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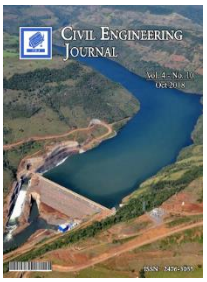

Effects of Site-Dependent Errors on the Accuracy of C/A Code DGPS Positioning

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Abstract

Several differential GPS processing techniques can be used; for instance, single differencing and double differencing, which are popular in practice. Irrespective of the DGPS processing technique used, the ultimate accuracy of the user-location depends on the existence of non-common or site-dependent errors, which occur at the points of observation and the reference. Of these, the most common and dominant site-dependent error is the multipath. Therefore, this research evaluates the effects of site-dependent errors on C/A code differential GPS correction accuracies by providing special emphasis on the multipath error. For the analyses, four segments of about 24-hour continuous static C/A code based DGPS observations were conducted at three precisely known ground stations and four different multipath environments were introduced by placing three different types of artificial signal reflectors at one of the observation stations. By using the known GPS receiver-reflector configuration, pseudo-range multipath was precisely calculated for each observation segment. C/A code DGPS positioning accuracies before and after multipath mitigation were presented by evaluating the effect of the most dominant site-dependent error, i.e., multipath, on C/A code DGPS correction accuracies.

Keywords: Multipath Error; C/A Code DGPS Corrections; Positional Accuracies.

1. Introduction

Differential GPS (DGPS) can be considered as the most effective technique that minimizes or completely remove the influence of almost all common mode errors from GPS observations [1]. According to the concept of DGPS technique, the estimated total pseudo-range error at the reference station is specified as the correction for other GPS receiver observations performed over a limited geographical area. However, it is apparent that the estimated total error for each individual pseudo-range is the combination of common and non-common (site-dependent) errors. Therefore, the non-common errors (multipath, receive and measurement noises), which affect the observation of the reference station contributes as accuracy diminishing factors for DGPS correction data estimations [11]. Furthermore, amongst all non-common error sources, multipath is predominant; hence, mitigation is essential to improve the accuracy of DGPS corrections.

Based on the above facts, therefore, most permanent GPS reference stations are capable of calculating its correction data with particular reference to common mode errors by minimizing the effect of multipath through careful site selection and/or augmentation with additional hardware such as utilizing choke-ring antennas [10]. These approaches are only effective for reducing the effects of multipath and ensuring the quality of DGPS correction estimation. However, in most of the practical situations, multipath-free or comparatively low site selection is not an easy task to be accomplished. Therefore, some residual multipath error, receiver, and measurement noises always remain and demolish the quality of

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