

PS Satellite Imagery and Visualization of the Caicos Platform*

By

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Abstract

The Caicos Platform has proven to be an area of continuing interest to researchers in modern carbonates, an important training venue, and a valuable modern analog for understanding facies patterns of subsurface isolated platforms. We hope to promote this interest by making readily available a set of processed satellite images and an offshore/onshore digital elevation model (DEM), along with examples of how this data can be visualized and used.

The clearest satellite images of Caicos Platform from 1972 to ~2004 were acquired and processed. Image processing was done so that apparent water penetration was maximized and delineation of submerged features was emphasized. The primary images are 30-meter Landsat TM complemented by older 57-meter Landsat MSS and recent 15-meter ASTER. The processed scenes were georeferenced to a base image in GIS, creating a stack of co-registered images that can be effectively used for change detection. Masks were created for water and land to enable integration of different images and maps. Soundings, along with earlier work deriving estimated water depths based on the spectral characteristics of a Landsat TM image, were used to create a digital bathymetric map. This offshore depth map was integrated with an onshore DEM derived from NASA Space Shuttle elevation data (SRTM) for the islands. Various satellite images and maps can be draped on the DEM within the GIS to provide perspective views. To increase accessibility, improve learning, and promote spatially accurate feedback, the stack of images, color-coded DEM, and maps are being exported out of GIS using the free Adobe Reader and TerraGo's GeoPDF.

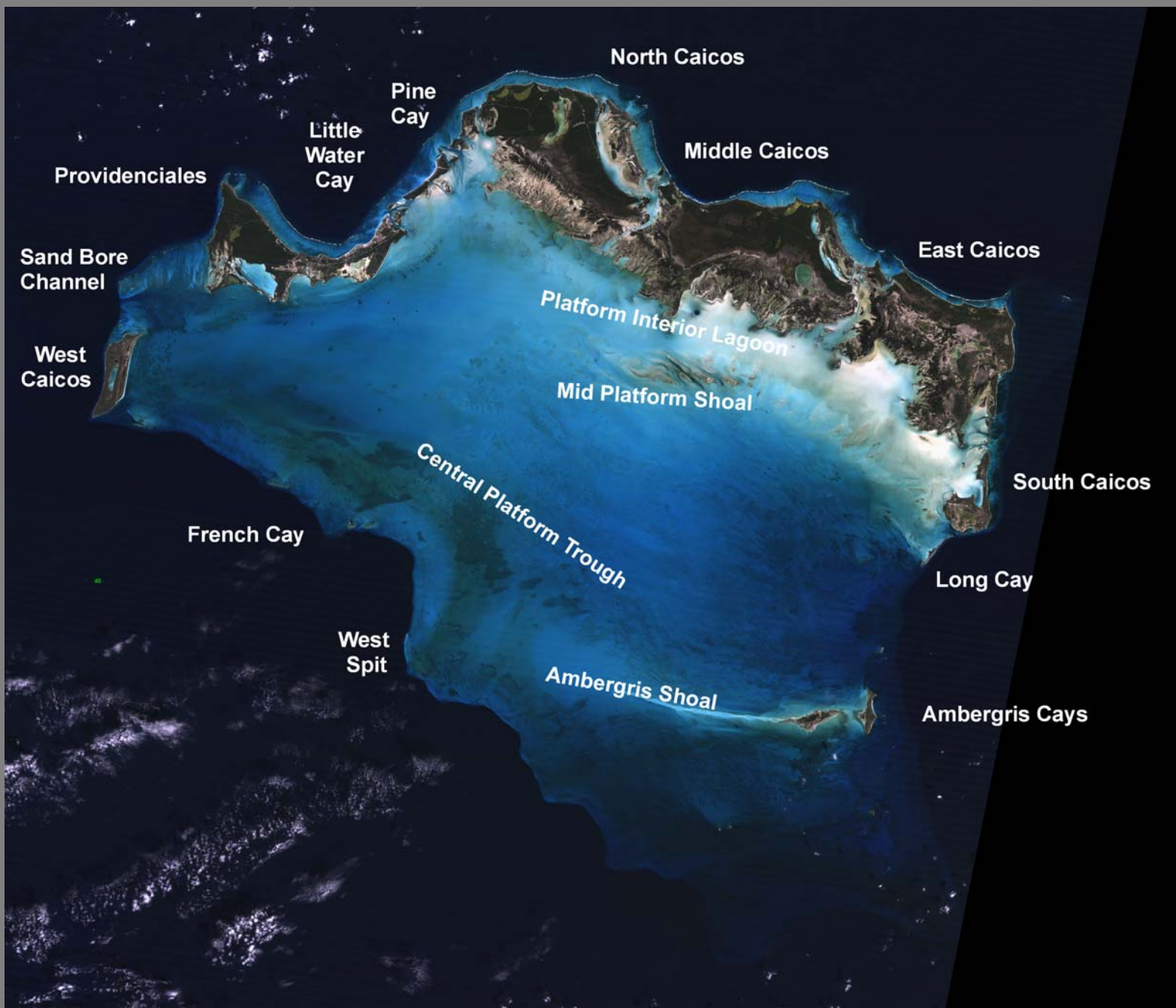
Satellite Imagery and Visualization of the Caicos Platform



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Rationale

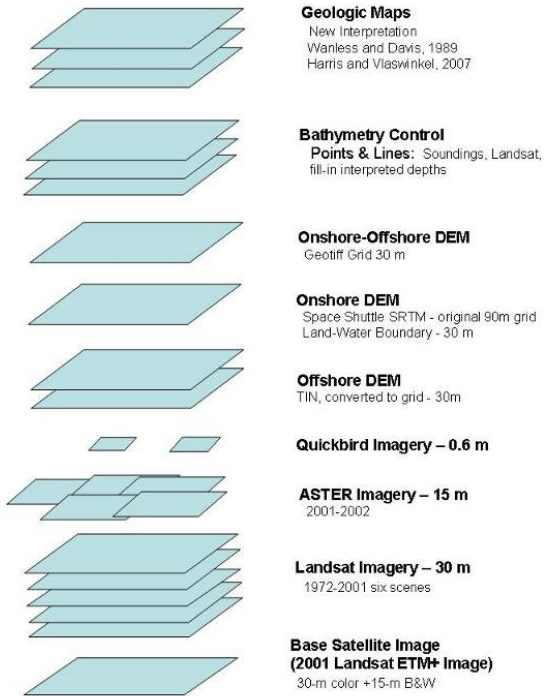
- The Caicos Platform is an area of continuing interest to researchers in modern carbonates, an important training venue, and a valuable modern analog for understanding facies patterns of subsurface isolated platforms.
- We hope to promote this interest by making readily available a set of processed satellite images, a digital elevation model (DEM), and examples of how this data can be visualized and used.



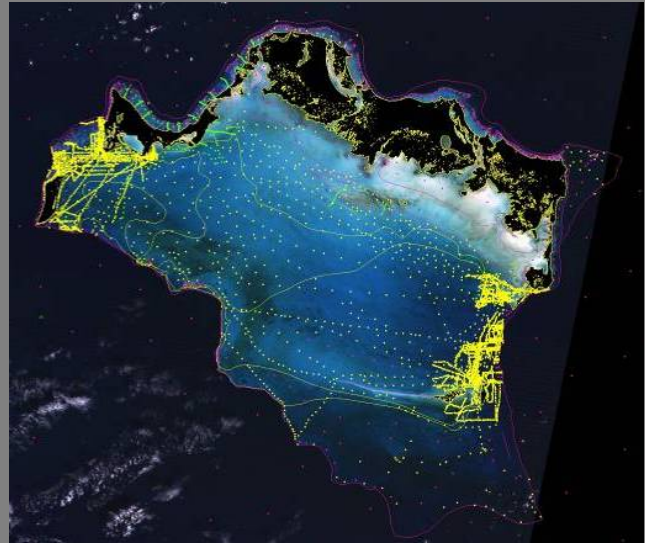
1990 Landsat TM natural color image in GIS with locations

Caicos GIS

GIS Stack of Images & Maps for Caicos Platform

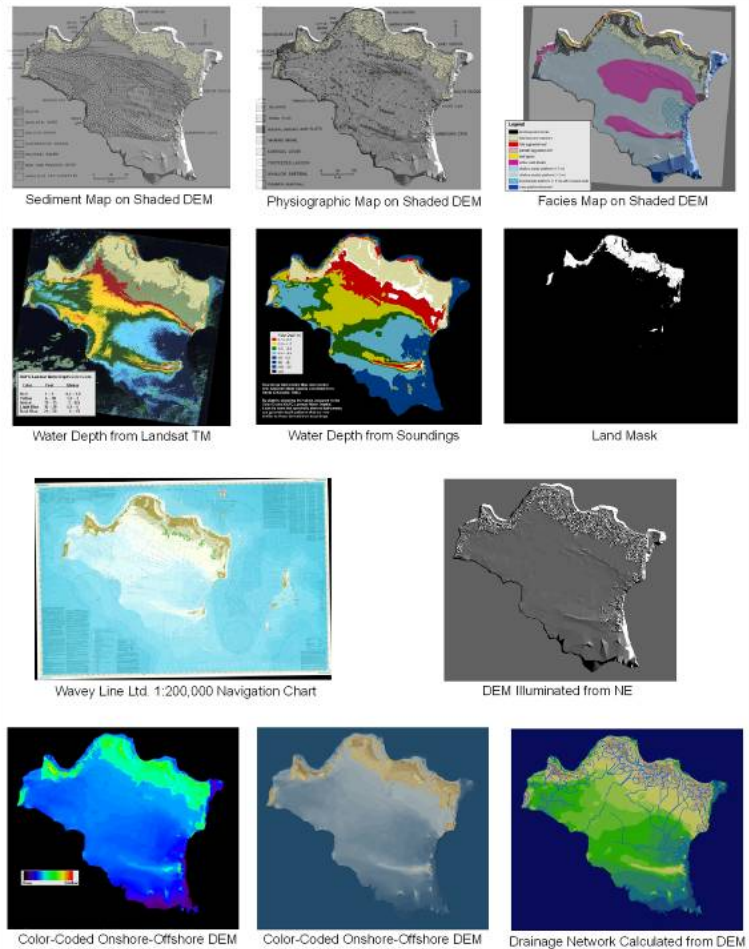


Stack of co-registered images, maps, and control data for Caicos GIS

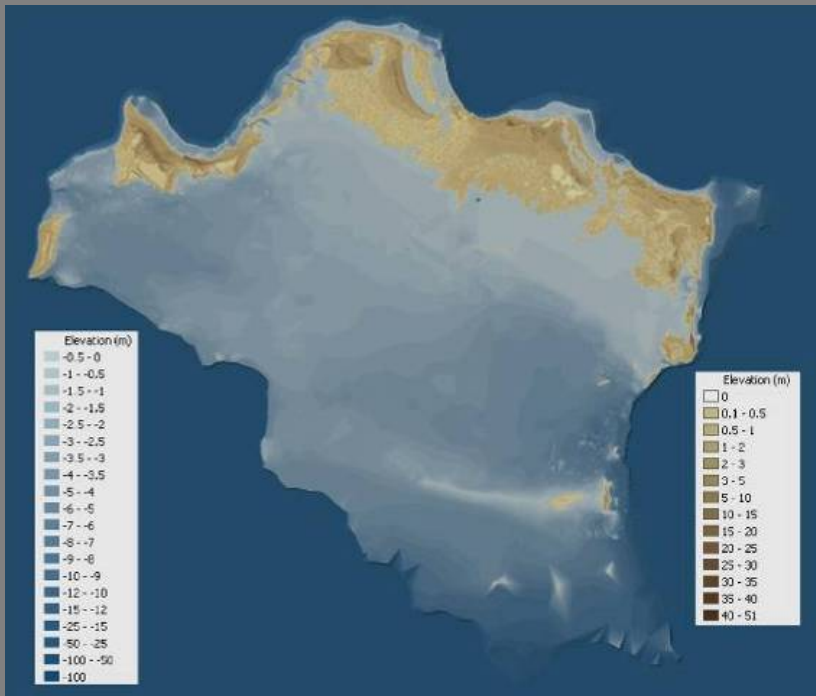


Bathymetric control data: Yellow dots and lines are measured data (soundings, Space Shuttle land/water boundary, interpolated contours); purple dots and lines are water depths interpreted from the Landsat imagery.

Overview of satellite images, maps and enhanced DEM in the Caicos GIS

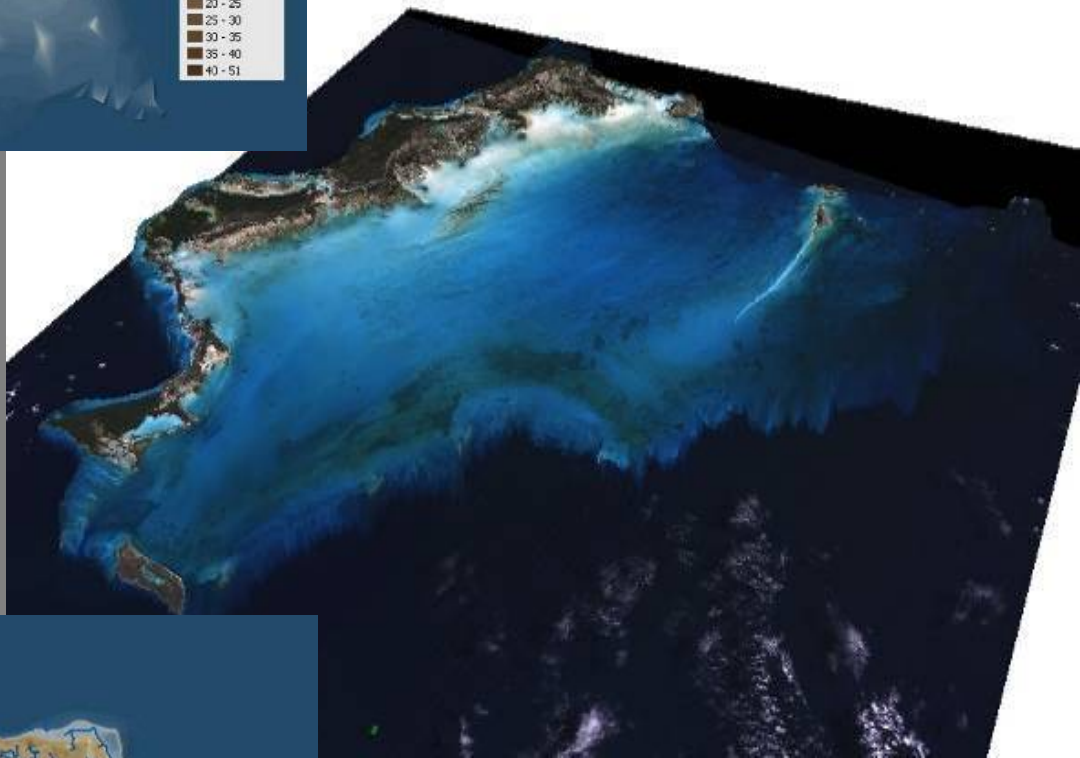


DEM and Examples



Offshore and onshore DEMs merged in GIS and color-coded with elevation or water depth in meters.

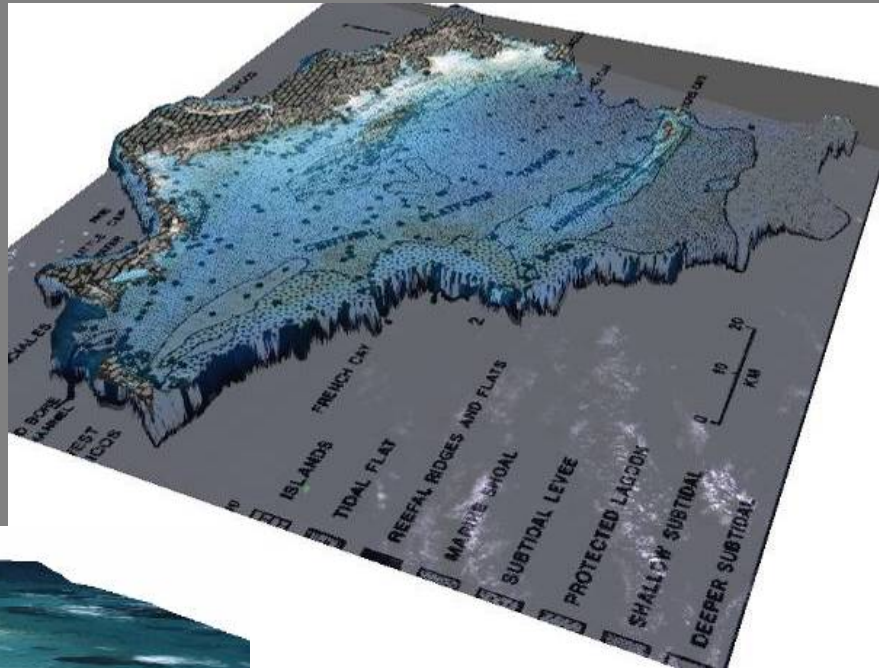
Perspective view looking ENE of 1990 Landsat TM image draped onto DEM (50X vertical exaggeration).



Drainage map showing pruned (low density) network derived from onshore-offshore DEM.

DEM and Examples

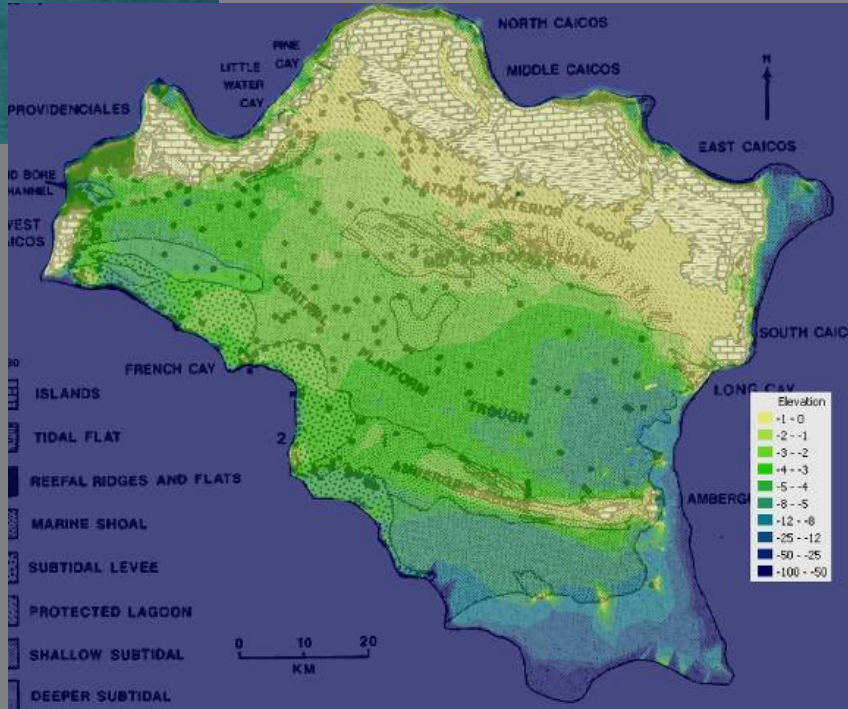
Perspective view looking ENE of physiographic map (Wanless and Dravis, 1989) merged with 1990 Landsat TM image and draped onto DEM.



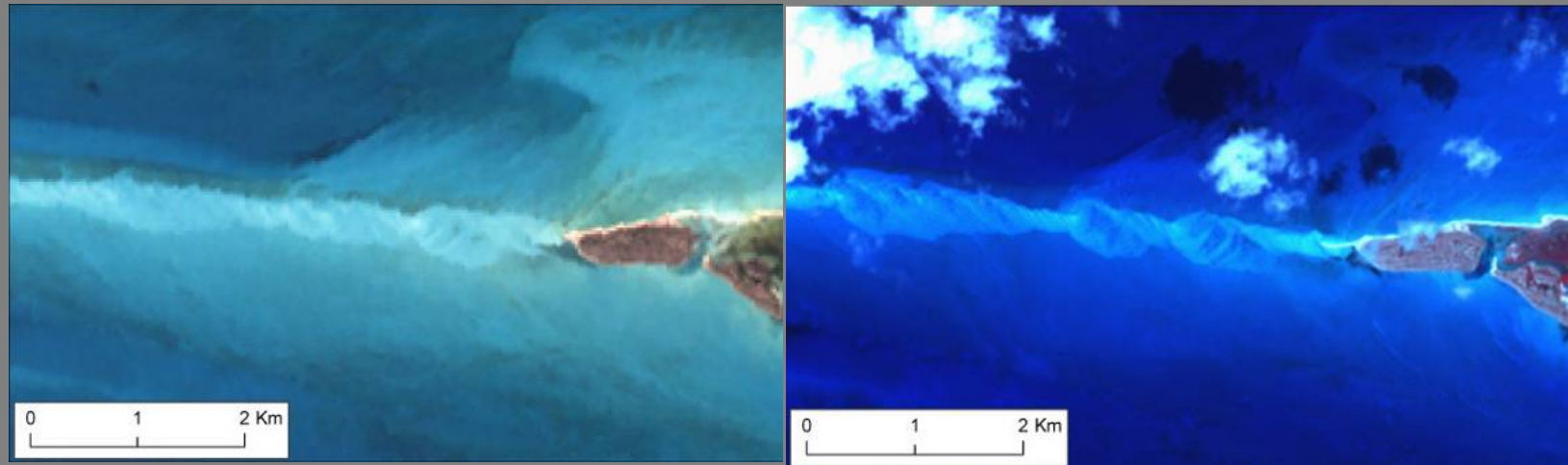
Close-up perspective view of Ambergris Shoal looking West with 2004 Quickbird satellite image draped onto DEM (50x vertical exaggeration).



Physiographic map (Wanless and Dravis, 1989) draped onto color-coded DEM. Bathymetry patterns and water depths can be compared directly with the geologic map.



Using the Data

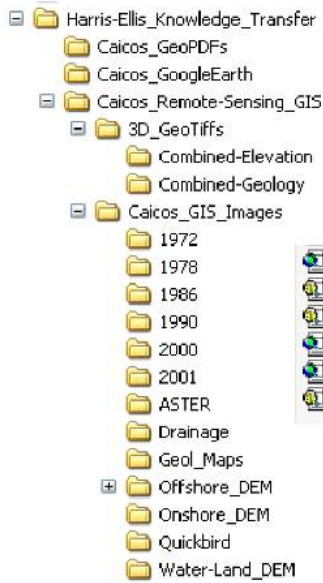


Change detection of sand waves along the Ambergis Shoal with 1986 Landsat (left) compared with 2002 ASTER (right). Wave fronts have moved and the geomorphology of the sand waves has changed.

Perspective view of Little Water Cay (looking ESE) with sediment map (Wanless and Dravis, 1989) in background and high-resolution Quickbird satellite image draped over DEM (10X vertical exaggeration) in foreground. Satellite imagery supports both regional and detailed mapping.

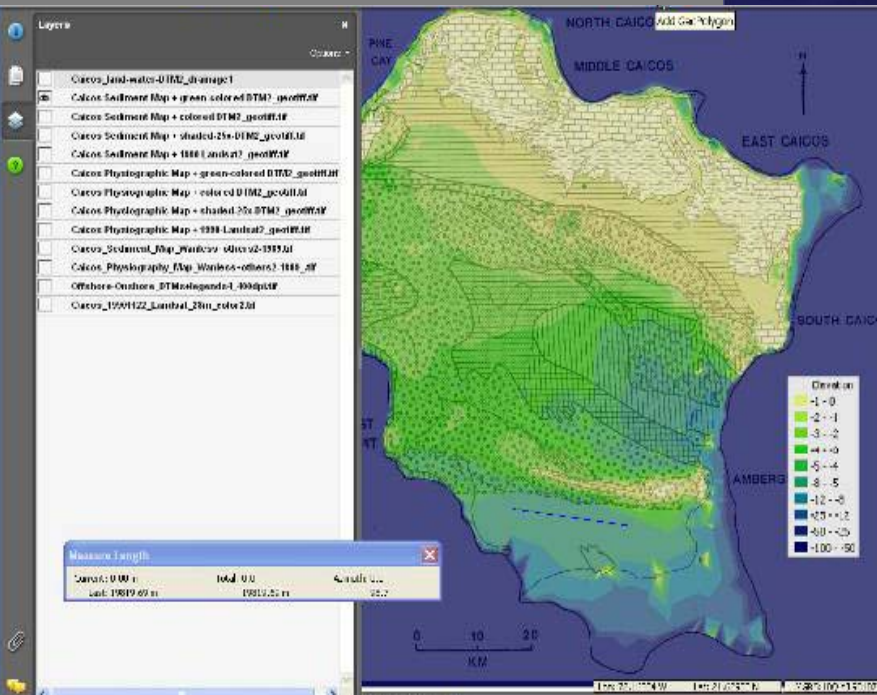


Knowledge Transfer



Full-resolution satellite imagery and maps in GIS format (with ESRI ArcGIS 9.2 mxd and sdx project files), GeoPDFs, and GoogleEarth images are provided on a DVD (Harris-Ellis Knowledge Transfer) included with our paper. The organization of the digital files is shown to the left.

A GIS layer (the onshore-offshore color-coded DEM) transferred out of the GIS and displayed in GoogleEarth.



The GIS stack of geologic maps transferred out of the GIS and into Adobe Reader using GeoPDF, enabling image and map comparison, location, measurement, and interpretation to be done outside of GIS.

