

IMU-CDC Individual Research Travel Support Program
Activity Reporting Form

Name of Grantee: Dr. Ikha Magdalena
Home Institution and Country of Grantee: Institut Teknologi Bandung, Indonesia
Name of the Host: Prof. Dominic E. Reeve
Name of the Host Institution and Country: Swansea University, Wales, United Kingdom

Topic of the Research Activity: An integrated studies for waves generated by bottom movement
Dates spent Center/Host Institution: 18 Feb 2022 – 21 March 2022



Dr. Magdalena and Prof. Reeve conducted studies on the research topic, assisted by two students and a post-doctoral fellow: the students were Wang Xin, from Swansea University, Alvedian Mauditra Aulia Matin, from Institut Teknologi Bandung, and Dr. Jose Horrillo-Caraballo, a post-doctoral fellow at Swansea University, was in charge of the experiment. Over the course of this visit, a non-hydrostatic two-layer model for waves generated by bottom movement was validated by analyzing data collected from an experiment conducted at the host university. Experimental datasets were reviewed, a model was formulated, the laboratory set-up was used to modify model parameters to fit them, and plate movement was modeled based on experimental bottom movement data. Simulations were then run and analyzed. Dr. Magdalena gave a talk on the effect of seagrass on wave attenuation to an audience consisting of students and faculty members from Swansea University's Mathematics and Engineering Departments.



The research visit yielded one paper on the experiments conducted in Swansea University to investigate tsunami generation by bottom movement, one paper on a two-layer non-hydrostatic numerical model for tsunami generation with validation using an analytical solution and experimental data. These papers are being prepared for submission. Furthermore, the run-up process has been simulated experimentally and will be the subject of further research. The relationship between Swansea University and the Bandung Institute of Technology was also strengthened by this visit. Dr. Magdalena and Prof. Reeve are now in the process of applying for funding from the UK-Indonesia Consortium for Interdisciplinary Sciences together.

Experimental, Analytical, and Numerical Studies for
Waves Generated by Bottom Movement

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Abstract

In this study, we present a two-layer model to analyze the development of surface waves caused by bottom motion. To obtain the surface elevation as a function of x and t , we solve the model analytically using the Fourier-Laplace Transform. Besides, we also solve the model numerically using a staggered finite volume technique with a predictor corrector step to capture wave generation and propagation across an uneven bottom. Several comparative test scenarios were run to assess the accuracy of our numerical model. Experimental research was carried out to demonstrate our model's capacity to capture wave creation and propagation across an uneven bottom. The effect of movement height, width, and phase has been studied employing sensitivity analysis. We believe that this finding will be useful to others attempting to develop an early warning system.