The complexity of gathering high resolution, accurate geo-spatial datasets in the inter-tidal zones of a tropical urban coastal city-state.

UN Global Geospatial Information Management

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The need ...

• Nearshore topography / bathymetry data is important
  • A key parameter that influences nearshore wave evolution
  • Needed for engineering design of coastal protection structures

• Integrated models for coastal / pluvial flooding models can now easily incorporate the necessary high resolution data to model the run-up and incorporate far-field information e.g. wave / wakes
Models need the information ...
Local challenges ...

• Difficult for a marine survey vessel to safely come in

• Inability to safely walk out from the shore to utilize land survey equipment effectively

• No-fly zones ...
Present state / methodology

• Separate data gathering methods and times for landward and seaward data

• This could potentially result in large differences in the measured value at the same location if
  • the data gathering windows for both landward and seaward are separated over a large period of time particularly if separated by a spring tide.
  • the bed is particularly mobile

• At some points this can potentially result in data gaps as well
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Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not reflect the views of National Research Foundation, Singapore and Ministry of National Development, Singapore.

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The Project’s problem statement

• Evaluate and demonstrate the feasibility of developing a cost-effective high resolution single operation method(s)
  • That can be used across the entire country’s coastlines to obtain the required intertidal vertical data given the different water turbidity and complexity of topography across the country.

• Due to the non-uniform variation of the chart datum across Singapore island a need arises which this proposal intends to fill by developing a translation method to convert the single operation collection data efficiently between the SHD and CD for use in both marine and land charting across the island.
Approaches in play

• Total station on land in combination with survey vessel mounting Multi-Beam Echo Sounder [Baseline]
• Shallow draft unmanned surface vessel (USV) mounting LiDAR with Single Beam Echo Sounder (SBES) array
• Drone with multi-spectral camera (RGB, R, B, G, RE, NIR, NR)
• Multi / hyper-spectral satellite imagery e.g. Worldview-3 or equivalent (8 band minimum)
Methodology

• Carry out comparison of 4 different survey methods at 3 different locations over 3 different time periods
  • Survey methods
    • Total station on land in combination with survey vessel mounting Multi-Beam Echo Sounder [Baseline]
    • Shallow draft unmanned surface vessel (USV) mounting LiDAR with Single Beam Echo Sounder and / or inferometric sonar
    • Drone with 8 Band multi-spectral camera (RGB, R, B, G, RE, NIR, NR)
    • Multi-spectral satellite imagery e.g. Worldview-3 or equivalent (8 band)
  • Locations (Kranji, East Coast Park, Lazarus Island)
  • Time periods (NE monsoon; SW monsoon; 1 Inter-monsoon)
Why 3 locations?

Maps powered by streetdirectory
Why 3 seasons?

• Previous satellite post-processing work to determine bathymetry around Singapore required detailed knowledge of turbidity that was provided through the team’s monitoring program.

Reference - https://doi.org/10.1080/01431161.2012.734934
Where are we at this point?

- Purchasing of equipment
- Sourcing of surveyor to conduct baseline survey
- Gathering supplementary data
- Testing the alternative gap fill methods

Looking at small, Man-portable, Yet fully integrated USVs

Lightweight, off-the-shelf
Alternative gap fill methods?

• Data models

Merged product with DATA MODEL TO FILL GAPS

Data models require guidance

Work previously carried out under MSRDP P46
In the end ...

Accurate! And high-resolution

Datum A

Datum B

A new unified Datum X?
Thank you!

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