Forecasting Coral Bleaching Weather for the Florida Reef Tract

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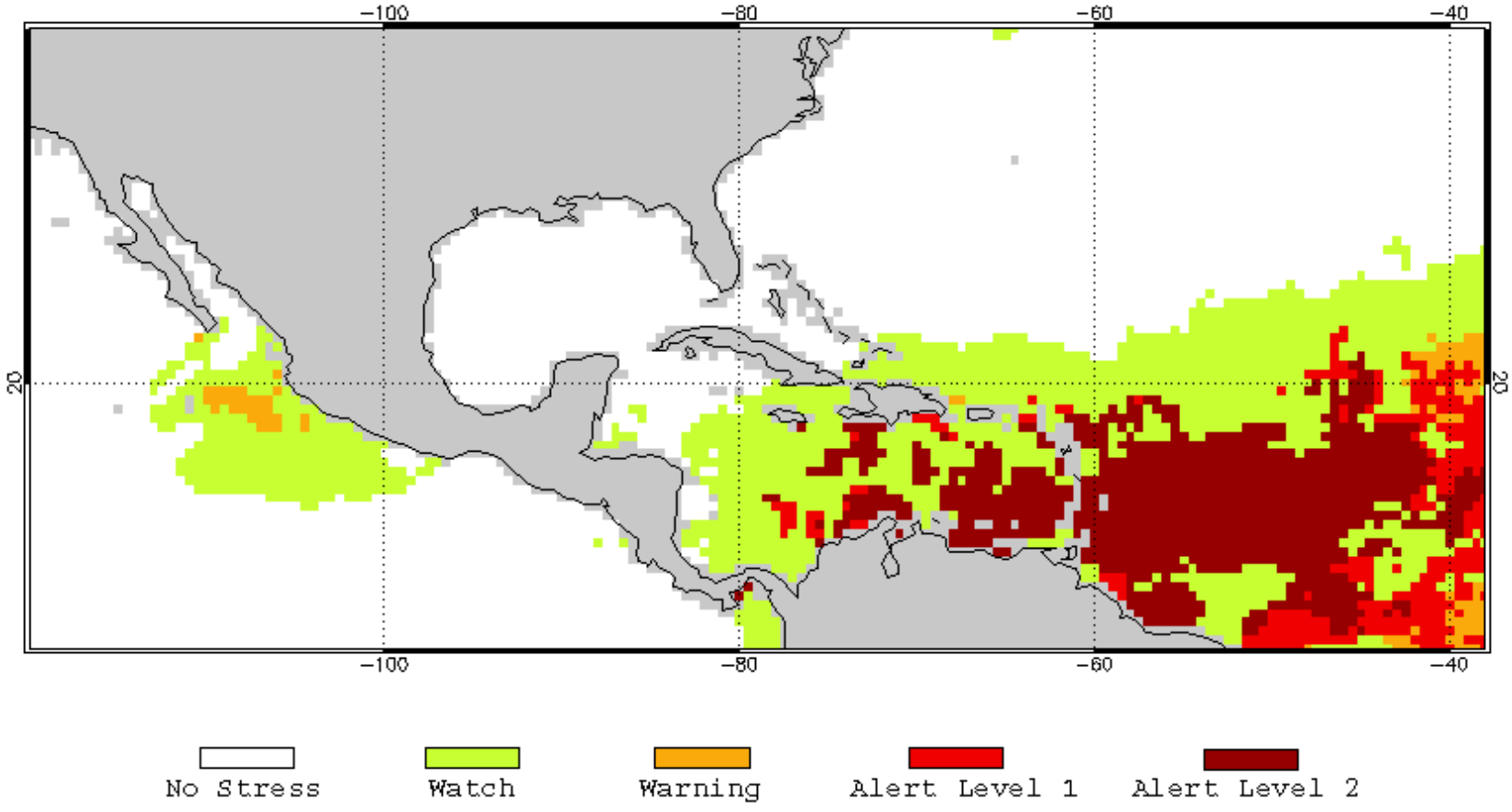
“One-NOAA” Partnership

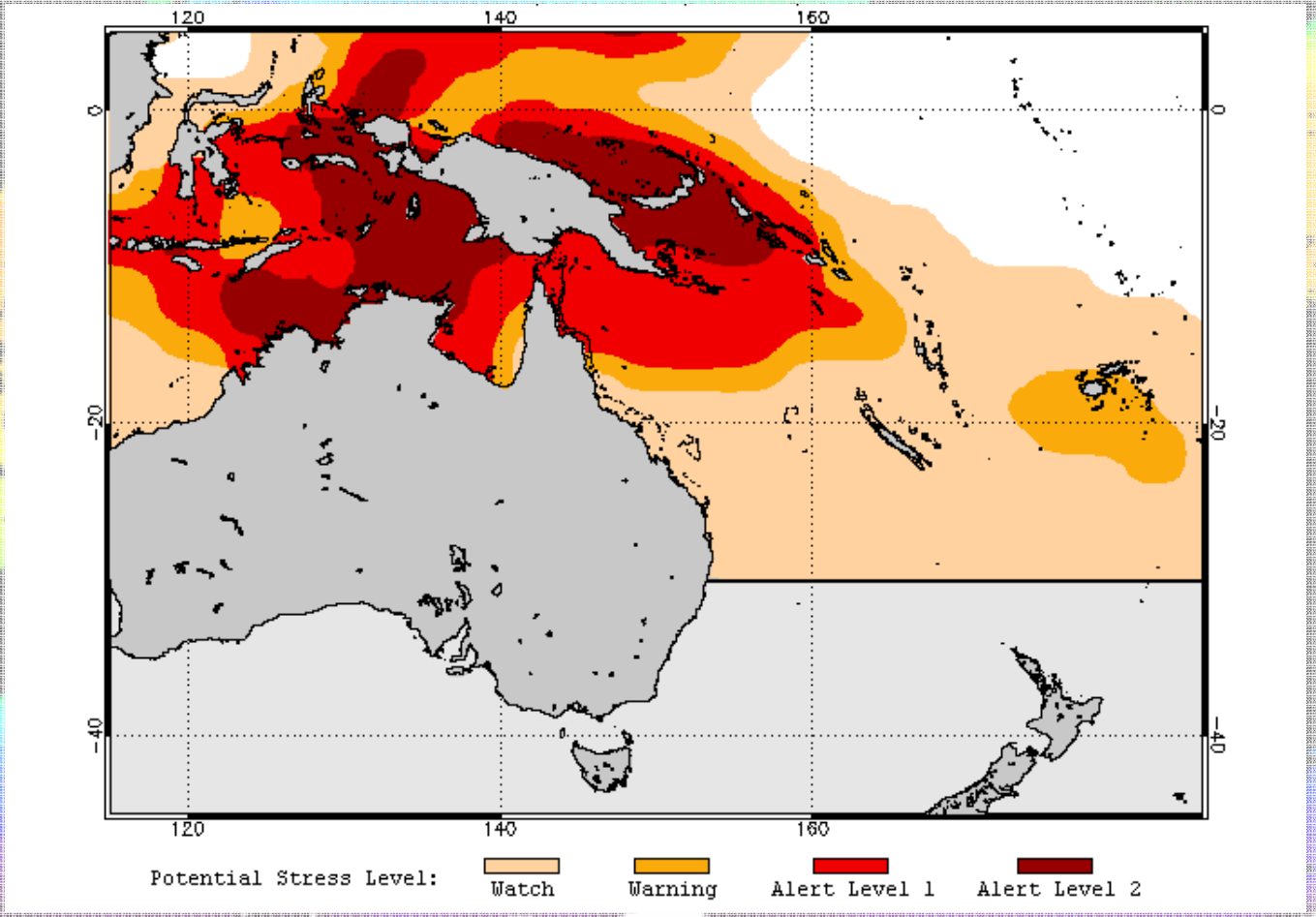
- NWS Weather Forecast Office, Key West
- Coral Reef Watch (CRW) program
  - NOAA Satellite Service in Silver Spring, MD
  - Funded by the NOAA Coral Reef Conservation Program
- Idea started at 2010 IMPACT meeting
- Detail at FKNMS headquarters, Key West

CRW uses satellite SST to look for current bleaching risk.



Bleaching outlook, 18 October 2010

CRW uses SST models to look for seasonal bleaching risk.

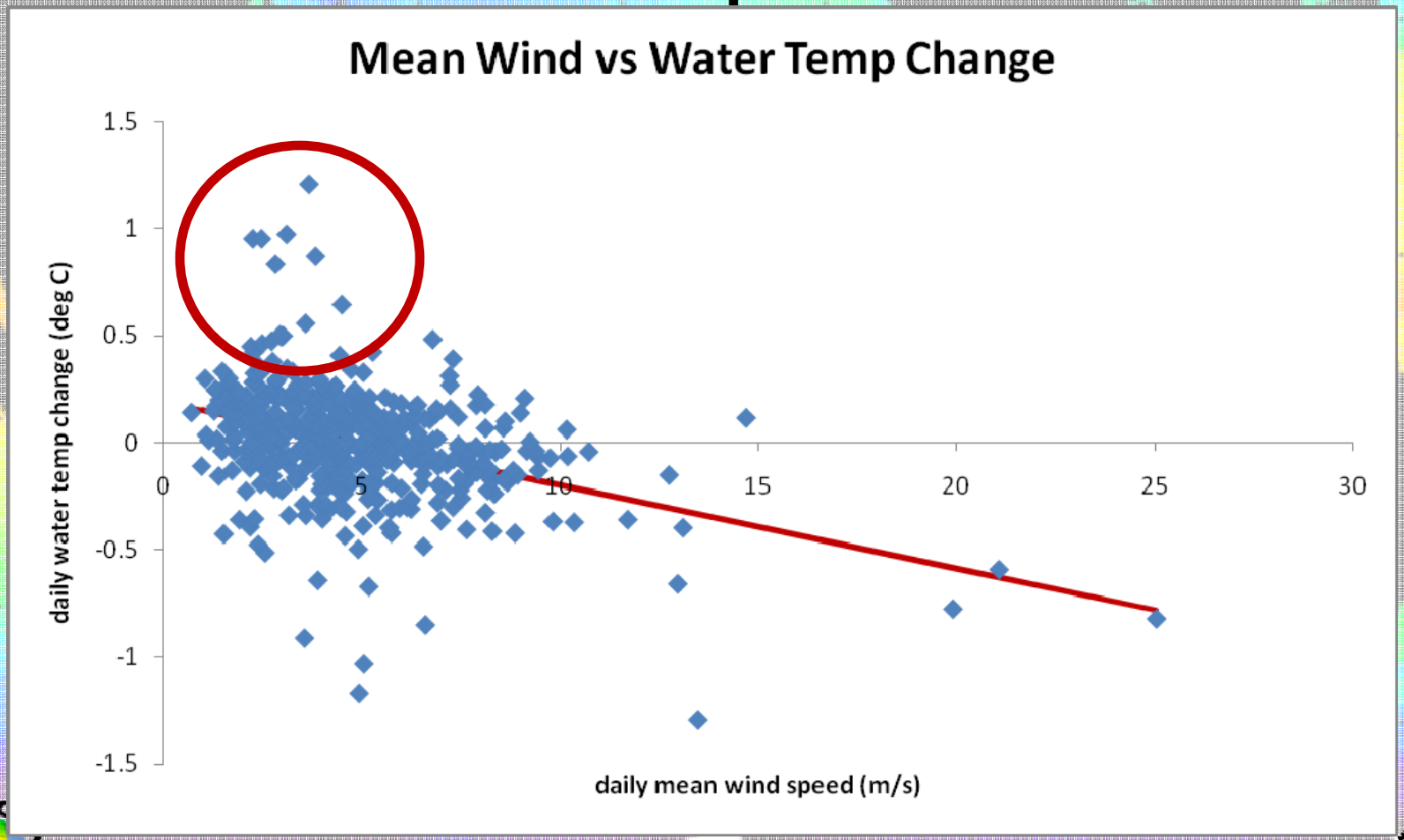


Bleaching outlook, 19 October 2010

Forecast will give a week's early warning for "bleaching weather".

- Bleaching is caused by:
  - high water temperature
  - high sunlight
- Weather sets up bleaching conditions
  - low wind
  - low cloud cover
  - (low waves)
- Elements of standard National Weather Service marine forecast system
- Combine into experimental bleaching weather outlook

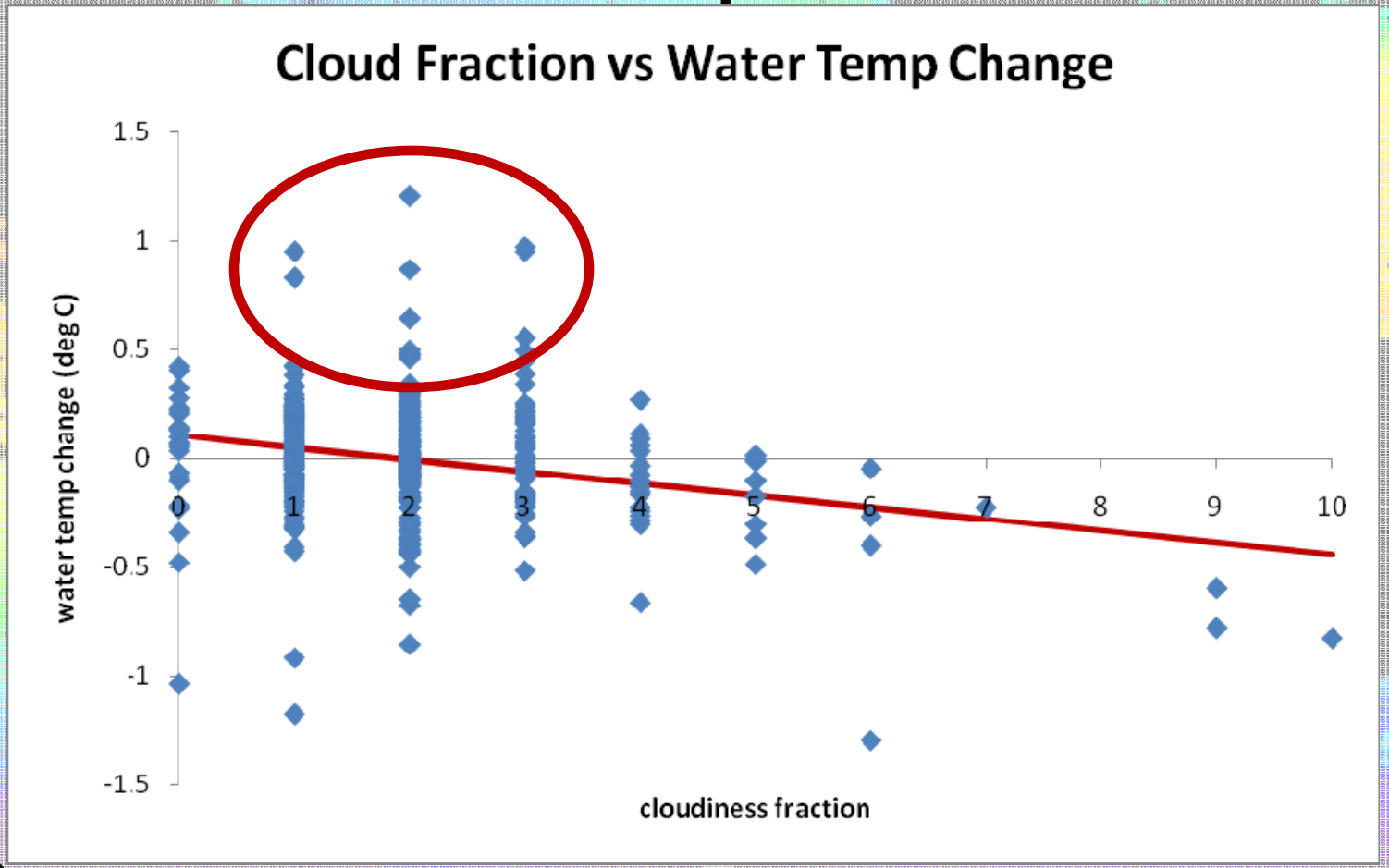
Low wind leads to increasing water temperature.



Sombrero & Molasses buoys (summer 2005-10)

$p < 0.0001$ $R^2 = 0.15$

Clear sky leads to increasing water temperature.



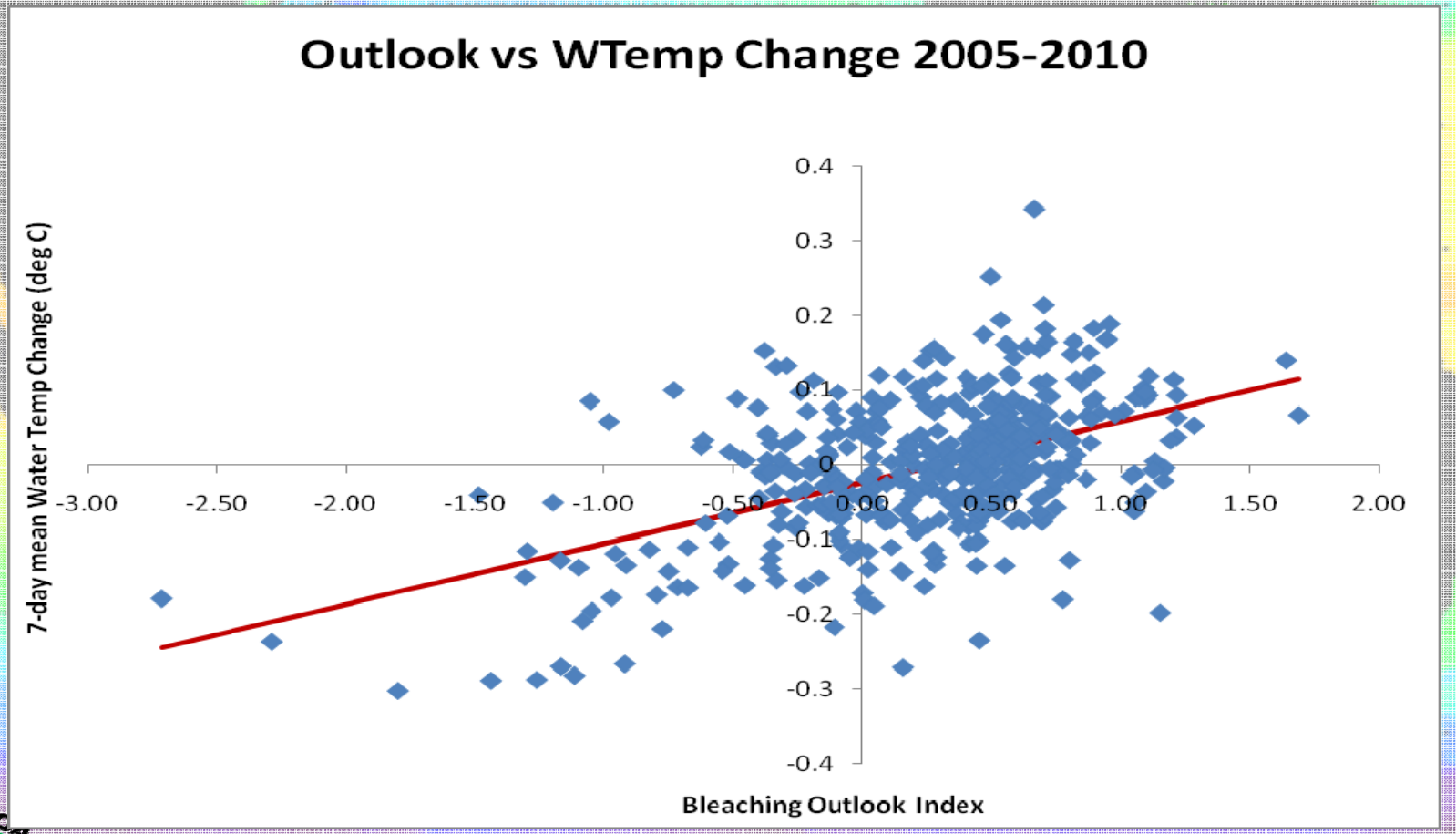
Key West, Sombrero & Molasses buoys (2005-10)

$p < 0.0001$ $R^2 = 0.07$

Forecasting Bleaching Weather

- Wind and cloud cover
- Calculations
  - Daily forecast
  - Subtract July-Sept mean to make anomaly
  - Divide by mean to normalize
  - Add wind + cloud effects
  - Average over 7-day forecast period
- Simulated forecast from buoy data by looking forward 7 days

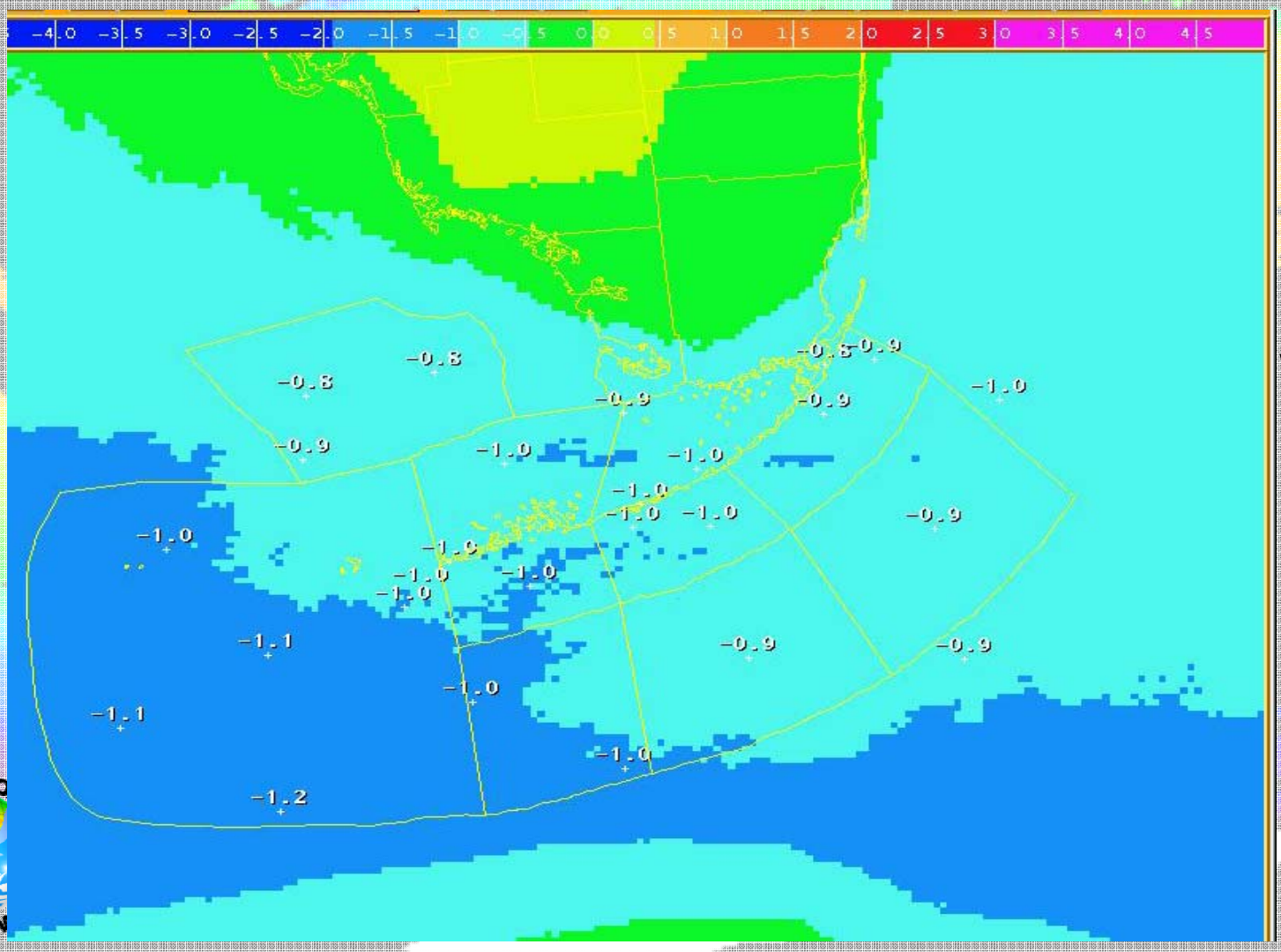
Simulated outlook matches water temperature changes.



Sombrero 2005 – 2007, Molasses 2009 & 2010

$p<0.0001$, $R^2=0.25$

KWFO using clouds and wind to forecast bleaching weather.



cloud fraction

wind speed & direction

bleaching weather index

Coming soon… experimental Bleaching Weather forecasts.

- 2x per week – with CRW alerts
- Testing phase in summer 2011
- Trial run with a focus group at first
- Eventual public release
  - Part of marine forecast
  - May go out on NOAA weather radio
- May expand to other forecast locations


Thank you!
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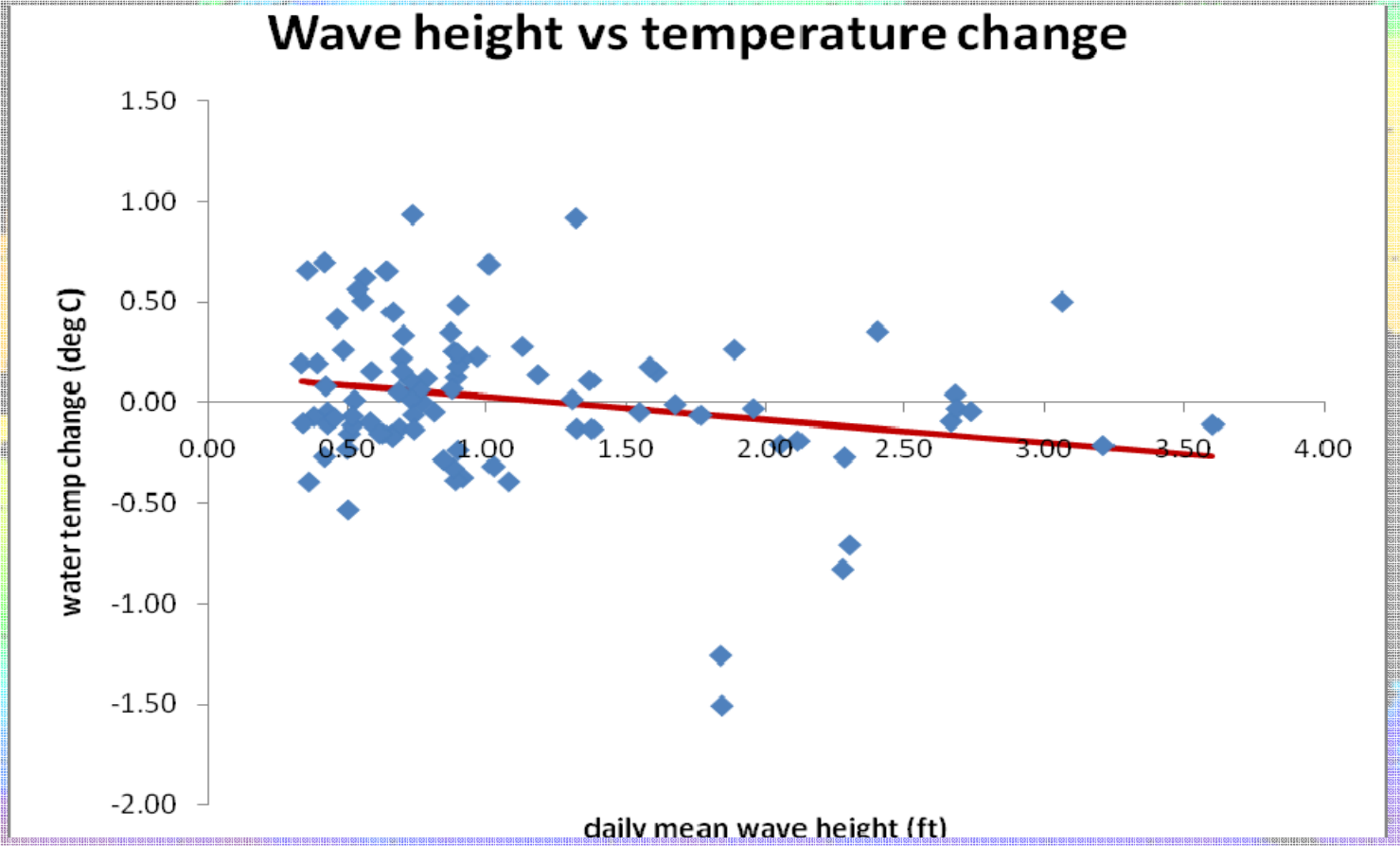
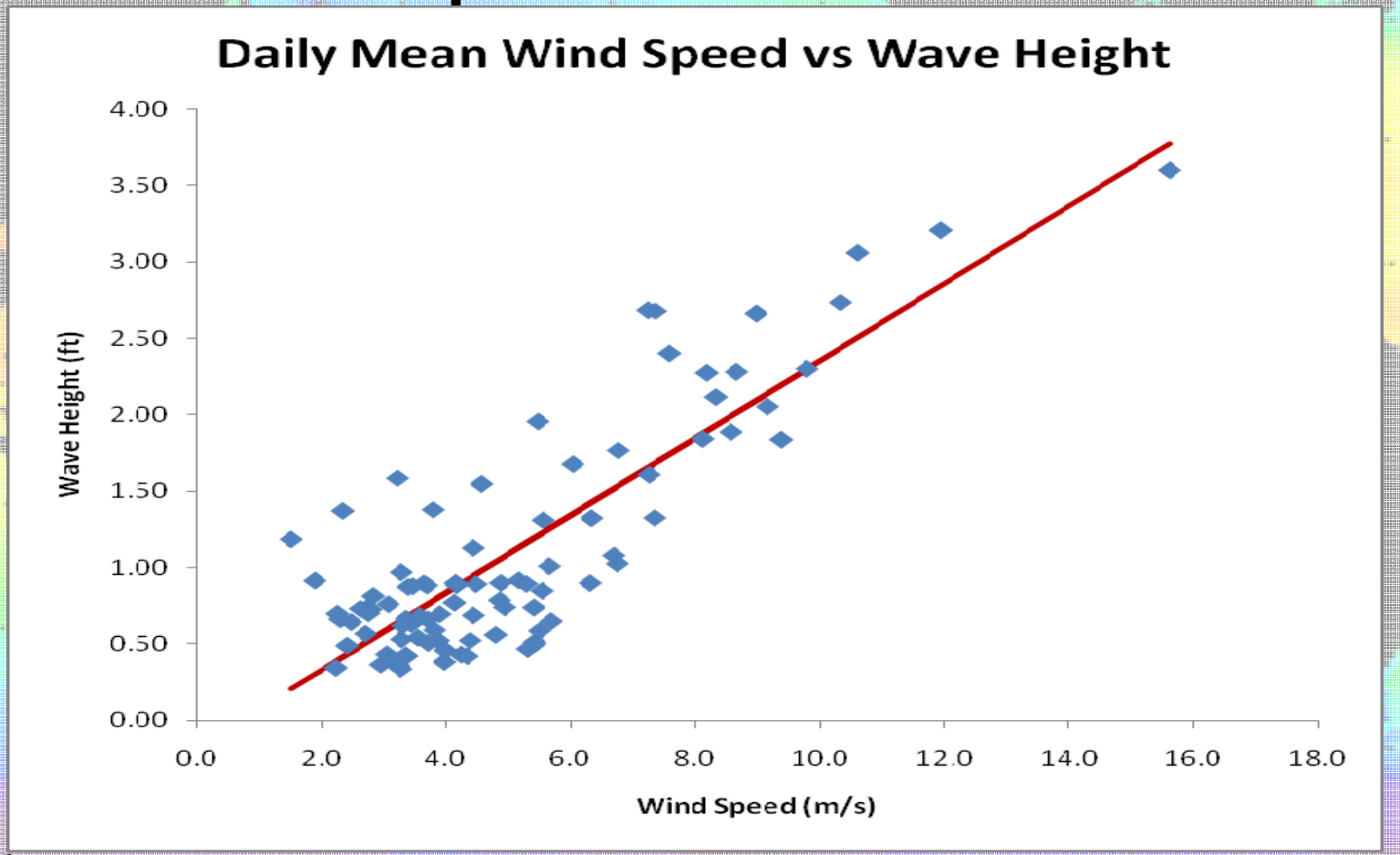
Low waves leads to increasing water temperature…



Buoy offshore from Cape Canaveral (summer 2005)

$p = 0.03$ $R^2 = 0.05$

… but waves are wind-driven, so no separate wave effect.



Buoy offshore from Cape Canaveral (summer 2005)

$p < 0.00001$ $R^2 = 0.71$

2010 simulated outlook