

## **Paper Title: Phase-Resolved Wave Simulation over Isolated Seamount**

### **1. Summary**

This paper investigates the wind wave deformations above two isolated shallow seamounts using a phase-resolved wave model simulation using the HAWASSI-AB software. The simulations found that isolated shallow bathymetry may generate a crossing sea region endangering ships. The phase-resolved wave simulation results determine detailed wind wave conditions and wave spectra over the whole area, compensating for a lack of experimental data. Waves in the vicinity of the summit surround the seamount and create a central region with more significant waves downstream. Upon traversing Socotra Rock, the interplay of waves results in a turbulent sea in the deep water. Conversely, after surpassing Glagah, waves downstream are somewhat diminished over a considerable stretch of the coastline. In both scenarios, the phase-resolved wave simulation outcomes provide comprehensive information on wind wave conditions and wave spectra across the entire area, addressing the absence of experimental data.

#### **1.1 Motivation**

Research on coastal waves is vital for designing protective structures like harbors and dikes, as well as for sedimentation studies. Numerical simulations play a key role in obtaining detailed information about wave interactions with structures, bathymetry, and beaches, offering insights crucial for coastal safety and management. Shallow bathymetry in the open ocean, as explored in a past study, has global implications, affecting heat, energy, momentum, and material transport in the coastal and regional context, like the East China Sea.

#### **1.2 Contribution**

This study employs numerical simulations using a phase-averaged wave mode which helps to efficiently capture interactions between surface waves and the seafloor.

#### **1.3 Methodology**

This paper will deal with numerical wave simulations over shallow seamounts to investigate the wind wave characteristics around the seamount. Numerical phase resolved wave simulations are conducted based on Boussinesq equations over large domains. The numerical simulations are performed with the well-tested HAWASSI software for nonlinear irrotational wave simulations with a spectral implementation.

#### **1.4 Conclusion**

In conclusion, this article describes numerical simulations of phase-resolved waves around two shallow seamounts. The detailed findings in both scenarios reveal that the seamounts function like optical lenses, significantly refracting and diffracting the waves, causing wave intersections downstream of the summit.

### **2 Limitations**

There was a lack of computation data and the model suffers from limitations in the complex breaking phenomena and bottom friction effect.

### 3 Synthesis

In the future, simulations with a sufficiently large domain are required to support structural designs and coastal safety investigations. Improvement and optimization of the model and validation should be considered for more practical applications.