ANNUAL REPORT FOR SCOR WORKING GROUP 103

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THE ROLE OF WAVE BREAKING ON UPPER OCEAN DYNAMICS

Wave breaking is a widespread phenomenon on the wind driven sea surface that contributes unique characteristics to the boundary layers on either side of the air-sea interface. Despite the strong influence of wave breaking on upper ocean dynamics and air-sea interaction processes, reliable prediction and quantification of the occurrence and dynamical consequences of wave breaking remain elusive goals.

The societal benefits of this research area are through improved reliability in marine environmental model predictions for commercial and recreational offshore enterprises. This is particularly important during severe marine weather events, where safety concerns are paramount.

Our working group includes leading modellers, theoreticians and experimentalists who have joined forces to highlight the shortcomings of our present scientific knowledge and signal future research directions. Our goal is to stimulate the development of more realistic predictive models for upper ocean dynamics that include the very significant influence of wave breaking.

Update

Comprehensive review articles on this topic appeared in the literature since the formation of the WG, necessitating a revision in the terms of reference. In response to the request of the 1997 SCOR meeting for a fuller statement of the new orientation of the WG, the timing of the proposed WG103 meeting in January 1999 in relation to the later-than-usual SCOR meeting in November necessitated getting early approval of financial support. Accordingly, the Executive Director sought, and obtained, the approval of the Executive for funding of $12,500 on the basis of the document submitted for consideration by the SCOR Executive in April 1998.

Revised Terms of Reference

To hold a workshop in January 1999 in conjunction with the Air-Sea Interface (ASI) Symposium to be held in Sydney, Australia in January 11-15, 1999. Invited participants in this special session will be the Working Group members and interested ASI Symposium participants. The goals of this workshop are to

(a) review the present status of our knowledge of wave breaking on the wind driven sea surface in the light of very significant recent advances in theoretical and observational techniques, particularly the quantification of its dynamical and interfacial flux implications for air-sea interaction.

(b) discuss the formulation of strategies for future modelling and experiments arising from these recent significant theoretical and instrumentation developments. These exciting advances include

- the discovery of universal thresholds for predicting breaking in nonlinear modulating gravity wave groups, both unforced and wind-forced, for irrotational waves and waves on a

vertical shear current. This has generated new insight in the modelling of wave breaking statistics and wave breaking influence in spectral sea state prediction models.

- the detection and quantification of wave breaking through infra-red imagery this technique has the potential to detect breaking events, both whitecaps and even micro-scale breakers, through the thermal signature of these structures and to provide a measure of the strength of breaking events.
- several major refinements to our understanding of micro-scale breaking waves and their implications for air-sea interfacial fluxes.
- new developments in modelling upper ocean mixing processes enhancement due to interfacial wave breaking

(c) highlight the contributions made to larger scale atmosphere and ocean modelling from research on wave breaking and the outstanding needs of the larger scale atmosphere and ocean modellers for more realistic parameterisation of physical processes in which interfacial wave breaking plays a significant role.

Scientific Goals of the WG

The overall goal is to prepare an authoritative paper for publication in the open literature under the SCOR umbrella encapsulating the issues (a), (b) and (c), to be submitted within twelve months following the meeting.

Membership

M. L. Banner (Chair)	Australia
S. A. Thorpe	U.K.
V. Kudryavtsev	Ukraine
M. A. Donelan	U.S.A.
O. M. Phillips	U.S.A.
Y. Toba	Japan
W.K. Melville	U.S.A.

1999 Budget

As per the Update, a budget of US$12,500 was approved by the SCOR Executive to support the travel expenses of the above six WG members from the USA, Japan and Europe to attend the SCOR WG 103 workshop in January 1999 in Sydney, Australia.