



# Synthetic Aperture Radar Marine User's Manual

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**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
National Environmental Satellite, Data, and Information Service  
Office of Research and Applications



# Synthetic Aperture Radar Marine User's Manual

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**IN MEMORY OF  
JOHN R. APEL  
(1930 – 2001)**



This Manual is dedicated to Dr. John Ralph Apel who conceived of its creation. The “Father” of SEASAT was a pioneer in the use of remote sensing, in particular synthetic aperture radar (SAR), for investigating the physics of the sea. John believed the key to the wide spread acceptance of SAR was in educating potential users to its benefits. It was a great loss in creating this Manual not to be able to fully take advantage of John’s 40 years of experience. Those who knew and worked with John found him to be a dedicated researcher, a visionary leader and a delightful companion. We will miss him.

## ACKNOWLEDGEMENTS

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The views, opinions, and findings contained in this report are those of the author(s) and should not be construed as an official National Oceanic and Atmospheric Administration or U.S. Government position, policy or decision.

## PREFACE

The objective of this Manual is to lay out, for a wide range of users, the types of information that may be obtained from SAR images of the ocean, and methods of analyzing the imagery. It is intended for non-expert but scientifically literate workers who wish to use synthetic aperture data in their studies but who do not quite know what to make of the data.

Spaceborne synthetic aperture radar (SAR) provides a unique view of the Earth's surface. The finely detailed imagery of the ocean's surface from a SAR is assuredly the most complex and least understood data provided by remote sensing instruments. The sea surface can appear featureless or contain the signatures of such diverse phenomena as surface and internal waves, upwelling, current boundaries, shallow water bathymetry, wind, rainfall, roll vortices, convective cells, storms, and a wide variety of sea ice forms.

This book is divided into four sections. The background material in the first section presents the basic properties of SAR as well as introduces the factors behind how the sea surface and sea ice are observed by radar. The remaining sections are devoted to oceanic, atmospheric and boundary layer measurements and sea ice observations. Where appropriate, information is included on how SAR is being used routinely to aid the operational mission of environmental agencies (see for example Chapters 12, 13 and 20).

One of the keys to the broad acceptance and use of SAR is educating potential users about the capabilities of the sensor. Hence the need for the creation of this Manual. It is hoped that it will prove useful to anyone interested in understanding and applying SAR imagery to their work in the marine environment.

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