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Wave and Tidal Studies off Kanyakumari Coast, Bay of Bengal, India

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***Abstract* - Ocean dynamic studies on the variability of the tides and wave characteristics have been studied in relation to the wind condition along the Kanyakumari Coast, Bay of Bengal during the NE and SW monsoon period of 2011. The maximum tidal height (1.13 m) was found in Kanyakumari tip during the Northeast monsoon period with the tidal pattern of mixed mainly semidiurnal tides. Wind speed varied from 0.1 – 9.5 m/s and 1.4 – 7.2 m/s with the average wind speed of 5.8 m/s and 4.4 m/s in NE and SW monsoon respectively wind blows (direction) predominantly with the average direction of the Northeast (550) and Southwest (1990) in NE and SW monsoon. The relationship between wave height and wind speed shows that they are weakly correlated with a significant level of 0.01.**

***Keywords*- Waves and tidal characteristics, wind speed and direction, Kanyakumari, Bay of Bengal.**

I. INTRODUCTION

1. Hydrodynamics

Ocean dynamics outline and describe the motion of water among the oceans. Hydrodynamics is the study of the motion of liquids, and in particular, water. The wind processing over the ocean surface generates wind waves. They develop with time and area below the action of the wind and become large waves referred to as ocean surface waves. The hydrodynamic processes that exist in the nearshore region are generating by a number of different drivers. Coastal hydrodynamics could be disproportionately affected by small changes in wave height, wave direction or sea level, but these changes would vary from one location to another and could only be quantified through detailed site-specific.

2. Wind

Wind direction is that the direction from that a wind originates. It is typically reportable in cardinal directions or in angle degrees. There live a range of instruments won't to measure wind direction, like the wind sleeve and weather vane. Both of those instruments work by moving to reduce air resistance. The way a weather vane is pointed by prevailing winds indicates the direction from which the wind is blowing. The gap of a drogue faces the direction that the wind is blowing; its tail points within the other way. Modern instruments are wont to live wind speed and direction square measure known as anemometers and wind vanes severally. These varieties of instruments square measure employed by the wind energy trade, each for wind resource assessment and rotary Engine management. In primitive situations where these modern instruments are not available, a person can use their index finger to test the direction of the wind. This would be done by wetting the finger and pointing it upwards. Thus, the side of the finger which feels cool is the direction from which wind is blowing. The coolness is caused by associate degree raised rate of evaporation of the wetness on the finger because of the air flow across the finger. The same principle is used to measure the dew point (using a sling psychomotor, a more accurate instrument than the human finger), and thus the "finger technique" of measuring wind direction doesn't work well in either terribly wet or very popular conditions.

Wind speed is suffering from a variety of things and things, in operation on varied scales (from small to macro scales). These embrace the pressure gradient, Rossby waves and jet streams, and native climatic conditions. There also are links to be found between wind speed and wind direction, notably with the pressure gradient and surfaces over that the air is found.

The pressure gradient is a term to describe the difference in air pressure between two points in the atmosphere or on the surface of the Earth. It is important to wind speed, as a result of the bigger the distinction in pressure, the quicker the wind flows (from the high to low pressure) to balance out the variation. The pressure gradient, once combined with the issue and friction, additionally influences wind direction. Rossby wave's area unit robust winds within the higher layer. These cares for a worldwide scale and move from West to East (hence being called Westerlies).

The Rossby waves square measure themselves a special wind speed from what we tend to expertise within the lower layer. Local weather conditions play a key role in influencing wind speed, as the formation of hurricanes, monsoons, and cyclones as freak weather conditions can drastically affect the velocity of the wind.

3. Waves

Waves are generated by winds. Strong winds create rough waves, and light winds cause the water to be calmer. During storms, violent winds create storm surges that case temporarily raises the sea level in low-lying areas and cause serious flood damage to coastal villages. Wave action constantly batters shorelines, causing the erosion of beach sands and the undercutting of cliffs. Over time, waves sculpt caves in the sides of outcroppings, and these deepen until the outcroppings become distanced from the shore. The resulting rocky promontories, such as those in the Algarve region of southern Portugal, are called sea stacks. Tides and waves conjointly have an effect on stream deltas by transporting sediment on the shore or dead set ocean. Wave action, below-bound conditions, creates sandbars and spits on coastlines.

Waves are made up of two main parts they are crests and troughs. A crest is the highest purpose of a wave. A trough is the lowest purpose of a wave. Imagine a roller coaster designed with many rises and dips. The top of a rise on a roller-coaster track is similar to the crest of a wave. The bottom of a dip in the track resembles the trough of a wave. The distance between two adjacent wave crests or wave troughs is a wavelength.

The vertical distance between the crest and trough of a wave is termed the wave height. The period of a wave is that the time it takes for one full wavelength of the wave to pass a particular purpose. The different kinds of waves that can be found in the ocean as linear responses to exterior forces. They are usually classified into two families, depending on their typical period and on their dynamical structure. They are; Poincare waves and Rossby waves.

3.1 Poincare waves - the period of which is of the order of a day, are fast dispersive waves. They are due to the Coriolis force, which is to the rotation of the Earth.

3.2 Rossby waves - propagate much slower, since the departure from geostrophic (that is equilibrium between pressure and Coriolis force) is very small. They are actually related to the variations of the Coriolis parameter with latitude. In particular, they propagate only eastwards.

4. Amplitude (a)

The largest distance that a wave displaces particles from their resting position is named the amplitude of the wave. In a transverse wave, for example, the amplitude (a) is the distance between the resting position and the wave's crest or trough. Simple crosswise waves have similar shapes, in spite of however giant they're or what medium they travel through. These waves are shaped like a sine curve. A sine curve looks like a Slying on its side. Waves with the form of circular function curves, just like the one higher than, area unit known as circular function waves. Although many waves are not perfect sine waves, a sine curve is good estimates of their shapes.

5. Wavelength (λ)

The crests of ocean wave's imbrication informed the beach is also many meters apart. In contrast, ripples on a pond may be separated by only a few centimeters. In transverse waves, the distance between one crest and the next, or one trough and the next, is the wavelength. In a longitudinal wave, the wavelength is the distance between two neighboring compressions or rarefactions. Generally, the wavelength is the distance between any two neighboring identical parts of a wave. The figure below shows the wavelengths of a crosswise wave and a longitudinal wave. Not all waves have an obvious wavelength. Most sound waves have a complicated shape. That makes it difficult to determine their wavelengths.

6.Tide

In the equilibrium theory of tides, we have a tendency to assume that the form of the ocean surface was continuously in equilibrium with the forcing, despite the fact that the forcing moves relative to the Earth as the Earth rotates underneath it. From this Earth-centric coordinate system, so as for the ocean surface to "keep up" with the forcing, the ocean level bulges have to be compelled to move laterally through the ocean. As we discussed, the tide-producing forces are a tiny fraction of the total magnitude of gravity, and so the vertical balance (for the long wavelength appropriate to tidal forcing) remains hydrostatic. Therefore, the relevant force, the attractive force, is the projection of the tide-producing force onto the local horizontal direction. The equations square measure identical as those who govern rotating surface gravity waves and Kelvin waves. The tide is forced by the sum of the pressure gradient force (due to the bulging sea surface) and the attractive force and propagates like a Kelvin wave.

Ocean tides are defined as the periodic rise and fall of sea surface caused by the gravitational attraction of the moon and sun on earth. The rise and fall are the most obvious features to most observers but fundamentally the prime phenomena are horizontal tidal motion. The rise and fall at the coast is simply a consequence of the convergence and divergence occurring there when the tidal currents flow towards or away from the shore. Ocean tides often dominate the mixing in estuaries. The highest water of the tide is called the high tide and lowest water is the low tide. The rise of the water is designated as flood, the fall as ebb.

The bulges that form in earth's oceans as a result of the moons gravitational pull are called high tides. In high-tide areas, the water level is higher than the average sea level. In low tides areas, the water levels are lower because the water is pulled toward high-tide areas. As the moon moves around Earth, the tidal bulges sweep around the planet in a regular pattern. As a result, many places on Earth experience two high tides and two low tides every day.

6. Tidal types

In most areas on Earth should experience two high tides and two low tides of unequal heights during a lunar day. I observe, however, the assorted depths, sizes, and shapes of ocean basins modify tides in order that they exhibit 3 completely different patterns in numerous elements of the planet. The tide is broadly classified into three types, which are described below and illustrated in diurnal (diurnal=daily), semidiurnal (semi=twice, diurnal=daily), and mixed tide.

6.1. Diurnal Tide

A diurnal tide has a single high and low tide at each lunar day. These tides are common in shallow inland seas such as the Gulf of Mexico and along the coast period of 24 hours 50 minutes.

6.2 Semidiurnal Tide

A semidiurnal tide has two high tides and two low tides each lunar day. The heights of successive high tides and successive low tides are approximately the same. Bay of Bengal experience in the semidiurnal tide. The tidal periods are 12 hours 25 minutes.

6.3 Mixed Tides

Mixed tides may be characteristics of both diurnal and semidiurnal tides. Successive high tides and or low tides can have considerably totally different heights, a ordinarily have a recurrent event amount of twelve hours twenty five minutes, however they'll conjointly exhibit diurnal periods. Mixed tides are the most common type in the world, including the Indian Ocean, Arabian Sea.

7. Tidal variations

The sun is much larger than the moon, but the sun is much farther away Earth than the moon is so; the sun's pull on tides is weaker than the moon's pull. The combined forces of the sun and the moon on Earth result in different tidal ranges. A tidal range is a difference between levels of ocean water at high tide and low tide. Tidal range depends on the positions of the sun; earth and the moon.

8.Spring tides

Tides that have the most important daily periodic event vary area unit spring tides. Spring tides happen once the sun, Earth and also the moon area unit aligned. In other words, spring tides happen when the moon's between the sun and Earth or when the moon and the sun are on opposite sides of Earth. Spring tides happen throughout the new-moon and full-moon phases, or each fourteen days. During these times, the sun and moon cause one pair of very larger tidal bulges.

9. Neap tides

Tides that have the tiniest daily recurrent event vary area unit high water tides. Neap tides happen when the sun, earth, and the moon form a 90o angle. Neap tides occur halfway between the occurrences of spring tides, during the first quarter and third, the sun and moon cause two pairs of smaller tidal bulges.

The objectives of the present study are to investigate the seasonal variability of

- Tidal characteristics,
- Wave dynamics and
- Wind conditions of the coastal regions off Kanyakumari.

II. DESCRIPTION OF THE STUDY AREA

Kanyakumari District is situated on the southern tip of peninsular India (Lat 80o 5' N, Lon 77o 32' E) and its coastal area comprises of about 68 km in length. Coastal length of Kanyakumari district along Arabian Sea is 59 km and along Bay of Bengal are 11 km is shown in figure _ 1. Wave climate of east coast of India is dominated by three different seasons namely, the southwest monsoon from June to September, the northeast monsoon from October to January and the non-monsoon from February to May. This coast receives two monsoons annualy, the southwest from June to August and the Northeast from October to December.

The wave activity is generally quite intensive during the southwest monsoon (June to September) with comparatively calm period during the remaining part of the year. However, frequent occurrence of cyclones in the Bay of Bengal during the northeast monsoon period would considerably increases the wave activity along the east coast of India leading to extreme wave conductions. The coast encompasses a diverse range of features including beach terraces, low cliffs, sandy beaches, dunes, rocky shores, estuaries wetlands and forests.

The area has rocky shore and extensive beaches with temples nearby Kanyakumari Coast very confluence of the three water-bodies.The southern eastern boundaries is formed by the Gulf of Mannar. The south-west boundaries are Indian Ocean and the Arabian Sea, both these seas mingle with the Indian Ocean. The coastal stretch of this District is studded with 44 coastal fishing villages.The coast has a heavy concentraction of fisher folk, almost one village per 1.5 km. Many tourist spots, cultural sites and archaeological sites are found along the Coastal areas of Kanyakumai.The east and west coasts are markedly different in their geo-morphology. The west coast is generally exposed with heavy surf and rocky shores and headlands. The coast has a wide range of wild flora and fauna. Every year the land receives 1,188.6

meters of rainfall. The maximum temperature goes to 35◦C and falls to a minimum of 21◦C. The abundant natural resources, the urbanization and population increases rapidly on the coastal areas. They put high pressure on the coastal areas and finally they are under severe threat and hazards.The coast has also experiences drastic changes in beach morphology. The nature of the sand in the beaches of Kanyakumari is unique as it is multicolored. The southern parts of the coast are sandy beaches with beaches with beach sands containing heavy minerals on the eastern and western sides of Kanyakumari.

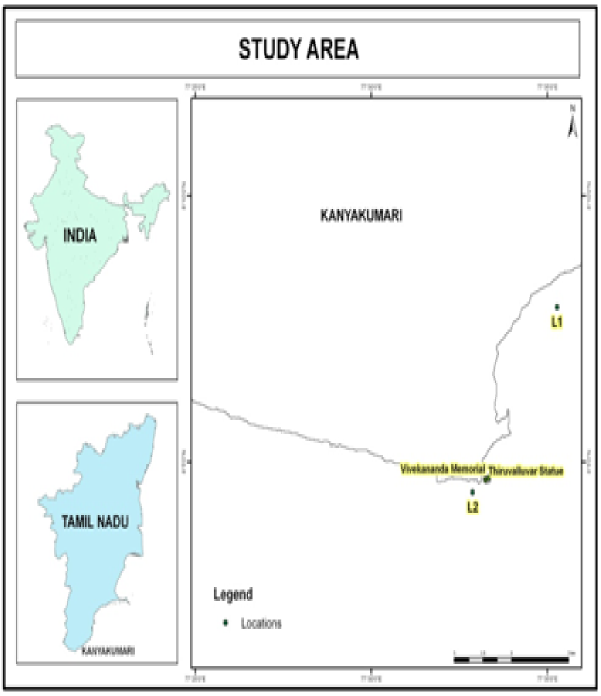

Fig.1. Location map of Kanyakumari coast.

III. RESULTS AND DISCUSSION

1. Coastal hydrodynamics

Coastal hydrodynamics refers to the part of the coastal process which deals with tides and waves.

2. Tidal characteristics:

The observed water level clearly reproduces the tidal variation at locations L1 and L2 along the Kanyakumari coast. The highest high tide (1.13m) and lowest low tide (0.14m) were found in L2 during the Northeast monsoon period. The data indicate that the maximum range of sea surface elevation occurred on the 2nd of Feb 2011 (NE monsoon). The tidal patterns for NE (L1 and L2) and SW (L1 and L2) are shown in figures (2 and 3). These Water elevations also exhibit the diurnal inequality of the tidal signal, caused by the declination of the moon in respect to the earth's equatorial plane.

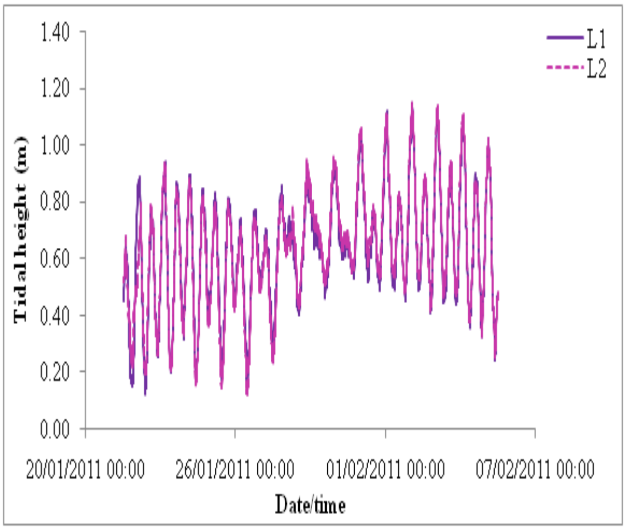

Fig.2.Comparison of Tides for L1 and L2 during NE monsoon period.

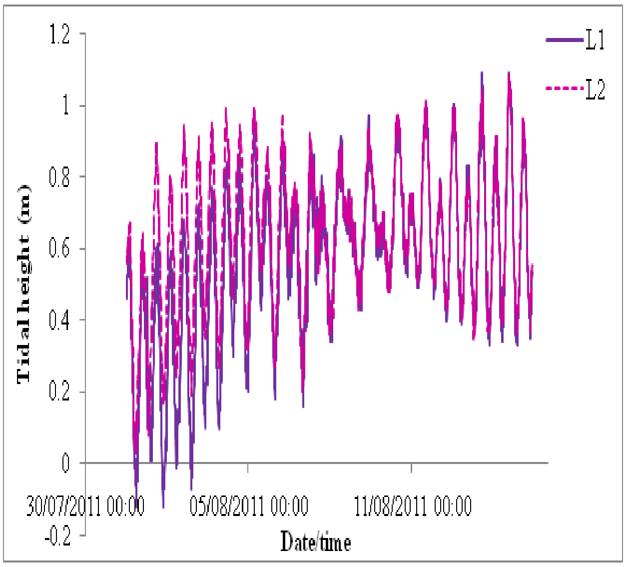

Fig.3.Comparison of Tides for L1 and L2 during SW monsoon period.

3. Distribution of Amplitudes and phase lag

The amplitudes of the principal tidal constituents M2, S2, K1, and O1 are shown in figure _4. The mean spring range 2(M2+S2) was 0.621 m for NE and 0.626 m for SW (L1), 0.589 m for NE and 0.603 m for SW (L2) monsoon period. The mean neap range 2(M2-S2) was observed about 0.134 m (L1) and 0.138 m (L2) for NE and 0.135 (L1) and 0.143 m (L2) for SW monsoon period. The type of tides at a given location can be determined using the Form Number, which is the ratio of the sums of the amplitudes of the diurnal (K1 and O1) and semi-diurnal constituents (M2 and S2).). From the results, a fundamental characteristic of tidal form factor in Kanyakumari coast was identified as mixed, mainly semi-diurnal tides in nature, having a Form Number of 0.518 (L1), 0.562 (L2) for NE monsoon and 0.458 (L1), 0.50

(L2) m for SW monsoon period. The overall comparison of NE and SW monsoonal observation M2, S2, K1, and O1 tides is shown in Fig _4. The main features of the M2 tidal regime are seen in both monsoon periods with the strongest tides in Kanyakumari coast. The maximum range of M2 amplitude reaches about 0.197 min L1 (SW) and 0.189 min L2 (NE) which reflects that the coast was strongly dominated by M2 tides. The distributions of most dominant M2 amplitudes are higher in L1 than the L2 with the strongest amplifications occurring from South-North. Similar results are observed for the SW monsoon (L1 and L2) but for the NE monsoon, the tidal component K1 dominates over S2 at L2. The dominance of K1 component is due to the flow of water from the Arabian Sea during NE monsoon. Similar results were reported by Cochin and Bayport area.

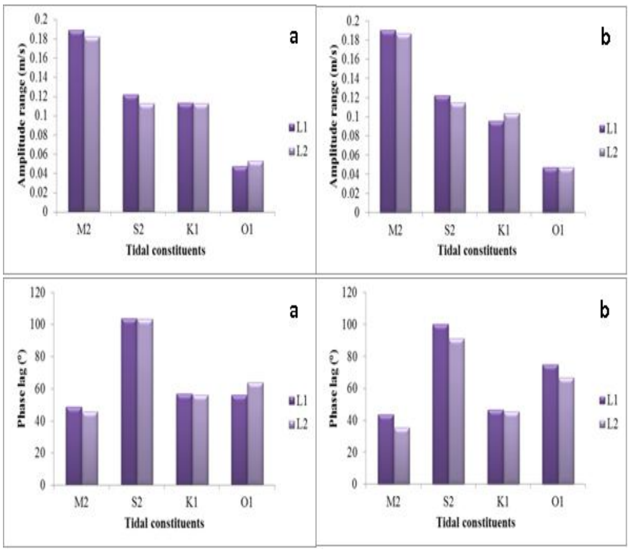

Fig.4. Shows the amplitudes and phases for four major constituents M2, S2, K1 and O1.

Here, NE monsoon period indicated by and SW monsoon period indicated by b.

4. Wave characteristics

Sea state is usually outlined exploitation few parameters derived from the wave spectrum. Significant wave height (Hs) and peak period (Tp) are the most commonly used parameters. Mean wave period associated with the high wave is usually obtained by assuming a significant wave steepness. In the present case, Significant wave height (Hs) m, wave height (m), mean period (T1) sec, significant wave period (T1/3), zero crossing wave period (Tz), mean wave direction, peak period (Tp) and peak direction are considered.

Table I: Wave parameters of maximum, minimum and average value for the January-2011.

S. NO	Wave parameters	NE monsoon					
		L1 (Vattaikottai)			L2 (Kanyakumarai)		
		Min	Max	Avg	Min	Max	Avg
1.	Significant wave height (Hs) in m	0.39	1.26	0.70	0.52	1.78	0.84
2.	wave height (H_{max}) in m	0.59	1.93	1.10	0.81	2.79	1.32
3.	Mean period (T1) in sec	4.62	12.04	7.24	5.58	11.66	7.80
4.	Significant wave period (T1/3) in sec	3.63	19.20	11.31	4.07	19.20	11.66
5.	Zerocrossing period (Tz) in sec	4.32	11.23	6.64	5.29	10.92	7.20
6.	Wave direction in deg	110.95	153.20	136.68	143.87	195.99	168.83
7.	Peak period (Tp) in sec	3.46	18.29	10.79	3.88	18.29	11.10
8.	Peak direction in deg	92.00	169.30	149.28	123.00	213.10	179.76

Table II: Wave parameters of maximum, minimum and average value for the July-2011.

S. No	Wave parameters	Southwest Monsoon					
		L1 (Vattakottai)			L2 (Kanyakumarai)		
		Min	Max	Avg	Min	Max	Avg
1.	Significant wave height (Hs) in m	0.15	2.49	1.30	0.82	2.86	1.52
2.	Maximum wave height (H_{max}) in m	0.24	3.91	2.05	1.29	4.49	3.39
3.	Mean period (T_1) in sec	2.23	16.62	10.47	6.30	18.96	10.71
4.	Zerocrossing period (Tz) in sec	2.16	15.39	9.84	5.80	17.98	9.82
5.	Significant wave period (T1/3) sec	2.04	22.40	13.10	5.17	22.40	14.58
6.	Wave direction in deg	128.68	284.74	156.49	-	-	-
7.	Peak period (Tp) in sec	1.94	21.33	12.87	4.92	21.33	13.89

5. Distribution of Wave Height

The significant wave height (Hs) is commonly used to represent wave heights. Hence the Hs are used here to present the wave height characteristics. The time series of Hs, during the study period (NE and SW monsoon, 2011) are presented in Fig _ (5 and 6). The seasonal distributions of significant wave heights in this region are dominated by SW monsoon with average (Hs) of about 1.52 m. Maximum Hs of 2.86 m and 1.78 m was observed in L2 during the measurement period of SW and NE monsoon respectively. The closest ranges of 2.76 m have observed along the Visakhapatnam coast during the SW monsoon period (Suresh et al, 2013).

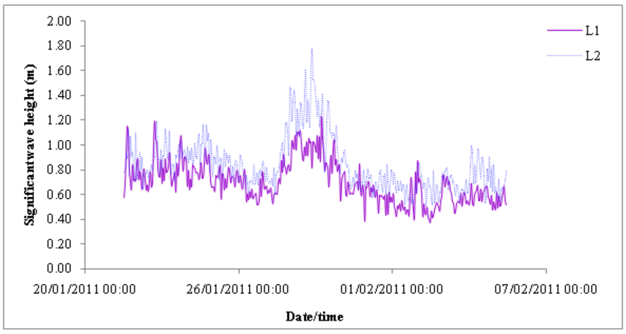

Fig.5. Time series significant wave heights at L1 and L2.

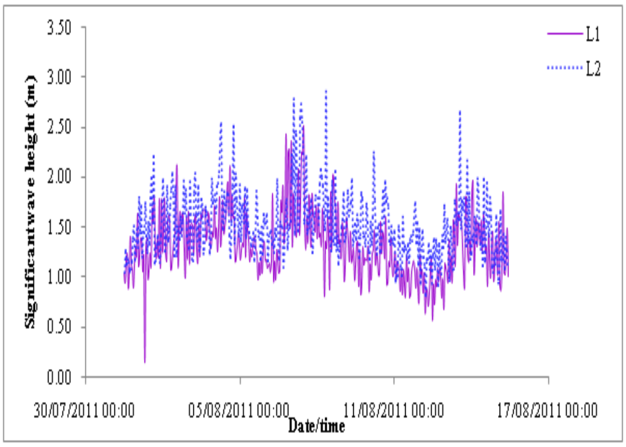

Fig.6.Time series significant wave heights at L1 and L2.

The lowest low average Significant wave height (0.70 m) are observed during the NE monsoon season and highest high average significant wave height (1.52 m) are observed during the southwest monsoon period. This observation clearly indicates that the waves are calm in NE monsoon season. During the cyclone period (Nov 1998), SanilKumar et al (2004); Bhaskar Rao et al (2001) has observed Maximum wave height of 3.29 m along the east coast of India, Which are more frequent over the Bay of Bengal than the Arabian Sea.

6. Wave period

The seasonal average Wave periods predominantly vary between 7.24- 7.80 and 10.47- 10.71 during the period of NE and SW monsoon. During the study period, the observed minimum and maximum wave period are 4.62- 12.04 sec and 2.23- 16.62 sec in NE and SW monsoon respectively are presented Fig _ 7 and 8. In general, short period and intermediate waves are classified into two categories based on the peak period Tp <8 second and 8<Tp<13 seconds respectively. The observed peak periods for the two monsoon season shows the intermediate waves with the average peak period 10.79 (L1), 11.10 (L2) and 12.87(L1) and 13.89 (L3) NE and SW period respectively.

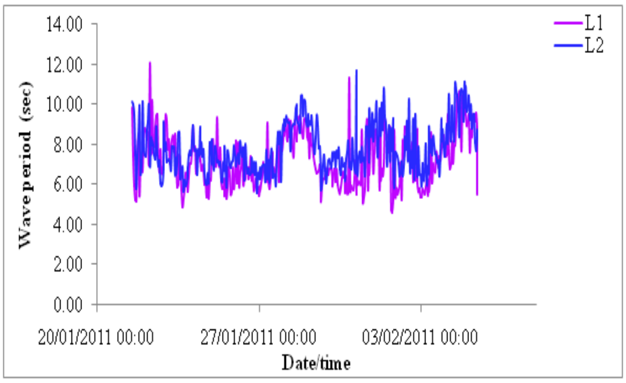

Fig.7.Time variations for the wave period at the L1 and L2 during NE monsoon periods.

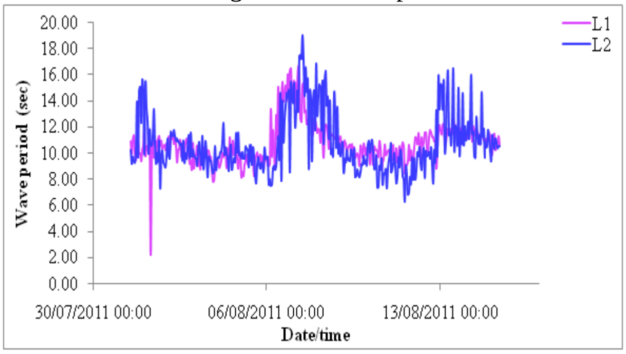

Fig.8.Time variations for the wave period at the L1 and L2 during SW monsoon periods.

7. Wind

Wind parameters such as wind speed and direction were measured along Kanyakumari coast by using Automatic weather station for15 days at a height of 10m from mean sea level for southwest monsoon season (August to September) and North East monsoon period (January to February). The wind speed and direction are shown in the figures- 13 and 14. The maximum wind speed of 9.9 m/s was recorded during the 08:50 hr 24th January 2011and minimum wind speed of 1 m/s recorded during 5:10 hr 5th February 2011. The maximum wind direction 2200 was recorded during the 10:30 or 15th 2011 and minimum wind directions of 60 recorded during 02:00 hr 23rd February 2011 are shown in the Fig _ 9 and 10.

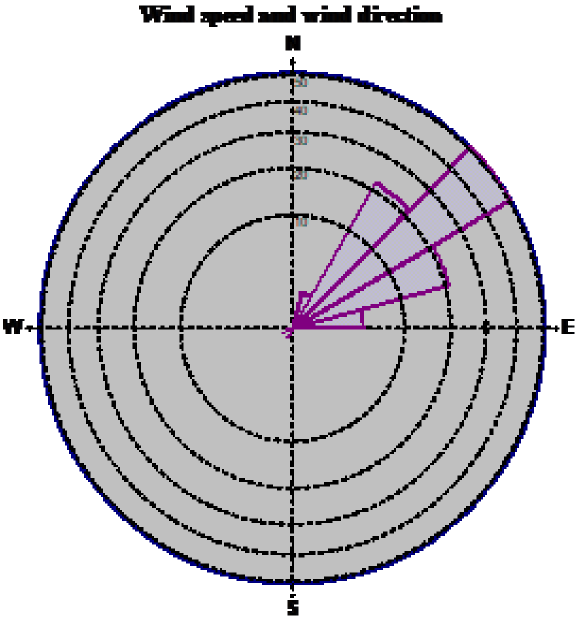

Fig.9.Wind speed and wind direction at Northeast monsoon season along kanyakumari coast.

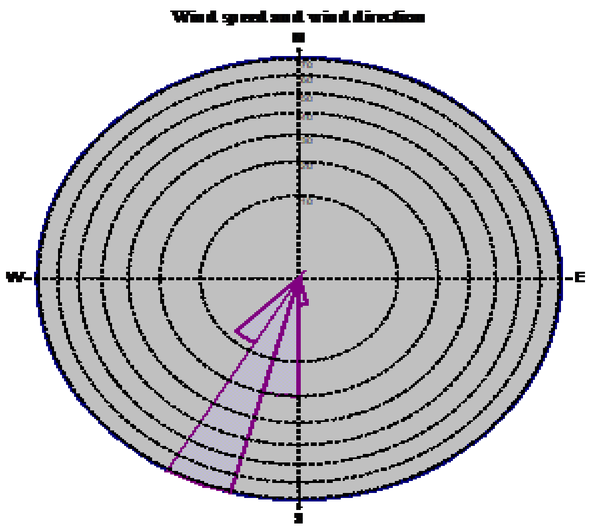

Fig.10.Wind speed and wind direction at southwest monsoon along kanyakumari coast.

Kumar and Anand (2004) reported that the wind speed varied from 0.1 to 12 m/s with an average speed of 3.5 m/s during 2002 and from 0.1 to 10 m/s with an average speed of 3.7 m/s during 2003. Wind direction was predominantly from the sector between north and east and from the sector between west and north expect during the southwest monsoon period. During the southwest monsoon period, the wind was from the sector between south and west with a mean direction of 230°. The daily pattern in the wind was diurnal with the relatively strong wind in the afternoon than in the forenoon. For the present study period, wind speed varied from 3.2 to 9.9 m/s with an average of 6.5 m/s during northeast monsoon season and the wind speed varied from 1.2 to 7.4 m/s with an average wind speed of 4.4 m/s during southwest monsoon season 2011. The wind direction was predominantly 60 to 830 with an average direction of 520 for the northeast winter season and 1800 to 2200 with an average wind speed of 2010 during southwest monsoon season 2011 respectively.

- **Relationship between wind speed and waves parameters**

The wind and wave climate in the Bay of Bengal (Hastenrath and Lamb 1979; Young and Holland 1996) suggests that the observed wind and wave activity in the Bay during the rough weather season (May - September) is primarily controlled by the southwest monsoon activity over the tropical Indian Ocean. During July and August, the southwesterly winds sweep the south-central Bay of Bengal and the wind speed reaches up to 9 to 15 m/s in July which is the peak of the southwest monsoon. The present observation showed maximum (9.5 m/s) wind speed observed in the NE monsoon period, whereas in the SW monsoon period the wind speed ranges from 1.3-7.2 m/s.

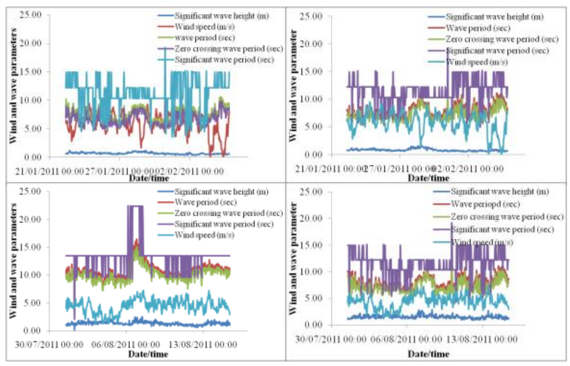

Fig.11.Comparison between wind speed and wave parameters. Here, a, b and c, d shows the L1 and L2 for NE and SW monsoon period.

The mean wave height in the central Bay during July and August (peak of the SW monsoon season) reaches up to 2.5 and 2.0m respectively due to the wind sweep. Therefore, the observed variability in any particular month or year departs from the meteorological factors. In particular, Gower (1996) presents a comprehensive comparison of wind speed and wave height between the TOPEX altimeter measurement and 14 moored buoys along the west coast of Canada. Based on the observation, time series plots (fig _ 11) have been plotted among wind speed and wave (significant wave height) parameters considering understanding the coupling or interdependence between two parameters. The present study demonstrates that the temporal coherence of Hs is varied by the WS in our study area. The relationship between wind speed and Hs are shown the significant wave heights are weakly associated with the wind speed U10, are presente in Fig _ 12.

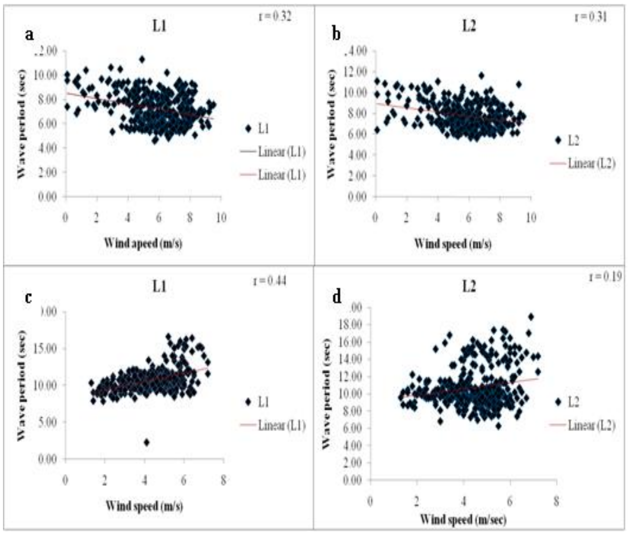

Fig.12.Scatter plots; relationship between wind and significant wave height. a, b and C, d shows for NE and SW monsoon season respectively.

Table III. Correlation between wind speed and significant wave height. Here, ** indicates the 0.01 significant.

Name of the locations	NE monsoon *r* values	SW monsoon *r* values
L1	-0.321**	0.439**
L2	-0.312**	0.196**

The statistical properties (r) of the Hs difference based on the wind speed are very, the correlation coefficient -0.321 to -0.312 and 0.439 to 0.196 m/s for NE and SW respectively. Here, the NE monsoon shows the negative correlation and SW monsoon shows the positive correlations (Table _3). The correlation coefficient in L1 shows higher than the L2 as the wind measurement located nearby the L1.

IV. CONCLUSION

Hydrodynamic studies on the variability of tides and wave characteristics have been studied in relation to the Wind condition along the Kanyakumari coast, Bay of Bengal during the NE and SW monsoon period of 2011. In the present study, seasonal cycle of tides have been studied with a specific emphasis on the role played by them in forcing the seasonal cycle of wind and waves at Kanyakumari, along the southwest coast of India, using short time series data. The maximum tidal height (1.13 m) was found in L2 during North east monsoon period with the tidal pattern of mixed mainly semidiurnal tides. The main features of the M2 shows the maximum tidal amplitudes in both monsoon periods, which indicates the strongest tides in Kanyakumari coast. Wind speed varied from 0.1- 9.5 and 1.4- 7.2 m/s with the average wind speed of 5.8 and 4.4 m/s in NE and SW respectively. Wind blows (direction) predominantly from NE in NE monsoon wind and SW in SW monsoonal wind with the average direction of 55° and 199° in NE and SW monsoon. During the normal wind conditions, wave height maximum (2.86 m and 1.78 m) has been observed L2. From the primary qualitative analysis it was seen that there is a significant increasing trend in wave height in two locations. In both monsoons, L1- L2 the significant wave height shows a gradual increasing trend in height. From the results, it is concluded there is no unusual wave condition due to the high wind or cyclone. The relationship between wave height and wind speed shows that they are weakly correlated with a significant level of 0.01.

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