

# PREDICTION OF SHORELINE CHANGES FOR DIFFERENT COASTAL CONFIGURATIONS USING FUTURE CLIMATE PROJECTIONS

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## INTRODUCTION

The estimation of shoreline change as well as sediment transport at a specified site can be reliably made with the help of corresponding numerical models that are run with the help of historical wave data generated using wind-wave models based on the input of past wind conditions. It is well known that the magnitude and behavior of historical wind and waves would not remain same in future as a result of the climate change induced by global warming. (Komar et al., 2010). In this light the present study attempts to understand what happens if future wind and waves are generated using regional climate models (RCMs) and the shoreline change and sediment transport is determined on that basis instead of historical wind and wave data. Toward this we have considered three different types of shorelines, namely (a) an uninterrupted coastal stretch, (b) the coast interrupted by an artificial structure and (c) the coast interrupted by natural features. This study goes beyond an earlier one (Rajasree et al., 2016) in which only case (a) was discussed and where coastal vulnerability was not assessed.

## MATERIALS AND METHODS

The study area with different geomorphologic features as above pertains to India's central west coast facing Arabian Sea. The specific coastal segments are (a) the continuous coastal stretch off Udupi, (Figure 1a), (b) the discontinuous coastal configuration off New Mangalore Port, (Figure 1b) and (c) the shoreline intercepted by the estuary of River Gangavali (Figure 1c).

We have considered two time slices of 36 years each in the past and into the future. To begin with, four historic satellite imageries were selected at around 12 years interval and shorelines were delineated to evaluate the shoreline change rate of the past by constructing transects along the region at 250 m interval (Figure 1). Thereafter wave simulation was carried out using the commercial wave model: Mike21-SW for the 36 years of past (1979-2014) and future (2015-2048). The wind input for this purpose was extracted from the Coordinated Regional Downscaling Experiment (CORDEX) South Asia project forming part of Climate Model Inter-Comparison Project Phase 5 (CMIP-5). The future wind conditions belonged to a moderate global warming scenario called: Representative Concentration Pathway (RCP)-4.5. These wave data in turn formed input to the numerical shoreline and sediment transport model named: Litpack of Danish Hydraulics Institute. The rates of sediment transport as well as shoreline changes were determined at all the three sites using satellite imageries, numerical models and also a third alternative in the form of artificial neural network (ANN) seen as an option to the statistical linear regression incorporated in the imagery analysis. The ANN's were trained using past imageries.

## RESULTS AND DISCUSSIONS

Analysis of historical and future wave data showed that the wave activity would intensify in future at the sites. It

was found that at all sites the existing sediment transport would increase in future and similarly the rates of shoreline shifts as well as that of accretion and erosion would accelerate. The ANN predicted smaller rates than the numerical model but higher than the satellite imageries. The numerical modeling typically showed that at the port site the rise of 29% in the annual mean significant wave height over a period of next 36 years could increase the net sediment transport by 109 %, calling for revised sediment transport strategies in future.. The vulnerability of these coastal stretches to future environmental and socio-economic variables is also assessed on the basis of the analytical hierarchical process.

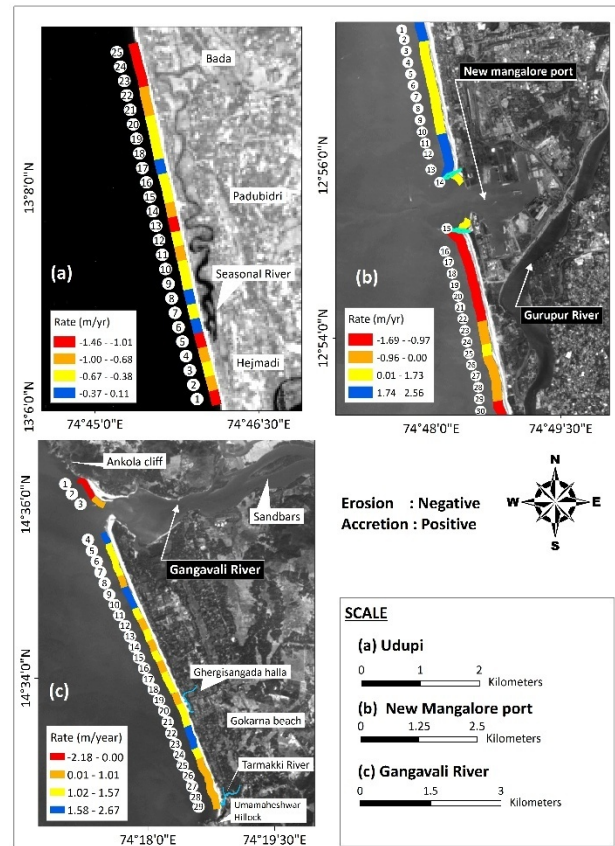


Figure 1: Past shoreline rate of change along (a) Udupi (b) New Mangalore port and (c) Gangavali River, (Different colours stands for different range of rates)

## REFERENCES

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