UNDERWATER OPTICAL MAPPING

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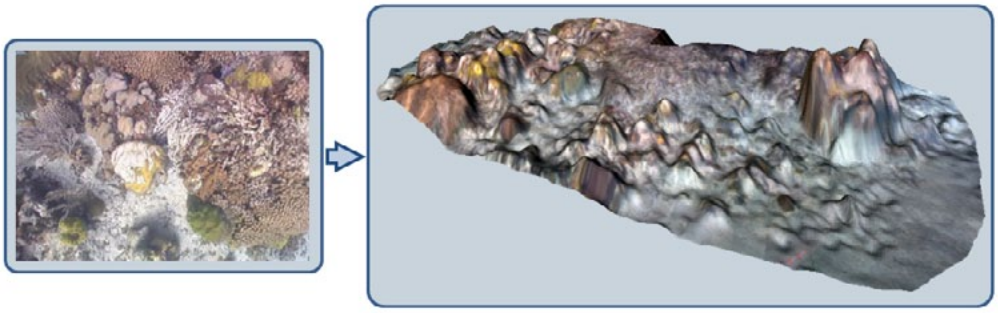
Robot navigation and mapping has greatly advanced in the last few years as a tool for environmental monitoring and seafloor characterization. Seafloor imagery is routinely acquired during near-bottom mapping surveys conducted with both remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs). Deep-sea hydrothermal fields or shallow-water coral reef communities are, for instance, two scenarios that have long been the target of such studies. Imagery is useful to characterize the nature and distribution of geological features and biological communities, extract ecological indicators, and to provide a permanent visual record of the seafloor condition. However, imaging studies often yield large numbers of images (several tens of thousands, especially in deep-sea cruises) that are frequently underutilized largely because of the difficulties inherent in processing and visualizing large data sets. Moreover, light suffers from a rapid and nonlinear attenuation underwater that affects the acquired images.

In this paper we will describe ongoing work at the University of Girona towards development and application of vision-based seafloor survey methodologies, including large area 2D mosaicing (>1sqkm), monocular-based 3D mosaicing, and stereo seafloor modeling. The developed tools set a first step towards detecting and documenting the temporal variations associated with the active processes operating at these sites.

We will also illustrate the result of blending composite mosaics into a seamless high-resolution picture of the seafloor to provide a meaningful representation of the seafloor. Light attenuation, suspended particles (producing light scattering), strong parallax and frequent moving elements are typical in underwater imagery. Therefore, conventional blending techniques used in terrestrial imagery are not always adequate in the underwater context. Finally, we also present an approach to create accurate three-dimensional textured models of the seafloor using monocular video sequences. The method takes into account the geometry of the scene through a 3D vertex selection mechanism which results in a reduction in the complexity of the final 3D model, with minimal loss of precision.



SUBMARINE ACTIVITIES OF THE ROYAL NAVAL OBSERVATORY

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The Eurasian-African plate boundary crosses the called "Ibero-Maghrebian" region from the San Vicente Cape (SW Portugal) to Tunisia including the south Iberia, Alboran Sea, and northern of Morocco and Algeria. The low convergence rate at this plate boundary produces a continuous moderate seismic activity of low magnitude and shallow depth, where the occurrence of large earthquakes is separated by long time intervals. In this region, there are also intermediate and very deep earthquakes. In this area there are several seismic networks deployed, as for example the WM BB network. But, due to the fact of that many events are located at marine areas and the pour geographic azimuthal coverage at some zones provided by land stations, earthquakes parameters (location, depth,…) are poorly determined. To solve these problems, two ROA initiatives have been funded by the Spanish "Ministerio de Educación y Ciencia": The ALBO project (RIOA05-23-002) and the FOMAR net project (CGL2005-24194-E), both of them supported by Spanish Navy.

The ALBO project aims to install a permanent ocean bottom observatory in the surroundings of the Alboran island. This submarine observatory was installed about 1800 meters away from the island on the ocean bottom, with a 46 meters depth, and linked to the surface by a fiber optic submarine cable. The surface equipments, installed on land, collect all data and transmit them to ROA by Navy intranet facilities and by satellite. In the submarine part several instruments have been deployed: a broad band seismic sensor (CMG-3T BB) and a pressure gauge are integrated in the Güralp system, but also a current meter will be installed in the future. Also, several TCP-IP connections and power are available for future additionally instruments. Complementary on the island, a permanent geodetic GPS station and a meteorological station are installed. The Alboran island is declared as a Natural Park and also as an underwater reserve, so authorizations for the installation was needed from several autonomic and national institutions.

The FOMAR net project consists to deploy three long term temporal OBS's at the Gulf of Cádiz and Alborán sea. The OBS's were manufactured in KUM Laboratories with a BB seismic sensor (CMG-40T), an Hydrophone (HTI-04-PCA/ULF) and a KUM compass for orientation, and the recorder is a GEOLON-MCS (manufactured by SEND). All system is contained in titanium pressure tubes including batteries. First deployment was carried out past April.

The actual situation of both projects is shown in this work.