Graduate Seminar

&

Student Technical Conference

Wednesday, November 19, 2014

Department of Geodesy and Geomatics Engineering

University of New Brunswick

The Department would like to welcome you to the

Fall 2014 Graduate Seminar & Student Technical Conference

Where:

Gillin Hall – Room D-108

When:

Wednesday, November 19, 2014 at 10:00 am

Department of Geodesy and Geomatics Engineering

Geodesy and Geomatics Engineering

Graduate Seminar and Student Technical Conference

Fall 2014

Chair: *Danar G Pratomo (PhD)*

Wednesday, November 19, 2014   *(GD108)*

 9:55   **Welcome note**

10:00   **Douglas Luiz Da Silva Pereira**

"Improving Shallow Water Multibeam Target Detection at Low Grazing Angles"

10:20   **Andrew Kubiak**

"Calculating a GPS Baseline Every Day for a Year: Issues and Solutions"

10:40   **Michael Klu**

"Determination of Gravimetric Geoid for Ghana Using the Stokes-Helmert Method"

11:00   **Timi Shodimu**

"Examining the Role of Geo-Spatial Images in the Analysis of Land Cover Changes in the Grand Lake Meadows"

11:20   **Jaime Garbanzo Leon**

"Evaluating the Risk of Contamination of Water Springs Based on the Human Activities and Environmental Attributes of the Surrounding Areas with a Low Cost Methodology. Case Study: San Rafael, Montes de Oca, Costa Rica"

11:40   **Heather McGrath**

"Sensitivity Analysis of Flood Damage Estimates: A Case Study in Fredericton, New Brunswick"

12:00   **Titus Tienaah**

"Trajectory Simplification Under Space Constraints"

 12:20   **Closing Remarks**

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ABSTRACTS

You may contact the Authors for a copy of the full papers.

Department of Geodesy and Geomatics Engineering

Improving Shallow Water Multibeam Target Detection at Low Grazing Angles

Douglas Luiz Da Silva Pereira

Email: douglas.pereira@unb.ca

Abstract

Beyond around 60º of beam's incidence angle, depth accuracy and seabed target detection in compliance with International Hydrographic Organization (IHO) standards degrade hugely in most modern Multibeam Echo Sounders (MBES). In some cases, a target at low grazing angles is not detected due to inappropriate selection of the bottom detection method and filters applied by fabricators. A data gap on DTM or a shadow into the backscatter image are possible yet not firm indication of that target presence. As part of the author's M.Sc.E. research project, this paper presents a refined bottom detection algorithm based on Bearing Direction Indicator (BDI) method that potentially improves target detection capability at low grazing angles in shallow waters by finely discriminating each echo direction of arrival better than the beam spacing. Two appropriate datasets collected using the MBES Kongsberg® EM 2040D over a site with lots of deployed IHO compliant man-made targets will be used to assess its capability of detecting low grazing angles targets prior and after application of the proposed algorithm.

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Calculating a GPS Baseline Every Day for a Year: Issues and Solutions

Andrew Kubiak

Email: Andrew.Kubiak@unb.ca

Abstract

Differential GPS techniques have long been used for a variety of purposes such as coordinating land surveying control markers and photogrammetric control markers, measuring long-term tectonic plate movements, determining short-term kinematic rover movements, and modeling deformations of natural and cultural features. The first step towards modeling structural movement using only a single baseline is taken here with a simple test of the baseline measurement itself. A short DGPS baseline (~2km) is determined using historic observations at 30-second intervals across a year's worth of observations collected in 2005. The baseline's mean daily characteristics are determined using only that day's data (observations, orbits, etc.). Flaws with this daily approach include unmodeled subdaily and daily periodic movements as well as discontinuities due to a lack of overlapping data from adjacent days. Another flaw with this approach is its inability to model seasonal periodicities, since the campaign spans only a single calendar year. The majority of the processing is performed using the Bernese GPS Software v5.0, published by the Astronomical Institute of the University of Bern. In total 348 days of baseline lengths are calculated. Five of those days, spread evenly across the year, were calculated a second time using another processing engine, called RTKLIB, an open source GNSS processing suite. A comparison of these two sets of results is made using IPython. The two sets of data agree to within 12 cm. To clarify, no novel approaches, determinations or analyses are included in this work. The effort described herein has been one of familiarizing the author with existing techniques and models.

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Determination of Gravimetric Geoid for Ghana Using the Stokes-Helmert Method

Michael Klu

Email: Michael.Klu@unb.ca

Abstract

The aim of this research is to compute a gravimetric geoid model for Ghana using the Stoke-Helmert approach which was developed at the University of New Brunswick (UNB). A gravimetric geoid model of Ghana is important because of the use of Global Positioning System (GPS) for all survey and mapping activities in the country. This geoid model is to enable surveyors and mapping professionals in converting geodetic heights to orthometric heights which is more useful. In spite of the sparse terrestrial gravity data of variable density, distribution and quality, this research aims to model the geoid as accurately as achievable. To model a regional gravimetric geoid using the modified Stokes formula requires a combination of terrestrial gravity data of the area and a Global Geopotential Model (GGM). In this research, a two-space setup will be used in formulating the boundary value problem and defining gravity values (quantities), which will be appropriate for downward continuation from the Earth's surface to the geoid level. The topographical effect will be formulated in spherical form. The solution of the Stokes boundary value problem employs a modified Stokes formula in conjunction with the low-degree contribution of a GGM. The data set used for the computation will consist of gravity data, various rock densities covering the entire country of Ghana and the European Improve Gravity field of the Earth by New techniques and Gravity Recovery and Climate Experiment (EIGEN-GRACE) mission for the global geopotential model. Regarding the evaluation and refinement of the terrestrial gravity data, the cross-evaluation technique will be used for the detection of outliers. The geoid model for Ghana will be tested with GPS Levelling data from areas with varying terrain such as a low terrain and a relatively high terrain and any discrepancy will be investigated.

Examining the Role of Geo-Spatial Images in the Analysis of Land Cover Changes in the Grand Lake Meadows

Timi Shodimu

Email: o.shodimu@unb.ca

Abstract

Grand Lake Meadows (GLM) are considered a historically and ecologically a significant area in the province of New Brunswick. However, there have been changes in the land cover and use of the area, mainly due to the re-routing of the trans-Canada highway and developed settlements. Changes in the land cover and land use considerably affect key aspects of ecosystem functioning and services. The aim of this study is to assess the state of fragmentation and degradation of the GLM landscape through the approaches of quantitative landscape ecology. This study proposes a methodology that relies on the use of archival aerial photographs and satellite images for mapping the land cover and use patterns in the GLM area. Classification of historical images over a certain period will depict the land cover changes in the Grand Lake Meadow. Other available environmental, demographic, and economical data will be gathered and combined with the land cover information to create a database within a Geographic Information System (GIS) environment. The GIS will be used to depict the spatial and temporal changes and also to conduct geo-statistical analysis to show the state of habitat conditions and interactions for environmental monitoring. The result will aid the decision makers to understand the dynamics of the changes, leading to a better planning and implementation of land use management in GLM wetland.

Evaluating the Risk of Contamination of Water Springs Based on the Human Activities and Environmental Attributes of the Surrounding Areas with a Low Cost Methodology. Case Study: San Rafael, Montes de Oca, Costa Rica

Jaime Garbanzo Leon

Email: Jaime.garbanzo@unb.ca

Abstract

Urban development and economical activities may potentially put water springs (WSs) at risk. Garbanzo and Vargas (2011) created a methodology for assessing the risk of contamination in water springs based on the economic activities of the surrounding areas, the violation of protected zones, and the physical characteristics of WSs. This assessment was carried out in the district of San Rafael (Montes de Oca, Costa Rica) in collaboration with the local government and the MINAET (Ministerio Nacional de Ambiente, Energía y Tecnología). Information about the springs was extracted from field surveys and orthophotos. After the assessment, a total of 10 WSs, corresponding to the best 5 and the worst 5 graded, were chosen for water quality testing and compared with the quality parameters of the code for water quality of the Republic of Costa Rica decree No. 32327-S (Water quality regulation, 2005). A water spring (WS), which was between the 5 lowest graded WSs, presented a high level of contamination. However, another WS, also between the 5 lowest graded WSs, presented a low level of contamination. This outcome shows that although the methodology used in this research needs further testing, it provides a logical and low-cost procedure for an assessment of WSs' risk of contamination.

Sensitivity Analysis of Flood Damage Estimates: A Case Study in Fredericton, New Brunswick

Heather McGrath

Email: Heather.McGrath@unb.ca

Abstract

Recently, the U.S. FEMA's standardized best-practice methodology Hazus for estimating potential losses from common natural hazards, including earthquakes, flood, and hurricanes has been adopted for use in Canada. Flood loss estimation relies on the combination of three components: flood level, inventory of the built environment, and pre-selected vulnerability parameters such as depth-damage functions, all of which have large associated uncertainties. Some of these parameters, such as occupancy schemes and vulnerabilities, have been carried over from the U.S. version on the presumption of regional similarities between Canadian provinces and states south of the border. Many of the uncertainties can be reduced by acquiring additional data or by improving the understanding of the physical processes. This paper presents results from a series of flood model analyses to illustrate the sensitivity that can be associated to depth-damage functions and flood level and to identify their relative impacts on the resulting losses. The city of Fredericton is chosen as the test case as it was subjected in 2008 to flood water levels breaching 1.86 m above flood stage resulting in more than 680 residents evacuated from their homes, and economic costs of more than $23 million. The loss results are expressed by the number of flooded residential buildings which varied between 579 and 623 and the range of replacement cost is $21 million. These results highlight the importance of proper selection of input parameters customized to the study area under consideration.

Trajectory Simplification Under Space Constraints

Titus Tienaah

Email: ttienaah@unb.ca

Abstract

The positions of moving objects (humans, vehicles, animals, and goods) are recorded at varied spatiotemporal resolutions through the use location positioning technologies. It is beneficial to collect mobility data at the highest resolution possible and then extract data points of interest at a coarser resolution for different applications without collecting new data at the needed resolution. Reducing the granularity of data in isolation of the imbedded space often leads to topological, direction and distance inconsistencies. In this paper, we extend a trajectory simplification algorithm (Synchronized Euclidean Distance) with an imbedded space as constraints to preserve topology, direction and distance relations. The algorithm is implemented in the context of sea vessel trajectories with islands as space constraints.

University of New Brunswick
Department of Geodesy and Geomatics Engineering

Head Hall – 15 Dineen Drive
PO Box 4400
Fredericton, NB
Canada E3B 5A3