A method for mapping submarine sand waves using multi-angle optical sun glitter remote sensing images

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**Abstract.** Submarine sand waves are visible in optical sun glitter remote sensing images and multi-angle observations can provide valuable information. In this paper, we present a method for bathymetric mapping of submarine sand waves using multi-angle sun glitter information from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) stereo imagery. Based on a multi-angle image geometry model and a sun glitter radiance transfer model, sea surface roughness is derived using multi-angle sun glitter images. These results are then used for water depth inversions based on the Alpers-Hennings model, supported by a few true depth data points (sounding data). Case study results show that the inversion and true depths match well, with high correlation coefficients and root mean square errors (RMSEs) from 1.45 m to 2.47 m, and relative errors from 5.48% to 8.12%. The proposed method has some advantages over previous methods in that it requires fewer true depth data points, it does not require environmental parameters or knowledge of the sand-wave morphology and it is relatively simple to operate. On this basis, we conclude that this method is effective in mapping submarine sand waves and we anticipate that it will also be applicable to other similar topography types.

**Keywords:** multi-angle; sun glitter remote sensing; submarine sand waves; bathymetric mapping