NOTICE OF THESIS PROPOSAL PRESENTATION

Geodesy and Geomatics Engineering

Doctor of Philosophy

Chaochao Wang

June 16, 2004
Head Hall – Room E-11 @ 10:00 am

Supervisor: Dr. Peter Dare

Supervisory Committee: Dr. Richard Langley
Dr. Donghyun Kim

Chair: Dr. Sue Nichols

Quality Analysis of GPS-Derived Precipitable Water Vapour

ABSTRACT

With the development of GPS technology, more and more importance has been put on better understanding GPS tropospheric delay. As is known, the GPS tropospheric delay can be divided into two components: the hydrostatic delay and the wet delay. The hydrostatic delay is fairly stable and can be determined to a high accuracy using meteorological sensors and appropriate models. The wet delay, however, is temporally variable and dominated by the precipitable water vapour (PWV) in the upper atmosphere. In the case that the coordinates of the GPS antenna are well known, it is possible to retrieve the PWV from GPS line-of-sight measurements with collocated meteorological sensors. Accurate knowledge of water vapour can be used effectively in GPS precise positioning as well as in short-term weather forecasting and climate studies.

My thesis work is to seek an answer to the following question: Is it possible to develop a quality indicator of tropospheric wet delay or PWV using GPS carrier phase measurements? A related secondary question coupled with first one is what kind of improvements could be achieved by introducing the quality estimates for data assimiliation in NWP or water vapour tomography. To prove this thesis statement, some researches will be done in the following areas. In order to evaluate the optimal performance of GPS PWV sensing technology, different GPS processing strategies are used in the estimation of the tropospheric delay. A novel GPS processing algorithm to precisely estimate tropospheric delay using a Kalman filter technique is developed based on the UNB GPS processing prototype, namely DIPOP. The conversion factor from the tropospeheric delay into PWV, which is a function of mean temperature of upper air, is investigated using both the radiosonde measurements and Numerical Weather Prediction (NWP) models. The effect of modeling errors introduced by mapping functions on PWV estimation is examined. The stochastic modeling of PWV estimates from GPS measurements are implemented in the software and a quality indication scheme of GPS PWV is developed based on knowledge of remaining error sources of GPS measurements. A tomography approach is developed to reconstruct the 4-D water vapour distribution in a regional area. The quality indicator of PWV will be evaluated with the independent reference from NWP and radiosonde results.

Faculty Members and Graduate Students are invited to attend the 20 minute presentation