



A three dimensional representation of the Northern tip of Diego Garcia atoll derived from a combination of satellite data and vessel-based soundings. Reef geomorphology is clearly resolved.

Three dimensional reconstructions of Chagos reefs from satellite

The reefs of the Chagos are remote and inaccessible. Opportunities to research the coral formations are rare, with the sheer size of the archipelago precluding detailed surveys of geomorphology. The clear waters of the central Indian Ocean, however, allow sunlight to penetrate to great depths and illuminate the seabed. These conditions are excellent for imaging the reefs from orbit. Modern commercial spaceborne platforms such as the Ikonos satellite provide imagery with very high spatial resolution; that is they can resolve very fine detail on the Earth's surface. At an altitude of 680km (423 miles), the Ikonos orbits the globe every 98 minutes, continually collecting data in the visible portion of the electromagnetic spectrum at a pixel resolution of 16m². By considering the two wavelengths that penetrate water to the greatest degree (blue and green), satellite data can be processed to retrieve values of water depth¹. The production of bathymetric maps from satellite data is possible since the absorption of short wavelength light (450–530 nanometers) by water is well constrained, and relative differences in attenuation between spectral bands can be inverted to give a measure of the thickness of water imaged. When a limited amount of independent bathymetric soundings are available with which to tune the retrieval algorithm, the technique is accurate in up to fifteen metres water depth. The extracted bathymetry and original satellite image can be combined to yield a three dimensional view of the seabed. In turn, this product can be used to investigate reef geomorphology, complexity, and habitat distribution². During the 2006 Chagos expedition, the technique was employed to test the degree to which reef fish respond to the roughness and complexity of the seabed on the atoll rim of Diego Garcia³.

¹ Stumpf RP, Holderied K, Sinclair M (2003). Determination of water depth with high-resolution satellite imagery over variable bottom types. *Limnol Oceanogr* 48:547-556

² Purkis SJ, Myint S, Riegl B (2006) Enhanced detection of the coral *Acropora cervicornis* from satellite imagery using a textural operator. *Remote Sens Environ* 101:82-94

³ Purkis SJ, Graham NAJ, Riegl B (2008) Predictability of reef fish diversity and abundance using remote sensing data in Diego Garcia (Chagos Archipelago). *Coral Reefs* 27:167-178

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