CURRENT METER DATA FROM THE SOUTHEASTERN CARIBBEAN SEA: AUGUST --ETC\(U\) SEP 80 J D BOYD; T H KINDER

UNCLASSIFIED NORDA-TN-76

1 of 3
Current Meter Data from the Southeastern Caribbean Sea, August 1978 to February 1979

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SEPTEMBER 1980
ABSTRACT

Thirteen vector-averaging current meters were deployed on four moorings in the southeastern Caribbean Sea from August 1978 to February 1979. Velocity and temperature data are presented graphically as time series, histograms, and as variance spectra. Low-pass filtered data (72 hour period at the half-power point) are presented graphically as progressive vector diagrams, vector diagrams (stick plots), time series, and spectra.

Scalar mean speeds ranged from 4 to 38 cm/s, and (mostly westward) vector mean speeds from 2 to 36 cm/s (all but one were less than 9 cm/s). The velocity and temperature variance were distributed among three frequency bands: subinertial, inertial, and tidal. In the velocity spectra the subinertial variance accounted for an average of 50% of the total variance, inertial 5%, and tidal 10%. In the temperature spectra the subinertial accounted for 75% of the total variance, inertial 1%, and tidal 10%. Individual records had peaks at periods between 10 and 45 days.
ACKNOWLEDGEMENTS

Lou Banchero of NORDA and the officers and crew of the USNS KANE deployed and recovered the moorings. Kim Saunders and Mark Bergin of NORDA and personnel from the Physical Oceanography Branch, Naval Oceanographic Office (NAVOCEANO), contributed to the development of the necessary computer programs. Dick Stanford of NAVOCEANO produced the plots.
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I. INTRODUCTION

The southeastern Caribbean Sea (Fig. 1) manifests intense mesoscale variability (Wyrtki et al., 1976), and it is the location of strong inflows from the Atlantic Ocean (Stalcup and Metcalf, 1972) which begin the Caribbean Current/Loop Current/Gulf Stream current system. Instabilities in these strong inflows may form eddies in Grenada Basin, west of the narrow passages through the southern Lesser Antilles (Leming, 1971).

We have examined the mesoscale variability in this region using both observations (Mazeika et al., 1980a and 1980b) and numerical modeling. Our goal is to understand the mesoscale variability through a synthesis of field observations and modeling, and to test a sophisticated numerical model in a regime different from the Gulf of Mexico, for which it was designed (Hurlburt and Thompson, in press).

In order to assess the time scales and energy levels of subinertial variability (presumably coincident with mesoscale spatial variability), four current meter moorings were deployed from August 1978 to February 1979 (Fig. 1 and Table 1). This report presents the preliminary analysis of the resulting data and the techniques used.

II. MEASUREMENTS

We used AMF vector averaging current meters (model 610), which recorded average speed, direction, and temperature every 15 minutes. Speed was accurate to \( \pm 1 \text{ cm/s} \) and the threshold of the Savonious rotor was 3 cm/s or lower. Direction was accurate to \( \pm 3^\circ \). The installed thermistors were accurate to \( \pm 0.1^\circ \text{C} \) and were precise to \( \pm 0.01^\circ \text{C} \). The manufacturer's manual (AMF, 1976) gives further details on instrument construction, and Woodward and Appel (1973) and McCullough (1975) describe determination of accuracies.

Actual depths of the instruments varied from the planned depths. Corrected depths given in Table 1 were estimated by comparing the temperature data with deployment and recovery cruise CTD profiles from Teague (1979) and Teague (1980). Corrected depths are used in the text, but planned depths are given on the figures.

III. PRESENTATION OF DATA

A. EDITING AND TIME SERIES

The data were first plotted as time series to examine each record for anomalous data. We removed beginning and ending transients, and replaced isolated spikes with interpolated values. Figures 2-26 display the edited series. Current meter problems are tabulated in Table 2. Seven of thirteen instruments ran for the full deployment without problem. Meter 296 had a noisy temperature record (Fig. 17) that was not amenable to simple editing. Meter 216 had no velocity data and meter 407 had an erratic temperature record (Fig. 24). Appropriate plots from these three meters are missing because of these data problems.

The records show high frequency fluctuations of 0.4-2.0 cycles per day (2.5-0.5 day periods) superimposed on lower frequency fluctuations of less than 0.1 cycles per day (10 day period). Later in this report we show that the 0.4-2.0 cycles per day fluctuations occur primarily at inertial and semi-diurnal frequencies.
Two peculiarities of the data are not instrumental errors as they might appear. The temperature spike near day 260 (all dates are in year-day for 1978; see Table 3) in Figure 7 corresponded to similar events at the other two instruments on mooring A (Figs. 3 and 5). Similarly, the large negative temperature excursion of meter 300 near day 260 in Figure 15 corresponded to similar events at the other instruments on mooring C (Figs. 17 and 19).

B. STATISTICS AND CURRENT HISTOGRAMS

Figures 27-38 show speed histograms, direction histograms, and cumulative speed distributions. Disregard those portions of the speed histograms lying at or below the VACM threshold of about 3 cm/sec.

Table 4 lists basic statistics. Scalar mean speeds varied from 4.5 to 38.5 cm/s, and vector mean speeds from 2.2 to 35.7 cm/s. Records from mooring A had the most unidirectional flow, closely followed by the mooring C records. Least unidirectional records were from mooring D, except from the deepest meter where the flow was as persistent as that at mooring A.

A significant mean flow was present in all records. At mooring A the mean flow was W, from WNW at the shallow meter to W at the two deeper meters. At mooring B the mean was also W, from WNW at the two shallower meters to NWW at the deepest meter. At mooring C the mean was NW, from N at the shallow meter, to NNW at the intermediate meter, to NW at the deepest meter. The monotonic sense of rotation of the mean at all three moorings was counterclockwise proceeding from the shallowest to the deepest meter. At mooring D the mean flow at the two shallowest meters was NNE, and the mean flow was S at the deepest meter.

C. SPECTRA OF UNFILTERED RECORDS

The east-north and clockwise-counterclockwise velocity spectra and temperature spectra are presented in Figures 39 to 108. Coherence magnitude squared and phase (for the east-north decomposition) and rotary coefficient (for the clockwise-counterclockwise decomposition) are also given. The rotary coefficient is the clockwise minus counterclockwise variance divided by their sum, and is zero for rectilinear motion and plus one for circular clockwise motion (e.g., Calman, 1978; Mooers, 1973; and Gonella, 1972). We use rotary spectral analysis extensively because of its independence from coordinate system orientation. In locations away from large topographic gradients, rotary spectra often prove more satisfactory than coordinate-dependent spectra.

Prior to spectral calculations, the number of points in the 190 day records were halved by low-pass filtering to remove high frequency (>1 cph) energy and resampling at 30 minute intervals. All records were then tapered with a Hann window and fast Fourier transformed. Spectra were corrected for the effects of the window and were frequency band averaged over frequency - increasing numbers of points to increase spectral stability and to reduce the number of points plotted at high frequencies. The frequency-dependent averaging scheme is reflected in the changing sizes of the confidence intervals and significance levels on the plots.

The record from current meter 298, the intermediate depth meter on mooring B, had typical results (Figs. 63-68). There was high variance density (Figs. 63 and 64) at frequencies below 1 x 10^-2 cph (100 hours), a spectral valley separating these frequencies from the inertial peak (inertial frequency ≈ 1.93 x 10^-2 cph, or 52 hour period), a strong semidiurnal peak, then a decrease with about -2 slope to the Nyquist frequency. The Nyquist frequency was 1 cph for the resampled
records, and 2 cph for the shorter records. Small peaks occurred at the first and second harmonics of the semidiurnal (M2) frequency.

The coherence squared between east and north components (Fig. 65) was generally significant. Typical of all records, a broad peak in coherence corresponded to the broad inertial peak in variance density. This peak extended toward frequencies higher than the local inertial frequency. A narrow peak in coherence corresponded to the narrow variance density peak at the semidiurnal frequency. The phase plot showed a plateau near +90° coincident with the broad inertial peak in spectral plots.

At most frequencies the rotary spectrum (Fig. 66) resembled the spectra from the east-north decomposition. Notably different were the domination of both the clockwise variance at the inertial peak and the domination of counterclockwise variance at the lowest frequencies. The rotary coefficient (Fig. 67) was nearly +1.00 across the inertial peak and about -0.60 at the lowest frequencies.

The temperature spectrum (Fig. 68) had high variance density at low frequencies, a small inertial peak, and peaks at the semidiurnal frequency and its first two harmonics. The temperature spectra typically lacked a clearly defined valley separating low-frequency and inertial variance.

The spectral results were all plotted as variance density, i.e., variance per frequency bandwidth. This presentation can obscure the relative amount of variance contained in different frequency segments. To examine the amount of variance in different segments, we constructed Tables 5 and 6 using three frequency ranges: low frequency, inertial, and tidal. The low frequency band was all harmonic coefficients at frequencies less than 1.39 x 10^{-2} cph (72 hour period), the inertial band was the first harmonic coefficient at a frequency higher than the inertial frequency, and the tidal segment was the sum of the two harmonic coefficients nearest 4.18 x 10^{-2} cph (23.93 hours, K1) and 8.05 x 10^{-2} cph (12.42 hours, M2). The total variance is that represented by the harmonic coefficients after correcting for tapering. The tables list both variance and percent of total variance.

Several effects reduce the precision of these calculations. Because the spectra have high variance densities at the lowest frequencies, longer records have more low frequency variance. The inertial peak is typically quite broad, but only one estimate was used to represent this peak (it was always the largest harmonic coefficient within the inertial peak). The tidal peaks were defined by harmonic coefficients representing frequency bands that were not centered on the tidal frequencies. Finally, the total variance was calculated after filtering (longest records only) and tapering (a correction was applied), so that this variance is not identical to the variance of the original time series. In spite of these effects, the tables quantitatively show the division of variance corresponding to peaks in the spectral plots.

The record from meter 298, for example, had 87% of its velocity variance and 82% of its temperature variance in the three categories. Examining the velocity variance of all records, low frequencies accounted for about 50%, inertial for about 5%, and tidal for about 10% of the total variance. For temperature, low frequencies accounted for about 75%, inertial for about 1%, and tidal for about 10% of the total variance. In all cases the sum of the three categories included over 50% of both the velocity and temperature variances.
Table 7 lists data for the inertial frequency. Inertial waves (or near-inertial waves) would be expected to have the following properties: equipartition of energy between east and north components, all variance in the clockwise component, a coherence of 1.00, and a phase between east and north components of +90°. Table 7 shows that this was nearly satisfied in all records, even those from the deepest current meters.

Table 8 lists tidal variance at the diurnal frequency, semidiurnal frequency, and at the first two harmonics of the semidiurnal frequency. For both velocity and temperature the semidiurnal variance is much greater than diurnal variance. There was often no peak at the diurnal frequency, while the semidiurnal frequency always had a peak, usually a prominent one. The first harmonic of the semidiurnal frequency usually had a peak that contained more variance than was contained at the diurnal frequency.

D. LOW PASS FILTER

Our primary interest in these data is in the low frequency variability. In order to examine this region of the spectrum more carefully, we low-pass filtered the time series to remove inertial and higher frequencies. We chose 1.39 x 10^-2 cph (72 hours) as the half power point of the filter because this frequency is in the spectral valley that separated the low frequency and the inertial peaks in the longest records. Following filtering, the series were resampled every 12 hours. Examination of the records after filtering revealed: about 99% of the variance at 8.6 x 10^-3 cph (116 hours) passed, about 0.2% of the variance passed at 1.8 x 10^-2 cph (56 hours, the inertial period at mooring D); about 2 x 10^-4% of the variance passed at 2.0 x 10^-2 cph (49 hours, the inertial period at mooring A); and about 2 x 10^-10% of the variance passed at 8.1 x 10^-2 cph (12.4 hours, the M2 tide). Because of the long filter length used, about eight days were lost from each end of the records.

Table 9 compares the low frequency variance estimated from the spectra of the unfiltered records (Tables 5 and 6) to the variance in the spectra of the filtered series (discussed in further detail later). For the longest records, about 90% of the velocity and about 100% of the temperature variance passed the filter. Because the frequency bands were not identical for the filtered and unfiltered calculations, and because the series lengths were different, agreement between unfiltered and filtered variance is imperfect.

E. LOW-PASS FILTERED RECORDS

After low-pass filtering the records, current and temperature series were again plotted (Figs. 109-143). Velocity was plotted as a progressive vector diagram and as a stick plot, and temperature was plotted as a time series.

The progressive vector diagram for meter 298 (Fig. 121), for example, shows variability at periods of 10 to 20 days imposed on the mean (3.9 cm/s at 290°; see Table 4). The mean itself can be viewed as the resultant of two long segments of flow, the first about 50 days long (240 to 290) northward and the second about 100 days long (290 to 390) west-southwestward.

Results from the progressive vector diagrams enlarge upon the conclusions drawn from the basic velocity statistics in section 3-B. The flow at mooring A tended to be W. Greatest variability occurred at the deepest meter (Fig. 115): flow W for about 40 days, S for about 80, then NW. At mooring B the flow was initially N for about 60 days, then predominantly W or SW. Mooring C indi...
mainly W or NNW flow. The most variable flows were at mooring D (Figs. 135, 138, 141). The upper meter indicated S for about 60 days, then mostly N. Flow at 850 m was predominantly SSE for 60 days, then became N. At the deepest meter (1650 m) flow was predominantly S. Superimposed upon these flows were occasional closed paths, which may indicate the passage of eddies or waves.

The vector or stick plot (e.g., Fig. 122) is a vector plotted every 12 hours along a time axis. The length of the vector is proportional to speed, and the direction of the arrow from the time-axis to the tip is current direction; north is up in all our plots. Although the low pass filter had a half-power point at 72 hours, plotting vectors every 12 hours resolves clearly motions of a few days' period.

Three features characterize the low passed temperature time series plots. The first is a large amplitude modulation of the records at very long periods (only a few cycles per 100-178 day record). The second is an intermediate amplitude periodicity ranging between 10 to 30 day periods (4 to 1 x 10^{-3} cph) and the last is a low amplitude, 4-16 day period (10 to 7 x 10^{-3} cph) oscillation, which is also evident from the spectral analysis in the next section.

F. SPECTRA OF LOW-PASS FILTERED RECORDS

The low-passed spectra are displayed as periodograms (magnitude squared of the coefficients of the Fourier decomposition) plotted for periods greater than or equal to 72 hours, the half-power point of the filter. Unsmoothed periodograms are erratic because the variance estimates are inconsistent (their variability does not decrease as record length increases), but we chose to let the eye rather than the computer smooth the plots because, depending on record length, only 10-58 raw spectral estimates were available.

Since rotary spectra are independent of coordinate system orientation, plots from the rotary decomposition not from the east-north decomposition are presented here. In virtually all cases, however, peaks in the rotary spectra have corresponding peaks in the east-north spectra.

Low-passed current rotary spectra and the rotary coefficient (clockwise minus counterclockwise variance divided by their sum) are given in Figures 144 to 178. Counterclockwise motion dominates long periods (low frequencies) down to about 10 days (4.0 x 10^{-3} cph) in the upper meters of all moorings and the intermediate meters of moorings B and C (for the upper meter of D, the counterclockwise domination is true only down to about 35 days). Predominantly clockwise motion with periods from 8 to 30 days (5.0 to 1.0 x 10^{-3} cph) characterizes the intermediate and deep meters of mooring A. No preferred sense of rotation is evident for most meters at periods shorter than 8 days.

Moorings A, B, and D have maximum variance density at the very longest periods and spectra falling off with about a -2 slope, with various local maxima between 30 and 10 days (1.0 to 4.0 x 10^{-3} cph). Mooring C, the only mooring clearly located over the Grenada Basin abyssal plain, has distinctive inverted U-shaped spectra. Significant peaks with variance densities as large or larger than those at very long periods occurred at 45-50 days (0.9 to 0.8 x 10^{-3} cph) (shallow and deep meters), 20-30 days (2.0 to 1.0 x 10^{-3} cph) (all three meters), and 10 days (4 x 10^{-3} cph) (intermediate depth meter).

The low-passed temperature spectra show many peaks at a variety of periods. The large amplitude, very low frequency motion - if indeed it is periodic - cannot
be resolved with these record lengths; but the large amplitude is reflected in the
great low frequency variance density of the temperature spectra. Only one meter,
the deepest of mooring D, however, appears to have a particular low frequency peak,
at about a 50 day period (0.8 x 10^-3 cph).

The intermediate amplitude periodicity between 10-30 day periods (4.0 to
1.0 x 10^-3 cph) is ill-defined in the temperature spectra. No particularly
dominant periods appear. Nine meters have peaks between 10 and 20 days (4.0 to 2.0
x 10^-3 cph), while four have peaks between 25-35 days (1.6 to 1.0 x 10^-3 cph).
The 4-6 day (10.0 to 7.0 x 10^-3 cph) oscillation evident in most of the temper-
ature time series plots is perhaps reflected in the plethora of peaks visible in
virtually all spectra at 3-9 day periods (14.0 to 4.6 x 10^-3 cph).

IV. SUMMARY

Four current meter moorings with thirteen AMF vector averaging current meters
were deployed in the southeastern Caribbean from August 1978 to February 1979 as
part of a study to examine space and time scales of the mesoscale variability in the
area.

Significant mean flows were observed at all moorings. Scalar mean speeds were
4.5 to 38.5 cm/s and vector mean speeds 2.2 to 35.7 cm/sec. Flow at mooring A was
generally W, at B, first N then W or SW, and at C, N or NNE. Net flow at the upper
meters of D (250 m and 850 m) was N, but substantial direction changes on a 1-4
month time scale occurred three times. Flow at mooring D's deepest meter (1650 m),
however, was persistently S.

High variance densities at subinertial frequencies (presumably corresponding
to the mesoscale processes of interest) were separated from inertial and tidal peaks
by a distinct spectral valley in the current spectra, but by a considerably less
conspicuous valley in the temperature spectra. In the velocity spectra, the sub-
inertial variance accounted for about 50% of the total variance, inertial for about
5%, and tidal for about 10%. In the temperature spectra the corresponding values
were 75%, 1%, and 10%.

The data were filtered to pass only energy at subinertial frequencies and were
resampled at a 12 hour interval. Many peaks appeared in the spectra of the filtered
data, but not at any particular frequencies.

In the current spectra, variance at moorings A, B, and D was maximum at lowest
frequencies and declined with increasing frequency (shorter periods). A variety of
minor peaks were seen between 10 and 30 days (4.0 to 1.0 x 10^-3 cph). Spectra
from mooring C had a distinctive inverted "U" shape, with significant peaks at one
or more meters at about 45 days (0.9 x 10^-3 cph), 20-30 days (2.0 to 1.0 x
10^-3 cph) and 10 days (4.0 x 10^-3 cph).

Filtered temperature spectra had variance falling off with increasing
frequency and a plethora of minor peaks. Four meters had peaks between 25-35 days
(1.7 to 1.0 x 10^-3 cph), nine between 10-20 days (4.0 to 2.0 x 10^-3 cph), and
all meters between 3-9 days (14.0 to 4.6 x 10^-3 cph).

Finally, a significant temperature event appeared near day 260 in the time
series from moorings A and C. We have no explanation for its cause, but do not
think it is due to instrument malfunction, since it appears in all six records from
two widely separated moorings.
V. REFERENCES

AMF (1976). Vector Averaging Current Meter, Model 610C. AMF Electrical Products Development Division of AMF Incorporated, Herndon, VA.


Table 1. Mooring Summary

<table>
<thead>
<tr>
<th>Mooring</th>
<th>Location and Water Depth</th>
<th>Date Deployed and Recovered</th>
<th>Meter Number</th>
<th>Planned Depth (m)</th>
<th>Estimated Depth (m)</th>
<th>Record Length (days)</th>
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<tr>
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<td>14-10.4 N 62-33.7 W 2583 m</td>
<td>5 August 1978 10 February 1979</td>
<td>406 416 412</td>
<td>193 393 793</td>
<td>100 300 700</td>
<td>55 120 190</td>
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<tr>
<td>B</td>
<td>13-24.3 N 62-26.9 W 2983 m</td>
<td>5 August 1978 13 February 1979</td>
<td>219 298 417</td>
<td>193 393 793</td>
<td>200 400 800</td>
<td>60 190 190</td>
</tr>
<tr>
<td>C</td>
<td>13-04.9 N 61-59.4 W 2983 m</td>
<td>6 August 1978 14 February 1979</td>
<td>300 296 410</td>
<td>150 350 750</td>
<td>150 350 750</td>
<td>190 110 190</td>
</tr>
<tr>
<td>D</td>
<td>12-19.6 N 63-01.8 W 2895 m</td>
<td>6 August 1978 14 February 1979</td>
<td>289 216 407 414</td>
<td>150 350 750 1500</td>
<td>250 450 850 1650</td>
<td>190 0 190 190</td>
</tr>
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NOTE 1. No velocity data; 190 day temperature record.
Table 2. Current Meter Problems

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<td>A393</td>
<td>416</td>
<td>Stopped early (120 days record length)</td>
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<td>C150</td>
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<tr>
<td>C350</td>
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<td></td>
<td></td>
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<td>C750</td>
<td>410</td>
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<tr>
<td>D150</td>
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<tr>
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Table 3. Day Conversion

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<td>244</td>
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Table 4. Velocity Statistics

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<th>Maximum Component Speeds (cm/s)</th>
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<td>Standard Deviation</td>
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<td>39.6</td>
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<td>A 412</td>
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<td>6.1</td>
<td>38.3</td>
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Table 5. Velocity Variance (cm²/s², %)

<table>
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<th>Low Frequency¹</th>
<th>Inertial²</th>
<th>Tidal³</th>
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<td>21 (7)</td>
<td>26 (9)</td>
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<td>91 (100)</td>
<td>55 (60)</td>
<td>1 (1)</td>
<td>10 (11)</td>
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<td>A 412</td>
<td>101 (100)</td>
<td>73 (73)</td>
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<td>5 (5)</td>
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<td>B 219</td>
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<td>100 (64)</td>
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<td>6 (12)</td>
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<td>D 407</td>
<td>88 (100)</td>
<td>62 (70)</td>
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<tr>
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<td>13 (100)</td>
<td>5 (39)</td>
<td>2 (14)</td>
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1. Sum of estimates with periods longer than 72 hours.
2. First estimate with period shorter than inertial period.
3. Sum of two estimates nearest 12.42 hours (M2) and 23.93 hours (K1).
Table 6. Temperature Variance (°C², %)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Low Frequency¹</th>
<th>Inertial²</th>
<th>Tidal³</th>
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<tr>
<td>406</td>
<td>1.88 (100)</td>
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<td>412</td>
<td>0.37 (100)</td>
<td>0.31 (83)</td>
<td>0.004 (1)</td>
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<tr>
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<td>0.02 (7)</td>
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<tr>
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<td>0.018 (100)</td>
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<td>0.85 (100)</td>
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<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>407</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>414</td>
<td>0.0003 (100)</td>
<td>0.0002 (75)</td>
<td>0.0000 (5)</td>
<td>0.0000 (6)</td>
</tr>
</tbody>
</table>

1. Sum of estimates with periods longer than 72 hours.

2. First estimate with period shorter than inertial period.

3. Sum of two estimates nearest 12.42 hours (M2) and 23.93 hours (K1).
Table 7. Inertial Variance

<table>
<thead>
<tr>
<th></th>
<th>Variance (cm/s)²</th>
<th>East-North Coherence (Coherence)²</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>East</td>
<td>North</td>
<td>Total</td>
</tr>
<tr>
<td>406</td>
<td>5.8</td>
<td>14.8</td>
<td>20.6</td>
</tr>
<tr>
<td>416</td>
<td>0.4</td>
<td>0.2</td>
<td>0.6</td>
</tr>
<tr>
<td>412</td>
<td>2.2</td>
<td>2.3</td>
<td>4.6</td>
</tr>
<tr>
<td>219</td>
<td>1.6</td>
<td>1.7</td>
<td>3.4</td>
</tr>
<tr>
<td>298</td>
<td>2.9</td>
<td>3.6</td>
<td>6.5</td>
</tr>
<tr>
<td>417</td>
<td>3.1</td>
<td>2.6</td>
<td>5.6</td>
</tr>
<tr>
<td>300</td>
<td>5.2</td>
<td>5.2</td>
<td>10.4</td>
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<tr>
<td>296</td>
<td>0.3</td>
<td>0.4</td>
<td>0.7</td>
</tr>
<tr>
<td>410</td>
<td>2.4</td>
<td>2.7</td>
<td>5.2</td>
</tr>
<tr>
<td>289</td>
<td>9.2</td>
<td>9.9</td>
<td>19.1</td>
</tr>
<tr>
<td>216</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>407</td>
<td>2.3</td>
<td>2.8</td>
<td>5.2</td>
</tr>
<tr>
<td>414</td>
<td>1.1</td>
<td>0.8</td>
<td>1.8</td>
</tr>
</tbody>
</table>

1. The first coefficient with center frequency higher than inertial was used. In all cases this coefficient had the highest variance density within the broad inertial peak.
Table 8. Tidal Variance

<table>
<thead>
<tr>
<th></th>
<th>Velocity (cm/s)²</th>
<th>Temperature (°C)²</th>
<th>Diurnal</th>
<th>Semidiurnal</th>
<th>H₁</th>
<th>H₂</th>
<th>Diurnal</th>
<th>Semidiurnal</th>
<th>H₁</th>
<th>H₂</th>
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</thead>
<tbody>
<tr>
<td>406</td>
<td>1.57</td>
<td>24.5</td>
<td>6.62</td>
<td>2.00*</td>
<td>0.010</td>
<td>0.759</td>
<td>0.030</td>
<td>0.009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>416</td>
<td>0.77*</td>
<td>9.7</td>
<td>1.75</td>
<td>0.43*</td>
<td>0.010</td>
<td>0.111</td>
<td>0.039</td>
<td>0.004*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>412</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>219</td>
<td>0.38*</td>
<td>16.1</td>
<td>1.11*</td>
<td>0.57*</td>
<td>0.001*</td>
<td>0.032</td>
<td>0.011</td>
<td>0.001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>298</td>
<td>0.43*</td>
<td>14.9</td>
<td>0.60</td>
<td>0.22</td>
<td>0.002</td>
<td>0.017</td>
<td>0.003</td>
<td>0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>417</td>
<td>0.29*</td>
<td>4.2</td>
<td>0.49</td>
<td>0.15</td>
<td>0.0001</td>
<td>0.0009</td>
<td>0.0003</td>
<td>0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>1.32</td>
<td>28.2</td>
<td>2.12</td>
<td>0.92</td>
<td>0.003*</td>
<td>0.031</td>
<td>0.009</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>296</td>
<td>0.79*</td>
<td>8.6</td>
<td>0.65</td>
<td>0.52</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>410</td>
<td>0.50</td>
<td>5.6</td>
<td>0.73</td>
<td>0.25</td>
<td>0.0001</td>
<td>0.0046</td>
<td>0.0001</td>
<td>0.00005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>289</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>216</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>407</td>
<td>0.45*</td>
<td>3.6</td>
<td>0.54</td>
<td>0.14*</td>
<td>0.001*</td>
<td>0.001</td>
<td>0.0003</td>
<td>0.0001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>414</td>
<td>0.13</td>
<td>1.7</td>
<td>0.06</td>
<td>0.03</td>
<td>2x10^-6</td>
<td>16x10^-6</td>
<td>2x10^-6</td>
<td>1x10^-6*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Diurnal is the coefficient nearest 23.93 hours (K₁) and semidiurnal is the coefficient nearest 12.42 hours (M₂). H₁ and H₂ are the first and second harmonics of M₂. An asterisk indicates that the amplitude was not larger than both of the two adjacent coefficients.
Table 9. Low-Pass Variance

<table>
<thead>
<tr>
<th>Record</th>
<th>Velocity Variance</th>
<th>Temperature Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length (days)</td>
<td>Unfiltered (cm/s)^2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unfiltered (°C)^2</td>
</tr>
<tr>
<td>406</td>
<td>30</td>
<td>119</td>
</tr>
<tr>
<td>416</td>
<td>100</td>
<td>55</td>
</tr>
<tr>
<td>412</td>
<td>172</td>
<td>101</td>
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<tr>
<td>219</td>
<td>35</td>
<td>100</td>
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<tr>
<td>298</td>
<td>174</td>
<td>88</td>
</tr>
<tr>
<td>417</td>
<td>174</td>
<td>28</td>
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<tr>
<td>300</td>
<td>174</td>
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<tr>
<td>296</td>
<td>90</td>
<td>81</td>
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<td>410</td>
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<td>289</td>
<td>174</td>
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<td>216</td>
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<tr>
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<td>174</td>
<td>62</td>
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<tr>
<td>414</td>
<td>174</td>
<td>5</td>
</tr>
</tbody>
</table>

1. The low-pass filtering reduced the useful length of the time series.
2. The unfiltered variance is the variance that was estimated for the low frequency segment of the spectrum. See Tables 5 and 6.
Figure 1. Location of moorings
Figure 2. Meter 406 current time series

File: VACMF
Meter: 406
Latitude: 14.17300
Longitude: 62.54450
Start: 06 AUG 1978
End: 21 SEP 1978

Array: A
Depth: 193

Figure 2. Meter 406 current time series
Figure 3. Meter 406 temperature time series
Figure 4. Meter 416 current time series
Figure 5. Meter 416 temperature time series
Figure 6. Meter 412 current time series
Figure 7. Meter 412 temperature time series
Figure 8. Meter 219 current time series
Figure 9. Meter 219 temperature time series
Figure 10. Meter 298 current time series
Figure 11. Meter 298 temperature time Series
Figure 12. Meter 417 current time series
Figure 13. Meter 417 temperature time series
Figure 14. Meter 300 current time series
Figure 15. Meter 300 temperature time series

File: VACMF 300
Meter: 1308230
Latitude: 61.99000
Longitude: 150
Start: 07 AUG 1978
End: 14 FEB 1979

Time (Julian Days)
Figure 16. Meter 296 current time series
Figure 17. Meter 296 temperature time series
Figure 18. Meter 410 current time series
Figure 19. Meter 410 temperature time series
Figure 20. Meter 289 current time series
Figure 22. Meter 216 temperature time series
Figure 23. Meter 407 current time series
Figure 25. Meter 414 current time series
Figure 26. Meter 414 temperature time series

File : VACMF
Meter : 414
Latitude : 12.33000
Longitude: 63.03000

Array : D
Depth : 1500
Start : 08 AUG 1978
End : 14 FEB 1979
Figure 27. Meter 406 speed and direction histograms.
Figure 28. Meter 416 speed and direction histograms
Figure 29. Meter 412 speed and direction histograms
File: VACMF  Array: B
Meter: 219  Depth: 193
Latitude: 1340500  Start: 07 AUG 1978
Longitude: 62.44900  End: 27 SEP 1978

Figure 30. Meter 219 speed and direction histograms

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Figure 31. Meter 298 speed and direction histograms.
Figure 32. Meter 417 speed and direction histograms
Figure 33. Meter 300 speed and direction histograms
Figure 34. Meter 296 speed and direction histograms.
Figure 35. Meter 410 speed and direction histograms.
Figure 36. Meter 289 speed and direction histograms
Figure 37. Meter 407 speed and direction histograms
Figure 38. Meter 414 speed and direction histograms
Figure 39. Meter 406 east spectrum
CURRENT SPECTRUM

Figure 40. Meter 406 north spectrum

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CROSS SPECTRAL PHASE & COHERENCE

95% Significance level

Figure 41. Meter 406 east-north coherence
Figure 42. Meter 406 rotary spectrum

Variable: U
Depth: 193
Meter: 406
Lat.: 14.17300
Long: 62.54450

Variable: V
Depth: 193
Meter: 406
Lat.: 14.17300
Long: 62.54450
Variable: U
Depth: 193
Meter: 406
Lat.: 14.17300
Long: 62.54450

Variable: V
Depth: 193
Meter: 406
Lat.: 14.17300
Long: 62.54450

Figure 43. Meter 406 rotary coefficient
TEMPERATURE SPECTRUM

Figure 44. Meter 406 temperature spectrum

Variable: T
File: VACMF
Meter: 406
Lat.: 14.7300
Long: 62.54450

Array A
Depth: 193
Start: 6 AUG 1978
End: 20 SEP 1978
CURRENT SPECTRUM

Figure 45. Meter 416 east spectrum
CURRENT SPECTRUM

Variable: V
File: VACMF
Meter: 416
Lat.: 14.7300
Long.: 62.54450
Array A
Depth: 393
Start: 6 AUG 1978
End: 26 NOV 1978

Figure 46. Meter 416 north spectrum

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CROSS SPECTRAL PHASE & COHERENCE

Figure 47. Meter 416 east-north coherence
ROTARY SPECTRUM

Figure 48. Meter 416 rotary spectrum
Variable: U
Depth: 393
Meter: 416
Lat.: 14.17300
Long: 6254450

Variable: V
Depth: 393
Meter: 416
Lat.: 14.17300
Long: 6254450

Figure 49. Meter 416 rotary coefficient
Figure 50. Meter 416 temperature spectrum
CURRENT SPECTRUM

Variance (cm/sec^2)/cph

cycles/hr

Variable: V
File: VACMF
Meter: 412
Lat.: 14.87300
Long: 62.54450
Array: A
Depth: 793
Start: 6 AUG 1978

Figure 51. Meter 412 east spectrum
Figure 52. Meter 412 north spectrum
CROSS SPECTRAL PHASE & COHERENCE

Figure 53. Meter 412 east-north coherence
Figure 54. Meter 412 rotary spectrum
ROTARY COEFFICIENT

Figure 55. Meter 412 rotary coefficient
Figure 56. Meter 412 temperature spectrum
CURRENT SPECTRUM

Figure 57. Meter 219 east spectrum
CURRENT SPECTRUM

Figure 58. Meter 219 north spectrum
CROSS SPECTRAL PHASE & COHERENCE

Squinted Coherence

Significance level 95%

Variable: U
Depth: 193
Meter: 219
Lat.: 13.40500
Long: 62.44900

Variable: V
Depth: 193
Meter: 219
Lat.: 13.40500
Long: 62.44900

Figure 59. Meter 219 east-north coherence
Figure 60. Meter 219 rotary spectrum

Variable: U
Depth: 193
Meter: 219
Lat.: 13 40500
Long: 62.44900

Variable: V
Depth: 193
Meter: 219
Lat.: 13 40500
Long: 62.44900
Figure 61. Meter 219 rotary coefficient
CURRENT SPECTRUM

Figure 63. Meter 298 east spectrum
CURRENT SPECTRUM

Figure 64. Meter 298 north spectrum

Variable: V  
File: VACMF  
Meter: 298  
Lat.: 1340500  
Long.: 6244900  
Array: B  
Depth: 393  
Start: 6 AUG 1978  
End: 9 FEB 1979
CROSS SPECTRAL PHASE & COHERENCE

Squadr Coherence

Degrees


cycles/hr


cycles/hr

Variable : U
Depth : 393
Meter : 298
Lat. : 13.40500
Long : 62.44900

Variable : V
Depth : 393
Meter : 298
Lat. : 13.40500
Long : 62.44900

Figure 65. Meter 298 east-north coherence
ROTARY SPECTRUM

Variable: U
Depth: 393
Meter: 238
Lat: 13.40500
Long: 62.44800

Variable: V
Depth: 393
Meter: 238
Lat: 13.40500
Long: 62.44800

Figure 66. Meter 298 rotary spectrum
Figure 67. Meter 298 rotary coefficient
Figure 68. Meter 298 temperature spectrum
CURRENT SPECTRUM

Figure 69. Meter 417 east spectrum
CURRENT SPECTRUM

Figure 70. Meter 417 north spectrum
Figure 71. Meter 417 east-north coherence
Figure 72. Meter 417 rotary spectrum
Variable: U
Depth: 793
Meter: 417
Lat: 1340500
Long: 6244900

Variable: V
Depth: 793
Meter: 417
Lat: 1340500
Long: 6244900

Figure 73. Meter 417 rotary coefficient
TEMPERATURE SPECTRUM

Variable: T
File: VACMF
Meter: 412
Lat.: 14.7300
Long.: 62.54450

Array A
Depth: 793
Start: 6 AUG 1978
End: 8 FEB 1979

Figure 74. Meter 417 temperature spectrum
CURRENT SPECTRUM

Figure 75. Meter 300 east spectrum
CURRENT SPECTRUM

Figure 76. Meter 300 north spectrum

Variable: V  
File: VACMF  
Meter: 300  
Lat: 13.08230  
Long: 61.99000  
Array: C  
Depth: 150  
Start: 8 AUG 1978  
End: 10 FEB 1979
CROSS SPECTRAL PHASE & COHERENCE

Variable: U
Depth: 150
Meter: 300
Lat: 13.08230
Long: 61.99000

Variable: V
Depth: 150
Meter: 300
Lat: 13.08230
Long: 61.99000

Figure 77. Meter 300 east-north coherence
ROTARY SPECTRUM

Figure 78. Meter 300 rotary spectrum

<table>
<thead>
<tr>
<th>Variable</th>
<th>U</th>
<th>Variable</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
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<td>Depth</td>
<td>150</td>
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<tr>
<td>Meter</td>
<td>300</td>
<td>Meter</td>
<td>300</td>
</tr>
<tr>
<td>Lat</td>
<td>13.08230</td>
<td>Lat</td>
<td>13.08230</td>
</tr>
<tr>
<td>Long</td>
<td>61.99000</td>
<td>Long</td>
<td>61.99000</td>
</tr>
</tbody>
</table>

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Figure 79: Meter 300 rotary coefficients
Figure 80. Meter 300 temperature spectrum
Figure 81. Meter 296 east spectrum
CURRENT SPECTRUM

Figure 82. Meter 296 north spectrum
CROSS SPECTRAL PHASE & COHERENCE

Figure 83. Meter 296 east-north coherence

Variable: U
- Depth: 350
- Meter: 296
- Lat: 13.08230
- Long: 61.99000

Variable: V
- Depth: 350
- Meter: 296
- Lat: 13.08230
- Long: 61.99000
Figure 84. Meter 296 rotary spectrum
ROTARY COEFFICIENT

Variable: U
Depth: 350
Meter: 296
Lat: 13.08230
Long: 61.99000

Variable: V
Depth: 350
Meter: 296
Lat: 13.08230
Long: 61.99000

Figure 85. Meter 296 rotary coefficient
CURRENT SPECTRUM

Figure 86. Meter 410 east spectrum
CURRENT SPECTRUM

Figure 87. Meter 410 north spectrum
**CROSS SPECTRAL PHASE & COHERENCE**

Variable U
- Depth: 750
- Meter: 410
- Lat: 13.08230
- Long: 61.99000

Variable V
- Depth: 750
- Meter: 410
- Lat: 13.08230
- Long: 61.99000

Figure 88. Meter 410 east-north coherence
ROTARY SPECTRUM

Figure 89. Meter 410 rotary spectrum

Variable : U
Depth : 750
Meter : 410
Lat : 13.08230
Long : 61.99000

Variable : V
Depth : 750
Meter : 410
Lat : 13.08230
Long : 61.99000
ROTARY COEFFICIENT

Variable U
Depth . 750
Meter  410
Lat    13 08230
Long   61 99000

Variable V
Depth . 750
Meter  410
Lat    13 08230
Long   61 99000

Figure 90. Meter 410 rotary coefficient
Figure 91. Meter 410 temperature spectrum
CURRENT SPECTRUM

Figure 92. Meter 289 east spectrum

Variable | U
---|---
File | VACMF
Meter | 289
Lat | 12.33000
Long | 63.03000

Array | D
Depth | 150
Start | 8 AUG 1978
End | 10 FEB 1979
CURRENT SPECTRUM

Figure 93. Meter 289 north spectrum
CROSS SPECTRAL PHASE & COHERENCE

Variable U
- Depth 150
- Meter 289
- Lat 12.33000
- Long 63.03000

Variable V
- Depth 150
- Meter 289
- Lat 12.33000
- Long 63.03000

Figure 94. Meter 289 east-north coherence

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ROTARY SPECTRUM

Figure 95. Meter 289 rotary spectrum

<table>
<thead>
<tr>
<th>Variable</th>
<th>U</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
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<tr>
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<td>12.33000</td>
</tr>
<tr>
<td>Long</td>
<td>63.03000</td>
<td>63.03000</td>
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</tbody>
</table>

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Figure 96. Meter 289 rotary coefficient
Figure 97. Meter 289 rotary spectrum
Figure 98. Meter 407 east spectrum
Figure 99. Meter 407 north spectrum
CROSS SPECTRAL PHASE & COHERENCE

Variable U  
Depth  750  
Meter  407  
Lat  12.33000  
Long  63.03000

Variable V  
Depth  750  
Meter  407  
Lat  12.33000  
Long  63.03000

Figure 100. Meter 407 east-north coherence
Figure 101. Meter 407 rotary spectrum
Variable U
Depth: 750
Meter: 407
Lat: 1233000
Long: 6303000

Variable V
Depth: 750
Meter: 407
Lat: 1233000
Long: 6303000

Figure 102. Meter 407 rotary coefficient
Figure 103. Meter 414 east spectrum
CURRENT SPECTRUM

Figure 104. Meter 414 north spectrum

Variable V
File VACMF
Meter 414
Lat 12.33000
Long 63.03000
Array D
Depth 1500
Start 8 AUG 1978
End 10 FEB 1979
CROSS SPECTRAL PHASE & COHERENCE

Significance level

95 %

Figure 105. Meter 414 east-north coherence
ROTARY SPECTRUM

Variable U
Depth 1500
Meter 414
Lat 1233000
Long 6303000

Variable V
Depth 1500
Meter 414
Lat 1233000
Long 6303000

Figure 106. Meter 414 rotary spectrum
ROTARY COEFFICIENT

Variable: U
Depth: 1500
Meter: 414
Lat: 12.33000
Long: 63.03000

Variable: V
Depth: 1500
Meter: 414
Lat: 12.33000
Long: 63.03000

Figure 107. Meter 414 rotary coefficient
TEMPERATURE SPECTRUM

Figure 108. Meter 414 temperature spectrum
* Every 120 Hours Starting At 0000 Julian Day 226

File : VACMF Array : A
Meter : 406 Depth : 193
Latitude : 14.17300 Start : 14 AUG 1978
Longitude : 62.54450 End : 13 SEP 1978

Figure 109. Meter 406 progressive vector diagram
File: VACMF
Meter: 406
Latitude: 14.17300
Longitude: 62.54450
Time Interval: 12,000 Hours

Array: A
Depth: 193
Start: 14 AUG 1978
End: 13 SEP 1978

Scale: 50.0 cm/sec

Figure 110. Meter 406 current vector diagram
* Every 168 Hours Starting At 0000 Julian Day 226

File: VACMF
Meter: 416
Depth: 393
Latitude: 14.17300
Longitude: 62.54450
Start: 14 AUG 1978
End: 22 NOV 1978

Figure 112. Meter 416 progressive vector diagram
Figure 113. Meter 416 current vector diagram
Figure 114. Meter 416 low-pass temperature time series
* Every 168 Hours Starting At 0000 Julian Day

File: VACMF Array: A
Meter: 412 Depth:
Latitude: 14.17300 Start: 14 AUG
Longitude: 62.54450 End: 02 FEB

Figure 115. Meter 412 progressive vector diagram
File: VACMF  Array: A
Meter: 412  Depth: 793
Latitude: 14.17300  Start: 14 AUG 1978
Longitude: 62.54450  End: 02 FEB 1979
Time Interval: 12.0000 Hours

Figure 116. Meter 412 current vector diagram
* Every 168 Hours Starting At 0000 Julian Day 227

File : VACMF       Array : B
Meter : 219        Depth : 193
Latitude : 13 40 50 0  Start : 15 AUG 1978
Longitude : 62 44 90 0  End : 19 SEP 1978

Figure 118. Meter 219 progressive vector diagram
Figure 19. Meter 219 current vector diagram.
File: VACMF
Meter: 219
Latitude: 13.40500
Longitude: 62.44900
Array: B
Depth: 193
Start: 15 AUG 1978
End: 19 SEP 1978

Figure 120. Meter 219 low-pass temperature time series.
* Every 168 Hours Starting At 0000 Julian Day 227

File : VACMF
Meter : 298
Latitude : 13 40500
Longitude : 62.44900

Array : B
Depth : 393
Start : 15 AUG 1978
End : 05 FEB 1979

Figure 121. Meter 298 progressive vector diagram
Figure 122. Meter 298 current vector diagram
* Every 168 Hours Starting At 0000 Julian Day 227

<table>
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<tr>
<th>File</th>
<th>VACMF</th>
<th>Array</th>
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<td>417</td>
<td>Depth</td>
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<tr>
<td>Latitude</td>
<td>13.40500</td>
<td>Start</td>
<td>15 AUG 1978</td>
</tr>
<tr>
<td>Longitude</td>
<td>62.44900</td>
<td>End</td>
<td>05 FEB 1979</td>
</tr>
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Figure 124. Meter 417 progressive vector diagram
Figure 125. Meter 417 current vector diagram
Figure 126. Meter 417 low-pass temperature time series.
* Every 168 Hours Starting At 0000 Julian Day 228

File : VACMF
Meter : 300
Latitude : 13.08230
Longitude : 61.99000

Array : C
Depth : 150
Start : 16 AUG 1978
End : 06 FEB 1979

Figure 127. Meter 300 progressive vector diagram
File: VACMF
Meter: 300
Latitude: 13.08230
Longitude: 61.99000
Time Interval: 12.0000 Hours

Array: C
Depth: 150
Start: 16 AUG 1978
End: 06 FEB 1979

Figure 128. Meter 300 current vector diagram
Figure 129. Meter 300 low-pass temperature time series
Every 168 Hours Starting At 0000 Julian Day 228

File : VACMF  
Meter : 296  
Latitide : 13.08230  
Longitude : 61.99000

Array : C  
Depth : 350  
Start : 16 AUG 1978  
End : 15 NOV 1978

Figure 130. Meter 296 progressive vector diagram
Figure 131. Meter 296 current vector diagram
* Every 168 Hours Starting At 0000 Julian Day 228

File : VACMF
Meter  : 410
Depth  : 750
Latitude : 13.08230
Longitude : 61.99000
Start  : 16 AUG 1978
End    : 06 FEB 1979

Figure 132. Meter 410 progressive vector diagram
Scale: 500 cm/sec

File: VACMF
Meter: 410
Latitude: 13.08230
Longitude: 61.99000
Time Interval: 12.0000 Hours

Array: C
Depth: 750
Start: 16 AUG 1978
End: 06 FEB 1979

Figure 133. Meter 410 current vector diagram
* Every 168 Hours Starting At 0000 Julian Day 228

File : VACMF  Array : D
Meter : 289  Depth : 150
Latitude : 12.33000  Start : 16 AUG 1978
Longitude : 63 03000  End : 06 FEB 1979

Figure 135. Meter 289 progressive vector diagram
Figure 136. Meter 289 current vector diagram
* Every 168 Hours Starting At 0000 Julian Day 228

File: VACMF
Meter: 407
Depth: 750
Latitude: 12.33000
Start: 16 AUG 1978
Longitude: 63.03000
End: 06 FEB 1979

Figure 138. Meter 407 progressive vector diagram.
Scale: 500 cm/sec

File: VACMF
Meter: 407
Latitude: 12.33000
Longitude: 63.03000
Time Interval: 12.0000 Hours

Array: D
Depth: 750
Start: 16 AUG 1978
End: 06 FEB 1979

Figure 139. Meter 407 current vector diagram
Figure 140. Meter 407 low-pass temperature time series
* Every 168 Hours Starting At 0000 Julian Day 228

File: VACMF  Array: D
Meter: 414  Depth: 1500
Latitude: 12.33000  Start: 16 AUG 1978
Longitude: 63.03000  End: 06 FEB 1979

Figure 141. Meter 414 progressive vector diagram
Scale: 500 cm/sec

File: VACMF
Meter: 414
Latitude: 12.33000
Longitude: 63.03000
Time Interval: 12.0000 Hours

Array: D
Depth: 1500
Start: 16 AUG 1978
End: 06 FEB 1979

Figure 142. Meter 414 current vector diagram
ROTARY SPECTRUM

Variable: U
Depth: 193
Meter: 406
Lat.: 14.77300
Long: 62.54450

Variable: V
Depth: 193
Meter: 406
Lat.: 14.77300
Long: 62.54450

Figure 144. Meter 406 low-pass rotary spectrum
Figure 145. Meter 406 low-pass rotary coefficient
TEMPERATURE SPECTRUM

Figure 146. Meter 406 low-pass temperature spectrum
Figure 147. Meter 416 low-pass rotary spectrum
Variable | U | Variable | V
Depth | 393 | Depth | 393
Meter | 416 | Meter | 416
Lat | 1417300 | Lat | 1417300
Long | 6254450 | Long | 6254450

Figure 148. Meter 416 low-pass rotary coefficient
Figure 149. Meter 416 low-pass temperature spectrum
ROTARY SPECTRUM

Figure 150. Meter 412 low-pass rotary spectrum

Variable U
Depth 793
Meter 412
Lat 14.17300
Long 62.54450

Variable V
Depth 793
Meter 412
Lat 14.17300
Long 62.54450
Figure 151. Meter 412 low-pass rotary coefficient
TEMPERATURE SPECTRUM

Figure 152. Meter 412 low-pass temperature spectrum
Figure 153. Meter 219 low-pass rotary spectrum
ROTARY COEFFICIENT

Figure 154. Meter 219 low-pass rotary coefficient
TEMPERATURE SPECTRUM

Figure 155. Meter 219 low-pass temperature spectrum
Figure 156. Meter 298 low-pass rotary spectrum
ROTARY COEFFICIENT

Figure 157. Meter 298 low-pass rotary coefficient
Figure 158. Meter 298 low-pass temperature spectrum
Figure 159. Meter 417 low-pass rotary spectrum
Variable: U
Depth: 793
Meter: 417
Lat: 13 40500
Long: 62 44900

Variable: V
Depth: 793
Meter: 417
Lat: 13 40500
Long: 62 44900

Figure 160. Meter 417 low-pass rotary coefficient
TEMPERATURE SPECTRUM

Figure 161. Meter 417 low-pass temperature spectrum
ROTARY SPECTRUM

Figure 162. Meter 300 low-pass rotary spectrum
<table>
<thead>
<tr>
<th>Variable</th>
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<th>Variable</th>
<th>V</th>
</tr>
</thead>
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<tr>
<td>Long</td>
<td>61.99000</td>
<td>Long</td>
<td>61.99000</td>
</tr>
</tbody>
</table>

Figure 163. Meter 300 low-pass rotary coefficient
TEMPERATURE SPECTRUM

Figure 164. Meter 300 low-pass temperature spectrum

Variable: T
File: VACMF
Meter: 300
Lat: 1308230
Long: 61.99000
Array C
Depth: 150
Start: 16 AUG 1978
End: 6 FEB 1979
ROTOR SPECTRUM

![Graph showing variance versus cycles/hr with markers for CW and CCW, and variable information and coordinates for Meter 296, Depth 350, Lat 13.08230, Long 61.99000, Variable U and V)](image)

Figure 165. Meter 296 low-pass rotary spectrum
CURRENT METER DATA FROM THE SOUTHEASTERN CARIBBEAN SEA, AUGUST --ETC(U) SEP 80. J D BOYD, T H KINDER

UNCLASSIFIED NORDA-TN-76
Figure 166. Meter 296 low-pass rotary coefficient

Variable: U
Depth: 350
Meter: 296
Lat: 13.08230
Long: 61.99000

Variable: V
Depth: 350
Meter: 296
Lat: 13.08230
Long: 61.99000
ROTARY SPECTRUM

Variable: U
Depth: 750
Meter: 410
Lat: 1308230
Long: 61.99000

Variable: V
Depth: 750
Meter: 410
Lat: 1308230
Long: 61.99000

Figure 167. Meter 410 low-pass rotary spectrum
Figure 168. Meter 410 low-pass rotary coefficient
Figure 169. Meter 410 low-pass temperature spectrum
Figure 170. Meter 289 low-pass rotary spectrum
Figure 171. Meter 289 low-pass rotary coefficient
TEMPERATURE SPECTRUM

Figure 172. Meter 289 low-pass temperature spectrum

Variable: T
File: VACMF
Meter: 289
Lat: 12.33000
Long: 63.03000
Array: D
Depth: 150
Start: 16 AUG 1976
End: 6 FEB 1979
Figure 173. Meter 407 low-pass rotary spectrum

Variable: U
Depth: 750
Meter: 407
Lat: 12.3300
Long: 63.0300

Variable: V
Depth: 750
Meter: 407
Lat: 12.3300
Long: 63.0300
ROTARY COEFFICIENT

Figure 174. Meter 407 low-pass rotary coefficient

Variable: U
Depth: 750
Meter: 407
Lat: 12.33000
Long: 63.03000

Variable: V
Depth: 750
Meter: 407
Lat: 12.33000
Long: 63.03000
Figure 175. Meter 407 low-pass temperature spectrum
ROTARY SPECTRUM

Figure 176. Meter 414 low-pass rotary spectrum

Variable U
Depth 1500
Meter 414
Lat 12.33000
Long 63.03000

Variable V
Depth 1500
Meter 414
Lat 12.33000
Long 63.03000
Variable: U
Depth: 1500
Meter: 414
Lat.: 12.33000
Long.: 63.03000

Variable: V
Depth: 1500
Meter: 414
Lat.: 12.33000
Long.: 63.03000

Figure 177. Meter 414 low-pass rotary coefficient
TEMPERATURE SPECTRUM

Figure 178. Meter 414 low-pass Temperature spectrum
Current Meter Data from the Southeastern Caribbean Sea, August 1978 to February 1979

Thirteen vector-averaging current meters were deployed on four moorings in the southeastern Caribbean Sea from August 1978 to February 1979. Velocity and temperature data are presented graphically as time series, histograms, and as variance spectra. Low-pass filtered data (72 hour period at the half-power point) are presented graphically as progressive vector diagrams, vector diagrams (stick plots), time series, and spectra. Scalar mean speeds ranged from 4 to 38 cm/s, and (mostly westward)
mean speeds from 2 to 36 cm/s (all but one were less than 9 cm/s). The velocity and temperature variance were distributed among three frequency bands: subinertial, inertial, and tidal. In the velocity spectra the subinertial variance accounted for an average of 50% of the total variance, inertial 5%, and tidal 10%. In the temperature spectra the subinertial accounted for 75% of the total variance, inertial 1%, and tidal 10%. Individual records had peaks at periods between 10 and 45 days.
DATE
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