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TEXTURAL CHARACTERIZATION OF COASTAL SEDIMENTS ALONG UDUPI COAST, WEST COAST OF INDIA.

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Abstract

Particle size characterizations of beach sediments along Udupi coast was carried out in the present study. The prime objective of this study is to identify the textural behavior of beach sediments based on the grain size parameters. To achieve the above-mentioned objective tri-plot analysis was performed. Grain size characteristics such as mean size, sorting, kurtosis and skewness were estimated using GRADISTAT and discussed in this paper. Maximum frequency distribution of sediment samples lies between the range of medium sand and fine sand. In the study, the entire study area was characterized into well sorted, moderately well sorted and moderately sorted sediment environments. Sediments were also identified as fine skewed or coarse skewed with platykurtic, mesokurtic and leptokurtic characters. From this study, it was concluded that the beach erosion, accretion, and stability of beaches are controlled by strong hydrodynamic and hydraulic processes and are highly significant in influencing the textural behavior.

Key words: Beach Sediments, GRADISTAT, Mean size, Sorting, Kurtosis, Skewness

INTRODUCTION

Grain size is the one of most important physical property of sediment and is a commonly used parameter for understanding the processes involved in transportation and deposition of sediments (Folk and Ward, 1957). Grain-size parameters are required in various fields of investigations such as preparation of Sediment Trend Matrix. The sediment particle size data is employed to study the trends of surface processes related to the dynamic conditions of transportation and deposition. Engineers apply the data to revise sample permeability and stability under load. Hydrologists use it when studying the movement of subsurface fluids. The objectives of grain-size analysis is to accurately measure the individual particle sizes to determine their frequency distribution and to prepare a statistical report that effectively characterizes the samples. In this study, an attempt has been made to analyze the beach sediment characteristics along the Udupi coast. [Sathish Sathasivama et al., 2015, Alsharhan and El-Sammak, 2014, Azman Azid et al., 2004, Udhaba Dora et al., 2011, 2012, Hegde, V.S. et al., 2015, Mohd Fauzi et al., 2014, McLaren and Bowles, 1985, Hanamgond and Chavadi, 1993, Saravanan and Chandrasekar, 2010, Selvam et al., 2011, Simon et al., 2001, Ram Kumar et al., 2015, Srinivas and Kurian, 2010, Ramaswamy and Rao, 2006, Sanil Kumar et al., 2011, Sathasivama et al., 2015]

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STUDY AREA

A stretch of Udupi coast starting from Malpe in the south to Delta in the north has been covered for this study. The area covers a distance of 12 km along the West coast of India. The predominant wave direction during SW monsoon season when major part of rainfall takes place is west and maximum wave height is between 4m to 6m. The next predominant wave direction is Southwest and max wave height is about 4.0 to 6.0 m in June and July, and 2 to 3m in September. The wave heights are small after the months of October varying from 2 to 2.5m in NE direction.

MATERIAL AND METHODS

Hand grasp method was used to collect samples along the high tide line at every 0.5 km interval. Forty-eight samples were collected during the month of February, 2016 from the backshore, high tide and foreshore line of Udupi coast. Simultaneously positioning of samples was conducted by using GPS. Samples were carefully preserved in polythene bags and brought to the lab. In the laboratory, dead shells were separated from sediments and the mixed saline content was removed from the grains by washing with water. The grain size distribution was carried out by using a sieve shaker consisting of 8 sieves with mesh sizes 75µm, 125µm, 250µm, 425 µm, 2000µm, 4000µm and 4750µm.

Table 1. GRADISTAT multiple data input screen

Aperture (microns)	Class Weight Retained (g or %) in Different Samples							
Sample Identity:	center 1	left 1	right 1	center 2	left 2	right 2	center 3	left 3
Initial Sample Weight:	1000	1000	1000	1000	1000	1000	1000	1000
4750	0	0	0	0	0	0	0	0
4000	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0
425	318	10	170	302	5	199	198	15
250	410	79	698	490	92	652	603	87
125	256	780	123	200	793	141	190	751
75	15	129	8	7	108	7	8	146

Table 2. GRADISTAT multiple data statistics

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FOLK AND WARD METHOD (f)	MEAN	1.941	2.875	1.690	1.922	2.870
	SORTING	0.725	0.325	0.471	0.707	0.321
	SKEWNESS	0.152	-0.070	-0.264	0.149	-0.074
	KURTOSIS	0.502	4.300	4.009	0.997	4.333
FOLK AND WARD METHOD (Description)	MEAN:	Medium Sand	Fine Sand	Medium Sand	Medium Sand	Fine Sand
	SORTING:	Moderately Sorted	Very Well Sorted	Well Sorted	Moderately Sorted	Very Well Sorted
	SKEWNESS:	Fine Skewed	Symmetrical	Coarse Skewed	Fine Skewed	Symmetrical
	KURTOSIS:	Very Platykurtic	Extremely Leptokurtic	Extremely Leptokurtic	Mesokurtic	Extremely Leptokurtic

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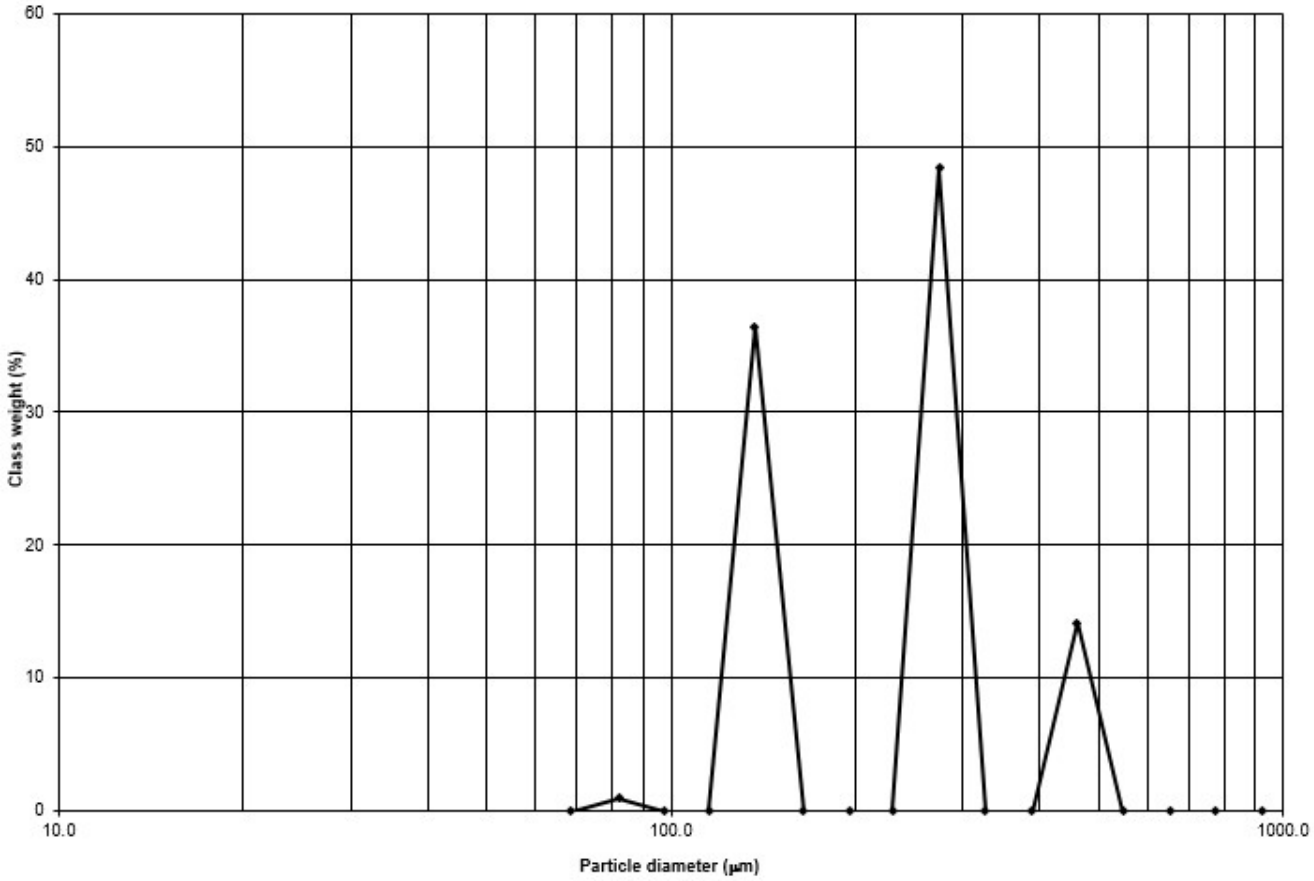

Figure 1. Sediment weight distribution with respect to particle diameter

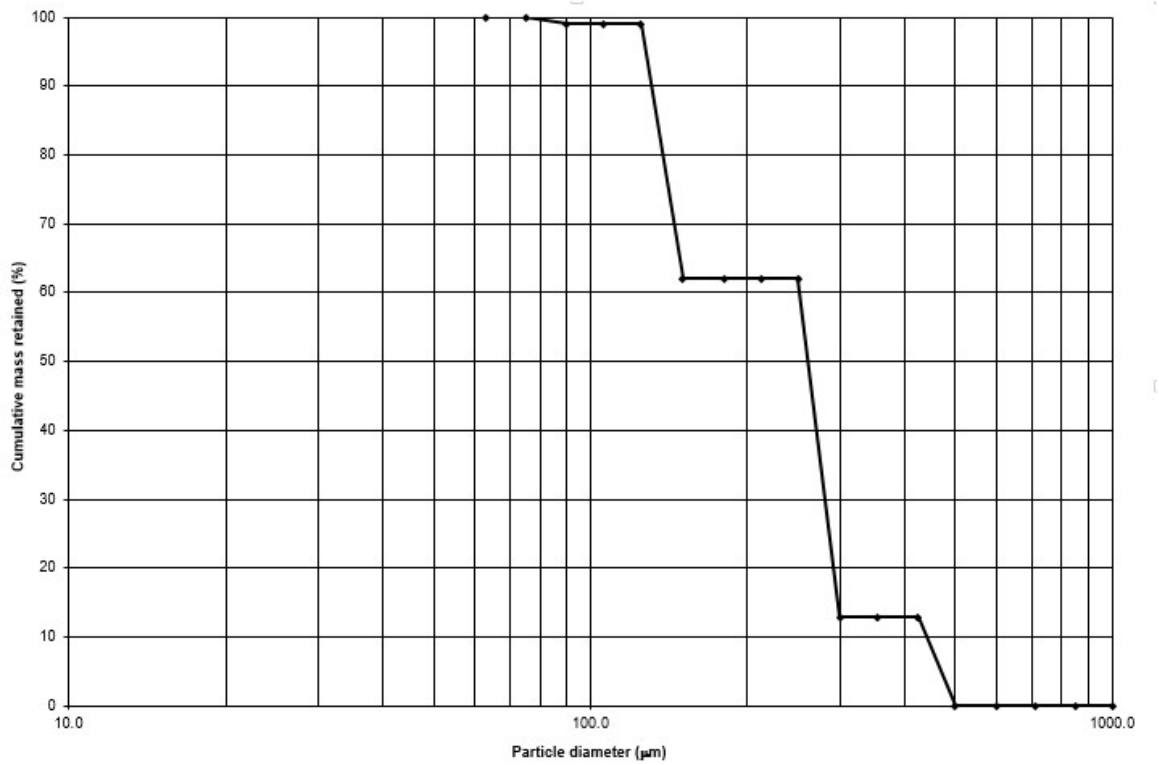

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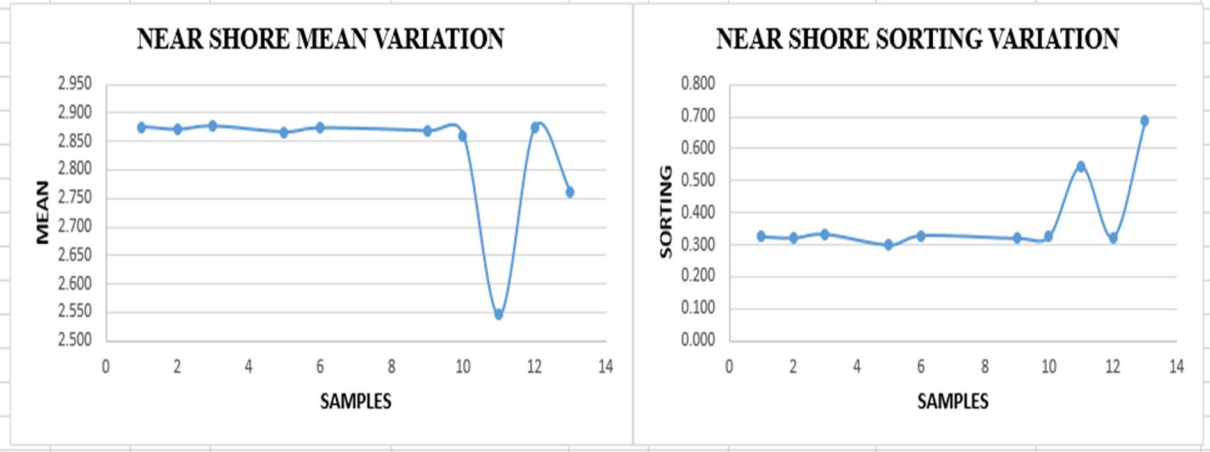
Figure 2. Cumulative sediment weight distribution with respect to particle diameter

A sample of the GRADISTAT input screen where sieve analysis results were fed is shown in Table 1.1. The output statistics of the sediment properties such as mean, sorting, skewness and kurtosis on the basis of Folk and Ward method are shown in Table 1.2. Also, the sediment weight distribution is presented graphically as weight percentage curves with respect to particle size (Figure 1.1) and cumulative weight percentage curves with respect to particle size (Fig. 2).
Sediments have many imperative characteristics of which particle size is only one. Particle size refers to the sizes of all of the particles in sediment. The mean particle size computed does not predict about the range of sizes occurring in that area. If estimation of a range is done, it does not predict the shape of the distribution which might be normal, strongly skewed, coarse or fine. Mean is in fact the arithmetic average size of the sediment and is expected to be influenced by source of supply, transportation and environment of deposition.

RESULTS AND DISCUSSION

The parameters used to describe the particle size distribution are mean, standard deviation (sorting), skewness and kurtosis. These parameters can be easily acquired by mathematical or graphical methods. The mathematical 'method of moments is the most accurate since it represents the entire sample population. However, consequently the statistics are greatly affected by outliers in the tails of the distribution, and this form of analysis should not be used unless the size distribution is known. The graphical representation of the grain size parameters of the study area are shown in figures 3 – 5.



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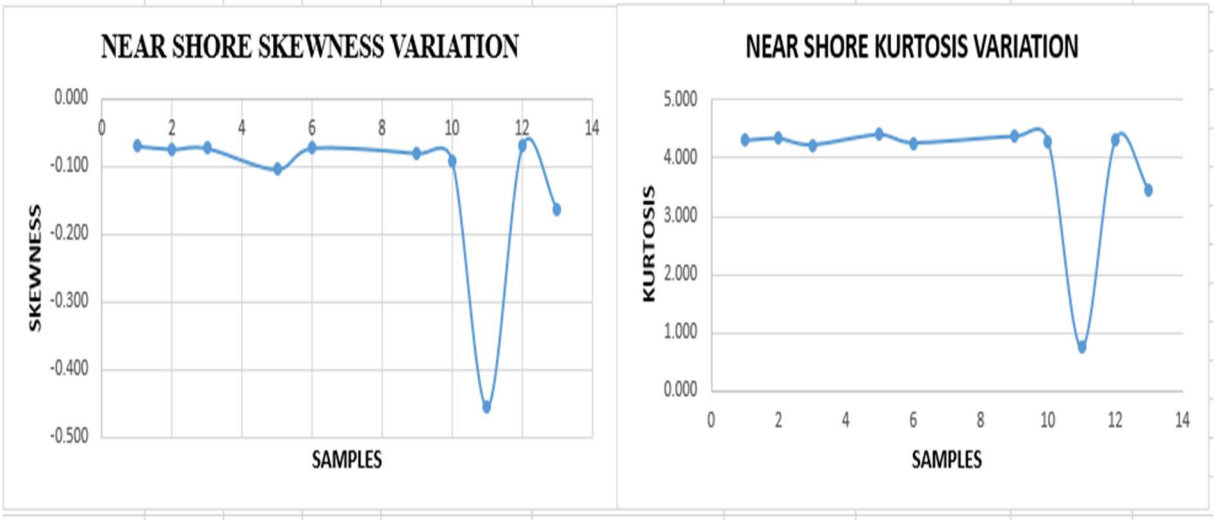

Figure 3. Grain size parameter's variation along nearshore line

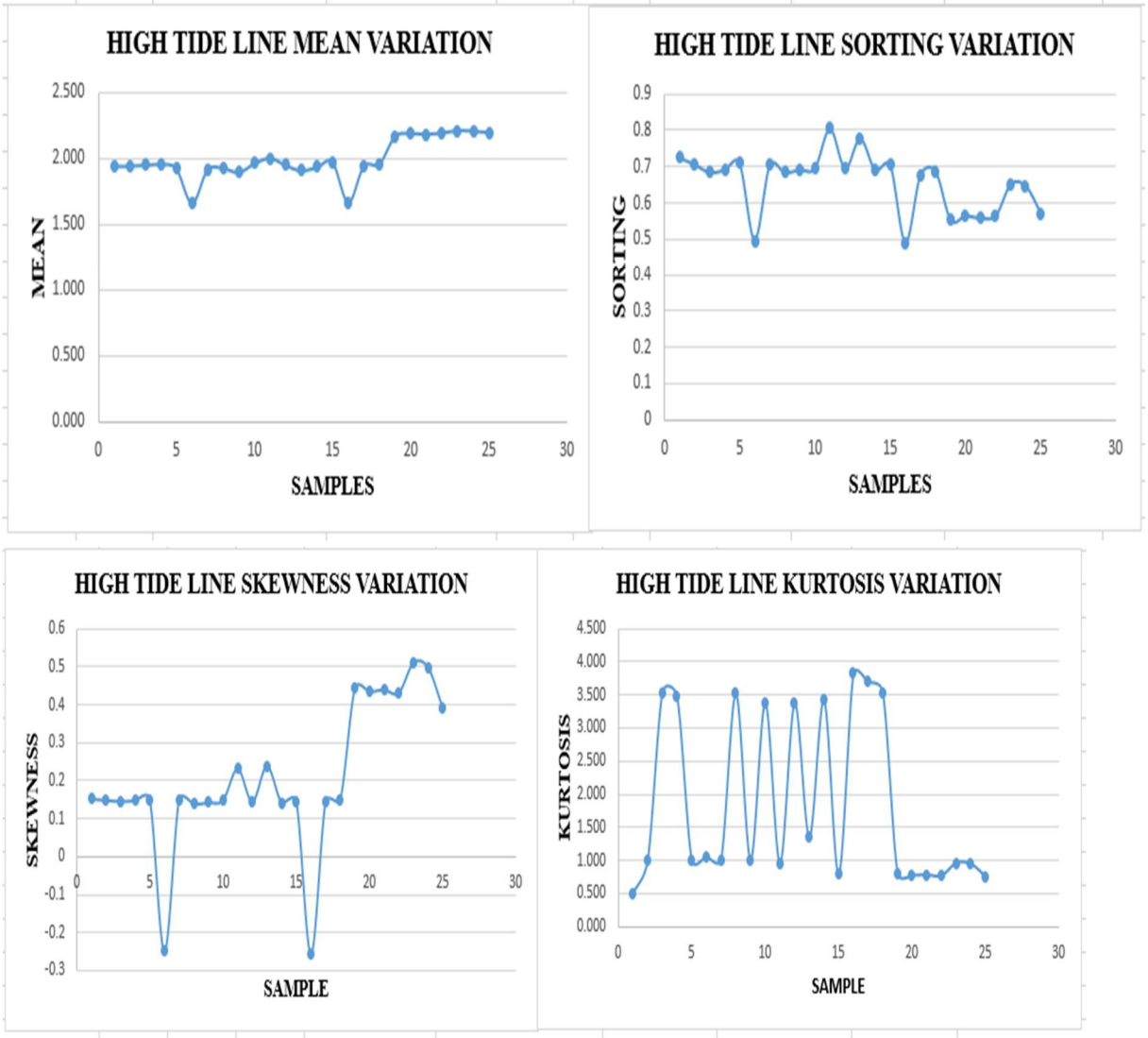

Figure 4. Grain size parameter's variation along high tide line

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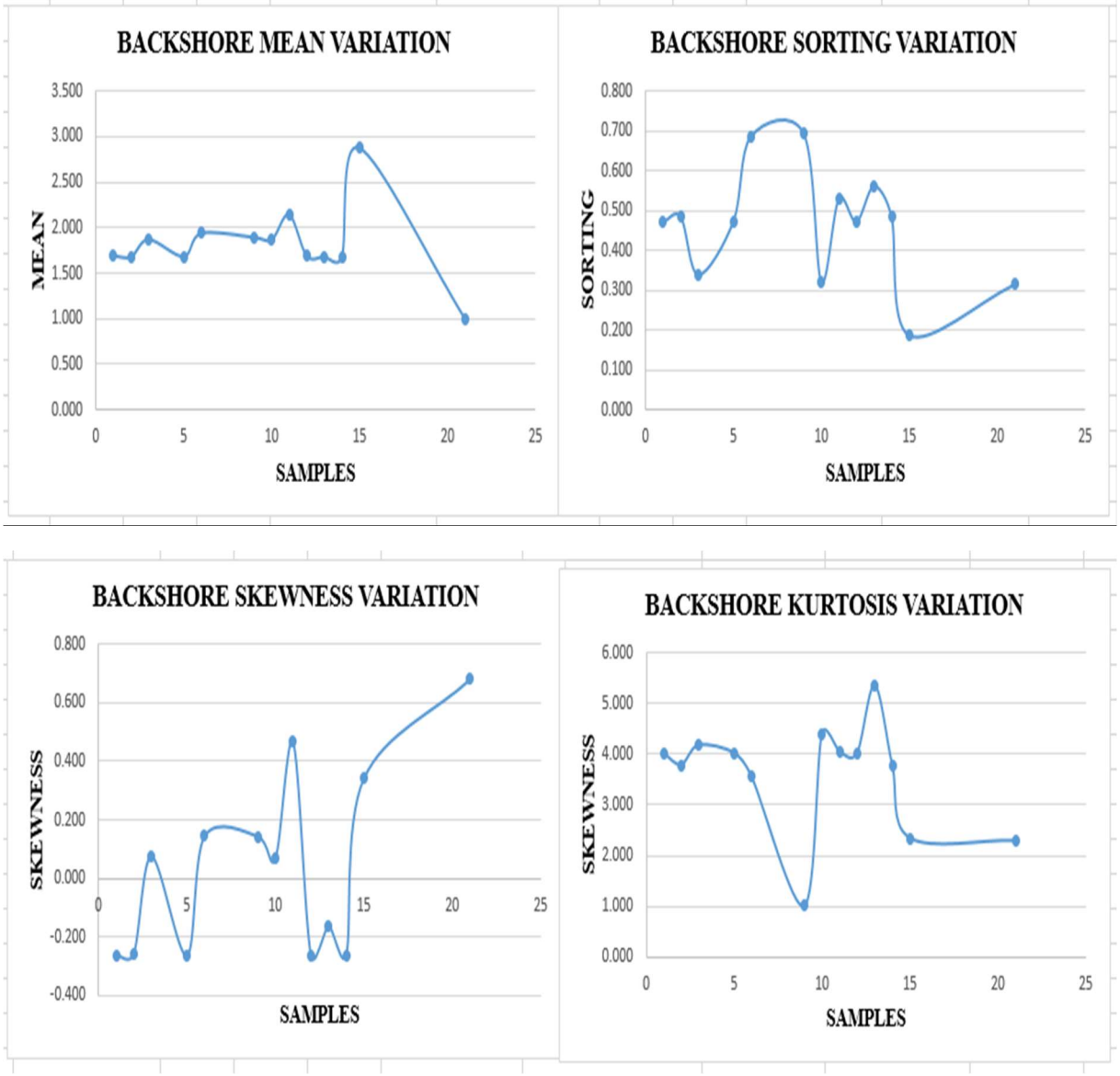

Figure 5. Grain size parameter's variation along offshore line

Standard deviation of most of the offshore samples emerged to be well sorted or moderately well sorted, mean values indicating mostly medium sand, skewness varying from very fine to coarse skewed and kurtosis values ranging from mesokurtic to extremely leptokurtic. The high tide line values ranged from moderately well sorted to well sorted, mean values varying from fine sand to medium sand, skewness very fine to coarse and kurtosis occurred in all ranges. In foreshore, standard deviation values mostly ranged from well sorted to very well sorted, the mean value indicating fine sand to medium sand and kurtosis ranging widely. Friedman (1962) suggested that extreme high or low values of kurtosis implied that part of the sediment achieved its sorting elsewhere in a high energy environment. Also it is suggested that the negative skewness values indicated coarse-skewed material, whereas the positive values represented that more material in fine skewed.

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CONCLUSIONS

From the discussion above which reveal the surface sediment properties of the Udupi coastal area, their major inputs and their main transport and deposition processes it is concluded that along the near shore, off shore and high tide line the sediment has mean size varying between fine to medium sand ranges. The sorting value also changed from moderately well sorted to very well sorted as we moved from off shore towards the near shore. The skewness value ranged widely from very fine to coarse sand except that very coarse sand was absent. The kurtosis value also showed wide range of variation for different samples but most samples were in extreme range indicating that most samples achieved part of its sorting elsewhere.

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