

Development of Hydrographic Survey with kinematic GPS technique

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The chart datum level (CDL) is a zero level of water depth in nautical chart. CDL has the same role as the geoid for the reference of geographical height in land. CDL is defined by considering the mean sea level (MSL) and amplitude of tidal sea height changes in the shallow sea area. In hydrographic surveys, the sea depth data obtained by sounding the sea bottom from the instantaneous sea surface, which changes temporally, must be transformed to the depth from CDL, which does not change. In this paper, we tried to determine the geographical distribution of CDL height from WGS84 reference ellipsoid. Also we conducted several pilot experiments to monitor the sea surface height from the same reference ellipsoid by observing the 3-D position of survey vessel with kinematic GPS technique, 3-dimensional precise positioning technique with GPS carrier phase data. The purpose of this study is to establish the geodetic aspects of CDL and to develop more efficient hydrographic survey with precise GPS positioning technique, which will be necessary to construct high resolution sea bottom topography map.

The study area for the development of a model of CDL height distribution is the inland Sea, Setonaikai, where sea depth is less than 100 meters and tidal sea height changes reaches more than 4 meters peak-to-peak in maximum. At more than 50 points in Setonaikai, MSL is determined by using GPS survey technique based on Geonet, the GPS fixed station network operated by Geographical Survey Institute (GSI). At first, the surface geometry of MSL is estimated so as to construct a smooth distribution of difference between MSL and Geoid2000 of GSI. Now, in Japan, the height differences between MSL and CDL, which is called Z_0 , is defined as the summation of major 4 harmonic coefficients of tidal sea height changes. The geographical seamless distribution of Z_0 is estimated by using the observed data and the results of ocean tide computer simulation (Japan Hydrographic Association, 2003).

The field experiments were executed to determine the sea surface height in reference with the WGS84 reference ellipsoid with survey vessels. We examined the validity of our technique to transform the actual sounding depth to the depth from CDL by calculating the height difference between CDL and instantaneous sea surface.

The accuracy of developed CDL model, which covers the Setonaikai, is not evaluated all over the Setonaikai. We must continue the evaluation and improvements. Also, about the accuracy of height determination with kinematic GPS technique, we have to be careful because sometimes it is unreliable, mainly because of the bad satellite constellation. This study is supported by Nippon Foundation.