26th International Congress on Modelling and Simulation, Adelaide, SA, Australia, 30 Nov–4 Dec 2025
mssanz.org.au/modsim2025

Combining catchment hydro-sedimentological models with wetland eco-geomorphological models to assess mangrove resilience to climate and land use changes in the Pacific Islands

E. Jorquera[a], J. F. Rodríguez[a], P. M. Saco[b] J. P. Quijano Baron[a], A. Breda[c] and S. Sandi[d],

[a] School of Engineering, The University of Newcastle, Callaghan, Australia. [b] School of Civil and Environmental Engineering, University of Technology Sydney, Ultimo, Australia. [c] Water Modelling Systems, WaterNSW, Sydney, Australia. [d] School of Engineering, Deakin University, Waurn Ponds, Australia.
Email: Jose.rodriguez@newcastle.edu.au

Abstract: Mangrove wetlands of the Pacific Islands are crucial ecosystems that offer a range of valuable services, including provision of habitat for marine life, protection against floods, and carbon storage. These wetlands are typically found in low-lying coastal areas that are vulnerable to sea level rise (SLR). When combined with climatic and human-induced pressures on surrounding regions, this vulnerability can lead to destabilization of these sensitive environments.

The ability of mangroves to withstand changes in climate and land use is closely tied to the availability of sediment. Mangroves can adapt to rising sea levels by incorporating sediment and decomposing biomass into the soil, which helps elevate the forest floor through a process known as accretion.

This study applies an eco-geomorphological model to mangrove wetlands in the Pacific Islands to forecast their development over the next century and evaluate their resilience under different climate and land use scenarios. To assess changes in the catchment, hydro-sedimentological models are used, and the resulting sediment loads are integrated into eco-geomorphological models alongside SLR effects. The approach relies primarily on remote sensing data, making it highly applicable for evaluating the vulnerability of other mangrove wetlands globally, especially in areas with limited ground-based information.

Keywords: *Pacific Islands, mangroves, eco-geomorphological modelling, hydro-sedimentological modelling, climate change*