Spatiotemporal Physical Modeling of Tropical Islands Within the Digital Ecosystem Avatar (IDEA) Project

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Abstract: The Moorea Island Digital Ecosystem Avatar (IDEA) project has been initiated in 2013 by a group of international researchers to build a virtual representation of Moorea Island, South Pacific. The main aim of the project is to model an entire ecosystem, observe the changes through it and be able to predict future changes reliably. The Moorea IDEA project incorporates observations, experiments, data, and theory across a coupled 3-D marine-terrestrial landscape to model where physical, chemical, biological, and social processes interact to shape the island's phenotype.
In order to generate the 3D physical model of the Island, multi-sensor data with varying accuracies, timestamps and spatial resolutions need to be fused. High resolution optical satellite images (Pleiàdes, Worldview-2), LIDAR data over land and water, existing DTMs, aerial film photography extracted and scanned from archives, underwater sonar measurements for modelling the bathymetry, underwater photogrammetry for monitoring the coral growth, UAV flights recording of archaeological sites and for mapping the lagoon habitat are among the data being processed in the project. This paper describes the project and addresses the processing methods and the problems encountered during the processing of multi-sensor and multi-resolution data. High resolution DSMs and orthoimages have already been generated using Pleiàdes images with 70 cm pan resolution acquired over Moorea and Tetiaroa in summer 2014. The images have been acquired in triplet mode. High resolution bathymetry data has also been integrated into the generated DSM. The final physical 3D model, amended by landuse data and other semantic information will provide a presentation and a geospatial analysis platform to the project participants from many other disciplines.

Keywords : Ecosystem Modeling, Satellite Imagery, LiDAR, UAV, Underwater Photogrammetry