



Some characteristics of sea current in the region near the coast of the central vietnam

Bởi:

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Abstract: *The observation data on the sea currents at four points in the region near the coast of Central Vietnam is treated in order to obtain quantitative characteristics of currents such as maximum velocities, direction and phase of oscillations and residual components. Due to the current feature the region stretching from 11 to 18 o N is differentiated into two parts. The northern part from 16 o N northward is characteristic by the gentle residual current and the vertically homogenous strong tidal currents of the diurnal type. In the rest part, the tidal current is of mixed type and light force. There, the non-periodic currents are complicated and consisted of both locally developed wind-generated component and the steady current descended from the cold circulation system of the west of the South-china sea in winter. This component prevails over all the others and causes the southward undersurface strong stream of water along the coastline of the Central Vietnam.*

The sea region near the coast of the Central Vietnam belongs to the zone of activity of the circulation system in the west of the South-china sea. To identify the features of the sea currents in this region is an important problem of the regional oceanography. The information on the sea water circulation is very useful in the interpretation of many features of the natural conditions of the region such as oceanographic fields, the distribution of sea bottom sediments, the transition property and the abundance in species composition of the livings in this coastal segment of the sea. The existing publications on the South-china sea circulation [1-6] show that the sea region near the coast of the Central Vietnam is the place of the intensification of the cold current in

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Western South-china sea in the winter, where this current converges to the local current from the gulf of Bacbo. At the same time there develop different wind currents that create a complicity of the circulation regime in the place.

The next task is to describe in detail the space structure of the sea current system in this region and to obtain quantitative characteristics necessary in many practical applications. This paper presents the main features of the sea currents in studied region derived from the analysis of sea current observations obtained in the Vietnam-Russia joint expedition cruise in winter 1994-1995.

To obtain quantitative characteristics of the current components the algorithm for the principal component analysis was applied to the observation series (table 1). For the current series with observation length of four days and more the harmonic analysis by least square method has been used to compute the harmonic constants of the tidal constituents (tables 2 and 3).

Upon the basis of obtained quantitative characteristics of the currents we can make the following generalized remarks on the regime of sea currents in the considered region.

In the northern part of the studied region represented by the measured point of $17^{\circ}38'N$ latitude and $107^{\circ}01'E$ longitude the purely diurnal tidal current dominates. For all thickness of the water the great axes of the tidal ellipses of diurnal component and of semi-diurnal one have the direction northwest–southeast, i.e., the direction paralleled to the shoreline. The magnitude of the diurnal component takes the lead of the semi-diurnal one. The revolving of the tidal current is observed for the semi-diurnal component, but this component is of the magnitude insignificant in comparison with the diurnal component. There is shown the identity of the maximum current direction and the phase of oscillation at all horizons from the surface to the bottom. The maximum diurnal tidal currents for three horizons are almost simultaneously southeastward at 0 o'clock and northwestward at 12 o'clock of conventional time. The phase lag between horizons is about 0.1 hours only. The same picture is observed for the semi-diurnal tidal components. The residual currents at the horizons from 20 m down to the bottom are characterized by small speed about 13 cm/s and have the east direction and turn left with the increasing of the depth. This is a sign of wind current that is generated in friction shallow water domains.

The region from $16^{\circ}18'N$ to $16^{\circ}40'N$ more clearly presents the revolving property of the tidal currents of the deep open sea. The tidal current has a speed much less than that in the northern part. Moreover, the magnitudes of diurnal and semi-diurnal currents have no much different values. The left turn of the current speed vector with the depth increase is expressed clearly both in diurnal and in semi-diurnal components. An irregularity is observed for the observation point $108^{\circ}41'E-16^{\circ}18'N$: the phase lag

between horizons 30 m and 60 m appears to be complex – the phases of oscillation at two these horizons are almost opposed. Because of the lack of observations for the horizon 60 m at point 109°00'E-16°40'N this irregularity can not be checked.

The residual currents at the horizons near to the surface are very weak, just about 10 cm/s speed and its speed decreases rapidly with the depth. Certainly, these are currents caused by local wind. At the same time at the horizon 60 m in the observation point 108°41'E-16°18'N observed a strong residual current with speed value greater 40 cm/s. Most likely this the current component of the steady winter current system of north-south direction because this horizon is coincide with the depth of the steam jet of steady winter currents system in the west part of the South-china sea. The southern part of the studied region represented by the measured point of 11°00'N latitude and 109°10'E longitude is characterized with a regime of tidal currents of mixed type and gentle strengthen. The diurnal current is less than 20 cm/s and the semi-diurnal current is less than 10 cm/s. Again, there reverse tidal currents typical to near-shore shallow waters takes the lead. With the depth increasing, a right turn of the diurnal and semi-diurnal currents is observed and a phase lag equals about one hour for 10 m depth increase in the case of the diurnal tidal current. The residual current in this region is comparatively impressive. At horizon 10 m the speed reaches 60 cm/s and more, at horizon 60 m it equals 35 cm/s also and at horizon 90 m it decreases rapidly down to 13 cm/s. This place is situated in the last segment of the west South-china sea steady current system where the stream jet tends to rise toward sea surface and the residual currents at the near-surface horizons are much stronger than that of the lower horizons. It is obvious that the origin of the current is not local winds since at relatively deep horizons bellow the sea surface there observed great speed still.

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Longitude and latitude	Horizon (m)										
		Diurnal component	Semi-diurnal component	Residual current	Speed (cm/s)	Direction (°)	Phase (hour)	Speed (cm/s)	Direction (°)		
107°01'E	20				143	0.1	7	156	6.1	13	108
17°38'N					323	12.1		336	0.1		
	30				147	23.6	7	152	6.2	13	97

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			327	11.6		332	0.2		
	40	38	147	23.5	8	138	6.0	13	84
			327	11.5		318	0.0		
109°00'E	10	14	119	11.2	12	126	2.3	8	155
16°40'N			229	23.2		306	8.3		
	30	24	101	11.1	12	102	2.5	4	53
			281	23.1		282	8.5		
108°41'E	30	30	149	16.1	8	170	8.0	13	171
16°18'N			329	4.1		350	2.0		
	60	39	131	3.2	18	44	6.4	44	182
			311	15.2		224	0.4		
109°10'E	10	15	100	7.5	8	102	5.4	63	278
11°00'N			280	19.5		282	11.4		
	30	10	153	9.2	3	124	4.3	55	195
			333	21.2		304	10.3		
	60	9	17	1.2	6	175	6.0	35	197
			197	13.2		355	0.0		
	90	20	22	3.5	6	193	5.6	13	210
			202	15.5		13	11.6		

Hence, the sea region near the coast of the Central Vietnam can be divided into two parts with differentiated features of sea currents. In the northern part which stretches from the parallel 16°N northward and belongs to the opening of the Bacbo gulf the steady currents develop relatively weak but the tidal currents, especially the diurnal tidal component, have great magnitude and homogeneity in all water thickness. In the second part composed of middle and southern part of studied region the circulation structure is more complicate. There exist wind currents, steady current and tidal currents. The tidal currents are of the weak speed and mixed type. The depth homogeneity of the tidal currents does not express clearly and this shows the tide is a result of tidal waves coming

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from different directions and they have a complex interaction as known for the case of the tidal oscillation of water level. Since this region is under the influence of the cold current system in the west of the South-china sea the steady current has a dominance among all other components.

Harmonic constants of observation point 109°00'E-16°40'N (above line – amplitude cm/s, bellow line – phase °)

Com-ponent	Resi- dual											
Tidal constituents												
<i>M 2</i>	<i>S₂</i>	<i>N 2</i>	<i>K₂</i>	<i>K₁</i>	<i>O₁</i>	<i>M₄</i>	<i>Q₁</i>	<i>M₄</i>	<i>MS₄</i>	<i>M₆</i>		
Horizon 10 m												
Meri- dional	-8	4	2	1	1	16	17	5	4	0	1	0
		274	225	274	225	32	321	32	321	197	294	148
Latitu- dial	0	6	2	1	1	24	23	8	5	0	0	0
		60	45	60	45	166	91	166	91	333	214	119
Horizon 30 m												
Meri- dional	4	1	3	0	1	8	9	3	2	2	1	0
		284	225	284	225	25	297	25	297	317	27	68
Latitu- dial	4	8	10	2	3	34	23	11	5	3	4	1
		17	45	17	45	167	94	167	94	103	140	288

All above remarks once again confirm the general picture of sea current system of the coastal zone that stretches from latitude 11° to 18°N and covers an important segment of the sea shore of our country. The northern part, i.e., from 16 to 18°N, is a place of meeting of the two currents of the South-china sea: the west Bacbo gulf long-shore current and the winter cyclonic current of west South-china sea. The first current takes the start from the Bacbo gulf and follows its west shoreline southeastward. Originating in a small and shallow water body as Bacbo gulf and reaching the southwest opening of this gulf with the increased depth, certainly this current can not develop to a strong stream. In fact, the southeastward current measured at Bacbo gulf opening was of about ten cm/s speed for horizon 20 m. The second current has a longer travel: it comes from the northeast from the South-china shelf across the exposed domain off the Bacbo

gulf opening, so it has a larger scale and a greater intensity. Meeting off shore of the north of the Central Vietnam either winter current of west South-china sea encroaches the west Bacbo gulf current or two currents associate to one flow and continue to follow southward along the shore of the Central Vietnam. On this continue travel, since the flow follows closely to the shore and since the winter northeast monsoon field is favorable to development the flow becomes more intensive and due to the deepness of this coastal zone the flow can develop not only near the surface but mainly in lower horizons some tens meters bellow. At the observation points on the way of this flow the velocity of non-periodic surface currents was small, but for the deeper horizons it is relatively great. Reaching the threshold of the southwest shelf of the South-china sea, the flow tends both to continue follow the shoreline and to rise toward the surface turning left along the outer edge of the shelf. In all probability here or some where southward no far from here is the place of the activity end of the winter current system of the west South-china sea.

Harmonic constants of observation point 108°41'E-16°18'N (above line – amplitude cm/s, bellow line – phase °)

Com-ponent	Resi- dual											
Tidal constituents												
<i>M 2</i>	<i>S₂</i>	<i>V 2</i>	<i>K₂</i>	<i>K₁</i>	<i>O₁</i>	<i>M₄</i>	<i>Q₁</i>	<i>M₄</i>	<i>MS₄</i>	<i>M₆</i>		
Horizon 30 m												
Meri- dional	-14	5	2	1	1	20	15	7	3	5	3	1
		68	45	68	45	67	344	67	344	9	77	171
Latitu- dial	0	7	7	1	2	23	26	8	5	5	3	1
		237	225	237	225	252	170	252	170	148	227	339

The existence of the sea current, which has the shape of a narrow stream, closely follow the shoreline and bringing water from different places to sea region surrounding the shore of our country, forms a well-developed hydrological front zone with great gradient of oceanographic characteristics in the studied region. The space structure of the fields of temperature and salinity and other elements of sea water in this region shows a close agree with the above described dynamic picture.

The transfer of water by the current from higher latitudes to the tropical sea in the steady northeast monsoons certainly is the season of many other processes of this sea region not only in the winter but also in all time of the year. The problem of investigation on

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the changes of marine conditions of west part of the South-china sea and possibly the climate of our country as well and their prediction depends much on what we know about this sea current system.

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MỘT SỐ ĐẶC TRƯNG DÒNG CHẢY Ở VÙNG BIỂN GẦN BỜ MIỀN TRUNG

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Đã xử lý những số liệu quan trắc về dòng biển tại bốn điểm trong vùng biển gần bờ miền Trung Việt Nam để nhận những đặc trưng định lượng của dòng chảy như tốc độ và hướng của các dòng cực đại, pha dao động của dòng chảy, các dòng dư...

Theo những đặc trưng của dòng chảy, vùng biển dọc bờ miền Trung từ vĩ độ 11 đến 10°N phân hóa thành hai phần. Phần phía bắc vĩ tuyến 16°N đặc trưng bởi dư lưu tương đối yếu và các dòng triều toàn nhật mạnh đồng nhất theo phương thẳng đứng. Phần thứ hai còn lại dòng chảy triều thuộc loại hỗn hợp với cường độ yếu. Trong phần này các dòng chảy phi tuần hoàn tỏ ra phức tạp và bao gồm cả thành phần dòng chảy do gió hình thành tại chỗ lẫn thành phần dòng chảy ổn định có nguồn gốc từ hệ thống dòng biển lạnh tây biển Đông trong mùa đông. Dòng này có cường độ áp đảo so với tất cả các dòng khác và hình thành luồng nước mạnh dưới mặt hướng xuống phía nam dọc theo bờ biển miền Trung Việt Nam.