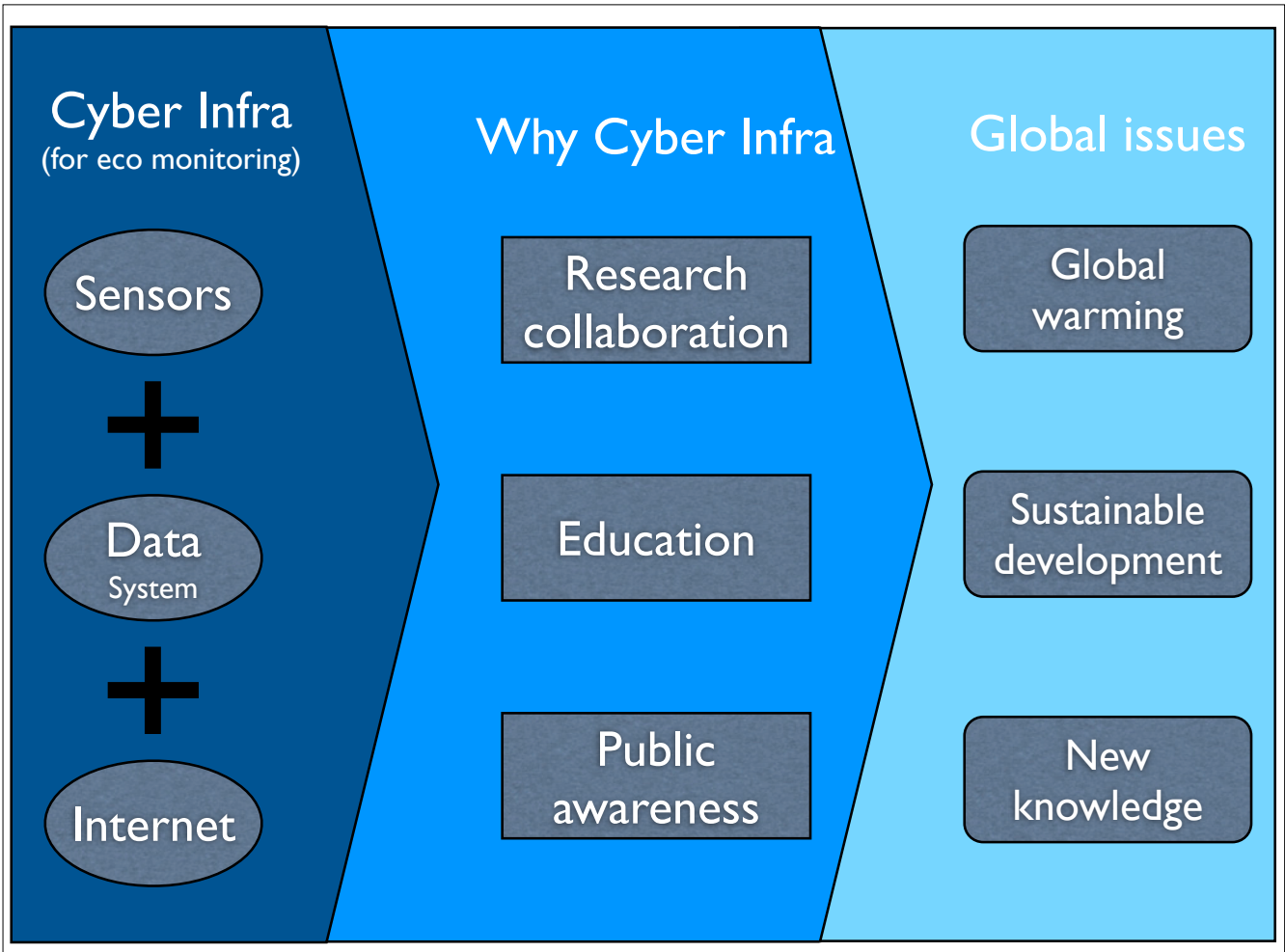


การใช้ระบบ cyber infrastructure ติดตาม การเปลี่ยนแปลงสภาพแวดล้อมทางทะเล

ศรเทพ วรรณรัตน์
LSR/NECTEC

NAC, 1 April 2013





CREON is a collaborating association of scientists and engineers from around the world striving **to design and build marine sensor networks**. Presently this is not a formal organization but instead the group is bonded by good will and the financial assistance of the Moore Foundation. New members are welcome.

Sensor networks on land are becoming common. Extending this to the marine environment poses **many challenges such as fouling and data transmission**. However the benefits are enormous as we attempt **to understand the stresses that are shaping the marine world**. In particular coral reefs are exhibiting signs of decay around the world as global warming, over fishing and pollution have an impact.

Creon Sites

Australia



[Great Barrier Reef]

French Polynesia



[Moorea Coral Reef (MCR)]

Taiwan



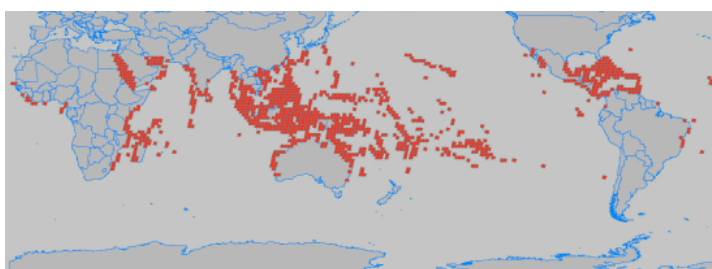
[Kenting]
[Orchid Island]

Thailand



[Koh Racha Yai]

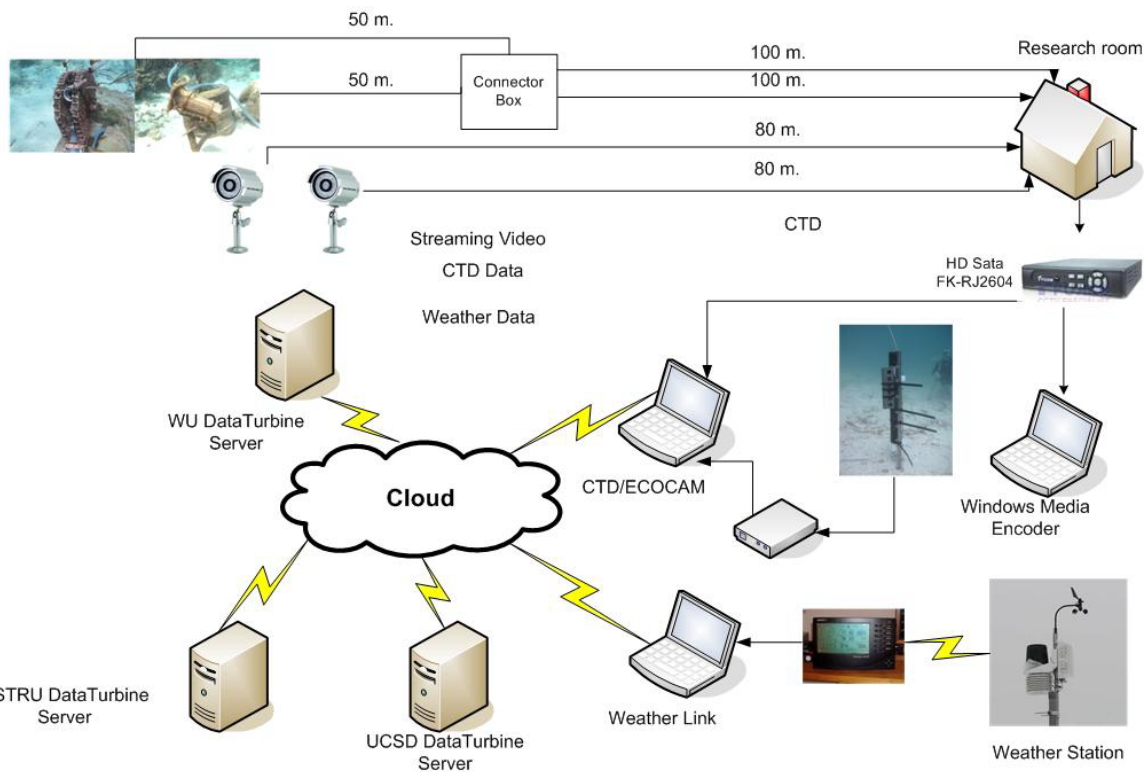
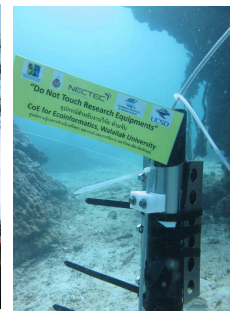
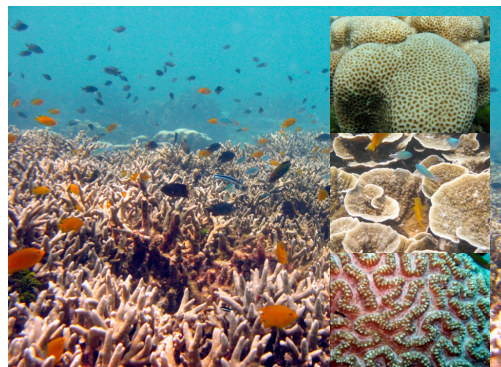
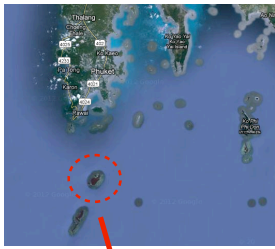
Where are coral reefs found?



- $17^{\circ}\text{C} < \text{Temp} < 34^{\circ}\text{C}$
- $30 < \text{Salinity} < 38$ (PPT)
- Depth < 200 ft
- others e.g. wave, current, wind, pH

<http://www.coral-reef-info.com/>

Coral Reef Monitoring



System Overview of Racha Island, Walailak University

User login

Username *

Password *

[Request new password](#)

User menu

- Recent content

Search

DataTurbine

DataTurbine is a robust **real-time streaming data engine** that lets you quickly stream live data from experiments, labs, web cams and even Java enabled cell phones. It acts as a "black box" to which applications and devices send and receive data. Think of it as express delivery for your data, be it numbers, video, sound or text.

DataTurbine is a **buffered middleware**, not simply a publish/subscribe system. It can receive data from various sources (experiments, web cams, etc) and send data to various sinks (visualization interfaces, analysis tools, databases, etc). It has **"TiVO" like functionality** that lets applications pause and rewind live streaming data.

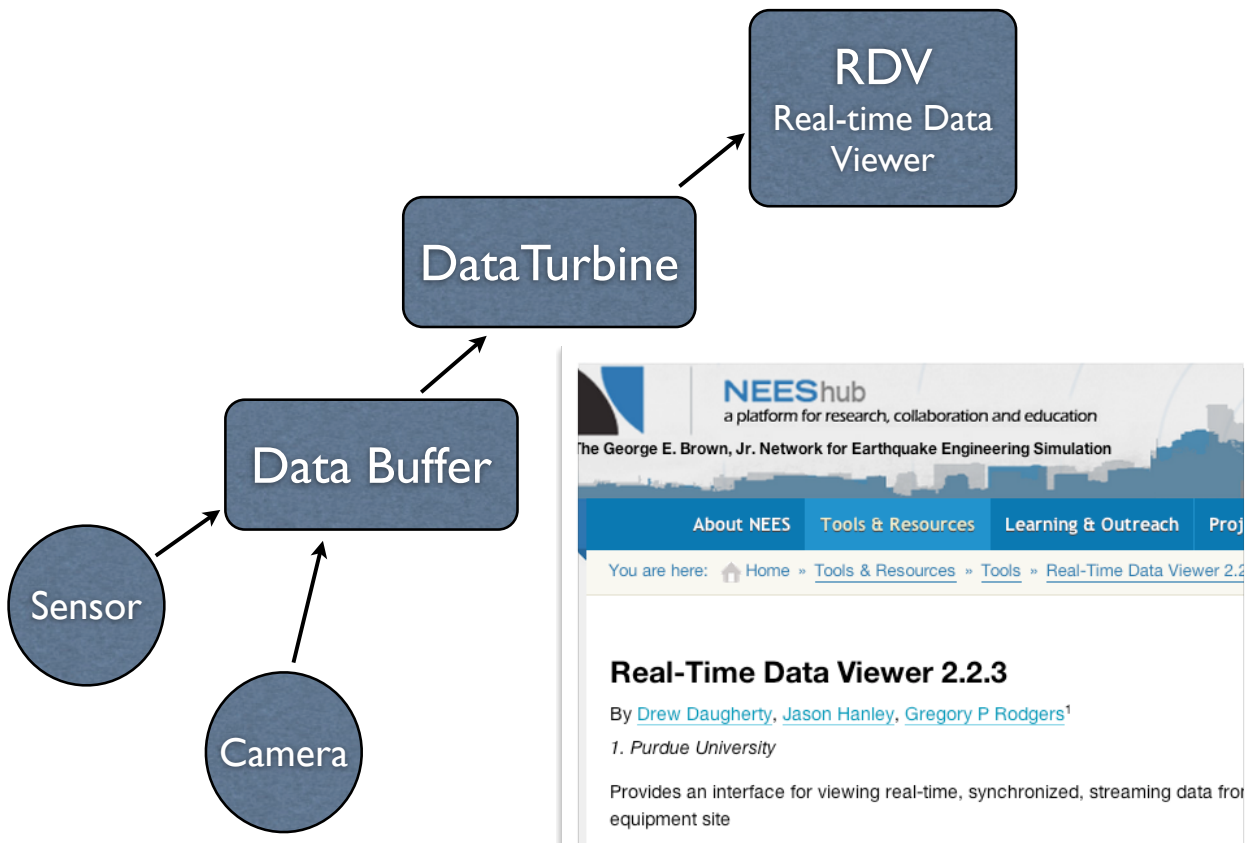
DataTurbine is **open source** and free. There is also an active developer and user community that continues to evolve the software and assist in application development.

Why Use It??

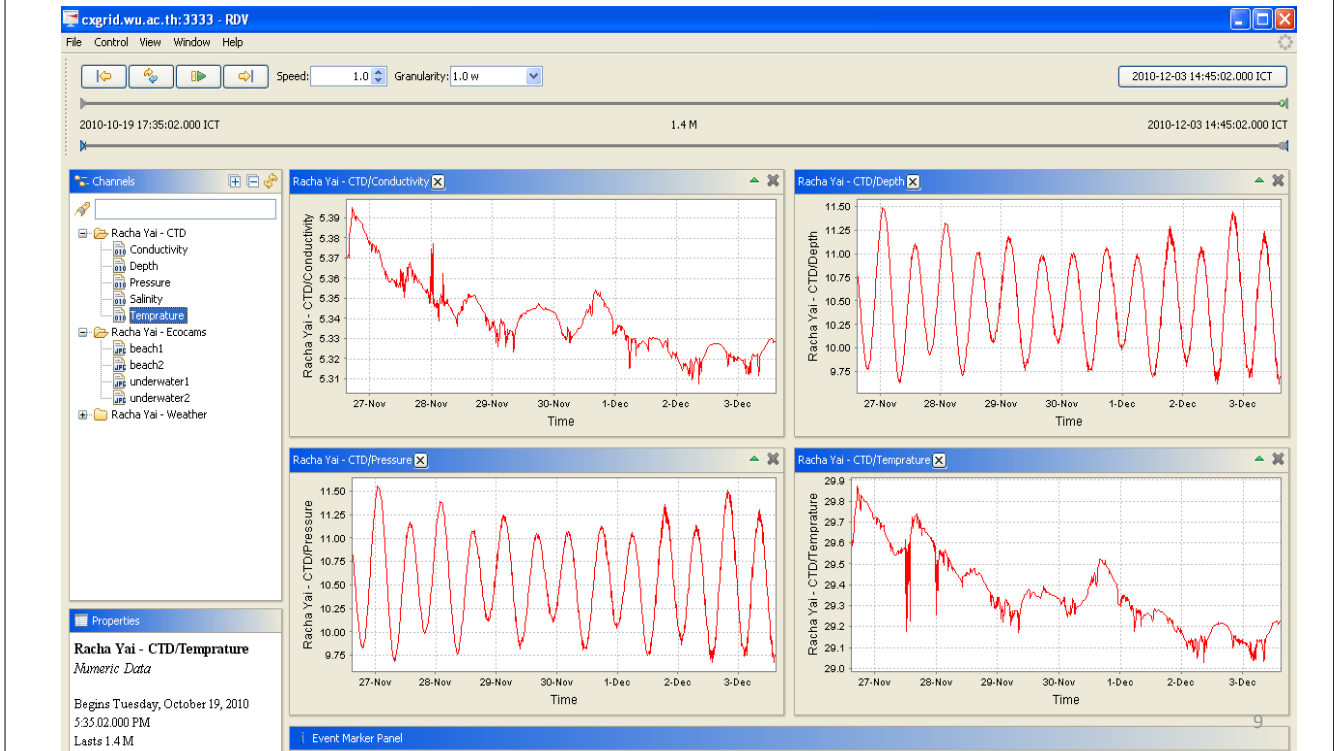
- Extendable:** It is a free Open Source project with an extensive well documented API.
- Scalable:** It uses a hierarchical design that allows a network structure that grows with the requirements of your application
- Portable:** DataTurbine runs on devices ranging from phones & buoys to multicore servers.
- Dependable:** Using a Ring Buffered Network Bus, it provides tunable persistent storage at key network nodes to facilitate reliable data transport
- Growing:** There is also an active developer and user community that continues to evolve the software and assist in application development.

Latest News

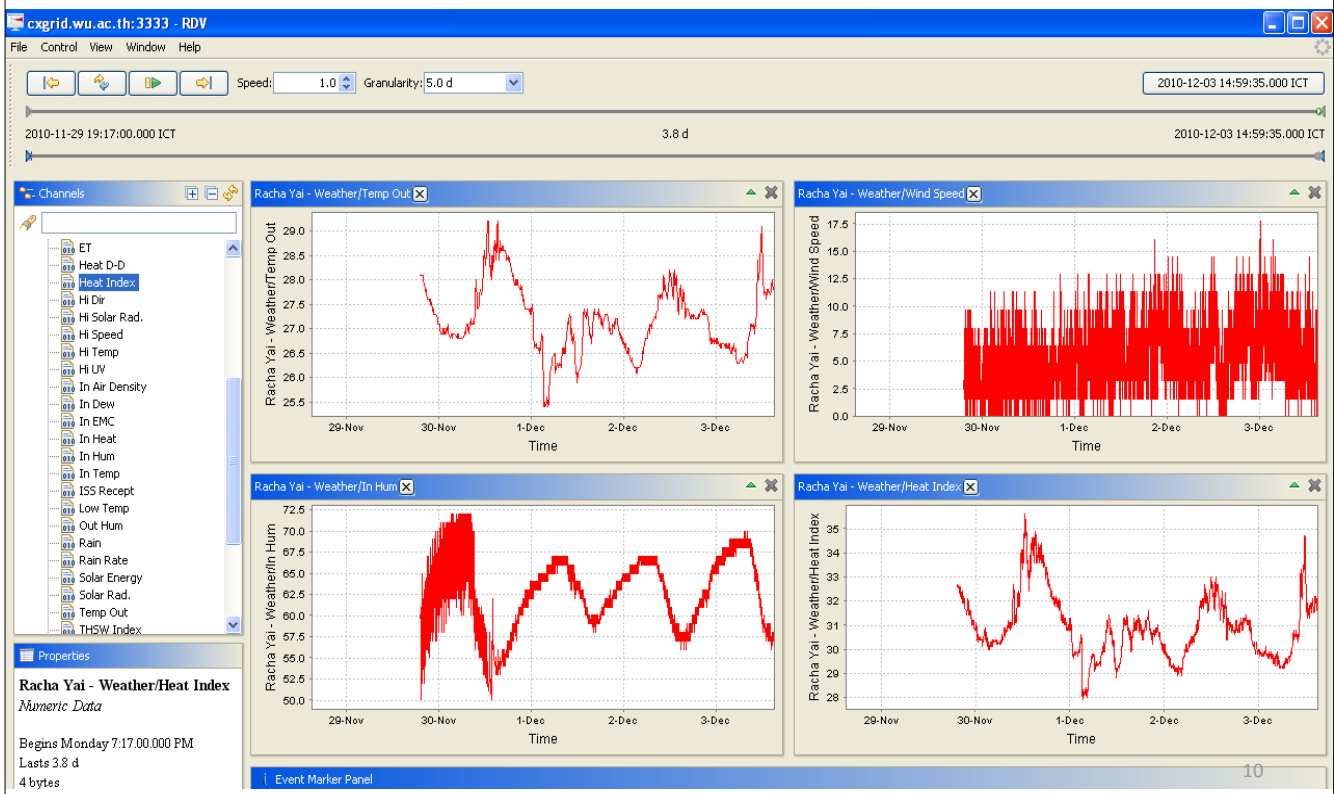
Training workshop: Software tools and strategies for managing sensor networks, April 23-26, 2013	Feb 14 2013
New OSDT release: Open Source DataTurbine (V3.2 Production)	Sep 29 2012
OSDT Group Collaborates with Researchers at Northern Arizona University in NSF Southwest Experimental Garden Array (SEGA) project	Sep 12 2012
OSDT Team Deploys Android Sensor Pod in Crystal Lake Wisconsin	Aug 7 2012
Data Android Turbine Sensor Pod Presentation at 12th Annual International Coral Reef Symposium (ICRS)	Jul 8 2012
OSDT presents at LTER Workshop	Apr 30 2012 to May 4 2012
Testing of OSDT Sensor Pod at Moorea LTER	Jan 2 2012 to Jan 31 2012



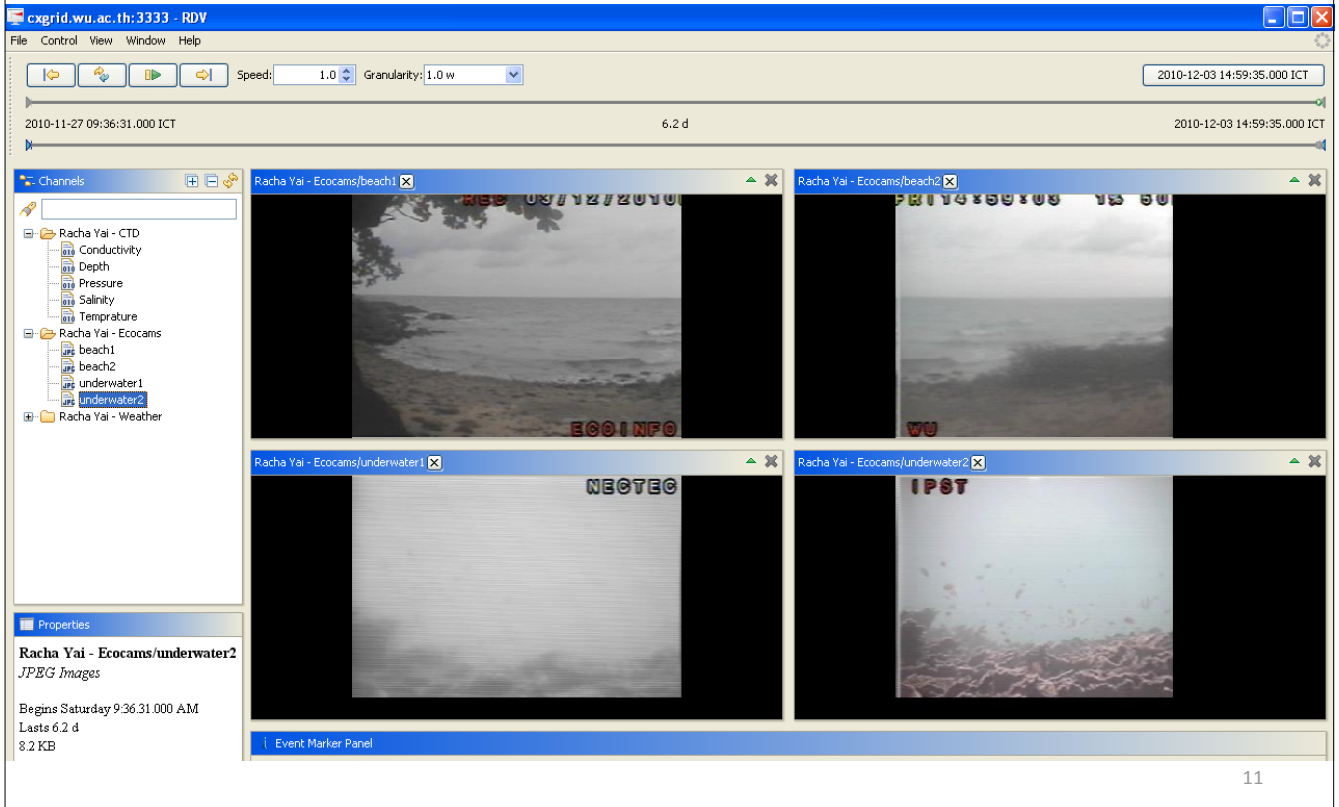
DataTurbine Real-time Data Viewer (RDV): CTD data



RDV: Weather data



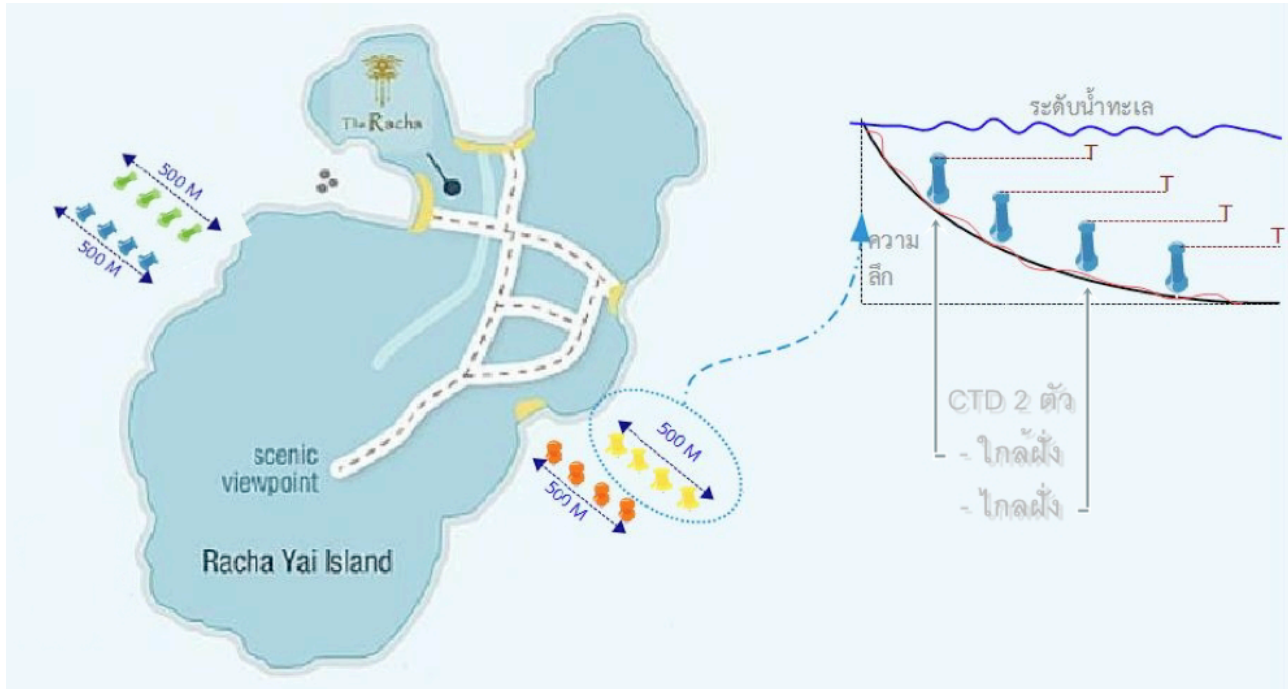
RDV: Ecocam data



The screenshot displays the RDV (Real-time Data Viewer) software interface. The main window shows four video feeds from ecocams at Racha Yai. The feeds are labeled 'Racha Yai - Ecocams/beach1', 'Racha Yai - Ecocams/beach2', 'Racha Yai - Ecocams/underwater1', and 'Racha Yai - Ecocams/underwater2'. The interface includes a menu bar (File, Control, View, Window, Help), playback controls (Speed: 1.0, Granularity: 1.0 w), and a channel list on the left. The bottom left panel shows properties for 'Racha Yai - Ecocams/underwater2', including 'JPEG Images', 'Begins Saturday 9:36:31.000 AM', 'Lasts 6.2 d', and '8.2 KB'. The bottom right corner shows the number '11'.

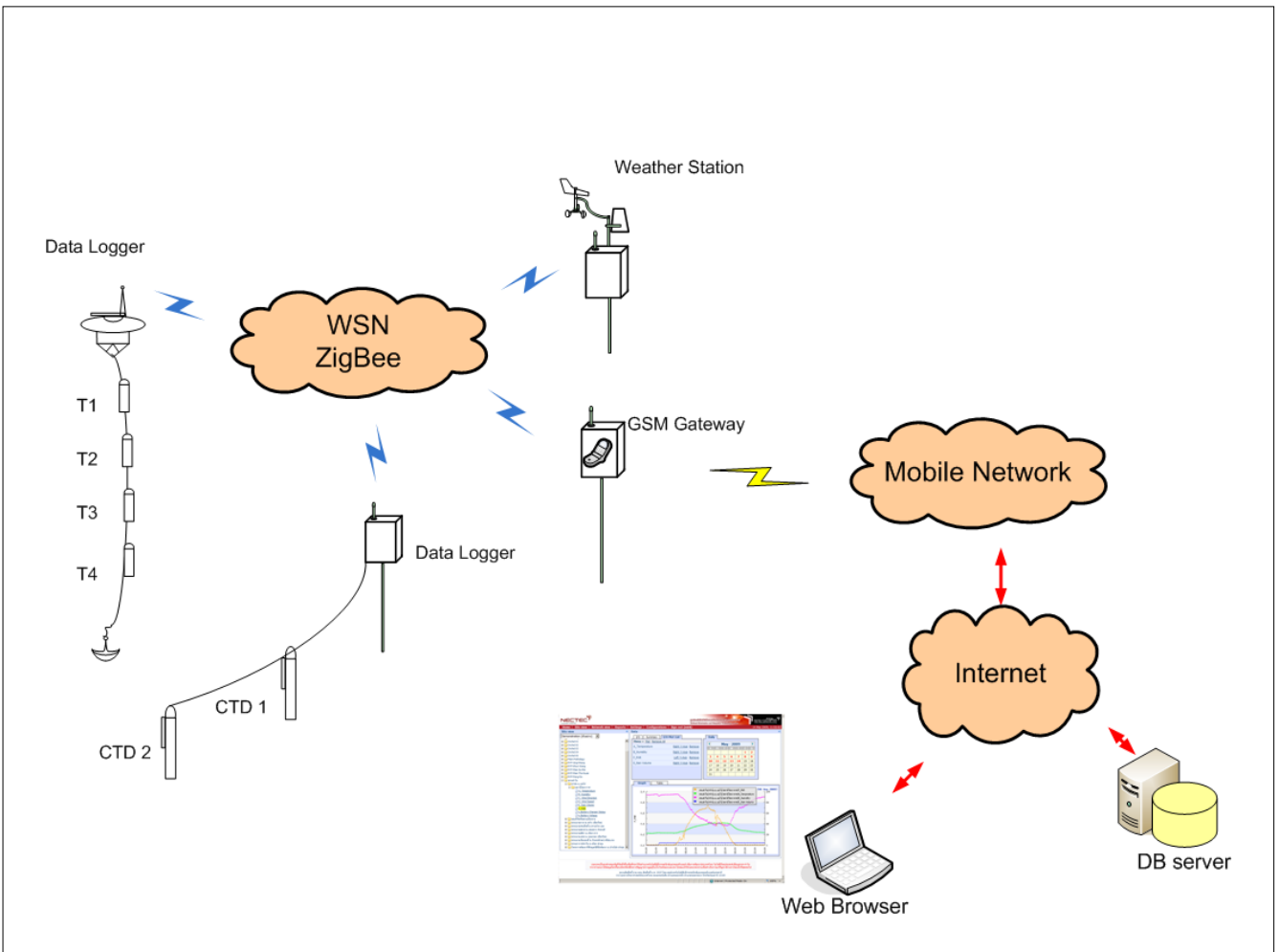
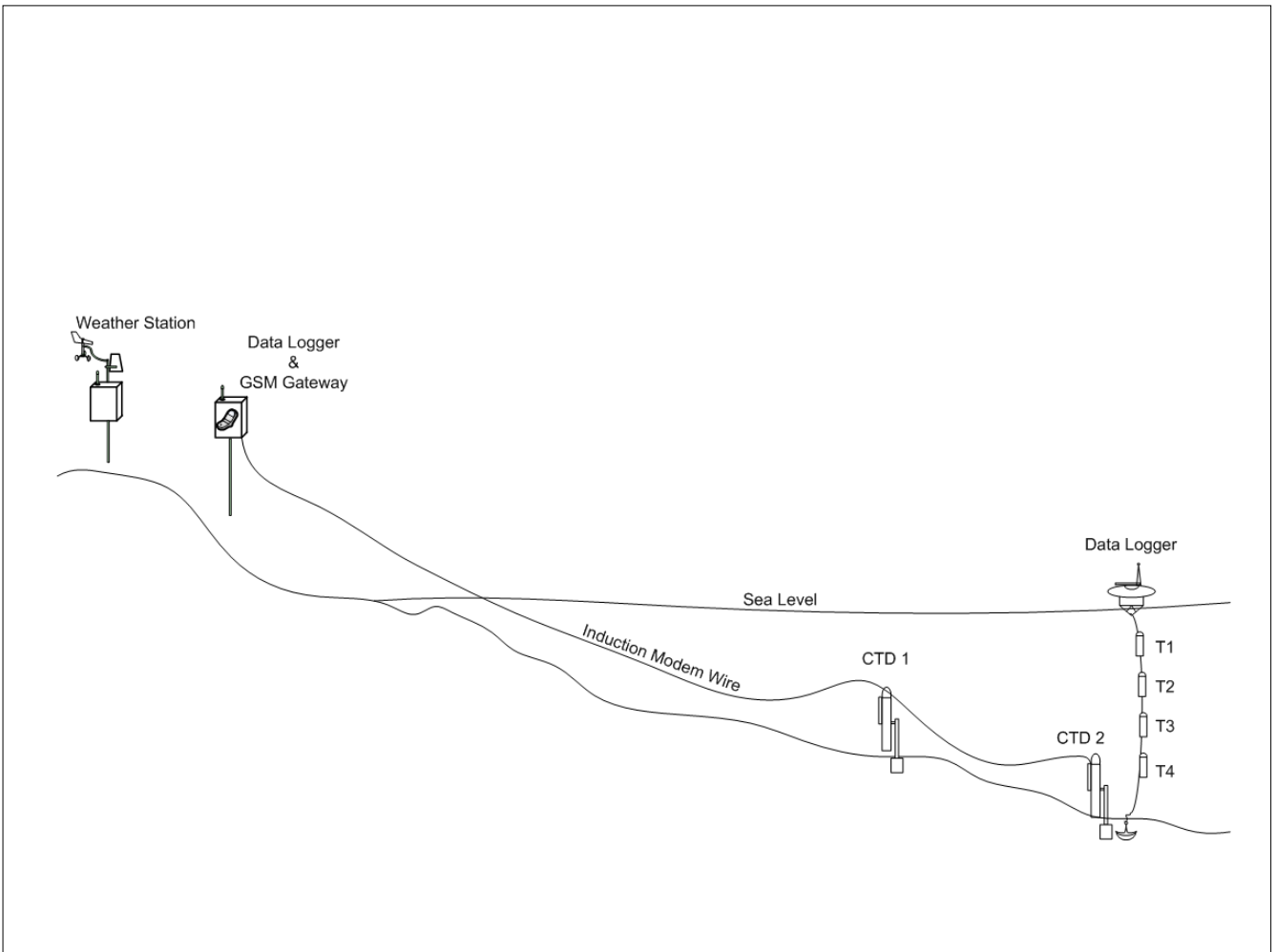
โครงการ
 การพัฒนาระบบเทคโนโลยีสารสนเทศแบบ real
 time เพื่อการติดตามระบบนิเวศปะการังระยะยาว
 (กรณีศึกษา เกาะราชาใหญ่ จังหวัดภูเก็ต)
 สนับสนุนงบประมาณโดย สวทช.

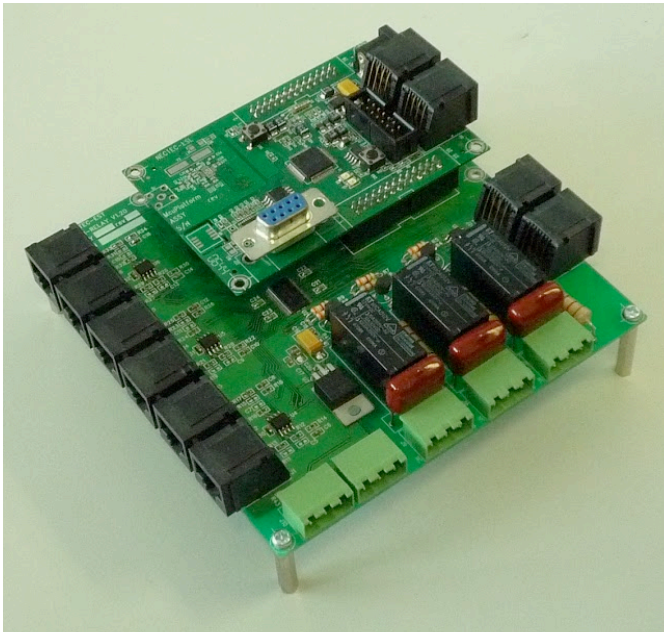
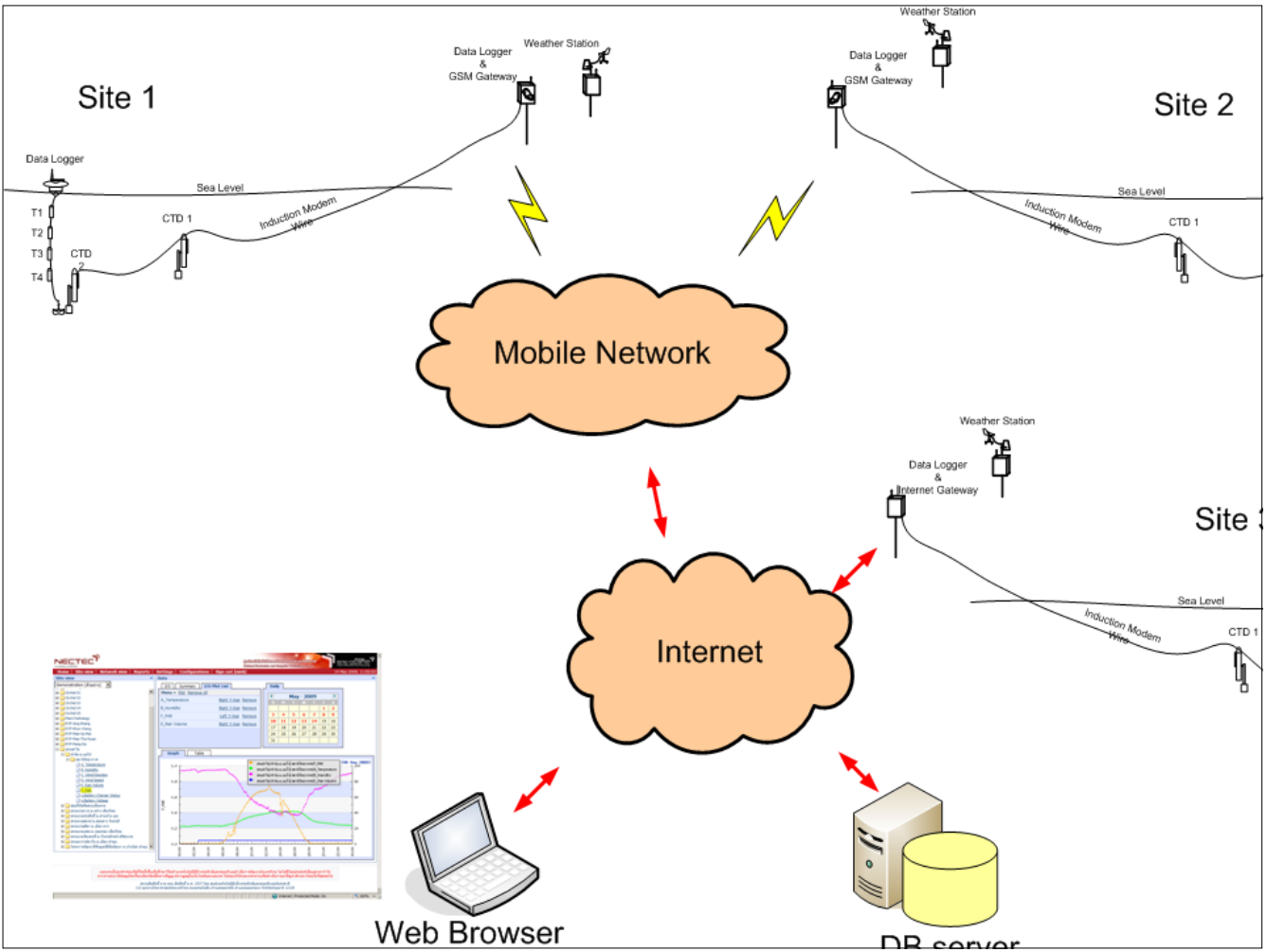
Installing more sensors



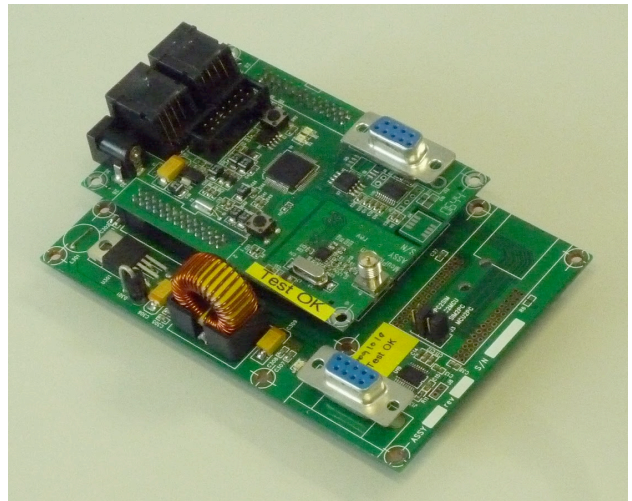
Challenges

- Power: low power devices and software, battery, solar cell, wind, wave
- Communication: line, radio, light, sound, induction
- Connectivity: line, wifi, GPRS/3G, continuous or burst
- Humidity, sunlight, temperature, water pressure, salinity, sand, wave, anchor
- Maintenance: batteries, cleaning, broken parts, diagnose, large number
- Thief
- Data management: long term, large number, team work, user requirements



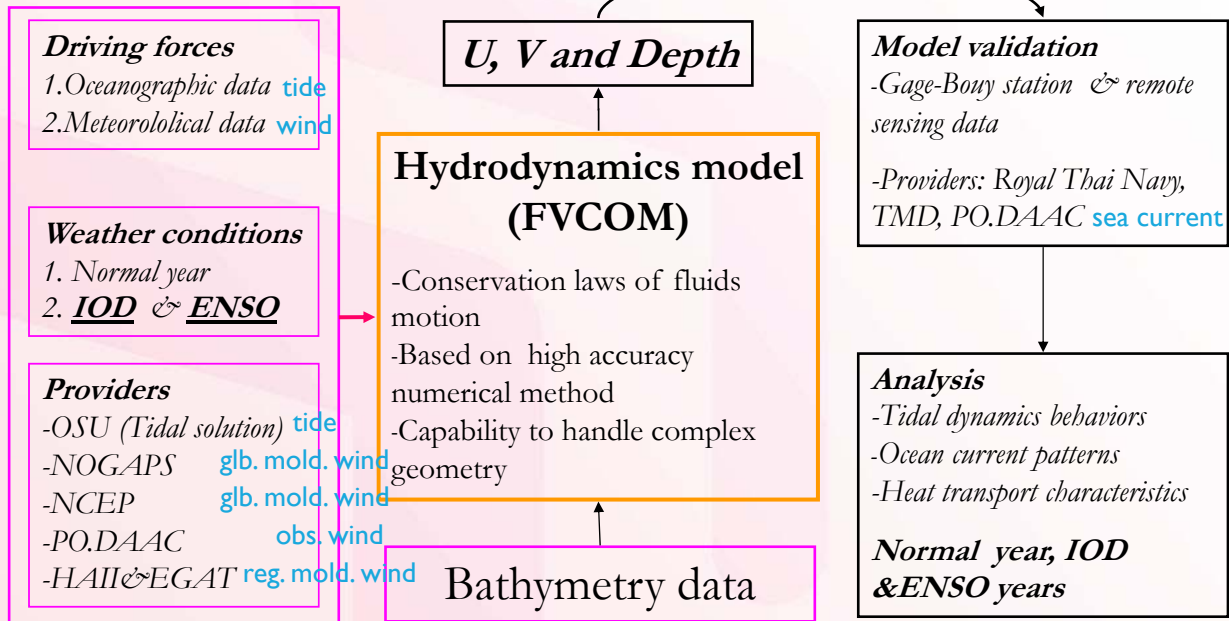


Data logger



GSM Gateway

Methodology: Simulation & Analysis



IOD = Indian Ocean Dipole

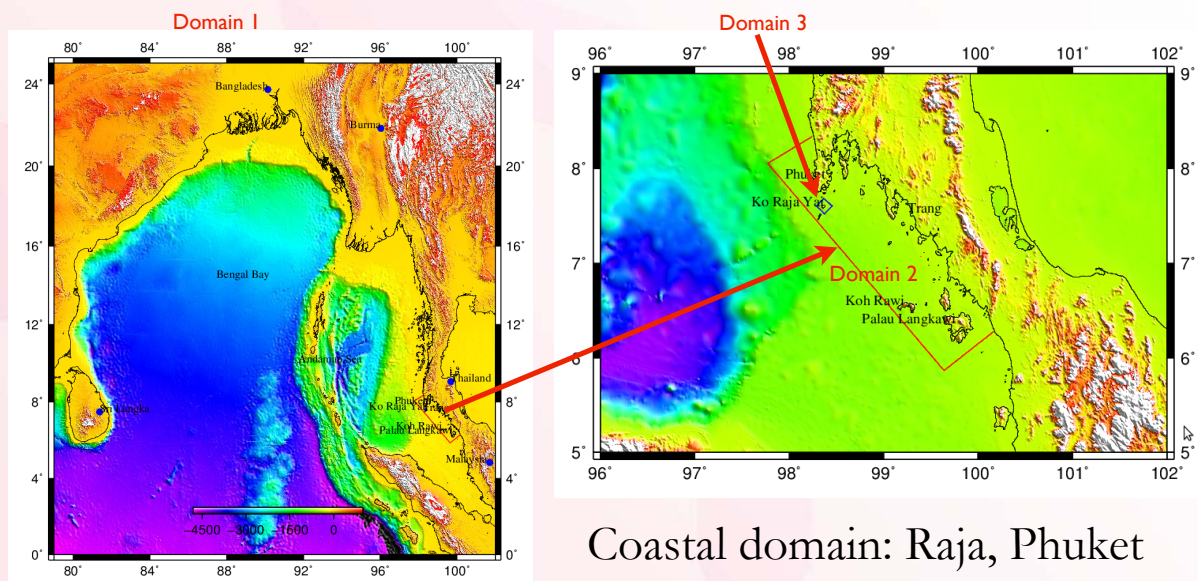
ENSO = El Niño / La Niña - Southern Oscillation

PO.DAAC = The NASA Jet Propulsion Laboratory: [Physical Oceanography Distributed Active Archive Center](#)

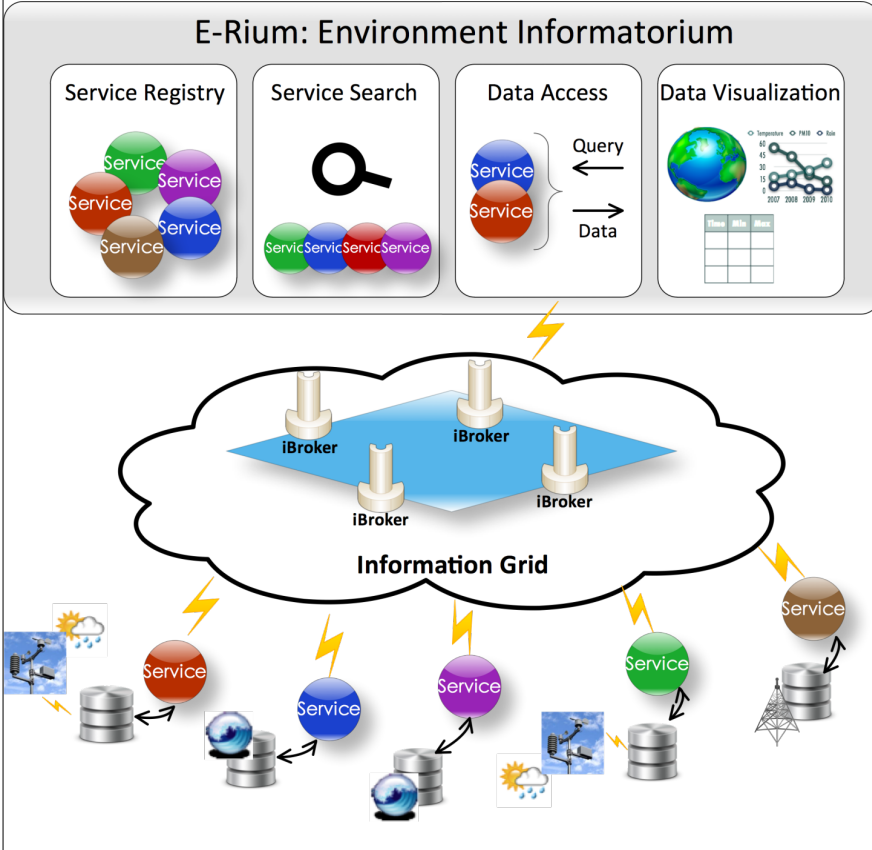
[A Driving Force for National Science and Technology Capability](#)

TMD = Thai meteorological department

Methodology: Area of interest



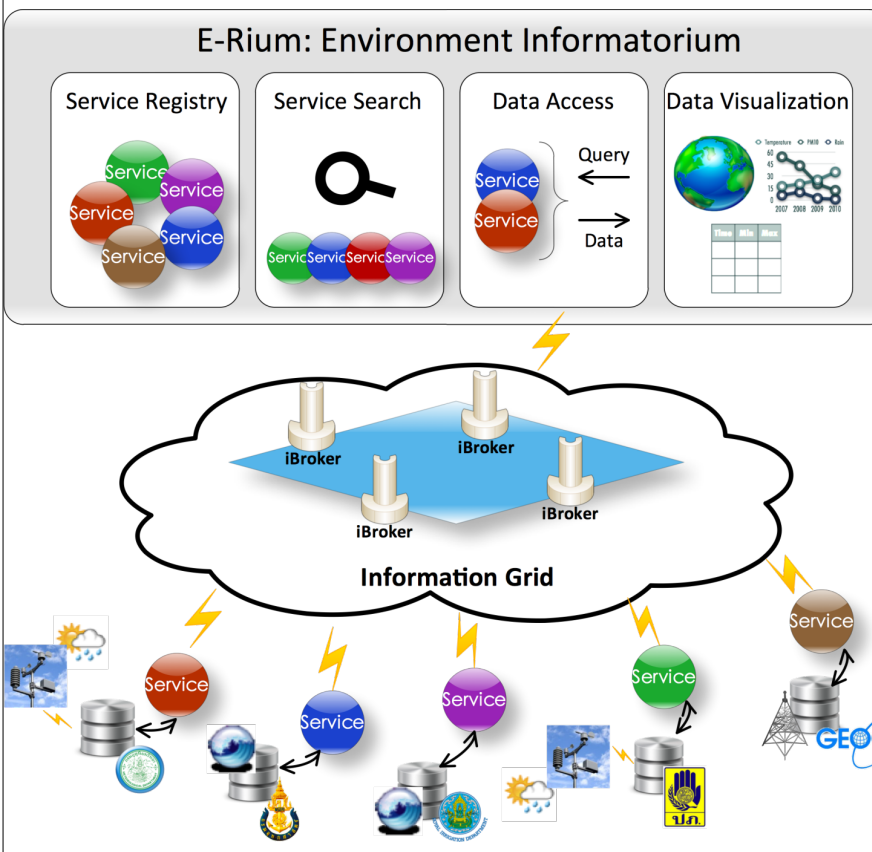
Data Management



Overall Capabilities:

- 1 Catalog for two kinds of heterogeneous services: OGC-SOS & LSR-SDS
- 2 Simple data access across geographically distributed and heterogeneous services
- 3 Basic visualization of different data types via map, graph and table

Collaborations



Current Collaborators:

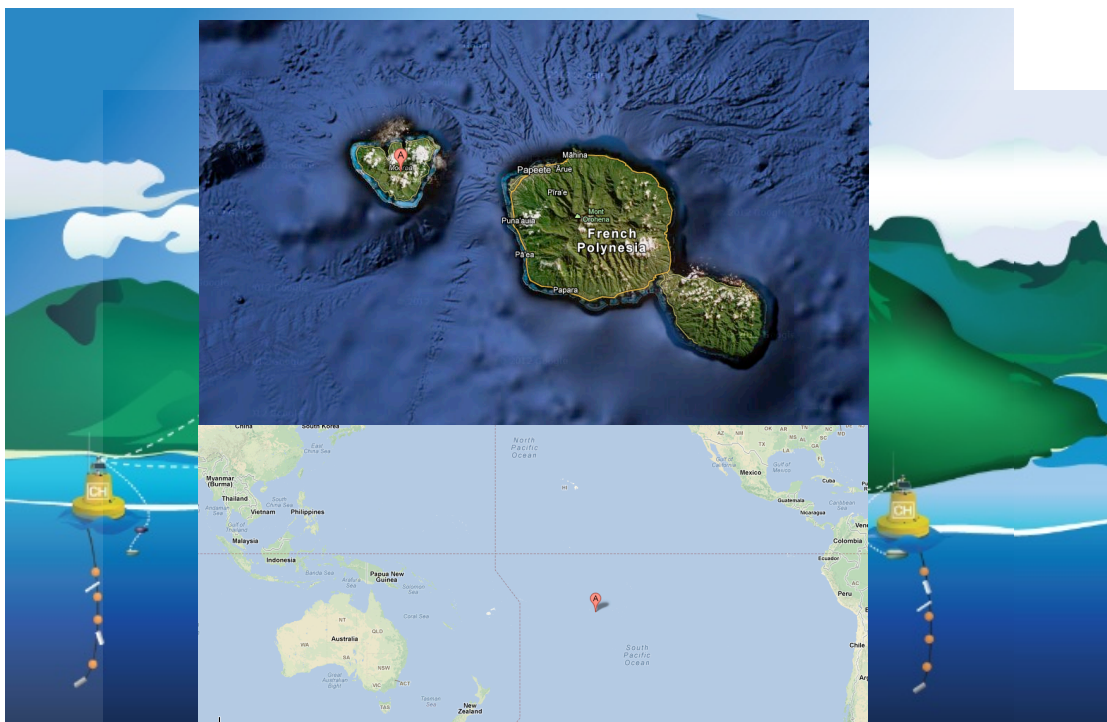
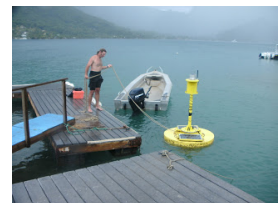
- 1 GeoGrid:
Sun Photometer Data
- 2 Disaster Department:
Temperature Data
Rain Data
Humidity Data

To-be Collaborators (hopefully):

- 1 Royal Irrigation Department:
Tidal Data and etc.
 - 2 Navy Department:
Tidal Data and etc.
 - 3 Thai Meteorological Department:
Weather Data and etc.
- + Sensor data
+ Simulated data

Other possibilities

Moorea Coral Reef LTER



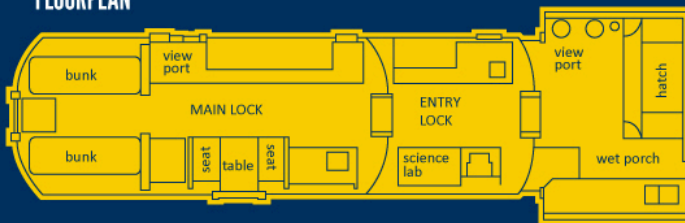
WHAT IS AQUARIUS?

Aquarius Reef Base is a unique ocean science and diving facility in Florida Keys National Marine Sanctuary that provides unparalleled means to study marine ecosystems, test new underwater technology, train divers and astronauts, and spark the imagination of people worldwide in the name of exploration, learning and conservation.

THE HABITAT

Aquarius is the last operating underwater sealab of its kind. The habitat allows scientists to live and work underwater 24 hours per day for up to two-week missions where they can participate in the world's longest running and most detailed coral reef monitoring program.

FLOORPLAN



PORT SIDE



AQUANAUTS LIVING IN AQUARIUS CAN STAY UP TO 2 WEEKS, AND HAVE 6 TO 9 HOURS OF DIVING DOWN TO ABOUT 95 FT. EACH DAY.

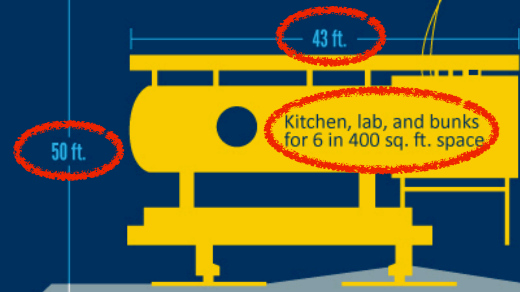


THE LIFE SUPPORT BUOY

provides power, air compressors, communications and other support equipment.

100 Mbps

connectivity for broadcast quality streaming video and call capability to international space station.



ENVIRONMENT



Aquarius is located within a special "research only" zone of Florida Keys National Marine Sanctuary. Four miles off Key Largo on Conch Reef, part of Great Florida Reef, the world's 3rd largest barrier reef.

AQUARIUS HISTORY

- 1986 Built in Victoria, Texas
- 1992 Deployed near Key Largo
- 1993 Long-term coral reef monitoring begins
- 1994 Crew forced to evacuate during Hurricane Gordon's 15-ft. seas
- 2001 NASA begins using Aquarius for its Extreme Environment Mission Operations (NEEMO)
- 2012 115th and final Aquarius mission takes place.

OCEAN LIFE



Atlantic Giant Grouper: A massive fish that can reach 8 ft. long, weigh almost 800lbs. Aquarius Reef Base has its own resident groupers.

Barrel Sponge: Sponges are now the dominant habitat-forming animals on Caribbean coral reefs. Among them, the giant barrel sponge, *Xestospongia muta*, has the greatest biomass on Florida coral reefs.



Corals: Not just pretty rock-like animals, corals are voracious predators. Using tentacles, they capture small creatures which swim by.

OPERATIONS

- Owner:** National Oceanic and Atmospheric Administration
- Operator:** University of North Carolina Wilmington
- Participants:** 1266 astronauts, scientists, grad students and film makers
- Partners:** NASA, US Navy



FIVE - FOLD MISSION



SCIENTIFIC RESEARCH

Hundreds of peer-reviewed scientific papers



TRAINING

NASA astronauts simulating extreme space environments



OCEAN EDUCATION & OUTREACH

Live broadcasts from a 16-day mission reached 450,000 students



R&D OF UNDERSEA TECHNOLOGY

Development of various technologies for ocean exploration



CORAL REEF & OCEAN OBSERVATION

20 years of in depth research and real-time analysis

A PROJECT OF AQUARIUS REEF BASE
**MISSION
AQUARIUS**

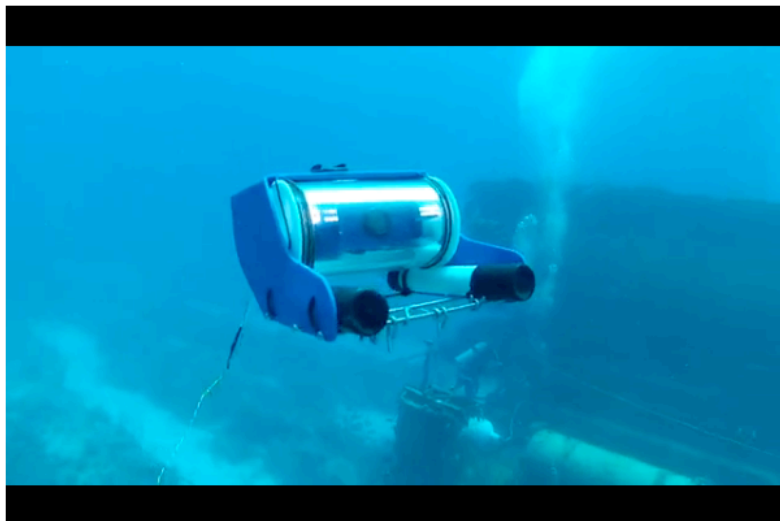
**ONEWORLD
ONEOCEAN**.ORG



OPENROV

Open-source Underwater Robots for
Exploration and Education

[BUILD ONE](#) | [OPENROV KITS](#) | [PARTICIPATE](#) | [BLOG](#) | [ABOUT](#)



This is the OpenROV 2.3 Prototype. Check out more photos [HERE](#). The Kickstarter project just closed, but we'll have a web store up shortly.

Welcome to
OPENROV
[Sign Up](#)
or [Sign In](#)

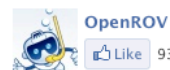
Or sign in with:



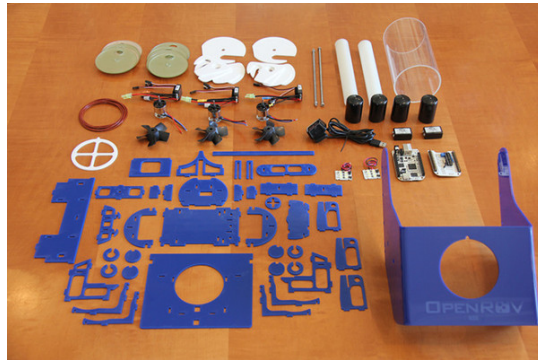
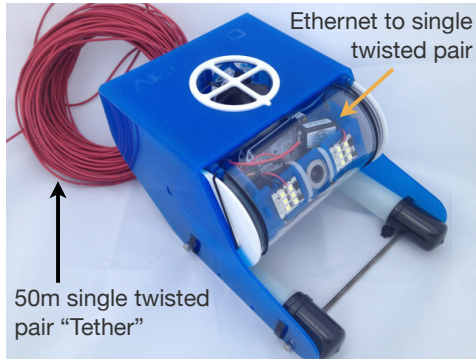
OpenROV is a DIY community centered around underwater robots for exploration & adventure. We're a group of amateur and professional ROV builders and operators from over 50 countries who have a passion for exploring the deep.

Join the group if you've got design ideas, adventure ideas, or just want to join the fun! No prior experience necessary.

[Follow @OpenROV](#)



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NonCommercial-ShareAlike 3.0
Unported License.



OpenROV Kit

\$830.00

INCLUDED ELECTRONICS

- BeagleBone Single Board Computer
- OpenROV BeagleBone Cape
- HD USB Webcam
- Ethernet to Single Twisted Pair Adapter (2x)
- Electronic Speed Controller for Brushless Motors (3x)
- 800KV Brushless Motor (3x)
- 87lm LED light array (2x)
- Tilt servo

Embedded Linux



About How it works Support/API Search

Where the Internet of Things is being built.

Connect devices and apps on the Cosm platform, exchange data and ideas with developers, and bring smart products to the world.



The Internet of Things was an idea. Now it's a reality. Right now on the Cosm platform, developers and companies are connecting devices and apps to securely store and exchange data. It's the one solution that brings big ideas about the world to the world.

Build.

Connect your device

Prototype with Arduino, configure commercial fitness trackers, energy monitors and air quality sensors, or **deploy your own product**.

Handle real-time data

Push and pull XML, JSON and CSV data to our secure and scalable **RESTful API** and **socket-server** for bi-directional interaction between devices and the web.

Control, monitor and analyze

Customize your console to track device state and location, add **alerts and notifications**, and review historical activity.

Scale securely

Create commercial apps and services or handle large-scale deployments using **OnBoard**, a hosted device provisioning and web registration service.

Engage.

Search for devices

Query for devices and sensors by user, location, tag and unit or find **commercial products** that are pre-configured for Cosm.

Find interesting data

Browse and **search** to discover what's happening right now, both near you and throughout the world.

Collaborate with others

Get help from other developers, follow people and devices and build **communities** and conversations around data.

Share securely

Install **mobile and web apps** created by others yet maintain **total control** of how, where and whether your data is used by them.

The Arduino Ethernet is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz crystal oscillator, a RJ45 connection, a power jack, an ICSP header, and a reset button.

cosm Connect to your world About How it works Support/API


Where the Internet of Things is being built

Umoya, which means "spirit wind", is a South African startup company that manufactures Vertical Axis Wind Turbines.

- providing energy from renewable energy
- sharing of data such as energy production, wind speed, and temperature to facilitate communication between the company, investors, and the growing renewable energy community.


Handle real-time data

Arduino & Arduino Ethernet



Arduino Ethernet: a microcontroller board with digital input/output pins, and, analog inputs, a RJ45 connection. An optional Power over Ethernet module can be added to the board as well.

Search for devices



airqualityegg

Share securely

An open source project aiming to give citizens a way to participate in the conversation about air quality. It is composed of a sensing device that measures the air quality in the immediate environment and an on-line community that is sharing this information in real-time.

Umoya Wind Turbines
Jasper Pons

The Arduino Ethernet is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz crystal oscillator, a RJ45 connection, a power jack, an ICSP header, and a reset button.

Pachube is now Cosm Cosm is everything you know and love about Pachube, with more power to connect and build the Internet of Things today. Find out more

cosm Connect to your world About How it works Support/API Search

Forgot password Sign Up

Username Password

CREON_RACHA_ISLAND last updated Mon, 10 Oct 2011 06:04:54 +0000

CTD_Temp CTD temperature 30 days

This datastream has no datapoints yet.

Feed ID: 37107

Creator: creon
 Website: <http://www.coralreefeon.org>
 Email: s.bainbridge@aims.gov.au
 Created: Sun, 09 Oct 2011 23:19:34 +0000


Racha Island site of the Coral Reef Ecological Observatory Network

Feed Formats: JSON XML CSV

Tags: coral CREON pressure reef salinity temperature weather

Followers 0


Location Name: Racha Island, Thailand (Ko Racha Yai)
 Exposure: outdoor
 Elevation: -10.5
 Disposition: fixed
 Latitude: 7.60488
 Domain: physical
 Longitude: 98.376600000000



Google Earth

Ocean data layers:
Shipwrecks, Dead zones,
Animal tracking

Global Tagging of Pelagic Predators
White shark

Tagging Data	Animal Facts	Tag Facts
		
Swim with me: Quickly Slowly		
Where I went: Download track		
Depth Profile: 0m  900m		

Eutrophication & Hypoxia
Nutrient Pollution in Coastal Waters

Hx The Chin River Estuary

Classification: Hypoxic
Frequency: Unknown
Country: Thailand
Decade of discovery: 2000

The Tha Chin River is a distributary of the Chao Phraya River in Thailand. It splits near the town Chainat and then flows westerly from the Chao Phraya through the central plain, until it flows into the Gulf of Thailand at the town Samut Sakhon. Brackish to marine areas in the Tha Chin Estuary are strongly hypertrophic during both dry and wet periods. High nutrient loads to the

Tourist boats on the Tha Chin River near Nakhon Chaisi. Photo Credit: Heinrich Damm | Wikimedia Commons

Explore bathymetry

Google earth

NOAA Coral Reef Information System

coris.noaa.gov

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

CoRIS
noaa's coral reef information system

Home Data & Publications Map Search Regional Portal About Coral Reefs Professional Exchanges Activities Glossary

NOAA's Coral Reef Information System (CoRIS) is a web-based information portal that provides access to NOAA coral reef information and data products with emphasis on the U.S. states, territories and remote island areas. NOAA Coral Reef activities include coral reef mapping, monitoring and assessment; natural and socioeconomic research and modeling; outreach and education; and management and stewardship.

Discover NOAA's Coral Data!

CoRIS provides a variety of ways to access coral data including the new Geoport search tool.

New! CoRIS Geoport Search Tool

The [Regional Data Portal](#) provides background information on each geographic region and supports data queries that are based on particular locations of interest. The [Map Search](#) application displays an array of data products within a specific geographic area. The CoRIS Geoport search

NOAA CORAL REEF CONSERVATION PROGRAM

Special Notes

[Glossary of Terminology Search](#)

[Acronym and Abbreviation List Search](#)

[Coral Ecosystem Publications](#)
[RSS Feed](#)