



# Monitoring Coral Bleaching at Racha Yai Island



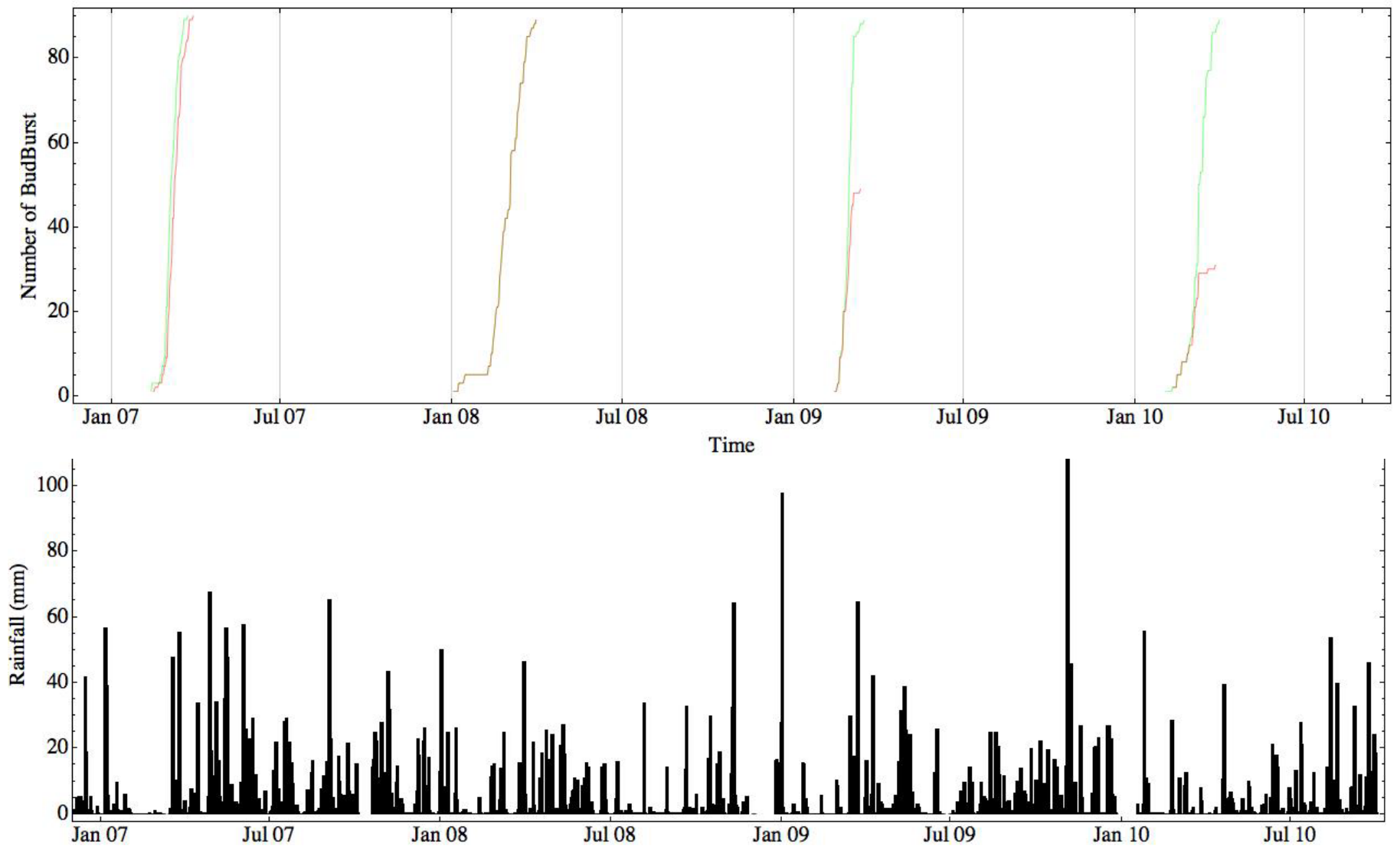
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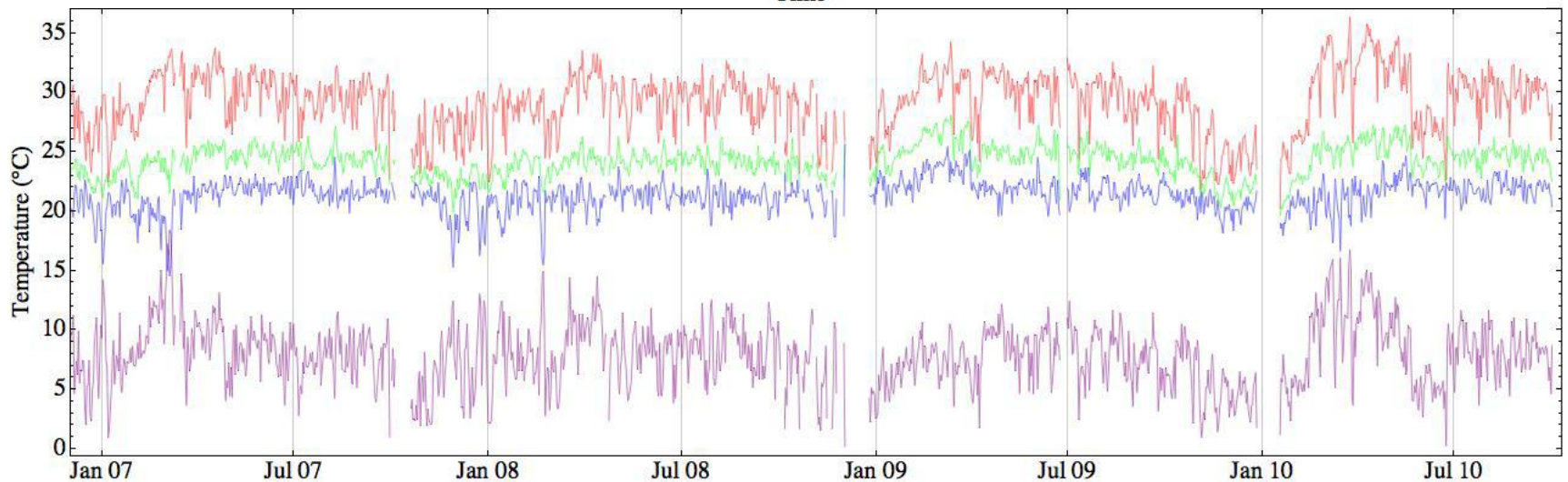
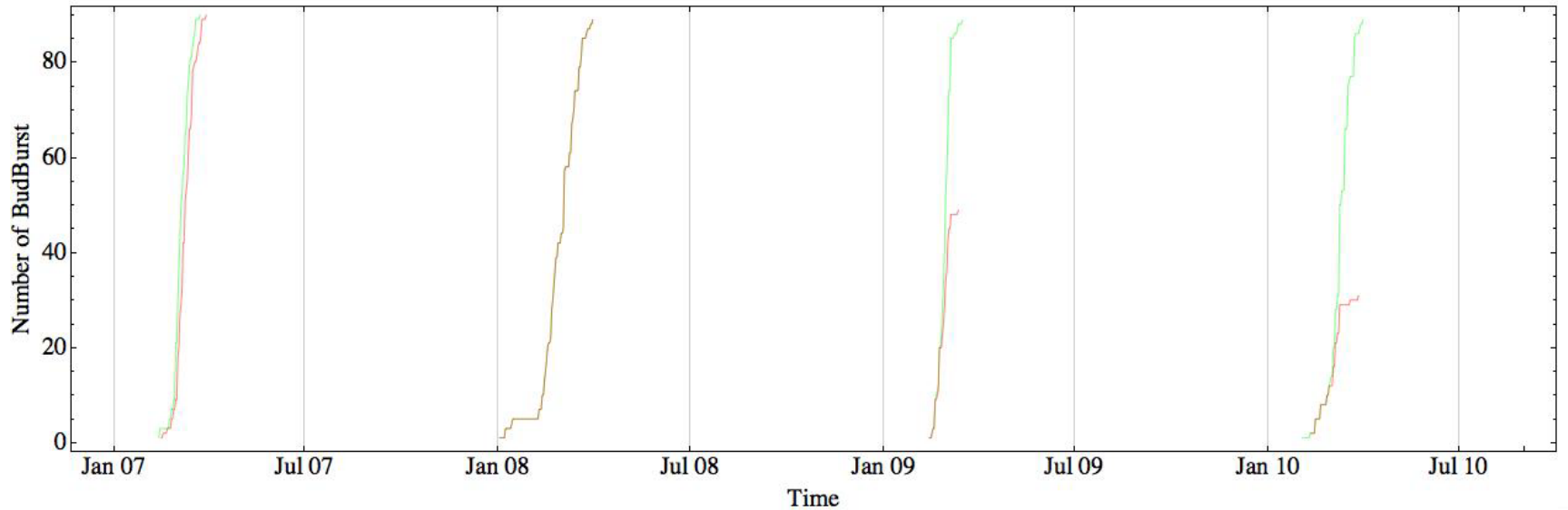
# Science Questions

- Global warming?
- Climate change?
  
- Earth is a complex system (GAIA)
- Physical sensor data are not enough.
- Need ecological indices too!

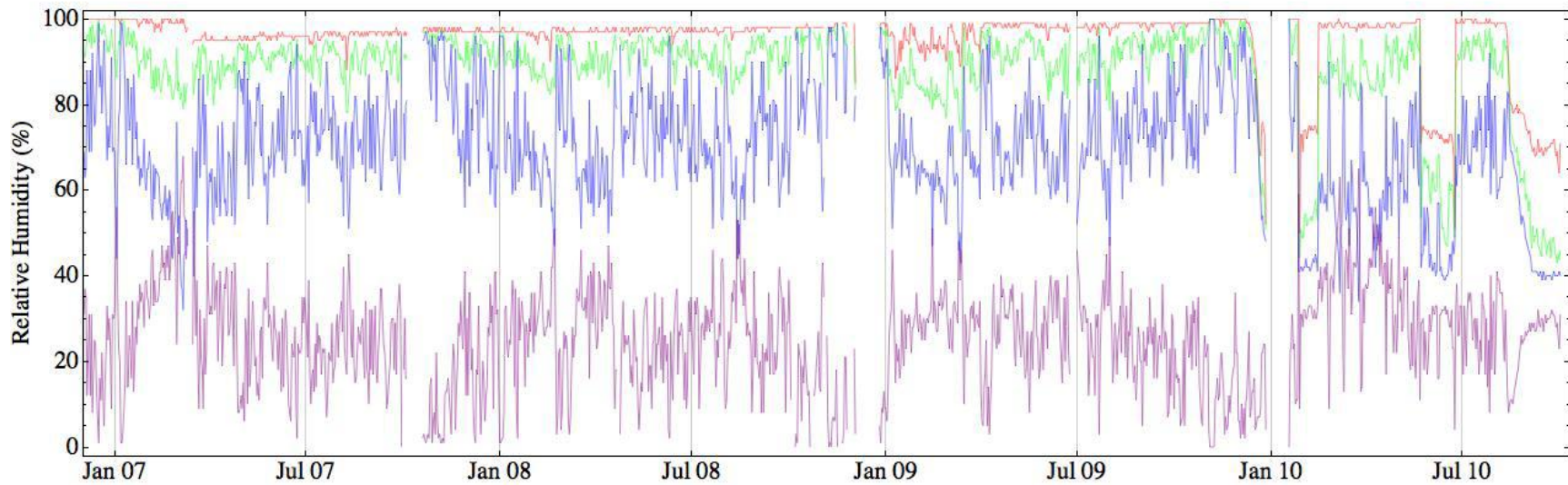
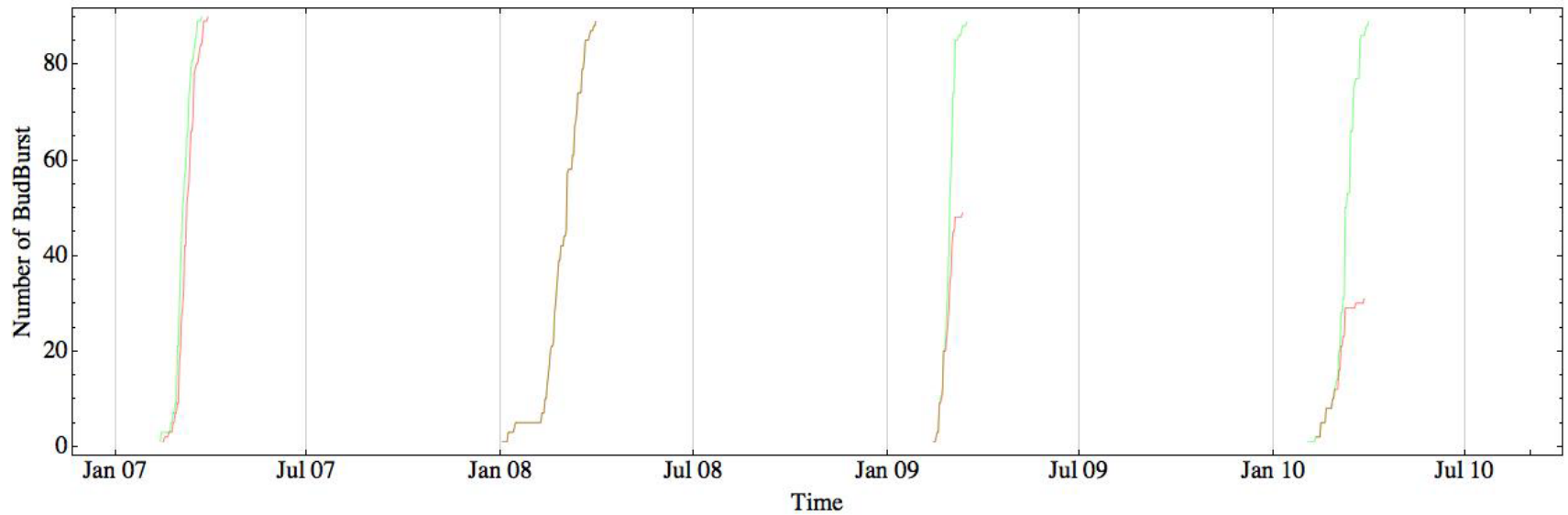
# Phenology and Rainfall



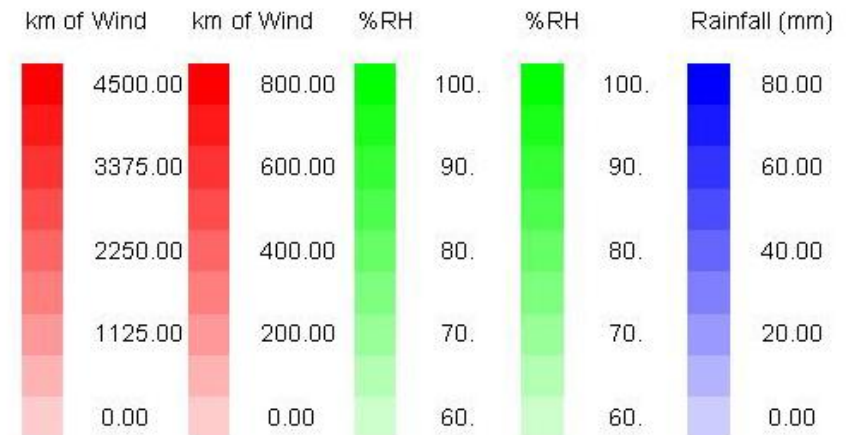
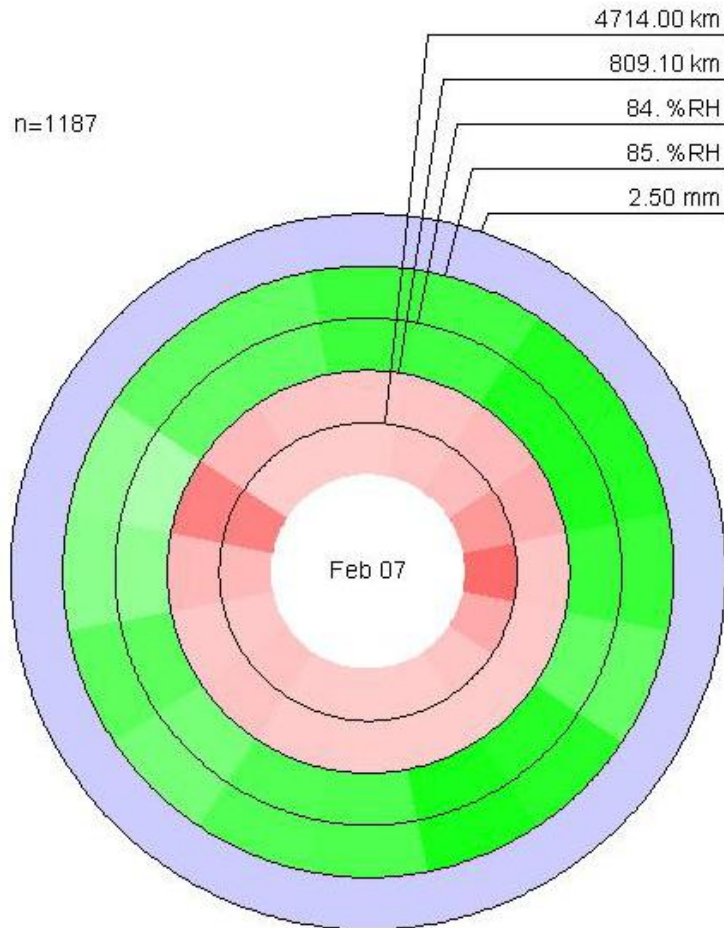
# Phenology and Temperature



# Phenology and Relative Humidity

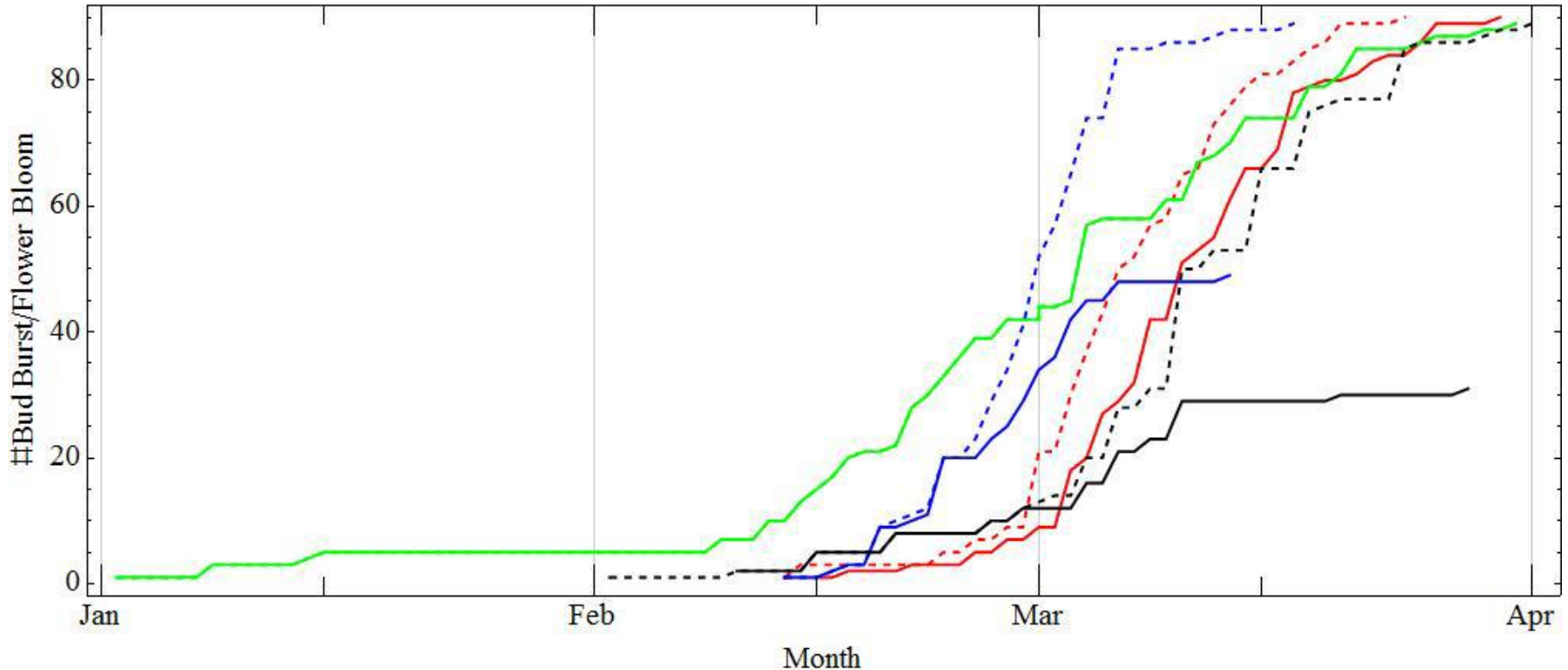


# Phenology and wind direction



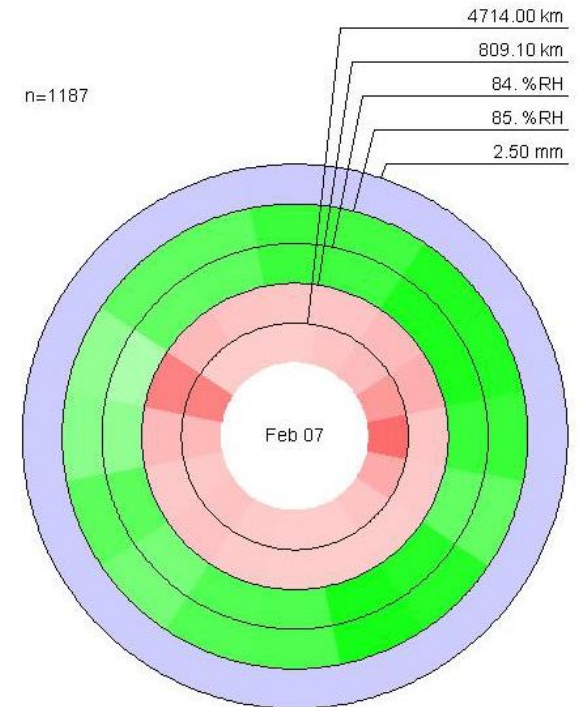
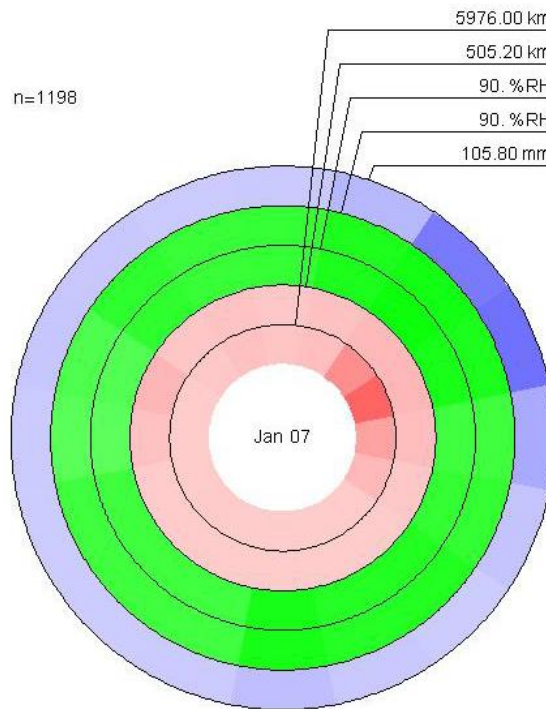
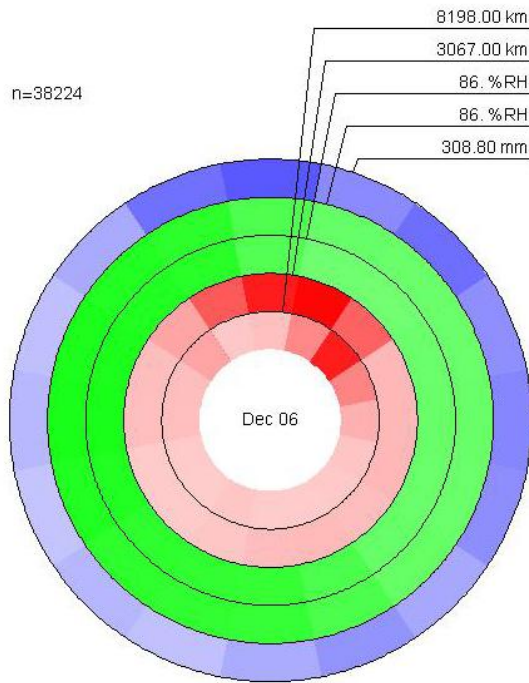


# Parah Phenology



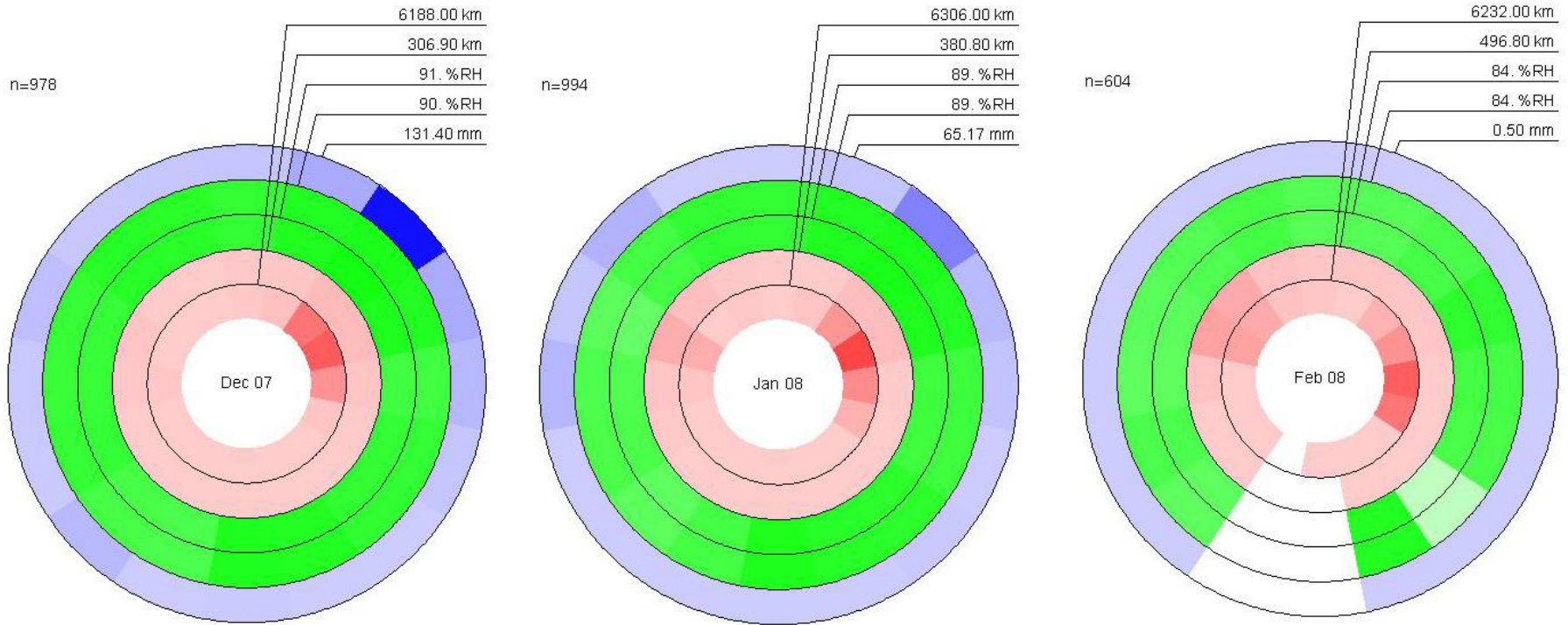
- Red (2007), Green (2008), Blue (2009), Black (2010).
- Dashed lines (bud burst), solid line (flower bloom)

# Phenology and wind direction



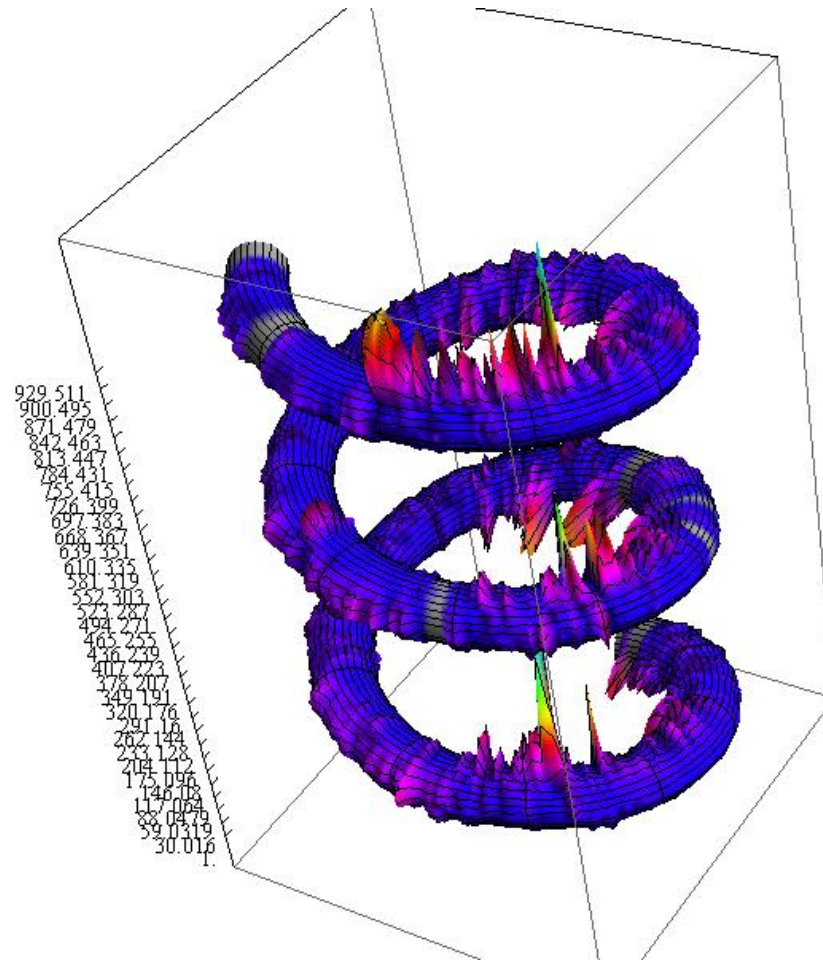


# Phenology and wind direction

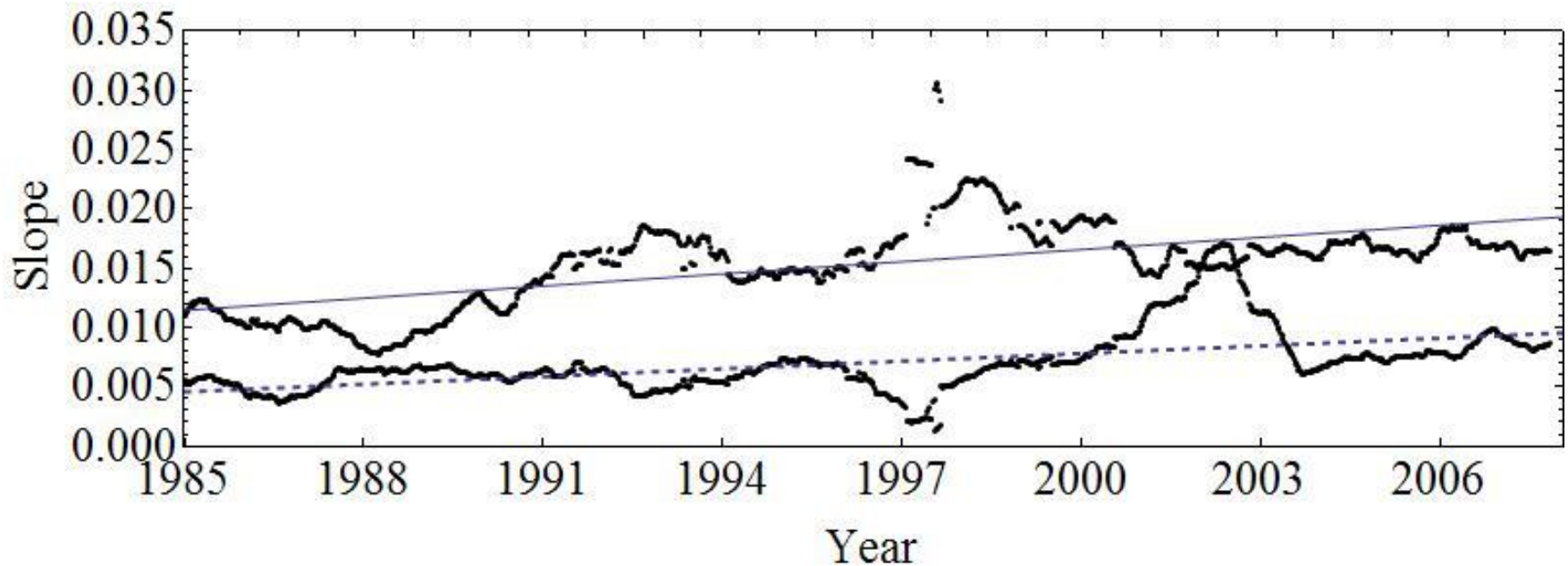


- Budbursts occurred when they got North-western wind (lower relative humidity).

# 3D Viz – Wind Spring



# Results and Discussion



*Latitudinal trend in slopes of SD of SSTA moving average.*

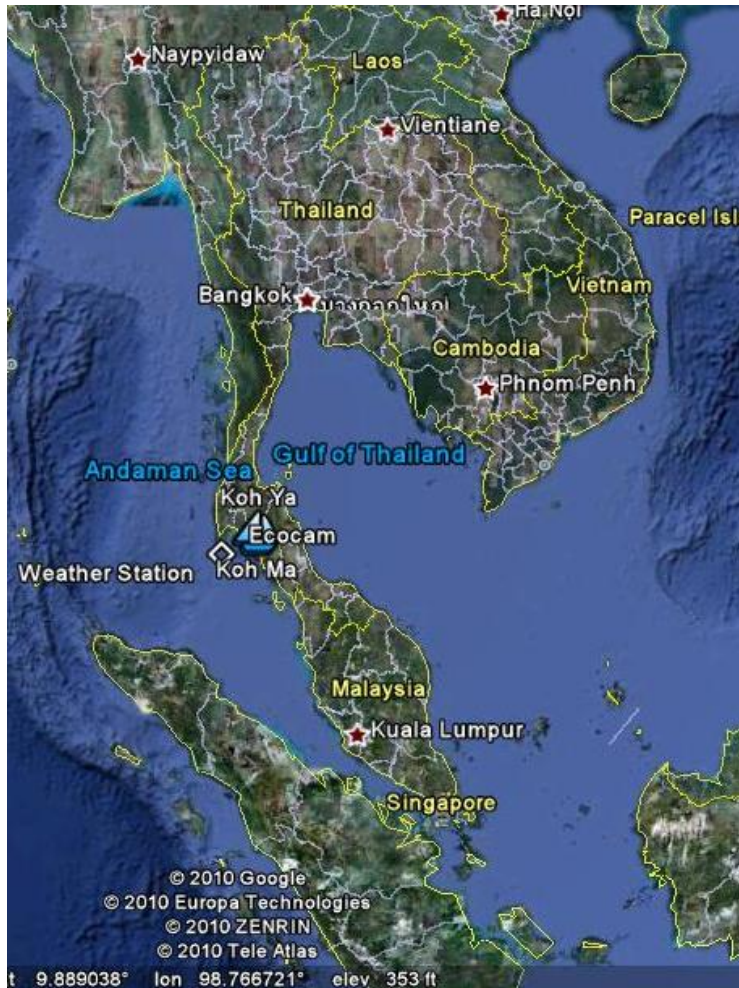
*Northern Hemisphere (Solid line) ( $y = 0.011 + 6.575 \times 10^{-6}x$ ,  $R^2 = 0.397$ ,  $P < 0.001$ )*

*Southern Hemisphere (Dash line) ( $y = 0.005 + 4.154 \times 10^{-6}x$ ,  $R^2 = 0.295$ ,  $P < 0.001$ )*



# Site Location

- Racha Island, Thailand is located at latitude  $7.61528^{\circ}\text{N}$  and longitude  $98.37125^{\circ}\text{E}$ .





# Racha Island's coral diversity



Healthy reefs = Largest Solar Cell on Earth



# Racha Island's diversity

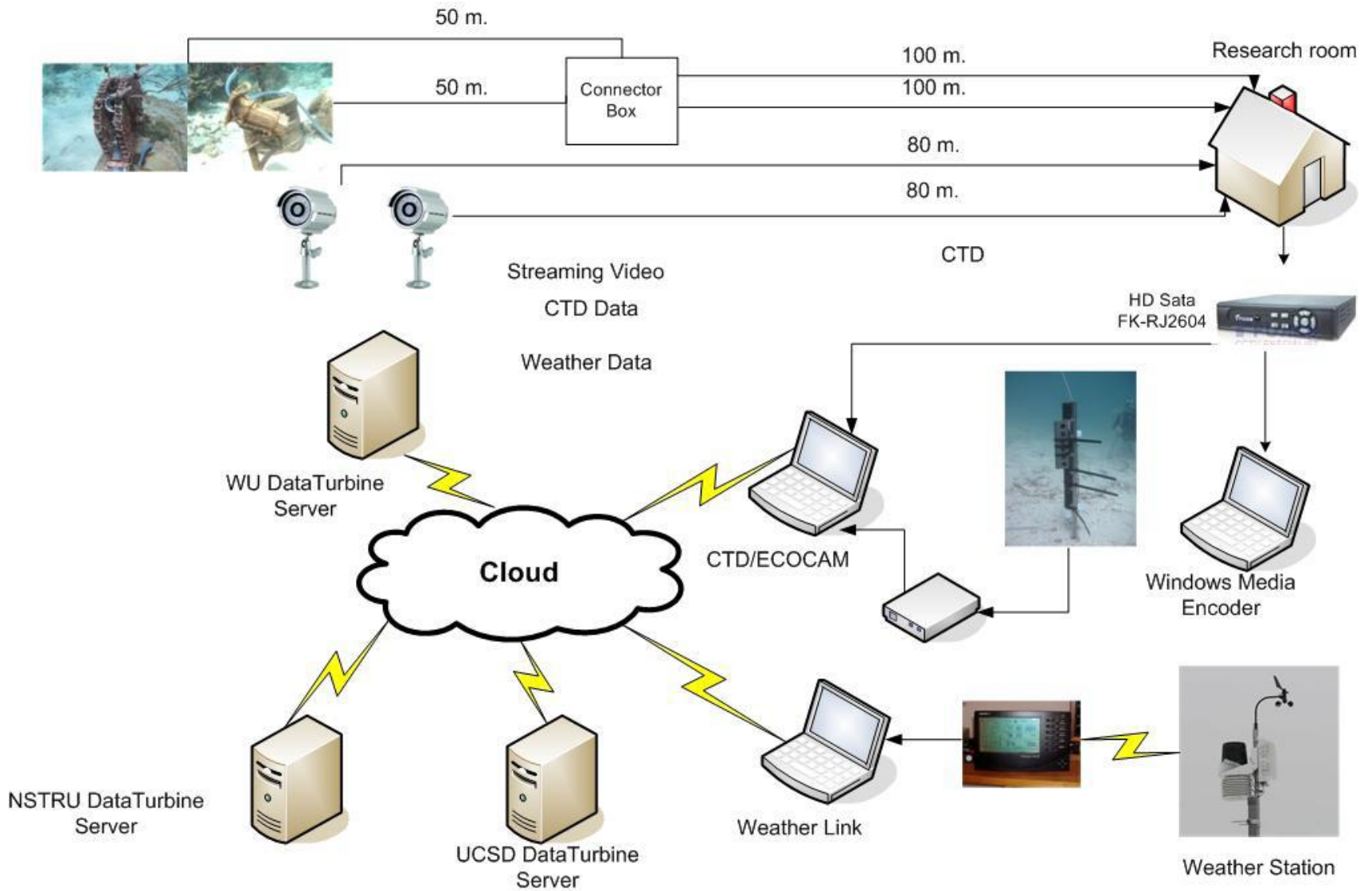


# Virtual Site at Racha Island

The screenshot shows a Facebook page titled "Virtual Koh Racha Yai" viewed in a Windows Internet Explorer browser. The browser's address bar shows the URL: <http://www.facebook.com/home.php?#!/pages/Virtual-Koh-Racha-Yai/180266240679?ref=ts>. The page layout includes a navigation bar with "facebook" and a search bar, and a main content area with a map of Koh Racha Yai on the left. The map is titled "เพิ่มเป็นหน้าโปรดของฉัน" and "แนะนำเพื่อน". Below the map, there are two video posts from "Virtual Koh Racha Yai" showing a cuttlefish, with the caption "นมักระดอง/Cuttlefish [HQ]" and a duration of 0:35. The first video post has a timestamp of "20 กรกฎาคม เวลา 15:36 น." and is liked by "คุณและ Wayne Engelbrecht ชอบสิ่งนี้". On the right sidebar, there is a chat window titled "สร้างโฆษณา" with a Thai text-based conversation. The chat text includes: "小喬請呂布坐公車", "小喬: 請問有零錢嗎(手上拿着一百元)喬傻了一下, 看了他的一百元: 你是要15元下車嗎? 布: 對啊, 喬: 呃, 喬: 拿了15元給布, 布: 這, 算我借你的好了。布: (借我? 那我下次還你(拿出電話)) 喬: 不用了, 算我請你好。布: 怎麼好意思, 下次還你好了(手機還是緊握著) 喬: 不用了(乾笑)布:", "ถูกใจ", and "MarketPlace of i168.net". The Windows taskbar at the bottom shows the system tray with the time "3:00 PM" and date "9/9/2010".



# Sensor Network at Koh Racha Yai

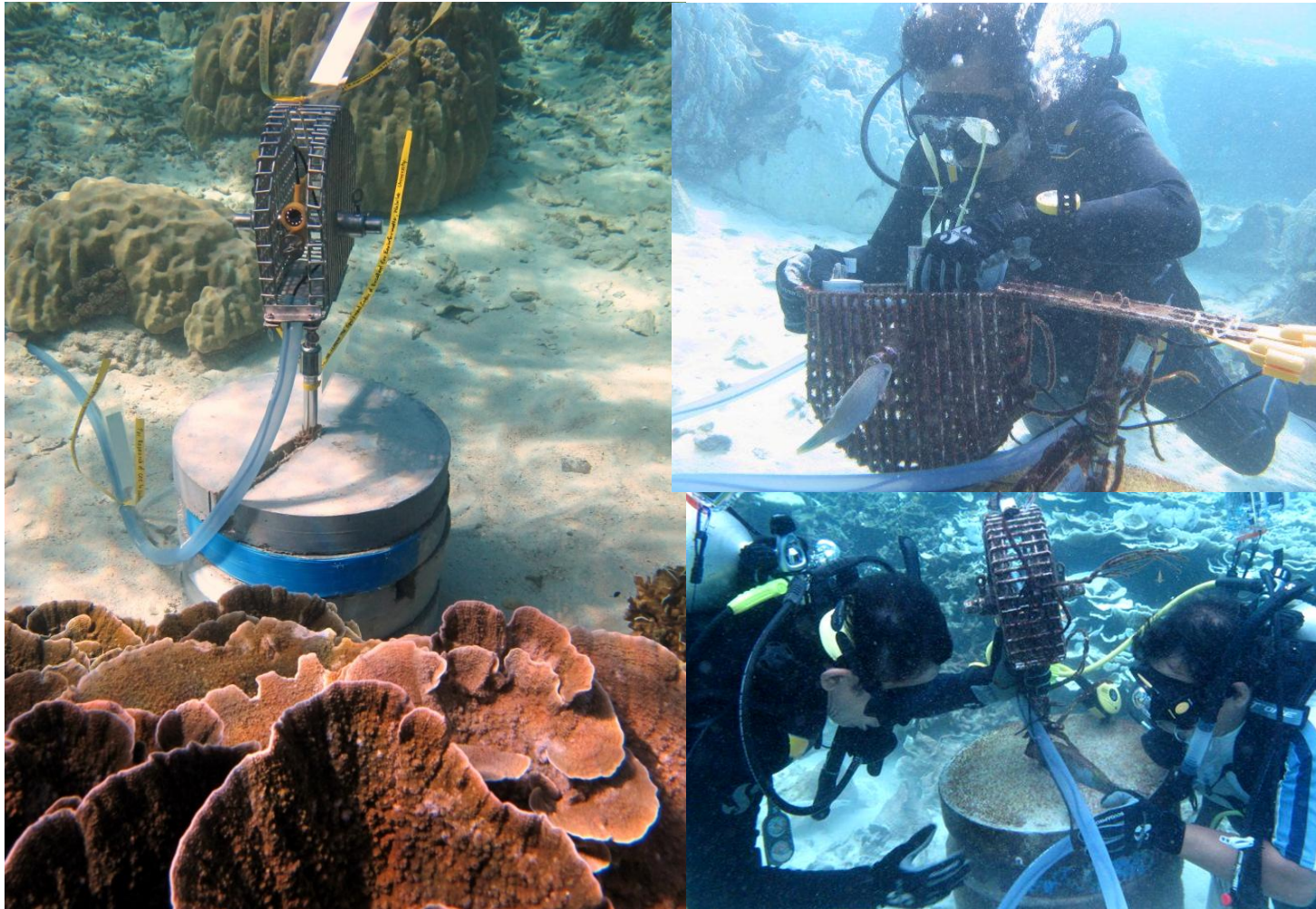


# Deploying Temperature Sensor





# Installing Ecocam at Racha Island





# Installing Automatic Weather Station



- Davis Vantage Pro II Plus was installed at Racha Island since Nov 2009.
- 26 weather data were measured, e.g. max/min temp, RH, rainfall, UV index, solar radiation, wind speed, wind direction.



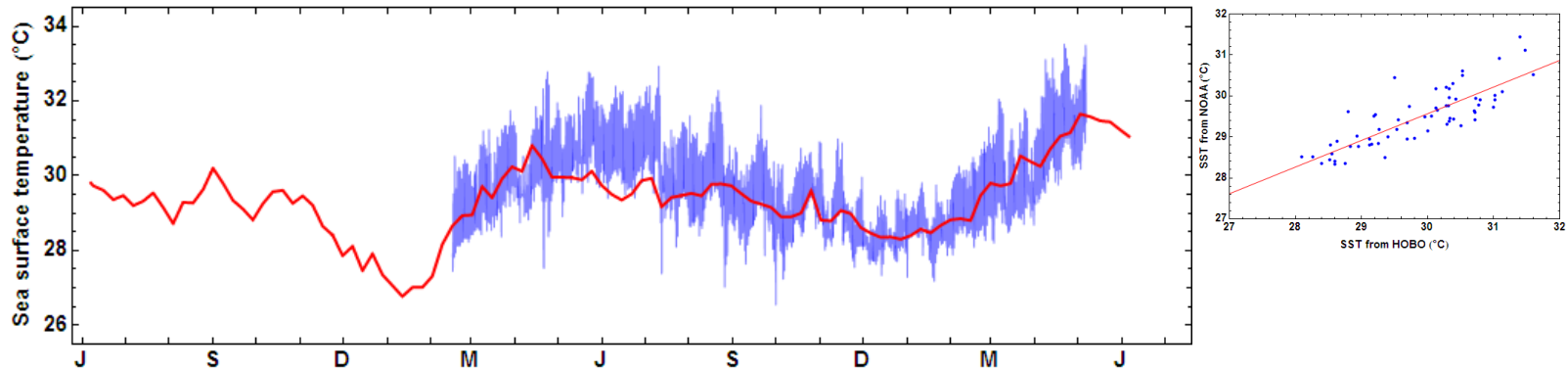
# New sensor installation



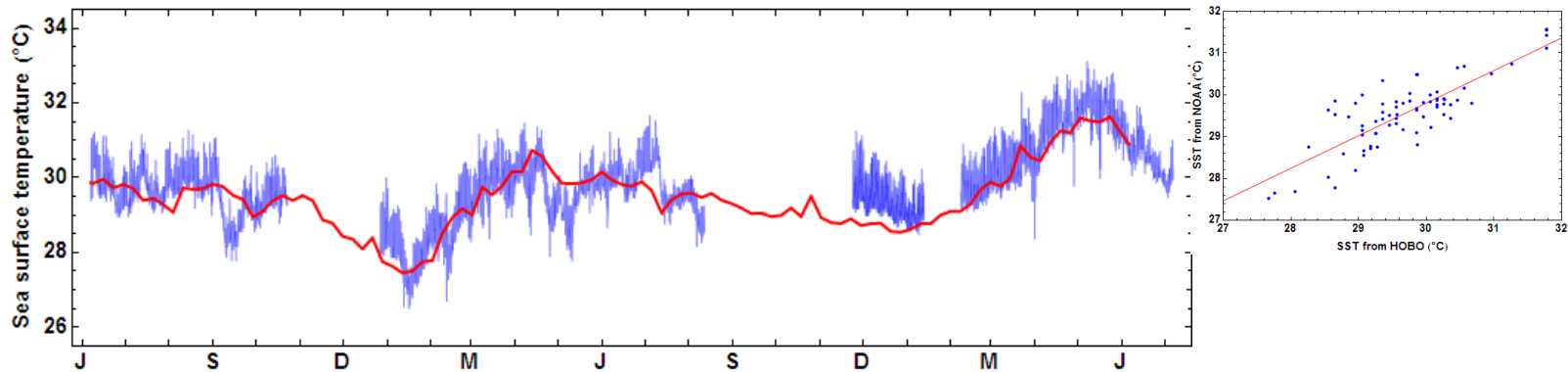
- CTD
  - Conductivity
  - Temperature
  - Depth
- We installed CTD sensor at 19 Oct, 2010
- Data was measure in very 5 minutes

# Comparison between sensor data and NOAA data

Koh Tan

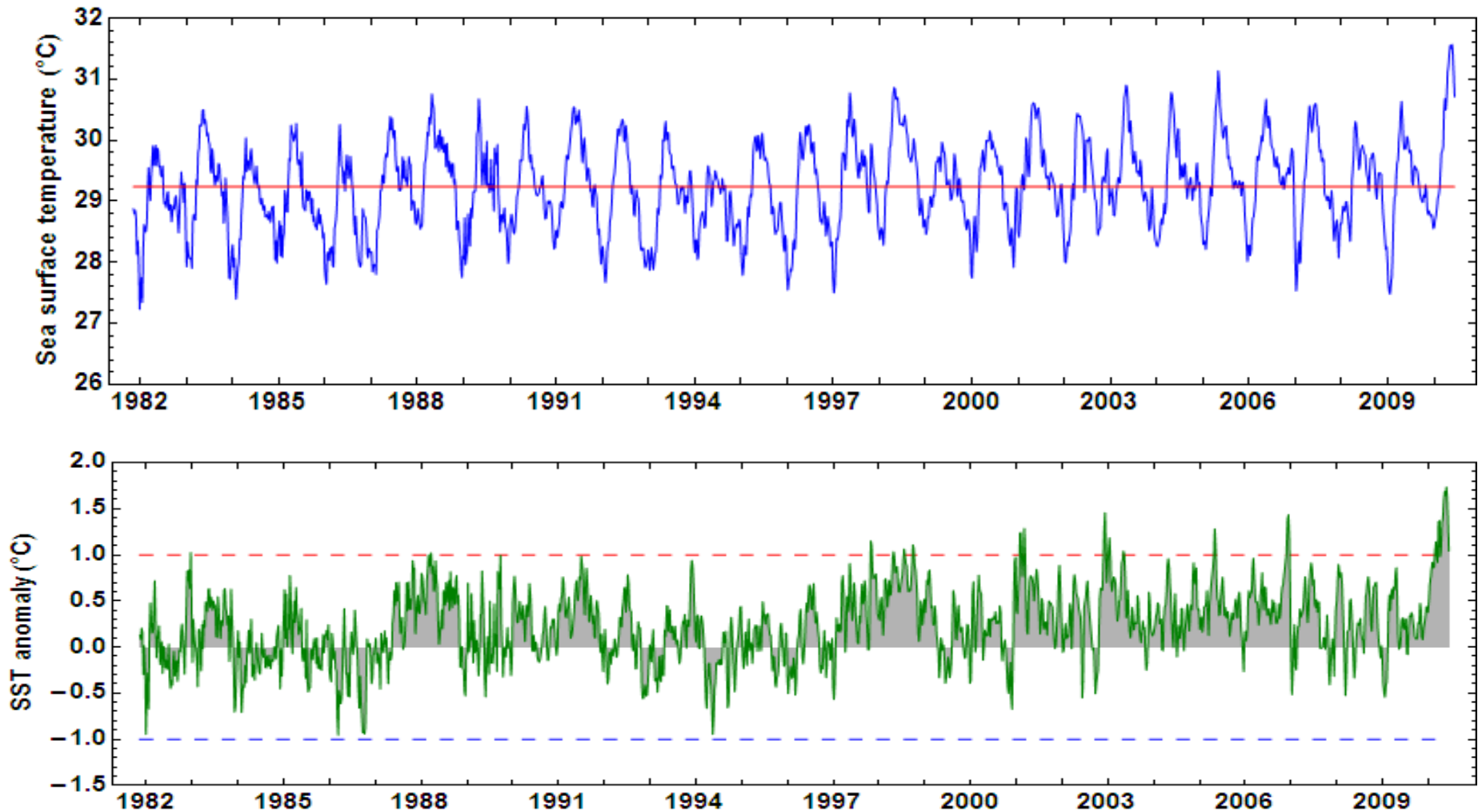


Koh Racha



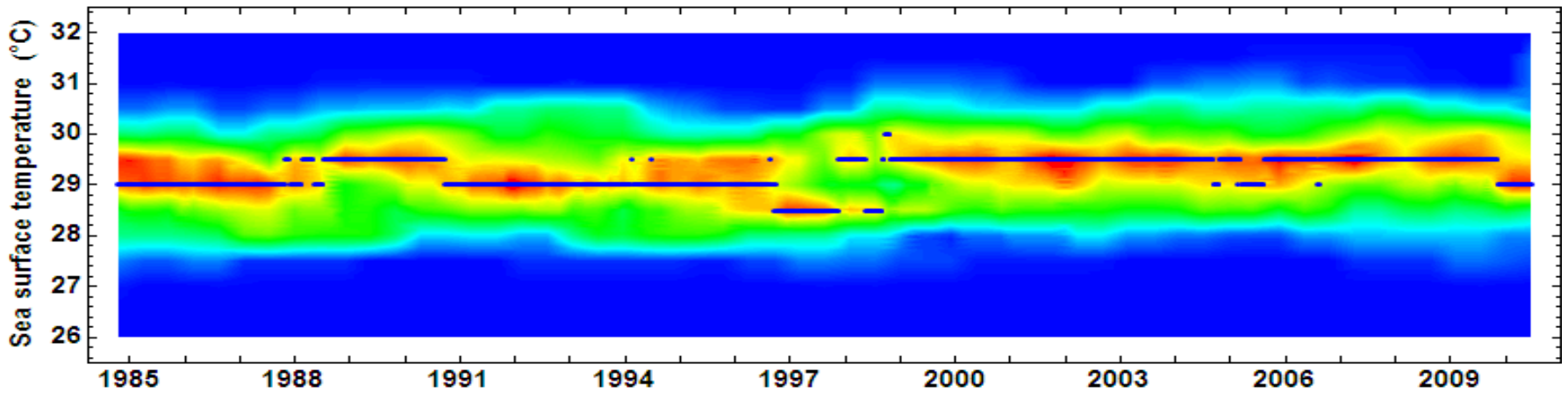
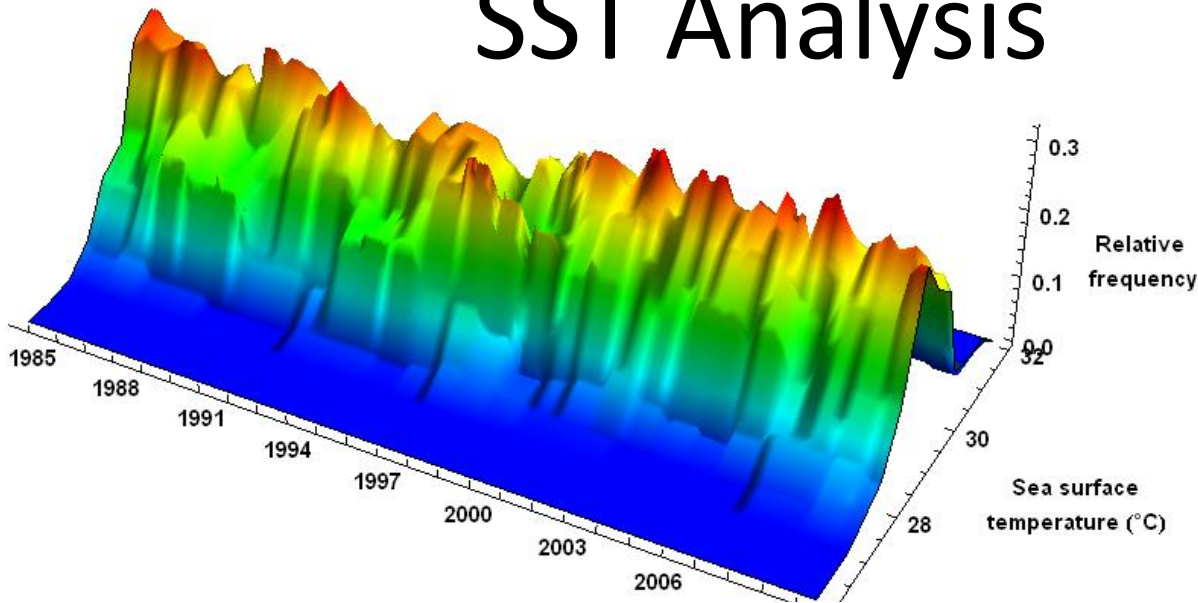
*SST from HOBO (blue line) and NOAA (red line): Tan Island in the Gulf of Thailand (16 Feb 2009-7 May 2010) and Racha Island in the Andaman Sea (7 June 2008-7 July 2010),*

# SST and SSTa from NOAA data





# SST Analysis



*SST 3D moving histogram at Racha Island.*

*SST contour moving histogram at blue dots represent SST modes.*



# Weather data at Racha Island is online!

**WeatherLink® Network**

COE Ecoinformatics - Koh Racha Station

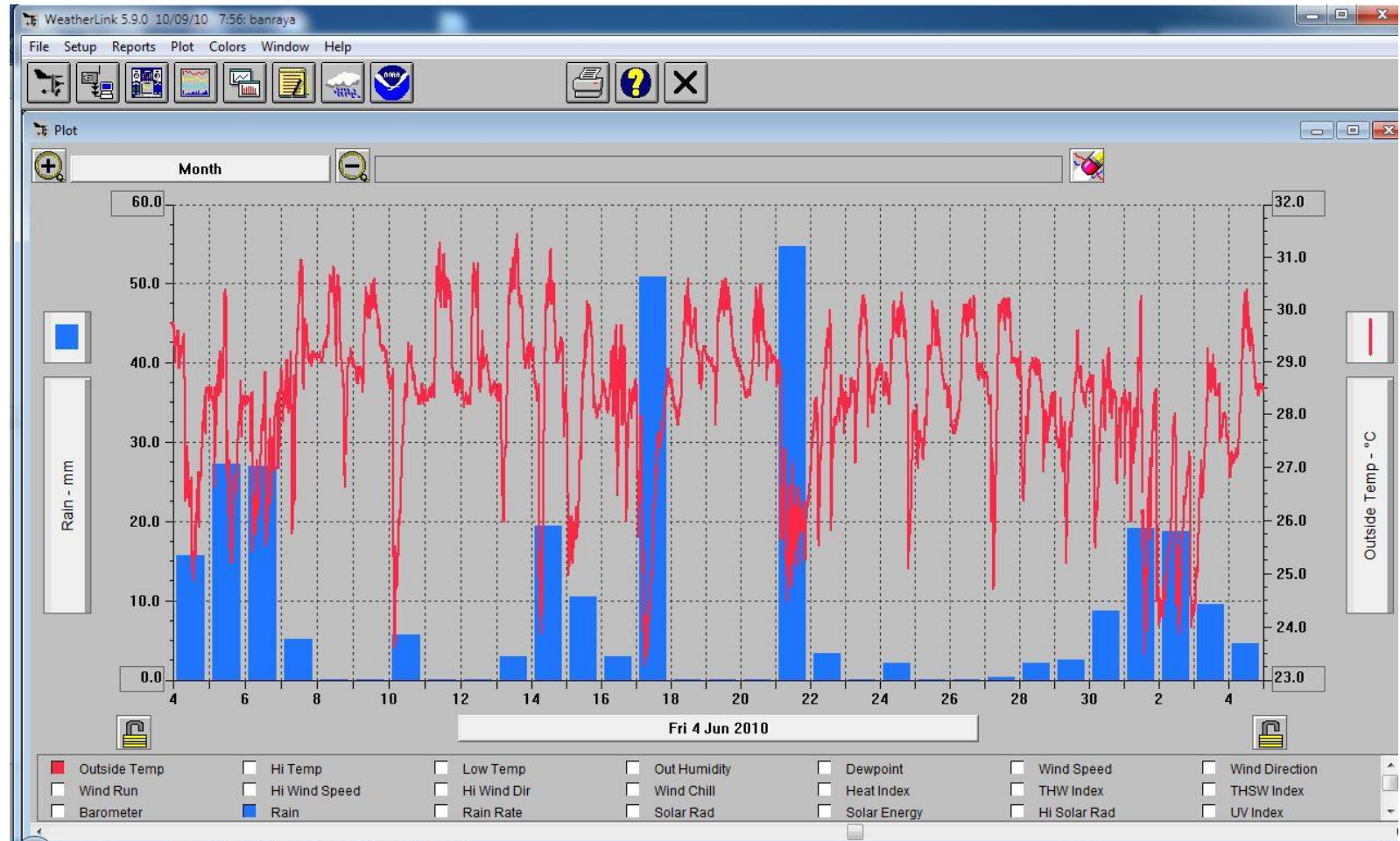
<b>28°</b>	<b>HIGH 28°C</b>	at 00:00
	<b>LOW 26°C</b>	at 02:56
<b>Wind</b>	<b>NNE 5 km/h</b>	High Gust 39 km/h at 02:32
<b>Humidity</b>	<b>85%</b>	Feels Like 33°C
<b>Rain</b>	<b>0.4mm</b>	Seasonal Total 553.8mm
<b>Barometer</b>	<b>1006.1mb</b>	Rising Rapidly

Current Conditions as of 20:56 Thursday, September 9, 2010

**DAVIS**

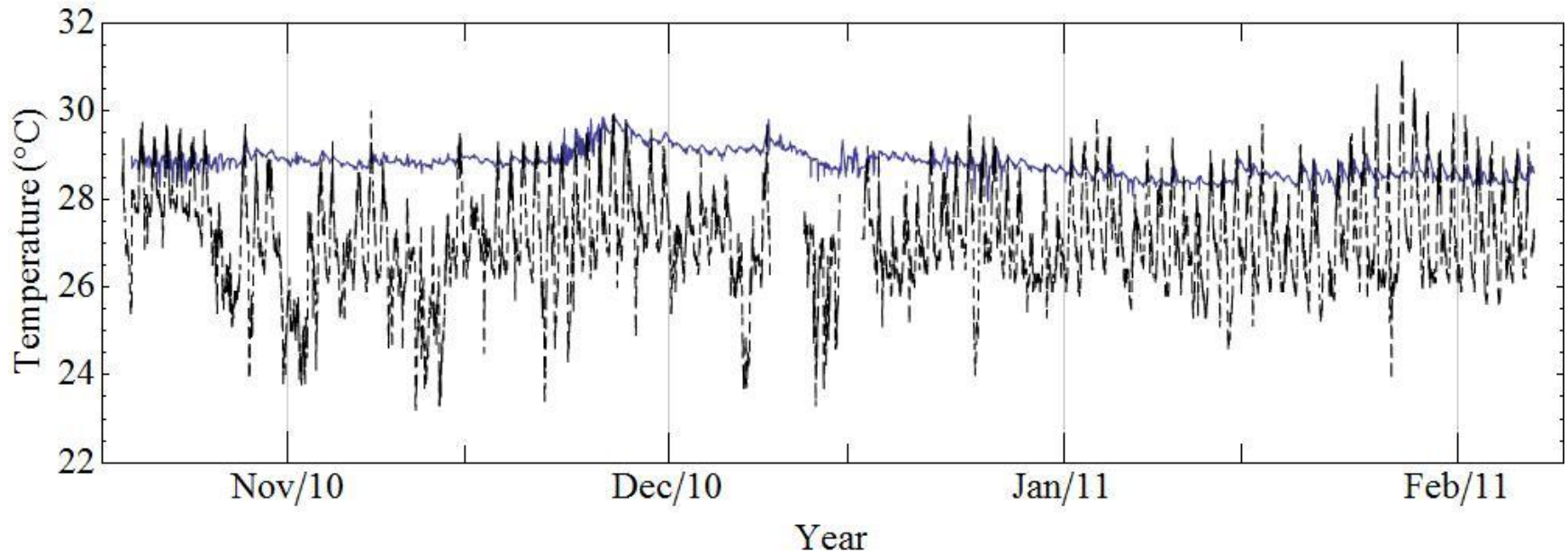
at this URL <http://www.weatherlink.com/user/nstwscoe>

# Weather data visualization



For example, rainfall (mm) and Temperature (degree C) can be displayed monthly and daily.

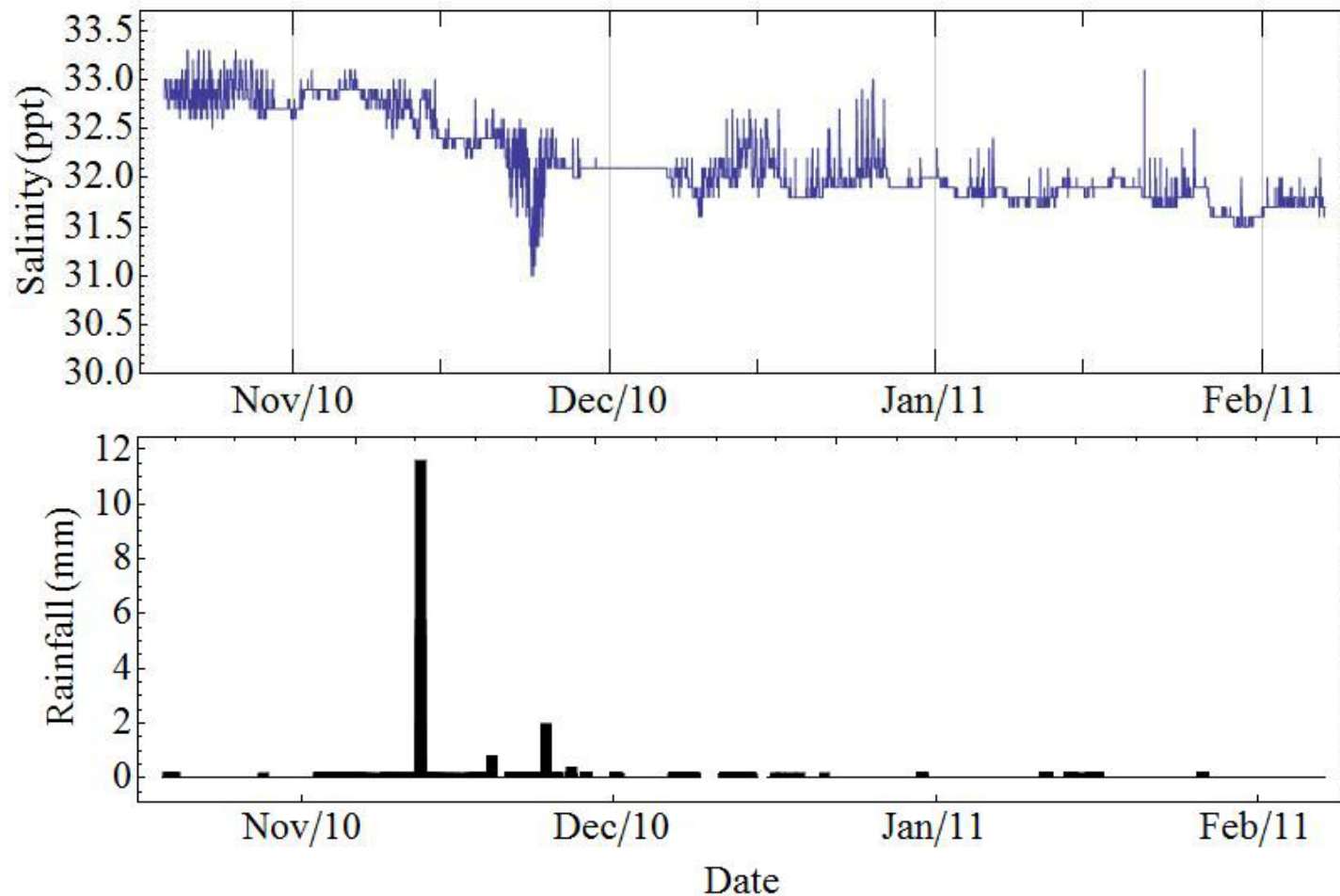
# Temperature data from CTD compare with Weather Station



Mean±SD of Sea temperature  $28.83 \pm 0.29$  °C

Mean±SD of temperature  $27.09 \pm 1.14$  °C

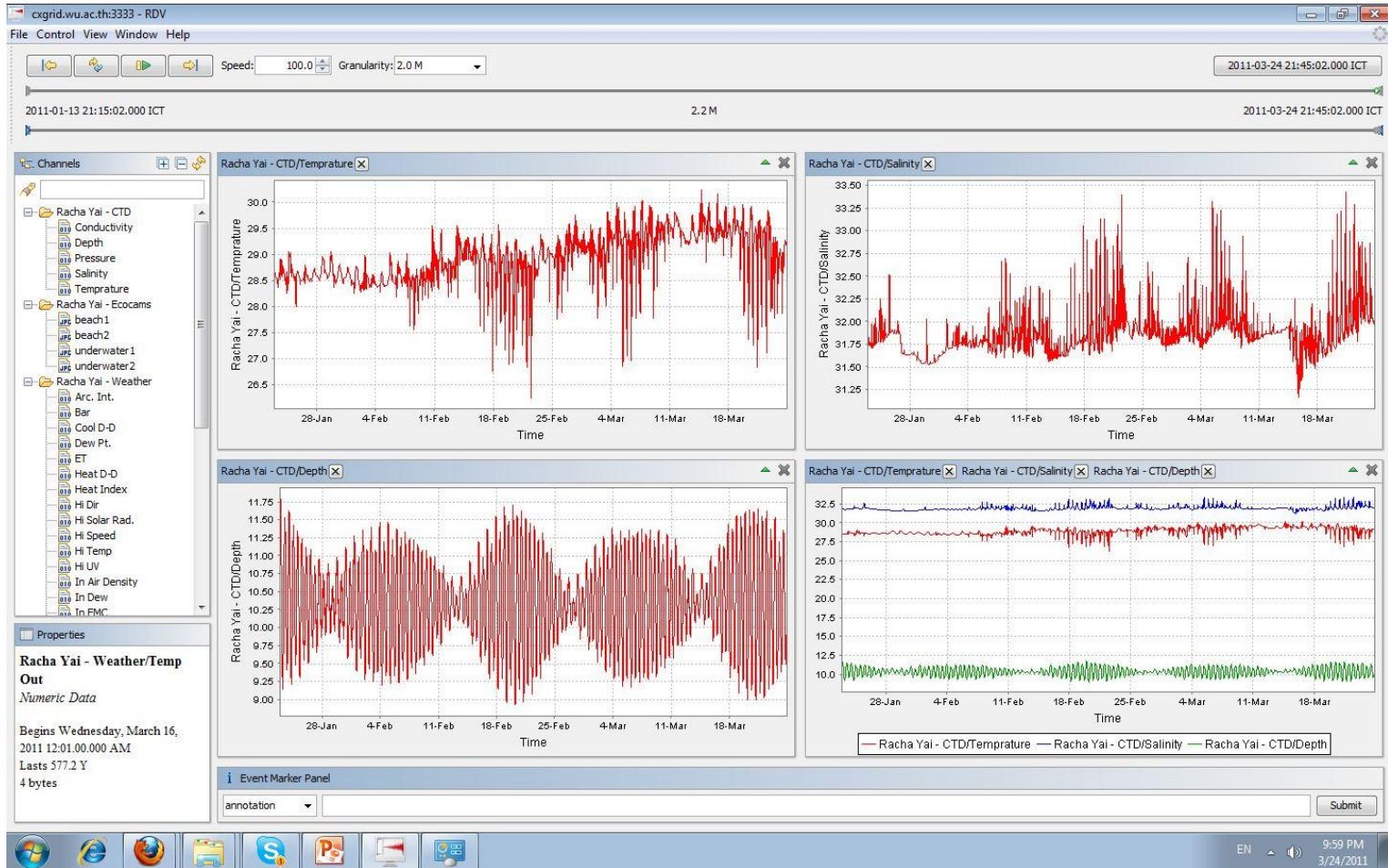
# Salinity data from CTD compare with Rainfall data from Weather Station



Mean $\pm$ SD of Salinity  $32.16 \pm 0.42$  ppt and  
Total Amount of Rainfall 213.8 mm

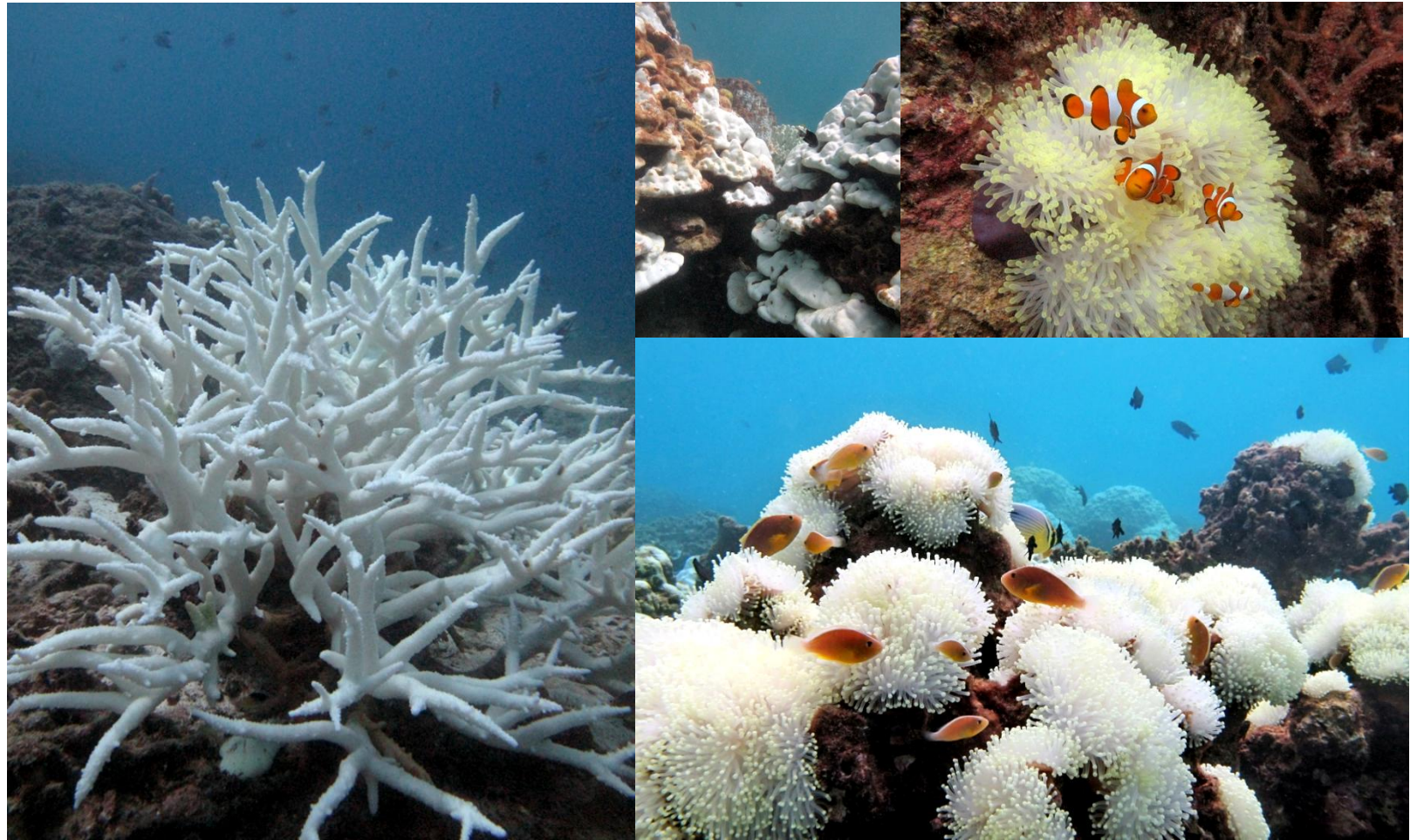


# Real-Time Online Data



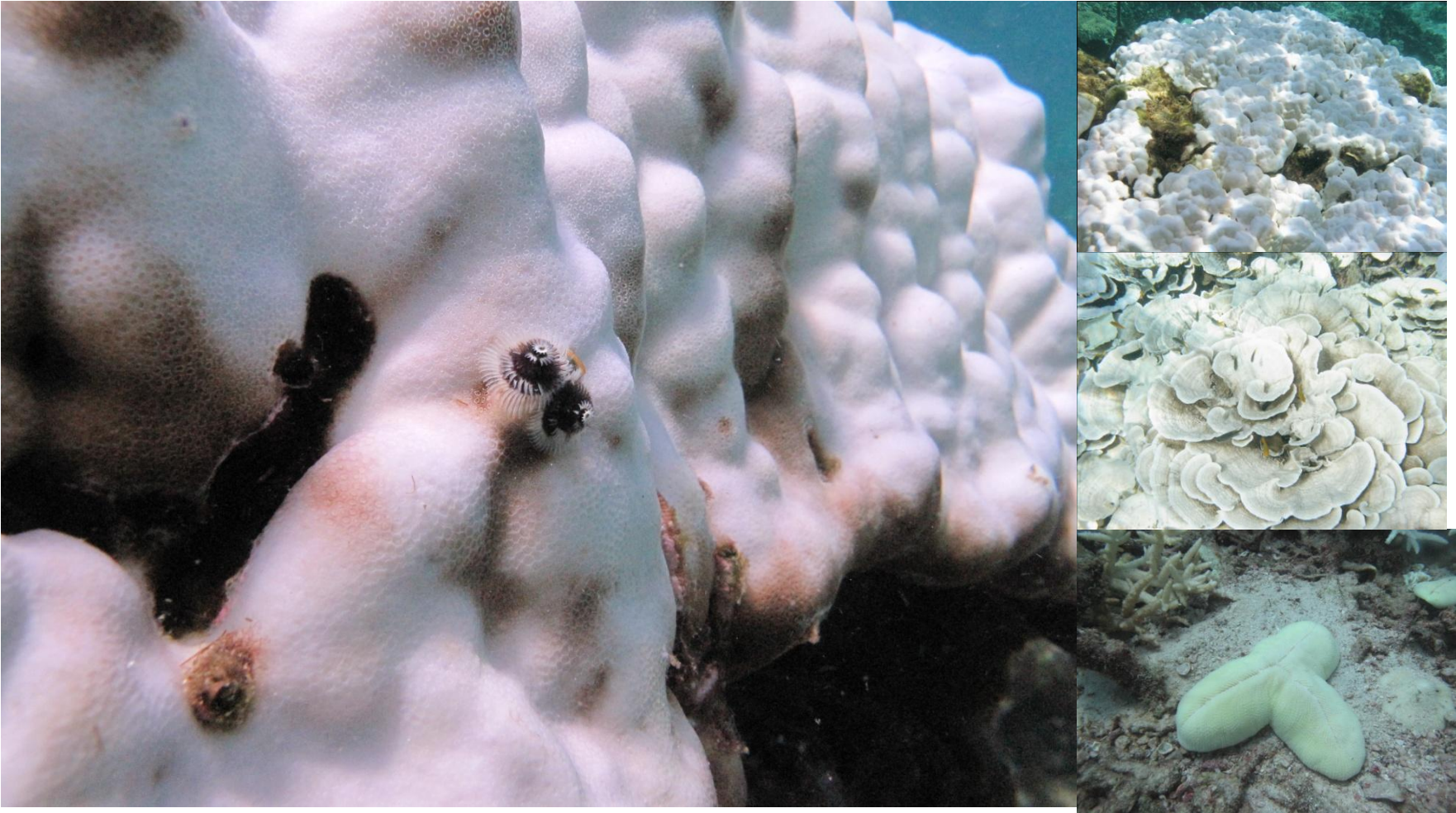


# Bleaching Event at Racha Island on May 2010





# Bleaching Event at Racha Island on May 2010





# Acknowledgements

- This work was supported in part by
  - Nakhon Si Thammarat Rajabhat University
  - Office of the Higher Education Commission, Thailand for supporting by grant fund under the program Strategic Scholarships for Frontier Research Network for the Ph.D. Program Thai Doctoral degree for this research (2/2552)
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  - University of California, San Diego (UCSD)
- We would like to thank
  - Tony Fountain and Michael Nekrasov from UCSD for suggestion and helping us to setup DataTurbine
  - Scott Bainbridge, Damien Eggeling and Geoff Page from AIMS for helping us to install CTD
  - Banraya resort and spa staff for kindly helping us



# Thank you



Photo by Tourism Informatics  
Center of Excellence for Ecoinformatics  
Rachana/Durban/kinga-bask shrimp umazhe/luq/Rachana Yai

