M.S.48. NEELAKANDAN NAMBOODIRIPAD, K.S.–Studies on the Propogation of Errors in Physical Oceanographic Computations–1984–Dr. P.G. Kurup

Measurement of independent variables at sea is subject to random errors. These errors get propogated, through the series of computational procedures, into the final derived results. The magnitude of errors in the final results may, at times, of such magnitude as to vitiate the results themselves. This study is an attempt to examine the limit of errors contained in the basic data and the magnitude of error component in the derived results of dynamical oceanography.

After discussing the general theory of errors relevant in the context of studies on the propogation of errors in physical oceanographic computations, an expression is derived for the computations of standard deviation of a normal error distributionl representing the distribution of errors in the summation of a large number of values, when only the maximum individual error is known.

Errors in the measurement of independent oceanographic variables, namely, temperature, pressure and salinity are then discussed. It is shown that the magnitudes of total errors, both in the protected and unprotected reversing thermometer readings, are ±0.01°C upto a depth of 200 m and ±0.02°C below 200 m depth. The corresponding total errors in the depth computations are shown to be ±2 m and ±4 m respectively. It is also shows that the total error in the determination of salinity by the method of titration and by the method of conductivity ratio measurement are ±0.04% and ±0.02% respectively.

The errors committed in the measurement of independent Oceanographic variables are propogated, through the computational procedures, into the computed values of dependent oceanographic variables, namely, sigma-t and specific volume anomally. It is shown that maximum error in the computed values of sigma-t, when salinity is determined by the method of titration and when it is determined by the method of conductivity ratio measurement, are ±0.03 and ±0.02 respectively. The corresponding errors in the computation of specific volume anomally are 3 cl/ton and 2 cl/ton respectively.

The errors propogated into the computed values of derived quantities, namely, dynamic height anomaly of isobaric surfaces and relative currents, are then discussed. It is shown that deeper the selected reference surface, larger is the magnitude of error in the determination of dynamic height anamaly of isobaric surfaces. It is also shown that the magnitude of error in the computed relative current is directly proportional to the error in the determination of difference in dynamic height anomalies and inversely proportional both to the distance between the two stations and the sine of latidude angle.

After critically discussing different methods for the identification of a level of no motion, a more dependable method for the negigibly small, by the application of shtokman's density model for th oceanic mass field, is discussed.

The existing methods for the extension of selected zero reference surface to the shallow regions of the ocean for the purpose of current computation are then critically examined. A new method for the same purpose which consists in the extrapolation of dynamic height anomaly of the isobaric surface, which represents the deepest sampling depth at the shallow station, is proposed and discussed. It is shows that this method is free from the objection raised in connection with the existing methods.

A method of smoothening of the dynamic relief of an isobaric surface, in a profile, within certain error limits is then discussed. It is shown that the smoothened values of the dynamic height anomalies of isobaric surface will give a more dependable picture of the oceanic circulation pattern. The reduction of computed current relative to any reference surface to the zero reference surface, arrived at by the use of Shtokman's density model to the oceanic mass field, is then discussed.