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Satellite-derived bathymetry of the Achziv coastal area, northern Israel

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Abstract

Satellite-derived bathymetry provides a useful reconnaissance tool for hydrographic surveying programs. This study presents preliminary results of the satellite-derived bathymetry and a comparison with acoustic (multibeam echosounder) dataset.

1. Goal

1.1 Generate a shallow water bathymetry for habitat mapping

The current available bathymetry depicted from the chart is only on a scale of 1:100,000 and is based on dated surveys. A seamless bathymetric model was generated based on satellite imagery and multibeam datasets (deeper than 4 m).

2. Available resources

Reference bathymetry

Landsat 7 imagery (May, 2002)

System: Kongsberg EM1002
Resolution: 2m

Bands: Blue (450 to 520 nm), Green (530-610 nm) and NIR (780-900 nm)
Resolution: 28.5 m

3. Procedure

3.1 Landwater separation
It is possible to extract the water areas from the dry land using Near Infrared (NIR) band.

3.2 Applying water mask
A mask polygon of the submersed areas is used to extract only the water body from the Landsat imagery in the Green and Blue bands.

3.3 Bathymetric algorithm
The Stumpf et al. (2003) was used to generate a bathymetric model using a Blue/Green band ratio.

3.4 Referencing the bathymetric model
Using a statistical analysis, it is possible to reference the algorithm values to the chart’s datum.

4. Results

Final satellite-derived bathymetry model

Contours of the derived model overlaid on the multibeam bathymetry

Effectively, the bathymetry was mapped up to 17 m below MSL. Although the significant depth contour matched the reference bathymetry, with an overall average difference of 0.3 m. The standard deviation was relatively high (10 = 2.4 m).

5. Future directions
The shallow-water bathymetry will be used to estimate the water attenuation occurring in aerial and satellite imagery.

The satellite-derived bathymetry procedure is a useful reconnaissance tool deriving bathymetry and water clarity in the coastal region.

An additional benefit of the procedure is the possibility to generate a time-series that shows changes in bathymetry using multiple Landsat images. This is particularly useful for monitoring seafloor changes in the coastal environment.

References


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