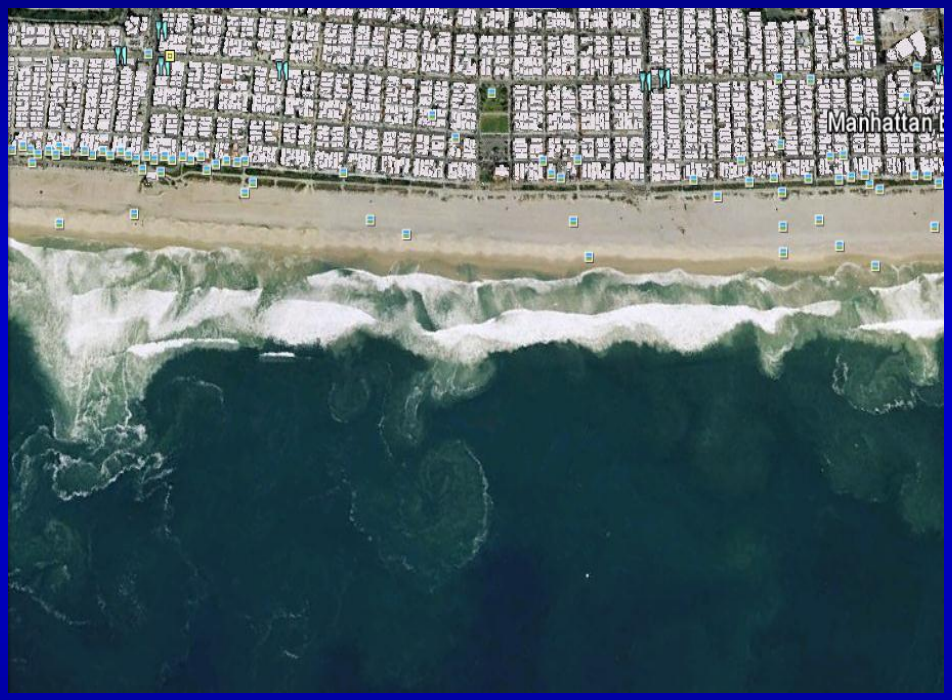
Rip Current Local Collaboration Project

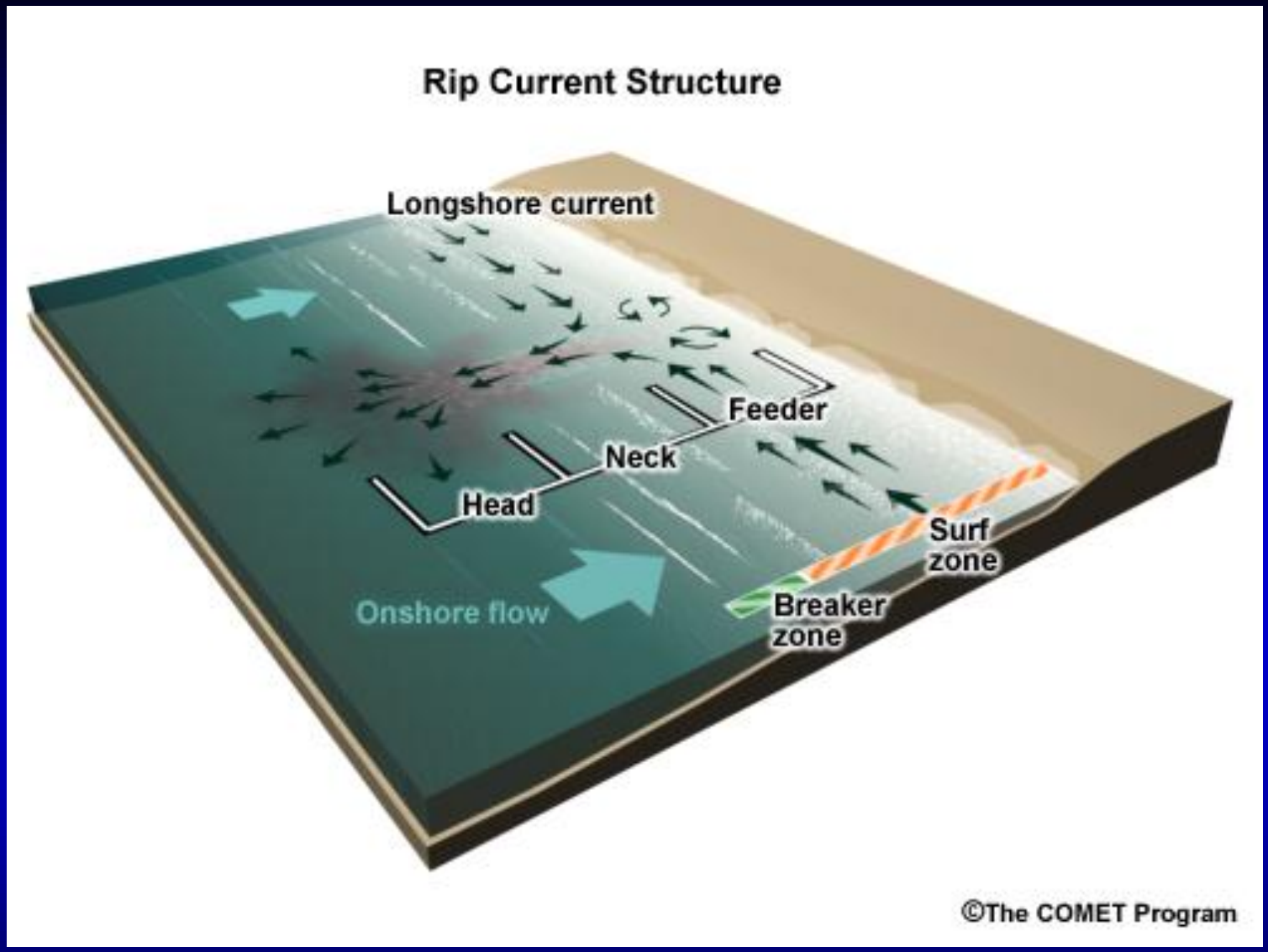
Observation, Analysis, and Forecasting

Mike Churma, John Schattel, Chung-Sheng Wu

NWS Meteorological Development Laboratory

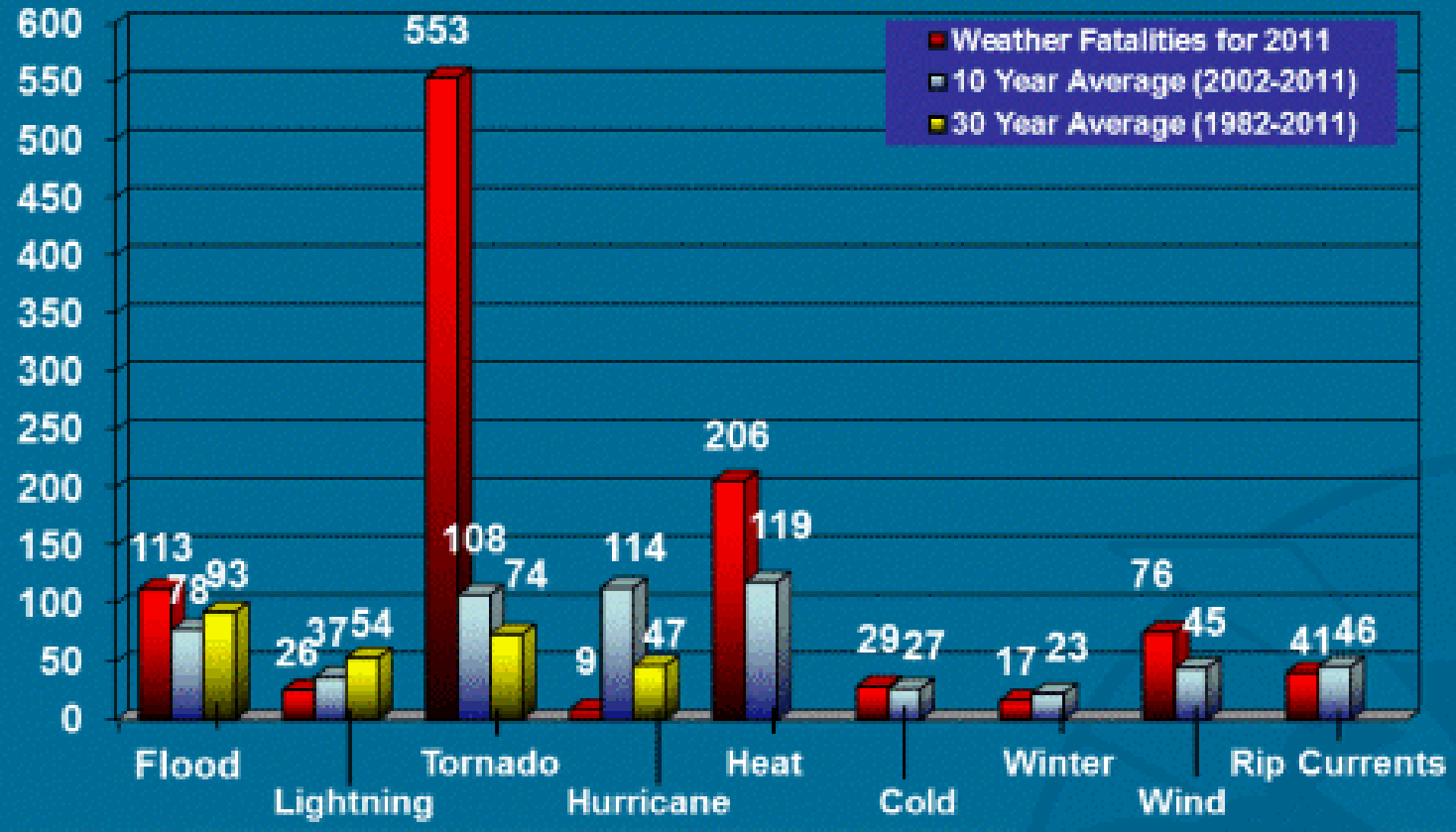


Rip Currents -- A jet-like seaward flow across the surf zone of a beach.

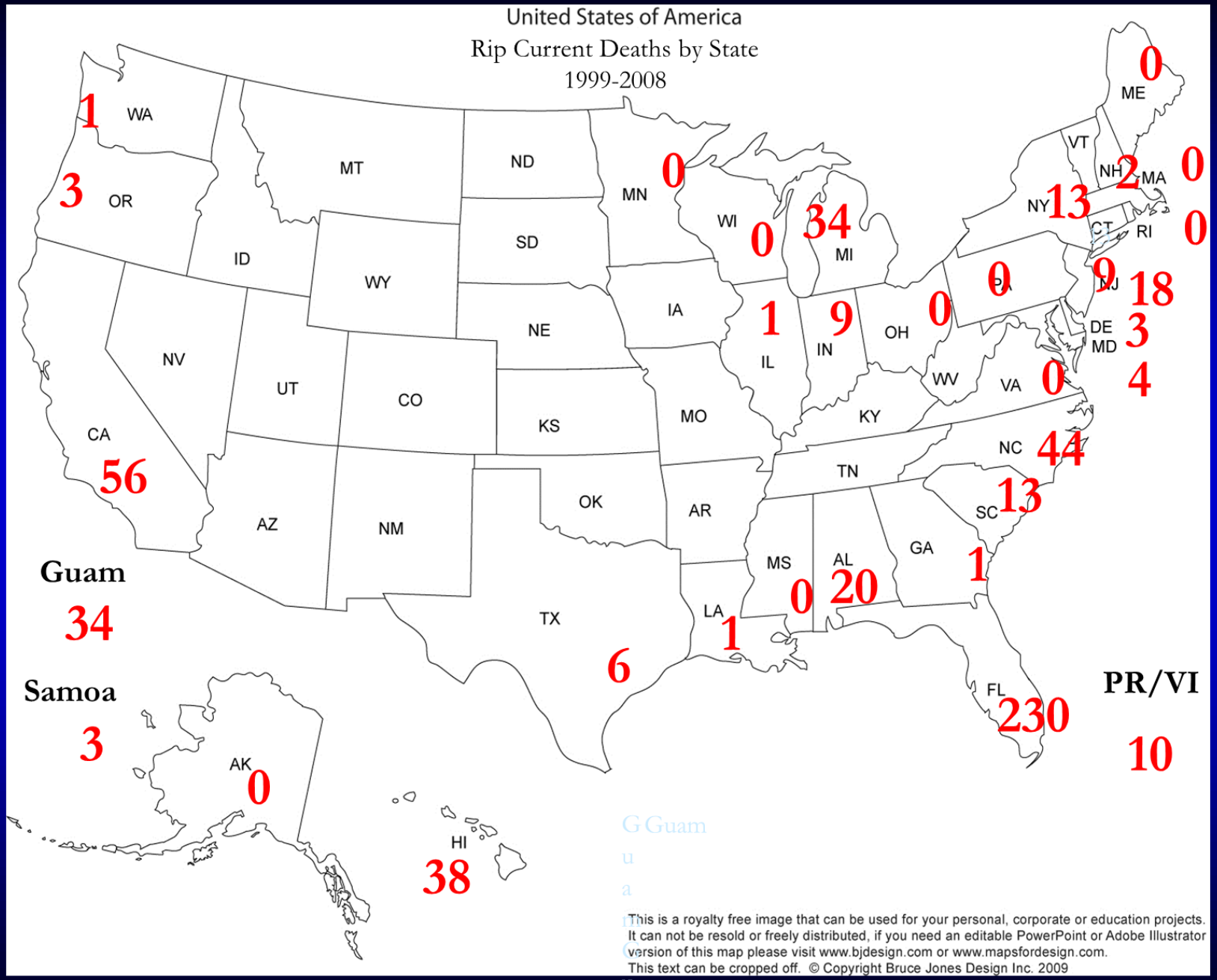


In 2011 , 30,981 out of 60,635 total rescues by lifeguards involved rip currents (Source – usla.org)

Weather Fatalities



http://www.nws.noaa.gov/os/hazstats/resources/hazstat-chart12.gif


United States of America
Rip Current Deaths by State
1999-2008
WA 1
OR 3
CA 56
NV
ID
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX 6
MN 0
IA
MO
AR
LA 1
WI 0
IL 1
MS 0
MI 34
IN 9
KY
TN
AL 20
OH 0
WV
GA 1
FL 230
SC 13
NC 44
VA 0
PA 0
NY 13
ME 0
VT
NH 2
MA 0
CT
RI 0
NJ 18
DE 3
MD 4
Guam
34
Samoa
3
AK 0
HI 38
PR/VI
10
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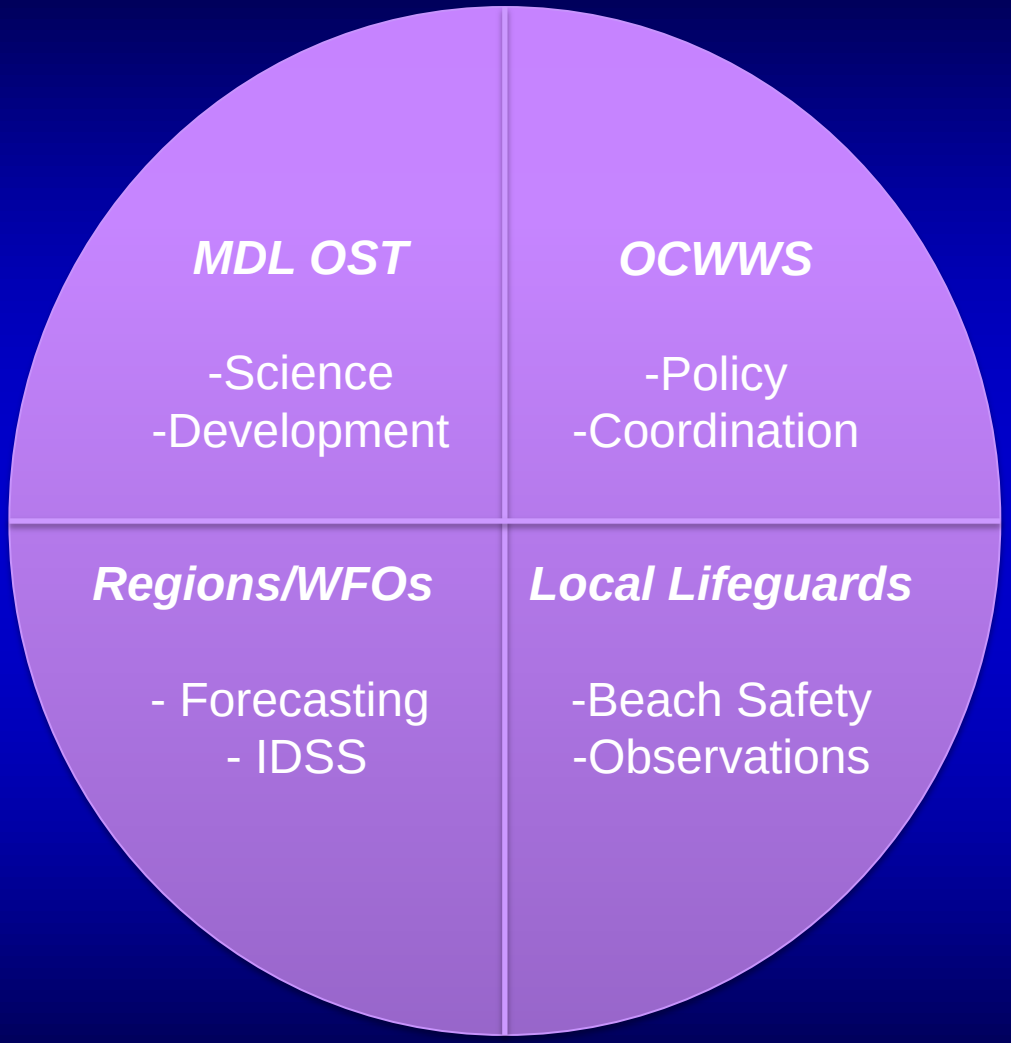
- Without observations of rip currents we can not verify rip current forecasts for beach safety.

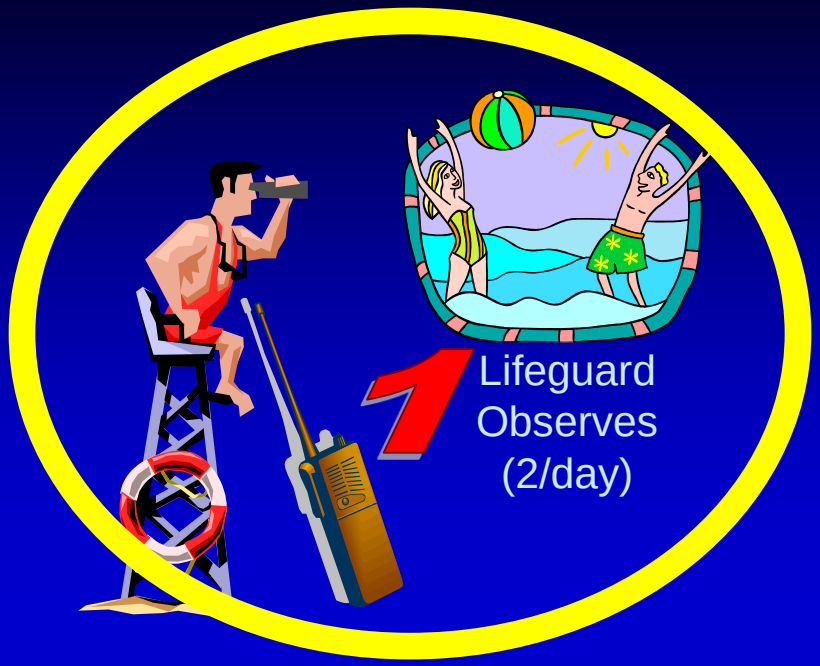
- 2004 NWS-Sea Grant Rip Current Technical Workshop:

“A pilot program should be implemented to monitor rip currents so as to reduce the hazard they pose to the public.”

Stakeholders: A Team Approach




LOT
IWX
OKX
ILM
SGX
JAX
MLB
Participating Beaches



1 Lifeguard Observes (2/day)

2 Observation entered into web form

3 Observation Stored In Rip Current Database

4 Supplemental Data Added

5 Analyze Observations

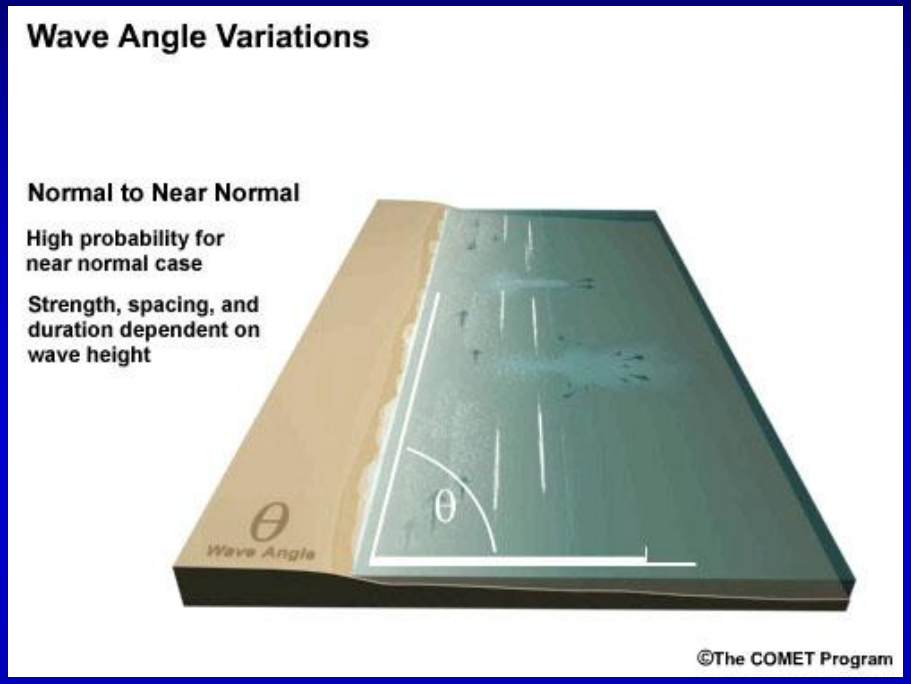
NWS Web Farm

Internet

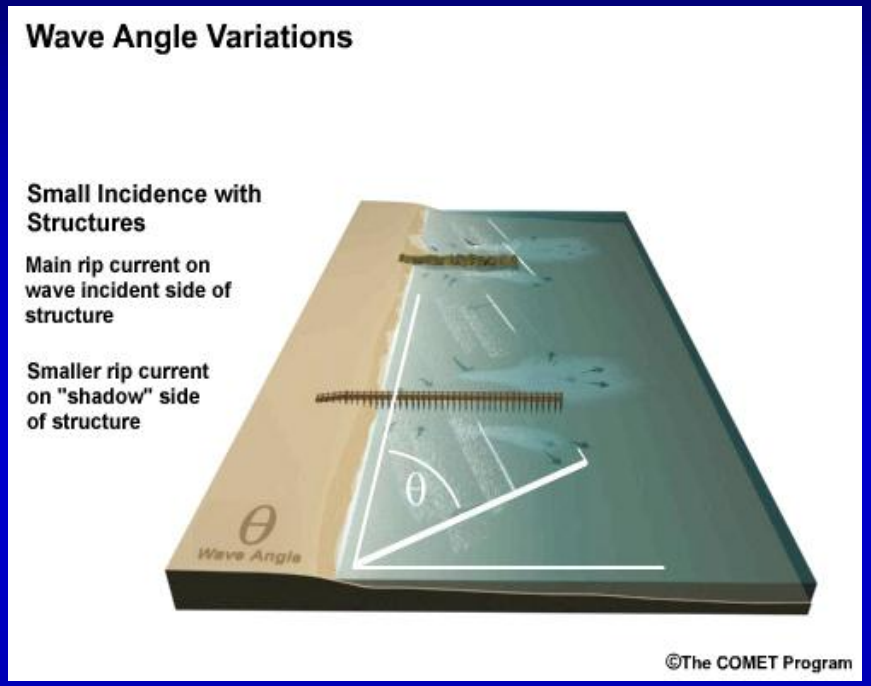
MDL

WFO

HQ

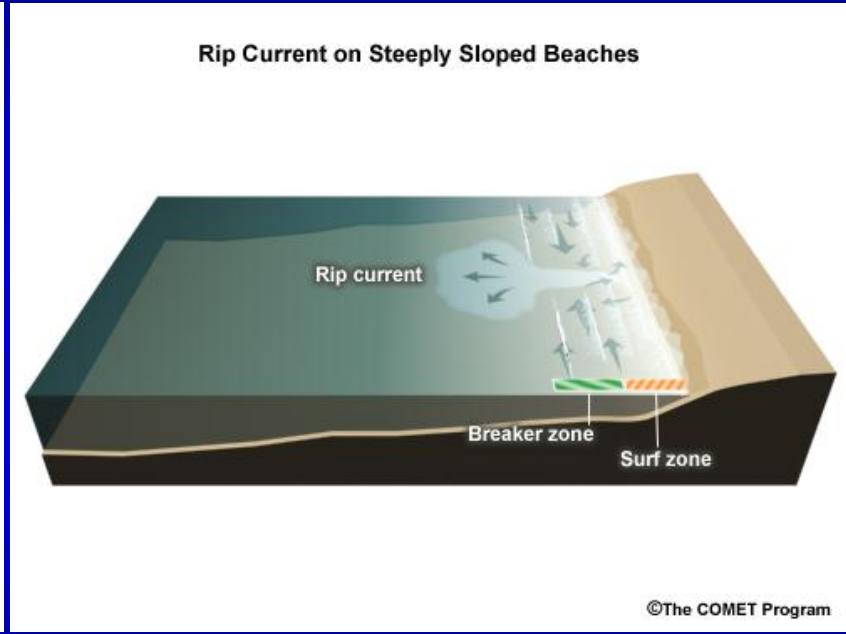


Near-normal incoming waves will most likely cause rip currents at beaches with no permanent outcroppings.

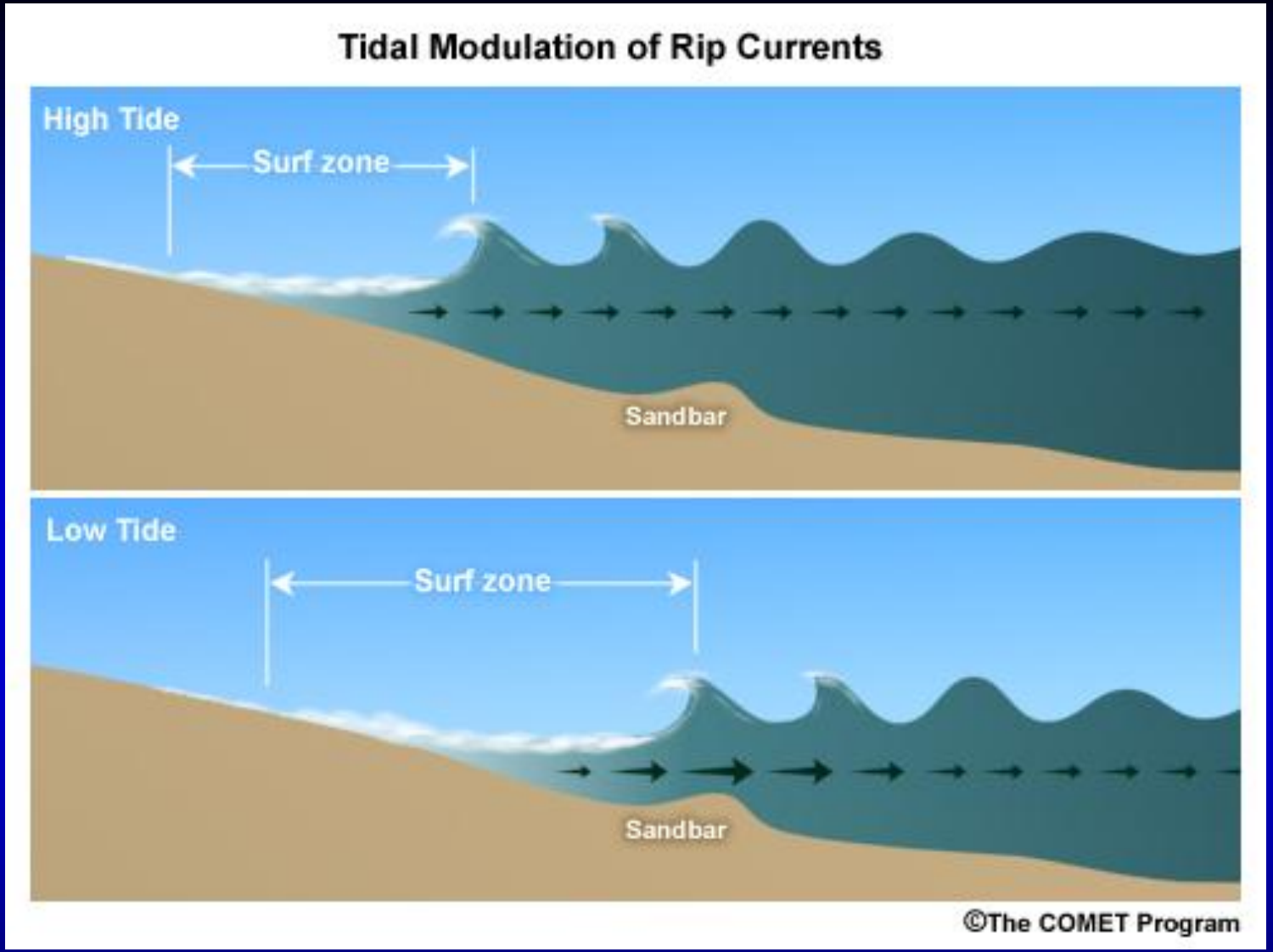


Permanent outcroppings along the shoreline, such as jetties or piers, can cause rip currents, especially with oblique wave angles.

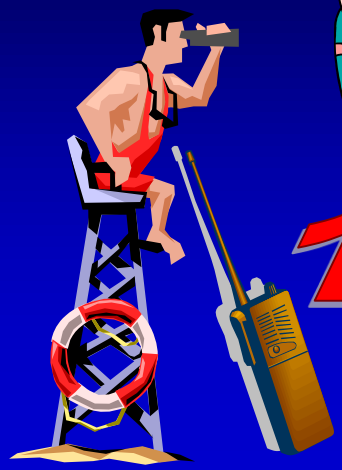
Wave breaks when wave height is > ~0.8 times the water depth.



Rip currents are more often seen at beaches with mild slopes instead of steep slopes, because this affects the surf zone width and therefore the amount of water transport.



Changes in water level via tides or (in the Great Lakes) seiches or seasonal water level variations can provoke rip currents through surf zone with changes and increase channeling through sandbars.



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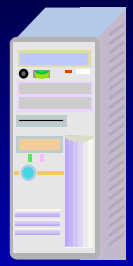
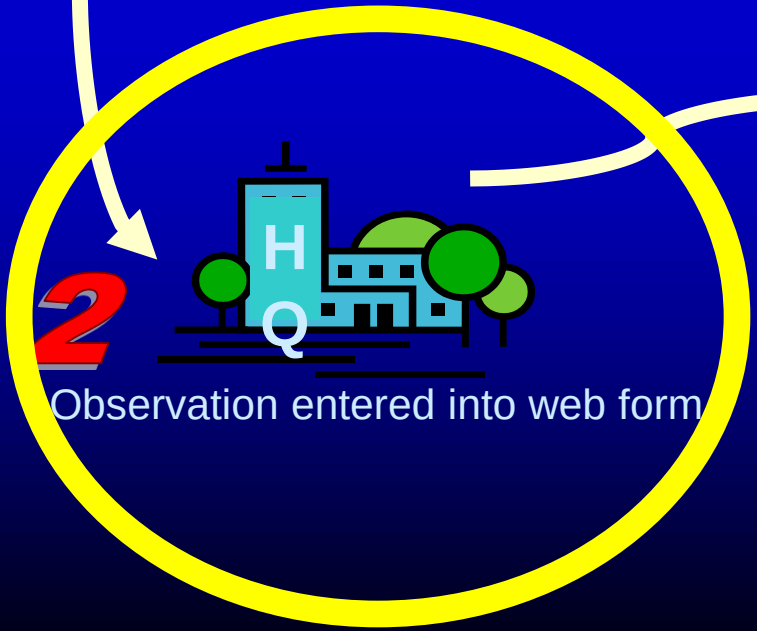


4 Supplemental Data Added

Internet



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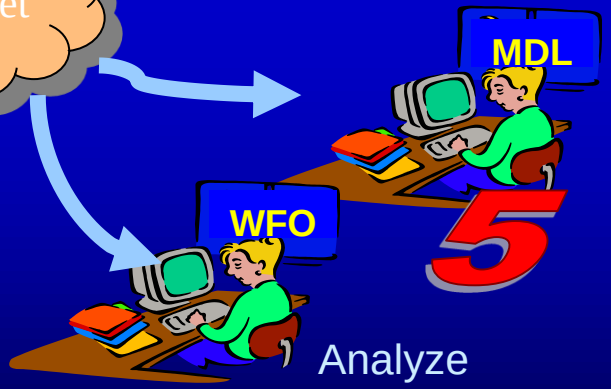
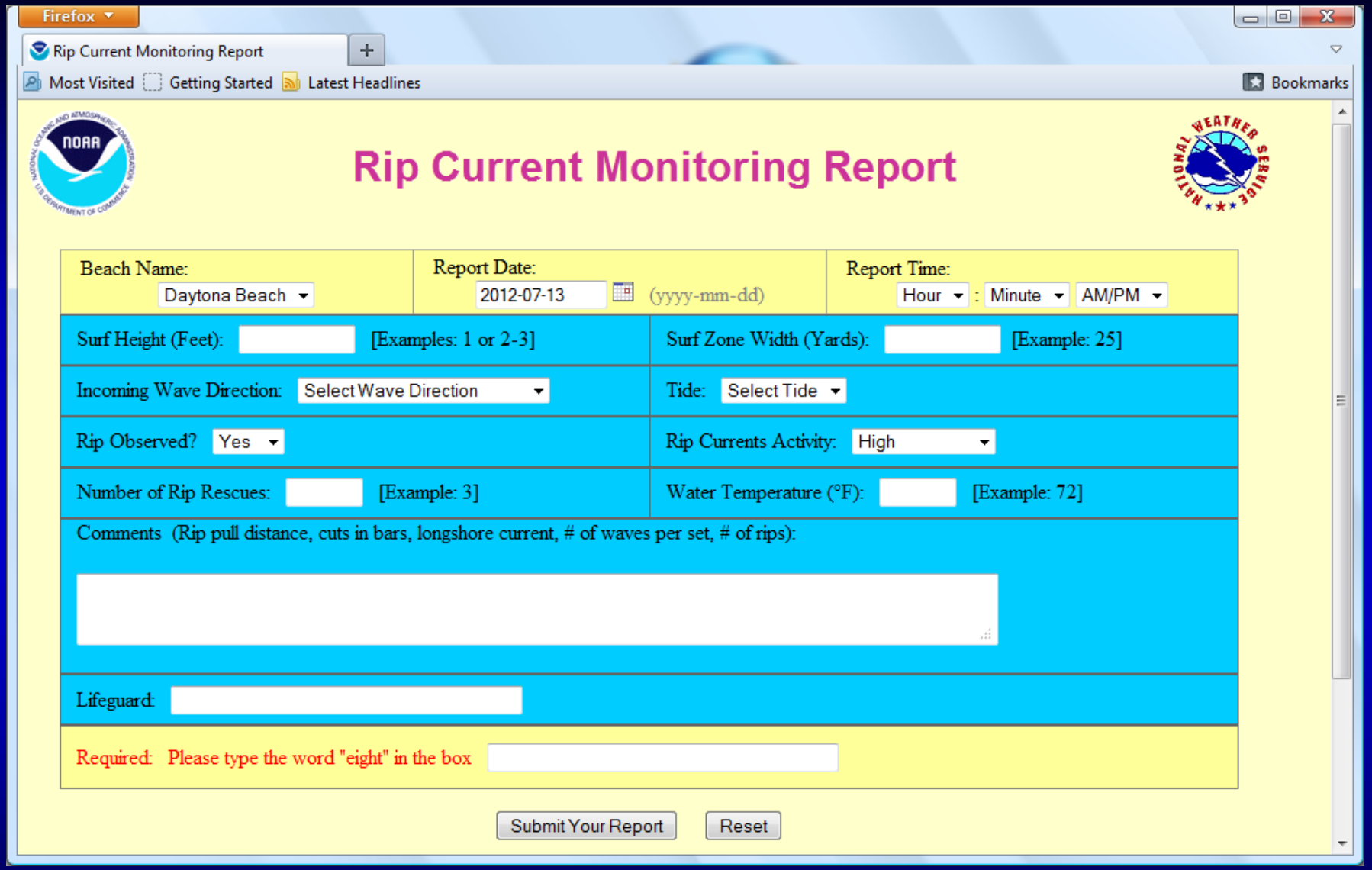
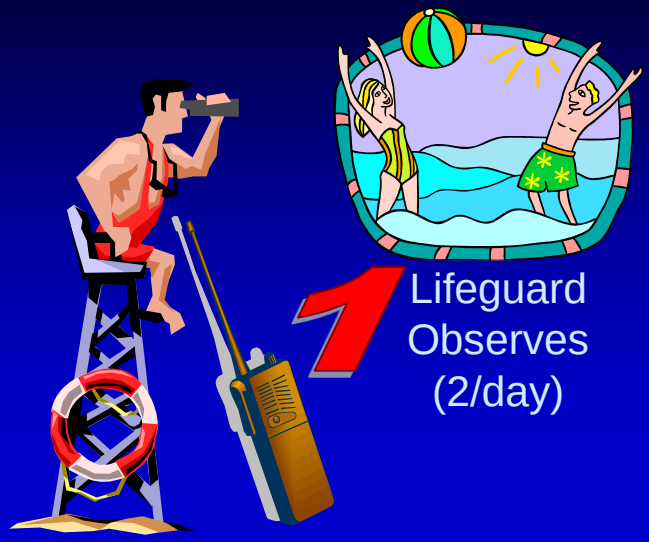


5 Analyze Observations



MDL Rip Current Report Form (WFO-MLB)



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Jacksonville Beach Rip Current Report

LOCATION:	Jacksonville Beach
OBSERVATION TIME (L):	2012-07-17 12:05 PM
SURF HEIGHT (FT):	2-3
SURF ZONE WIDTH (YDS):	80
WAVE DIRECTION:	E
WATER LEVEL CATEGORY:	Falling
RIP CURRENT OBSERVED (Y/N):	Yes
RIP CURRENTS ACTIVITY:	High
RIP RESCUES:	5
WATER ATTENDANCE:	High

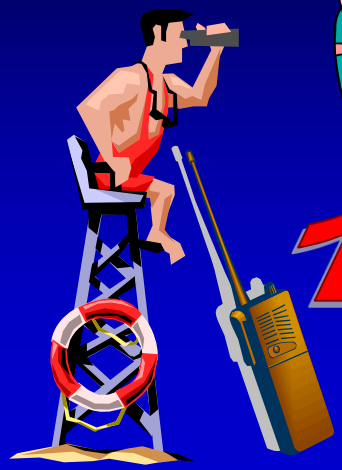
COMMENTS: Extremely hazardous conditions persist throughout area. Deep sloughs and powerful feeder currents are creating unusually strong rip current conditions.

LIFEGUARD: Taylor Anderson

Rip Current Activity Level

-- A subjective assessment of activity of rip currents that could impact swimmers at a particular beach. It encompasses aspects of both the strength and number of rip currents

- High Activity: Many, strong rip currents
- Medium Activity: Many, weak rip currents
- Low Activity: A few weak rip currents
- No Activity: No rip currents



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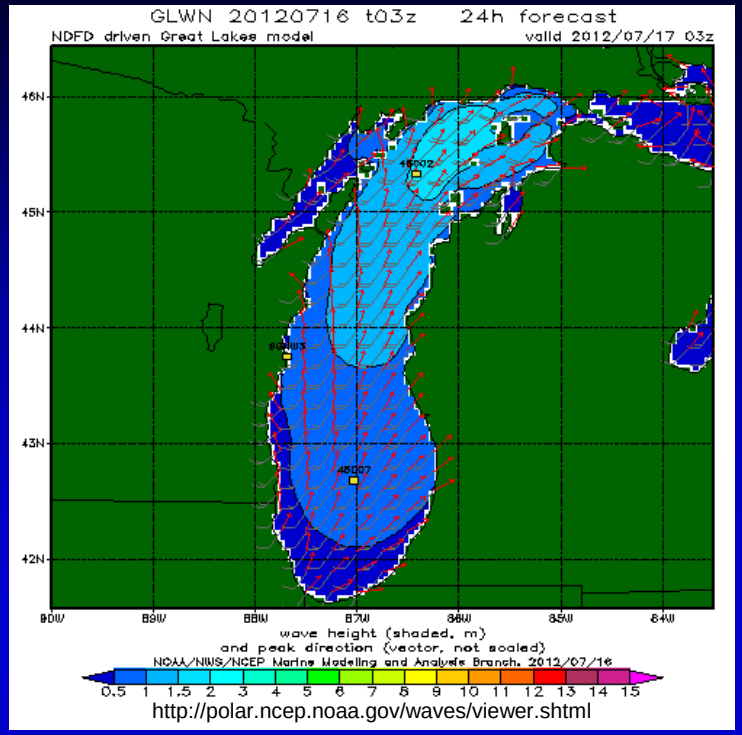


http://polar.ncep.noaa.gov/waves/viewer.shtml

Stored Obs/Forecast Parameters (when available):

- Wave Ht/Pd/Dir
- Swell Ht/Pd/Dir
- Tide Level
- Water Temperature


http://www.ndbc.noaa.gov

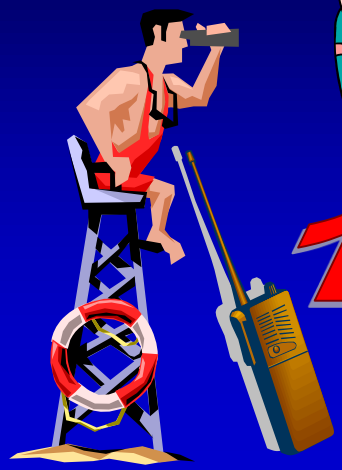
Models:

WaveWatch III

Coastal Data Information Program (CDIP)

Great Lakes Coastal Forecasting System (GLCFS)

Corresponding model data and station observations are paired with the lifeguards reports for later analysis



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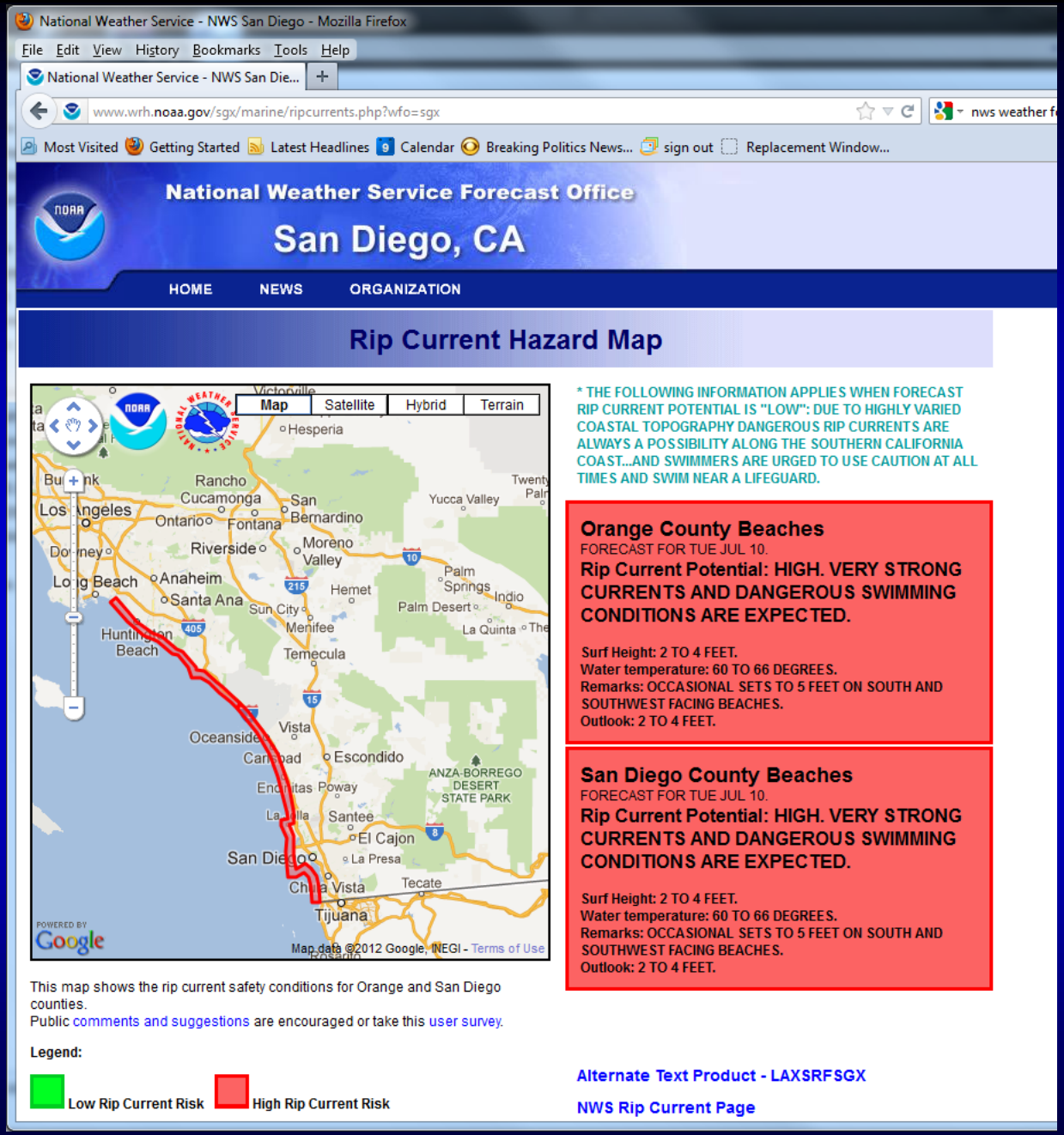
Surf (ft) / Tide level	1.5 - 2.0	2.0 – 3.0	3.0 - 5.0	Preventive warnings
Low	2	5	3	1270
Mid	3	9	0	456
High	0	4	1	49
Sub-total	5	18	4	1775

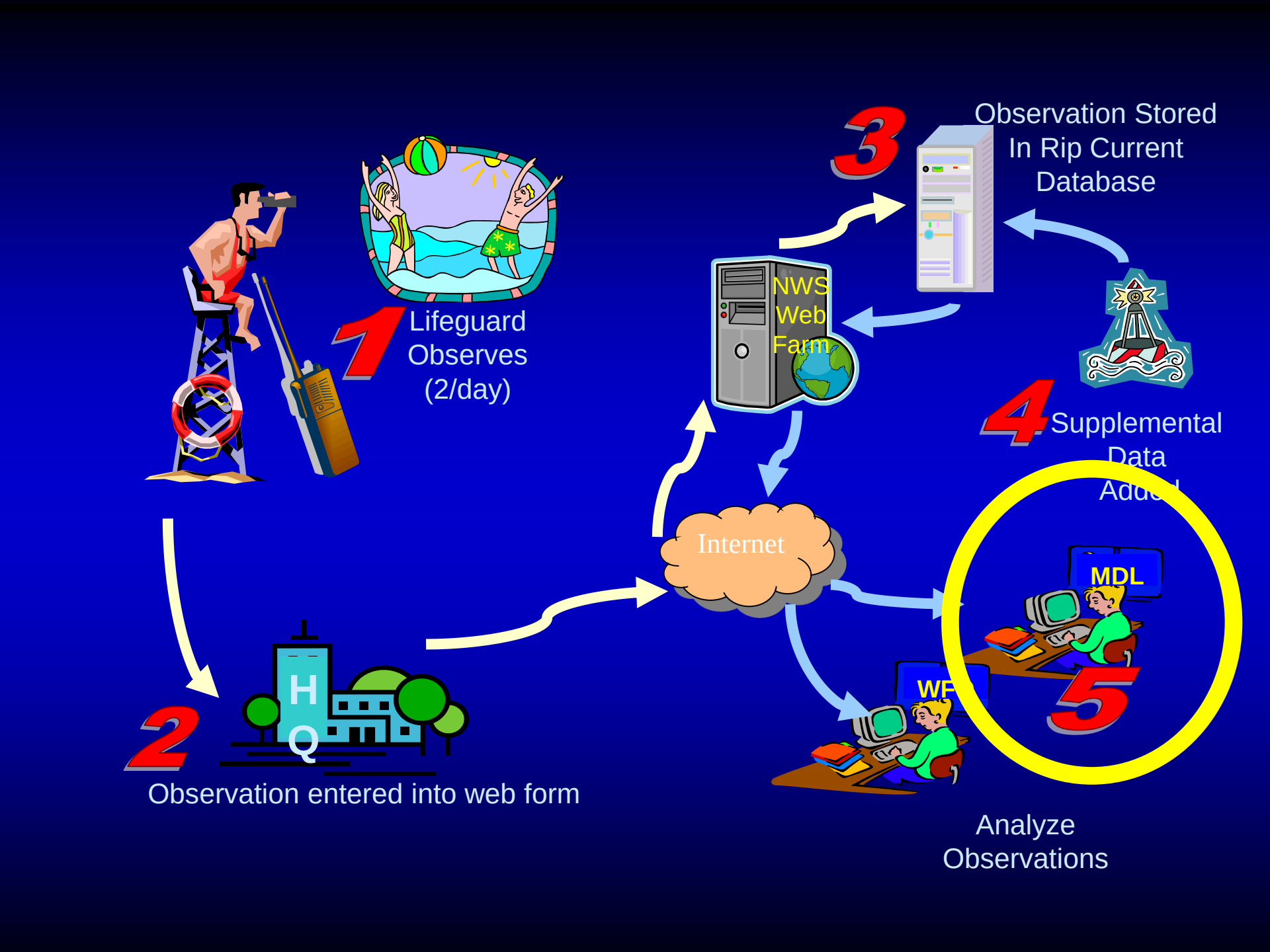
Encinitas Lifeguards safety service record (7/1-8/30/2008)

Many beach rescues occur in 2-3 ft waves (WFO-SGX).



"This ongoing project is a good example of how a clear goal and good communications between HQ, WFO, emergency partners, and media can work and be successful for a common cause."

Noel Isla, WFO-SGX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Analyze Observations

Rip Current Forecasting Tools (Wu)

Incorporating input from key rip current forcing factors:

- Significant Wave Heights
- Coastal Winds
- Peak Wave Periods
- Total Water Levels

Other factors to take into account:

- beach orientation
- hot weather
- beach sand characteristics

Model types tested:

- Check List Tables
- Parametric Models
- Regression Models


3:19AM EDT 29-AUG-2011
HISTORY of IRENE
ALL TIMES EDT
11PM 8/28
Storm No Longer Tropical
9AM 8/28
Makes Landfall
8AM 8/27
Makes Landfall
3AM 8/27
5AM 8/26
Makes Landfall
11AM 8/24
2AM 8/24
8AM 8/24
7:50PM 8/2
5PM 8/23
Makes Landfall 3AM 8/22
©2010 AccuWeather.com


1:50PM EDT 10-SEP-2011
HISTORY of KATIA
ALL TIMES AST
Last Advisory
11AM 9/10
5PM 9/6
5AM 9/6
5AM 9/7
11AM 9/4
11PM 9/5
7AM 9/4
5PM 9/5
©2011 AccuWeather.com


5:03PM EDT 16-SEP-2011
HISTORY
of MARIA
ALL TIMES EDT
5PM 9/16
Storm No Longer Tropical
Last Advisory Issued
5PM 9/15
11AM 9/7
5PM 9/6
Tropical
Depression
14 Forms
©2011 AccuWeather.com
accuweather.com

Automated Local Rip Current Guidance

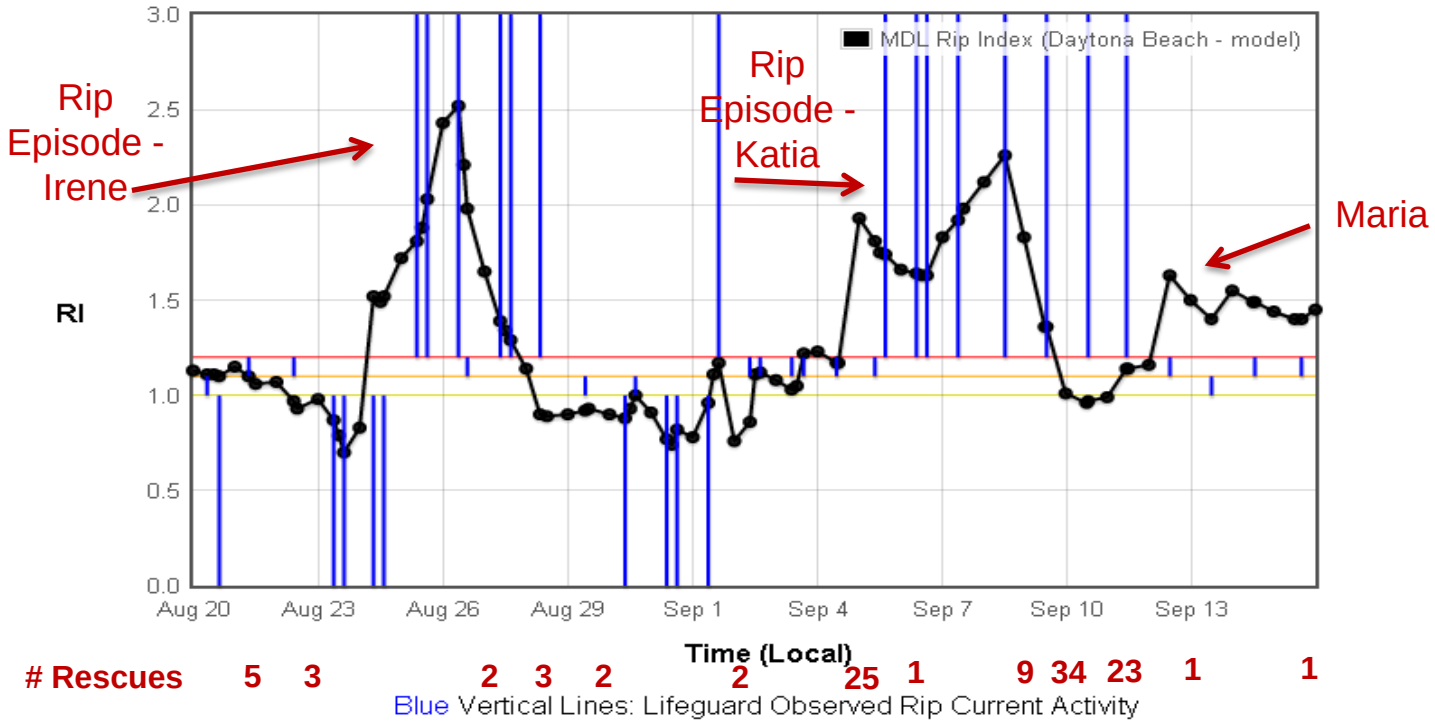
$$RI = A*H + B*T - C*h$$

H=Surf Zone wave ht; T=Surf Zone Wave Pd.; H = Water Level

A, B, C = empirically-derived coefficients (e.g., beach slope and orientation)

None or Very Low: RI < 1.0 Low: 1.0 ≤ RI < 1.1

Medium: 1.1 ≤ RI < 1.2 High: RI ≥ 1.2



Mouse hovers at (8/19/2011 10:28, 1.56).

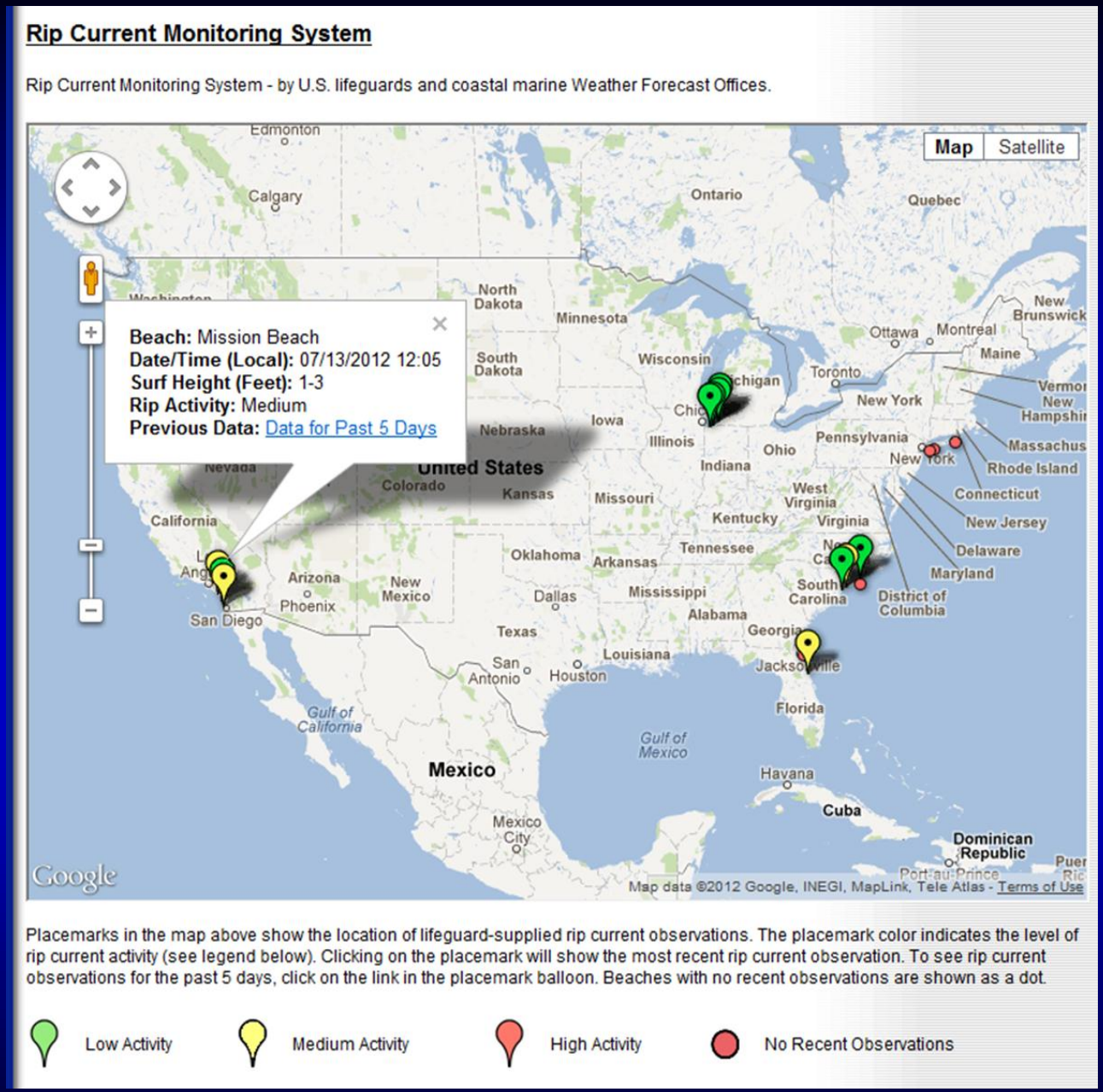
Daytona Beach, Florida

Rip Current Episode -- An extended period of medium to high rip current activity at a beach lasting from a few hours to several days

MDL Automated Local Rip Current Guidance Skill Scores

Summer 2011 at Daytona Beach, FL

	POD (Probability of Detection)	FAR (False Alarm Rate)	CSI (Critical Success Index)
Hurricanes Irene & Katia 08/24 – 09/15	0.71	0.26	0.67
Summer 2011 05/20-09/25	0.65	0.27	0.63



Experimental MDL Rip Current Activity Level page – Lifeguard Rip Activity reports mapped to beaches.

http://www.nws.noaa.gov/mdl/survey/pgb_survey/dev/rip_current/index.php?L=259

Short-Term Goals

1. Provide WFO's and partners with instant access to past lifeguard reports, supplemental data, and automated local rip current guidance.

2. Assist WFO's with setting up rip current collaboration with local lifeguard agencies.

3. Send rip current reports/alerts to WFO's via AWIPS.

Long-Term Goals

1. Develop beach-specific rip current forecasts and diagnostics.

2. Create methodology that can be shared with WFO's to develop their own formulas.

3. Share lifeguard reports and rip current diagnostics/forecasts with the public.

-- Working towards an Impacted-Based Decision Support Services approach for rip current hazards.

- (Listed from left to right):
- Julie Thomas, Andrew MacAuthor, Dr. William O'Reilly, Dr. C-S Wu, Michael Khuat, Ivory Small, Mayor Maggie Houlihan, Noel Isla, Dr. Stephan Smith, Capt. Larry Giles, Jason Taylor, and Sgt. David Rains