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# NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

## THESIS

### COASTAL BATHYMETRY USING 8-COLOR MULTISPECTRAL SATELLITE OBSERVATION OF WAVE MOTION

by  
Bradley L. McCarthy  
September 2010 Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion

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Advisor: Second Reader: Richard C. Olsen Fred A. Kruse

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**13. ABSTRACT (maximum 200 Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion words)**

Coastal bathymetry was measured using wave motion as observed by a commercial satellite imaging system. The linear finite depth dispersion relation for surface gravity waves was used to determine nearshore ocean depth from successive images acquired by the WorldView-2 satellite of the coastal area near Camp Pendleton, California.

Principal component transforms were performed on co-registered images and Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion principal component four was found to very effectively highlight wave crests in the surf zone. Change detection images, which included principal component four Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion from successive images, contained both spatial and temporal information. From these change detection images, wave celerity could be determined and depth inversion could be performed.

For waves farther from shore, principal component four no longer highlighted wave crests. Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion Waves could be resolved within a single RGB composite image with equalization enhancement. The wavelength of a wave above a known depth was measured and the wave period method was used to determine depth for other waves in the propagation direction of this wave. Our depth calculations compared favorably to our reference bathymetry. The spatial resolution for this method of determining depth is higher and perhaps more accurate than our reference bathymetry, particularly in the surf zone.

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# **COASTAL BATHYMETRY USING 8-COLOR MULTISPECTRAL SATELLITE OBSERVATION OF WAVE MOTION**

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## **ABSTRACT**

Coastal bathymetry was measured using wave motion as observed Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion by a commercial satellite imaging system. The linear finite depth dispersion relation for surface gravity waves was used to determine nearshore ocean depth from successive images acquired by the WorldView-2 satellite of the coastal area near Camp Pendleton, California.

Principal component transforms were performed on co-registered images and principal component four was found to very effectively highlight wave crests in the surf zone. Change detection images, which included principal component four from successive images, contained both spatial and temporal information. From these change detection images, wave celerity Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion could be determined and depth inversion could be performed.

For waves farther from shore, principal component four no longer highlighted wave crests. Waves could be resolved within Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion a single RGB composite image with equalization enhancement. The wavelength of a Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion wave above a known depth was measured and the wave period method was used to determine depth for other waves in Coastal Bathymetry Using 8-Color Multispectral Satellite Observation of Wave Motion the propagation direction of this wave. Our depth calculations compared favorably to our reference bathymetry. The spatial resolution for this method of determining depth is higher and perhaps more accurate than our reference bathymetry, particularly in the surf zone.

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## Coastal Bathymetry Using 8 Color Multispectral Satellite Observation Of Wave Motion

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