Volume 23/1991/EMECS '90

Sediment Transport on the Foreshore

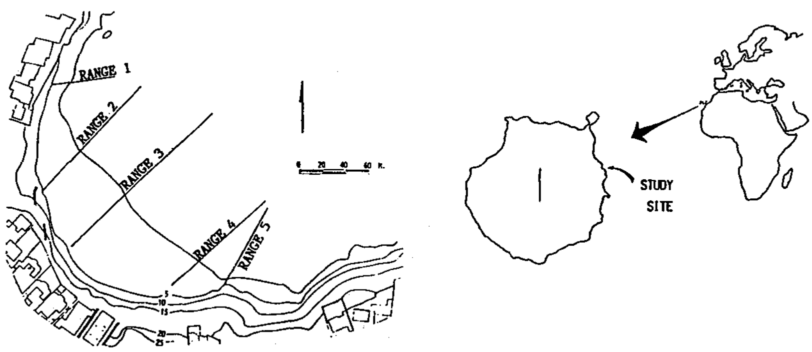
I. ALONSO
University of Las Palmas de Gran Canaria, Department of Physics, Apartado 550, Las Palmas, Spain

Beach face profiles have been measured at El Hombre Beach (Las Palmas, Spain) during thirteen months. Changes in beach profiles have been related to the standard desviation, which is used as a good method of fixing the berm position. Sand volume changes are related to the maximum tidal range, and an important agreement is found.

1 Beach location and data collection

Present field study about sediment transport on the foreshore has been carried out at El Hombre Beach, located on the east coast of the Island of Gran Canaria and faced to the prevailing NNE winds and swell. (See location map).

The beach is a typical pocket beach 200 metres in length and 100 metres in width in the central sector. Five rangelines across the beach were surveyed fifteen times between December 12, 1988 and December 1, 1989, approximately at monthly intervals. Surveys were always carried out at low tide using the standard leveling method down to about 1.5 metres below MSL.



Location map of El Hombre Beach, showing position of the rangelines.

2 Beach face profile changes

Many studies have been carried out in order to quantify the sediment transport in the inner part of the profile, shoreward the breaker line, but just a few of them are field studies. First of them, Beach Erosion Board (1933) showed that the greatest sand transport occurred at the breaker line and decrease shoreward with another, peak in the swash, zone, as many, other, researchers have verified later on. (See, for example, Zenkovitch, 1960 and Walton and Chiu, 1978).

As this study only deals with foreshore profiles, it focusses on the peak observed in the swash zone. Figure 1 shows different profiles and the standard desviation at range 3. Two main features can be observed: 1) The sandard desviation shows an upward trend as the offshore distance increases, and 2) The peak corresponding to 80 m. in the X axis, agrees perfectly with the berm position.

Marine Pollution Bulletin, Vol. 23, pp. 695–697, 1991.
Printed in Great Britain
0025-326X/91 $3.00+0.00

Both features can be seen in figure 2 for all the profiles. Note that in profiles 1 and 5 the peak corresponding to the berm position is very close to the beginning of the profile, but from the location map it can be seen that the onshore end of ranges 1 and 5 is particularly close to the shoreline.

These results agrees perfectly with that of Katoh and Yanaguisima, (1988) in whose study both features were observed, but the maximum in changes of the foreshore profile were not related to the berm.

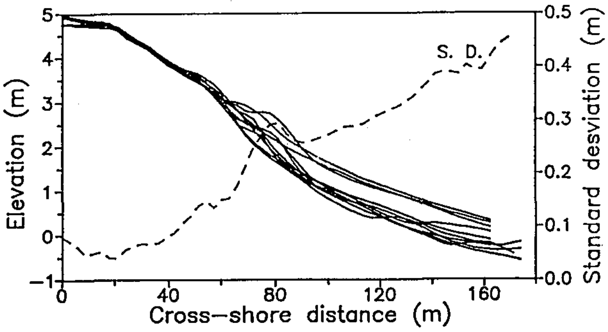


FIGURE 1 Different beach face profiles and standard desviation at range 3

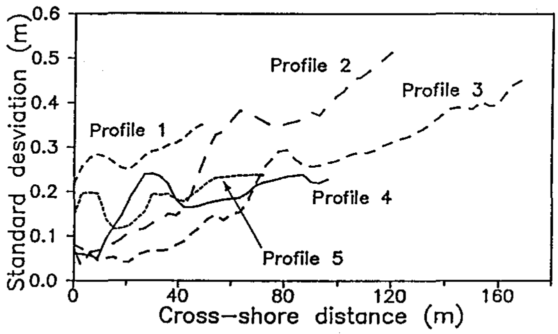


FIGURE 2 Standard desviation of profiles. Berms position can be perfectly observed.

3 Relation between tides and erosion/accretion

Figure 3 shows the volume changes in m3/m during 1989 relative to the survey of December 12, 1988 for all the profiles. The main features to be noted are:

- While no final erosion is observed in profiles 3, 4 and 5, the cental sector of the beach ends with a mean erosion of 50 m3/m.

- Only four times the same erosive/accretive process was observed in all the profiles, and always in very different proportions.Starting from this feature, it is possible to assume that the longshore transport is very important in this beach, specially taking into account that profiles 4-5 on the south side, and profile 1 on the north one, mostly present the opposite behaviour: While one of them erodes, the other accretes.

- It is specially interesting to note that profiles 3, 4, and 5 behave in a similar way during the whole period: if one of them erodes, so do the others, though in different proportion, and the same with accretions.

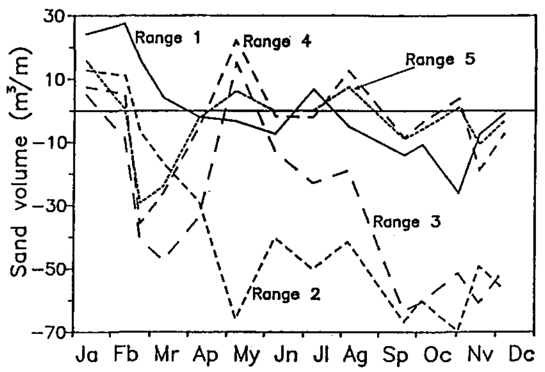


FIGURE 3 Beach face sand volume changes during 1989 relative to the survey of Decembre 12, 1988

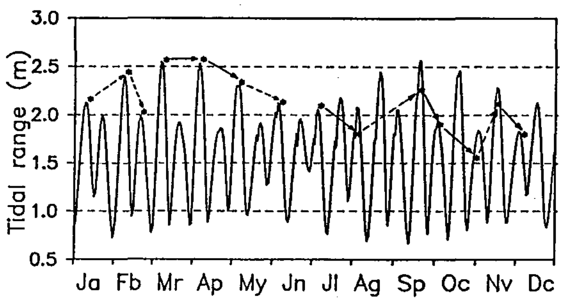


FIGURE 4 Maximum daily tidal range during 1989. Days of surveys are highlighted with *. Solid arrows mean accretion and dashed arrows erosion.

Considering the previous point, and taking into account that the portion of the beach influenced by profiles 3, 4 and 5 represents approximately two thirds of the beach surface, it is possible to assume that the accretionary/aresive behaviour of these profiles determines the general trend of the beach.

Figure 4 shows the maximum daily tidal range at the beach during 1989, as well as the days of surveys, dates which mostly agrees with the highest tidal ranges. It has also been plotted the erosive/accretive trend of profiles 3, 4 and 5, and it can be seen that an increase in tidal range mostly corresponds with erosion, and a decrease in tidal range involves accretion. There are only two exceptions in February and May, periods in which haevy storms happened.

This fact implies that tidal conditions are one of the most important features to be considered when studying beach face changes as Aubrey et al. (1976) stated, and this could be the reason of the disagreement of part of Allen's (1985) data, since in his study only wave and sediment data were considered.

4 Conclusions

From this field study it is possible to express the following conclusions:

- Computing the standard desviation of beach face profiles is a very simple and accurate method of stablishing the berm position on the cross-shore distance.

- Except for stormy events in which the waves energy is so high that in few days a big amount of sand can be eroded, the tidal effect is so big that should not be neglected when studying the evolution of foreshor profiles.

5 Acknowledgements

Thanks are due to Mr. Miguel Bruno, at University of Las Palmas de Gran Canaria, for providing the tidal data.

6 References

Allen, J.R., 1985. "Field evaluation of beach face response to wave steepness as predicted by the Dean model". Coastal Eng.,9: 71-80.

Aubrey, D.G., Inman, D.L. and Nordstrom, C.E., 1976. "Beach profiles at Torrey Pines, California". Proc. 15 CEC. ASCE. pp. 1297-1311.

Beach Erosion Board, 1933. Interim Report. U.S. Army Corps of Engineers, Washington,D.C.

Katoh, K. and Yanaguisima, S., 1988. "Predictive model for daily changes of shoreline". Proc. 21 ICCE. ASCE. pp. 1253-1264.

Walton Jr., T.L. and Chiu, T.Y., 1979. " Litoral sand transport on beaches". UFL/COEL/TR-041. 319 pp.

Zenkovitch, V.P., 1960. "Fluorescent substances as tracers for studying the movement of sand on the sea bed; experiments conducted in the U.S.S.R.". Dock and Harbour Authority, Vol.40, pp. 280-283.