NOTICE OF UNIVERSITY ORAL

GEODESY AND GEOMATICS ENGINEERING

Master of Science in Engineering

Chunlin Shen

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@ 1:00 pm
Room E11 - Head Hall

Board of Examiners:	**Supervisor:**	**Dr. Richard Langley, GGE**
	Examining Board:	**Dr. Peter Dare, GGE**
		Dr. Paul Williams, Geology
	Chair:	**Dr. Sue Nichols, GGE**

A Method for Processing Data From A Regional Continuous Crustal Deformation GPS Monitoring Network

ABSTRACT

This thesis focuses on improvement of methods for processing GPS data to detect regional crustal deformation signals of centimetre or even millimetre level, based on the DIfferential POsitioning Program (DIPOP) GPS software package.

The experimental field is the Western Canada Deformation Array (WCDA), a regional continuous GPS tracker network for monitoring crustal deformation in western Canada. As part of the Canadian National Earthquake Hazards Program, WCDA was established by the Geological Survey Canada, Natural Resources Canada primarily for the study of the seismic hazard in this region.

DIPOP is a development of the Department of Geodesy and Geomatics Engineering, University of New Brunswick. Since the birth of DIPOP 1.0 in 1985, DIPOP has been continuously upgraded with the advance of GPS and computer techniques, and is still under development.

Since error correction models directly affect the quality of processing results, the models of the tide and residual atmospheric delay corrections have been tested with the longest baseline of the WCDA network. Also, a weeklong GPS data set from 7 WCDA baselines was processed to evaluate the performance of DIPOP. The solutions for both the height component and baseline length show daily repeatability better than 1 cm for baselines ranging from 254 to 672 km. Differences between the weekly solutions from DIPOP and the ITRF2000 solutions published by International Earth Rotation Service (IERS) are of the order of a few cm in the components of latitude, longitude, and height.

In order to test the capability of DIPOP to extract deformation signals, continuous 52-week data set from 3 selected WCDA baselines was processed. Annual movement rates for the components of latitude, longitude, and height were estimated by weighted least squares linear fitting and assessed by values of the coefficient of determination and the F-test. The daily time series of the position solutions at the 3 remote sites show annual movement rates of 0.4 - 1.4 cm and -7.8 - 2.6 mm in the horizontal and vertical components, respectively.

By analyzing the processed results, potential error sources affecting the accuracy of the DIPOP solutions were assessed. It is suggested that the methods for estimating residual tropospheric delay and correcting receiver antenna phase center variation need to be improved; and reduction of multipath interference needs to be taken into consideration in processing of high-precision positioning.

Improvement of the technique for detecting and fixing cycle slips was also studied. A method of automatically detecting cycle slips was developed and implemented in the preprocessor PREDD of DIPOP. The new method shows better efficiency for data processing with DIPOP.