





1.ST PORTUGUESE-SPANISH HYDROGRAPHIC ENGINEERING CONFERENCE



## **HYDROGRAPHIC WORKFLOW**





Processing QA/QC

Visualization / Dissemination

Cartographic database



- Side Scan Sonars
- Multibeam Echo Sounders
- Satellite Derived Bathymetry (optical/radar)
- Aerial photogrammetry
- Bathy-Lidar

## **NEW TRENDS IN OCEAN MAPPING**

- Unmaned systems and remote hydrography
- Acoustic systems producing denser point
- clouds (LIDAR or SfM like) allowing realistic 3d reconstructions.
- SEABED





- Need of improved and automated methods for processing and quality assurance
- Impulse of ocean exploration (UN Ocean
- Decade , EuroFleets+ , Seabed 2030... )





## **COMMERCIAL SOFTWARE FOR PRODUCTION**

- Wide array of solutions for all steps
- Robust software
- Mostly industry and hydrographic offices oriented
- Provide near-real-time user support
- Requires specific training
- Costly licenses
- Source code is not accesible to the user













## **EXISTING FREE GEOSPATIAL TOOLS**



- Free available or open-source
- No only focused on ocean mapping (Earth Sciences, GIS, BIM,gaming...)
- Many are research oriented
- Mostly supported by institutions / community
- Linux and CLI often required





### **RESEARCH MOTIVATIONS**

- Many users cannot afford commercial licenses
- Commercial software may not cover all possible needs in the hydrographic workflow
- New trends could open the scope to using other tools
- Raise awareness on the existence of free geospatial software used by public institution and research centers



## **METHODS**

- Investigated more than 100 programs ٠
- Software running on Windows / Linux / Mac Os •
- Tested features, computational complexity and user ٠ experience on an average PC workstation
- Functionalities compared to those similar in • commercial software
- Ranked by suitability and applicability to ocean • mapping



GeoTIF etc)





### (A-priori Multi-beam Uncertainty Simulation Tool)

AMUST

- Uncertainty calculator (TPU/THU) for MBES for decision support
- Particularly useful for IHO standard "exclusive order" (S-44 Edition 6.0) survey design
- Runs only on Windows





# **MB-SYSTEM**

https://www.mbari.org

- Set of programs for processing MBES,SBES and side scan sonar datasets
- Most vendor formats are supported
- Provides tide correction based on the Oregon State University (OSU) tidal prediction software (OTPS)
- Command Line Interface (Linux, MacOS
  Windows (Docker on WSL)
- Data can be exported in ASCII format for further manipulation in other software

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## **GLOBE**

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### **GLOBAL OCEANOGRAPHY AND BATHYMETRY EXPLORER**

- Multibeam bathymetry and backscatter processing.
- Only Kongsberg, Reson and Caraibes formats supported
- Water column visualization
- Used by EMODnet Hydrography for manipulating and creating digital elevation models
- Windows / Linux / MacOS





# **CLOUDCOMPARE**

https://www.danielgm.net/cc/



- Widely used for point cloud manipulation (Lidar, photogrammetry) in 3d reconstruction tasks
- Provides means for high resolution
  MBES point cloud cleaning, alignment
  visualization and mesh/DEM
  generation
- Windows / Linux / MacOS



Westley et al, 2019. Optimizing protocols for high-definition imaging of historic shipwrecks using multibeam echosounder

### **RCIS®** trademark

- GIS desktop tool with a friendly interface
- OGIS allows visualizing, manipulating
  and analyzing data
- Plug in "Cruise Tools" for survey planning and quick raster visualization (<u>https://github.com/simondreutter/cruisetools</u>)
- Incoming native support for point cloud manipulation.
- Windows / Linux / MacOS

## QGIS

#### HTTPS://QGIS.ORG/







### PYDRO & HYDROFFICE

**OPEN TOOLS FOR OCEAN MAPPERS** 

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Pydro: NOAA Python distribution with a collection of open source hydrographic tools. Focused on NOAA procedures but widely applicable in other H.O. workflows

Hydroffice: A framework of libraries and tools for ocean mapping

- Sound Speed Manager ٠
- QC and QA Tools ۲
- Bress •

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### Sound Speed Manager



CesiumJS is an open-source JavaScript library for creating 3D globes and 2D maps in a web browser

Cross-platform and cross-browser.

Optimized for dynamic-data visualization.

Used in the Asseabed program (TerriaJS) for data exploration and visualization oveh the internet



#### https://cesium.com/cesiumjs/





#### https://portal.ga.gov.au/persona/marine



### RAYSHADER

#### www.rayshader.com





### VISUALIZATION LIBRARY IN R

## **USING FREE AND OPEN SOURCE SOFTWARE**



### Cost

- Some provide unique features
- Access to source code, flexibility

CESIUM Ge

Facilitates remote work

OBE

### <u>CONS</u>

- Relevant features (CUBE) not supported
- Lack of software for sonar data collection
- Some may be not suitable for production
- Different view of customer support
- Coding is often required (but it can be a +)

FOSS is not a substitute but a complement for commercial hydrographic software aimed for production



### **RECOMMENDATIONS AND FUTURE WORK**

- Encourage users to try and implement FOSS in their workflow routines
- Promote the use of Linux (WSL2 + Docker), Python and R for geospatial applications

An alternative workflow using only FOSS will be proposed in future thesis



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