INTRODUCTION AND OVERVIEW

The RPC (Rapid Prototyping Capability) experiment demonstrated the value of original design VIIRS (Visible/Infrared Imager/Radiometer Suite) and LDCM (Landsat Data Continuity Mission) sensor data to the NOAA Integrated Coral Reef Observation System (ICON)/Coral Reef Early Warning System (CREWS).

The NOAA Office of Oceanic and Atmospheric Research operates ICON/ CREWS as part of its Coral Reef Watch program, created in response to the increasing decline (bleaching) of coral reefs and related benthic ecosystems worldwide. NOAA and NASA support the U.S. Coral Reef Task Force created by Executive Order P.L. 13089, requiring the conservation and protection of the nation's coral reefs.

Coral bleaching events have dramatic long-term ecological impacts, including loss of reef-building corals, changes in benthic habitat and, in some cases, changes in larval fish populations. Even under favorable conditions, it can take many years for severely bleached reefs to recover. Some experts 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.

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 people with food, jobs, chemicals, protection against storms, and life-saving pharmaceuticals. For instance, anti-cancer drugs and painkillers have been developed from coral reef products.

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Applied Science Program
Gulf of Mexico Initiative

National Aeronautics and Space Administration

CREWS

Coral Reef Early Warning System

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ICON/CREWS IMAGE PROCESSING

Initial, or parent, sources of hyperspectral imagery were used in conjunction with the RPC tools to simulate VIIRS and LDCM imagery. Earlier RPC sensor simulations had been validated through comparisons with Landsat, Hyperion, the Advanced Land Imager (ALI), and high spatial resolution airborne imaging systems.

Hyperspectral imagery of two selected coral reef sites – Looe Key, FL, and Kaneohe Bay, HI – were downloaded and archived. Both Looe Key, EO-1 (Hyperion) and Kaneohe Bay (AVIRIS) imagery were atmospherically corrected and used to produce renditions of RPC simulated VIIRS and LDCM imagery.

From this simulated data, maps of chlorophyll concentrations, absorption, and scattering were produced for both coral reef study sites. Further, bottom type classifications were performed. Accuracies of about 30% were demonstrated for water quality parameters and about 77% accuracies for bottom classification maps.

Some example figures from the study are shown to the right (from top to bottom and left to right) and exhibit the chlorophyll image for Kaneohe Bay, an absorption coefficient image for Kaneohe Bay, the Looe Key benthic classification map, and the Kaneohe Bay bottom classification map respectively.

The conclusions of the study document the data continuity represented by NASA's future satellite missions to provide requisite data needed by partner agency decision support tools -- in the present instance, NOAA's ICON/CREWS program.