Estimation of Seabed Surface Areas from ROV Oblique Still Images

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ABSTRACT

Since 2008, the Portuguese Task Group for the Extension of the Continental Shelf has been operating the ROV "Luso" (rated for 6000m depth) for geological sampling of the deep North Atlantic seabed, performing surveys on, *e.g.*, seamounts and hydrothermal vent fields. Amongst other sensors, the ROV is equipped with a full HD video camera with which still images of the deep ocean floor are recorded. Fixed on the ROV's frame are two underwater "line" lasers, each generating a sharp green line (532nm) over the seabed. The two lasers are paralleled and calibrated at a set distance. Provided that the camera's angle of view is known, numerical values for seabed surface area may be calculated using direct measurements taken from the pictures containing the laser lines. We present the corresponding main mathematical formulas, which are derived from simple geometrical considerations, and discuss how to generalize these results for an arbitrary camera tilt or pan. We present an example of application of our method by estimating values for percent coverage of rock substrate versus sediment. Our results are also relevant for determining seabed polymetallic nodule abundances from still images obtained during ROV surveys.

Keywords: Image processing, Seabed areas and percent coverage, ROV surveys.