COASTAL BATHYMETRY FROM HYPERSPECTRAL DATA

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ABSTRACT

A study is underway at the Naval Research Laboratory to investigate relationships of water depth, bottom type, and water inherent optical properties to upwelling spectral radiance of coastal waters. A neural network and data from the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) are used to investigate these relationships. The present paper focuses on the extraction of water depth from AVIRIS data at two Florida test areas: Tampa Bay and Santa Rosa Sound. Sounding data obtained from the National Ocean Survey (NOS) hydrographic database serves as water depth ground truth for this study.

Spectral radiance data over the two test areas is shown to be of relatively low dimensionality, indicating that hyperspectral imaging of these coastal waters represents a high degree of spectral over sampling. Algorithms relating spectral radiance to water depth in these test areas will, therefore, require significantly fewer spectral bands than the total available from AVIRIS. However, the hypothesis explored is that, although high spectral resolution is not required for radiance to depth relationships at a single site, spectral over sampling can be exploited to develop radiance to depth relationships that can be universally applied to diverse sites, where water optical properties, bottom reflectance, and atmospheric conditions vary.

The neural network is the paradigm chosen to map spectral radiance into water depth. Neural networks are trained using the NOS ground truth to estimate water depth from AVIRIS measurements of spectral radiance. This training is done for each site individually and for combined data from both sites. Each test image contains a portion of clear atmosphere and a portion of considerable aerosol contamination. Both clear areas and combined clear and contaminated areas are included in the neural network training tasks. The results presented support the hypothesis that spectral over sampling can be exploited to form universal algorithms.