The interesting aspect of studying sea level variability on different time scales can be attributed to the diversity of its applications. There are many scientific and practical reasons to have a knowledge of the sea level variability, as it manifests itself in the dynamics of the ocean and atmosphere. Sea level has a controlling influence on many oceanographic (physical, chemical, biological and geological) and meteorological processes. Marine transport, coastal protection, harbour development, coastal pollution, design of coastal structures, fisheries, climate change and energy are some examples, which require information on sea level variability on different time scales.

Study of tides could perhaps be the oldest branch of physical oceanography. The measurement of sea level has also seen vast changes - from the most simple oceanographic measurement, using graduated staff, to the most advanced, using satellite altimetry involving complicated measuring techniques with a variety of corrections. Earlier, tide poles (vertically mounted graduated staffs) which are cheap and are easy to install, have been used. Even today, these are often the best choice for short term surveys. A variety of gauges - stilling well gauges, pressure mounted systems, reflection-time gauges, and for deep sea use - open sea pressure gauges are still being used. The last one can be deployed for periods of nearly a year at depths around 4000m. Satellite altimetry is an answer to the many of the problems that these gauges have, generating enormous quantities of data over large areas. The satellite altimetric data have its own limitations - it is of limited accuracy and a variety of corrections are to be applied. The GEOSAT data (4.5 years) were of limited accuracy and the subsequent TOPEX/POSEIDON data (1992-continuing) are of much better accuracy after the corrections are applied. It is, however, to be emphasised that whatever may be the status of the satellite techniques, traditional techniques will continue to be important. The traditional processing techniques have also seen a lot of change. Earlier, the data were digitised from the marigrams, usually at half hourly or hourly intervals and occasionally at
finer intervals (say, 10 minutes). Nowadays, the tidal information is recorded on the computer and one has the choice of recording information at time intervals of a minute or less. Processing software has also improved considerably and it is possible to make a good tidal analysis immediately after any specified period of data is collected - a fortnight, a month or a year.

The tide gauges along the Indian coastline have been installed exclusively for one purpose only - providing information on tides for navigational purposes in connection with the shipping activities. These gauges have been installed mostly in bays, gulfs, lagoons and estuaries.

Many of the tide gauge locations have become main centres of commercial activity and have been experiencing rapid industrialisation, urbanisation and population pressures. Many man-made changes are seen in the near vicinity, and at times at distances in the alongshore, offshore and in the downstream and upstream directions. Some of these man-made changes include - construction of dams, barrages, bunds, coastal protection measures, change in the prevailing bathymetry and coastline by dredging and land reclaiming. Indiscriminate deforestation in the catchment areas of rivers, removal of vegetation along the river banks and sand mining are some of the far field effects that have caused heavy siltation in estuaries. These change the flow patterns of water, upsetting ecological balance by changing tidal flow patterns and the long term seasonal sea level patterns.

Because of the complex nature of tidal wave propagation, a detailed study at each water body is required. The non-tidal sea level is also a function of a variety of oceanographical, meteorological and hydrological forcings. The tidal and non-tidal effects seen on the sea level could be due to a range of factors from seiches to changes associated with climate changes. Because of the interaction of so many variables, it is difficult to make generalisations on the characteristics. Detailed studies are required to understand the phenomenon.
In this thesis, the results of the studies on sea level variability at Cochin (southwest coast of India) are presented for the important time scales- tidal, seasonal and interannual, by making use of data compiled by different organisations. These data have been collected at different but regular time intervals using a variety of instruments. The seasonal and interannual variability of sea level at Cochin has been compared with that at 15 other stations along the Indian Subcontinent.

The thesis is presented in seven chapters. The first chapter gives, apart from a general introduction, a survey of literature on sea level variability on different time scales - tidal, seasonal and interannual (geological scales excluded), with particular emphasis on the work carried out in the Indian waters. The second chapter is devoted to the study of observed tides at Cochin on seasonal and interannual time scales using hourly water level data for the period 1988-1993. The third chapter describes the long-term climatology of some important surface oceanographic and meteorological parameters (at Cochin) which are supposed to affect the sea level. The fourth chapter addresses the problem of seasonal forecasting of the meteorological and oceanographic parameters at Cochin using autoregressive, sinusoidal and exponentially weighted moving average techniques and testing their accuracy with the observed data for the period 1991-1993. The fifth chapter describes the seasonal cycles of sea level and the driving forces at 16 stations along the Indian subcontinent. It also addresses the observed interannual variability of sea level at 15 stations using available multi-annual data sets. The sixth chapter deals with the problem of coastal trapped waves between Cochin and Beypore off the Kerala coast using sea level and atmospheric pressure data sets for the year 1977. The seventh and the last chapter contains the summary and conclusions and future outlook based on this study.