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Moored Current Meter Data from Flemish Cap January-July, 1979

by

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INTRODUCTION

As part of the NAFO Flemish Cap Experiment a plan was developed to deploy four moored current meter strings around Flemish Cap for a period of six months in 1979. In January, 1979, the moorings were installed at the locations shown in Figure 1. These moorings were to be in place for six months in order to monitor the environment on Flemish Cap and, hopefully, the array of four moorings could act as an antenna to detect the source of any possible large-scale flushing of the Cap. However, the recovery rate in July was far from expected. Moorings 323 and 325 were not located and mooring 324 had been severed directly above the deepest current meter. The only surviving data records were a complete suite of current velocity, temperature and salinity at 54m and 184m from mooring 322 and a partial record of current velocity with complete records of temperature and salinity at 185m from mooring 324. Mooring 324 was re-installed in July but was not recovered in January, 1980. It is believed that the reason for the high loss rate was the intensive fishing activity on Flemish Cap. The deployment of clusters of "guard buoys" around the subsurface instrument moorings was not adequate to protect the moorings. Because of the very high loss rate the moored instrument program was discontinued.

THE DATA

Instruments

All instruments were Aanderaa RCMs current meters equipped to measure current rate (speed), direction, temperature, salinity and pressure at 30 minute intervals. The pressure records showed very little change and are not presented in this report. The moorings were all supported by subsurface buoyancies located 50m below the surface. The moorings were recovered by the use of acoustic releases.

Special care must be taken in interpreting the salinity time series. There is a gross mismatch in the time constants of the sensors for temperature and conductivity. As salinity requires both variables to compute salinity there will be an error in salinity whenever the temperature is variable. Even at the best of times the salinity should not be interpreted to much better than $0.1^{o}/oo$.

Processing

All data records were examined for obviously faulty values and a few such cases were changed. The time series were then filtered using a cosine response termination filter of 89 weights with a cutoff frequency of 0.96 cpd and a cutoff rate parameter of 0.48 cpd. This filter gives a response between 97 and 103% from 0 to 0.98 cpd with a half power point at 1.30 cpd and less than 0.1% transmission beyond 1.82 cpd. This should effectively remove the semi-diurnal signal that was very strong in the original time series. These filtered time series (rate (speed), direction, temperature and salinity) when decimated to six-hourly values are displayed in figures 2a, b, c. Table 1 presents some statistics for each variable measured. These time series still contain significant energy at high frequencies. The decimated, filtered time series of current velocity were further filtered using the same type of filter with 49 weights, a cutoff frequency of 0.2 cpd and a cutoff rate parameter of 0.1 cpd. This filter gives a response between 99 and 102% from 0 to 0.20 cpd, a half power point at 0.27 cpd and less than 0.1% response beyond 0.38 cpd. Figures 3a, b, c present the velocity time series, each rotated to align the positive V component with the mean current. Also shown is a "stick" diagram where a vector at each time increment is drawn proportional to speed and in the direction of the current. Figures 4a, b, c present the progressive vector diagrams for each current record. This indicates the integrated displacement measured by the current meter. Year day numbers are marked at 20 day intervals.

DISCUSSION

Temperature

The means and standard deviations are given in Table 1. As might be expected, the two bottom records are very similar and the near surface record shows a higher mean and significantly greater standard deviation.

The temperature records (figure 2) at both near bottom instruments show very little variability over the six months. However, the two records do not appear to be coherent in the long period variations. Both time series are quiet during the first two months. The record at mooring 324 shows increased variability shortly after day 60 and rising to a broad maximum before day 120. The record for mooring 322 shows an onset of increased variability at day 80 which only lasts for about 3 weeks. This is followed by a general increase in temperature to the end of the record. The shallow record is dominated by the annual warming of the surface layer that is felt about day 90 and reaches maximum temperature about 40 days later.

Salinity

There is a reasonable amount of variability in the salinity signal that is not likely an artifact of the mismatch in time constants for the temperature and conductivity sensors. As with temperature, there are differences in the variability between near bottom records for moorings 322 and 324. It is quite possible that these variations are due to horizontal advection of salinity gradients past the instruments. This has not yet been investigated.

Currents

The mean currents in all cases are very closely tied to the direction of the local bathymetry. The records reinforce the idea that the residual circulation is anticyclonic but very weak. The original time series were dominated by the semidiurnal tidal signal. Figure 3 shows the filtered velocity components resolved so the V is in the direction of the mean currents. Apart from the very weak amplitude of the variations in current speed the most notable feature is the existence of a very periodic signal of about 4 days - particularly in the energetic period during the spring. The signal becomes much more quiescent during the summer, most likely a result of a decrease in wind forcing. One would be inclined to try to fit some sort of topographically trapped wave to the Cap that would give a resonant mode around the Cap. This might also be the source of the anticyclonic residual current. This has not yet been investigated and has to remain speculative.

Table 1.

Mooring Number	Position	Water Depth (m)	Instrument Depth (m)	Variable	Length of Record (days)	Mean	Standard Deviation
322	47°20.26N 45°08.53W	204	54	T(°C)	186	4.92	1.09
				S(°/oo)	186	34.2	0.07
				East(cm/s)	186	1.7	5.1
				North(cm/s)	186	0.9	5.5
			184	T	186	4.08	0.28
				S	186	34.6	0.08
				East	186	1.8	4.5
				North	186	1.2	4.2
324	46°41.06N 45°09.98W	205	185	T	176	4.09	0.31
				S	176	34.8	0.09
				East	95	-3.2	6.7
				North	95	3.8	9.1

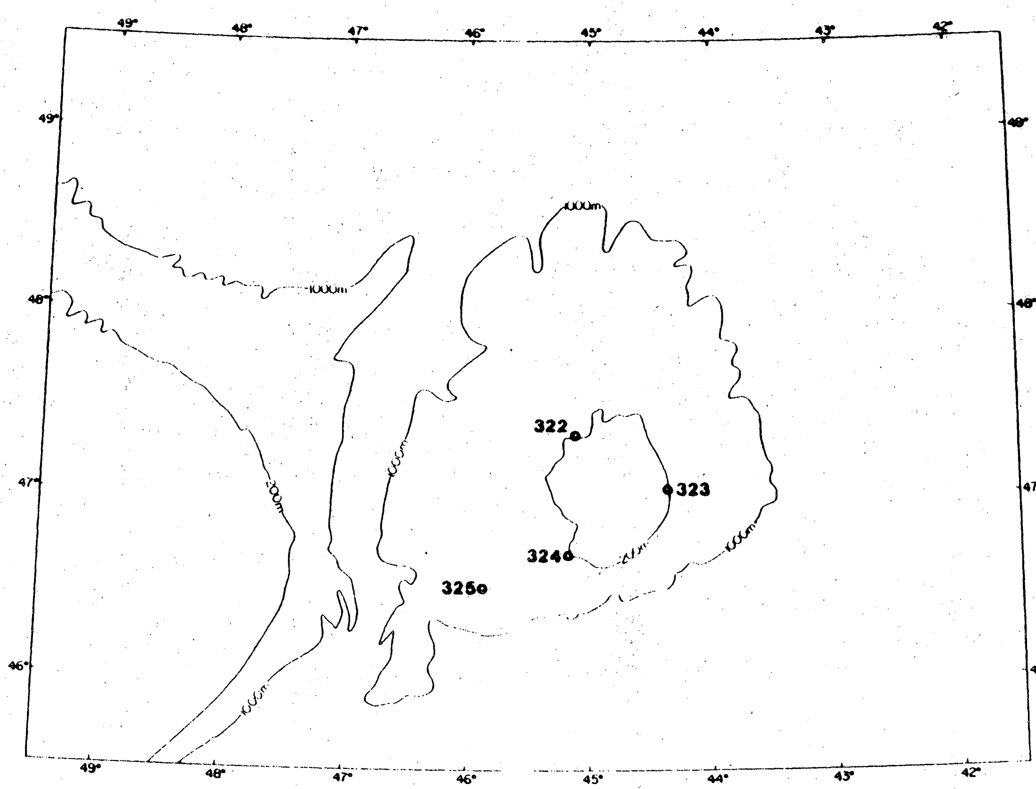

Figure 1: Location of current meter moorings, January-July, 1979.

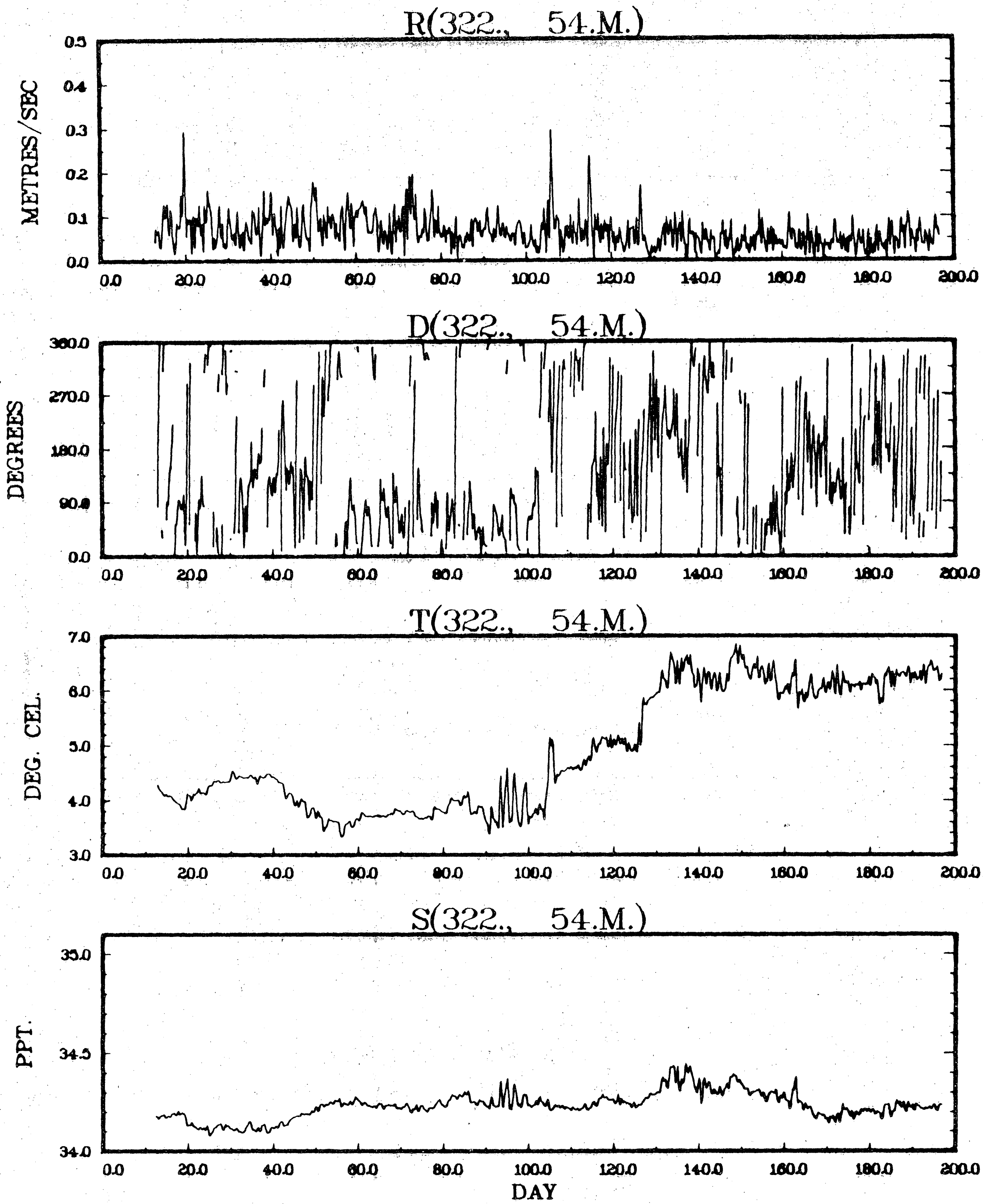

Figure 2a: Time series of rate (speed), direction, temperature and salinity at 54m on mooring 322. The time series has been filtered to remove signal with periods shorter than 0.77 days.

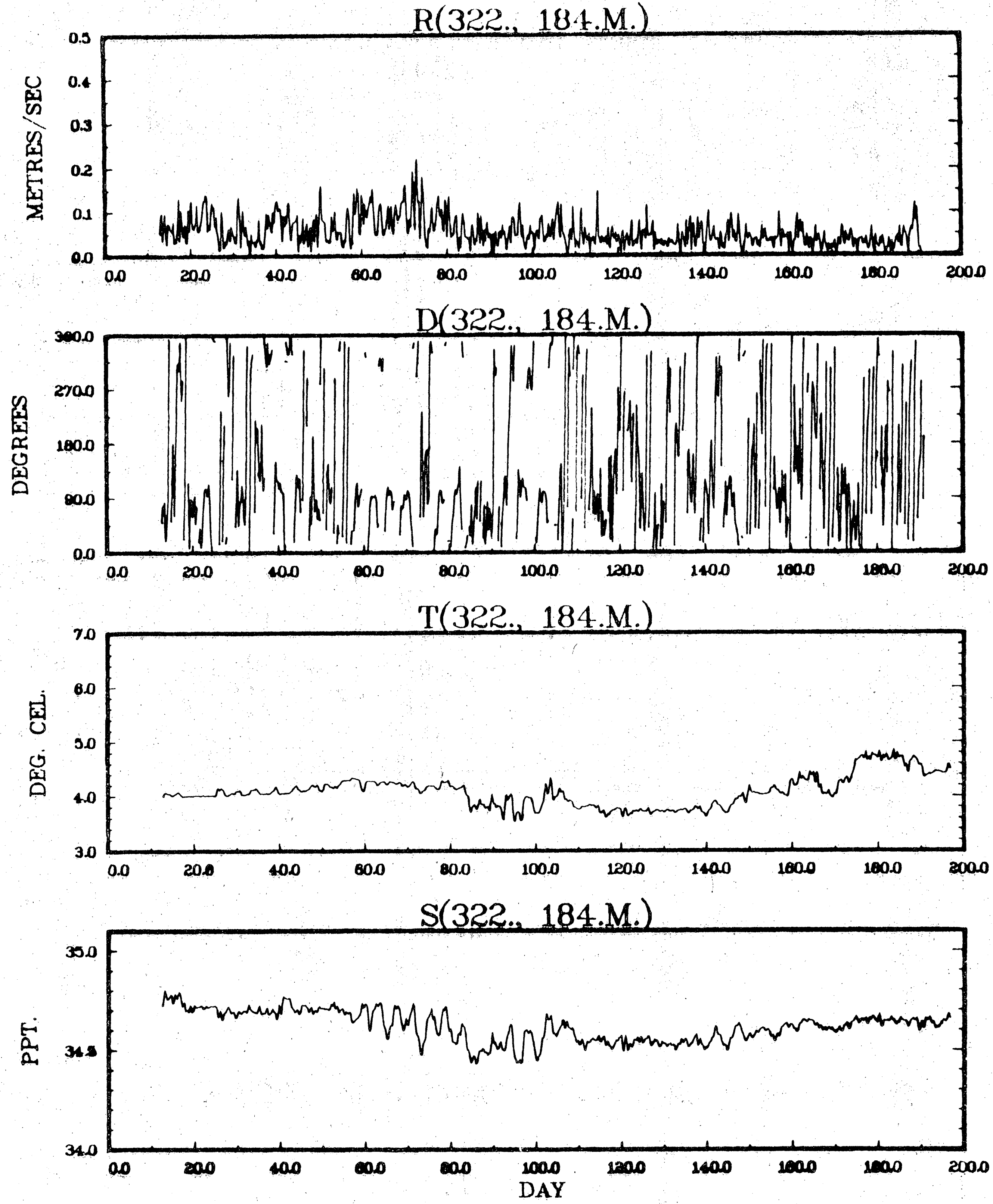

Figure 2b: Same as 2a for 184m on mooring 322.

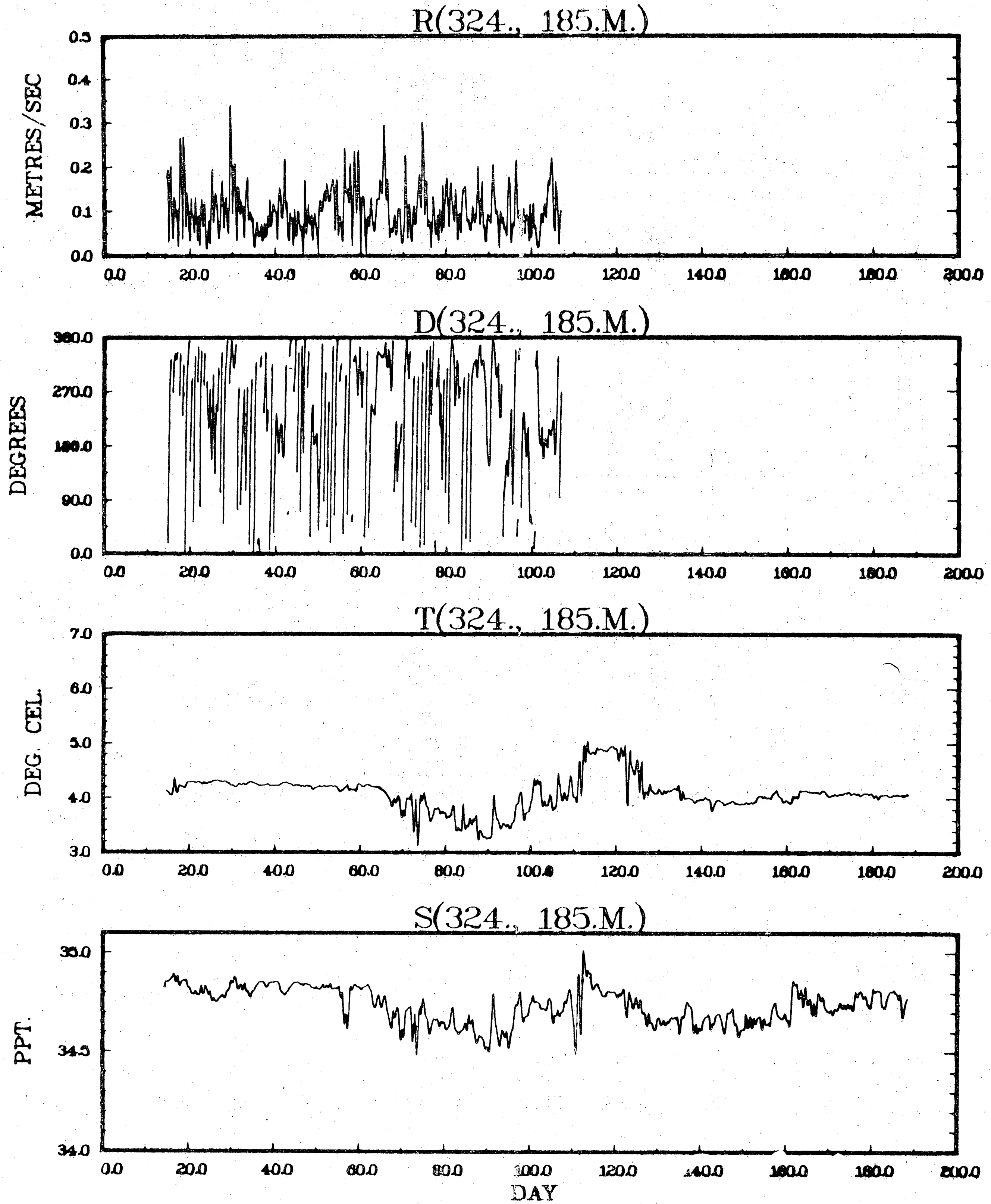

Figure 2c: Same as 2a for 185m on mooring 324.

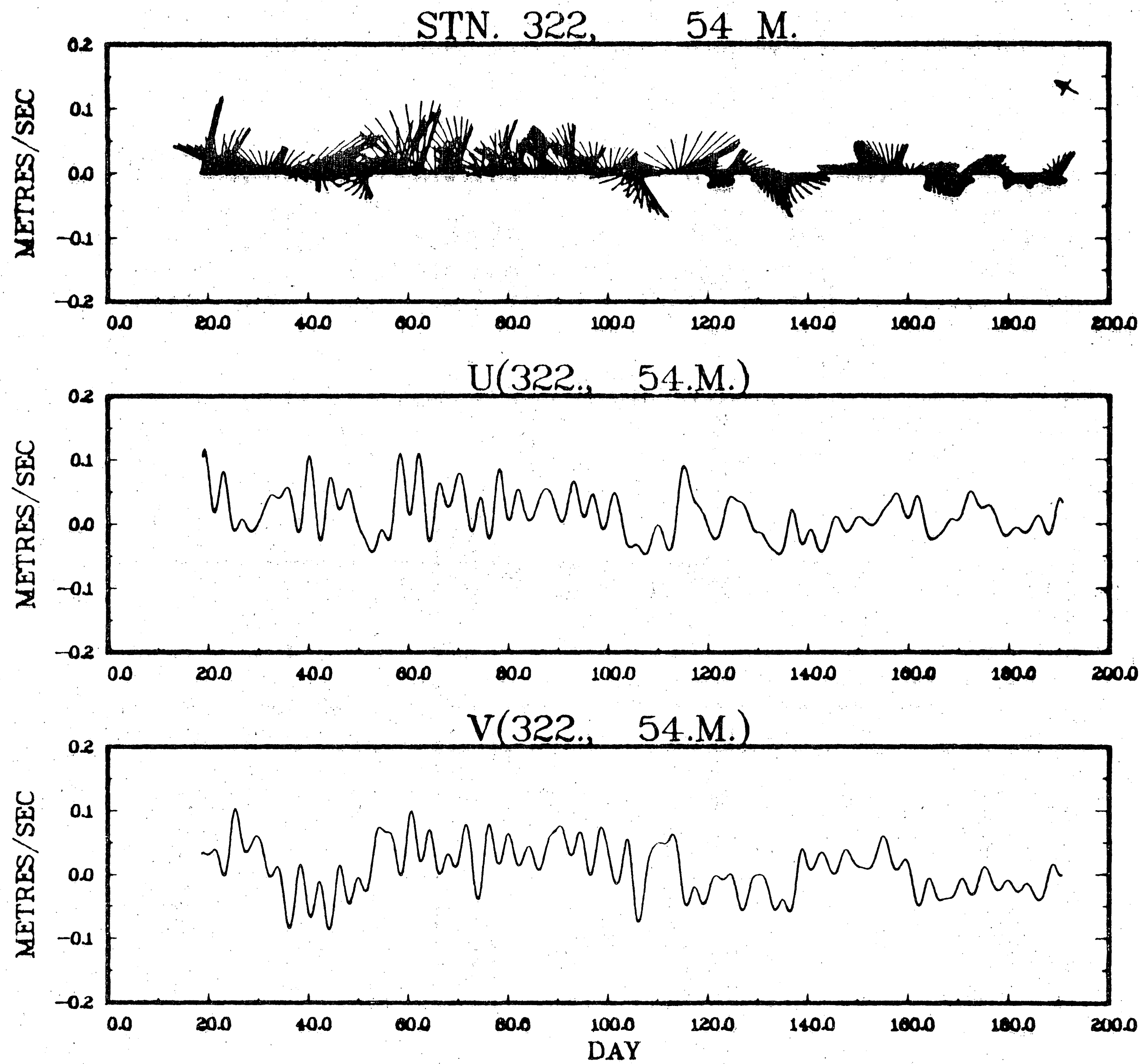

Figure 3a: Time series of current vectors and velocity components measured at 54m on mooring 322. The time series have been filtered to remove signal with periods shorter than 3.7 days. The axes have been rotated to align the V component with the mean current.

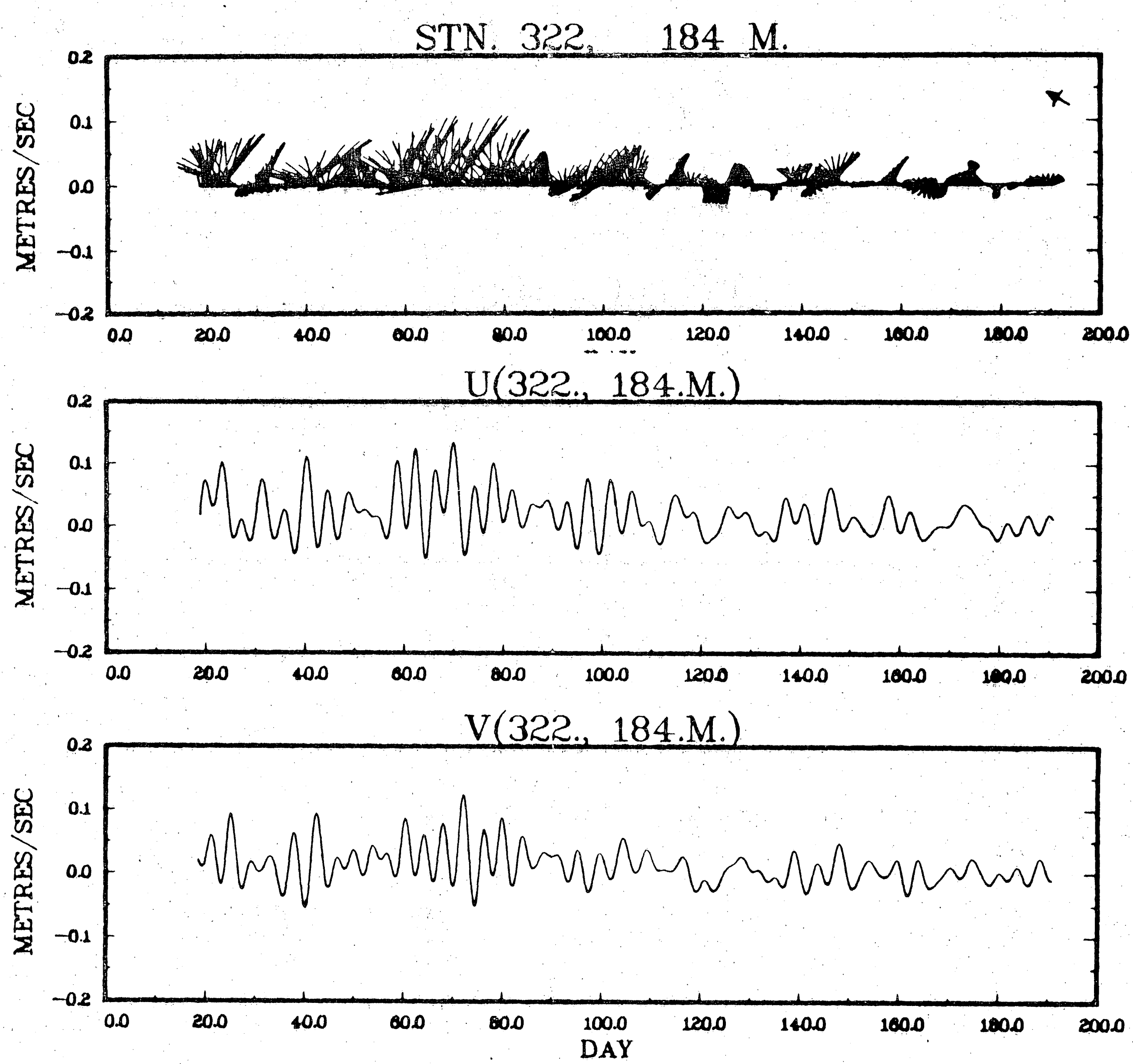

Figure 3b: Same as 3a for 184m on mooring 322.

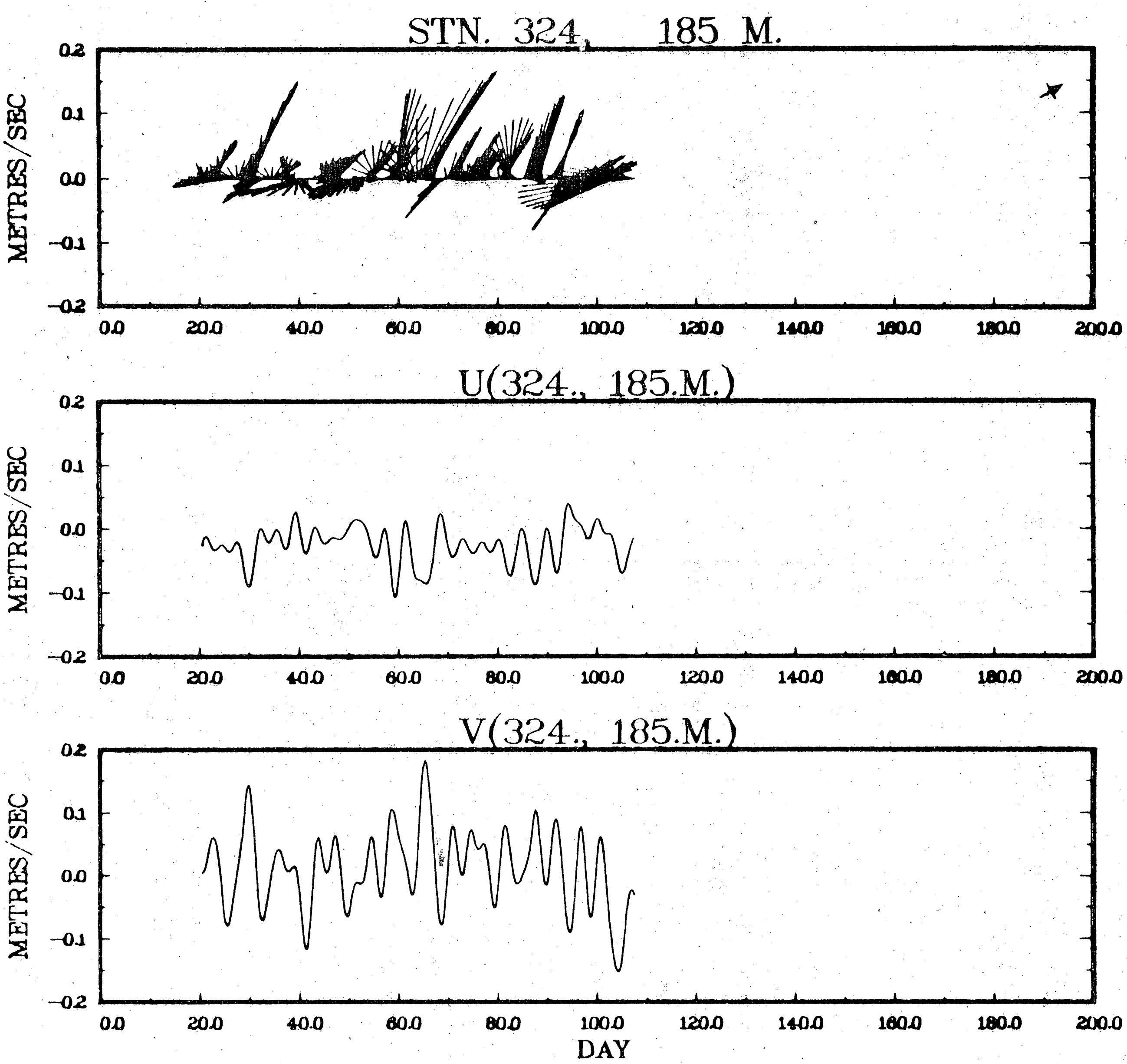

Figure 3c: Same as 3a for 185m on mooring 324.

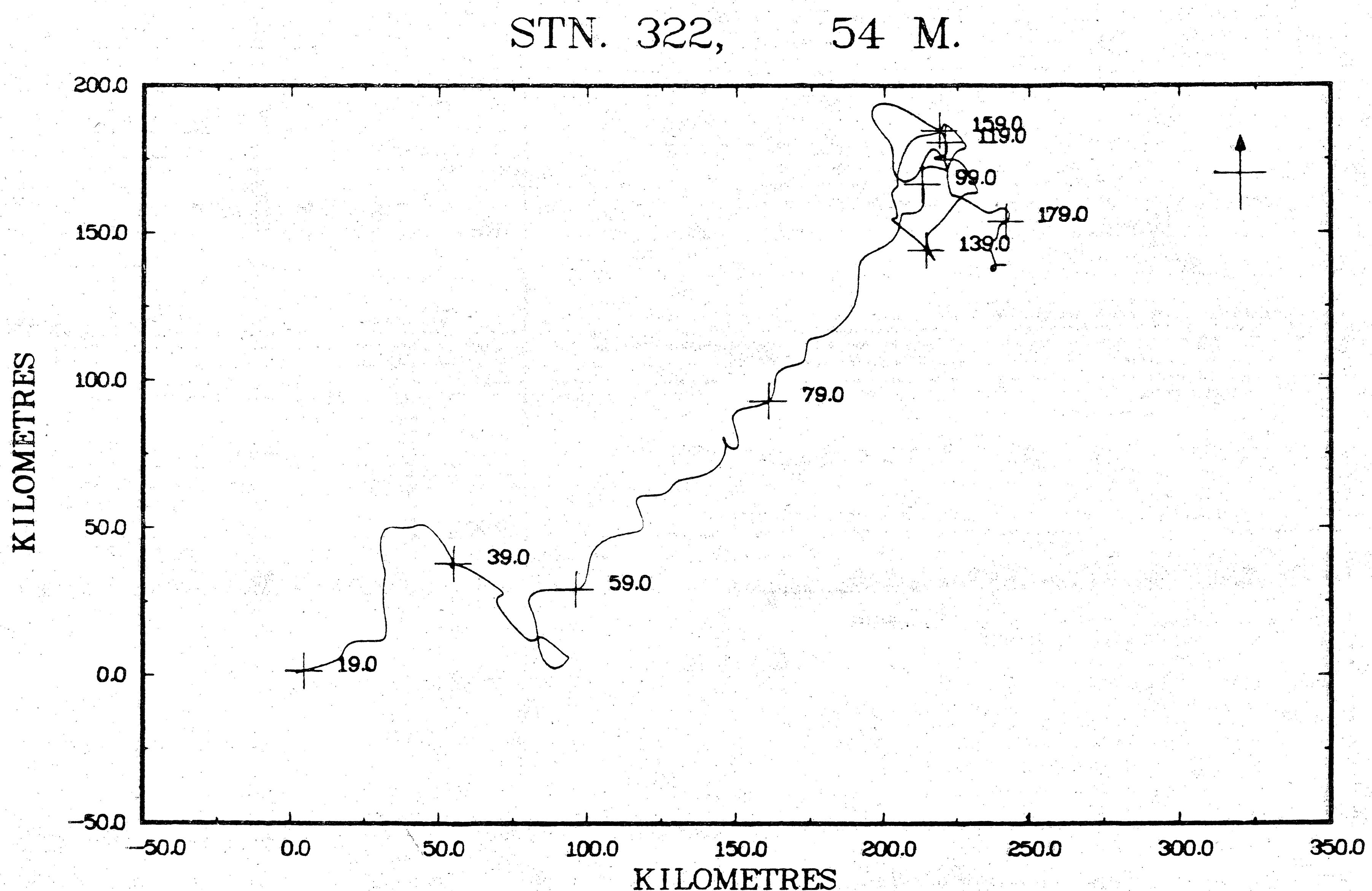

Figure 4a: Progressive vector diagram for currents measured at 54m on mooring 322.

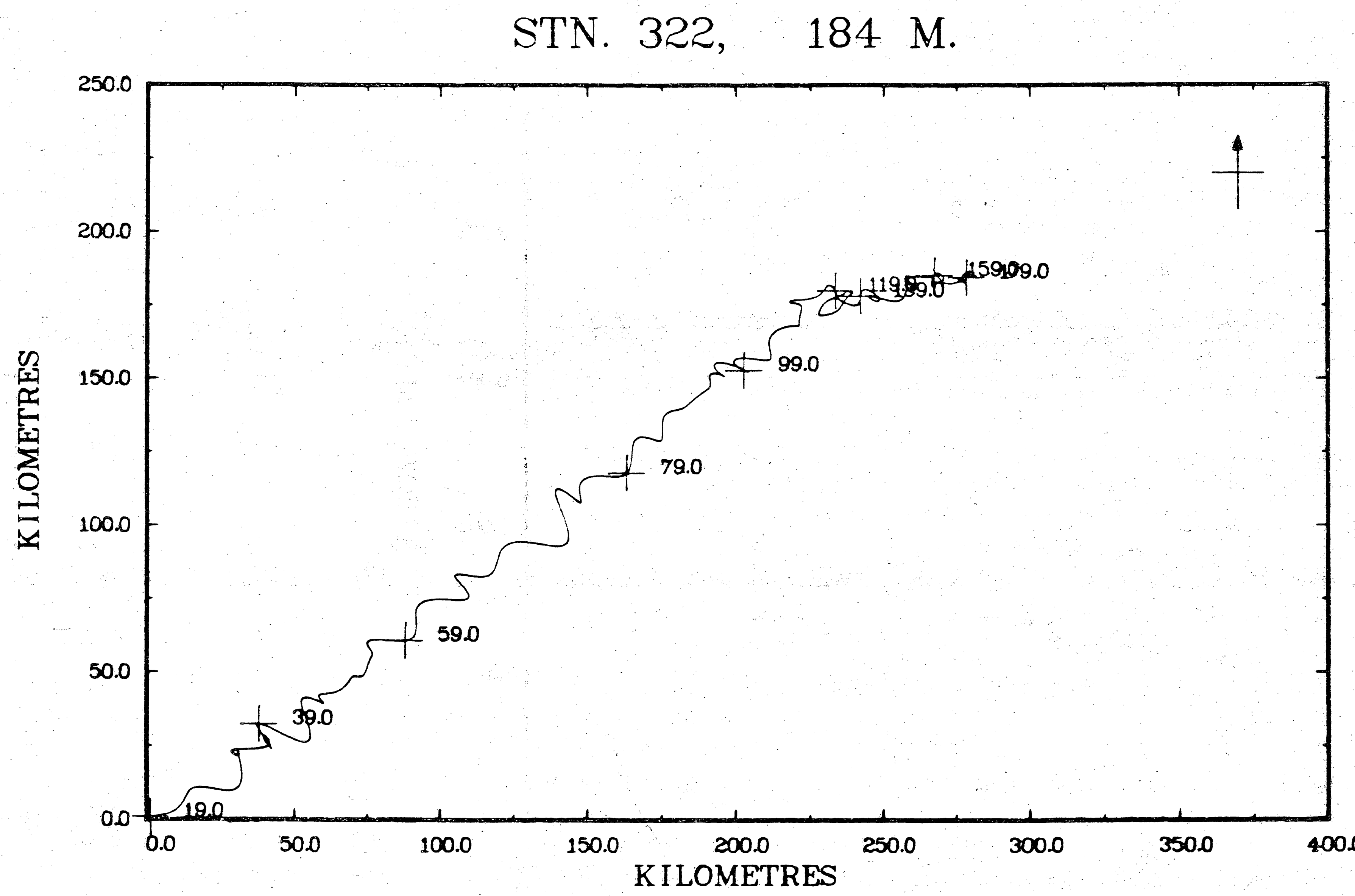

Figure 4b: Same as 4a for 184m on mooring 322.

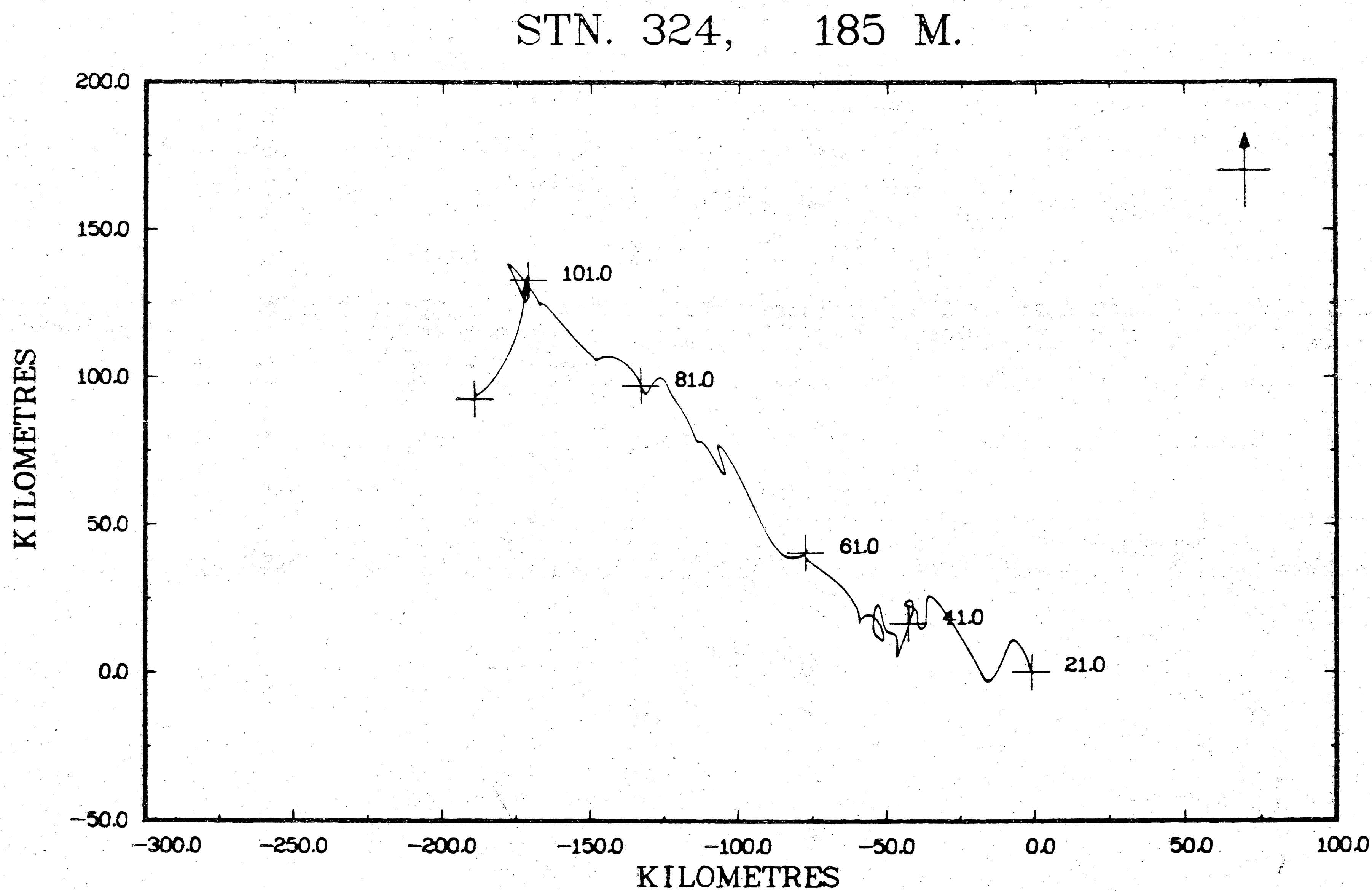

Figure 4c: Same as 4a for 185m on mooring 324.