Experimental Variogram Model for Estimate Coastal Topography with Remotely-operated Vehicle

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ABSTRACT
The purpose of this study is to investigate the efficiency problem of beach topographic survey with traditional method. Based on the Global Positioning System (GPS), the remotely vehicle is adapt for topographic survey. Experimental study area is in the Yen-Liao beach, and compare with the results obtain by the total station, the preliminary result shows that the remotely vehicle can used to the beach topographic survey, and can improve the survey efficiency. After that, we were build an server service with Google Web Toolkit (GWT) and Java 2 Platform Enterprise Edition (J2EE) using Java language to provide an online Kriging processing service for collect and analysis the near-shore topographic data systematically. And will create a variogram model database when get enough history datasets for suggest the fitness variogram model depend on the location.

KEY WORDS: Variogram; Topographic survey; Global positioning system; Total station; Kriging.

INTRODUCTION
Because of the topography of coastline were affect by naturally force such as tides, waves, winds, and currents in long-terms. It should contents a regionalized variable between the terrain elevations. By now, many of surveyors were using the Kriging method to estimate the nearshore topographic. As we knew, a good Kriging estimating is depended on a fitness experimental variogram model. But how to get a good experimental variogram model is an abstruse work for surveyor and need a lot of history data for study of the local area.

The efficiency of near shore topography protection is often difficult to test and verify in line with theory because of a lack of dense and complete survey data. Usually the efficiency of traditional survey work in the near shore zone is limited, because surveyors on foot cannot move easily within the zone. If large scale vehicles such as ATV are used to improve the efficiency of the surveying job, new problems are created, because when the vehicle move on an uneven surface, it will be necessary to correct the resulting tilt of the sensor. Therefore we aimed to improve the efficiency of such surveys and save manpower and man-hour costs.

For our study we replaced human surveyors with a remotely operated vehicle, due to its advantages for near-shore survey work such as portability, small height, and fast mobility, thus improving surveying efficiency and increasing data density. By installing a GPS or a Total Station tracking prism on the remotely operated vehicle to collect topographic data at a rate of more than one point per second, it is possible to efficiently achieve the goal of saving manpower and time. A comparison of the two datasets collected by the GPS and the Total Station tracking prism, showed that a GPS mounted on a remotely operated vehicle is suitable for surveys in near shore areas.

We used Google Web Toolkit (GWT) and Java 2 Platform Enterprise Edition (J2EE) with Java language to provide an online Kriging processing service (Figure 2) to systematically analyze the 3D coordinates collected by the remotely operated vehicle.

Figure 1 Deployment Diagram of the Online Kriging Service Survey Area and Test Plan

Figure 2 Yen-Liao Beach and Layout of Control Points