AN OVERVIEW OF STATISTICAL STUDIES ON OCEAN PARAMETERS IN NEARSHORE AND OFFSHORE REGIONS OFF WESTERN COAST OF INDIA

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ABSTRACT
Nowadays, the ocean parameters study from the WRB (Datawell directional wave rider buoys) generated data became popular. The review has to be concentrated on the WRB (Datawell directional wave rider buoys) generated data. Statistical studies carried out on ocean parameters in nearshore and offshore regions along western coast line of India have been reviewed. Aim of this study is to prepare a bibliography of the ocean parameter studies in Arabian Sea bordering west coast of India and to highlight the major contribution of different statistical studies. The review suggests that as far as ocean parameters of west coast are concerned, a total of 38 papers have been published, out of 80 research papers which dealt with Statistical study of ocean parameters in near shore and offshore regions. The review also shows that the majority of studies undertaken along western Indian coast have concentrated on real time forecasting of waves and to estimate the wave parameter aspects and very few attempts have been made for applied aspects of ocean parameter contents. A bibliographical account and theme wise review of various past publications have also been provided in this paper.

KEYWORDS: *Ocean Parameters, West coast of India, Statistical Study*.

I. INTRODUCTION

Statistical study on ocean parameter is most important study for coastal and ocean engineering. The random nature of sea surface makes it one of the most complicated phenomena. This is review paper of Statistical studies carried out on ocean parameters in near shore and offshore regions off western coast of India. This review shows that the majority of studies undertaken along western Indian coast have concentrated on ocean wave parameter.

The wind blowing over the sea surface generates wind waves. They develop with time and space under the action of the wind and become huge waves called ocean surface waves. According to present knowledge this process can be described as follows: the wind blowing over the water surface generates tiny wavelets which have a two-dimensional spectral structure. The spectral components develop with time and through space by absorbing the energy transferred from the wind. Nonlinear energy transfer among spectral components is also important in the development of the spectrum. The high frequency components then gradually saturate, losing the absorbed energy as the waves break, while the low frequency components are still growing. In this way, the spectral energy increases and the spectral peak shifts to the low frequency side. It takes a very long time to arrive at such a dynamical model of ocean waves. Ocean waves are mainly determined through field measurements, numerical simulation, statistical models and analytical solutions. Each method has its own advantages

and disadvantages. Now a day's Statistical models are taking crucial role for estimating and forecasting the waves.

Wind is also important ocean parameter have undertaken along western Indian coast and some satisfactory statistical work carried out by researchers. Wind is the mass movement of air due to the difference in pressure between two sections on earth. Wind is characterized by its speed, direction, time of occurrence mainly. Wind force is given by a scale called the Beaufort wind force scale which provides an empirical description of wind speed based on observed sea conditions. Wind produces waves in the ocean which have a lot of significance in real world.

In order to facilitate the future Statistical study, it is important to collect and evaluate published literature on ocean parameters specially waves, wind, and water depth and oil spill trajectory. Some initial efforts were made to provide a bibliographical account of ocean parameters. However detail review has not been carried out on ocean studies in western coast of India. Therefore an attempt has been made to provide an account of ocean parameters study exclusively carried out till date, in near along western coast line of India. Figure 1 shows the area considered for the present review along western coast of India. The main objectives of present paper are:

1. To prepare a bibliography of the ocean waves studies in Arabian Sea bordering west coast of India.
2. To highlight the major contribution of different statistical studies.
3. To review the work of analysis of data generated through WRB (wave rider buoys) off western coast of India.

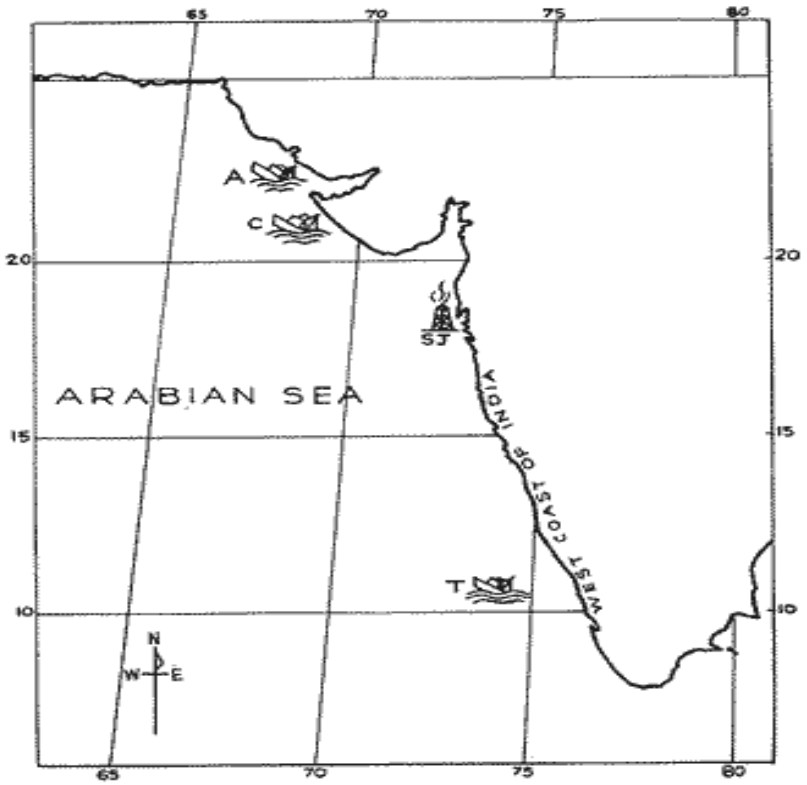

Figure 1. Area along west coast of India covered in the present review.

II. SALIENT OBSERVATIONS

The detailed statistical study of all published papers (table 1) on ocean wave's investigations along west coast of India revealed that as far as regions of west coast of India are concerned, a total 38 papers have been published. This is evident from the 24 research papers on statistical studies of ocean waves aspects published whereas , some satisfactory Statistical work carried out by researchers on all other ocean parameters viz, wind, water depth, sea level and sea surface temperature, oil spill trajectory.

Table 1. Status of Statistical study on ocean parameters off western Indian Coast line.

Sr. No.	Aspect of the Study	Statistical study						off Ratnagiri
		Descriptive Statistics	Symmetric/ Asymmetric distributions	Correlation & Regression	Artificial Neural Network	Time series analysis	Data mining/ simulation techniques	
1	Ocean waves (wind as well as swell)	06	04	02	06	03	03	04
2	Sea level/ sea surface current	00	00	00	00	03	00	00
3	Sea surface temperature	00	00	00	00	01	00	00
4	Mixed layer depth	00	00	00	00	01	00	00
5	Oil Spill Trajectory	00	00	00	00	00	01	00
6	Astronomical tides	00	00	00	00	02	00	01
7	Wind speed and wind Direction	00	00	03	00	01	02	01
	TOTAL	**6**	**4**	**5**	**06**	**11**	**6**	**06**

The close examination of all Statistical studies (table 2, 3, 4, 5, 6, 7and 8) also suggests that most of the studies undertaken along western coast of India were concentrated on time series analysis aspects as evident by 11 publications and neural network, Descriptive Statistics and Data mining/ simulation techniques aspects as evident each by 6 publications respectively. Contributions of other statistical studies Symmetric/asymmetric probability distributions, correlation and regression study are undertaken and 4and 5 publications respectively concerned in this review. However situation off western coast is not so encouraging as far as other aspects such as Salinity, Sea ice, Biogeochemistry and physical oceanographic parameters are concerned. Research on all these lines have been initiated along western coast of India. Even no Statistical study undertaken on survey related or ship observed information to the western coast of India. It is also interesting to note that Ratnagiri off have been paid less attention as far as Statistical studies are concerned which is reflected in low number of publications from these regions. Themewise review of various publications has also been provided below.

III. OCEAN WAVE STUDIES

As far as ocean wave studies on western coast of India are concentrated the initial credit goes to P. Jain, M.C. Deo [17], [18] who concentrated on forecasting significant wave heights using neural network approach. Other researcher includes V. Sanil Kumar and his group (V. Sanil Kumar [2], [24], [37], and [38]) who studied on fitting probability distribution to wave data. S. Mandal, Subba Rao, D.H. Raju [6] who concentrated on the missing wave data can be generated using trained network and comparative study made with NN and Scott spectra; G Muraleedharan and his group (G Muraleedharan et al[1], [7], [15],) studied on Weibull distribution for long term distribution of significant wave height. Mandal and S Prabaharan N[11] studied on recurrent neural network with rprop update algorithm and is applied for wave forecasting. P. Vethamony and his group (P. Vethamony et al [22]) who concentrated on wind and wave data during fair weather season using time series approach.

On the other hand, few study carried out by using basic statistical tools; V. Sanil Kumar and his group (V. Sanil Kumar et al [14], [19], [28]) studied on to know the variations in wave characteristics during

the wave growth and describes characteristics of the spectra , the wave parameters derived from the spectra and to examine the presence of the summer Shamal swells and to understand variations in wave characteristics and associated modifications in wind sea propagation using descriptive statistic approach. Also few study carried out by using time series analysis; R.P. Dubey[27]and Bitanjaya Das, V.M. Aboobacker et al[30], Prahlada R et al [35] , Johnson Glejin et al [37] , Sunil Deshpande et al [38] studied on forecasting the wave data by using time series analysis approach. Similarly few study carried out by using correlation and regression, data mining approach; V. Sanil Kumar[12], Deepthi. I. Gopinath and G.S. Dwarakish [34] studied on the variation of the spreading parameter estimated based on the wave data, to predict waves at New Mangalore Port Trust (NMPT) by using correlation and regression and R.D. Sathiya, G.B. Venkatraman and V. Vaithiyanathan [32] studied on Estimation of Significant Wave Height of various ocean parameters for prediction purpose.

IV. SEA LEVEL, SEA SURFACE CURRENT AND SEA SURFACE TEMPERATURE STUDIES

The application of statistical techniques to sea level and sea surface current data on western Indian coastal line stared with D. Shankar [3] who studied on Seasonal cycle of sea level and currents using time series analysis approach; P.K. D Kumar4 and A.D. Rao [20] who studied the variations in monthly mean sea level over a period of 50 years (1949-1998) and variability of coastal ocean processes using time series analysis approach. On the other hand only one study carried out on sea surface temperature that credit goes to (R. M. Dwivedi et al [8]) noticed that the frontal structures common in both SST and chlorophyll images, and few in number using time series analysis approach.

V. WIND SPEED AND WIND DIRECTION STUDIES

Satisfactory statistical study dealt with the wind speed and wind direction from west coast of India. Anurag More and M.C. Deo[5] , V. Aboobacker et al [23] , R. Rashmi et al [30] , S Neetu et al [13] studie on forecasting wind data , all above publishers study carried out by using correlation , regression and time series analysis approach. Also a few study carried by using mean square error, ANN and data mining technique for prediction of wind speed in real time. However as far as remaining ocean parameters tide and oil spill trajectories are concerned no concrete efforts have been made to statistical study.

Table 2. Major statistical work carried out on Ocean waves (wind as well as swell) along west Coast of India including Ratnagiri.

Sr.	Year	Author	Statistical Study	Remark
1	1999	G Muraleedharan [1] N Unnikrishnan Nair P G Kurup	Weibull distribution	The model will explain the long-term distribution pattern of redefined significant wave heights effectively and hence the parametric relations derived from this model will more effectively predict the various redefined significant wave height parameters.
2	2000	V. Sanil Kumar [2] K. Ashok Kumar N.M. Anand.	Joint distribution, Rayleigh distribution.	The model will explain the maximum wave height was 1.65 times the significant wave height and the wave heights follow the Rayleigh distribution. The joint distribution of wave height and period was not adequately represented by the commonly followed theoretical distributions. This could be relegated to the broad banded nature of the observed wave spectra.
3	2004	S. Mandal [6] Subba Rao D.H. Raju	Neural Network	In this study shows that the missing wave data can be generated using trained network and comparative study made with NN and Scott spectra, but the maximum energies are better estimated by NN as compared to Scott.
4	2005	S. P. Sathesh [7] V.K. Praveen V. Jagadish Kumar G Muraleedharan P G Kurup	Weibull and Gamma Distribution	In this study shows that the long term distribution of significant wave height is more effectively simulated by the Weibull model than the other were competing models. Also the Weibull and Gamma found to be empirically and logically the marginal distributions of significant wave height (Hs) - significant time

				period (Ts) and Hs – Tz more effectively than the bretschneider and Gluhovskii joint distribution models with zero correlation.
5	2006	Mandal S [11] Prabaharan N	Forecasting, Artificial Neural Network	A study was carried out on recurrent neural network with rprop update algorithm and is applied for wave forecasting. The recurrent neural network of 3, 6 and 12 hourly wave forecasting yields the correlation coefficients of 0.95, 0.90 and 0.87 respectively. This shows that the wave forecasting using recurrent neural network yields better results than the previous neural network application.
6	2006	V. Sanil Kumar [12]	correlation coefficient	A study was carried out on the variation of the spreading parameter estimated based on the wave data. The study shows that the spreading parameter can be related to significant wave height, mean period and water depth through the non-linearity parameter and can be estimated with an average correlation coefficient of 0.7 for the Indian coast and with higher correlation coefficient of 0.9 for the high waves (HS > 1.5 m).
7	2007	V.Sanil Kumar [14] K.Ashok Kumar P.Pednekar R.Gowthaman	Average, Range, maximum, minimum.	A study was carried out to examine the influence of sea and swell in the wave characteristics. The study shows that the conditions in the deep water are influenced by swell with 62%, whereas in the shallow water, the influence of wind seas with 68% is dominating in most of the period. The wind data shows that the wind direction wasp predominantly from sector between north to west at deep water and the sea was in the direction of the wind. Mean swell direction was 168° at deep water and 187° at shallow water. The spectra was narrow band in the deep water and relatively broad in the shallow water.
8	2007	G. Muraleedharan [15] A.D. Rao P.G. Kurup N. Unnikrishnan Mourani Sinha	Weibull Distribution	A study was carried out to examine the characteristic function of the Weibull distribution is derived and the model is suggested as a sampling distribution for newly defined significant wave heights by the method of characteristic function. This case study highlights the possibility of using the modified Weibull model for generating maximum wave height distribution and the parametric relations derived there from estimating the required wave height statistics for all weather sea wave conditions.
9	2007	P. Jain [17] M.C. Deo	Forecasting, Artificial Neural Network	A study was carried out to obtain forecasts of significant wave heights at intervals of 3, 6, 12 and 24 h. It is found that by doing so the long-interval forecasting is tremendously improved, with corresponding accuracy levels becoming close to those of the short-interval forecasts.
10	2008	Pooja Jain [18] M.C. Deo	Artificial Neural Network, Genetic programming and model trees.	A study was carried out to examine the time series forecasting scheme is employed. Based on a sequence of preceding observations forecasts are made over lead times of 3 hr to 72 hr. Both MT and GP results were competitive with that of the ANN forecasts and hence the choice of a model should depend on the convenience of the user.
11	2010	V. Sanil Kumar [19] C. Sajiv Philip T. N. B Nair	Average, Range, Standard deviation	A study was carried out to know the variations in wave characteristics during the wave growth by deploying a directional wave rider buoy at 14m water depth and hence waves measured are the transformed waves and the wave height and the wave direction measured will be different than that will be in the deep water.
12	2011	P. Vethamony [22] V.M. Aboobacker H.B. Menon K. Ashok Kumar L. Cavaleri	Time series analysis, Simulation, Diurnal Variations	A study was carried out on wind and wave data during fair weather season it reveals a distinct and systematic diurnal variation in wind speed, wave height and wave period, especially simultaneous increase in wave height and decrease in wave period with increase in local wind speeds due to sea breeze system. During a typical daily cycle, the wave height reaches its peak early in the afternoon, then it decays progressively back to the swell conditions within 5 or 6 hours. Swells from the southwest and to the local wind seas from the northwest leads to complex cross-sea conditions.
13	2012	S. P. Chempalayi [26]	Average,	A study was carried out on find the variations in nearshore wave

		V. Sanil Kumar Glejin Johnson G. Udhaba Dora P. Vinayaraj	Maximum, Variation.	parameters of collecting three WRB data and suggests that During all the three years, annual average variation of significant wave height; mean wave period and mean wave direction and maximum spectral energy density were the same.
14	2012	V Sanil Kumar [24] Glejin Johnson G Udhaba Dora S P Chempalayil Jai Singh P Pednekar	Average, Range, Time series	A study was carried out on describes characteristics of the spectra and the wave parameters derived from the spectra. Both reveal the dramatic changes that occur in the wave field due to the summer monsoon. The changes were virtually identical at all the three locations suggesting that the wave characteristics described here are representative of the conditions that exist along the coast of Karnataka State, west coast of India.
15	2013	R.P. Dubey [27] Bitanjaya Das	Forecasting, Gumbel, Weibull and Log-normal Distribution	A study was carried out on long term ocean wave and it reveals that it was expected and has been seen in the study that higher values of extreme wave condition have been obtained in the East Coast near Puducherry area, as compared to somewhat lower values predicted in the West Coast,
16	2013	V.M. Aboobacker [33] P. Vethamony S.V. Samiksha R. Rashmi K. Jyoti	Time Series Analysis	A study was carried out on the modification and attenuation in wave energy in the nearshore depths. Short wind seas off Goa were highly attenuated compared to the longer swells during the pre-monsoon season. The diurnal variations in wave parameters observed during pre-monsoon season are typical for the west coast of India as evident from the modeling results. However, the magnitude of variation decreases from north to south along the coast, as the intensity of sea breeze decreases from north to south. Higher reduction in wave heights is associated with high wind speeds indicating that role of refraction process is significant.
17	2013	Johnson Glejin [28] Sanil Kumar V Jai Singh T.N. B Nair Prakash Mehra	Average , Minimum, Maximum	A study was carried out to examine the presence of the summer Shamal swells and to understand variations in wave characteristics and associated modifications in wind sea propagation. This study identifies the presence of swells from the NW direction that originate from the summer Shamal winds in the Persian Gulf and that reach Ratnagiri during 30% of the summer Shamal period. Another important factor identified at Ratnagiri that is associated with the summer Shamal events is the direction of wind sea waves.
18	2014	R.D. Sathiya [32] G.B. Venkatraman V. Vaithiyanathan	Prediction, Artificial Neural Network	A study was carried out on estimation of significant wave height of various ocean parameters. Comparative study can be made with the significant wave height from the satellite imagery in relation to the actual measurement.
19	2014	Sisir Kumar Patra [31] B K Jena	Correlation and Regression anaysis	A study was carried out on the performance of Accelerometer and GPS wave buoy at 30 m water depth. results shows that Accelerometer and GPS wave buoy performed well and comparison between two wave buoys are as follows significant wave height between Accelerometer and GPS wave buoy compared well with local sea waves than swell conditions (R = 0.97 and 0.89 for sea and swell Hs).
20	2015	Prahlada R [35] Paresh C. Deka	Artificial Neural Network, Forecasting, Time Series.	Study was carried out on wavelet-ANN model for different station data to analyze the model performance, Also to identify a best methodology in wavelet-ANN model which gives a good result amongst other. Two different methods WLNN-1 &WLNN-2 employed for the first station data to forecast significant wave heights at higher lead times. From the result it is clear that the second method (WLNN-2) in wavelet-ANN model performed better than first method (WLNN-1). Hence method-2 is said to be a good and suggestible method for WLNN models as it takes less time and produces better results. Hence it is clear that more statistical variations in data lead to more number of decomposition levels and thus it increases the analysis time.
21	2015	Deepthi.I.Gopinath[36] G.S. Dwarakish	Artificial Neural Network	Study attempt has been made to predict waves at New Mangalore Port Trust (NMPT) located along the west coast of India using Feed Forward Back Propagation (FFBP) with LM algorithm and a

				recurrent network called Non-linear Auto Regressive with exogenous input (NARX) network. Field data of NMPT has been used to train and test the network performance, which are measured in terms of mean square error (MSE) and correlation coefficient (r). Comparison of the results of FFBP network and NARX network showed NARX performing better than the later as the 'r' obtained in case of NARX was 0.94.
22	2015	Johnson Glejin [37] Sanil Kumar V Jai Singh	Time series analysis, Moving average	A study was carried out on the inter-annual variations in the wave characteristics, The study shows that around 50% of the waves over an annual cycle are with significant wave height (Hs) between 0.5 and 1 m. Oscillations with lower periods are dominant during the first part of the wave data. Whereas, when the measurement period is advancing forward the oscillations with higher period are more dominant because of SW monsoon winds peaks up during the period. Inter-annual variations in monthly average Hs is maximum (0.5 m) in June and September due to the change in the monsoon intensity. The range of Hs in a day varied up to 1.5 m with the high values (>1 m) during the SW monsoon period. The swell heights are the highest in 2013 compared to other months.
23	2015	V. Sanil Kumar [38] M. Anjali Nair	Time series analysis	A study was carried out on the variations in wave spectral characteristics during 2009– 2012 are studied based on the measured wave data at 9m water depth. The study shows that the Inter-annual variations in the wave spectrum are observed for all months with large variations during January–February, May and October–November.
24	2015	Sunil Deshpande [34] Vilas B. Joshi	Time series analysis	A study was carried out on a hybrid use of renewable energy resources. The study shows that during pre-monsoon period (March–June), it is indicated that adequate wave potential power is available which can be harnessed for domestic supply purpose. Also shows the waves of about 0.5m to 1.0 m height are available for almost all the time throughout the year. Thus for consistent harnessing wave power is necessary to be consider this concept of "Every day waves" in WEC design. A near shore wave power plant in the wave breaking zone i.e. within 50 meters of reach from the beach should be provided which will reduce the cost of installation, cabling and maintenance in operational conditions.

Table 3. Statistical work carried out on Sea level/ sea surface current along west coast of India including Ratnagiri.

Sr.	Year	Author	Statistical Study	Remark
25	2000	D. Shankar [3]	Time series analysis	A study was carried out on seasonal cycle of sea level and currents. The reason appears to be the absence of salinity variation in these models. The large inflow of freshwater into the seas around India forces large changes in salinity, and hence, in coastal sea level.
26	2001	P.K. D. Kumar [4]	Time series analysis	The study focuses on the variations in monthly mean sea level over a period of 50 years (1949-1998). Analysis has shown that there are strong seasonal variations in the monthly mean sea level. Contrary to expectation, sea level values were found to be the lowest during the south west monsoon months, though this is the period of maximum discharge from rivers which debouch in the region. This is explained in relation to the geographic setting and associated upwelling in the region. It is also indicated that large fluctuations due to weather conditions do tend to balance through the years, and the periodic seasonal changes are mostly eliminated when annual averages are calculated.
27	2010	A.D. Rao [20]	Time series analysis	A study was carried out on variability of coastal ocean processes; Analysis of the model simulations and observations suggests that the extent of sub- surface warming is directly related to the depth of the thermo cline region.

Table 4. Statistical work carried out on Sea surface temperature along west coast of India including Ratnagiri.

Sr.	Year	Author	Statistical Study	Remark
28	2005	R.M.Dwivedi [8] H.U.Solanki S.R. Nayak D. Gulati V.S. Somvanhi	Time series analysis	A study was carried out on exploration of fishery resources through integration of ocean colour with Sea surface temperature. The study shows that an integrated approach for PFZ identification has been developed using ocean colour data SST, the frontal structures common in both SST and chlorophyll images are few in number.

Table 5. Statistical work carried out on mixed layer depth along west coast of India including Ratnagiri.

Sr.	Year	Author	Statistical Study	Remark
29	2005	K. V. Ramesh [9] R. Krishnan	Time series analysis	A study was carried out on to investigate the role of the southwest monsoon circulation in influencing the interactions between the oceanic mixed layer and the underlying thermocline. It is seen from the analysis of ocean temperature data sets that the seasonal surface cooling of the Arabian Sea, during the southwest monsoon months, is accompanied by a distinctive subsurface warming well below the mixed layer with maximum warming at a depth of about 150 m by as much as 1.2_C.

Table 6. Statistical work carried out on Oil Spill Trajectory along west coast of India including Ratnagiri.

Sr.	Year	Author	Statistical Study	Remark
30	2007	P.Vethamony [16] K. Sudheesh M.T. Babu S. Jayakumar R. Manimurali A.K. Saran L.H. Sharma B. Rajan M. Srivastava	Data mining technique, Simulation	A study was carried out on trajectory of an oil spill. The MIKE21 Spill Analysis model was used to simulate the spill trajectory. The observed spill trajectory and the slick area were in agreement with the model simulations. The present study illustrates the importance of having pre-validated trajectories of spill scenarios for selecting eco-sensitive regions for preparedness and planning suitable response strategies whenever spill episodes occur.

Table 7. Statistical work carried out on Astronomical tides along west coast of India including Ratnagiri.

Sr.	Year	Author	Statistical Study	Remark
31	2005	K. Srinivas [10] V. Kesava Das P. K. D Kumar	Time series analysis	A study was carried out on monthly sea level at 15 tide gauge stations along the coast line and three forecasting models have been used viz; Autoregressive, Sinusoidal and EWMA. The study shows that a strong domination of the annual cycle over the semi -annual cycle was seen at ten stations. While the autoregressive and sinusoidal models were satisfactory, EWMA technique was found to be best of all.
32	2013	M.P Subeesh [29] A. S. Unnikrishnan V. Fernando Y. Agarwadekar S.T. Khalap N.P.Satelkar S.S.C. Shenoi	Time series analysis	A study was carried out on the characteristics of both barotropic and baroclinic tidal currents. It is revealed the presence of significant barotropic tidal currents on the shelf associated with varying internal tidal current in different frequencies. Current spectra show narrow band signal at four tidal frequencies (M2, S2, K1and O1), and a broad frequency band at near inertial frequencies.

Table 8. Statistical work carried out on Wind speed and wind Direction along west coast of India including Ratnagiri.

Sr.	Year	Author	Statistical Study	Remark
33	2003	Anurag More [5] M.C. Deo	Time-series model, correlation, Neural Network.	A study was carried out on wind data forecasts. The analysis was carried out here by two methods viz, statistical time- series analysis and neural network. Finally result shows that the neural networks produced much more accurate forecasts than the traditional stochastic time-series model of ARIMA. It is indicating that their generalizing capacities are needed in wind speed forecasting over different sorts of time intervals.
34	2006	S Neetu [13] Satish Shetye P Chandramohan	Correlation, Time series analysis	A study was carried out on Impact of sea breeze on wind-seas. The study shows that the correlation between wind speed inferred from the TMA spectrum and the observed wind speed was quite significant for this period. This appears to be due to the contribution to the high frequency peaks arising from the wind-seas. Contribution of the swell waves was insignificant for the period studied here.
35	2010	M. A. Nayak [21] M C Deo	correlation coefficient, mean square error(MSE), ANN, Time series analysis	A study was carried out on to evaluates a neural network based time series approach to predict wind speed in real time over shorter durations of up to 12 hr based on analysis of three hourly wind data . ARMA models have an advantage that they can provide very accurate results for short term wind prediction if data have fairly smooth trend and stationary. If the data are not stationary and there are quite high variations and change trend suddenly they may lead to very inaccurate results. All the disadvantages above are fairly solved by using Artificial Neural Networks. Artificial Neural Networks depend on the training data and not on any physical relation. They take less amount of time in learning and giving results. The results showed that neural networks can give most accurate results for the long term wind speed prediction.
36	2011	V. Aboobacker [23] R. Rashmi P. Vethamony H.B. Menon	Time series analysis	A study was carried out on the dominance of pre-existing swells over wind seas. The analysis shows that swells dominate Goa coastal region not only during southwest monsoon (93%), but also during the post-monsoon (67%) season. Wind seas are dominant during the pre-monsoon season (51%). The correlation coefficients between measured and modeled significant wave heights and mean wave periods are 0.96 and 0.85, respectively. Numerical simulations reproduced the swell characteristics in the Indian Ocean, and from the model results potential swell generation areas are identified.
37	2012	P. Vethamony [25] R. Rashmi S. V. Samiksha V. Aboobacker	Data mining technique	To study the wave characteristics in the deep as well as near shore regions during different seasons. The potential generation of swells observed in the Arabian Sea is from SW direction during SW monsoon season and from SW/SSW and NW directions during both pre monsoon and post-monsoon seasons. The NW swells which occurs during shamal event, shows distinct characteristics such as an increase in wave height, decrease in swell period and a common propagation direction (northwest) for wind seas and swells.
38	2013	R. Rashmi [30] V. Aboobacker P. Vethamony M. P. John	correlation	A study was carried out on to understand the coexistence of wind seas and swells along the west coast of India during non-monsoon season. Study show distinct variations in the wave parameters due to the co existence of wind seas with pre-existing swells during non monsoon season (pre-monsoon and post monsoon seasons) which is fairly a calm weather season along these regions.

VI. CONCLUSION

The review of literature shows that there is no satisfactory contribution of statistical study on ocean parameters along Western Indian coastal line. The reason may be due to non availability of resources,

specially the lack of dedicated ocean research vessel to the academic organizations spread along western coast. It has been noticed that no concrete efforts have been made for study of ocean parameters from west coast of India.

VII. FUTURE SCOPE OF THE STUDY

1. After studying the review on ocean parameters, it is found that no satisfactory Statistical study of ocean parameters viz, wind, water depth, sea level, sea surface temperature and oil spill trajectory. Further research carried out by in this direction will certainly help to forecast whether, change in climate and ocean waves' height along Indian western coastal line.
2. However, it is need of the hour to prepare Atlas of Statistical studies from different regions along Indian coasts. Such an attempt will definitely facilitate, researcher to get aware with different statistical studies of ocean parameters along Indian coast.

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