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MULTIBEAM ECHO SOUNDER DATA UNCERTAINTY MANAGEMENT AND PROCESSING TIME

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إقـرار الطالب

أقر بأن المادة العلمية الواردة فى هذه الرسالة قد تم تحديد مصدرها العلمى وأن محتوى الرسالة غير مقدم للحصول علي أى درجة علمية أخرى، وأن مضمون هذه الرسالة يعكس آراء الباحث الخاصة وهى ليست بالضرورة الآراء التى تتبناها الجهة المانحة.

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ABSTRACT

International Hydrographic Organization (IHO) special publication (SP-44) does not contain procedures for processing and analyzing the resultant data gathered by Multibeam Echo Sounders (MBES) which are a fundamental part of the complete survey (IHO SP44, 2008). Since any surveying organization /office is responsible for its products, they must have a quality control guide line for these products. This study focuses on developing quality control procedures to manage uncertainty of large volume of data gathered by multibeam echo sounders while maintaining data integrity.

A brief review of recent methods of uncertainty management in the hydrographic field was presented, as well as its historical development with the use of hydrographic data to produce error model, taking into account the technological changes that have been taken place.

HYPACK®, as one of the most widely used hydrographic surveying packages in the world, was selected to give the power and flexibility to process the MBES data sets and provide all the tools necessary to complete the survey.

The range of skills on which surveyors should be trained and assessed in processing MBES data were established to measure their performance and processing time.

MBES data sets from different locations were processed by three different surveyors with different levels of experience in MBES data processing, the researcher was one of them. Each data set were processed three times, using 45°, 60° and 75° beam angle filter limits in the HYSWEEP® editor Module of HYPACK®. Each surveyor was asked to record the total time spent on editing each MBES data set, using the three beam angle limits. Assessment tools were examined and investigated after processing MBES data, by comparing the pre-analysis results with the processed ones.

An analysis was conducted to estimate the Total Propagated Uncertainty (TPU). The results proved that following the developed quality control procedures will lead to achieving the desired standards (performance targets) in all the considered cases. Also, analysis was conducted for the Total Propagated Uncertainty along with beam angle filter and the results showed that TPU was enhanced obviously when beam angle decreased.

The analysis for total time spent in processing MBES data showed that processing time depends on many factors such as beam angle, seabed complexity, surveyor experience, and raw data size.

The concluding remarks proved the potential use of quality control procedures to manage uncertainty in surveying data. A number of recommendations was made concerning the need for further development.

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LIST OF ABBREVIATION

CAD:	Computerized Aided Design
CEP:	Circle of Equal Probability
CHS:	Canadian Hydrographic Service
COG:	Centre of Gravity
CUBE:	Combined Uncertainty Bathymetry Estimator
DMS:	Dynamic Motion Sensors
drms:	distance root-mean square
ECDIS:	Electronic Chart Display and Information System
Ft:	Foot
GNSS:	Global Navigation Satellite System
HO:	Hydrographic Organization
IHO:	International Hydrographic Organization
IMO:	International Maritime Organization
IMU:	Inertial Measuring Unit
Km:	Kilo meter
MBES:	Multi-Beam Echo Sounder System.
MRU:	Motion Reference Unit
NMEA:	National Marine Electronic Association
QA:	Quality Assurance
QC:	Quality Control
QEP:	Quality Evaluation Procedures
QMS:	Quality Management System
ROV:	Remotely Operated Vehicle
SD:	Standard Deviation

SOP: Standard Operation Procedures

SP: Special Publication

SSS: Side Scan Sonar

SV: Sound velocity

SVP: Sound Velocity Profile

THU: Total Horizontal Uncertainty

TPE Total Propagated Error

TPU: Total Propagated Uncertainty

TVU: Total Vertical Uncertainty

UM: Uncertainty Management

WG: Working Group

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المستخلص

تصدر المنظمة العالمية للمساحة البحرية المنشور الخاص"معايير المساحة البحرية" هذا المنشور مع أهميته إلا أنه لا يحتوى على إجراءات تفصيلية لتجهيز وتحليل البيانات التى تم تجميعها بواسطة أجهزة مسح الأعماق متعددة الأحزمة. تعتبر هذه الإجراءات الجزء الأهم لإتمام العملية المساحية، وبما أن مؤسسات ومكاتب المساحة هى المسؤله عن منتجاتها المساحية النهائية، كانت هناك ضرورة لاختبار نظام يشرح كيفية مراقبة هذا المنتج .

تركز هذه الرسالة على وضع الإجراءات اللازمة لمعالجة وتحليل البيانات الهائلة المجمعة بواسطة أجهزة مسح الأعماق متعددة الأحزمة مع الحفاظ على سلامة البيانات . لذا فقد تم استعراض الأساليب الحالية المستخدمه لمراجعة عدم اليقين فى العمليه المساحية، مع إستخدام البيانات التاريخيه لإنشاء نموذجا للخطأ مع مراعاة التطورات التكنولوجية الحديثة التى حدثت .

تم تجهيز عدد خمس مجموعات للبيانات المجمعة بواسطة أجهزة مسح الأعماق متعددة الأحزمه وقد تم إسناد التحليل الى ثلاثة مساحين (منهم الباحث) من ذوى الخبرات المختلفه فى معالجة البيانات، وكل مجموعة من البيانات، تم معالجتها ثلاث مرات بإستخدام زاوية مسح مختلفه (٤٥°،٦٠°،٧٥) بواسطه الثلاثة مساحين، مع قيام كل مساح بتحديد إجمالى الوقت المستهلك فى معالجه البيانات .

أجرى تحليل لمحصلة عدم دقة العملية المساحية لكل مجموعة من البيانات مقارنة بالمعيارالخاص للمنظمة العالمية للمساحة البحرية وكانت جميع النتائج متوافقه مع هذا المعيار. كما أجرى تحليل لمحصلة عدم دقة العملية المساحية مقارنة بزاويه المسح المستخدمة فى المعالجه ، وكانت النتيجة هى تحسن محصلة عدم الدقه بشكل ملحوظ كلما قلت زاوية المسح المستخدمة بواسطة أجهزة مسح الاعماق متعددة الاحزمه .

أيضا تم إجراء تحليل للوقت المستغرق فى معالجة البيانات وكانت النتيجة توقف الوقت المستغرق فى المعالجه والتحليل على عدة عوامل أهمها: شكل قاع البحر، مستو خبرة المساحين، طبيعة العملية المساحية، حجم البيانات المجمعة بواسطة أجهزة مسح الاعماق وزاوية المسح المستخدمة .

احتوى الفصل الختامي على النتائج الخاصة بكل مجموعة من البيانات، مع وضع الأدلة على أهمية إتباع مخطط إدارة عدم دقة العمليه المساحيه، وتم تقديم عدد من التوصيات فيما يتعلق بالحاجة إلى مزيد من التطويرو البحث في هذا المجال.

الأكاديميه العربية للعلوم والتكنولوجيا والنقل البحرى

كلية النقل البحرى والتكنولوجيا

قسم الدراسات العليا البحريه

الإسكندريه ، مصر

تحليل عدم اليقين فى العمليات المساحية وتحليل الوقت المستخدم فى معالجه بيانات أجهزة مسح الاعماق متعدد الاحزمة

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رسالة مقدمة للأكاديميه العربية للعلوم والتكنولوجيا والنقل البحرى لإستكمال متطلبات نيل درجة **الماجستير**

فى

تكنولوجيا النقل البحرى

المسح البحرى الهيدروجرافى

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دكتوراة من كليه النقل البحرى و التكنولوجيا

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