Oceans are major contributors in regulating the climate. For the design of marine and coastal protection structures detailed knowledge on local wave conditions is an essential prerequisite. Direct and regular observations of sufficient length are not always available at the place of interest. Data from satellites are invaluable for applications including long term climate studies and engineering design. Most present applications of wind wave research for coastal engineering and environmental purposes involve the use of numerical models that simulate the evolution of directional wave energy spectra in time or space or both which can be used to forecast climate change, currents, and waves. Most important advantage is that they interpolate between sparse observations of the ocean produced by ships, drifters, and satellites.

The present study aims to hindcast waves in offshore and nearshore areas using National Centre for Environmental Prediction (NCEP) wind components and numerical modelling. North Indian Ocean was selected as study area for offshore wave prediction, while nearshore wave climate and littoral drift were estimated for Pulicat region. Downloaded and validated NCEP winds and bathymetry from Etopo2 were used for offshore wave model. The offshore wave climate predicted from January 2004 to December 2005 using Offshore Spectral Wind Wave module (OSW) of MIKE 21 was validated with OB8 (off Cuddalore) data buoy. Reanalyzed winds of NCEP with a correction factor of 0.92 found to be reasonable for the prediction of offshore wave climate. About 2% deviation in wave height is observed
between NCEP and QuikSCAT (Quik Scatterometer). Although there is no overlap between the satellite data, the present result indicate that there has been no measurable change in the wave field over the period of time spanned by the satellite missions. The accurate wave predictions not only for normal conditions, even during monsoon season and cyclonic conditions encourage the coupling of satellite data and numerical model to hindcast the offshore wave climate. The results of OSW indicate wave heights are underestimated in coastal areas by 30% due to grid resolution and non-linear processes. Hence the forcing from OSW has to be transferred to NSW, where coastal processes are resolved.

The bathymetry required for the nearshore model was obtained from Naval Hydrographic charts. Extracted offshore wave climate (August 2004 to July 2005) and bathymetry were given as input to the nearshore model. Thus predicted nearshore waves were validated with SW6 (Chennai coast) buoy data. The simulated results showed good comparison with buoy data in terms of wave height, but the wave period and direction are underestimated. The model is capable of depicting the wave climate, not only for normal conditions, better results are obtained even during monsoon as well as in cyclonic conditions.

To compute the littoral drift, nearshore waves and sediment characteristics were given as input to LITDRIFT. Computation of littoral drift from August 2004 to July 2005 showed a net northerly drift with a northward drift from March to October and southern drift from November to February.
Dynamics of tidal inlet migration at Pulicat was studied using toposheets, satellite and field data with the aid of Geographical Information System (GIS). The study reveals that the mouth migrates towards the north with respect to the littoral drift till northeast monsoon. The northeast monsoon provides fresh water to flush the sediments accumulated during non monsoon period, leading to the widening of the mouth. Severe monsoon play a significant role in widening the tidal inlet rather than normal monsoon and tsunami. This shows that fresh water inflow regulatory force is dominant over tidal regulatory force at Pulicat.

Present study demonstrates the potential of satellite data coupled with numerical modelling can be a powerful tool in the prediction of wave and sediment dynamics. Hence this approach which is cost effective, less time consuming and involves less manpower, can be considered as an effective substitute for conventional method of marine data collection.