Towards Predictive/Operational Assessment of Beach Closures Using Remotely Sensed Data

Speaker: Mark Judson/Environmental Monitoring Sensor Intelligence

EIM SENSOR
An Intelligent Environment

Research Team

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Special Thanks to contributors at Florida DEQ, Fish Wildlife, Coastguard, EPA, Escambia County Health Dept.

Project Goals

•Determine feasibility of linking existing NASA Earth Science products with empirical models of beach contamination.

• This effort will provide decision-makers with operational tools to gain a better situational awareness of potentially hazardous conditions in beach ecosystems.

•Better forecasting tools will potentially maximize the extremely valuable ecological services to humans that many urban coastal regions provide and enhance the revenue base to their associated communities.

Project Focus: Area of Interest

Florida, with the longest coastline in the lower 48 states, has approximately 1,350 miles of coastline not including the numerous inland rivers, bays and estuaries, and depends heavily upon its water tourism and recreation industries.

Water quality is a primary concern because nearly all of coastal Florida is used for recreation in one form or another.

Our proposed research was conducted in Pensacola Beach, Florida with current beach management groups on local and state levels.

What are the Issues?

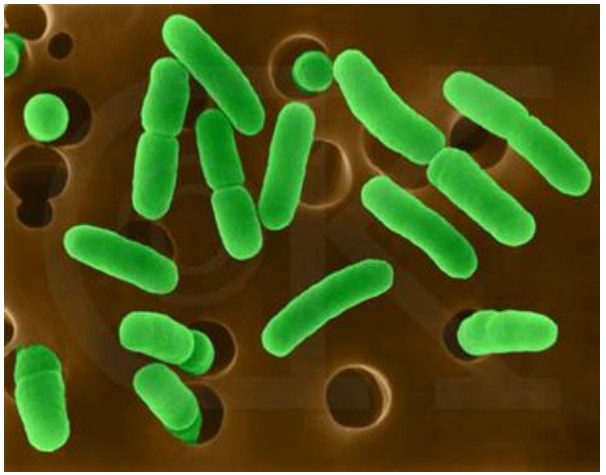
❖Public concern over microbial contamination of recreational waters has increased in recent years.

❖In 2000, Congress passed the Beaches Environmental Assessment and Coastal Health (BEACH) Act to address the increasing problems of beach contamination.

❖The Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 requires each state and territory with coastal recreation waters to adopt health-based bacteria standards that are "as protective of human health as" EPA's 1986 criteria for bacteria.

What are fecal coliforms?

- Total coliforms (A class of rod shaped bacteria) are commonly occurring bacteria that live in digestive tracts. Fecal coliforms are the fraction of total coliforms that originate in feces.



Where do they come from?

- Fecal coliforms originate from sewage, animals, and agriculture (via livestock and the practice of spreading manure as fertilizer).

Why are they important?

It is important to monitor these bacteria because they are indicators the presence of other pathogens (bacteria and viruses) that can harm human well being. Particularly to people engaging in water related activities like boating, swimming, fishing.

How can they harm humans?

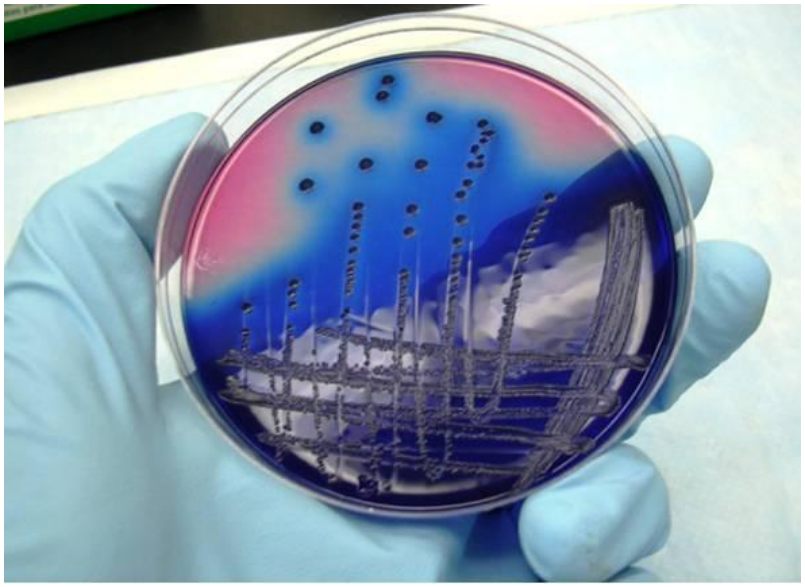
- Fecal coliforms are important to humans because they can cause infections, dysentery, hepatitis and various forms of gastroenteritis.

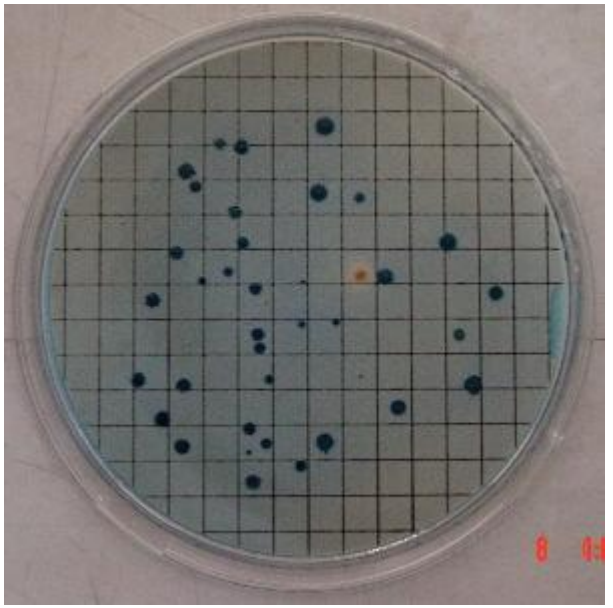
How can they harm the environment?

- As with all bacteria, if there are large amounts of organic matter, they will decompose it and use up all the oxygen in the process. Low oxygen (hypoxia) or no oxygen (anoxia) in the water causes the death of marine life.

What is currently done to monitor fecal coliforms?

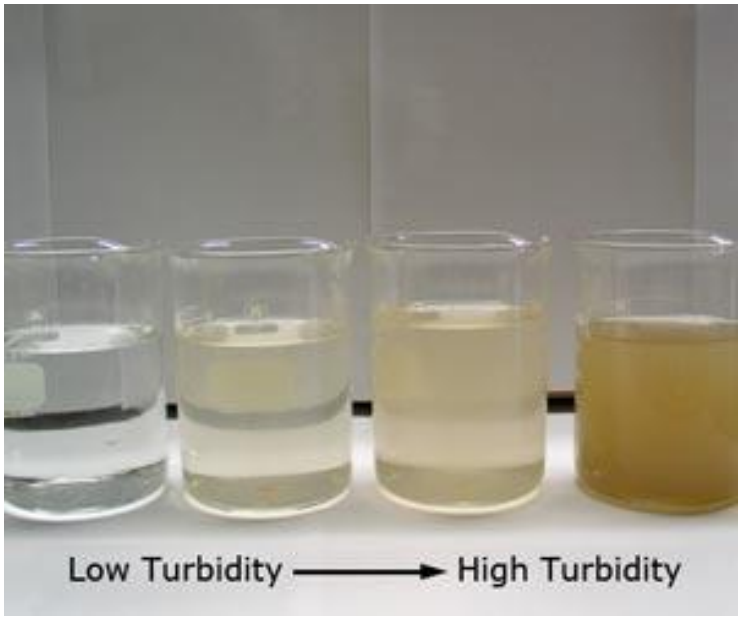
- Various Government, State, and Local agencies actively perform assays to detect total and fecal coliforms. These are performed on scales ranging from quarterly to bi-weekly.





How can monitoring be improved in the future?

- It has been found that there is a strong correlation between rain fall events and high bacterial counts. Influx of organic matter to the water nourishes these bacterial communities. Rain also increases turbidity due to materials carried in runoff as well as resuspension of particles already in the water.



How can monitoring be improved in the future?

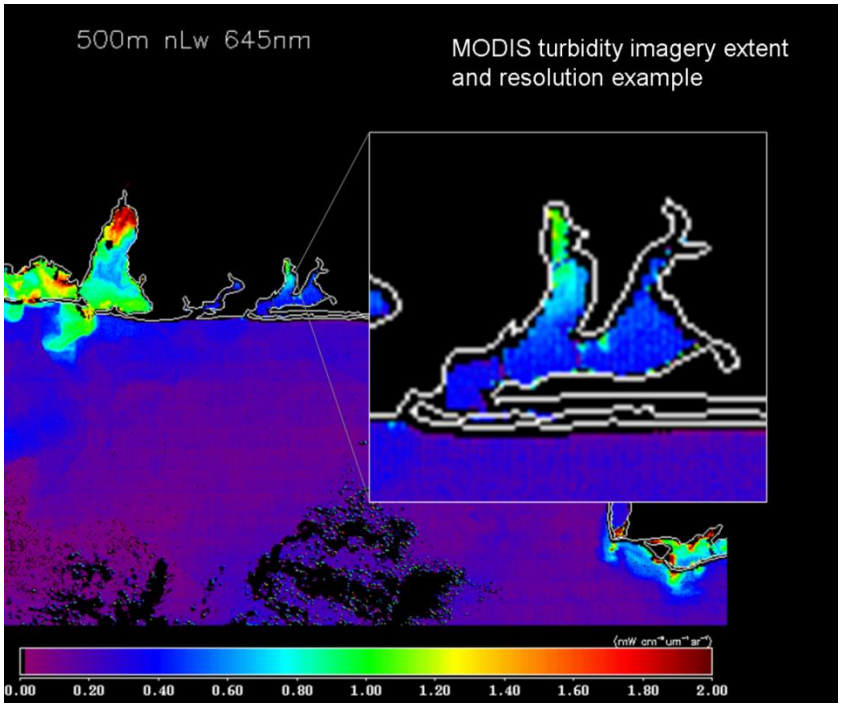
- Turbidity sensors, that measure back scatter, can be deployed on remotely operated buoys. These buoys can stream (via satellite) real-time turbidity data to the end user. The end user can use this to correlate turbidity to fecal coliforms and offer an early detection of risk to public waters.

- Because rain events occur so sporadically it is more appropriate to have a small sampling interval as opposed to bi-weekly. This way bacterial threats can be monitored on a daily to hourly basis.

Combining NASA imagery with in-situ measurements

EIM Sensor has partnered with the EPA gulf ecology lab to develop spatially enabled decision tools that combine in-situ measurements with NASA MODIS datasets.

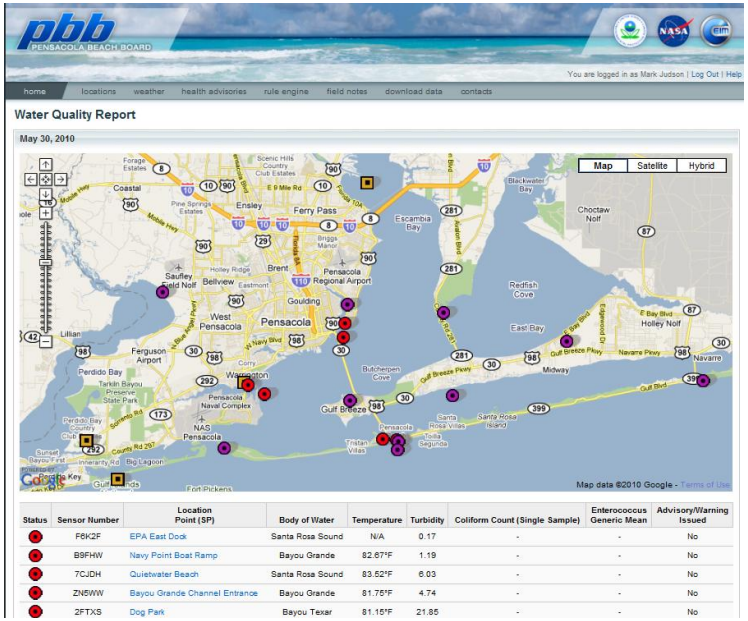
- NOWCAST Models
- Spatially enabled marine ecology tools.
- Geo-Enabled Data processing
- Satellite Imagery Analysis
- Decision Support Tools



Solutions Developed

End-to-End Water Quality Monitoring Products

- Environmental Monitoring Buoys
- Decision Support Tools



Status	Sensor Number	Location Point (SP)	Body of Water	Temperature	Turbidity	Coliform Count (Single Sample)	Enterococcus Generic Mean	Advisory/Warning Issued
	F6K2F	EPA East Dock	Santa Rosa Sound	N/A	0.17	-	-	No
	B9FHW	Navy Point Boat Ramp	Bayou Grande	82.67°F	1.19	-	-	No
	7CJDH	Quietwater Beach	Santa Rosa Sound	83.52°F	6.03	-	-	No
	ZN5WW	Bayou Grande Channel Entrance	Bayou Grande	81.75°F	4.74	-	-	No
	2FTXS	Dog Park	Bayou Texar	81.15°F	21.85	-	-	No

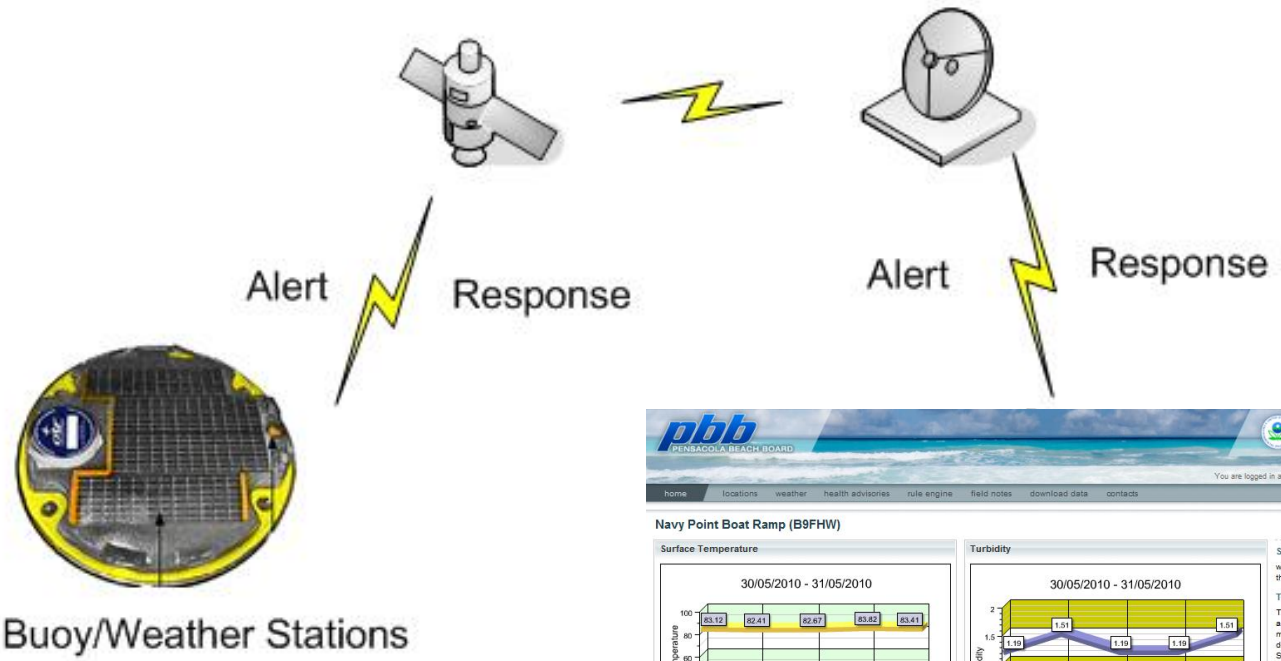
TemperatureF, DewpointF, PressureIn, WindDirection, WindDirectionDegrees, WindSpeedMPH, WindSpeedGustMPH, Humidity, HourlyPrecipIn, Conditions, Clouds, dailyrainin, SolarRadiationWatts/m^2,

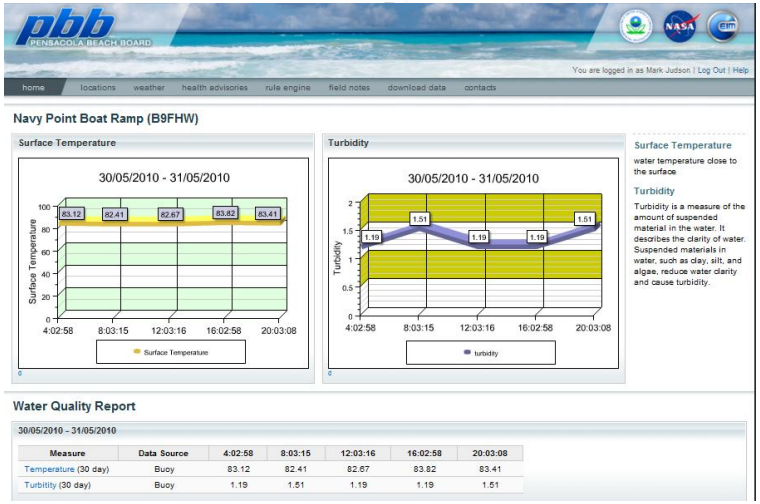
Beach Monitoring Data Correlated With Precipitation Events

Date	Location	Time	Temp	Salinity	Entero	Fecal	Geomean	TempF
4/5/2010	Navy Point North	12:25	23.80	9.70	3	26	9.01	74.8
4/12/2010	Navy Point North	11:32	23.80	10.80	37		10.19	74.8
4/19/2010	Navy Point North	11:15	23.10	11.80	15	57	12.24	73.6
4/26/2010	Navy Point North	11:18	24.40	14.10	220		20.94	75.9
5/3/2010	Navy Point North	12:31	25.30	14.30	180	380	36.63	77.5
5/10/2010	Navy Point North	12:00	25.60	16.10	21		54.06	78.1
5/17/2010	Navy Point North	11:59	25.60	13.60	26	520	50.37	78.1
5/24/2010	Navy Point North	11:30	31.20	14.30	6	67	41.94	88.2
6/1/2010	Navy Point North	11:32			9	41	22.13	
6/7/2010	Navy Point North	11:38	30.80	12.80	77		18.67	87.4
6/14/2010	Navy Point North	11:41	32.30	13.80	3	37	12.65	90.1
6/21/2010	Navy Point North	11:52	32.10	13.90	14		11.18	89.8
6/28/2010	Navy Point North	11:59	30.40	15.00	147	300	21.20	86.7
7/6/2010	Navy Point North	11:46	27.80	12.40	600		49.10	82.0
7/12/2010	Navy Point North	11:35	30.60	17.90	5	28	28.41	87.1
7/19/2010	Navy Point North	11:18	30.80	19.70	11		36.85	87.4
7/26/2010	Navy Point North	11:49	31.10	18.50	16	310	37.84	88.0
8/2/2010	Navy Point North	11:35	32.60	19.70	1		13.95	90.7
8/9/2010	Navy Point North	12:02	31.20	20.90	8	44	5.88	88.2
8/16/2010	Navy Point North	11:50	29.70	21.70	9		6.62	85.5
8/23/2010	Navy Point North	11:34	30.00	21.90	12	56	6.73	86.0
8/30/2010	Navy Point North	11:41	26.90	8.40	200		11.16	80.4
9/7/2010	Navy Point North	11:29	30.70	16.90	19	100	20.10	87.3
9/13/2010	Navy Point North	11:29	30.20	20.80	4		17.50	86.4

Pensacola Environmental Dashboard

Access to Near real-time environmental data sets





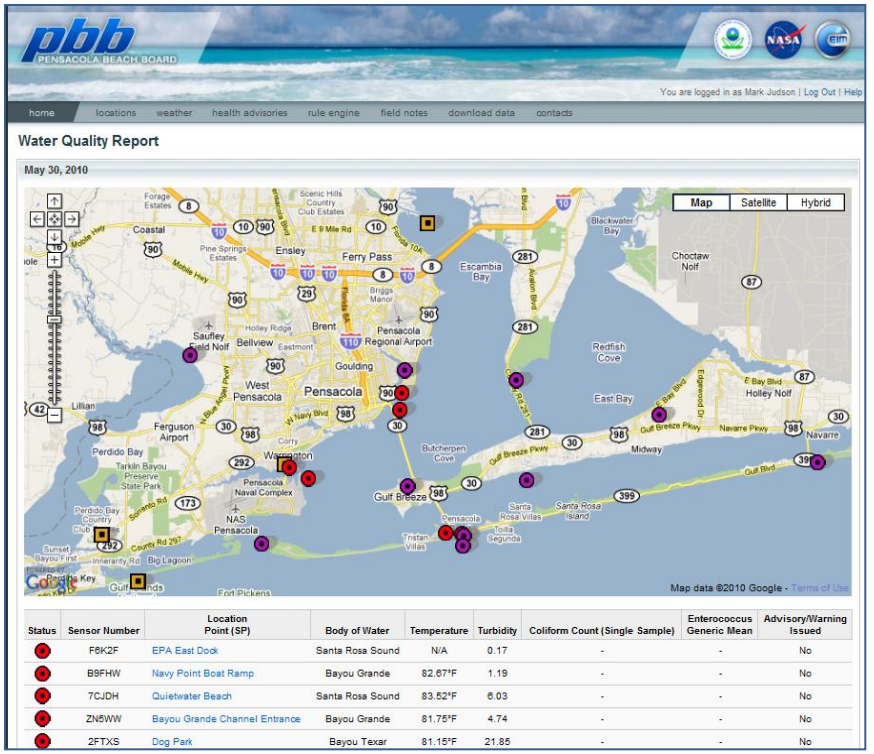
Environmental Data Sets

- Weather Data
- Toxicology Data
- NASA Earth Science Products

Market Application: Coastal Water Quality Monitoring

Fleet of EIM Sensor Buoys deployed to provide public notification of bacterial contamination within 24 hours.

- Water resource managers depend upon weekly microbiological reports
- Current coastal water monitoring has a 24-48 hour latency
- Results in health risks and adverse economic impacts



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Contact Information

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