NUMERICAL MODEL FOR SIMULATING SHORELINE CHANGE

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Mathematical modeling of shoreline change has proven to be a useful engineering technique for understanding and predicting the evolution of the plan shape of sandy beaches. In particular, mathematical models provide a concise, quantitative means of describing systematic trends in shoreline evolution. Reliable prediction of long term and short-term beach changes is important for planning and management of the beaches. In recent years numerical models capable of simulating shoreline changes have become an increasingly popular tool for investigating impacts of proposed coastal projects. Specially, shoreline change models are ideally studied for tasks involving analysis and evaluation of coastal projects with regard to long-term fate of beach fills, feeder beaches, renourishment cycles, and coastal structures designed to enhance the longevity of placed beach fill material.

Numerous studies have been carried out using N - line models, encouraging results have been obtained for engineering and beach management purposes. However, most of these models are capable of simulating the beach profile change due to either alongshore sediment transport or cross - shore sediment transport, only few models are capable of predicting the shoreline changes due to both modes of the above sediment transport.

The purpose of this research is to develop a numerical model to predict the shoreline change due to both the alongshore sediment transport rate and cross-shore sediment transport rate.

Since the most severe erosion is in South west coast, Kalutara – Wadduwa area was selected as the study area.

The development of the model capitalizes on one line model in modeling the shore line change by expanding the model to simulate series of contour lines. The model area is schematized into compartments in the alongshore direction (45 beach profiles) and then discretized into small grid cells having 0.1m depth in the cross shore direction. Each contour compartment is formulated as a one line model linked to adjacent compartments by cross shore sediment transport.

The alongshore sediment transport was calculated for each strip(Shore Protection Manual (1984)), and was distributed for cells (Komar (1998)). The cross shore sediment transport rate was calculated for each cell (Hanson et al (1999)). The shoreline change was computed by applying mass conservation to each cell and summing up the shoreline change. The model has been calibrated using Beach Profile Data (March, April, June data), and the model has been validated using August and October Beach Profile data. A model simulation was done for November.

The results of the model application showed that the model is capable of simulating the shoreline changes within a reasonable accuracy. The maximum error in predicting the shoreline change is about 17%, but for most beach profiles, the error is around 10%. The error can be due to the assumptions made, that the linear wave theory adequately describes dynamics within the surf zone but significant portion of the surf zone is dominated by highly nonlinear dynamics and models based upon linear theories are unlikely to represent real beach responses adequately.