Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MTT41-P16 Room:Poster Time:April 28 18:15-19:30

Estimation of the Horizontal Positional Accuracy of Geospatial Data

KOSHIMIZU, Hiroshi[1*] ; MURAKAMI, Masaki[2]

[1]GSI of Japan, [2]GSI of Japan

Expectations for positioning accuracy enhancement vitalize efforts for the advancement of positioning services. For example, various driving assist service with the use of 'Authority map' (which is a large scale map that anyone can use) is being studied in the field of ITS service. It is expected that further disclosure of information about the horizontal positional accuracy of map (which should be combined with positioning information) will be required.

As for the horizontal positional accuracy of map, the threshold (upper limit value) called 'standard deviation' is prescribed in the General Standard of Operation Specifications for Public Surveys for digital topography: 1.75m in the case of the scale 1:2500 (2.50m in the case of editing pre-existing data). However, this 'standard deviation' gives no specific information about probability density functions which are inevitable for the definition of the positional accuracy. Moreover, it is pointed out that above threshold is too large in relation to actual values of public survey works and thresholds of several rules in other countries.

We therefore give the definition of the index 'standard deviation' expressing the horizontal positional accuracy of map with the use of the past research of GreenWalt-Shultz (1968), which had a crucial impact in the FGDC accuracy standards (1998). Let X, Y be random variables which have horizontal residual component values x, y as realized values which are obtained from sample points in the map. Here, 'residual value' means the difference of the observed value and the value considered to be true concerning the same point. If a set { (x,y) } contains no bias and outlier, residual value (x,y) is considered to represent positional accuracy of the point. We assume that realized values of X (Y) are normally distributed with density function fx (fy) of mean 0 and variance sx^2 (sy^2). Let P(R) the probability which a sample point falls in the closed disc with radius R. P(R) is represented by the density function f which has fx and fy as a marginal density function on XxY with the use of conversion from (x,y) to polar coordinates. If sx=sy then we can easily show that P(sx)=P(sy)=0.3935, othewise P(s)=0.3935 leads an approximate expression s=0.5(sx+sy), which is shown by converting the polar coordinates expression of P(R) into the form of integral transformation of certain modified Bessel function (of the first kind) and using numerical calculation methods. If sx=sy then sx=sy=s. Therefore, we define the index 'standard deviation' by s, and call s 'Circular Standard Error' or 'CSE' for short. Estimated value of s should be calculated by { (x,y) }.

Based on this redefinition, we investigated the horizontal positional accuracy of public survey works for digital topography with the scale 1:2500. We regarded (independently) observed coordinate value of GNSS positioning as true value at the sample point, and removed the effect of bias and outlier as much as possible in advance. As a result, we obtained a rough estimate on the CSE: Estimated average value of CSE is 0.3~0.4m, and estimated threshold (upper limit value) is 0.8m. This estimation indicates the necessity of tightning the threshold for the positional accuracy in the General Standard of Operation Specifications for Public Surveys.

Keywords: positional accuracy