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Shallow Water Wave Modelling of Coastal Regions of the Oman Sea

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INTRODUCTION

It is well accepted that waves at the surface of the deep ocean can be well predicted with third-generation wave models, based on the energy or action balance equation. However, these kind of models cannot be realistically applied to coastal regions with horizontal scales less than 20-30 km and water depth less than 20-30 m due to their limits related to both shallow water effects and numerical techniques. In general, when dealing with coastal regions, two approaches are available: one is the approach of phase-resolving models which make use of the mass and momentum balance equations[2] while the other one is an extension of the phase-averaged approach of the energy or action balance equation by adding the required physical processes and using appropriate numerical techniques. On the other hand, phase-averaged models, based on the energy or action balance equation, reconstruct the wave spectrum changes in space and time domains. These are either of a Lagrangian nature or of a Eulerian nature. In Lagrangian models, the waves are propagated from deep water towards the shore by transporting the wave energy along wave rays. In Eulerian models, the wave evolution is formulated on a grid; this technique has been used for deep-ocean or shelf-sea wave models such as WAM wave model. With these considerations, an Eulerian phase-averaged model (SWAN) seems to be acceptable in many real field situations on a scale of 20-30 km with a water depth less than 20-30 m.

In fact, SWAN wave model accounts for refraction, wave generation by wind, triad wave-wave interactions, depth-induced wave breaking and wave reflection against obstacles (such as coastlines or breakwaters), in addition to the effects already included in other models such as WAM [1]. Also, wave propagation in cartesian system in near-shore has better accuracy than spherical system and applying shallow water wave model such as SWAN with nested option, make significant improvement in results.

In this paper, the authors have applied the SWAN model to one small-scale domain in the coastal region characterized by shallow water of the Oman sea (Chabahar Bay). This simolution is applicabled for the time interval 9-15 feb 2007.

MODEL FORMULATION

In SWAN, wave characteristics are described in terms of two-dimensional wave action density spectrum governed by the spectral action balance equation: