A collaborative project with Hancock High School, Kiln, MS

Stennis Space Center Salinity Drifter Project

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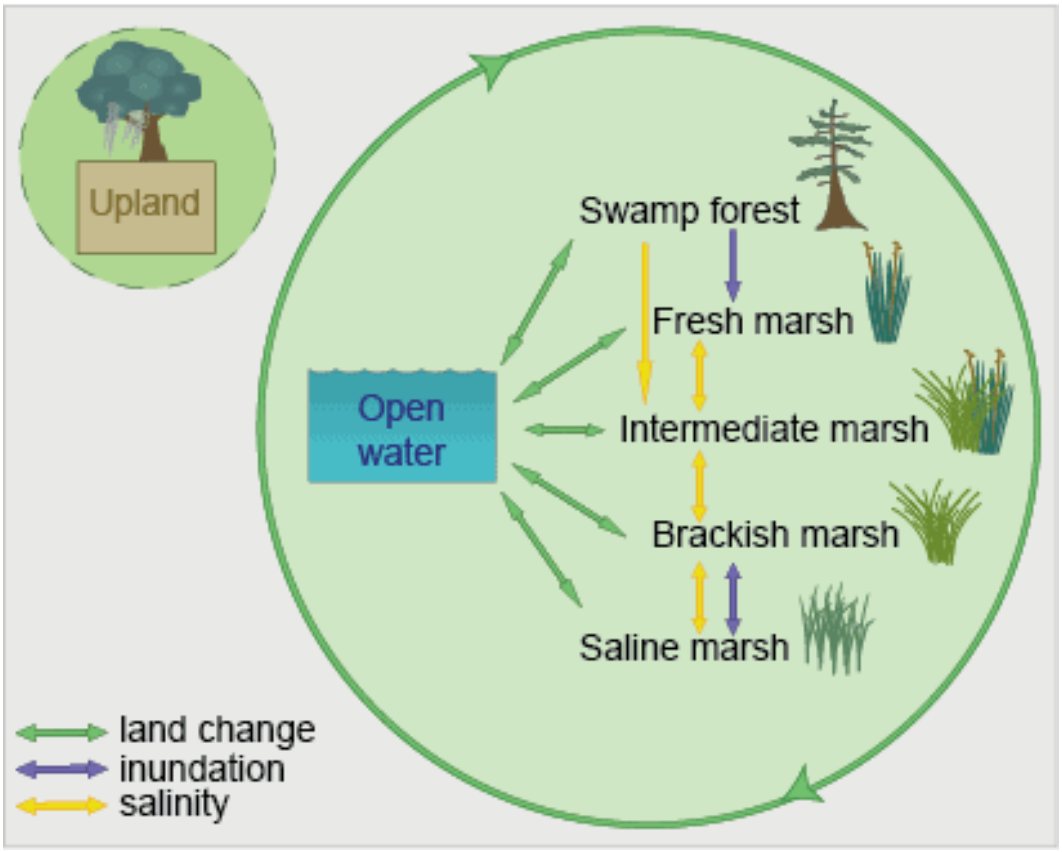
Funding provided by : Director, Stennis Space Center

Background

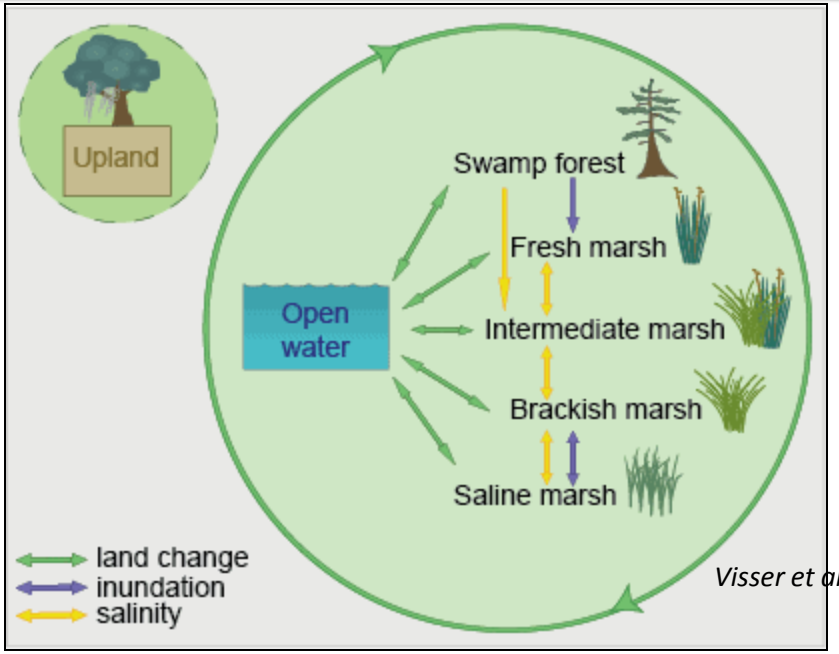
- Salinity is an important property of coastal waters:
  - The amount of salinity in coastal waters determines the types of vegetation and habitats for many species of birds, mammals, fish and shellfish.
  - Salinity changes can result from rising sea level, subsidence, storm surge, and erosion.
  - Changes in salinity can result in loss of vegetation, habitats and spawning grounds, as well as coastal erosion.

Habitat Switching Algorithm



from url: http://www.clear.lsu.edu/habitat_switching/

Habitat Switching Module



Visser et al. [1]

Habitat switching between marsh types depends on salinity and inundation. The module simulates shifts in vegetative community type given long-term shifts in salinity and inundation due to restoration projects.

Switches at 1-year time step

Year 0 habitat	Inter-mediate marsh	Brackish marsh	Saline marsh
Fresh marsh	$s > 2.5$		
Inter-mediate marsh	$1 < s \leq 6$	$s > 6$	
Brackish marsh	$s \leq 6$	$6 < s \leq 15$ and $pfl \leq 85\%$	$s > 15$ or $s > 6$ and $pfl > 85\%$

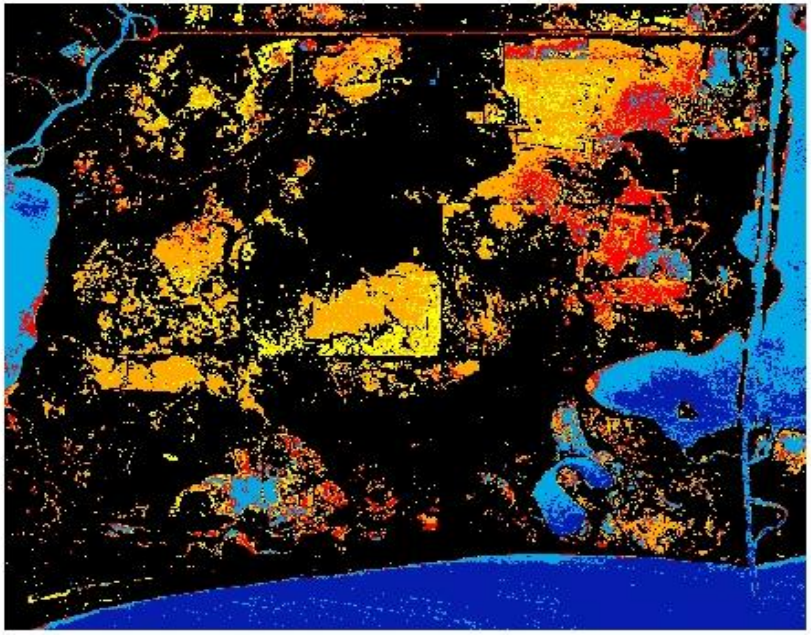
Excerpt from table in Visser et al. [1]

s=average salinity (ppt) over the time step;
pfl=average percentage inundation over the time step

[1] *Visser, J.M., C. Kaiser, and A.B. Owens. 2008. Forecasting 50-years of Habitat Switching in Coastal Louisiana: No Increased Action & Preliminary Draft Master Plan, Vol. IV, Chapter 4. In Coastal Louisiana Ecosystem Assessment & Restoration (CLEAR) Program: A tool to support coastal restoration., edited by R. R. Twilley. Baton Rouge.*

Salinity Estimates from Landsat For Sabine Calcasieu Basin

In-situ samples used to derive model of salinity from Landsat image.



Legend

Analyst approximation

<VALUE>

- Fresh (negatives)
- Land
- 0 - 4.5 Fresh
- 4.5 - 9.5 Oligohaline
- 9.5 - 12.5 Mesohaline
- 12.5 - 17.5 Polyhaline
- > 17.5 Euhaline

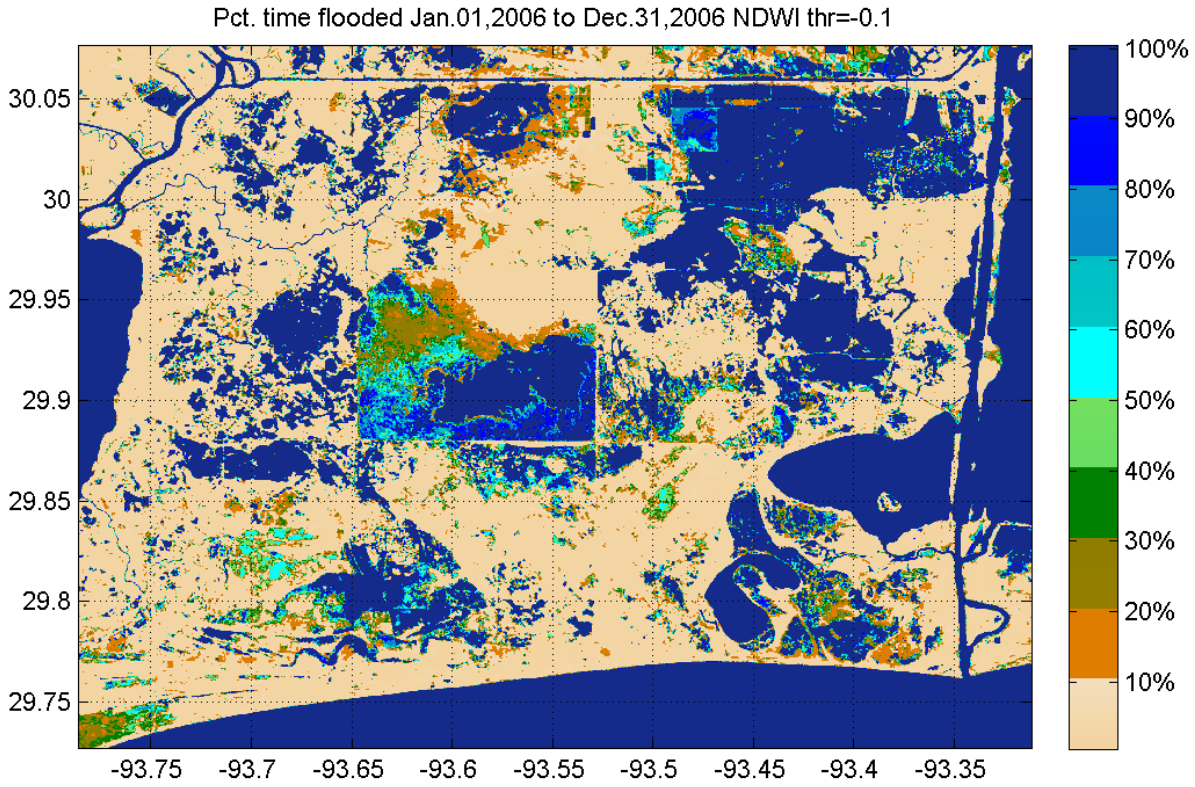
Variables: NDVI, McFeeters, Julian Day

R^2 = 0.84

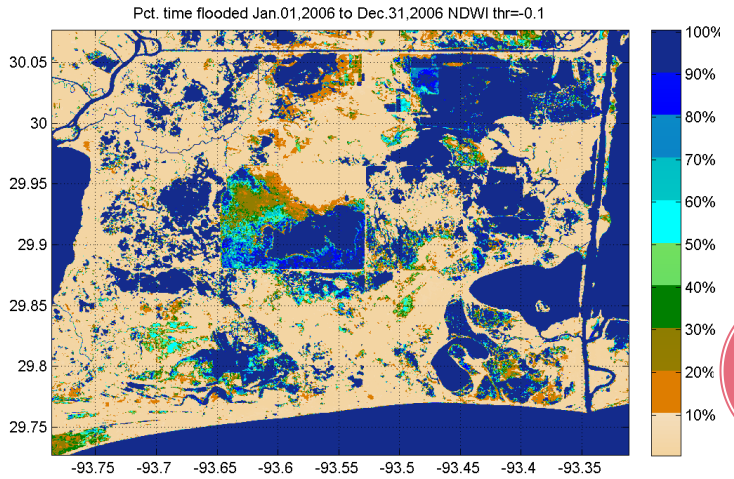
N = 42 (dropped 6 outliers)

Dark Object Subtraction

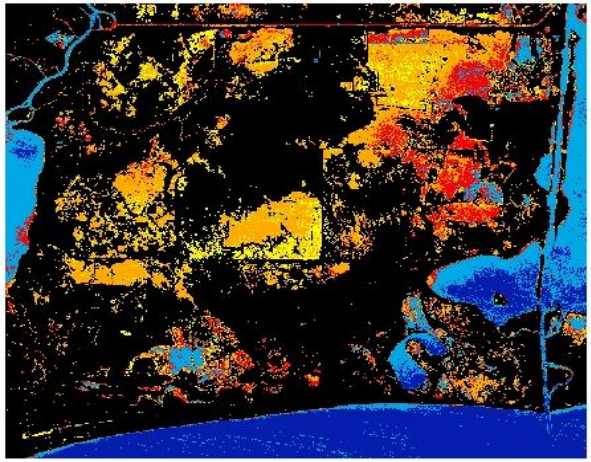
Percent of time inundated in 2006



Landsat Estimates of Persistent Flooding and Salinity as Potential Inputs to Habitat Switching Module



Percent Inundation



Salinity

Habitat Switching Module

Year 0 habitat	Inter-mediate marsh	Brackish marsh	Saline marsh
Fresh marsh	s > 2.5		
Inter-mediate marsh	1 < s ≤ 6	s > 6	
Brackish marsh	s ≤ 6	6 < s ≤ 15 and pfl ≤ 85%	s > 15 or s > 6 and pfl > 85%

Example: if salinity is greater than 2.5 *ppt* for one year, fresh marsh vegetation will change to intermediate marsh vegetation

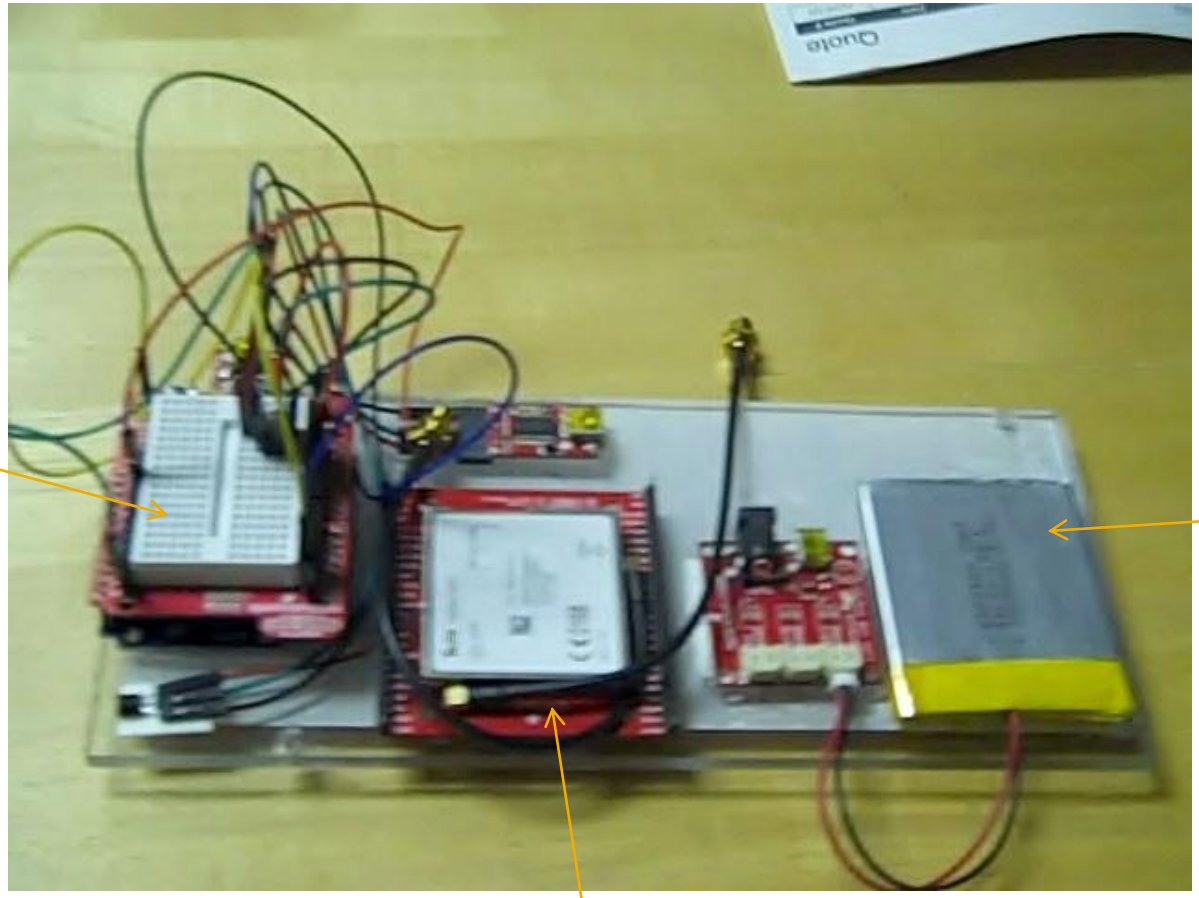
s=average salinity (ppt) over the time step; pfl=average percentage inundation over the time step

Habitat switching between marsh types depends on salinity and inundation. The module simulates shifts in vegetative community type given long-term shifts in salinity and inundation due to restoration projects.

Salinity Data

- Salinity modeling requires ground truth salinity, which is scarce
- The NASA Office of the Center Director for Stennis Space Center funded a pilot project to design a low-cost salinity measuring system that high-school students could build and monitor.
- The salinity values are fed to NASA's website via a cellular modem and the internet for use by NASA scientists.

Prototyping the System



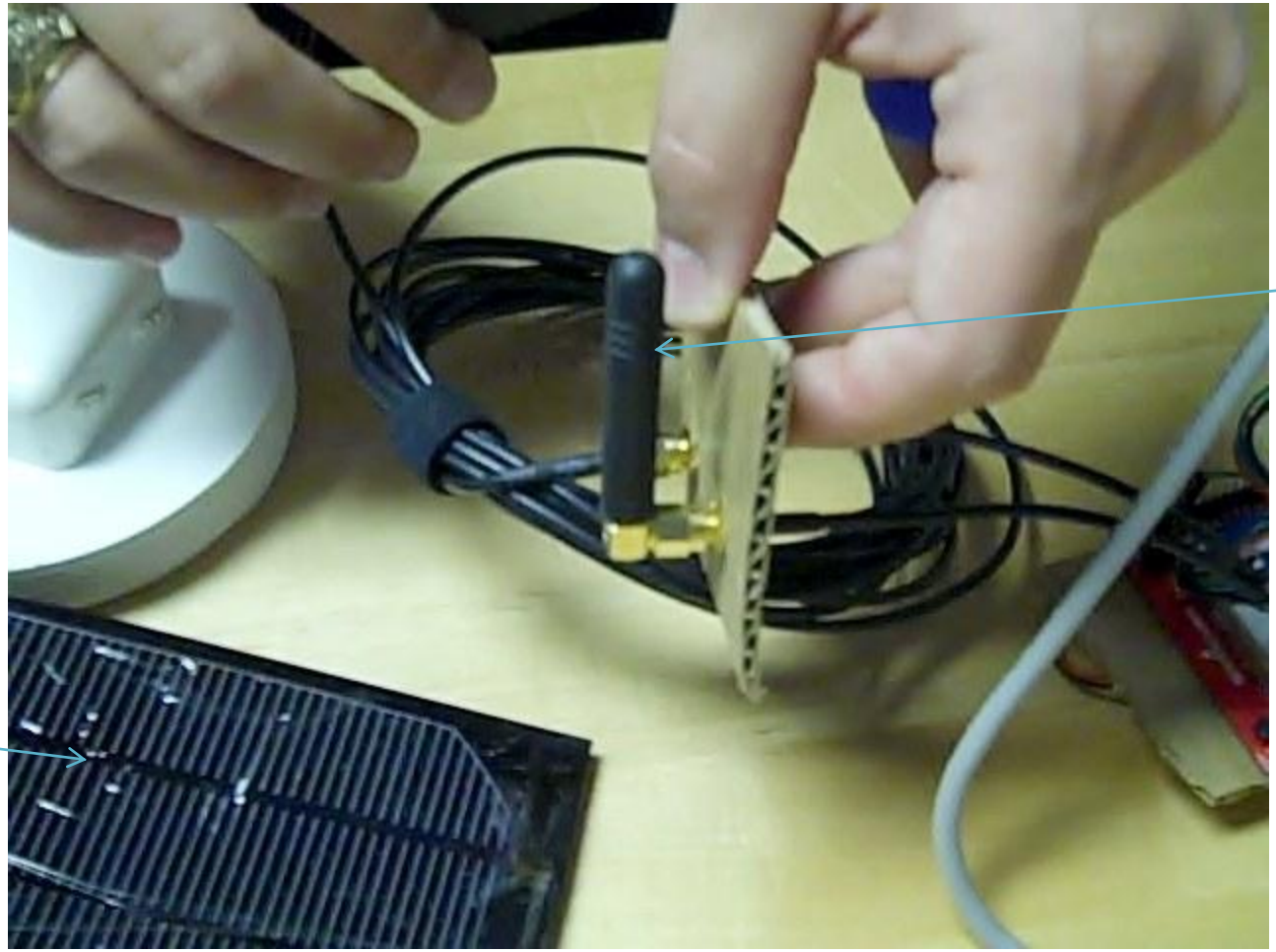
System as packaged for field tests

Salinity Probe and Casing

Opening for water flow

Tip of salinity probe is exposed to water through small opening.

Cellular antenna used to transmit data

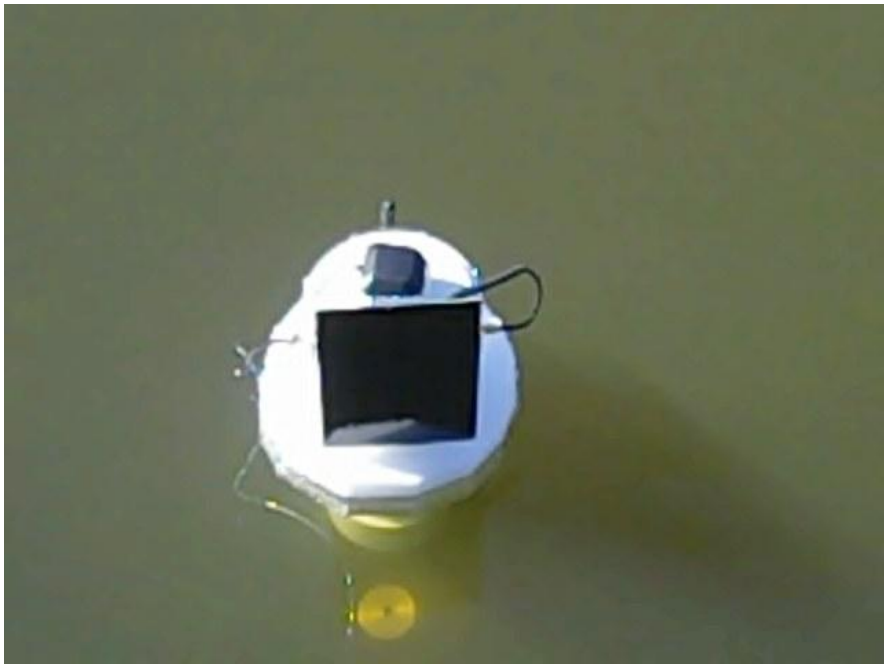


Preparing to launch

Left: Mark Turowski, design engineer with Jacobs Technology, prepares to launch the buoy.
Right top: Solar panel is mounted vertically to collect solar reflections off the water (specular reflection). Solar power is used to charge the battery.
Right bottom: Weight is affixed to bottom to help keep unit in upright position.

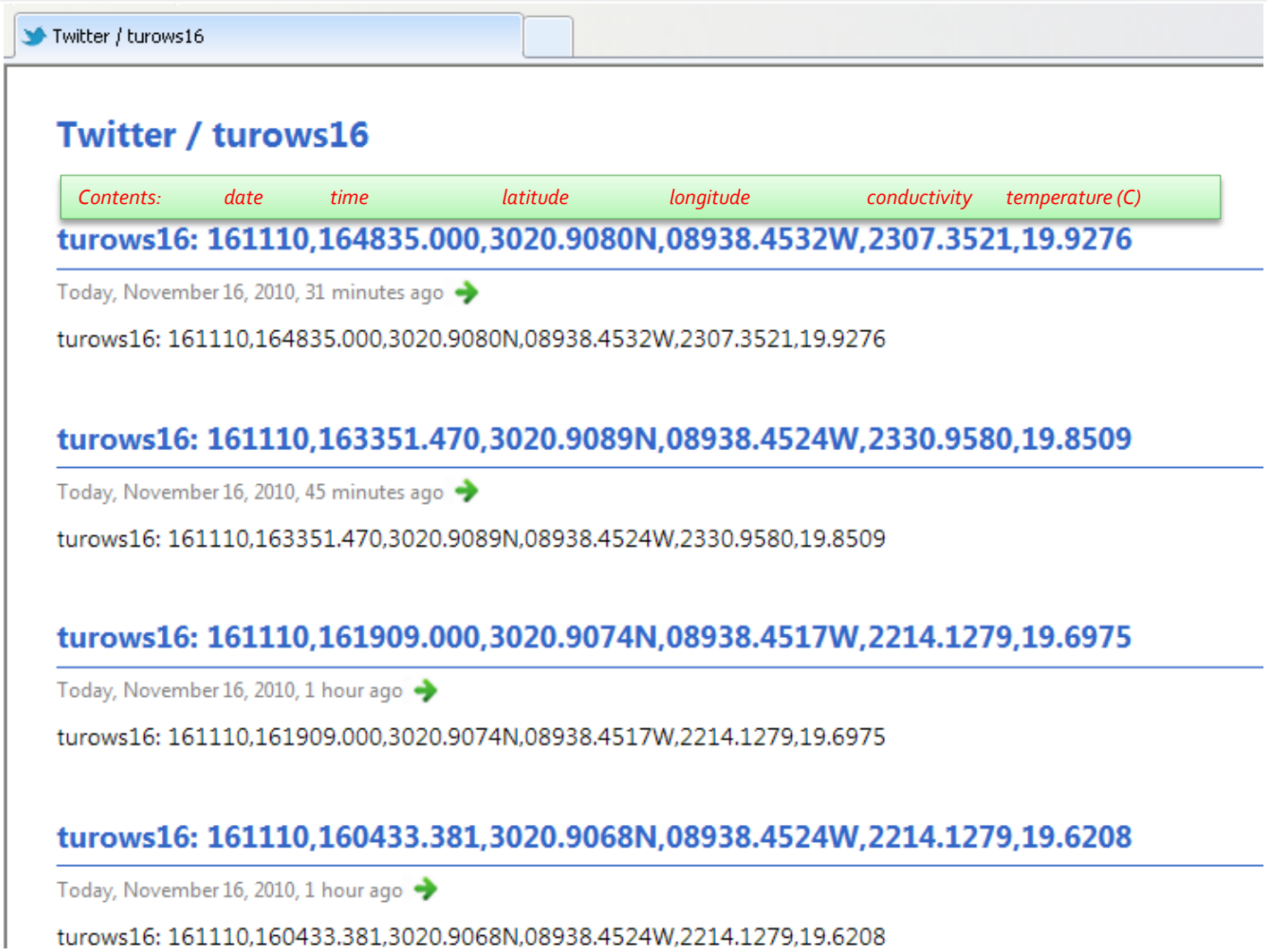
System is launched in the Pearl River at Stennis Space Center

System is lowered into the water from the pier; it is tethered with fishing line.

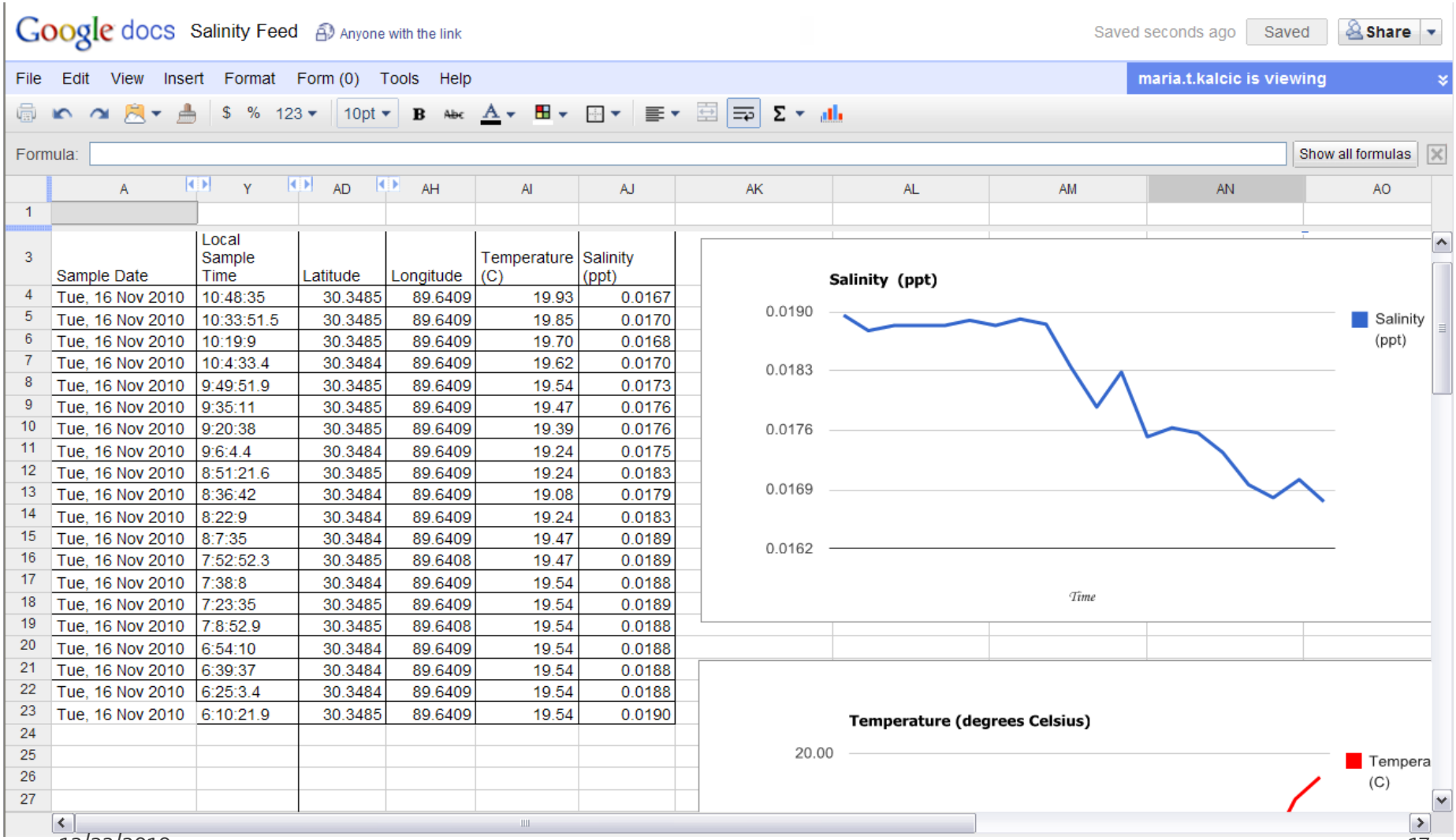


System floating in the river. GPS antenna and solar panel are visible

Data are transmitted to Twitter by cell phone modem every 15 minutes



Google Spreadsheet is used to import the data from the Twitter feed and to compute salinity (from conductivity) and display charts of salinity and temperature.



Sample Date	Local Sample Time	Latitude	Longitude	Temperature (C)	Salinity (ppt)
Tue, 16 Nov 2010	10:48:35	30.3485	89.6409	19.93	0.0167
Tue, 16 Nov 2010	10:33:51.5	30.3485	89.6409	19.85	0.0170
Tue, 16 Nov 2010	10:19:9	30.3485	89.6409	19.70	0.0168
Tue, 16 Nov 2010	10:4:33.4	30.3484	89.6409	19.62	0.0170
Tue, 16 Nov 2010	9:49:51.9	30.3485	89.6409	19.54	0.0173
Tue, 16 Nov 2010	9:35:11	30.3485	89.6409	19.47	0.0176
Tue, 16 Nov 2010	9:20:38	30.3485	89.6409	19.39	0.0176
Tue, 16 Nov 2010	9:6:4.4	30.3484	89.6409	19.24	0.0175
Tue, 16 Nov 2010	8:51:21.6	30.3485	89.6409	19.24	0.0183
Tue, 16 Nov 2010	8:36:42	30.3484	89.6409	19.08	0.0179
Tue, 16 Nov 2010	8:22:9	30.3484	89.6409	19.24	0.0183
Tue, 16 Nov 2010	8:7:35	30.3484	89.6409	19.47	0.0189
Tue, 16 Nov 2010	7:52:52.3	30.3485	89.6408	19.47	0.0189
Tue, 16 Nov 2010	7:38:8	30.3484	89.6409	19.54	0.0188
Tue, 16 Nov 2010	7:23:35	30.3485	89.6409	19.54	0.0189
Tue, 16 Nov 2010	7:8:52.9	30.3485	89.6408	19.54	0.0188
Tue, 16 Nov 2010	6:54:10	30.3484	89.6409	19.54	0.0188
Tue, 16 Nov 2010	6:39:37	30.3484	89.6409	19.54	0.0188
Tue, 16 Nov 2010	6:25:3.4	30.3484	89.6409	19.54	0.0188
Tue, 16 Nov 2010	6:10:21.9	30.3485	89.6409	19.54	0.0190

Results are uploaded to NASA's Applied Science and Technology Project Office Webpage

Webpage to be inserted here