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ACCURACY ESTIMATES OF DIGITAL ELEVATION MODEL (DEM) TOWARDS THE CREATION OF SATELLITE IMAGE MAP (SIM)

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Thesis submitted in fulfillment of the requirements
for the degree of
Master of Science

Faculty of Architecture, Planning & Surveying

August 2009

ABSTRACT

Satellite Image Map (SIM) integrates Remote Sensing, Geographical Information System (GIS), Global Positioning System (GPS) and Cartography in the production of digital cartographic maps. This thesis, explores the methodology towards evaluating the accuracy and effects of the use of digital elevation model (DEM) towards the creation of SIM. The DEM which were constructed using the topographical contour data, LiDAR and SPOT 5 HRG (High Resolution Geometric) were evaluated quantitatively and qualitatively. Quantitative evaluation were carried out using the Root Mean Square Error *(RMSE)* which are calculated based on the discrepancies of absolute and horizontal values of generated results toward the well defined point determined in the study. In the qualitative evaluation, the mismatch between the topographical, LiDAR and SPOT 5 HRG data were evaluated using four (4) different methods namely; quality evaluation of the DEM generated, orthorectification results, scale comparisons and comparison between the SPOT 5 HRG data with the SIM product produced by MACRES using the Landsat TM data.

The quantitative results shows that the $RMSE_z$ for Topographical, LiDAR and SPOT 5 HRG are 1.408 m, 0.250 m and 6.872 m respectively. The $RMSE_z$ for Topographical LiDAR complies with the USGS Mapping Accuracy Standards (1947) for mapping scale of 1:10 000 and above. However, SPOT 5 HRG complies with the USGS Mapping Accuracy Standards (1947) of 1: 25,000 scale and above respectively. For horizontal accuracy the $RMSE_{xy}$ for the Topographical, LiDAR and SPOT 5 HRG were 1.295 m, 0.941 m and 2.481 m respectively. For the qualitative results, topographical data provides a smooth generated DEM. The combination of the DEM with the 2.5 m SPOT 5 HRG data presents a good orthorectification results for the creation of SIM.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1   Background

Satellite Image Map (SIM) is "a geocoded remote sensing image overlaid and integrated with selected topographic features such as contour, hydrology, boundary and road network of the corresponding area" (MACRES, 1999a, 2001). Albert and Tauch (1994) define SIM as "an image combines rectified (orthoimage) with cartographic element (e.g names and grid) and is produced as the same format as the topographic maps".

SIM is produced as a complementary to the existing topographic map (Rahaman et al., 2001) and cartographically enhanced to make them readable, understandable and measurable (MACRES, 1999a and Kobben, 2003). SIM is capable to be used as a source for current and updated thematic data (Adnan et al., 1997; Rahaman et al., 2003).

The Malaysian Remote Sensing Agency which formally known as the Malaysian Centre for Remote Sensing (MACRES) with the collaboration of Department of Survey and Mapping Malaysia (JUPEM) have developed SIM project in 1997 and by the end of 2006, MACRES have produced one hundred and seventy seven (177), 1:50,000 scale SIM for the whole of Peninsular Malaysia.