Coupling optical and acoustic remote sensing techniques in coral reef environments for geomorphological studies (Magoodhoo Reef – Maldivian Archipelago)

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Combining optical imagery and acoustic seafloor mapping data have greatly improved geomorphological mapping techniques in tropical coral reef environments. Our work made use of multisource elevation data (i.e., satellite-derived bathymetry; 3D optical models generated by applying photogrammetric techniques to UAV imagery; multibeam bathymetry) collected over the entire Magoodhoo reef, which marks the discontinuous southwestern marginal rim of Faafu Atoll, in the Maldivian archipelago. Remote data were ground-truthed using an observational ROV on the fore reef and within the lagoon, and by collecting photo-transects over the reef flat. A geomorphological map of the Magoodhoo Reef was then generated, covering the entire Magoodhoo Island, the reef flat and the backreef zone, and the submerged sector of the reef to a depth of 120 m along the oceanic edge of the atoll, and 60 m along the lagoon edge. The map has led to a more detailed understanding of the processes driving the morphological changes of the entire Magoodhoo reef. The oceanward margin shows steep terraced slopes that reveal a complex history of late Pleistocene/Holocene sea-level fluctuations, while the backreef slopes are generally gentler, although in places they may show abrupt escarpments and overhangs. We mapped several levels of submerged reef terraces on the fore reef (from ~10 to ~120 m below present sea level) and a variety of reef-associated sedimentary landforms in the lagoon that respectively allowed us to better investigate the mechanisms and

timing of reef formation and the present morphodynamic processes governing the evolution of the island.

Keywords: Coral reef, Multibeam Echosounder, Photogrammetry, 3D models, geomorphological mapping, reef terraces