

SEDIMENT BUDGET OF A PORTION OF TRIVANDRUM BEACH (KERALA)

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ABSTRACT

Results of beach profile studies carried out on a section of 2.4 kilometres of the Trivandrum beach during the period April 1976 to March 1977 are presented in this paper. It is evident from these studies that shoreline recession takes place along this coast during the two monsoon seasons. The maximum erosion is observed during the months of July-August (south-west monsoon). During the process of erosion, most of the material appear to be transported offshore and the same material appears to be deposited back when the erosion phase is over. Eventhough a net loss has been noticed during the period of study, it is considered not very significant from the point of view of long-term changes which the beach may undergo.

INTRODUCTION

This work was undertaken as a part of a project sponsored by Vikram Sarabhai Space Centre, Trivandrum, to investigate the environmental conditions prevailing at a beach where severe erosion occurs during the monsoons. The main objective of the study was to suggest suitable remedial measures to protect this part of the beach from the threats of erosion. Since an understanding of the changes in the beach profile in relation to the offshore wave climate was necessary, monthly changes in the beach profiles were studied at five predetermined stations along the beach. The stations are shown in Fig. 1. The monthly changes of the beach profiles are presented in Fig. 2 (A, B, C, D & E). The rate of accretion and erosion computed for the entire 2.4 km length of the beach with reference to the conditions in April 1976 when the beach is relatively stable) is given in Fig 3. Fig. 4 shows the profiles at Valiyathura collected during 1967-68.

RESULTS AND DISCUSSION

The results of the beach profile studies as depicted in Fig. 2 (A, B, C, D & E) showed that the beach width as measured from the baseline to the low water mark was about 70 m at all the stations during the month of April-May 1976. In June the average beach width was reduced to 56 m. The erosion further continued reducing the beach width to around 35 m during the period July-August. In the months of September, October and November accretion started and there was widening of the beach at all the stations. By the end of November the beach had almost regained its width which was seen in April-May 1976. In general, the process of accretion continued till December except at the stations 2 and 4. A small decrease in the beach width was, however, noticed in January 1977. Thereafter, till March the beach width continued to increase.

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In general, the slope of the foreshore was 1 : 8 in April 1976 and 1 : 6 in May 1976, except at the station 4, where it was 1 : 3. When accretion along the beach was taking place, the foreshore slope ranged between 1 : 5 and 1 : 8. However, during the erosion cycle, the foreshore slope became somewhat steeper, and varied between 1 : 3 and 1 : 6. But some exceptions to these observations were noticed at certain stations. At station 1, the foreshore slope was found to be about 1 : 10 in the month of August 1976 when the erosion was at its maximum in this region.

The volumetric changes of the beach material above the mean low water level for the five stations are presented in Fig. 3. The changes of the volume of the beach material from month to month showed that there was accretion of $66 \times 10^3 \text{ m}^3$ of beach material from April 1976 to May 1976. Then gradual erosion was noticed till July/August 1976. The $102 \times 10^3 \text{ m}^3$ loss was maximum in the months of July and August. The volume of the beach material available on the beach during September and October was comparatively small with respect to April 1976. However, there was a general accretion during these months because the loss in July and August was made up by a deposition of $27 \times 10^3 \text{ m}^3$ of material in September and $64 \times 10^3 \text{ m}^3$ in October. During the period November 1976 to March 1977, the total beach material exceeded the April volume. High values of beach material were noted in the months of December 1976 and January 1977.

The net budget computed showed that $83 \times 10^3 \text{ m}^3$ of the beach material has been lost from the beach during the period of observation from April 1976 to March 1977. This works out to

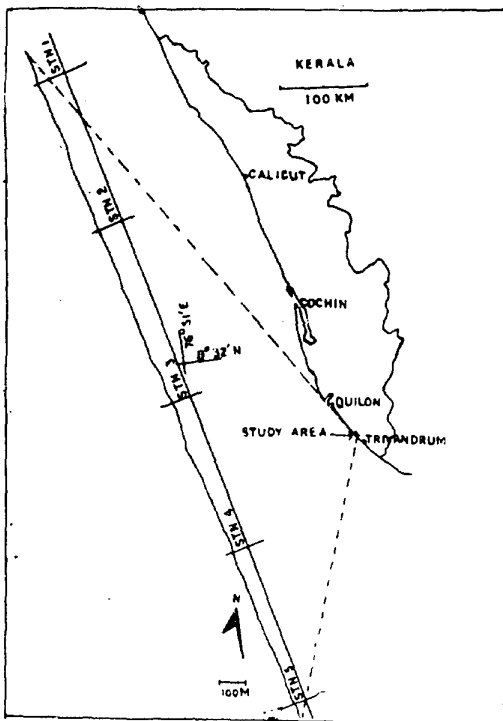


Fig. 1. Location map.

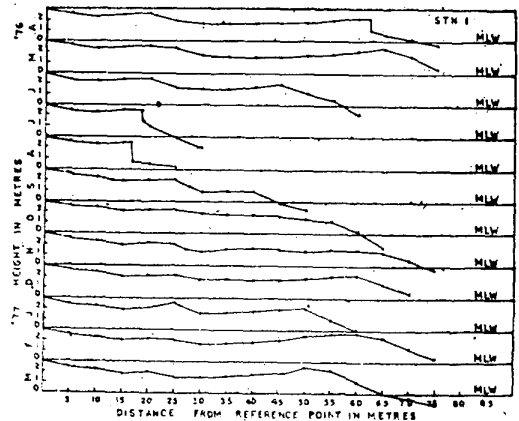


Fig. 2a. Monthly beach profiles at stn. 1.

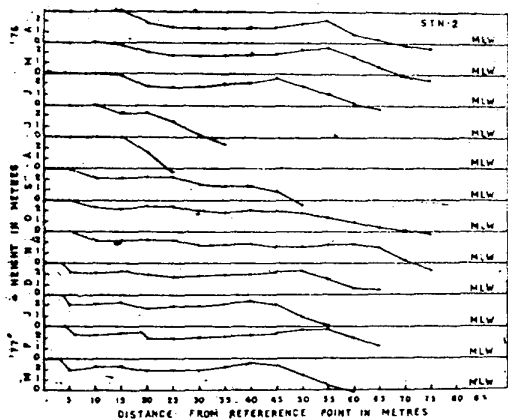


Fig. 2b. Monthly beach profiles at stn. 2.

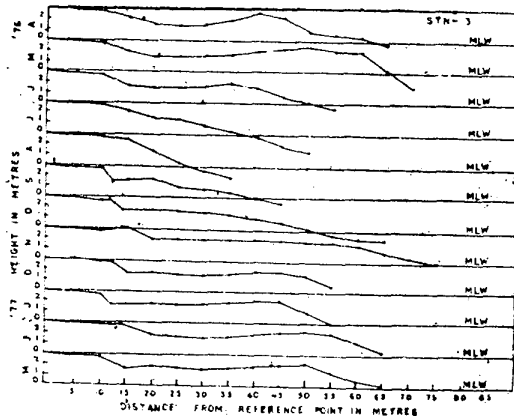


Fig. 2c. Monthly beach profiles at stn. 3.

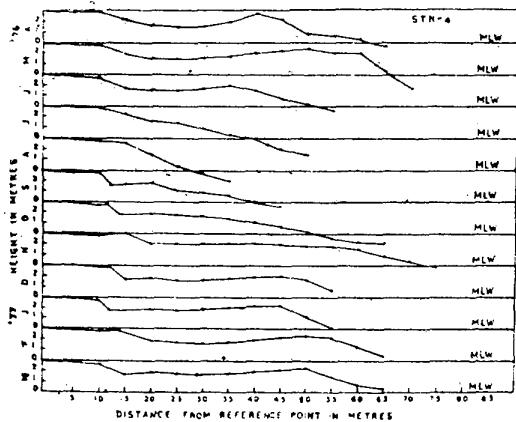


Fig. 2d. Monthly beach profiles at stn. 4.

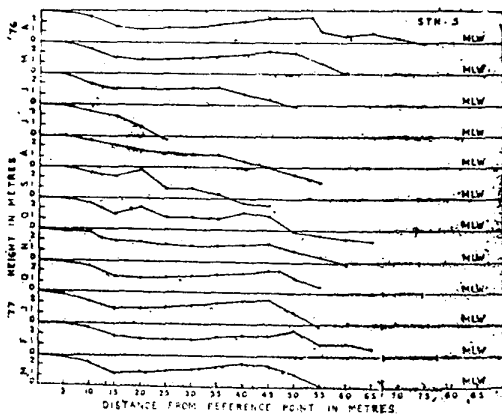


Fig. 2e. Monthly beach profiles at stn. 5.

be a loss of $34.58 \times 10^3 \text{ m}^3$ per km. The littoral transport rate computed for this part of the coast was of the order of $1181 \times 10^3 \text{ m}^3$ per year in the south-east direction.

This study had revealed the following general processes taking place at this part of the coast.

1. Erosion from June to August.
2. Accretion during September to November.
3. Erosion during December and January.
4. Accretion during February and March.
5. Almost stable conditions during April and May.

Thus it was seen that this part of coast was being subjected to considerable seasonal changes during the year. These changes are brought about by the offshore wave climate of the region, which had been studied by Narayanaswamy, Varma, Rama Raju, Pylee and Chandramohan, 1979. The results of these studies had revealed

the following characteristics in relation to the stability of this coastal region. During the southwest monsoon season, i.e., May to September a spectrum of narrow band (10–13 sec) and high energy waves H_s exceeding 1 m were observed. During the fair weather months, the coastal region normally had a wide band (6–15 sec) low energy spectrum of waves with H_s less than 80 cm were observed. These low energy waves would help in building up the beach.

It is presumed that during the phase of erosion during the southwest monsoon the eroded material moves offshore and later on gets deposited on the beach. This had been substantiated by the data collected earlier by NIO at Valiathura, Trivandrum. The data presented in Fig. 4 clearly indicate the offshore transport of beach material during the monsoon season and onshore transport during the subsequent months. Further observations (personal communications) by the Scientists of the Centre for Earth Science Studies, Trivandrum have supported the above findings.

Volumetric changes of the beach material studied indicate that there was a net loss of $83 \times 10^3 \text{ m}^3$ of sand from above M.S.L. during the period of study. This loss need not be considered significant comparing with the computed littoral transport rate of $1181 \times 10^3 \text{ m}^3/\text{year}$. Dewall, Prichett and Galvin (1971) and Shuyskiy (1970) have reported similar erosion of beach material above M.S.L. from short stretches of the beaches of Atlantic coast and have concluded that while impressive in aggregate, such sediment transport was minor compared to the longshore transport of sediment, which exceeded 1 million cubic yards per year.

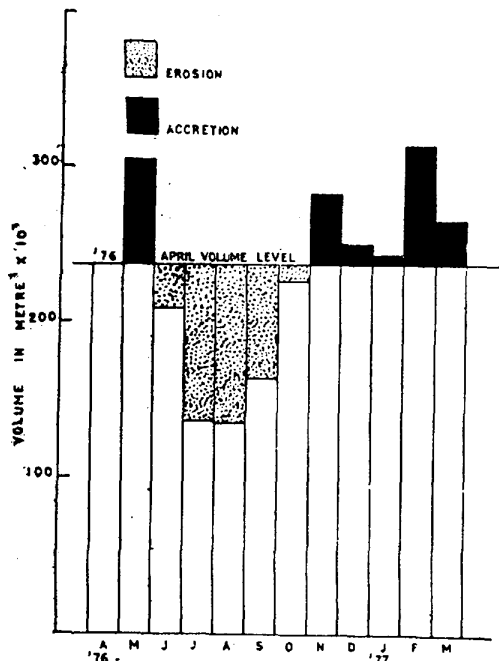


Fig. 3. Monthly changes in beach material.

In the absence of any historic data on the beach configuration, the information gathered from the local people revealed that the long period changes of the beach for the last few decades were not significant. This has proved that from the point

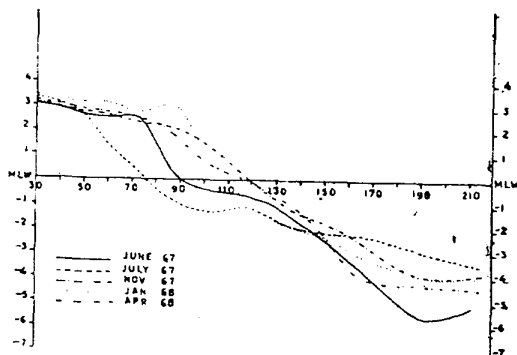


Fig. 4. Beach profiles at Valiathura (Trivandrum) '67-68.

of longterm changes, the seasonal fluctuations may be considered insignificant. However, seasonal cyclic changes are inevitable along this stretch of the beach.

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