

# Determination of water depth with high-resolution satellite imagery over variable bottom types

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ABSTRACT: A standard algorithm for determining depth in clear water from passive sensors exists; but it requires tuning of five parameters and does not retrieve depths where the bottom has an extremely low albedo. To address these issues, we developed an empirical solution using a ratio of reflectances that has only two tunable parameters and can be applied to low-albedo features. The two algorithms[]the standard linear transform and the new ratio transform[] were compared through analysis of IKONOS satellite imagery against lidar bathymetry. The coefficients for the ratio algorithm were tuned manually to a few depths from a nautical chart, yet performed as well as the linear algorithm tuned using multiple linear regression against the lidar. Both algorithms compensate for variable bottom type and albedo (sand, pavement, algae, coral) and retrieve bathymetry in water depths of less than 10-15 m. However, the linear transform does not distinguish depths .15 m and is more subject to variability across the studied atolls. The ratio transform can, in clear water, retrieve depths in >25 m of water and shows greater stability between different areas. It also performs slightly better in scattering turbidity than the linear transform. The ratio algorithm is somewhat noisier and cannot always adequately resolve fine morphology (structures smaller than 4-5 pixels) in water depths >15-20 m. In general, the ratio transform is more robust than the linear transform.