

## Accuracy of kinematic GPS precise positioning

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The accuracy of position of survey ship estimated by using kinematic GPS technique is important for the research of sea surface height, survey of sea floor, observation of sea bottom crustal deformation with GPS/Acoustic ranging technique. However, the accuracy of estimated position, especially estimated height, includes some systematic errors, which may stems from the bias error in single difference of pseudo range measurement for several satellites. In large VDOP condition, the errors of vertical coordinates become great.

We think that the major reasons of systematic errors are (1) ionospheric delay, (2) tropospheric delay, (3) antenna phase center variations which depend on local satellite elevation and azimuth, (4) multipath effect. Based on many observed data, we try to clarify the influence of these phenomena quantitatively.

However, it is difficult to control the systematic errors in pseudo range measurement. In that case it is important to evaluate the accuracy of estimated position. One way is to compare the estimated height with sea surface height model, which depend on geoid, sea surface dynamic height, tidal sea level changes, atmospheric pressure changes and sea water temperature changes. The reduction of high-frequency ship's height changes by using dynamic motion sensor is very useful.