

### Short-term Research Visits (Project No.: 28S-03)

Project title: Coastal Flood Risk Projection in Changing Climate

Principal Investigator: Dr. Harshinie KARUNARATHNA

Affiliation: Swansea University, UK

Name of DPRI collaborative researcher: prof. Hajime Mase

Name of visitor (Affiliation): Dr. Harshinie Karunarathna

Period of stay: 21.12.2016 ~ 29.12.2016

Location of stay: Kyoto and Kanazawa

Number of participants in the collaborative research: 04(provide numbers for DPRI and non-DPRI staff)

- Number of graduate students: None

#### Anticipated impact for research and education

New research collaboration between DPRI, Swansea University and Kanazawa University. This tri-lateral research link will form the foundation for the three Universities to work together to investigate application of coastal morphodynamic models and analysis of morphological change of Japanese beaches, which is extremely important for the sustainable management of beaches in future and also to understand how beach morphology responds to extreme conditions such as typhoons and tsunamis.

#### Research report

##### (1) Purpose

The purpose of the visit was to establish a new tri-lateral research collaboration between DPRI, Swansea University UK and Kanazawa University. The principal investigator Dr. Harshinie Karunarathna maintains strong collaborations between DPRI and has worked with Prof. Hajime Mase and Dr. Nobuhito Mori over a period of 8 years in the past. This collaboration has produced numerous research visits to Japan and UK and 10 research publications in leading international journals and conference proceedings to date. On the other hand Dr. Shiya Umeda at Kanazawa University and Dr. Harshinie Karunarathna have worked together for 2 years where Dr. Umeda spent 12 months at Swansea University, investigating the application of state-of-the-art European Coastal Area models to Japanese coastlines. The recent visit to DPRI and Kanazawa combined these two collaborations to form a new tri-lateral link between the three Universities to combine the varied and complementary research skills of the three investigators to study morphodynamic change of Japanese beaches.

##### (2) Summary of research progress

During Dr. Karunarathna's visit to Kanazawa University, she presented a detailed study on the application of data-driven and behavioural models to investigate the linkages between sediment composition, wave climate and beach profile variability. In addition, detailed discussions were held to further research on the application of coastal area morphodynamic models to investigate variability of Japanese beaches. Currently, Dr. Umeda has established XBeach/Delft3D coastal morphodynamic model to a beach in Kanazawa and in the process of model validation. In addition, some data driven modelling techniques developed by Dr. Karunarathna was applied to Joetsu-Ogata Coast Japan, under the direction of Prof. Mase, to investigate the beach morphology change at a range of timescales and the results were already published in journals and conference proceedings.

### (3) Summary of research findings

The potential of applying European coastal morphodynamics models to investigate beach change of Japanese coastlines has been established. Field measurements required for model validation has been identified. Seasonal variability and variability associated with storm conditions and local climatic variations of Japanese beaches facing Japan Sea and Pacific Ocean have been recognised. Further research is still on-going.

### (4) Publication of research findings

1. Bennet, W.G., Karunarathna, H., Mori, N. and Reeve, D.E. 2016. Climate Change Impacts on Future Wave Climate around the UK, Special Issue: Modeling of Waves in Coasts and Estuaries, *Journal of Marine Science and Engineering* (Open Access).
2. Karunarathna, H., Horrillo-Caraballo, J.M., Kuriyama, Y. Mase, H., Ranasinghe, R. and Reeve, D.E. 2016. Linkages between sediment composition, wave climate and beach profile variability at multiple timescales, *Marine Geology*, 381, pp.194-208.
3. Karunarathna, H. Mase, H. and Baba Y. 2015. Analysis of multi-scale morphodynamic behavior of a high energy beach facing the Sea of Japan, *Frontiers in Marine Science*, Vol 2(51) doi: 10.3389/fmars.2015.00051
4. Mase, H., Tamada, T., Yasuda, T., Karunarathna, H. and Reeve, D.E. 2015. Analysis of climate change impacts on seawall reliability, *Coastal Engineering Journal*, Vol. 57(3). DOI: 10.1142/S0578563415500102
5. Karunarathna, H. Kuriyama, Y. Mase, H. Horrillo-Caraballo, J. and Reeve, D.E. 2015. Forecasts of seasonal to inter-annual beach change using a reduced physics beach profile model, *Marine Geology*, 365, 14-20. dx.doi.org/10.1016/j.margeo.2015.03.009
6. Mase, H., Yasuda, T. Reis, M.T., Karunarathna, H. and Master, J-A, Y. (2014) Stability Formula and Failure Probability Analysis of Wave-Dissipating Blocks Considering Wave Breaking, *Journal of Ocean Engineering and Marine Energy*. DOI 10.1007/s40722-014-0004-0.
7. Karunarathna, H., Reeve, D.E. Mase, H., Kuriyama, Y. and Ranasinghe, R. (2016) Linkages between sediment composition, wave climate and beach profile variability, 20<sup>th</sup> IAHR-IPD Conference, Colombo, Sri Lanka.
8. Karunarathna, H. Kuriyama, Y. Mase, H. Horrillo-Caraballo, J. and Reeve, D.E. (2015) Modelling inter-annual scale beach change, *Coastal Sediment 2015*, San Diego, USA.
9. Karunarathna, H., Mase, H. and Baba, Y. (2015) Analysis of multi-scale beach change, 36<sup>th</sup> IAHR Congress, Hague, The Netherlands.
10. Mase, H. Karunarathna, H. and Reeve D.E. (2014) Climate change effects on seawall stability, SISC Second Annual Conference on Climate Change: Scenarios, Impacts and Policy, Venice, Italy.