SATELLITE DERIVED BATHYMETRY USING PHYSICS BASED ALGORITHMS AND MULTISPECTRAL SATELLITE IMAGERY

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Abstract: Satellite-derived bathymetry SDB becomes of greater interests to clients within the hydrographic, environmental and engineering communities, as it is capable to map large or remote coastal areas worldwide. Few different approaches are applied for satellite sensors, using stereoscopic image pairs, radar and SAR imagery interpreting the impact of water depth on surface waves or water level, and multispectral images analyzing the spectral response of reflected light on water depth. The latter is nowadays most effective for optical shallow waters.

This multispectral technology requires sophisticated algorithms that take into account sensor properties, multiple environmental impacts from atmosphere, sea surface, in-water and seafloor properties. The approach presented here is therefore based on a physics based retrieval algorithm within the Modular Inversion and Processing System MIP, that account for these impacts and is applicable for multi- and hyperspectral satellite and airborne sensors.

In this study, MIP was used to calculate and validate SDB in six areas, including different water types and distributed worldwide. Essentially we used Wordview-2 satellite imagery, supplemented with Rapideye and Landsat 7/8. Validation proofs SDB to be reliable within the range of 10-15% (CE90) compared to various in-situ data. The max. depth reached were are about 30-40m in clear water area, 10-15m in moderate turbid waters and about 1-5m in turbid waters. Unfavorable environmental conditions like strong sunglint, cloudiness and turbidity hamper the bathymetry extraction or disable it at all.

In contrast to traditional methods SDB proofed to be able to cover large spatial areas in short time, enable the mapping of very shallow water areas, is cost effective and requires no labour mobilisation and local infrastructure.

Key words: Bathymetry, water depth, seabed, satellite