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INFORMAL REPORT

CURRENTS ALONG THE EAST COAST OF AFRICA

DECEMBER 1967

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INFORMAL REPORT

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ABSTRACT

The major flows along the east coast of Africa are the East Africa Coastal Current north of 10°S, and the Agulhas Current south of 11°S. The former shows considerable monthly variation in speed and direction; the latter, however, is very constant and sets southward throughout the year.

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This manuscript has been reviewed and is approved for release as an UNCLASSIFIED informal report.



A. R. GORDON, JR.
Division Director

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CURRENTS ALONG THE EAST COAST OF AFRICA

Introduction

The descriptions of the coastal currents in this report are based on data obtained by direct methods. The two principal currents are the East Africa Coastal Current, also known as the Somali Current, and the Agulhas Current; they originate in the coastal region between about 10° and 11° S., where the Indian South Equatorial Current divides, part flowing north and part flowing south. The two currents differ greatly, and the region separating them is sharply defined; the variable East Africa Coastal Current is easily influenced by the northeast and southwest monsoons, and the constant Agulhas Current is under the steady influences of the southeast trade winds and the Indian South Equatorial Current.

East Africa Coastal Current

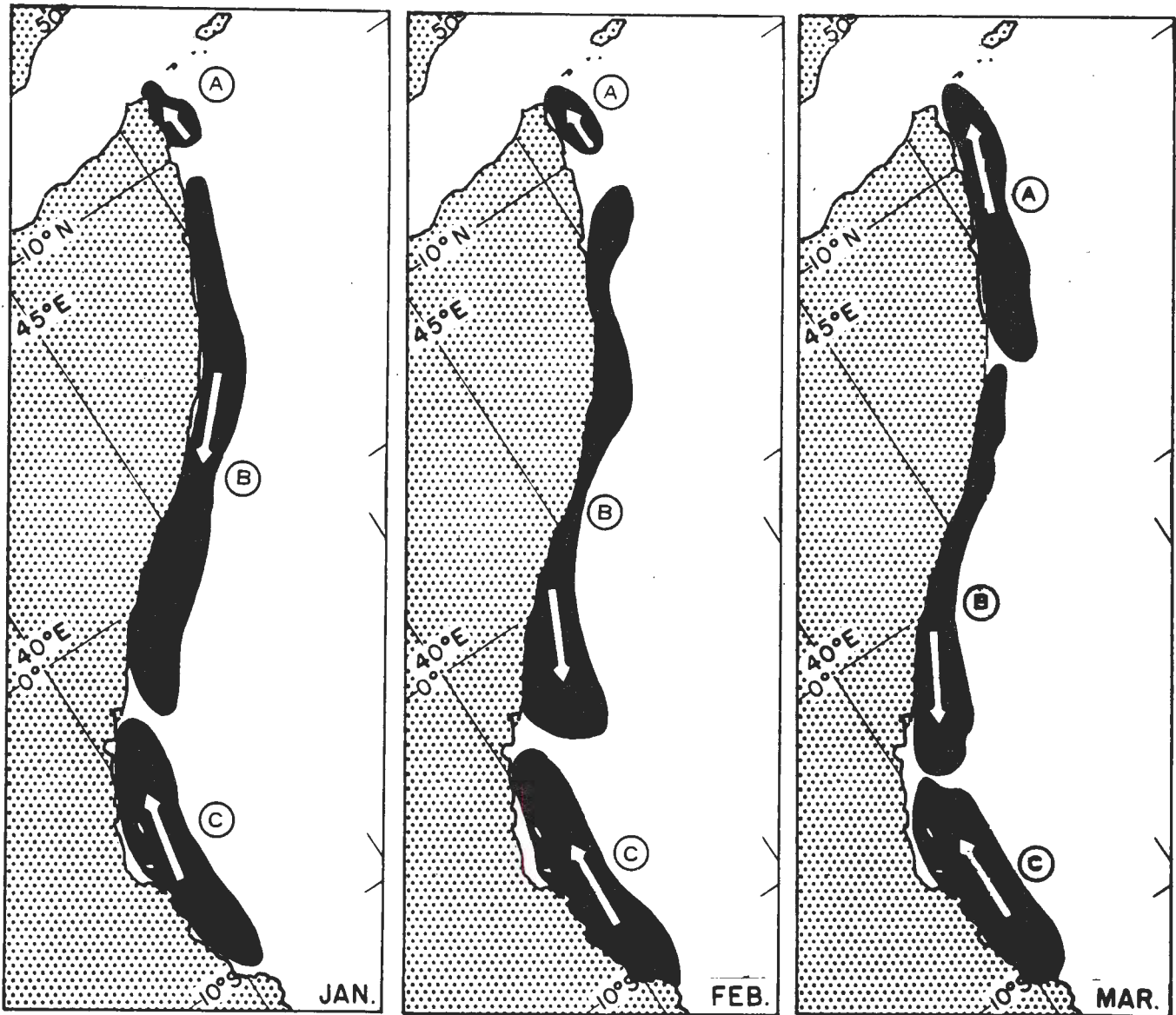
The East Africa Coastal Current originates mainly from the part of the Indian South Equatorial Current which turns north off the coast of Africa in the vicinity of 10° S. The surface current appears to vary considerably in speed and direction from month to month, as shown in Figures 1 through 4. The greatest changes coincide with the period of the opposing northeast monsoon during November through March.

This coastal current is most persistent in a north or northeast direction and strongest during the southwest monsoon from May through September, and particularly during August. Speed and frequency begin to decrease during the transition month of October. In November at about 4° N. a part of the current begins to reverse; this part expands northward

and southward until February. The region of reverse flow begins to diminish in March and disappears in April, when the northward set again predominates.

Directly measured currents in the upper 200 meters off the Somali coast in August 1964 are shown by the cross sections* in Figure 5.

*Woods Hole Oceanographic Institution, Reference No. 65-66, "Near surface currents off the Somali coast in the summer monsoon, August 1964," by John G. Bruce, Jr., Technical Report, December 1965, National Science Foundation Grant GP 821.

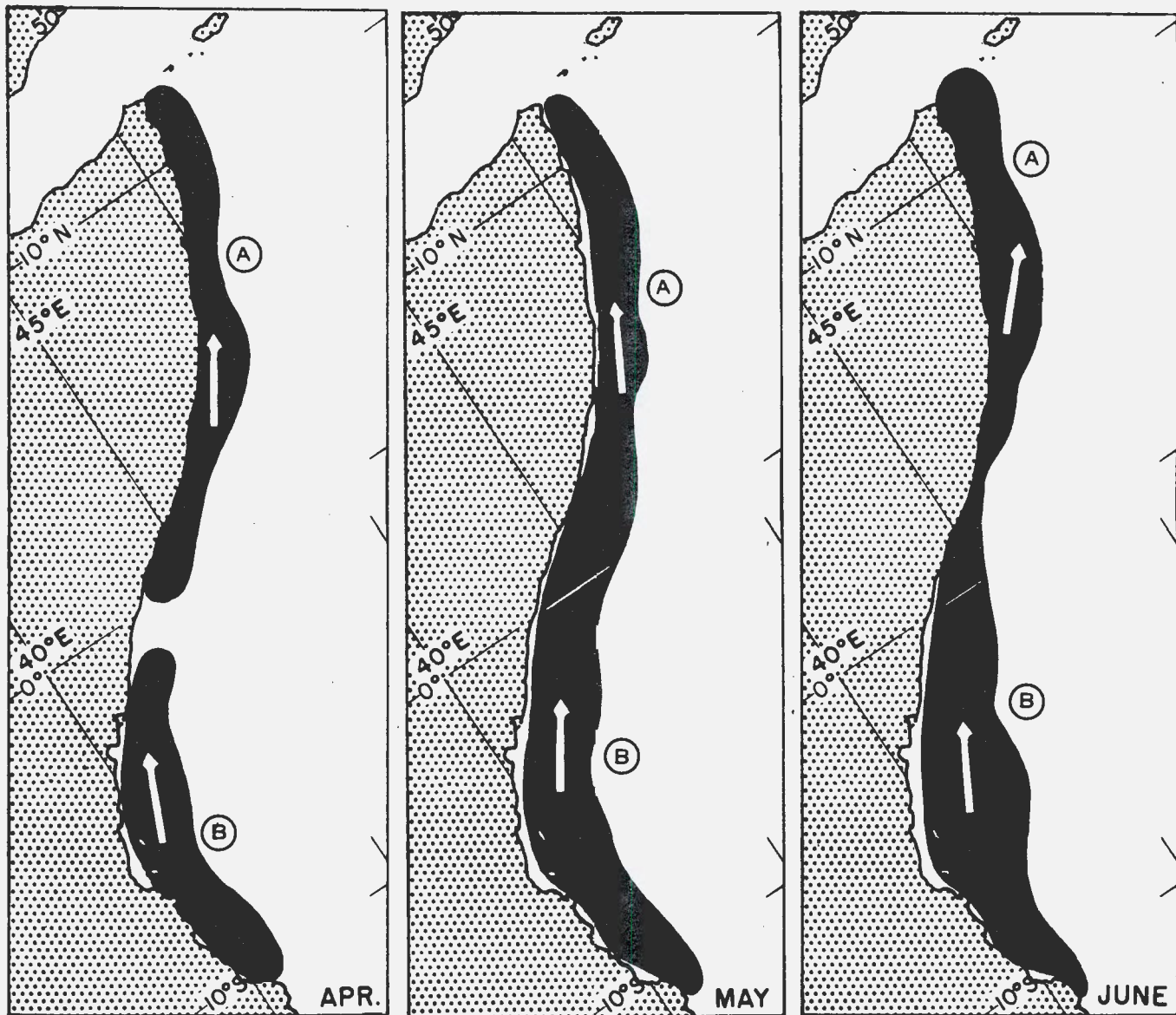


Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	WNW	55	0.7	1.9	241
B	WSW	70	1.3	2.8	180
C	N	60	1.0	2.2	134

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	N	50	0.7	2.1	231
B	WSW	70	1.5	3.0	143
C	N	45	0.6	2.0	111

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	N	50	0.8	2.2	257
B	WSW	75	1.5	3.0	102
C	N	75	1.0	2.4	52

Figure 1 Monthly variations in speed, direction, and frequency of prevailing current (Jan., Feb., Mar.)

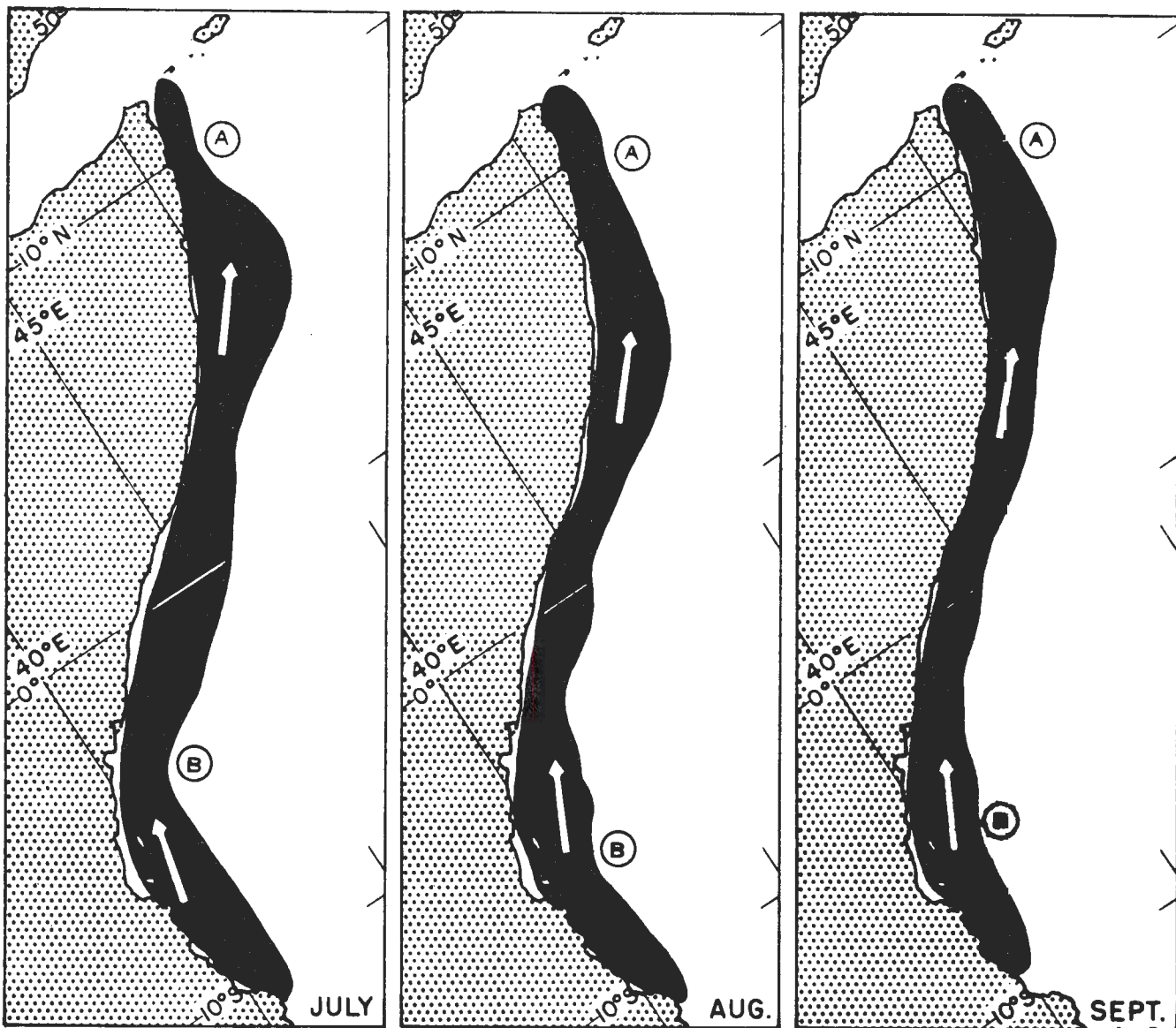


Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NNE	65	1.1	2.6	195
B	NNE	75	1.6	3.5	104

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NNE	70	1.3	3.5	392
B	NNE	75	2.2	3.6	127

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NE	85	1.7	3.9	904
B	NNE	75	2.3	4.0	225

Figure 2 Monthly variations in speed, direction and frequency of prevailing current (April, May, June)

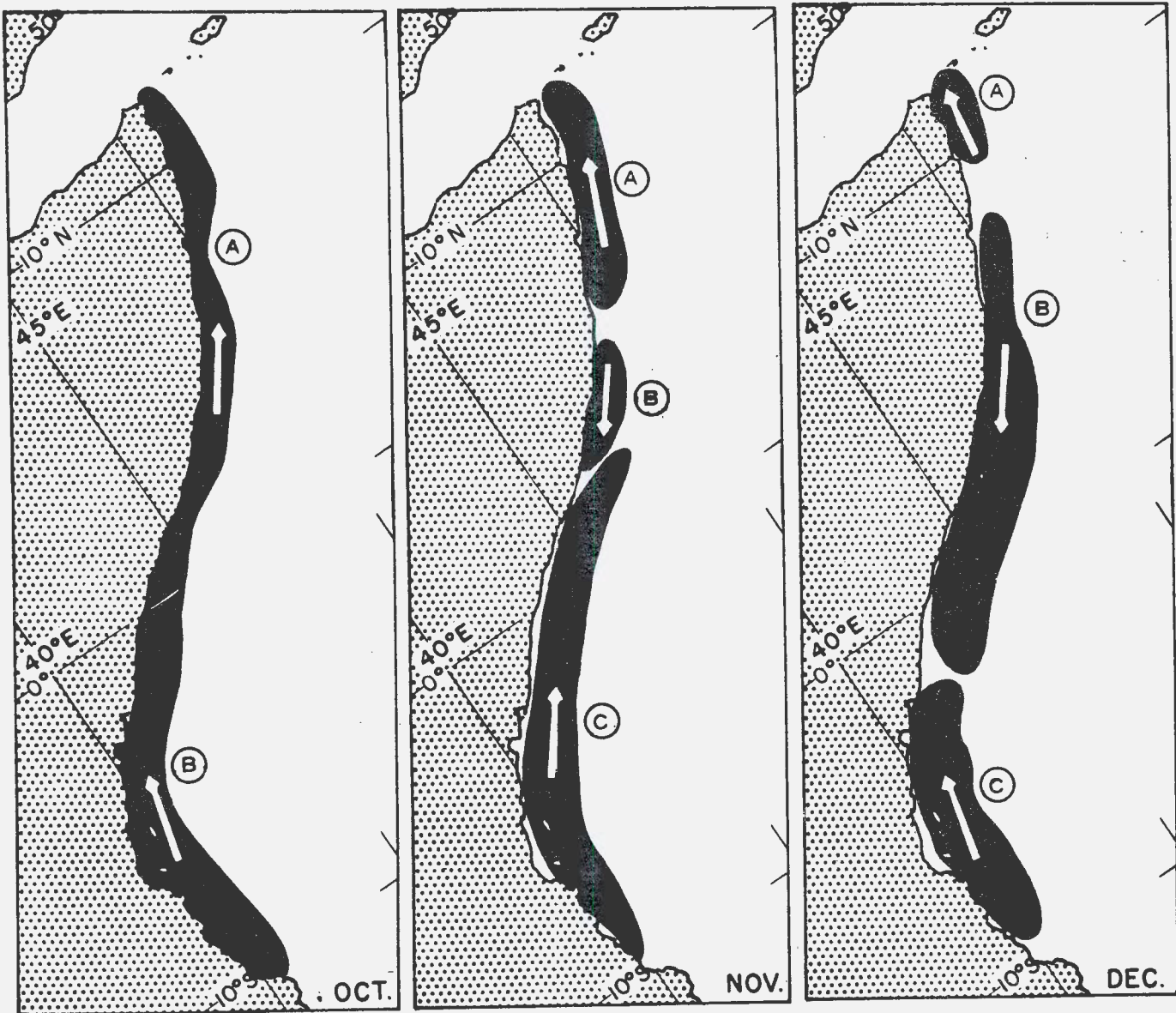


Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NNE	85	1.9	4.1	976
B	N	75	2.0	4.0	195

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NE	90	2.3	4.5	724
B	NNE	75	1.8	3.5	191

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NE	85	2.2	4.2	596
B	NNE	70	1.6	3.0	158

Figure 3 Monthly variations in speed, direction, and frequency of prevailing current (July, Aug., Sept.)



Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NNE	70	1.5	3.6	391
B	NNE	70	1.7	3.0	97

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	NNW	55	1.1	2.5	298
B	SW	65	1.6	2.0	37
C	NNE	70	1.7	3.3	193

Region	Dir.	%	Speed (kn.)		Total Obs.
			Mean	Max.	
A	N	35	0.9	2.0	240
B	SW	65	1.8	3.2	186
C	NNE	65	1.4	2.5	147

Figure 4 Monthly variations in speed, direction, and frequency of prevailing current (Oct., Nov., Dec.)

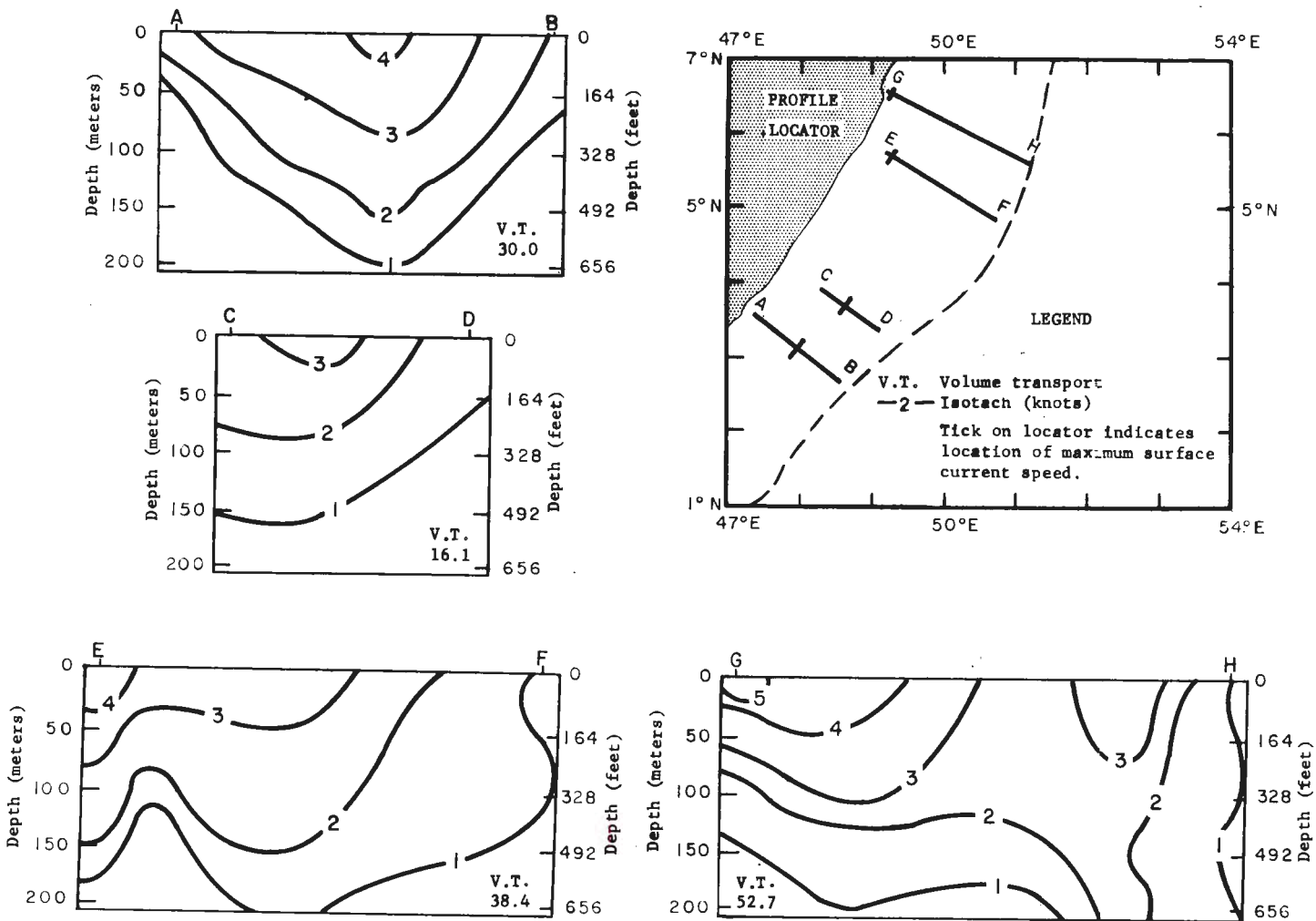


Figure 5 Direct current measurements (knots) and volume transport ($10^6 m^3/sec.$) from 0 to 200 meters, August

Agulhas Current

The Agulhas Current is a very constant coastal current that sets south and southwest along the southeast coast of Africa between 11°S. and the Cape of Good Hope. Highest speeds and greatest constancy are observed in the vicinity of the 100-fathom curve east of 28°E. within Region 4 of Figure 6; here, the surface current is strongest during February through April, when about 17 percent of all measured speeds in the prevailing direction exceed 3 knots, particularly between 31°30' and 33°30'S., where the speed occasionally exceeds 5 knots. These maximum speeds may occur at any time but less frequently during May through July.

Figure 6 also shows the slight seasonal change in the boundary of the Agulhas Current. The table shows seasonal prevailing directions, speeds, and frequencies. The graph shows mean monthly speeds of the surface current by prevailing direction for each of the five regions.

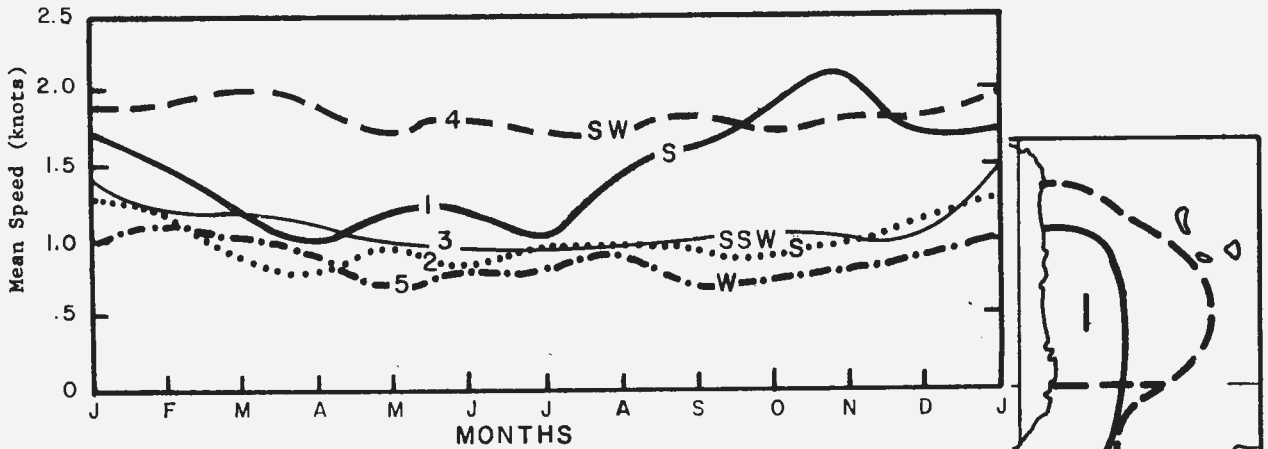
West of about 23°E. in the vicinity of Agulhas Bank the current branches. The main part continues westward past Cape Agulhas; the second part turns counterclockwise and sets southeast under the influence of the prevailing westerly winds and part of the east-setting South Atlantic Current that flows into the Indian Ocean. In this latter region the current is weaker and more variable, as shown in the table and graph, which indicate lower speeds and frequencies for Region 5. Current speeds usually do not exceed 2 knots, although speeds of 3 knots or more occasionally may be observed. Another factor which will tend to reduce the constancy of the current in Region 5 is the countercurrents between the coast and the Agulhas Current, where east and northeast sets between 0.5 and 1.5 knots may occur at irregular intervals at any time of the year.

Data on subsurface flow are scarce, but available information indicates that the surface set is maintained down to about 500 fathoms and that the speed decreases with depth. From about 500 fathoms to near the bottom, the set reverses and considerable variability occurs; subsurface speeds generally are less than 0.1 knot.

Conclusions

Surface data show that the coastal current north of 10°S. at times is quite variable and complex in speed and direction. The current has a tendency to flow north or northeast during all months. However, from November to April there is a continuing change in the flow pattern; the central segment sets southwest under the influence of the northeast monsoon, whereas the north and south portions of the current set northeast. When fully established in December through March, the central segment is stronger than the north-setting segments; its mean speed in December is 1.8 knots and its maximum speed about 3.2 knots.

The Agulhas Current is very constant and shows only little seasonal variation in speed; the greatest change is in the northern part of the current, where speeds are higher during November through February, probably because of the influence of the monsoon.



Regional Monthly Changes in Mean Speed for Prevailing Current Direction

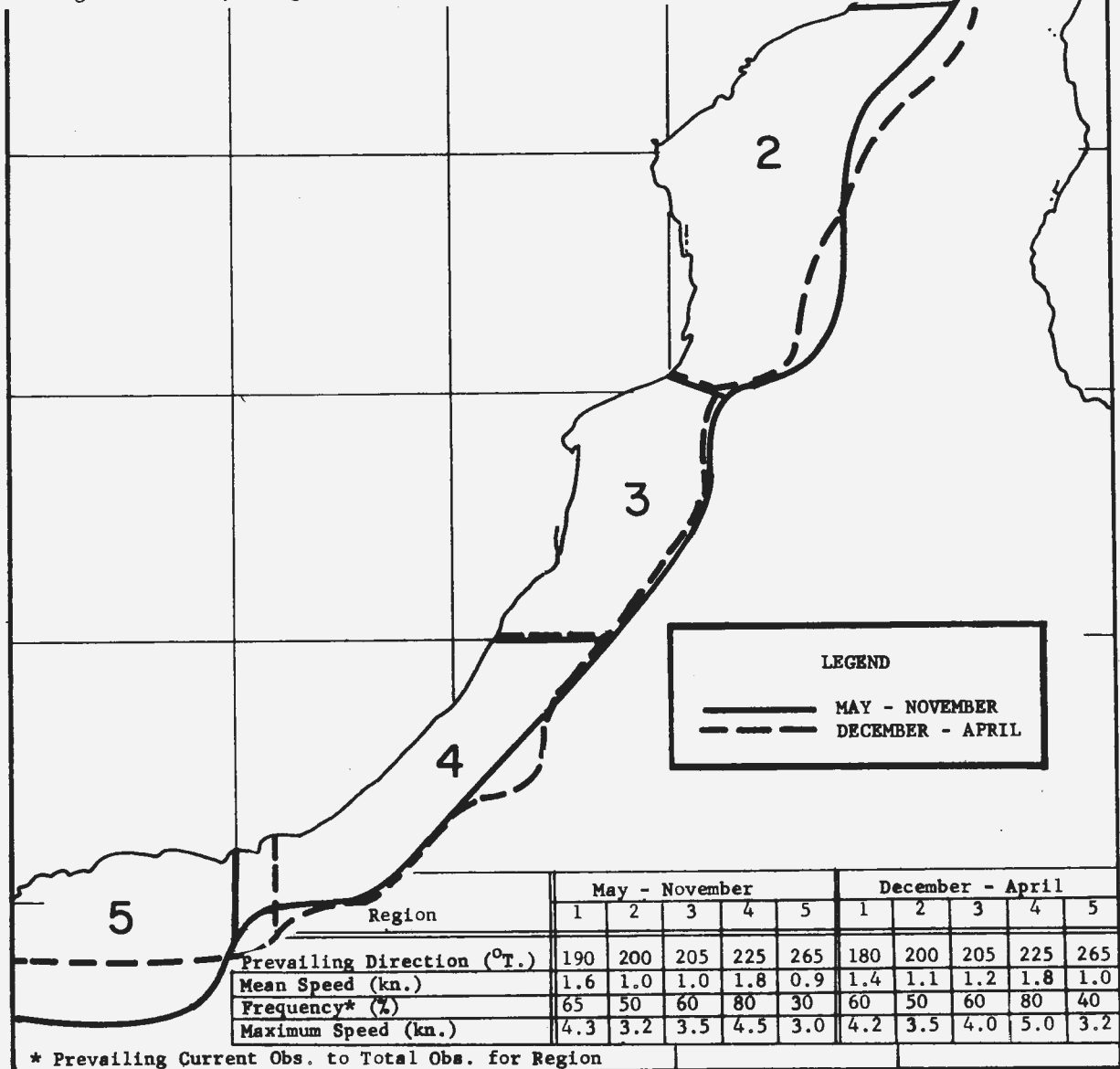


Figure 6 Seasonal characteristics of Agulhas Current