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FEATURES OF WAVE FIELD, ITS EFFECT TO EROSION – DEPOSITION PROCESSES IN THE CUADAI (HOIAN), CAI RIVER MOUTH (NHATRANG) AND PHANTHIET BAY IN TYPICAL LOCAL WIND CONDITIONS

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ABSTRACT Based on the hydrodynamic model and Shore Protection Manual (CERC - USA) we have calculated wave field characteristics in the typical wind conditions (wind velocity equal to 13m/s in the high frequency direction of the wind regime). Comparison between measured and calculated wave parameters was presented and these results were corresponded to each other. The following main wave characteristics were calculated:

-Pattern of the refraction wave field.
-Average wave height field.
-Longshore current velocity field in surf zone.

From distribution features of wave field characteristics in research areas, it could be summarized as following:

- The formation of wave fields in the research areas was unequal because of their local difference of hydrometeorological conditions, river discharge, bottom relief...
- At Cuadai (Dai mouth, Hoian) area in the N direction of incident wave field, wave has caused serious variation of the coastline. The coastline in the whole region, especially, at the south of the mouth was eroded and the foreland in the north of the mouth was deposited.
- At Cai river mouth (Nhatrang) area in the E direction of incident wave field, wave has effected strongly and directly to the inshore and channel structure.
- At Phanthiet bay area in the SW direction of incident wave field, wave has effected strongly to the whole shoreline from Da point to Ne point and caused serious erosion.

CAC ÑAC ÑIEM CUA TRÖÔNG SONG, ANH HÖÔNG CUA CHUNG TÔI CAC QUA TRÌNH XOI LÔ - BOI TU TAI CÖA ÑAI (HOI AN), CÖA SONG CAI (NHA TRANG), VÒNH PHAN THIET TRONG CAC ÑIEU KIEN GIO ÑÒA PHÖÔNG ÑIEN HÌNH

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Vien Hai Döông Hoc

TOM TAT Bang cac mo hình so trò va qui pham SPM (CERC-My), chung toi tính toan cac ñac tröng song ven bô öng vôi tröông gio mua manh, on ñònh (gio cap 6), cho cac höông tao song co tan suat cao. Ket qua tính toan ña ñöôc kiem chöng bang so lieu ño ñac tö nam 1997 – 2000 trong khuon kho cac ñe tai: cap Cô sô (1997, 1998, 1999); cap Trung tam (1998, 1999); cap Nha nöôc -ñe tai KHCN0608 (1997, 1998,1999, 2000) cua Vien Hai Döông Hoc [1, 4, 5, 6]. Cac ñac tröng cua tröông song ven bô ñöôc tính toan la:

-Tröông tia song khuc xa.
-Tröông ñoä cao song trung bình.
-Tröông toc ñoä dong chay doc bô do song ñoä nhao gay ra.

Tö sö phan bo cac ñac tröng cua tröông song ven bô chung toi böôc ñau ñanh gia tac ñong cua chung ñen qua trình bien ñong ñöôøng bô. Ñiem noi bat la ñieu kien tao song tai moi khu vöc nghien cöu co sö khac biet do sö khac nhau ve che ño khí töông –thuy van, löu löông nöôc song va ñac ñiem ñòa hình... Tai vung bien cöa Ñai (Hoi An) song höông bac

gaây ra söï bieán ñoäng ñöôøng bôø maïnh nhaát: xoùi lôõ toaøn daûi ven bôø nhaát laø bôø phía nam cöûa Ñaïi, boài tuï maïnh taïi muõi bôø phía baéc cöûa Ñaïi. Taïi vuøng bieån cöûa soâng Caùi (Nha Trang) soùng höôùng ñoâng taùc ñoäng maïnh nhaát gaây neân söï bieán ñoåi ñöôøng bôø vaø caùc baõi ngaàm beân ngoaøi cöûa soâng. Taïi vuøng bieån vònh Phan Thieát soùng höôùng taây nam gaây ra söï xoùi lôõ treân toaøn daûi ven bôø töø muõi Ñaù – muõi Neù.

INTRODUCTION

In the coastal zone of Central Vietnam (from Thuathien - Hue to Binhthuan provinces), the variant processes of shoreline have been happening very seriously, which induced the erosion - deposition processes of the shoreline and especially the movement of the river mouth. These processes have effected directly to the life of the local people, so the study on laws and prediction of erosion-deposition processes in the coastal zone and river mouth was a great interest of local government and scientist.

In this paper the authors only present their researched and calculated results for wave field characteristics in the coastal zone and preliminary estimation of impacts of wave field upon the erosion-deposition processes at Cuadai (Hoian), Cai river mouth (Nhatrang) and Phanthiet bay (Fig. 1). These areas can represent the coastal zone of Central Vietnam by complexity in the formation of coastal wave field and features of erosion - deposition processes. In addition, in recent years (1997-2000) at the above areas, the Institute of Oceanography has carried out many investigations to determine the principal causes, which control the variation of the shoreline and river mouth. Data have been collected, therein data of wave field in the coastal zone were especially interested.

+ Cuadai (Hoian) area

- Bottom topography of Quangnam area was taken from the map with scale of 1/100.000 issued in 1977 by Vietnamese Navy and bottom topography of Cuadai (Hoian) area was taken from the map of KHCN0608 National Project with scale of 1/25.000 made in 1998.

- Other necessary and related data were collected from surveys in September 1997, May 1998, August 1999, January 2000 of the National Project KHCN0608 [5].

+ Cai river mouth (Nhatrang)

-Bottom topography of Nhatrang bay was taken from the map with scale of 1/25.000 issued in 1964 by Vietnamese Navy and bottom topography of Cai river mouth (Nhatrang) was taken from the map of CS98.01 Project with scale of 1/25.000 made in 1998.

- Other necessary and related data were collected from surveys in July 1996, April 1997, April 1998, November 1998 of Projects CS97.03 and CS98.01 [4, 6].

+ Phanthiet bay

- Bottom topography of Phanthiet bay was taken from the map with scale of 1/100.000 issued in 1976 by Vietnamese Navy.

- Other necessary and related data were collected from surveys in August 1997, June 1998, October 1998 of Phanthiet bay Project [1].

BASICS AND METHODS FOR CALCULATION OF WAVE CHARACTERISTICS

1. Calculation of wave element in deep sea

- Wave parameters were calculated based on power spectra method. Basic equation is:

$$\overline{h_0}^2 = \sum_i \bar{h}_i^2 (V, r(\theta_i)\cos\theta_i)\Delta E_i \quad (1)$$

Where: $\bar{h}_0$ - average wave height; V - wind velocity; r(θ_i) - wind fetch length in the direction i; θ_i - angle of incident wind direction, that angulates with the normal of shoreline; ΔE_i : energy component of waves within the angle of $\theta_i - \Delta\theta/2$ to $\theta_i + \Delta\theta/2$ (from total energy of $-\pi/2$ to $\pi/2$), is defined from $\Delta E_i = E(\theta_1) - E(\theta_2)$.

With:

$$E(\theta)=\frac{\int_{\theta}^{\pi/2}\cos^2\theta_i d\theta_i}{\cos^2\theta_i d\theta_i}=\frac{1}{2}\left(1-\frac{2.\theta^0}{180^0}-\frac{\sin 2\theta^0}{2\pi}\right) \quad (2)$$

-Wave characteristics (height, period) were calculated in the complex conditions: wind field is variant in space and time and shoreline shape is complex variation.

We used the program of the Russian National Institute of Oceanography, which was formatted by power spectra method. Therein components of total wave height ($\bar{h}_i$) and average wave period were determined from following relations [3]:

$$\frac{g\bar{h}}{V^2}=0.00417(\frac{g.X}{V^2})^{1/3} \quad (3a)$$

$$\frac{gT}{V}=17.3(\frac{g.X}{V^2})^{4/5} \quad (3b)$$

$$\frac{g\bar{h}}{V^2}=0.0013(\frac{gT}{V})^{5/12} \quad (3c)$$

$$\frac{g\bar{\tau}}{V}=18.7(\frac{g.\bar{h}}{V^2})^{3/5} \quad (3d)$$

2. Calculation of wave field in the shallow water

Modified equation (1) will be:

$$h^2_{tb}=\sum_i \bar{h}_i^{\,2}(V,r(\theta_i)\cos\theta_i)K_{si}\Delta E_i \quad (4)$$

Where: $K_s = K_R \times K_d \times K_T$ (5)

- If it is supposed that the wave period is a constant, the celerity of a wave mainly depends on the local water depth. Refraction coefficient (K_R) was solved from wave rays of differential equation system, refraction wave zone is from H= 0.65 λ_o to breaker zone.

- Transformation coefficient was calculated by:

$$K_T=\frac{2ch^2KH}{2KH+sh^2KH} \quad (6)$$

- Diffraction coefficient (Kd) was calculated according to SPM [2].

3. Calculation of wave characteristics in breaker zone

According to SPM [2] wave characteristic was calculated as below:

-At the surf zone below criterion is used:

h_b=0.78H (7)

-At the breaker zone used criterion of Weggel (1970) :

$$h_b=\frac{bH}{1+(aH/g\tau^2)} \quad (8)$$

Where: a=43.75/1-e$^{(-19m)}$/; b=1.56/1+e$^{(-19.5m)}$/

-Wave – induced alongshore current velocity according to Longuet-Higgins (1970)

$V_b=M_1 \times m\,(gh_b)^{1/2}\sin 2\propto_b$ (cm/s) (9)

Where: $\propto_b$ – angle between incident wave ray with orthogonal contour in the shallow water (^{o}). M1 –coefficient depending on frictional coefficient and perturb coefficient, by experiment of Galvin and Eagleson, 1965 and it is supposed M_1=20.7.

CALCULATION OF WAVE FIELD CHARACTERISTICS

1. Features of studied areas

We have calculated wave characteristics in the typical wind condition: wind velocity is equal to 13m/s in the high frequency direction. General wave field characteristics in the deep sea are calculated, obtained result is h_o =1.7m, τ=6.7s.

1.1. Cuadai (Hoian) area (Figs. 1b, 2, 3, 4)

-Statistical wind data from 1977 to 1997 [5] showed that the major directions forming wave field were N, NE, E. This is an open sea, but in the offshore area, Cham island (about 8km wide) which is located about 12km in the NE direction far from Cuadai is barrier holding back the NE wave. Therefore, Cuadai is fallen down into shadow zone of wave in the NE monsoon. Relief slope is about 0.004-0.005. Here, the bars system is formed very strongly in front of the mouth; interaction between river and sea is very strong.

-Refraction and diffraction coefficients are calculated in the whole Hoian area in the incident wave from N, NE, E directions by grid system (space interval: ΔX=ΔY=1km).

-Wave characteristics in Cuadai were calculated by grid system (space interval: ΔX=ΔY=100m).

I.2. Cai river mouth (Nhatrang) area (Figs. 1c, 6, 7)

-Statistical wind data from 1983 to 1994 [1] showed that the major directions forming wave field were NE, E, SE. This is a relatively close sea area, because Nhatrang bay is bounded by forelands in the South, the North and Tre island in the offshore. Therefore, in the SE monsoon it is very strongly effected by diffraction stress; in the NE monsoon it is fallen down into shadow zone of incident wave. Relief slope is relatively strong (about 0.007-0.010), so wave energy from deep sea is effected strongly and directly toward the shoreline. Here, the interaction between river and sea is average.

-Refraction and diffraction coefficients are calculated for the whole Nhatrang bay from NE, E, SE directions by grid system (space interval: $\Delta X=\Delta Y=200m$).

-Wave characteristics in Cai river mouth are calculated by grid system (space interval: $\Delta X=\Delta Y=50m$).

I.3. Phanthiet bay area (Figs. 1d, 8, 9)

- Statistical wind data from Hydrometeorology Station at Phuquy island showed that the major directions forming wave field were NE, SW [1]. Phanthiet bay is a relatively open sea area blocked by foreland in the South and North. Therefore, in the NE and SW monsoons, it is fallen down into shadow zone of incident wave field. Relief slope is relatively small (about 0.002-0.003), so when wave from deep-sea travels to the coastal zone, its energy will be reduced. Here, interaction between river and sea is weak.

-Refraction, diffraction coefficients and wave characteristics are calculated in the whole Phanthiet bay in the incident wave from NE, SW directions by grid system (space interval: $\Delta X=\Delta Y=1km$).

2. Comparisons between the calculated and the observed data

The observed wave data by GM61 (Russia) and AWH16-M1 (Japan) automatic recorders have been analyzed and processed. Sites of wave observing stations are shown in Figs. 1b, 1c, 1d. During the field surveys, the data observation is conducted spontaneously for some periods on both the wave data and wind data. The wave height and the direction in the deep waters can be determined by the previously mentioned way. The tidal level at each station at any time is determined by the difference between the mean sea level (obtained from wave recorder). The calculated wave height has been compared with the observed ones at some stations as below:

Table 1: Comparisons between observed and calculated wave parameters at Nhatrang bay (Location: $\varphi=12^o15.246N$, $\lambda=109^o11.904E$; Depth: H $\approx$2m; Date: 5-6/4/1998)

Date and times	15h/5/4	17h/5/4	19h/5/4	22h/5/4
Wind features	NE (6m/s)	NE (5m/s)	NE (6m/s)	ENE (9m/s)
Wave features	G/L	G/L	G/L	G
Measured average wave height (m)	0.40	0.40	0.40	0.50
Calculated average wave height (m)	0.30	0.30	0.30	0.60
Error (%)	25	25	25	10
Measured average wave period (s)	6.7	7.0	6.1	5.9
Calculated average wave period (s)	3.8	3.5	4.0	4.5
Error (%)	43	50	34	23
Measured wave direction(^{o})	65	65	65	90
Calculated wave direction(^{o})	50	47	50	79
Error (^{0})	15	18	15	11

Notes: G/L - Wind wave combine with Swell; G - Wind wave; L - Swell

Table 2: Comparisons between observed and calculated wave parameters at Phanthiet bay
(Location: φ=10°55.900N, λ=108°12.500E; Depth: H ≈10m; Date: 13/10/1998)

Date and times	15h/13/6/98	12h/13/10/98	14h/13/10/98	16h/13/10/98
Wind features	S (5m/s)	SW (5m/s)	S (7m/s)	S (4m/s)
Wave features	G/L	G/L	G	G/L
Measured average wave height (m)	0.12	0.15	0.45	0.40
Calculated average wave height (m)	0.15	0.2	0.40	0.30
Error (%)	25	30	10	25
Measured average wave period (s)	6.5	7.0	5.3	5.0
Calculated average wave period (s)	3.8	4.0	4.5	4.2
Error (%)	41	42	15	16

Notes: G/L - Wind wave combine with Swell; G - Wind wave; L - Swell

At the Cuadai (Hoian), we have compared the calculated and observed wave fields, which were obtained from 167 serial observation stations and 4 long-time stations in August, 1999 (KHCN0608 National Project). Comparative results are shown in Fig. 5.

In Tables 1, 2 and Fig. 5 the comparative results between measured and calculated wave parameters were presented and these results were relatively satisfied to practice. However, calculated results are good while swell field is weak or equal to zero; during strong swell field there must be have two stations to measure wave parameter at sometime, one station is located at the deep sea zone, the other station is located at the nearshore zone.

FEATURES OF WAVE FIELD IN THE NEARSHORE ZONE AND ITS EFFECTS TO EROSION – DEPOSITION PROCESSES

According to LEO data [2], the longshore transport rate was calculated by:

$$I_L = 0.39\,P_{LS} \qquad (10)$$

$$P_{LS} = \frac{\rho g H_{sb} W V_{LEO}}{(\frac{5\pi}{2})(\frac{V}{V_0})_{LH}} C_f \qquad (11)$$

Where: I_L – Longshore transport rate, P_{LS} – longshore energy flux factor, ρ - fluid density, W – width of surf zone, V_{LEO} – average longshore current velocity due to breaking wave, C_f – friction factor, X – distance to dye patch from shoreline, $(V/V_0)_{LH}$ – the dimensionless longshore current.

The equations (10) and (11) showed that relation of longshore transport rate (I_L) and average longshore current velocity due to breaking wave (V_{LEO}) was strong. Therefore, we can comment upon erosion – deposition processes by distribution of longshore current velocity field.

1. Cuadai (Hoian) area

- In the N direction of incident wave (Fig. 2): most of studied area was strongly effected by incident wave field, especially at the bars system in the north of the mouth. The wave height in the northern part of the mouth was h_{tb} ≈ 2.0m, in the southern part was h_{tb} ≈ 1.0m. The wave induced alongshore current almost moved southward, especially at the bars system in the southern part of the mouth and the highest velocity was recorded at Anbang, Phuoctrach with values of V_L (mean) ≈ 0.2-0.3m/s, V_L (max) ≈ 0.8-1.2m/s. Generally, most of coastline was eroded, especially the bar system and river bank in the southern part of the mouth were most eroded. Foreland and bars in the northern part of the mouth were strongly deposited.

-In the NE direction of incident wave (Fig. 3): most of studied area wasn't affected by wave, because the whole area was in the wave shadow region of Cham island. The wave height in front of the mouth and at two banks was h_{tb} ≈ 0.5-1.0m, at the southern part (Dongson) was h_{tb} ≈ 1.0m, the highest value was recorded at Anbang h_{tb} ≈ 2.0m.The wave induced alongshore current almost moved toward the south (in the southern part of the mouth) and moved toward the north (in the northern part of the mouth). Generally, the velocity of the alongshore current was slow V_L (mean) ≈ 0.1-0.2m/s. So, the sediment movement did not occur in most of coastal area of the mouth.

-In the E direction of incident wave (Fig. 4): most of the mouth region was strongly affected by wave. Generally, the wave height was h_{tb} ≈ 1.5-2.0m, especially at the bar system in the southern part of the mouth. The wave induced alongshore current almost moved toward the north, especially at the northern bars and shore of the mouth, here current velocity reached to V_L (max) ≈ 0.8-1.2m/s. In the southern shore of the mouth this value was V_L(mean) ≈ 0.2m/s. Therefore, most of the southern shore of the mouth was deposited, especially at the southern foreland the deposition happened at the highest rate. The northern shore of the mouth was eroded, while the southern foreland of the mouth was deposited.

2. Cai river mouth (Nhatrang)

-In the NE direction of incident wave (Fig. 6): the wave height in most of the northern region of the studied area was h_{tb} ≈ 0.5m, because it was in the shadow region of incident wave. Around the War Memorial this value was h_{tb} ≈ 2.0m.The wave induced alongshore current almost moved toward the south, generally, V_L (mean) ≈ 0.3-0.4m/s, V_L (max) ≈ 1.0-1.2m/s, most of the shore from Lau Ong Tu to the War Memorial was most strongly effected by the wave, so the erosion happened most seriously.

-In the E direction of incident wave (Fig. 7): most of the coastal region especially at Lau Ong Tu the value of wave height was h_{tb} ≈ 2.0m. The wave induced alongshore current almost moved toward the south, but at several shoreline sections, the direction of alongshore current was irregular, generally, V_L (mean) ≈ 0.3m/s; at the War Memorial and Lau Ong Tu ...V_L (max) ≈ 1.0-1.2m/s. Most of the coastal zone of the studied area was strongly effected by wave and erosion – deposition processes.

3. Phanthiet bay area

-In the NE direction of incident wave (Fig. 8): most of the studied area wasn't strongly affected by incident wave, the wave height was h_{tb} ≈ 0.5-0.7m, because it was in the wave shadow region of Ne foreland. In the region from Da to Ne forelands this value was h_{tb} < 0.5m; the region around Ne and Checa forelands was most strongly effectedby wave, h_{tb} ≈ 1.0-1.5m.

-In the SW direction of incident wave (Fig. 9): most of the region from Checa foreland to Caty river mouth wasn't strongly affected by wave, h_{tb} < 0.5m, because it was in the wave shadow region of Checa foreland. The region from Da to Ne forelands was strongly effected by wave, h_{tb} ≈ 1.0-1.2m, this region has been strongly eroded, especially the region from Thienlong to Ne foreland was most strongly effected, h_{tb} >1.5m.

CONCLUSION

- In the coastal zone of Vietnam, especially the central region (from Thuathien-Hue to Binhthuan provinces), variant processes of coastline, channel, bars systems in front of the river mouth have been happening very seriously. However, these processes were not unified at the above areas. These areas were different in hydro-meteorological conditions, bottom relief features, river discharge...The interaction level between river and sea caused variant processes of coastline, the strongest levels were recorded at Cuadai (Hoian), Cai river mouth (Nhatrang) and Phanthiet bay. The impact level of wave field to the coastal region was strongest at Cuadai (Hoian), then at Cai river mouth (Nhatrang) and Phanthiet bay.

- At Cuadai (Hoian) the variant process of the shoreline was a consequence of interaction process between river and sea, in which Cham island played an important role in stopping the wave. The underwater bar system in Cuadai was either the cause and the consequence of above hydro-litho-dynamic process. As the wind field in the N direction is strongest and has highest frequency, Cuadai is continuing to move Southward.

- At the Cai river mouth (Nhatrang) the relief slope is high (≈ 0.010), therefore incident wave coming from deep sea almost directly impacted to the nearshore region. However, this is a relatively close bay, only the NE direction wave, especially E direction one strongly effected to nearshore region. Generally, the shore from Lau Ong Tu to the War Memorial was impacted by the wave field, so this region was eroded very strongly. The bar system and foreland in the south of the mouth were deposited in the SE monsoon. At present, perhaps Cai river mouth would be moved northward, but there is a headstone at the northern bank of the mouth and now its site is fixed.

- Phanthiet bay is a relatively open marine area, the main directions of incident wave are NE and SW, however, most of the area is prevented from the wave by Ne and Kega forelands. The region around Ne foreland and nearshore region from Da to Ne forelands were impacted by wave. The shore from Da to Ne forelands was eroded very strongly in the SW monsoon. Because the relief slope is small, the wave energy from deep sea propagated into the nearshore region and decreased.,.

Table 3: Symbols used in the paper

Series number	Symbol	Physical meaning	Units
1	h_0	Average wave height in deep water	m
2	h_{tb}	Average wave height in shallow water	m
3	h_b	Average breaker height	m
4	τ	Average period of wave	s
5	λ	Average wave length in shallow water	m
6	λ_0	Average wave length in deep water	m
7	V_L	Longshore current velocity induced by wave	m/s
8	V	Wind speed	m/s
9	T	Duration of wind activity	h
10	H	Bottom depth	m
11	m	Relief slope	
12	K	Wave number	
13	C_0, C	Wave celerity in deep and shallow waters	1/s
14	g	Acceleration of gravity	m/s^2
15	X	Wave fetch length	km

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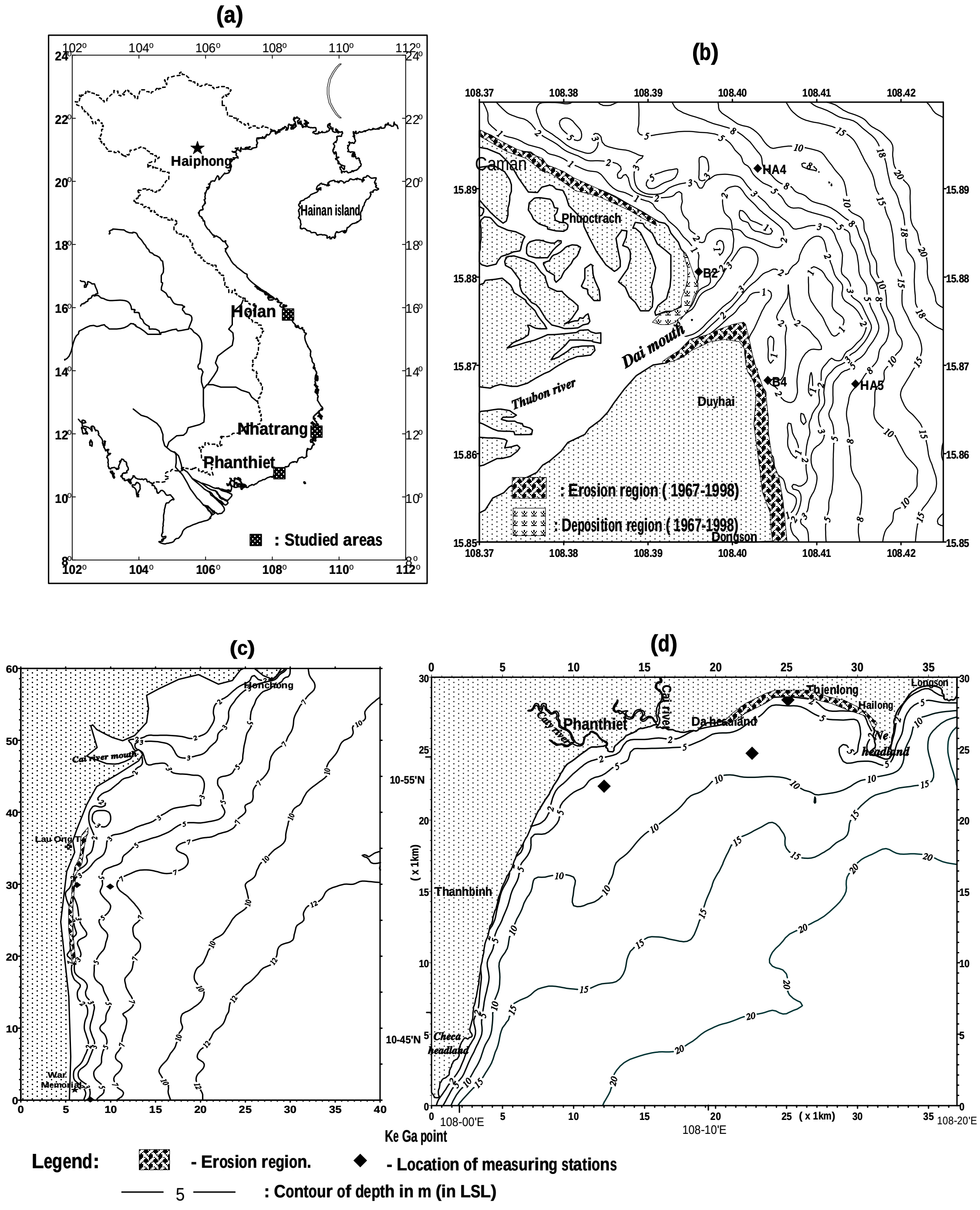
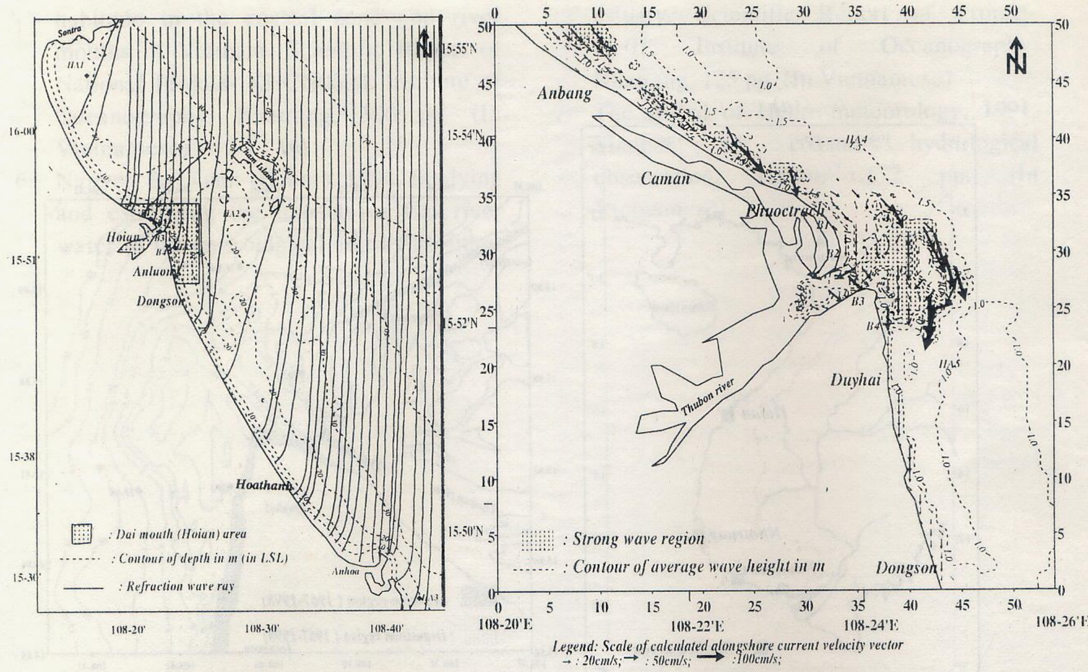
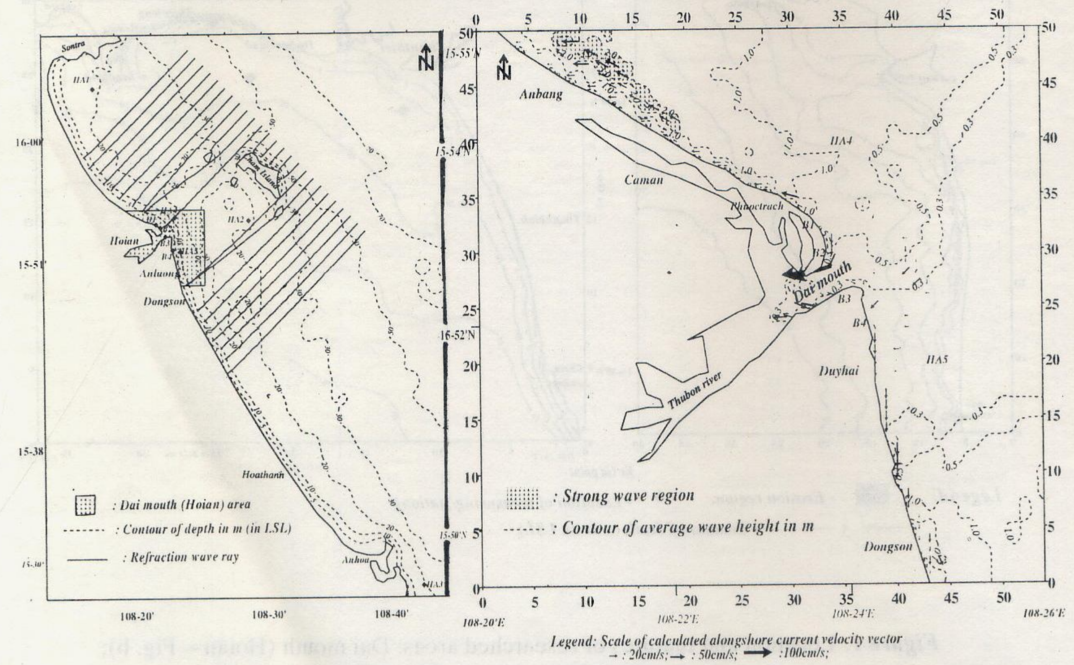


Figure 1: Location and features of researched areas: Dai mouth (Hoian – Fig. b); Cai river mouth (Nhatrang – Fig. c); Phanthiet bay (Fig. d)



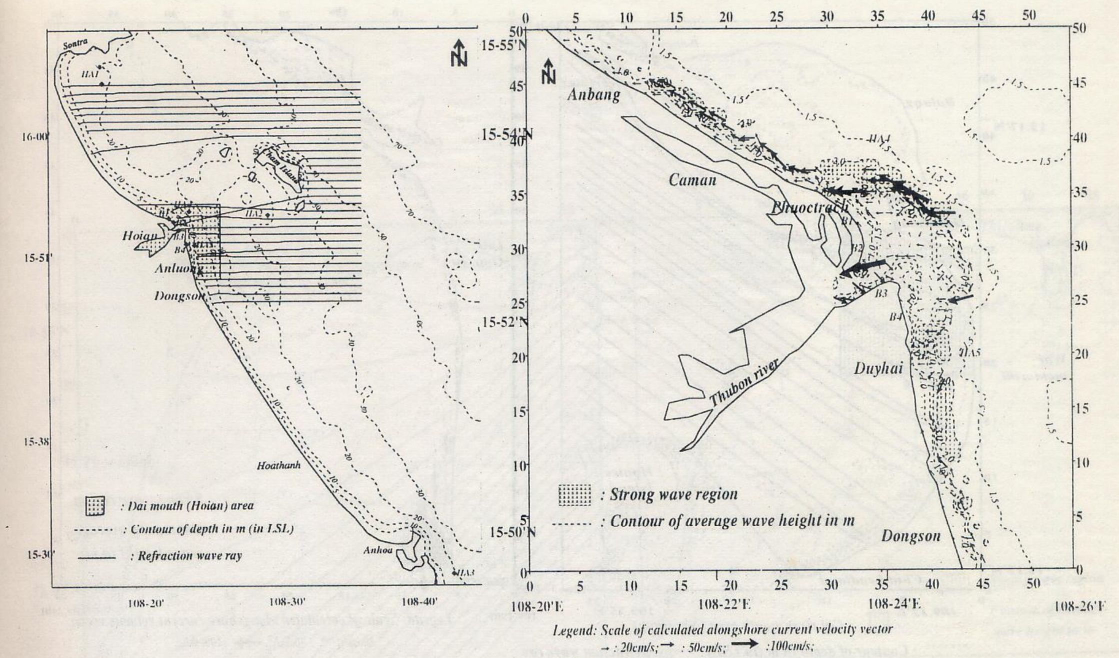
(a) : Wave refraction pattern *(b) : Wave characteristics in the coastal zone*

Figure 2: Features of wave field in the Dai mouth (Hoian) area
(in the wind condition: steady monsoon, direction – N, velocity = 13m/s)



(a) : Wave refraction pattern *(b) : Wave characteristics in the coastal zone*

Figure 3: Features of wave field in the Dai mouth (Hoian) area
(in the wind condition: steady monsoon, direction – NE, velocity = 13m/s)



(a) : Wave refraction pattern (b) : Wave characteristics in the coastal zone

Figure 4: Features of wave field in the Dai mouth (Hoian) area
(in the wind condition: steady monsoon, direction – E, velocity = 13m/s)

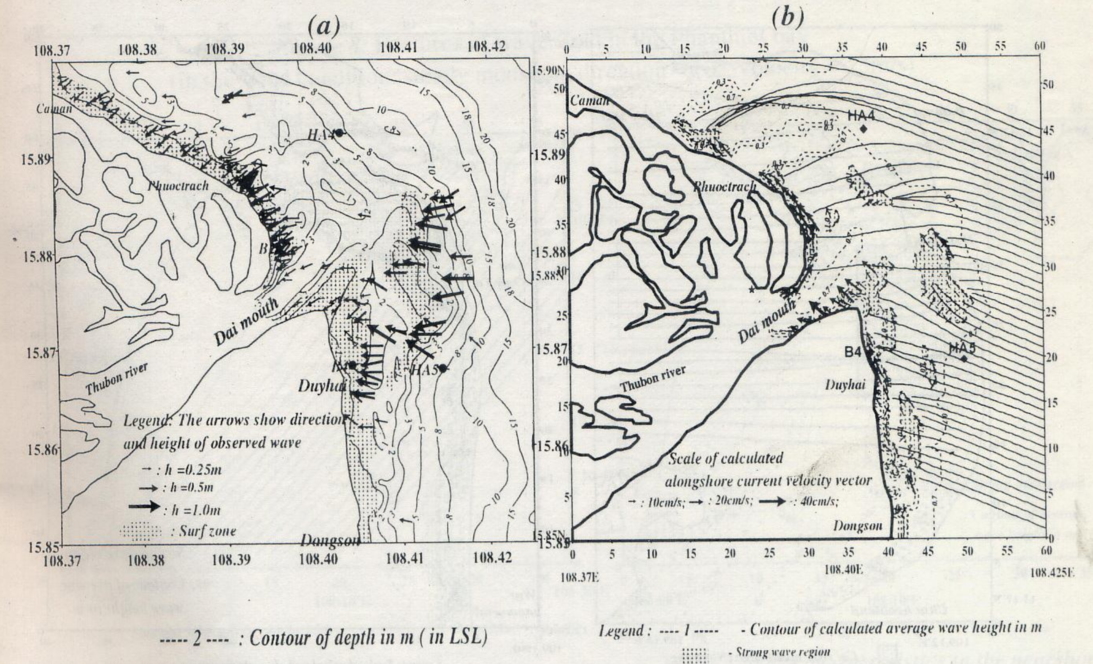
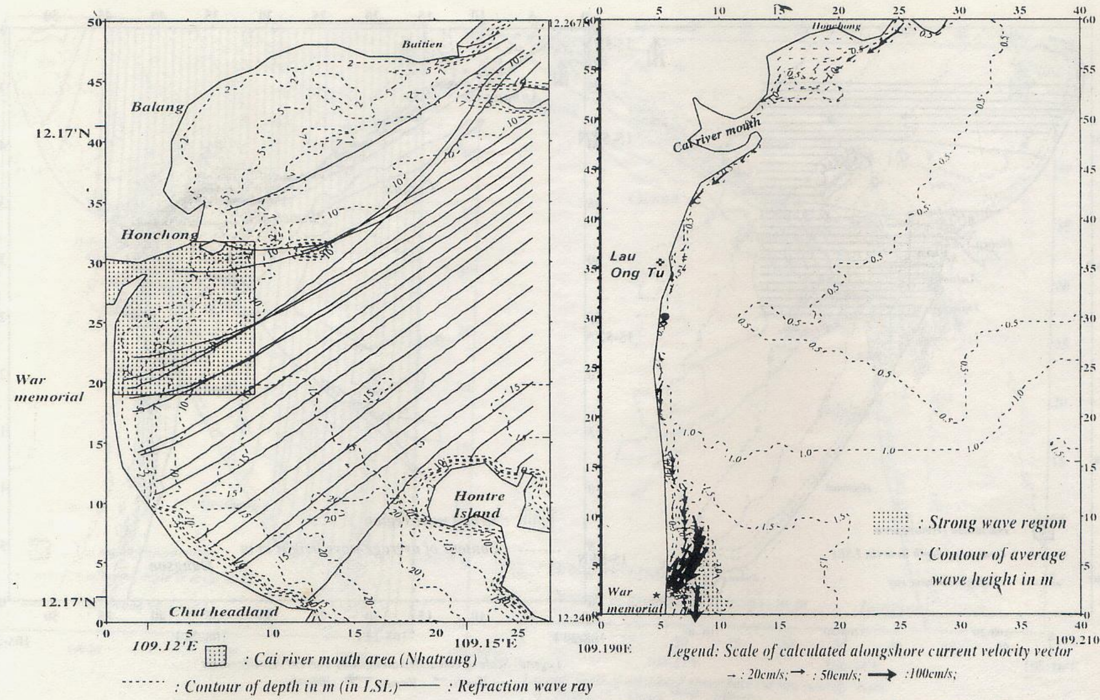
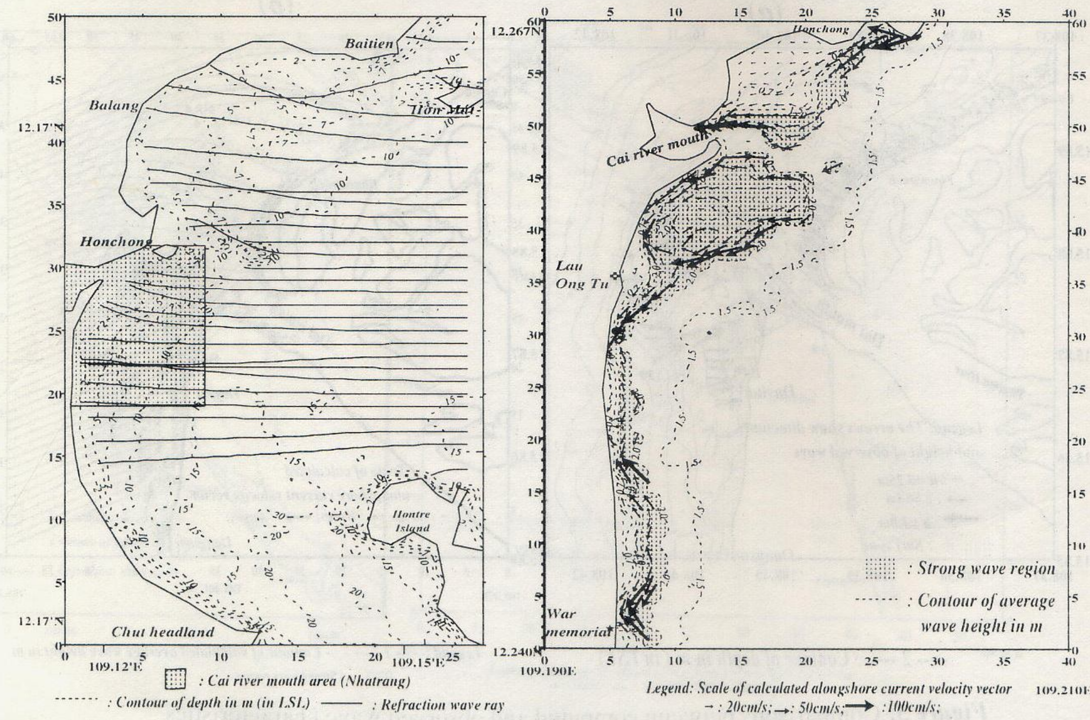


Figure 5: Comparisons between computed and observed wave characteristics
in the Dai mouth (Hoian)
(a): Observed wave field on 27-29/8/1999
(b): Computed wave field in the conditions of incident wave (ho = 0.7m, To = 5.5s, α_0 = 100o)



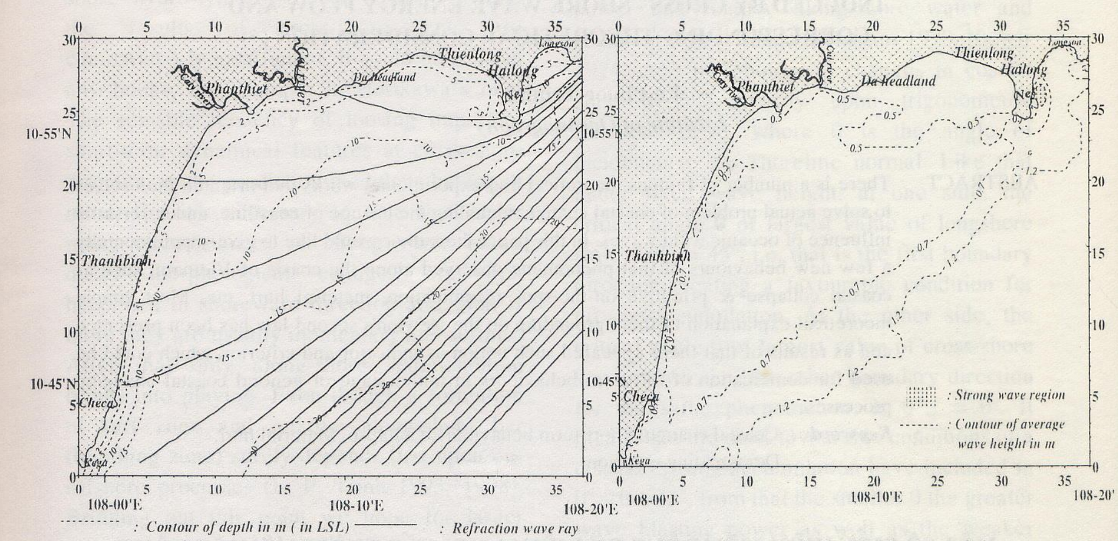
(a) : Wave refraction pattern (b) : Wave characteristics in the coastal zone

Figure 6: Features of wave field in the Cai river mouth (Nhatrang)
(in the wind condition: steady monsoon, direction – NE, velocity = 13m/s)



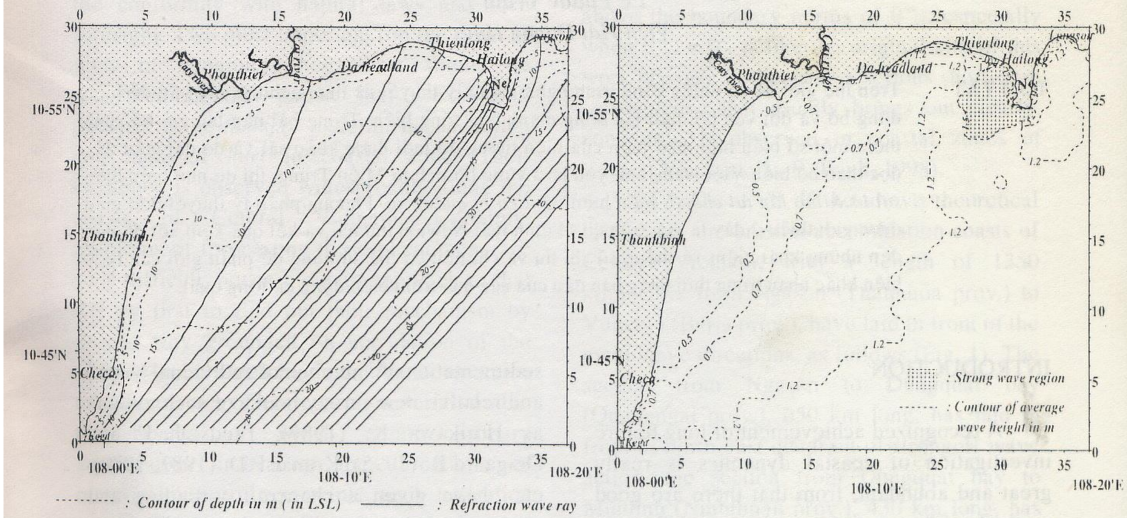
(a) : Wave refraction pattern (b) : Wave characteristics in the coastal zone

Figure 7: Features of wave field in the Cai river mouth (Nhatrang)
(in the wind condition: steady monsoon, direction – E, velocity = 13m/s)



(a) : Wave refraction pattern (b) : Wave characteristics in the nearshore

Figure 8: Features of wave field in the Phanthiet bay
(in the wind condition: steady monsoon, direction – NE, velocity = 13m/s)



(a) : Wave refraction pattern (b) : Wave characteristics in the nearshore

Figure 9: Features of wave field in the Phanthiet bay
(in the wind condition: steady monsoon, direction – SW, velocity = 13m/s)