UNIVERSITY OF CALIFORNIA, SAN DIEGO

Modeling Surface Gravity Waves in the Southern California Bight

A dissertation submitted in partial satisfaction of the

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in Oceanography

by

William C. O'Reilly

Committee in charge:

Professor Robert T. Guza, Chairman
Professor Walter H. Munk
Professor Robert L. Parker
Professor J. Enrique Luco
Dr. Richard J. Seymour
Dr. Reinhard E. Flick
Dr. Peter F. Worcester

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ABSTRACT OF THE DISSERTATION

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A methodology is developed for estimating the surface gravity wave field (f=.04–.10Hz) throughout the Southern California Bight using wave data collected at a limited number of sites. A non-negative least squares routine is used to find the deep ocean (outside the Bight) wave spectra which are most consistent with the measurements in a least squares sense. These deep ocean estimates are then used to predict wave conditions at uninstrumented Bight locations. The relationships between the deep ocean waves and the wave measurements and/or predictions inside the Bight are obtained using a numerical wave propagation model. Two wave models, spectral refraction and refraction-diffraction, are considered. Within the Southern California Bight, the two models are most similar for broad incident wave directional spectra, and in deeper waters that are in the far-field of the offshore islands and shoals. For a given location, forward model uncertainty is estimated to be O(30-40%) of the deep ocean energy for narrow incident wave spectra (5° wide in direction; .01Hz in frequency). These errors are often acceptable when compared to the much larger fluctuations in wave energy due to changes in the incident wave direction. Estimates of deep ocean wave spectra, based on existing wave observations, are

compared to wave hindcasts for three large wave events. Smoothness constraints in both direction and time are used to insure that the spectral estimates are both unique and physically realistic. The resulting estimates are consistent with hindcasts for two Northern Hemisphere events, but show poor agreement for a Southern Hemisphere swell. When the deep ocean spectrum is alternatively constrained to be a single, directionally narrow peak, better agreement with the south swell hindcast is obtained. Thus, the inverse estimate appears to be limited by the number of wave observations rather than the accuracy of the wave model itself. Finally, more optimal wave data collection networks are designed using "simulated annealing". A six month field experiment (August 1991 - February 1992) will temporarily expand the present network in an optimal way, and will result in a more definitive test of both the wave models and the overall estimation technique.

work feel like more than just a numerical exercise.

There are also many fellow students that have made both academic and social contributions to my graduate career. Some have gone before me: Uwe Send, Mark Merrifield, Cindy Paden, Scott Jones, and Joan Bernhard - and others are soon to follow: T. Webster Baines, Dan Conley, Scott France & Patty Rosel, Ron George, Phil Hammer, Michele Okihiro, and Cyndy Tynan.

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