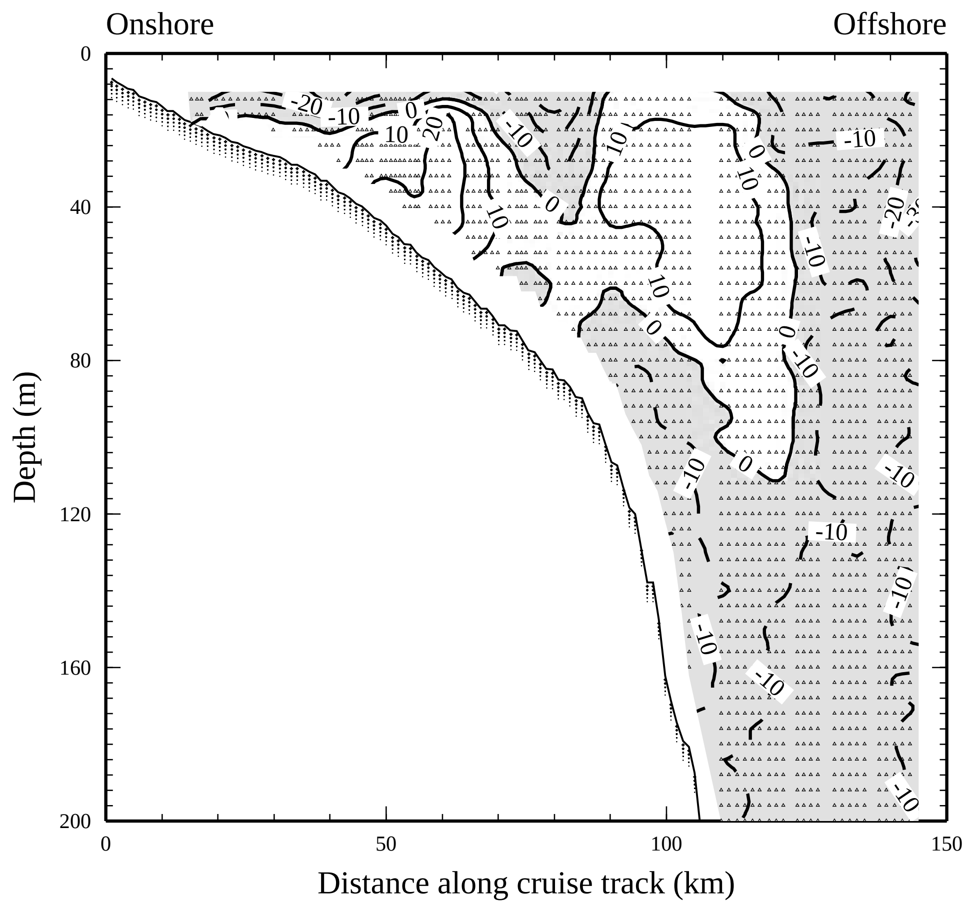

Figure 10.4.6. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 6 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

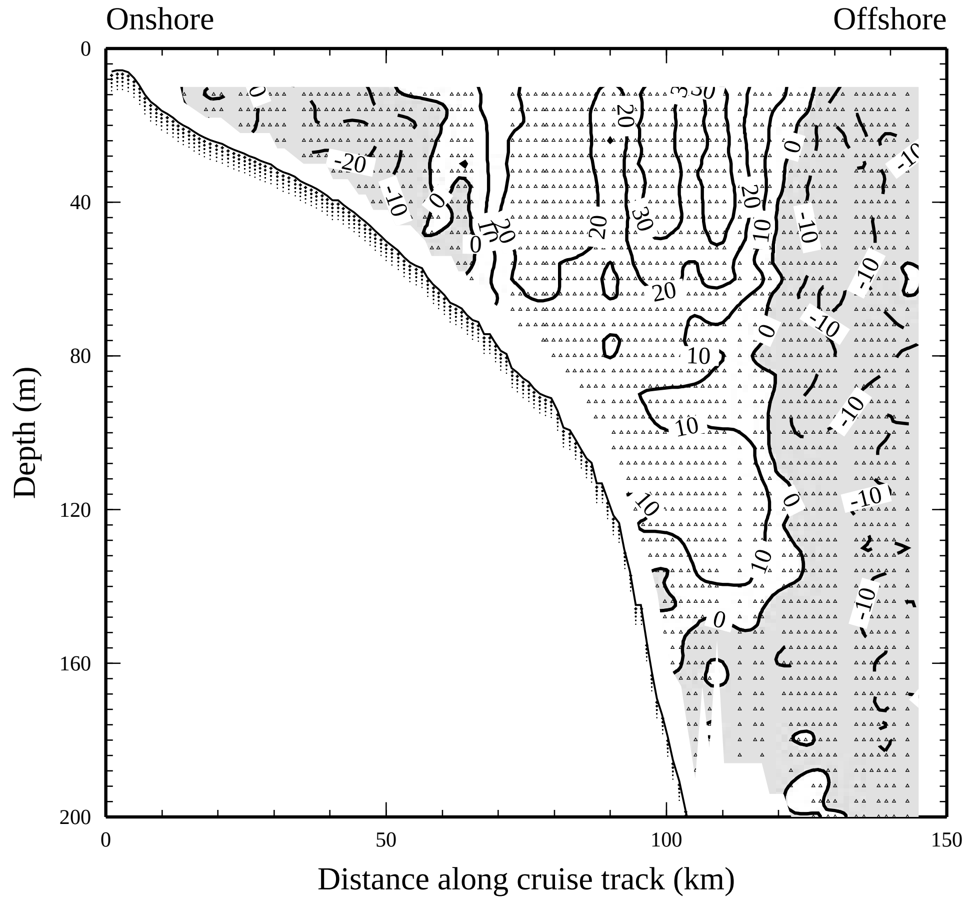

Figure 10.4.7. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 7 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

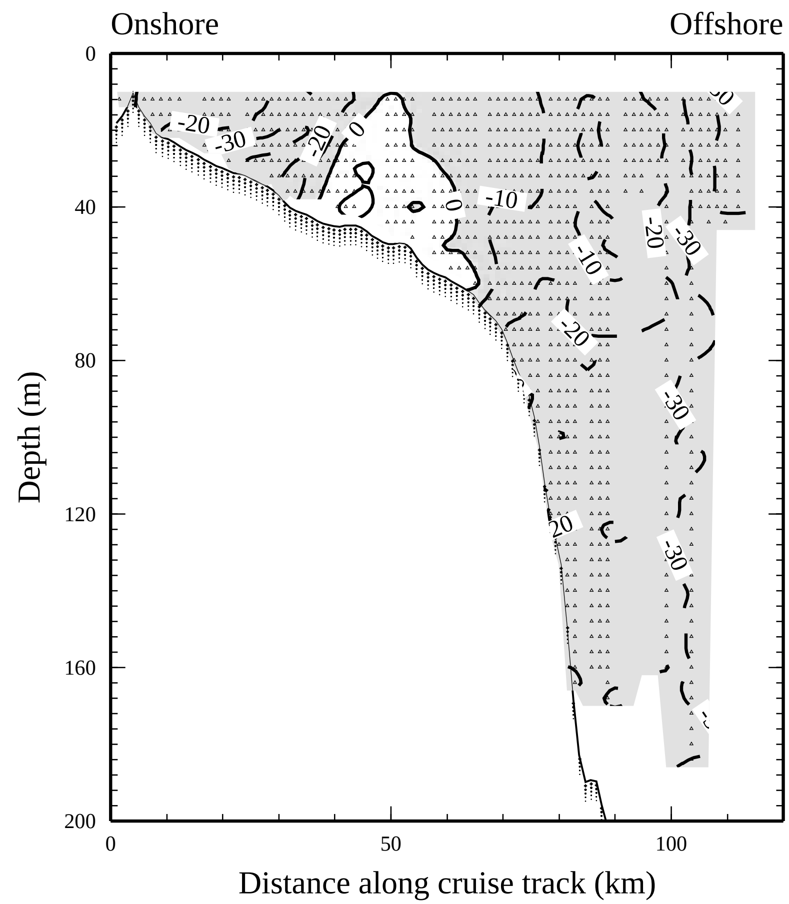

Figure 10.4.8. Vertical section of ADCP velocities ($cm \cdot s^{-1}$) normal to transect 8 for cruise H10, November 1994. Upcoast velocities (solid lines) are positive and into the page. Downcoast velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

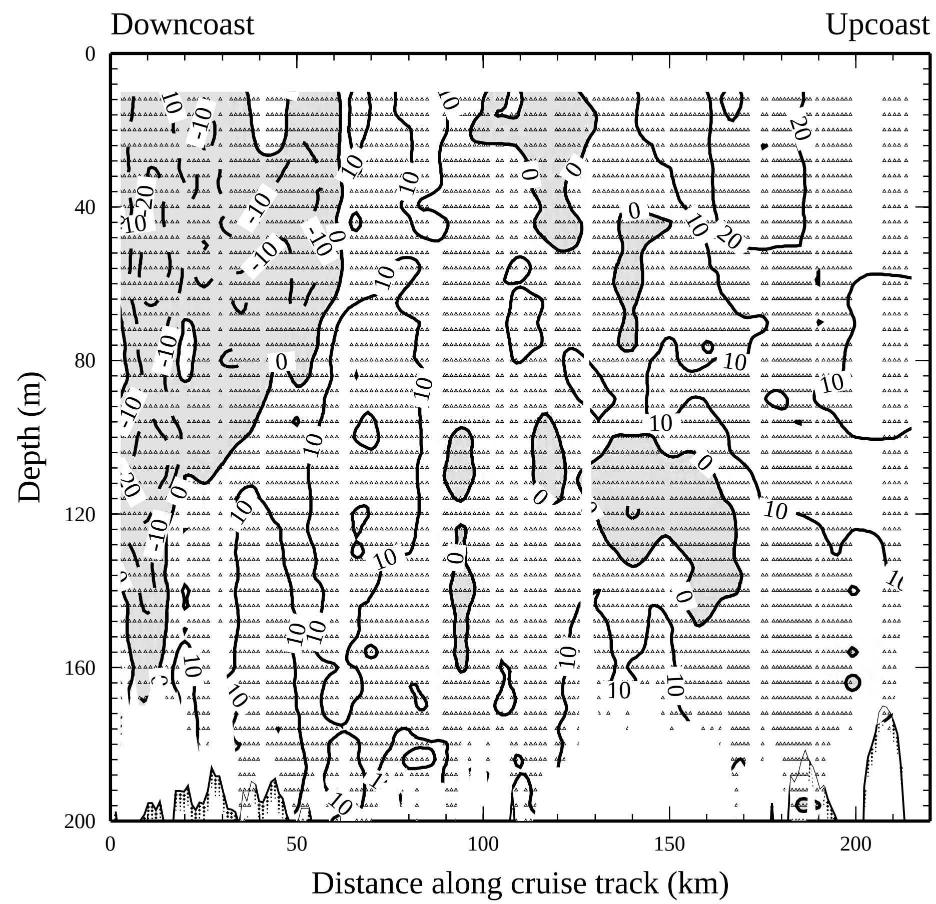

Figure 10.4.9. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 9 for cruise H10, November 1994. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

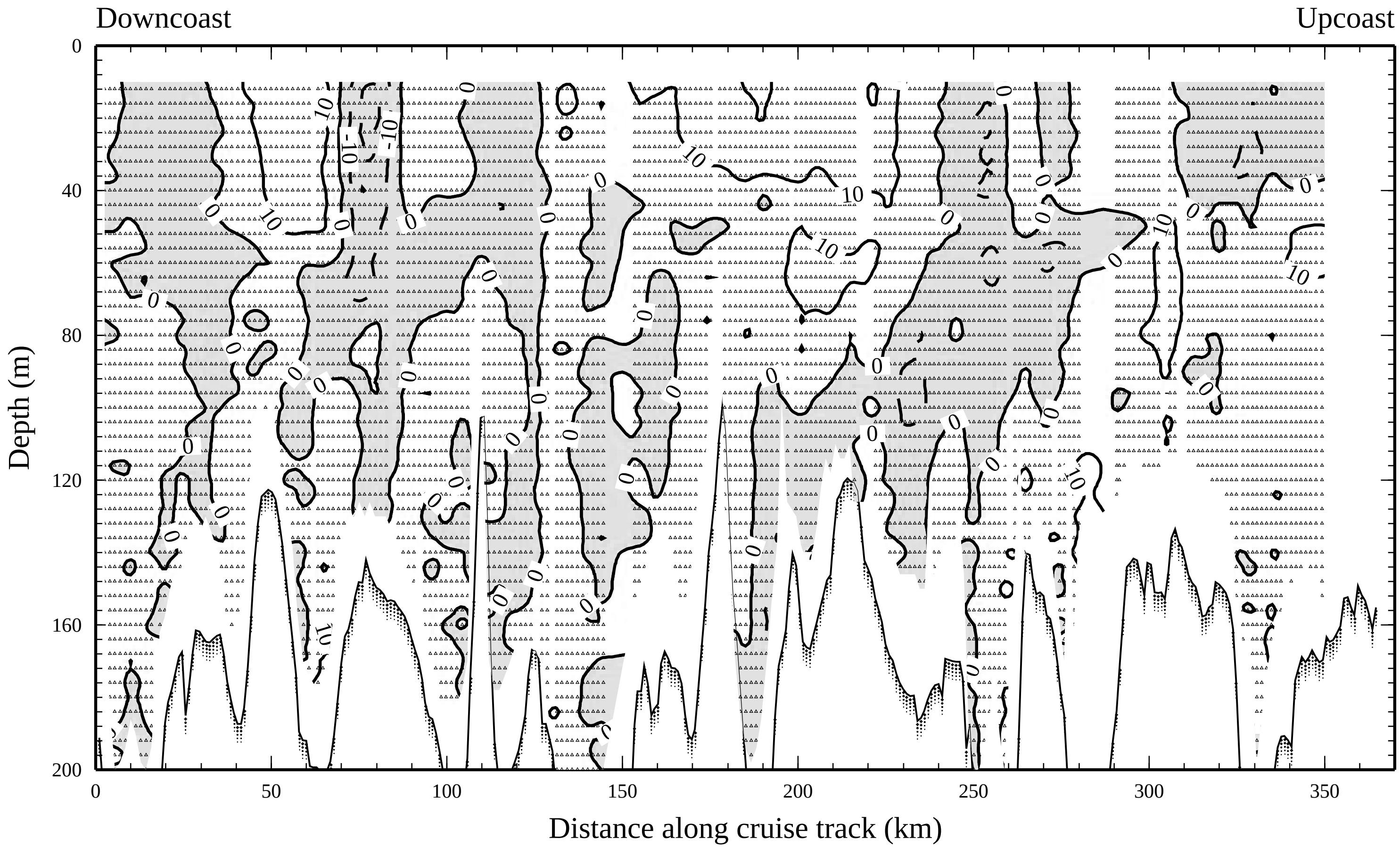

Figure 10.4.10. Vertical section of ADCP velocities (cm·s^{-1}) normal to transect 10 for cruise H10, November 1994. Onshore velocities (solid lines) are positive and into the page. Offshore velocities (dotted lines, shaded) are negative and out of the page. Ensemble locations are marked with a small triangle. Velocity contours extrapolated beyond regions of data coverage should be viewed cautiously.

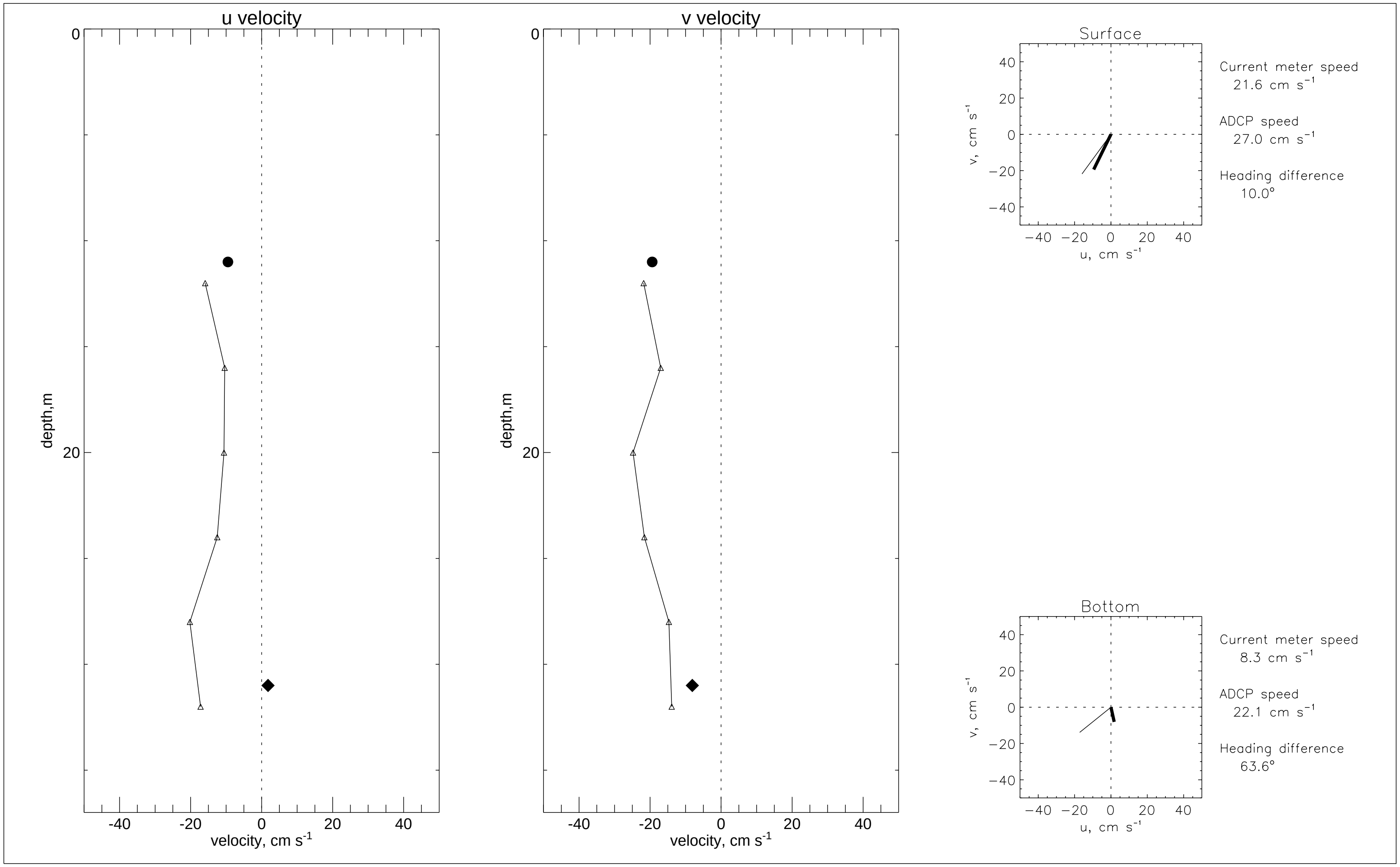

Figure 10.5.02. ADCP profile taken on 10 November 1994 at 2304 UTC (cruise H10) while passing by mooring CM02 at a distance of 6.5 km. Velocities for the surface meter (11 m) are marked with a circle and were recorded on 10 November 1994 at 2300 UTC. Velocities for the bottom meter (31 m) are marked with a diamond and were recorded on 10 November 1994 at 2305 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

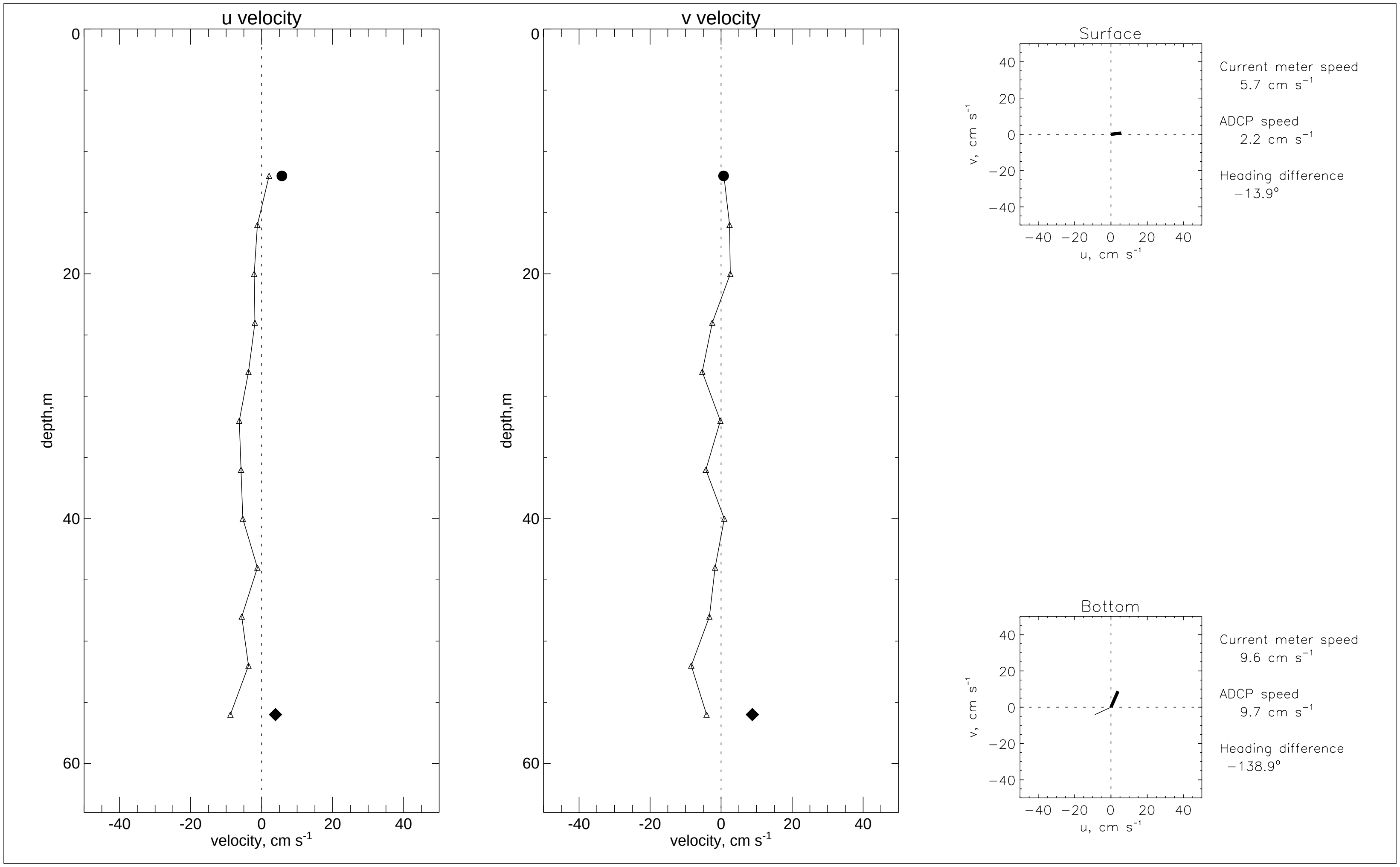

Figure 10.5.03. ADCP profile taken on 11 November 1994 at 0114 UTC (cruise H10) while passing by mooring CM03 at a distance of 9.8 km. Velocities for the surface meter (12 m) are marked with a circle and were recorded on 11 November 1994 at 0100 UTC. Velocities for the bottom meter (56 m) are marked with a diamond and were recorded on 11 November 1994 at 0100 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

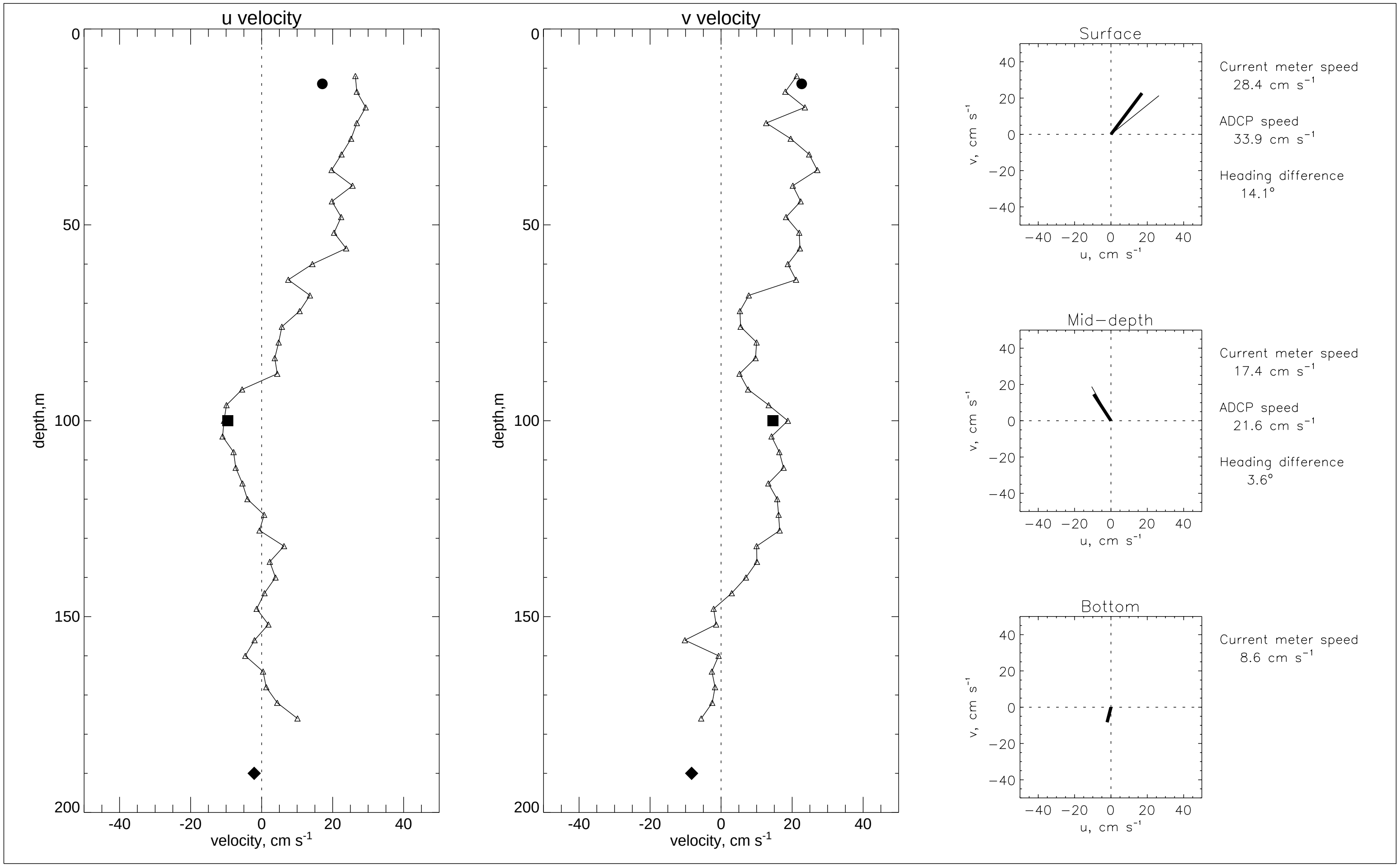

Figure 10.5.04. ADCP profile taken on 11 November 1994 at 0535 UTC (cruise H10) while passing by mooring CM04 at a distance of 1.0 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 11 November 1994 at 0530 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 11 November 1994 at 0530 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 11 November 1994 at 0530 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

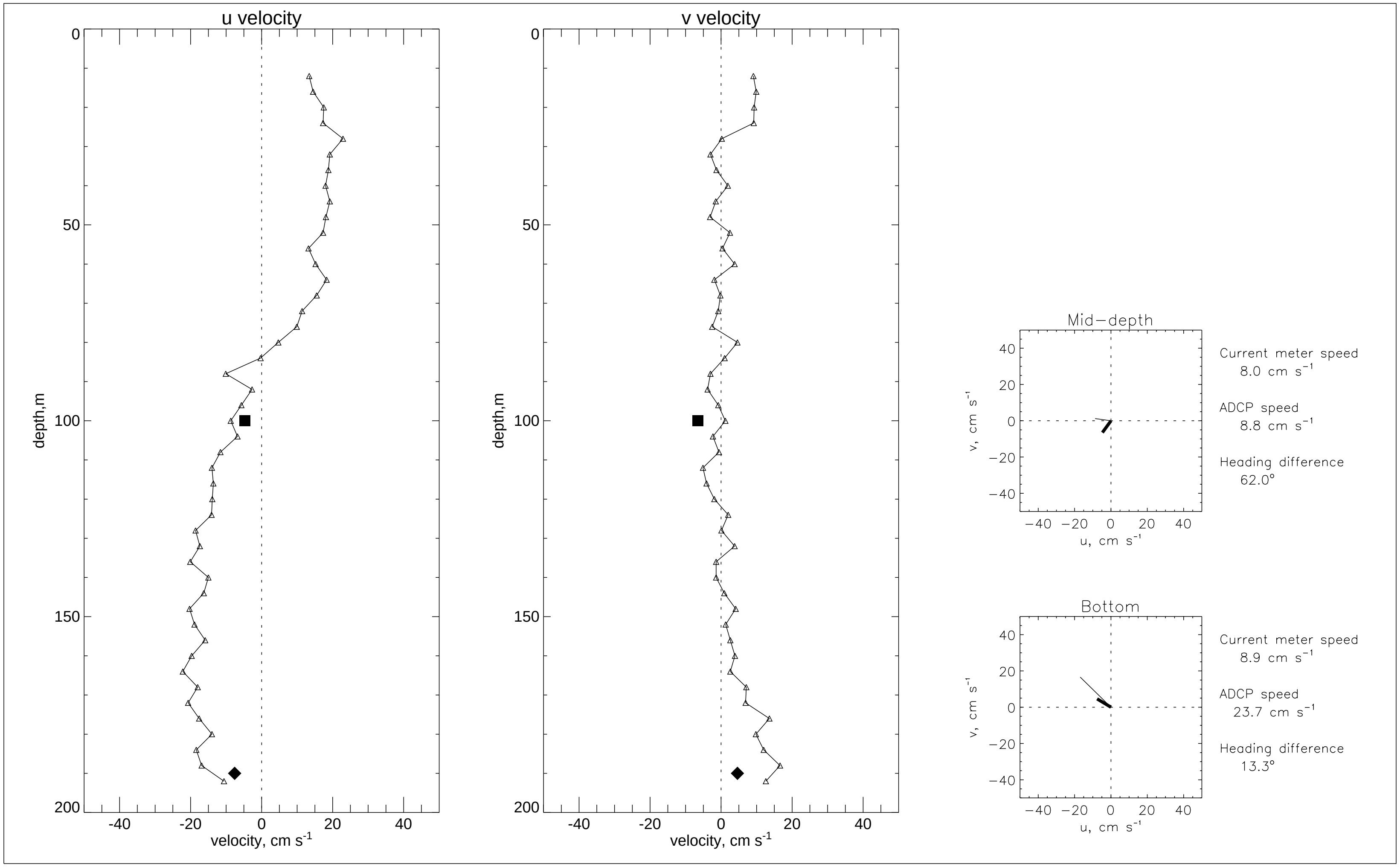

Figure 10.5.05. ADCP profile taken on 13 November 1994 at 0128 UTC (cruise H10) while passing by mooring CM05 at a distance of 1.3 km. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 13 November 1994 at 0130 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 13 November 1994 at 0130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

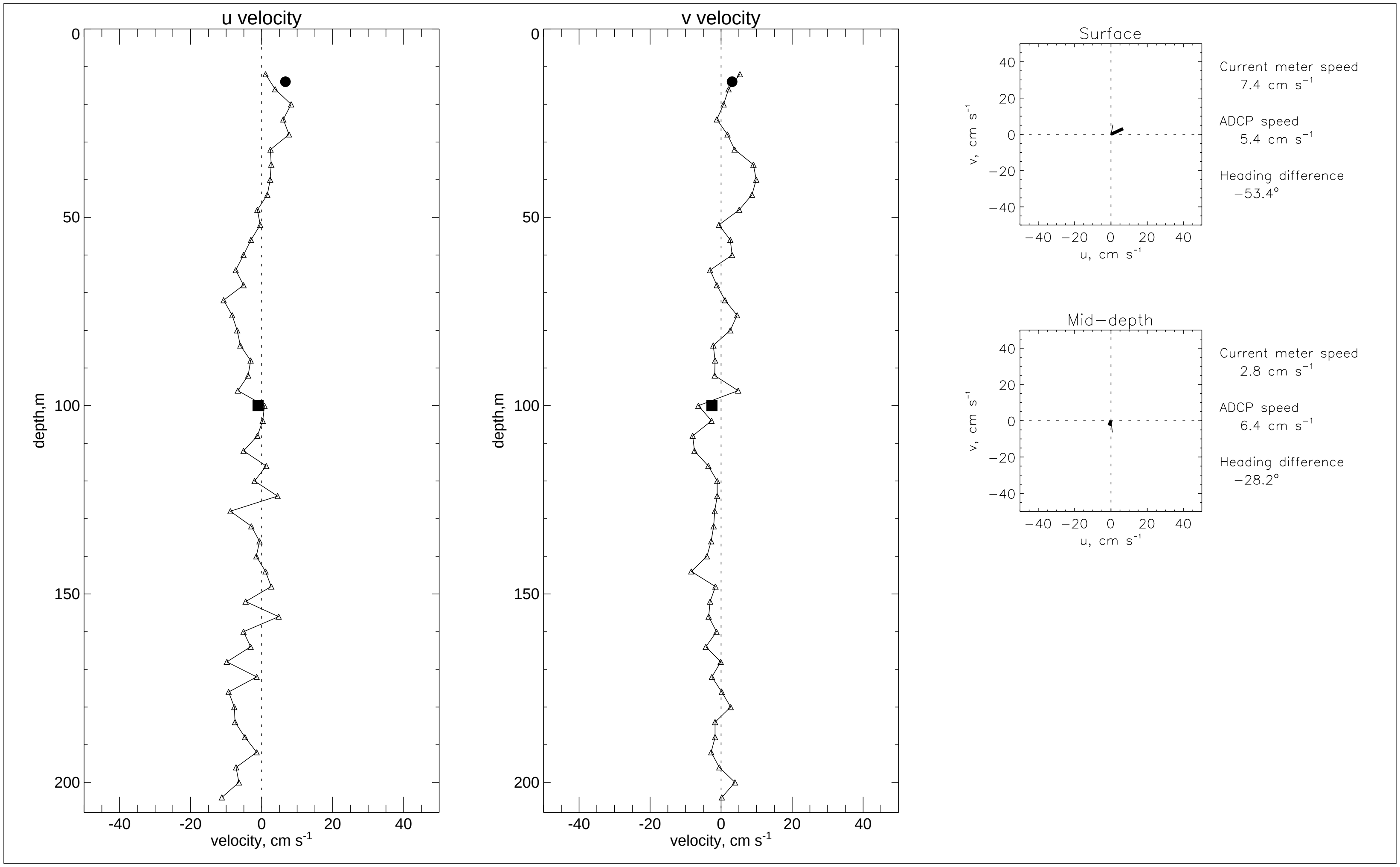

Figure 10.5.06. ADCP profile taken on 13 November 1994 at 0526 UTC (cruise H10) while passing by mooring CM06 at a distance of 3.7 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 13 November 1994 at 0530 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 13 November 1994 at 0530 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

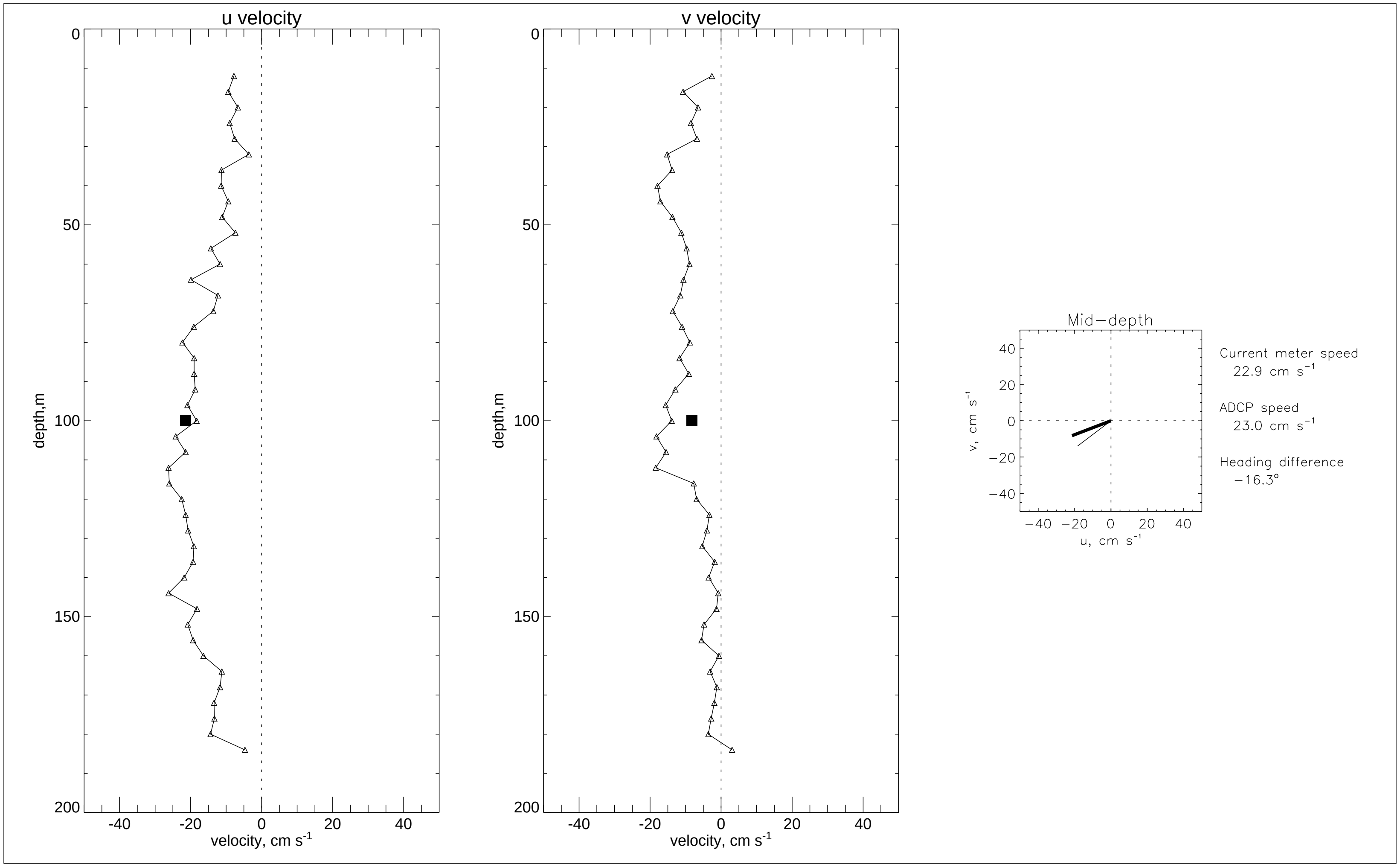

Figure 10.5.07. ADCP profile taken on 9 November 1994 at 1255 UTC (cruise H10) while passing by mooring CM07 at a distance o f 0.4 km. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 9 November 1994 at 1300 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

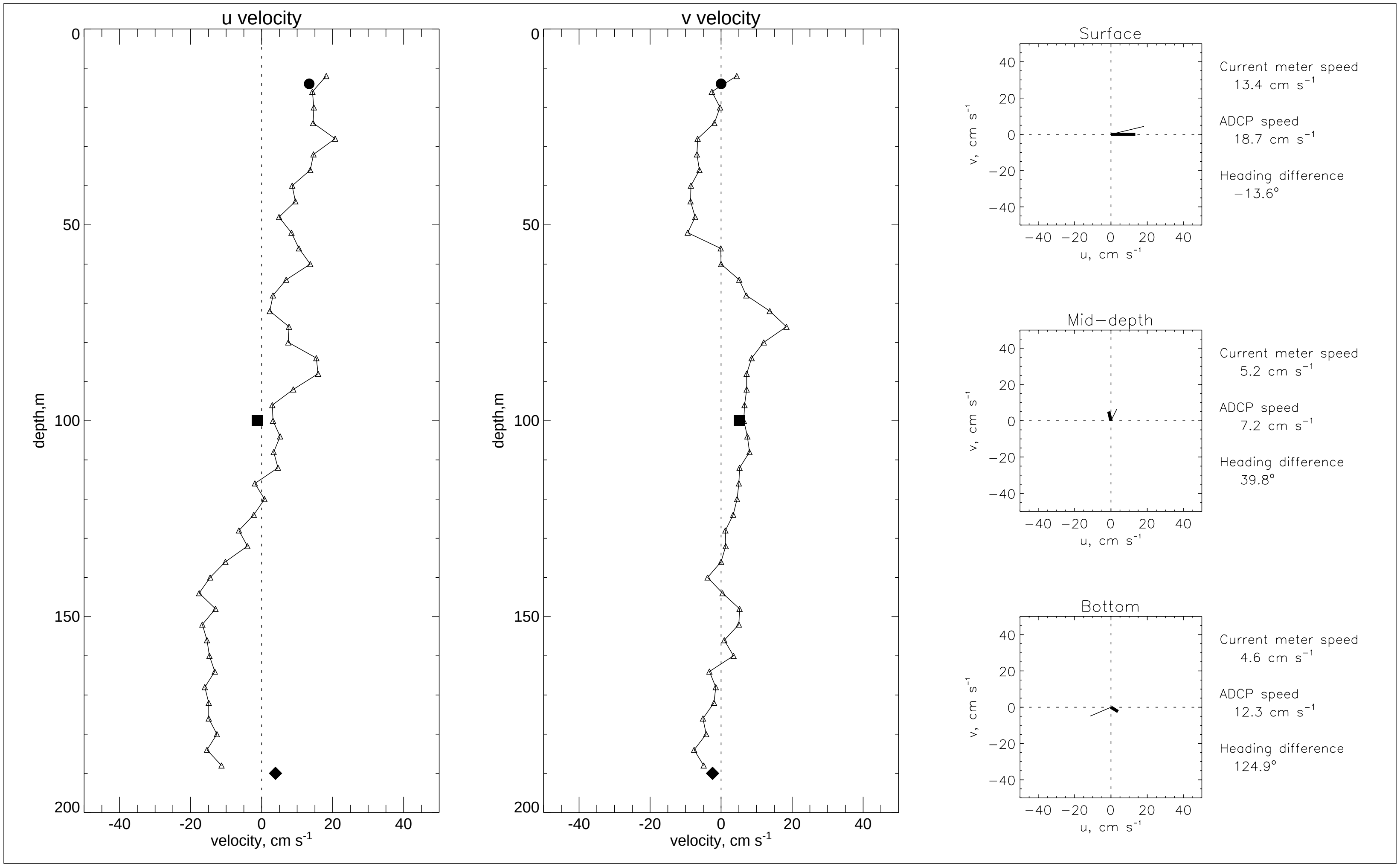

Figure 10.5.08. ADCP profile taken on 8 November 1994 at 0126 UTC (cruise H10) while passing by mooring CM08 at a distance o f 0.0 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 8 November 1994 at 0130 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 8 November 1994 at 0130 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 8 November 1994 at 0130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

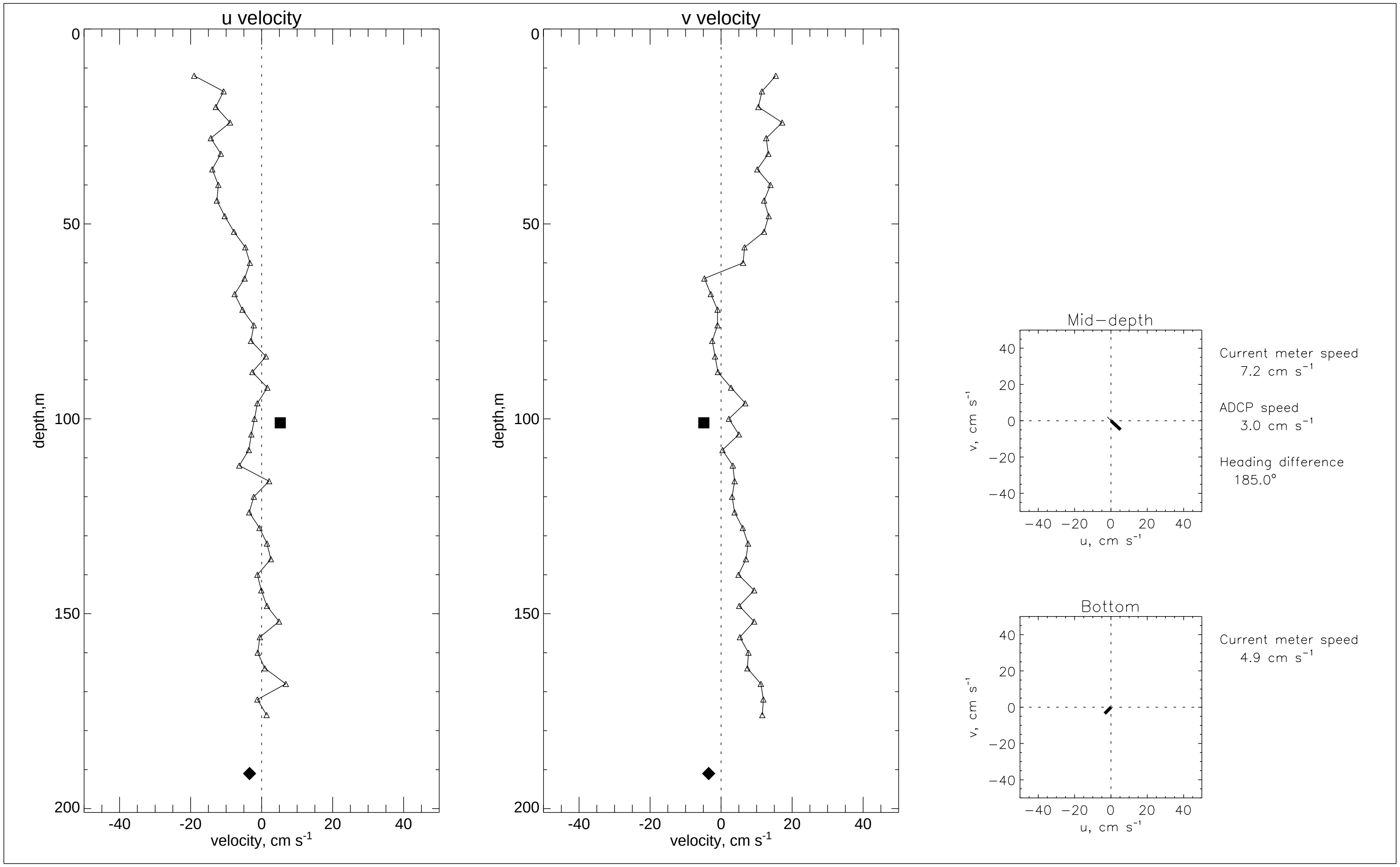

Figure 10.5.09. ADCP profile taken on 2 November 1994 at 1946 UTC (cruise H10) while passing by mooring CM09 at a distance o f 0.9 km. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 2 November 1994 at 2000 UTC. Velocities for the bottom meter (191 m) are marked with a diamond and were recorded on 2 November 1994 at 2000 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

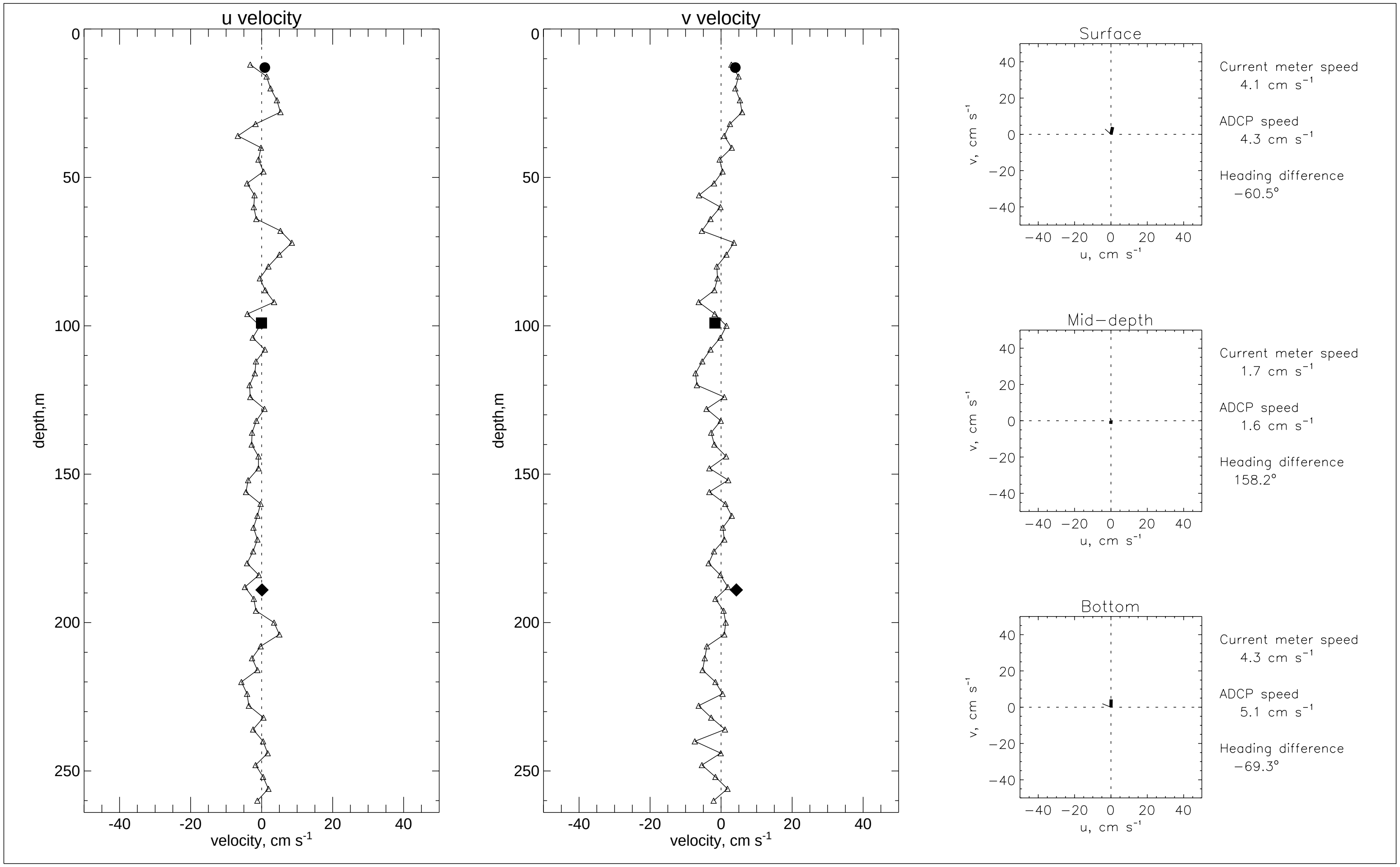

Figure 10.5.10. ADCP profile taken on 3 November 1994 at 0141 UTC (cruise H10) while passing by mooring CM10 at a distance o f 3.8 km. Velocities for the surface meter (13 m) are marked with a circle and were recorded on 3 November 1994 at 0130 UTC. Velocities for the mid-depth meter (99 m) are marked with a square and were recorded on 3 November 1994 at 0130 UTC. Velocities for the bottom meter (189 m) are marked with a diamond and were recorded on 3 November 1994 at 0130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

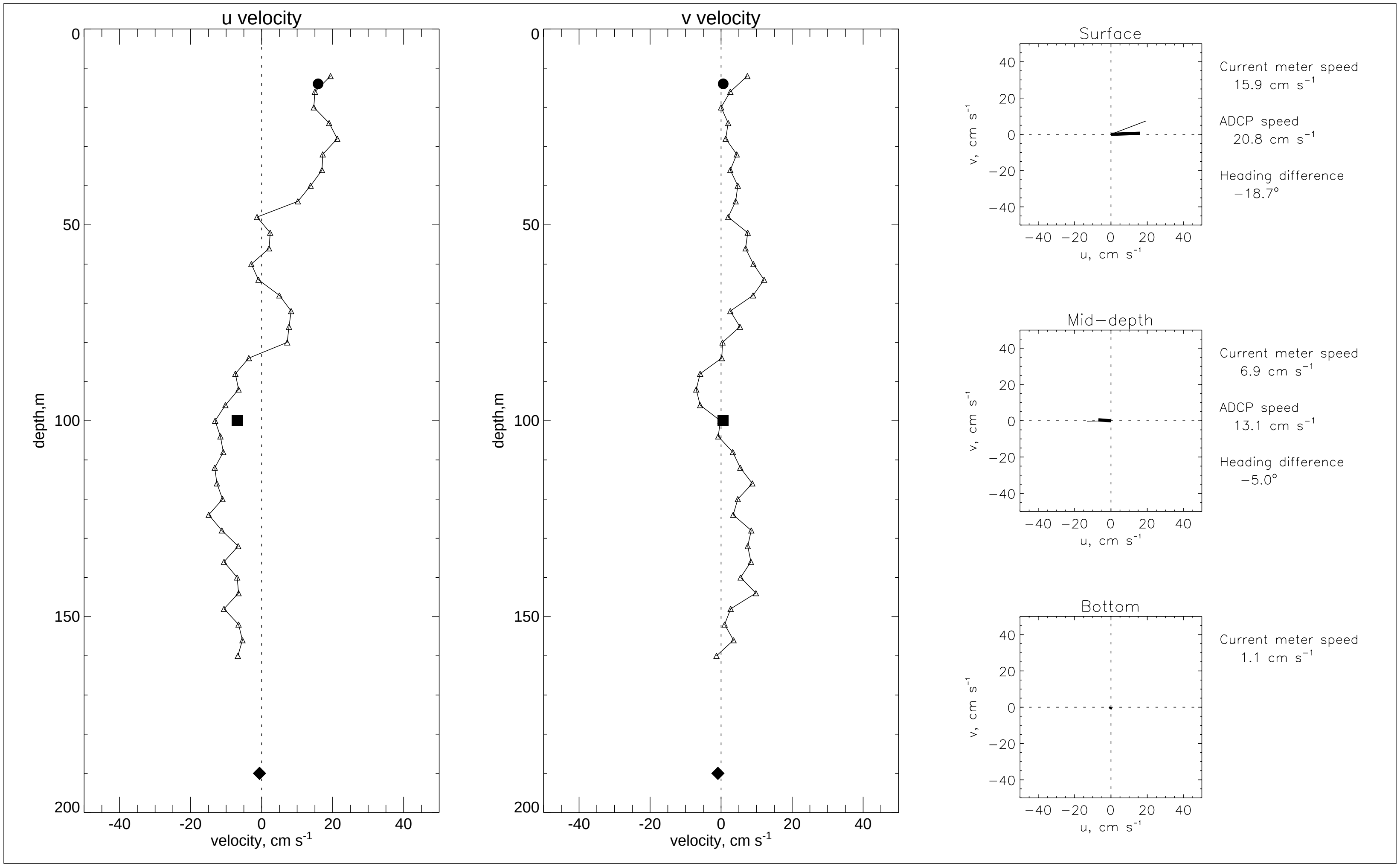

Figure 10.5.11. ADCP profile taken on 5 November 1994 at 1727 UTC (cruise H10) while passing by mooring CM11 at a distance o f 1.4 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 5 November 1994 at 1730 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 5 November 1994 at 1730 UTC. Velocities for the bottom meter (190 m) are marked with a diamond and were recorded on 5 November 1994 at 1730 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

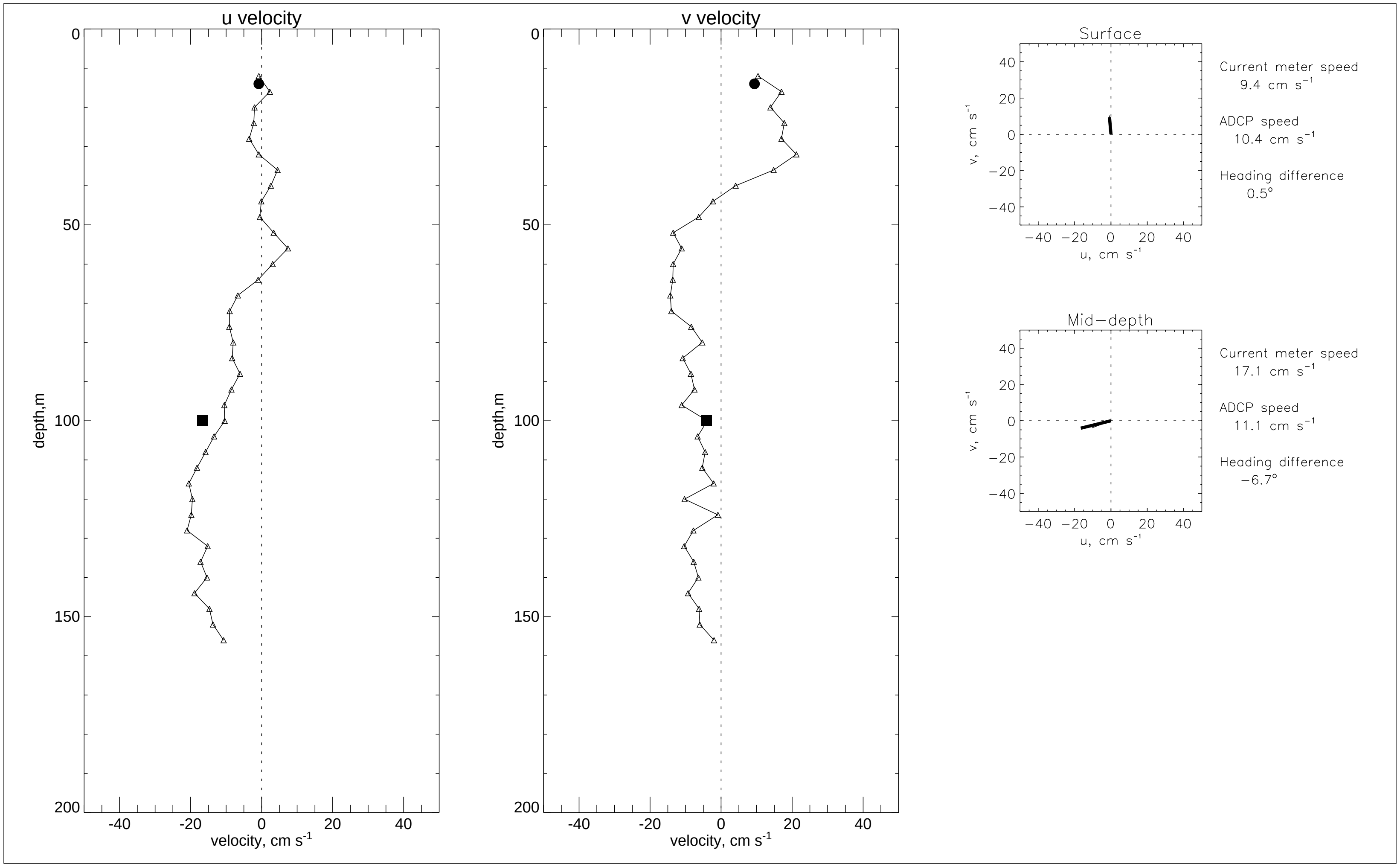

Figure 10.5.13. ADCP profile taken on 4 November 1994 at 0516 UTC (cruise H10) while passing by mooring CM13 at a distance o f 1.5 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 4 November 1994 at 0530 UTC. Velocities for the mid-depth meter (100 m) are marked with a square and were recorded on 4 November 1994 at 0530 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

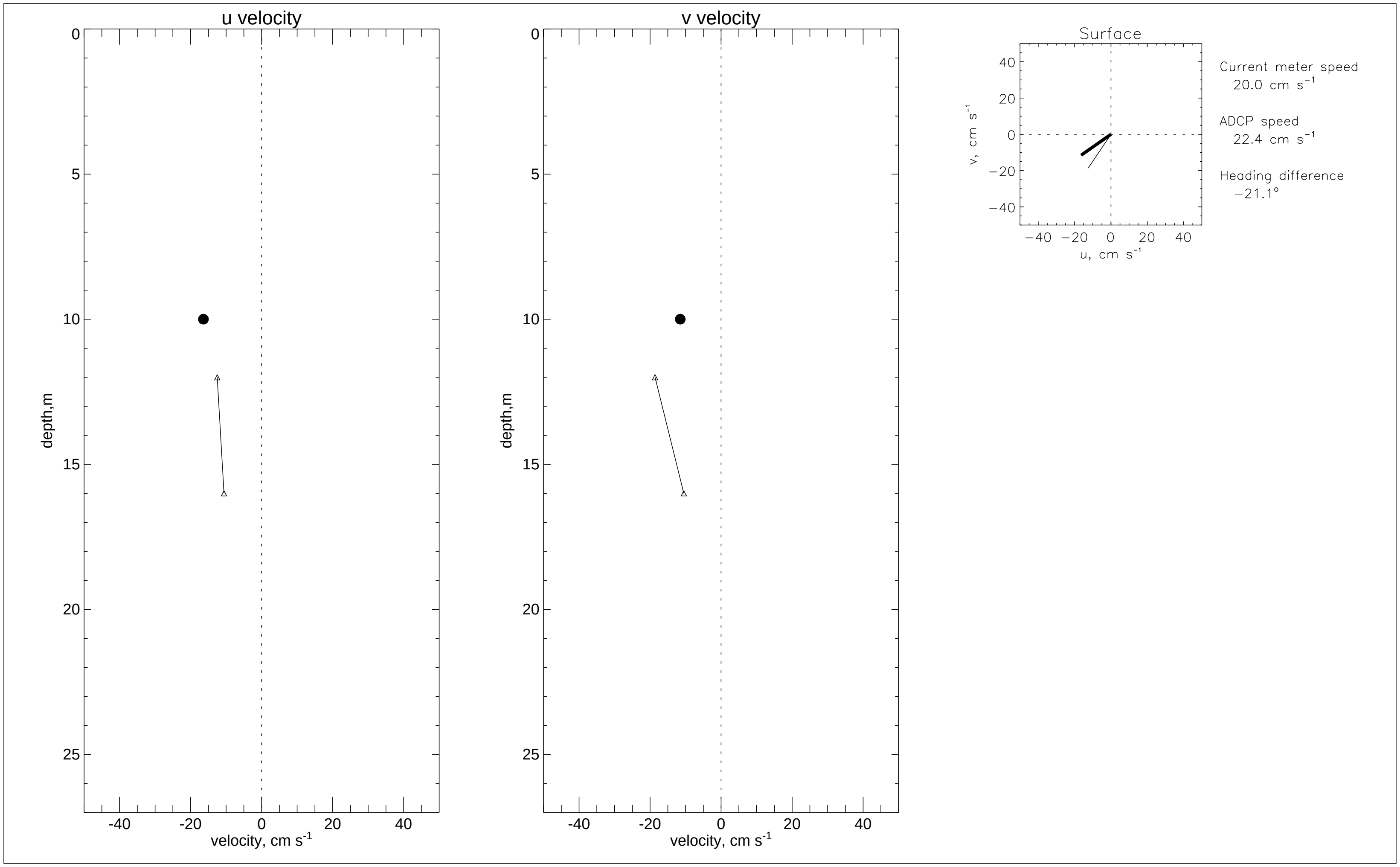

Figure 10.5.15. ADCP profile taken on 4 November 1994 at 1141 UTC (cruise H10) while passing by mooring CM15 at a distance o f 1.0 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 4 November 1994 at 1130 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

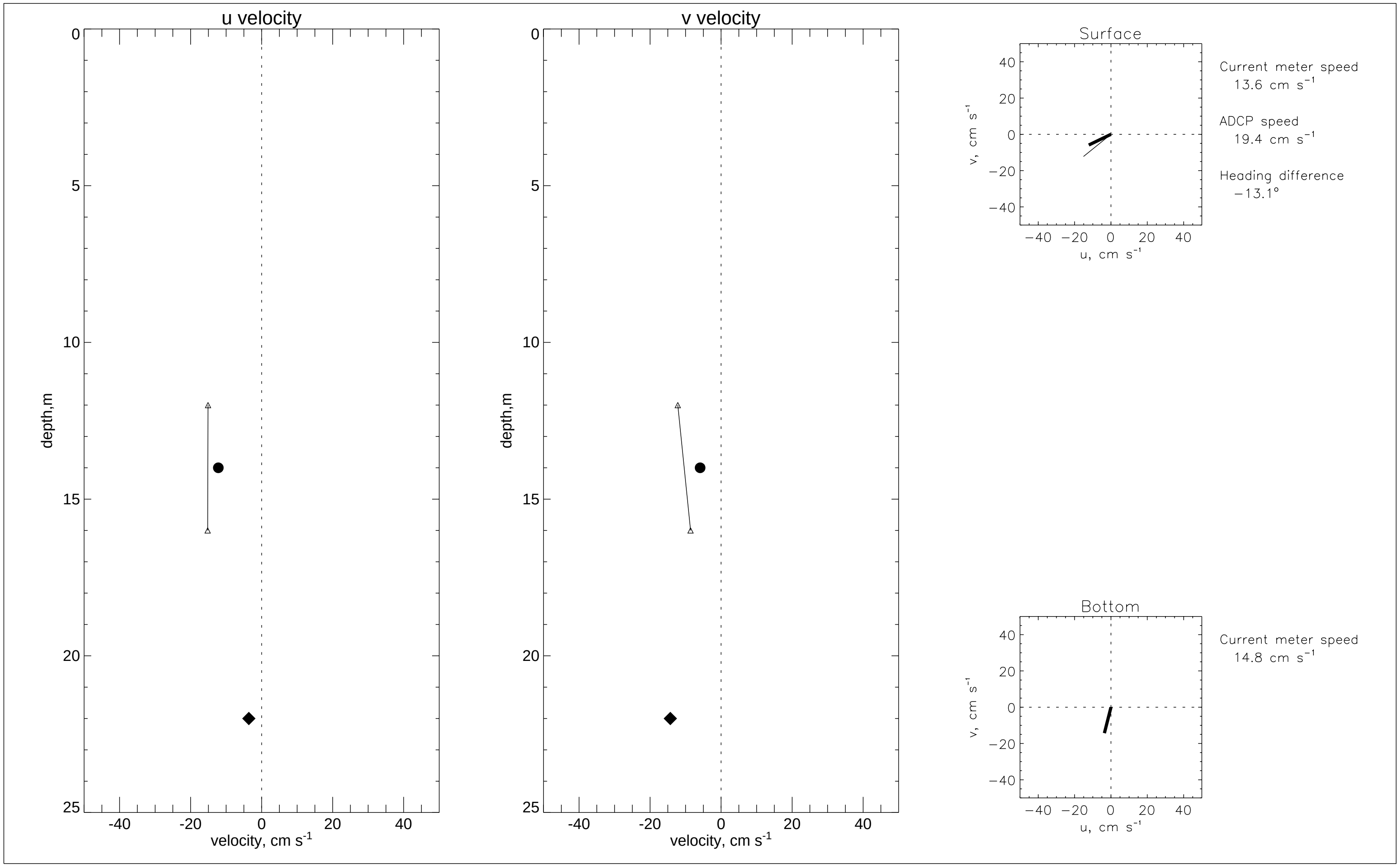

Figure 10.5.21. ADCP profile taken on 7 November 1994 at 1536 UTC (cruise H10) while passing by mooring CM21 at a distance o f 8.0 km. Velocities for the surface meter (14 m) are marked with a circle and were recorded on 7 November 1994 at 1530 UTC. Velocities for the bottom meter (22 m) are marked with a diamond and were recorded on 7 November 1994 at 1535 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

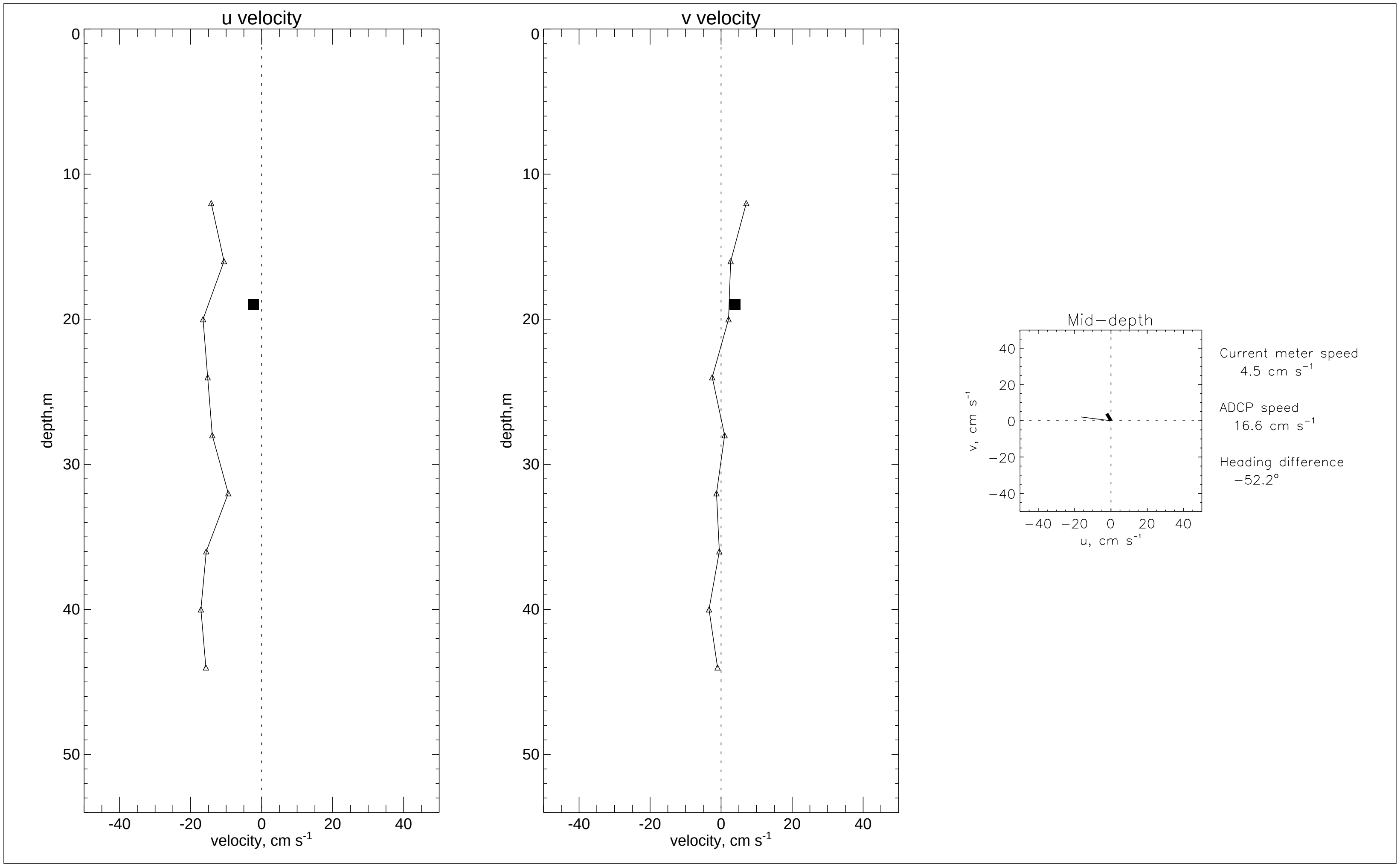

Figure 10.5.22. ADCP profile taken on 7 November 1994 at 2016 UTC (cruise H10) while passing by mooring CM22 at a distance o f 4.6 km. Velocities for the mid-depth meter (19 m) are marked with a square and were recorded on 7 November 1994 at 2030 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

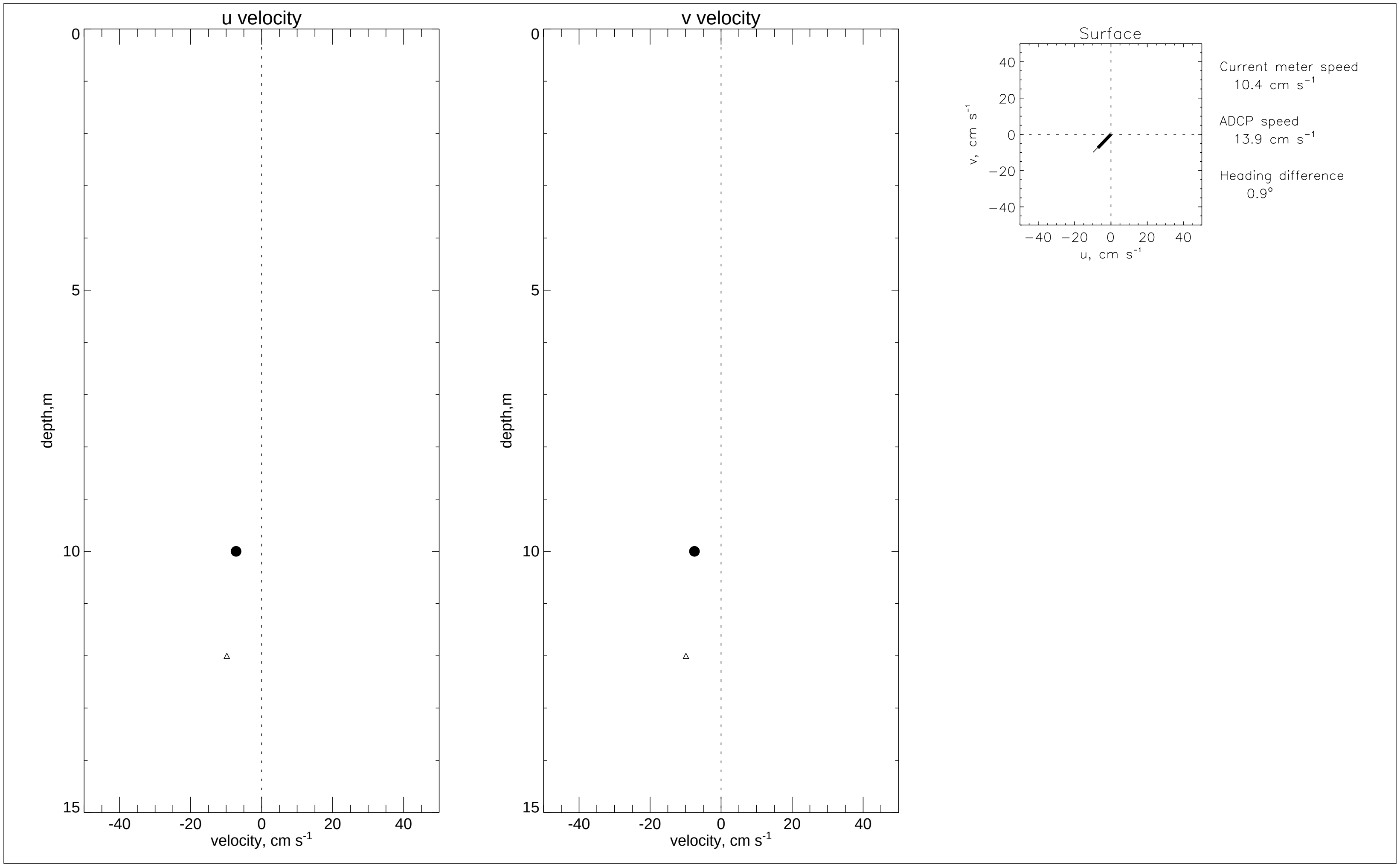

Figure 10.5.23. ADCP profile taken on 9 November 1994 at 0335 UTC (cruise H10) while passing by mooring CM23 at a distance o f 7.8 km. Velocities for the surface meter (10 m) are marked with a circle and were recorded on 9 November 1994 at 0330 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

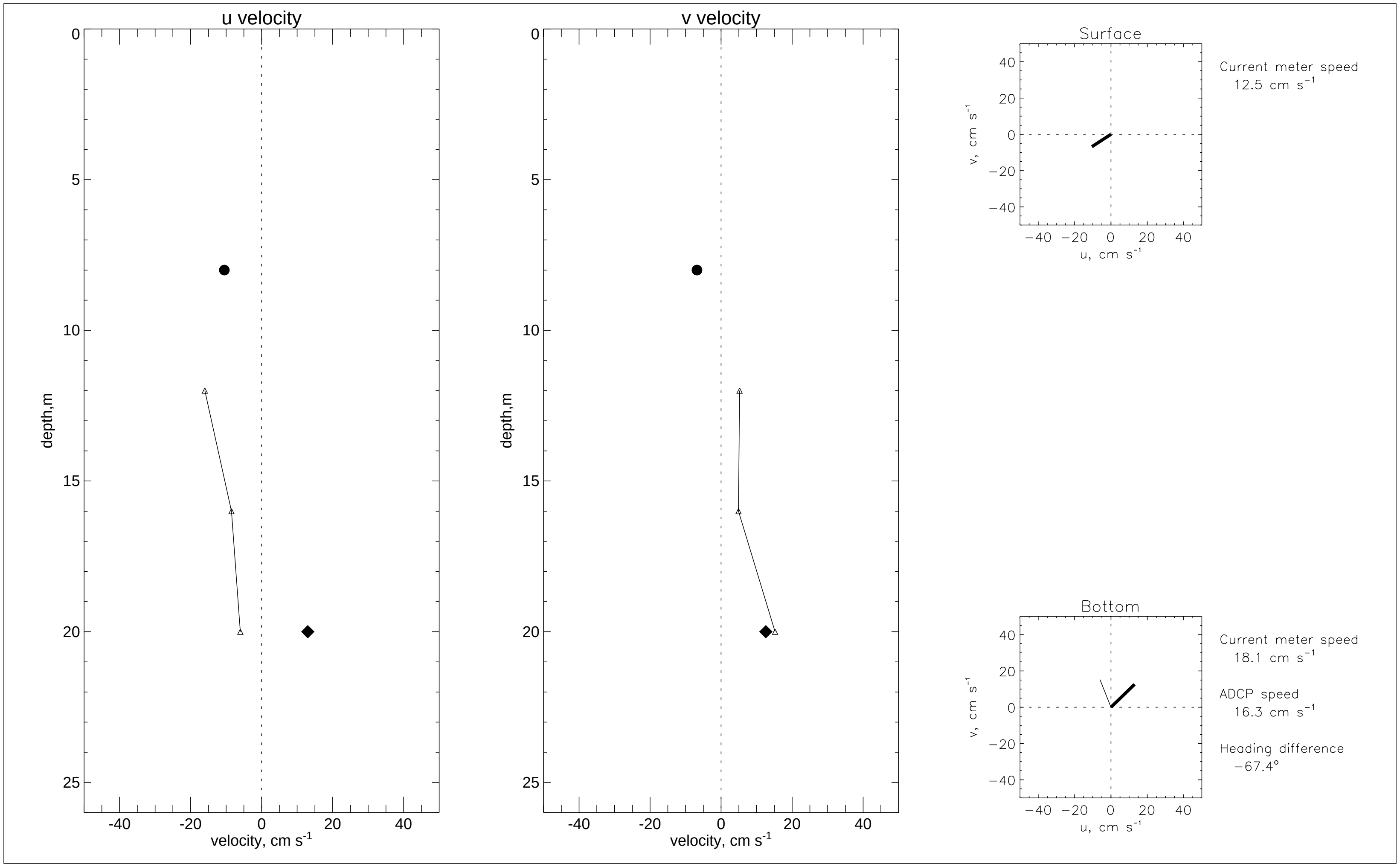

Figure 10.5.24. ADCP profile taken on 9 November 1994 at 0455 UTC (cruise H10) while passing by mooring CM24 at a distance o f 3.7 km. Velocities for the surface meter (8 m) are marked with a circle and were recorded on 9 November 1994 at 0500 UTC. Velocities for the bottom meter (20 m) are marked with a diamond and were recorded on 9 November 1994 at 0455 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

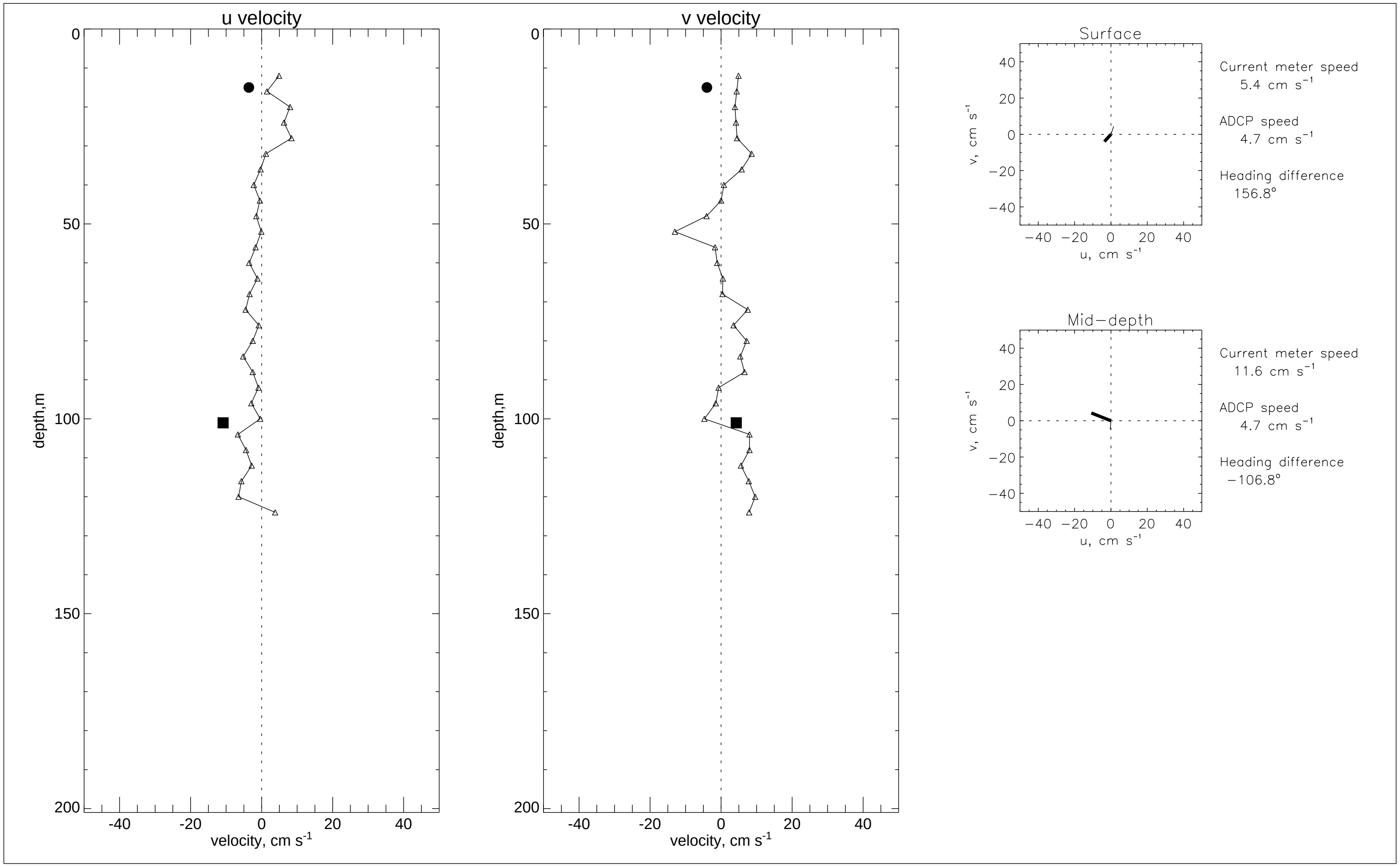

Figure 10.5.48. ADCP profile taken on 3 November 1994 at 1417 UTC (cruise H10) while passing by mooring CM48 at a distance o f 4.9 km. Velocities for the surface meter (15 m) are marked with a circle and were recorded on 3 November 1994 at 1430 UTC. Velocities for the mid-depth meter (101 m) are marked with a square and were recorded on 3 November 1994 at 1430 UTC. The left panel shows the velocity vectors for the current meter (thick line) and the corresponding ADCP bin (thin line).

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