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Underwater stereo-photographic measurement of small scale roughness: limits to spatial correlation accuracy

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In recent years stereo-photogrammetry measurements of seafloor small scale roughness have been reported in the literature. Stereo-photogrammetry algorithm consists of a comparison between areas (windows) belonging to corresponding regions of a pair of photos. This comparison may be performed numerically or by human eyes using a photogrammetric stereocomparator. The results of this process are then converted in an array of seafloor heights. Until now underwater stereo-photographic data are given with no quantitative measurement of the positions and position correlation lengths errors: this work addresses this problem applying the results to the SAPHO system (Seafloor Automatic PHOtogrammetry) developed at NURC. It is shown that positional error estimates for stereo-photographic systems must take into account not only line/matrix resolution and system geometry but also the effects of comparison window size and image quality. A method by which this can be achieved is described. It is also shown that the stereo-photographic systematic error has an important effect when the purpose of the measurement is to determine seafloor correlation length or power spectral density for acoustic scattering estimation.