Derivation of high resolution bathymetry from multispectral satellite imagery

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Bathymetric information is fundamental importance to coastal and marine planning and management, nautical navigation, and scientific studies of marine environments. Satellite derived bathymetry can be used in areas where conventional sounding data is lacking and conventional surveys are inaccessible. Log linear bathymetric inversion model and non-linear bathymetric inversion model provides two empirical approaches for deriving bathymetry from multispectral satellite imagery, which have been refined and widely applied over the last decade. This paper compares these two approaches by means of a geographical error analysis for the site Kankesanturai using WorldView-2 satellite imagery. In order to calibrate both models; single beam echosounding (SBES) data were used as reference points. The geographical distribution of model residuals was mapped and their spatial autocorrelation was calculated as a basis for comparing the performance of the bathymetric models. Comparisons reveal consistent geographical properties of errors arising from both models. A spatial error model is used to generate more reliable estimates of bathymetry by quantifying the spatial structure (autocorrelation) of model error and incorporating this into an improved regression model. Log linear model (R^2=0.846) performs better than the non-linear model (R^2=0.692). Finally, the spatial error models improved bathymetric estimates derived from linear and non-linear models up to R^2=0.854 and R^2=0.704 respectively. The root mean square error (RMSE) was calculated for all reference points in various depth ranges. The magnitude of the prediction error increases with depth for both the log-linear and the non-linear inversion models. Overall RMSE for log-linear and the non-linear inversion models were ±1.532 m and ±2.089 m respectively.

Keywords: bathymetry, log linear model, multispectral satellite imagery, spatial error model

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