BOOK REVIEW

SPACEBORNE SYNTHETIC APERTURE RADAR FOR OCEANOGRAPHY

R. C. Beal, P. S. Deleonibus, and I. Katz, Editors
The Johns Hopkins University Press, Baltimore, 1981

Here is a most unusual and provocative book for anyone interested in the small-scale physics of the air-sea interface. Stemming from a symposium held at The Johns Hopkins University Applied Physics Laboratory in March of 1980, the volume is mainly concerned with results from and the understanding of radar imagery of the ocean surface, particularly the synthetic aperture radar (SAR) carried by the SEASAT spacecraft. This subject is a significant departure from previous topics appearing in the series of publications on the Johns Hopkins Oceanographic Studies, most of which have been concerned with water mass properties and circulation.

The SAR has provided images of the sea that often exhibit puzzling and varied features which must be interpreted in terms of changes in the small-scale roughness (near 30 centimeters length) of the surface. The original function of the SEASAT SAR was to provide imagery of long length surface gravity waves, from which one might derive a badly needed quantity, i.e., two-dimensional surface wave spectra, via Fourier transform techniques. The ocean surface as seen through the radar's eye has proven marvelously more complicated than anticipated, however, with such additional features as internal waves, current boundaries, eddies, wind stress variations, rainfall, oil slicks, and shallow-bottom topographic features appearing in the radar imagery. While surface waves with lengths greater than perhaps 100 meters can often be seen in SAR images as periodic modulations, the functional relationship between the power spectral density (psd) obtained from the film and the surface wave psd is essentially unknown. Indeed, there is much discussion in the book over the basic hydrodynamic mechanisms that allow long waves to be imaged via variations in 30-centimeter wave energy. It follows that the theory of the imaging process for the ocean surface is in a relatively rudimentary state.

The book opens with generalized discussions of surface wave characteristics by D. M. Phillips and S. A. Kitaigorodskii, followed by a theoretical exposition on SAR imaging mechanisms by R. O. Harger, and a review of the state of our understanding of oceanic winds by W. J. Pierson. A number of more detailed research results are presented next, classified according to winds, waves, and circulation. These are punctuated by dramatic examples of SAR images, most of which are of regions off the U.S. east coast (thereby revealing the geographical orientation of the contributors to the book). The clear emphasis of the research papers is on geophysics, not radar technology. Then follows reproduction of some 21 full-swath SAR images of the western North Atlantic, New England, and the central Atlantic states, prepared by symposium organizer R. C. Beal; these illustrate the myriad land and ocean features that characterize SEASAT radar images.

This volume represents the first organized exposition of the oceanic results from SAR and, as such, clearly deserves a place on the bookshelves of anyone interested in this phase of the subject. Beyond this audience, however, there should be considerable interest on the part of oceanographers, marine meteorologists, and forward-looking civilian and military users of the sea. The results presented here are so unusual and compelling that the future will almost of necessity see additional imaging radars in space; however, a great deal of research work remains to be done before maximum use can be made of such an instrument.

JOHN R. APEL

John R. Apel formerly directed the Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration. He is now APL Assistant Director for Planning.