The Use of Simulated Visible/Infrared Imager/Radiometer Suite (VIIRS) and Landsat Data Continuity Mission (LDCM) Imagery for Coral Reef Monitoring

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INTRODUCTION

Coral reefs are some of the most biologically rich and economically important ecosystems on Earth. Coral reefs are Earth’s largest biological structures and have taken thousands of years to form. Coral reefs not only provide important habitat for many marine animals and plants, but they also provide humanity with food, jobs, chemicals, protection against storms, and life-saving pharmaceuticals.

Severe bleaching events have occurred that have dramatic long-term ecological impacts to corals, including loss of reef-building corals, changes in benthic habitat, and, in some cases, changes in larval fish populations (Holden and Ledrew, 1995). Some researchers suggest that 10 percent of Earth’s coral reefs have already been destroyed and that another 60 percent are in danger. Scientists have proposed that as much as 95 percent of Jamaica’s reefs are dying or dead.

This poster reports on a Rapid Prototyping Capability (RPC) experiment done to determine whether future NASA sensors – the Visible/Infrared Imager/Radiometer Suite (VIIRS) and Landsat Data Continuity Mission (LDCM) – could generate key data products for the Integrated Coral Reef Observation Network (ICORON)/Coral Reef Early Warning System (CREWS) Decision Support Tool (DST) operated by the National Oceanic and Atmospheric Administration (NOAA).

DATA PROCESSING FOR SELECTED SITES

Sites selected were Looe Key, FL, and Kaneohe Bay, HI.

EO-1 Hyperion image data over Looe Key, FL, located at NOAA’s National Coastal Data Development Center was collected in autumn (October 26, 2002). The imagery was composed of 242 bands that covered the spectral range from 355 nm to 2577 nm with 10 nm bandwidth. Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) imagery over Kaneohe Bay was obtained from NASA’s Jet Propulsion Laboratory archive. AVIRIS provides for 224 channels over a range of 380 nm to 2500 nm. The AVIRIS data over Kaneohe Bay was flown on a Twin Otter on March 1, 2005. This provided ~37 m pixels and a 1.9 km swath.

Preprocessing the image data included the following:

1) subsetting bands, 2) spatial cropping of image, 3) creating a land mask, 4) assessing striping, 5) removing bad lines, 6) performing an atmospheric correction on the imagery, and 7) deglittering the image.

Using their approach, a chlorophyll [Chl] concentration image was computed for the Looe Key area.

RESULTS

Kaneohe Bay is the largest sheltered body of water in the Hawaiian Islands. The chief physiographic zones of Kaneohe Bay are primarily the inshore-inner bay and outer bay. Numerous patch reefs, rising to less than a meter from the surface, typify the inshore section. The entire shoreline is edged by a fringe reef about 0.5 m deep. The outer bay portion consists of an extensive shallow coral-reef root of about 0.4 m in depth. Figure 2 exhibits an image of the study area.

The processing steps for the AVIRIS data paralleled that of the Hyperion data discussed above. The swath width of the low-altitude AVIRIS dataset (< 5 m pixel size) was not expansive enough for VIIRS simulation (~ 750 m pixel).

Figure 3a shows a [Chl] image for Looe Key based on simulated VIIRS data. The tan areas near the top of the image are land features. Figure 3b shows the Looe Key benthic classification map based on simulated LDCM data. LDCM RPC imagery was used to compute benthic habitat maps.

The atmospheric correction employed a cloud-shadow technique (Reinersman et al., 1998; Lee, 2007). This method was applied to compute the atmospheric radiance contribution using two nearby pixels in which one pixel was cloud-shadow and the neighboring pixel was in direct

RELEVANT REFERENCES


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