Seasonal Changes and Coastal Erosion in the South Western Part of Sri Lanka

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Abstract: Sri Lanka is an Island, the economy of which relies very much on the developments of the coastal region, which supports tourism and fisheries. In addition, especially in the South-Western part of the country, the infrastructure lays in the near proximity to the coast and the land is more precious and valuable. Further, the constructions around the coastal expanse, alter the sand dynamics of the coastal belt, increasing erosion and deposition at specific points. The erosion cannot be identified at a glance in one day, but when considering long-term sustainable developments, the loss of expanse due to erosion becomes vital. Hence, in this study we analysed the erosion pattern and gross land loss along South-Western part of Sri Lanka, considering duration of 6 months (Jun/07 till Jan/08). The variations of beach profile were determined from leveling perpendicular to the beach at 10 predetermined locations at one month interval. Grain size variations were also analysed from the samples collected from the mean sea level from each sampling locations. A strong correlation was observed at this location between the monsoon and erosion, while at Egodauyana, Panadura Moya, kani Lanka hotel and Payagala revealed rapid changes in erosion/deposition. Although the rainfall influences the beach variation, longshore currents, tides and coastal features (natural and artificial) are found to be dominating at these locations.

Keywords: coastal deposition, coastal features, grain size analysis, monsoon, sustainable development, tides

1. Introduction

Thirty two percent of the population reside in the coastal region around the world. Still, the attention of the nations are drawn almost to the instantaneous plight such as tsunamis rather than the most vigorous, slow and steady processes that deplete the coastal region such as coastal erosion. Some preventive measures are considered and implemented, but are not sustainable solutions. Presently due to increased mobilization around the coastal area of any ocean bound countries, the expanse faces threats and challenges, feared to exist indefinitely if not attended imperatively, of which, oil spills and coastal erosion are dominant and global issue. Sri Lanka, is a developing country

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and surrounded by the Indian Ocean. It is in extensive warning so as to safeguard the coastal belt, as it is the prime source of foreign income (tourism).

Therefore in this study we are trying to analyse coastal erosion, and the pattern according to which the erosion changes in relation to the trade winds and the monsoon rain fall.

Our objectives are to

- Determine the correlation: rainfall and coastal erosion/deposition
- Identify the effect of coastal erosion
- Identify the wave properties and energy regime and their effects on erosion/deposition

2. Methodology

In this study, the coastal stretch between Moratuwa to Balapitiya were separated

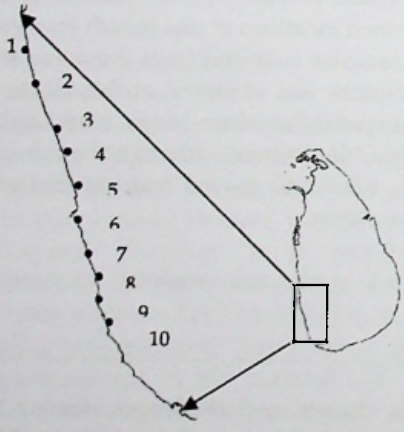

Figure 1- Selected representative beaches from Moratuwa to Balapitiya

into 10 equilibrium segments of beaches Note: 1. Egodauyana, 2.Panadura Moya, 3.Welladoda, 4. Kani Lanka Hotel Kalutara, 5.Payagala, 6. Beruwala, 7. Induruwa, 8. Kosgoda (with geo nets), 9. Kosgoda 10. Balapitiya

(Figure-1) and variation of the coastal profile was determined by levelling for 6 consecutive months (July 2007 to Jan. 2008) with respect to the mean sea level. This periods represents effects due to south western monsoon, inter monsoon as well as north eastern monsoon. In addition grain size variation at each location was also studied for the total period. Results indicate considerable variation in the coastal profile, both the beach width and the angle of slope. This variation is mainly controlled by monsoonal effects.

Study Area

The coastal stretch between Moratuwa to Balapitiya were separated into 10 equilibrium segments of beaches and this study was carried out from a representative location selected from these segments as indicated in the Figure 1.

In order to visualize the beach profile and to compare the results of the 6 months data, levelling was conducted on each visit. The mean sea-level was assigned to be the fixed point the coordinates of which is defined by distances from 2 (mandatory) or 3 (mandatory + auxiliary) fixed points (on the shore), as shown below (Figure 01).

Eg. Location 01. On identifying the pole, the levelling was done 10m (at 1m intervals) to and fro, in the direction perpendicular to the shoreline at that point.

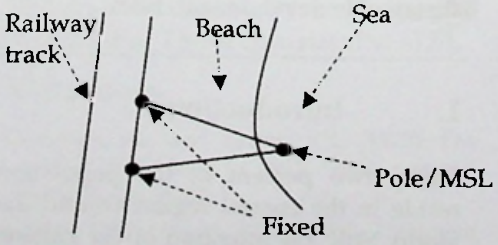

Figure 2- Pole Positioning for survey

And the levelling was done perpendicular to the shoreline 10m to-and-fro (at 1m interval).

In addition, the sieve analysis was performed in order to determine the particle size distribution on an aggregate material.

3. Results

Figure 3 shows the variaion of grain size, beach profile, vertical erosion and average beach angle at Wellaboda, location 3, for the total period. Vertical erosion at Wellaboda shows accelarated deposition during the South-Western monsoon (around 70cm vertically), and then slight deposition during inter-monsoon (around 10cm erosion and 40cm deposition) followed by erosion during North-Eastern monsoon (around 30cm). This was observed at the pole wich is the location where the Mean sea level was recorded during the first field vist. Beach slope tends to decrease during the South-western monsoon from 9.09^0 to 7.59^0 where as it is fairly stable during intermonsoon with an angle between 8.53^0 and 7.59^0. During the North Eastern Monsoon beach has slope graduall increase from angle of 7.96^0 to 10.12^0.

On the other hand, the mean grain size varies from 0.729 to 0.539 during South-Western monsoon, and then increase during inter-monsoon from 0.67 to 1.33. During the north Eastern Monsoon, the mean grain size again decreases to 0.97. The individual % of grain size analysis gives, a strong bi-modal structure in July, and a weak bi-modal structure in the other months.

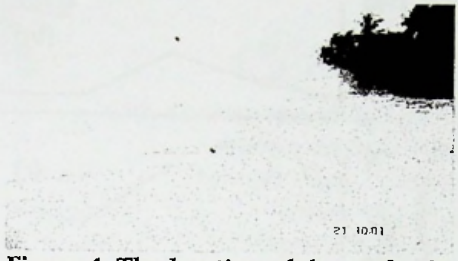

Figure 4. The location of the study site, Wellaboda

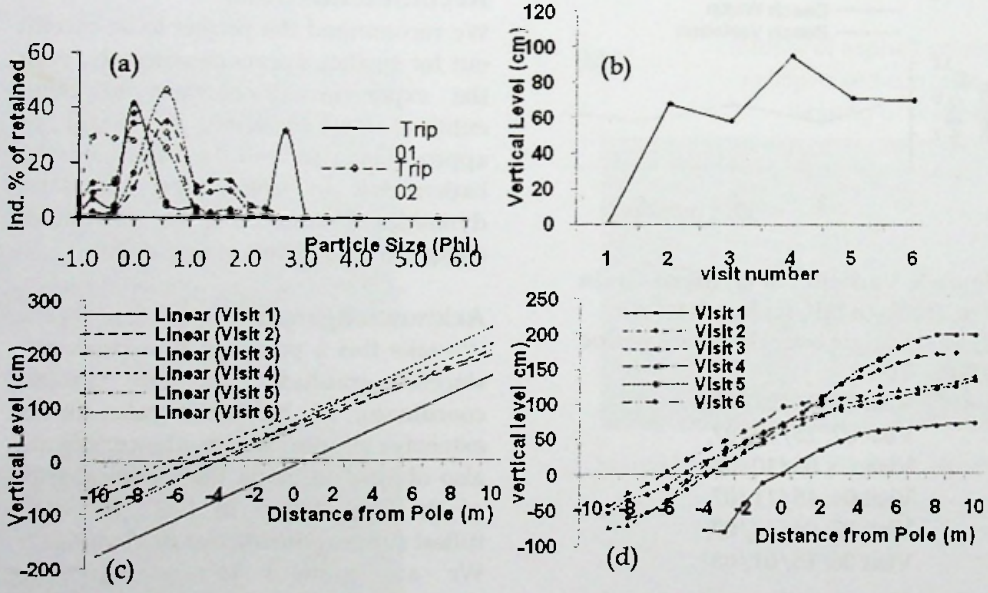

Figure 3. a) Grain size distribution, b) Vertical erosion at pole, c) Beach angle, d) Beach profile

4. Discussion

Except for the months of July and August, other months show strong correlation between the monsoon, beach slope and beach profile variation. The deposition is observed during inter-monsoon and erosion during monsoon. The beach slope attains lower values during deposition accounting for wider beaches, while it reaches higher values during erosion accounting for narrower

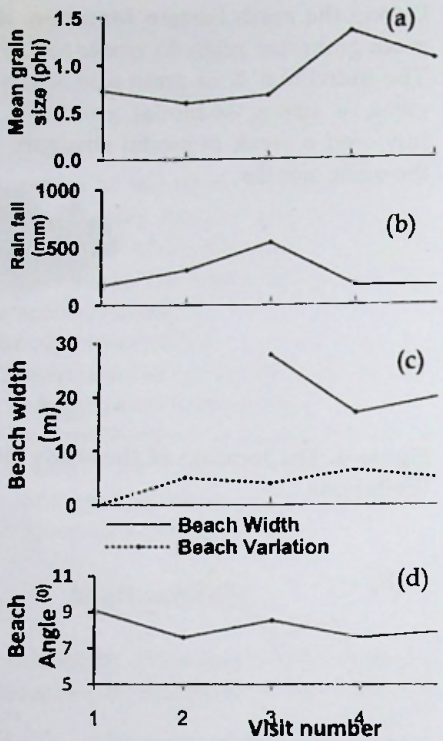

Figure 5. Variation of (a) Mean Grain Size, (b) Rain fall, (c) Beach width, (d) Beach angle over the study period (07/07 – 01/08)

Note: Visit 01: 21/07/07,
Visit 02: 25/08/07,
Visit 03: 05/10/07,
Visit 04: 15/11/07,
Visit 05: 04/12/07,
Visit 06: 15/01/08

beaches. However the predictions from the mean-grain size contradict the observation, which is strongly influenced by the second source, probably long-shore current.

The bi-modal structure of the grain-size analysis implicates two sources of sediment supply, and this again supports contribution of longshore current. Pethik, 1984 shows the relationship between mean grain size and beach slope variation with respect to the wave energy regime. The second source in this study found to be strongly correlated to the wave angle, which together with the wave energy, defines the strength of the longshore current. Therefore, the longshore current is accountable for the contradiction observed between the mean grain size and the predictions.

5. Conclusion

At this location, Wellaboda, the existence of two sources was evident throughout the period. The profile at large coincides with the monsoonal expectations while the mean grain size reveals contradicting results which is influenced by the long-shore current.

Recommendations

We recommend the project to be carried out for further 4years consistently, with the expansion of concern to other entities such as wind. It would be appropriate to study the coastal bathymetry to understand the sand dynamics. This needs to be generalised along the coastal belt of Sri Lanka.

Acknowledgement

We take this a privilege to express our sincere gratitude, to our project coordinator, Dr. NP Rathnayaka, for his extensive support and guidance. We are also obliged to thank the technical staff of the Department of ERE, for their fullest support during our field visits.

We are grateful to the surveying department of the Department of Civil Engineering, for lending the levelling instrument, Prof.WLW Fernando for allowing us to conduct the sieving practical in the Mineral Processing Laboratory. We also wish to thank, the officers in Meteorological Department and NARA for providing us with the data (rainfall, wind, tides etc).

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