

# Lecture Notes in Physics

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## Waves on Water of Variable Depth

Edited by  
D. G. Provis and R. Radok

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## INTRODUCTION

It is not an accident that over many years Australian theoretical and observational research have contributed significantly to the topic of this symposium. They have been stimulated by her 20,000 km long shoreline facing three of the Earth's four oceans, in particular, by her unique coast along the Southern Ocean and her substantial continental shelf. The meeting was conceived in the early Seventies and eventually found strong financial support from the International Union of Theoretical and Applied Mechanics (IUTAM) as well as locally from ESSO Australia Ltd., The Broken Hill South Ltd., the Shell Development (Australia) Pty. Ltd., The Broken Hill Pty. Co. Ltd. and Australian Academy of Science, which provided an excellent venue and supporting facilities. About 50 people, active in the field of water waves, attended this symposium, the first IUTAM symposium on the southern hemisphere. Lectures were delivered in the Australian Academy of Science which provided near ideal conditions for the participants.

The topic for the symposium can include a great variety of subjects, and this is reflected in the material presented by the speakers. The papers cover wave-motion on a wide range of scales, from small laboratory experiments and ordinary surface gravity waves to tides and very long-period topographic planetary waves. Some papers include no depth variation or even no finite depth, but despite this diversity there is much common ground. All examples are relevant to waves approaching or travelling along coasts and further coherence is provided by the mathematics used to describe the waves, although this varies from the simplest possible equations through involved non-linear approximations to elegant exact solutions.

Among the problems discussed, two which receive much attention are the generation and propagation of tsunamis and of long waves on the continental shelf. The latter is of special interest in Australia for a number of reasons. Quite a lot of pioneering work in this subject was done in Australia, and the Australian coastline provides some excellent examples in observations taken from tidal records. The mechanism of generation of these waves is not fully understood and new phenomena are being discovered as the available data are further analyzed.

There is still a lot to be discovered about the basic physical processes occurring in waves on water of variable depth, and the common thread running through the symposium is the search for an understanding of these fundamental processes. Several speakers emphasised that further experiments were needed to check this or that result, or that a new theory is needed to explain some experimental results. These sorts of comments included both field observations, with all their inherent complications, and laboratory experiments made under carefully controlled conditions. Our understanding is still limited, but the papers of the symposium represent some of the latest work in a multi-pronged attack on the problems.

Our mathematical techniques also leave much to be desired. In all cases, approximations need to be made and in an appreciable number of the papers the simplest possible equations, the linear long-wave equations, are used. The discussion of theoretical and experimental work for simple three-dimensional geometries, such as islands, shows the difficulties inherent in the subject. Although numerical solutions of these equations can be obtained for most specific problems, there is a clear need for analytical methods to be developed to improve our understanding. Even where analytical results can be obtained, the approximations necessary leave some doubt as to their utility in particular examples, so that careful experiments are desirable.

Papers are presented in roughly chronological order, but with some rearrangement under various headings. Most papers were invited, but an opportunity was given for other participants to present work, and such contributions have also been included.