ABSTRACT

The sound speed profile (SSP) in the ocean is an important parameter in the under water acoustics that has significant applications in strategic planning. Some of the applications of SSPs are in studying sonic layer depth (SLD), shadow zones and sound channels. The lack of direct measurements of vertical profiles of velocimeter or temperature and salinity (T/S) from which sound speed can be estimated hampers the application of SSPs. Besides subsurface phenomena, these profiles are mainly controlled by the surface parameters. Hence, it is worth attempting estimation of SSPs from surface parameters alone, particularly, from those that can be obtained from remote sensing platforms.

Remote sensing observations have been changing the courses of oceanographic research. This technology has significantly helped in overcoming the difficulty of in situ measurements. Besides estimating the SSPs from surface parameters, it is worth attempting to estimate these profiles from remote sensing data also.

The significant contribution of this thesis is in the estimation of SSPs and SLD from surface observations using the artificial neural network (ANN) technique. Since the other two applications of sound speed require ray theory, which is a research topic by itself, only SLD has been studied in this thesis. The north Indian Ocean spanning 0º- 25º N and 40º - 100º E was selected for this study. This region is influenced by unique seasonal reversing monsoons and transient cyclonic storms. Due to this uniqueness, this region presents dynamic environment with an unusual twice a year cycle in some of the physical oceanographic parameters including SLD.

Through this study, it has been possible to estimate SSPs and SLD from surface parameters alone with a fair degree of accuracy. Estimation of these two parameters from satellite data is also feasible provided a good number of collocated remote sensing surface and *in situ* profiles are available.

The first chapter of this thesis deals with the importance of SSPs in the oceans, the factors affecting them, significance of the study area and the datasets used in this

analysis. In addition, different applications of SSPs and the derived parameters like shadow zones and sound channels are discussed.

Conventional methods of estimation of SSPs along with their limitations and the ANN technique used in this study to estimate SSPs from surface parameters are discussed in the second chapter.

After estimating the SSPs from subsurface parameters using the conventional methods, their spatial and temporal variability have been studied in the third chapter using climatological and other observations from special campaigns. Effect of T/S on SSPs and an approach to estimate SSPs using instantaneous temperature measurements and climatological salinity alone is also presented in this chapter.

The fourth chapter is on the estimation of SSPs from surface parameters wherein temporal variations of surface parameters and effect of these parameters on SSPs are studied. Estimation of these profiles from surface parameters using ANN and the sensitivity of various parameters to SSPs are also discussed in detail. Estimation of these profiles from remote sensing observations and their limitations are also brought out in this chapter.

As an application of SSPs, SLD has been studied in the fifth chapter. Spatial and temporal variations of SLD, its estimation from remote sensing observations and the limitations therein are presented in this chapter.

The findings of the thesis are summarized in Chapter-VI on conclusions.

The list of publications arising out this thesis and related studies is given Appendix-1.