National Oceanic and Atmospheric Administration
Cooperative Remote Sensing Science and Technology Center

NOAA CREST

Remote Sensing and Bio-optical properties in Mayagüez Bay

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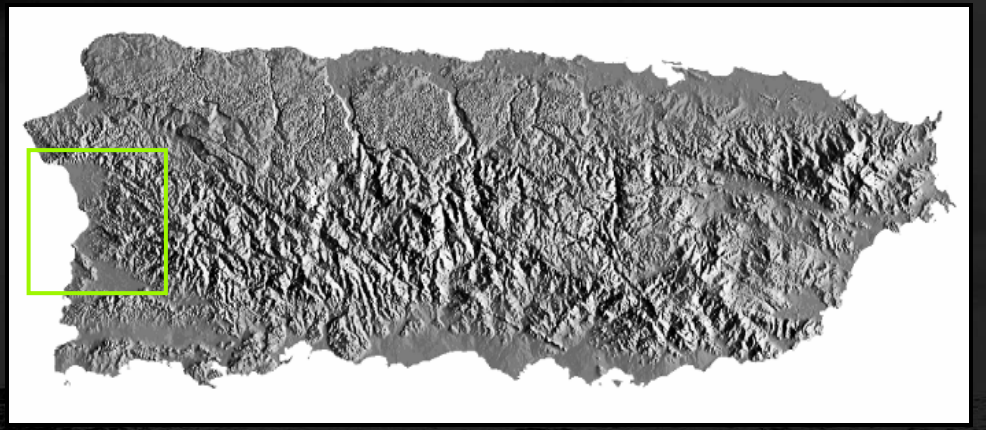
Geological and Environmental Remote Sensing Laboratory

GERS
Geological and Environmental Remote Sensing Laboratory
University of Puerto Rico at Mayaguez

Introduction

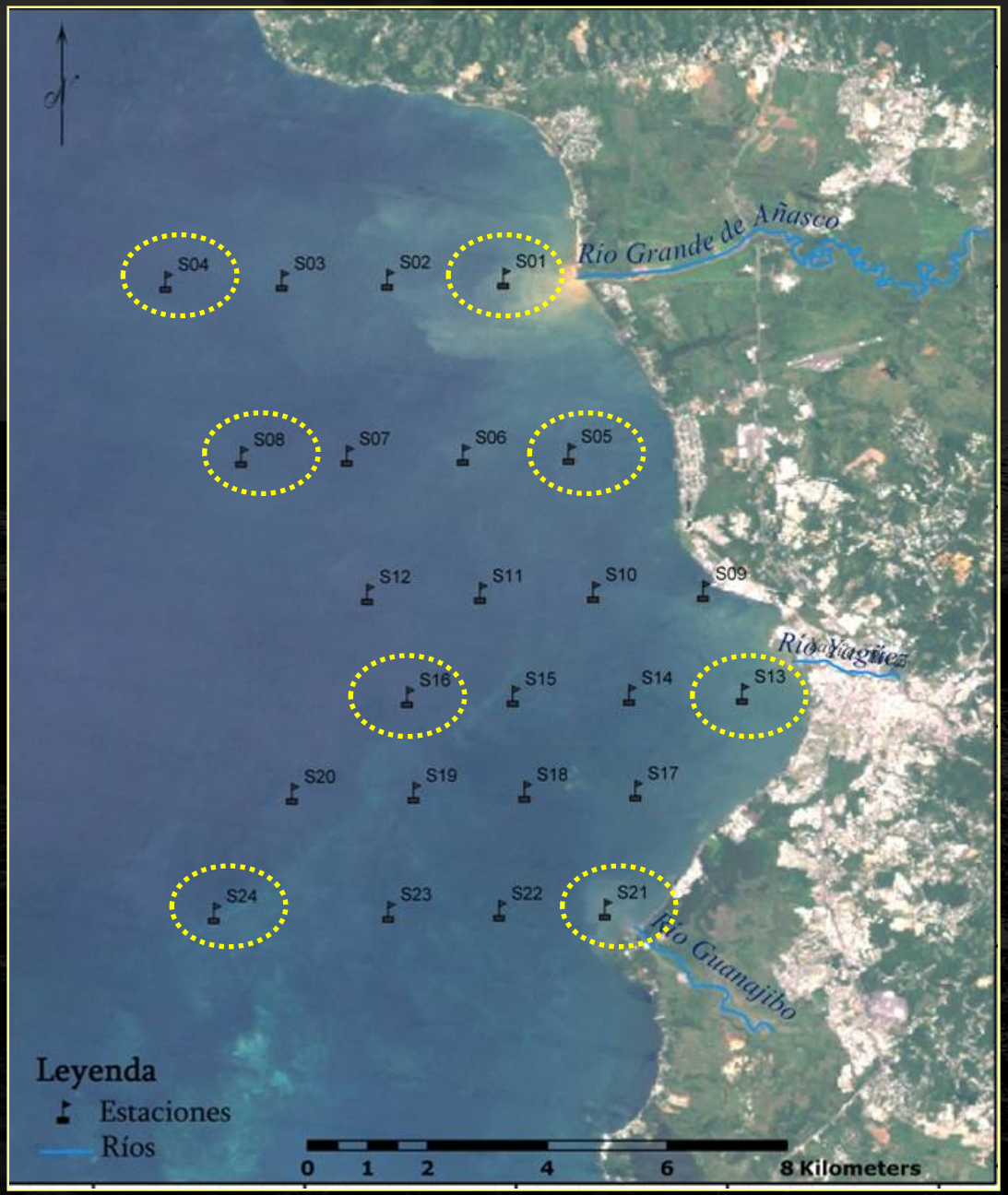
- The Mayagüez Bay is a semi enclosed Bay located at the west coast of Puerto Rico
- It suffers spatial and temporal variations in phytoplankton pigments and suspended sediments due to seasonal discharge of local rivers.
- The use of remote sensing for land-sea interface studies in this area requires better understanding of the bio-optical properties of the region.



General Objectives

- Evaluate the spatial and temporal variability of the bio-optical properties.
- Correlate water quality parameters and bio-optical properties.
- Develop bio-optical algorithms for Mayagüez Bay.

Study Area

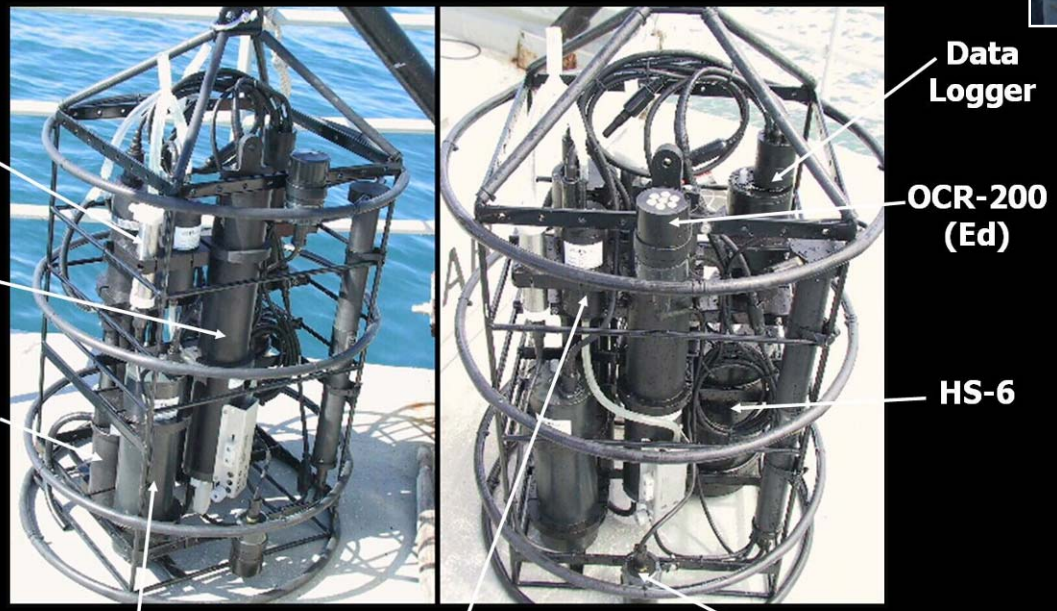


Study Period

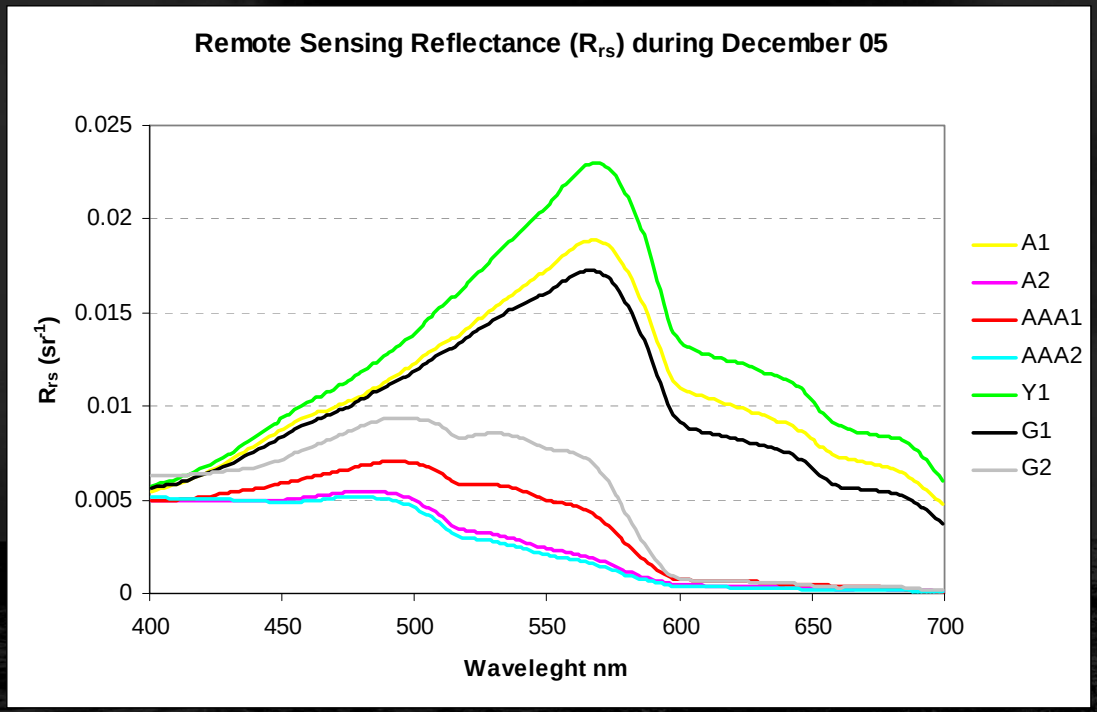
Date	Stations	Days
Apr-2001	24	3
Oct-2001	24	3
Feb-2002	24	3
Aug-2002	24	3
Feb-2003	24	3
Oct-2003	24	3
Jan-2004	24	3
Feb-2004	9	1
Aug-2004	10	1
Mar-2005	8	1
Jul-2005	8	1
Aug-2005	8	1
Sept-2005	8	1
Oct-2005	8	1
Dec-2005	8	1
Mar-2006	8	1
Apr-2006	8	1
Sept-2006	8	1
Oct-2006	8	1
May-2007	21	2
Mar-2008	6	1

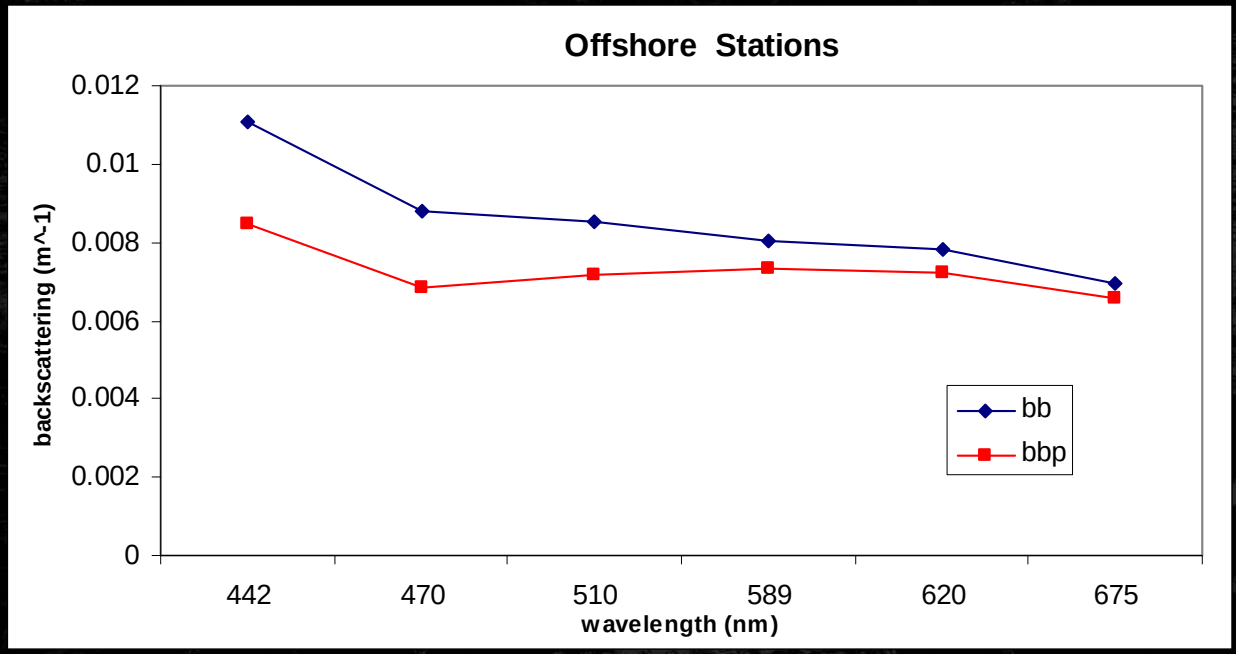
Methods

BIO-OPTICAL PACKAGE



Data samples





Remote Sensing and GIS applications

- Developing a method to monitor sedimentation processes using MODIS data.
- Studying spatial and temporal patterns of measured parameters by interpolation analyses using GIS.
- Publish research results in a web-based database using ArcIMS

MODIS

Moderate-Resolution Imaging Spectroradiometer

- Temporal resolution is 1 day
- Platform is on two satellites:
  - ✓ Terra (EOS AM)
  - ✓ Aqua (EOS PM)
- Spectral resolution- 36 bands: 0.41 - 14.385 μm.
- Spatial Resolution:
  - ✓ 250 m (bands 1 - 2)
  - ✓ 500 m (bands 3 - 7)
  - ✓ 1000 m (bands 8 - 36)
- Swath width: 2330 km

February 7th, 2008

Results

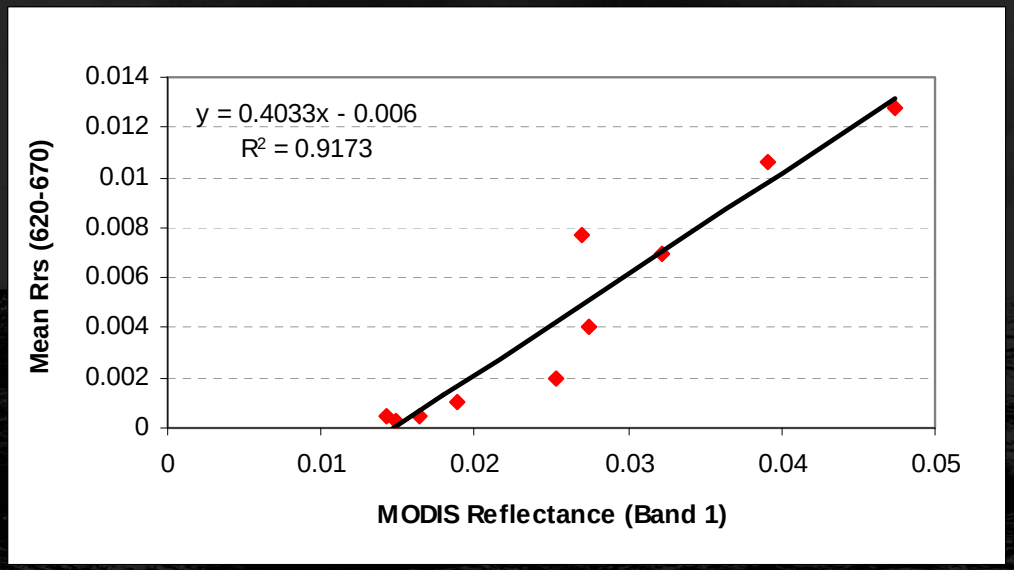
Equations defined in Band Math

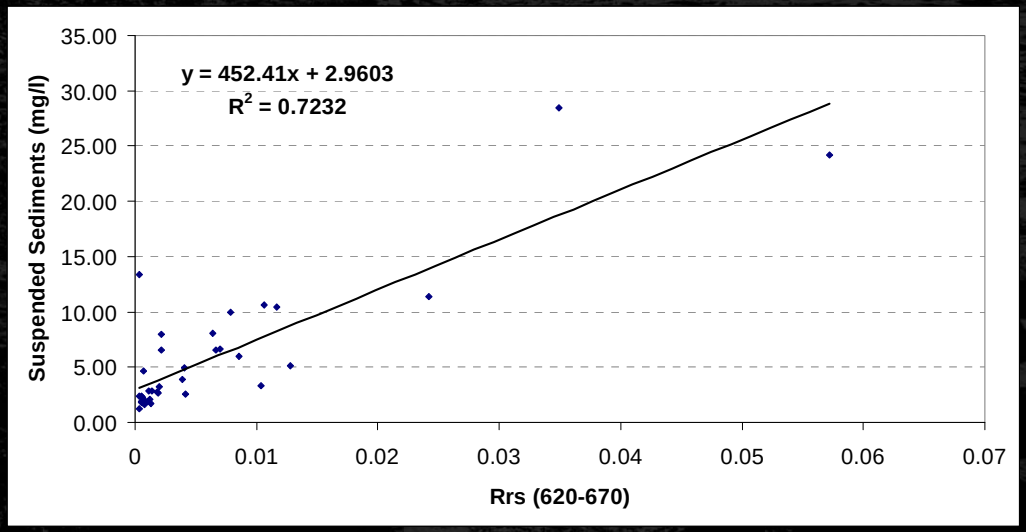
Equation # 1

- 0.4033 * float(B1) – 0.006
- B1 = Band 1 MODIS

Equation # 2 (mg/L)

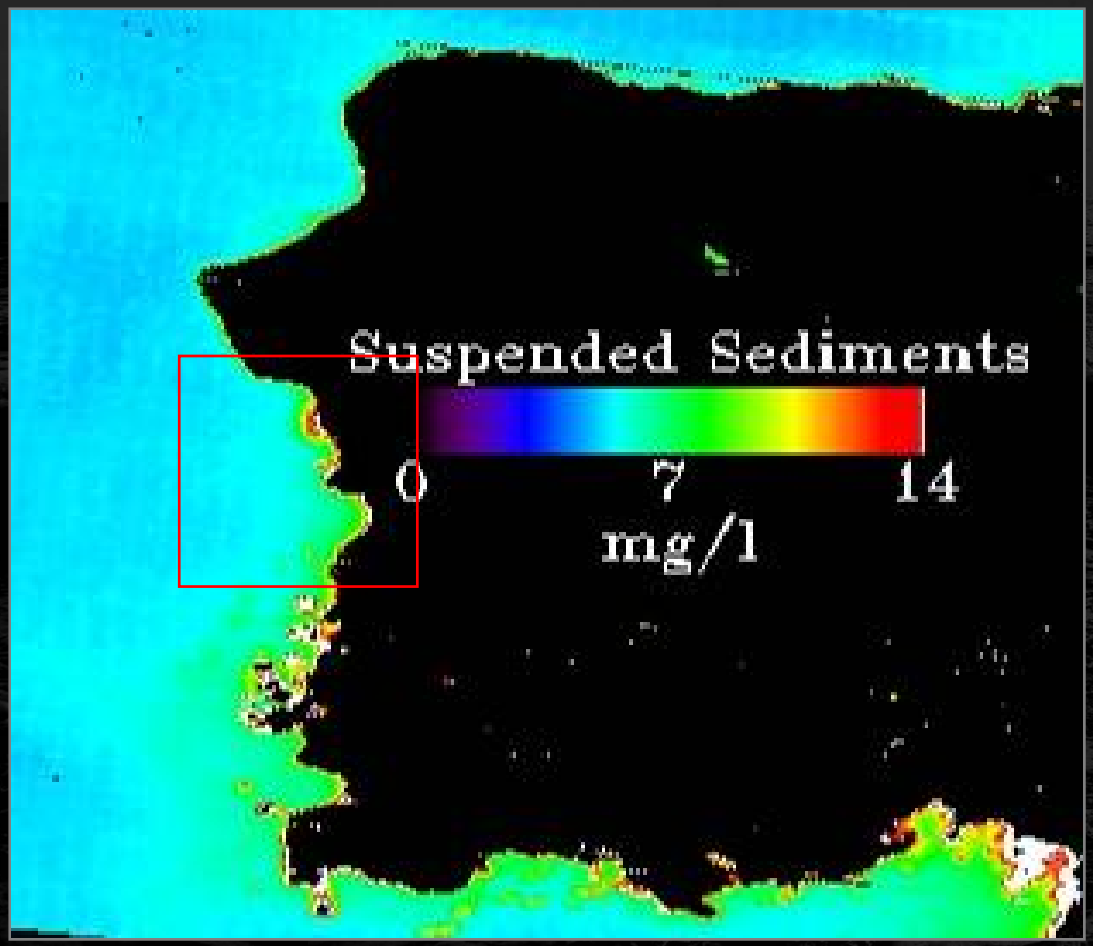
- 452.41 * float(B1) + 2.9603
- B1 = Equation # 1 Product

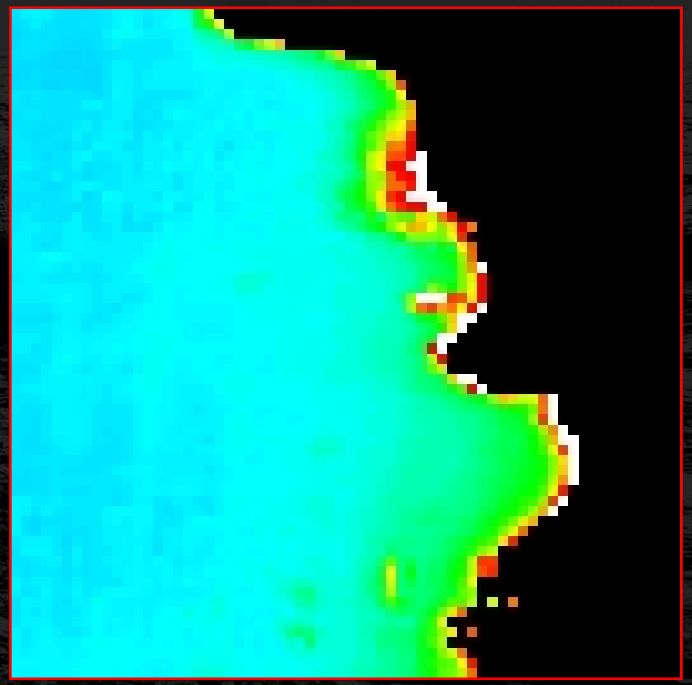




Suspended Sediments Estimations

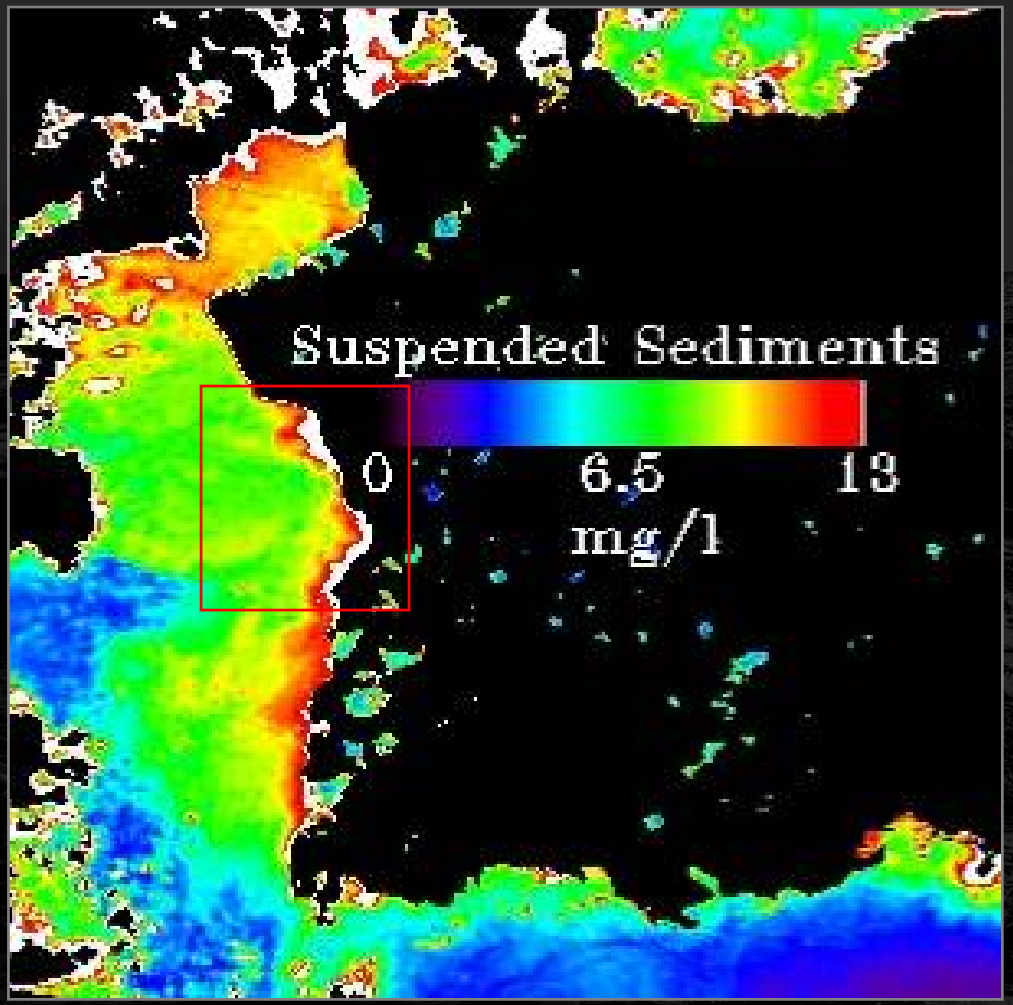
February 27, 2003

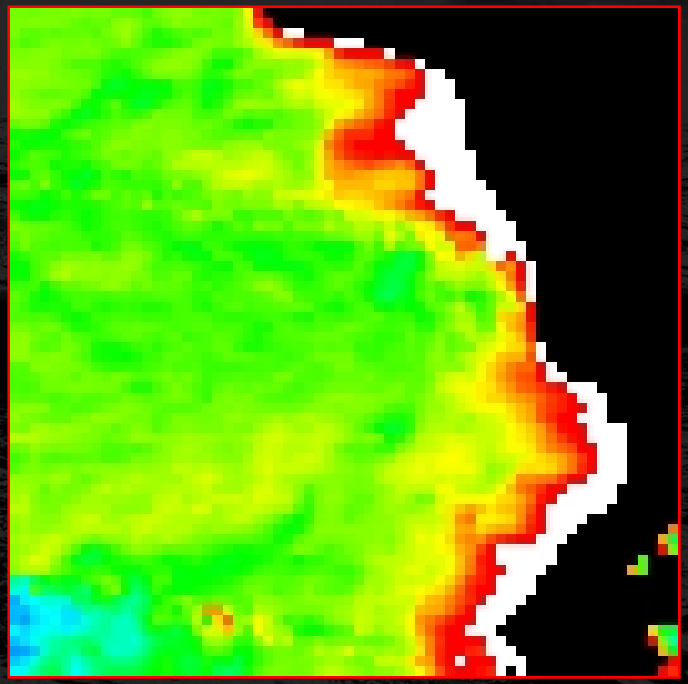




Suspended Sediments Estimations

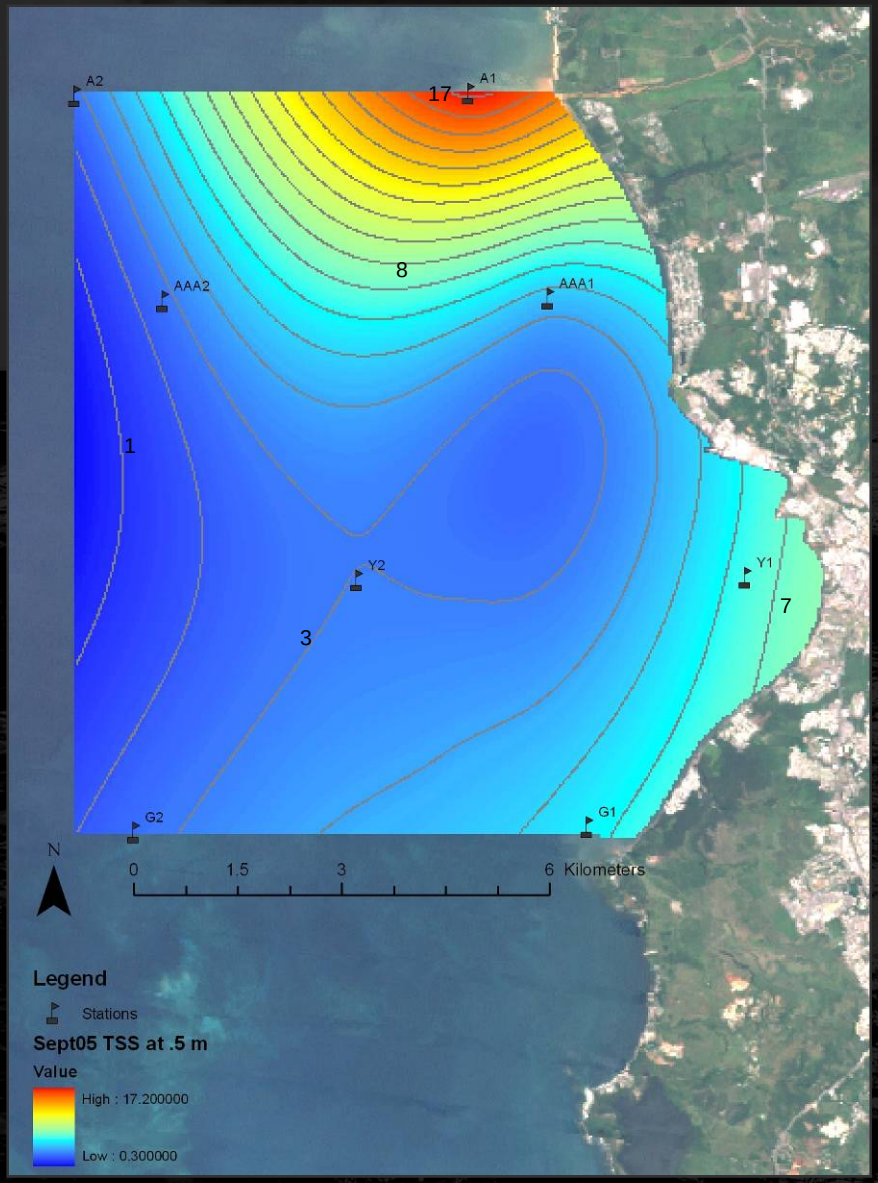
March 8, 2006



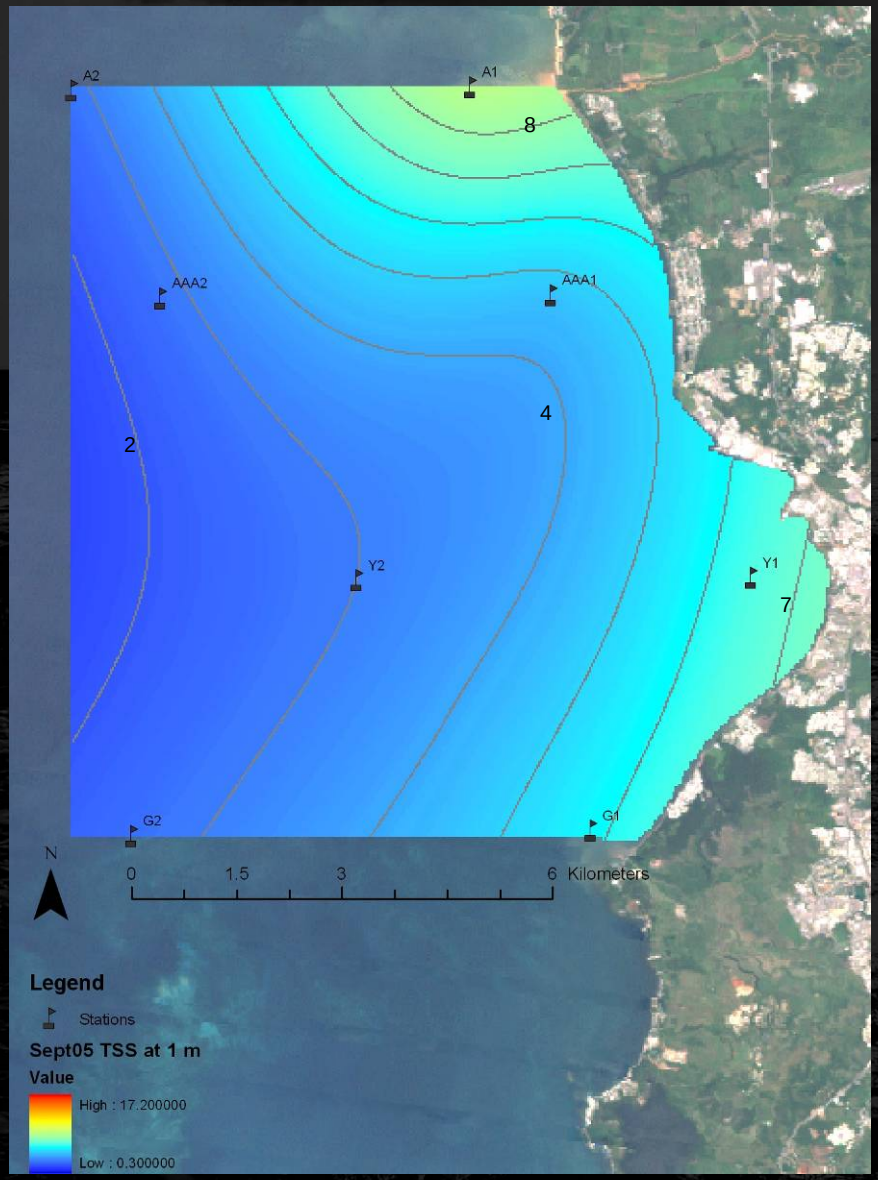


TSS estimations based on b_b at 620 nm

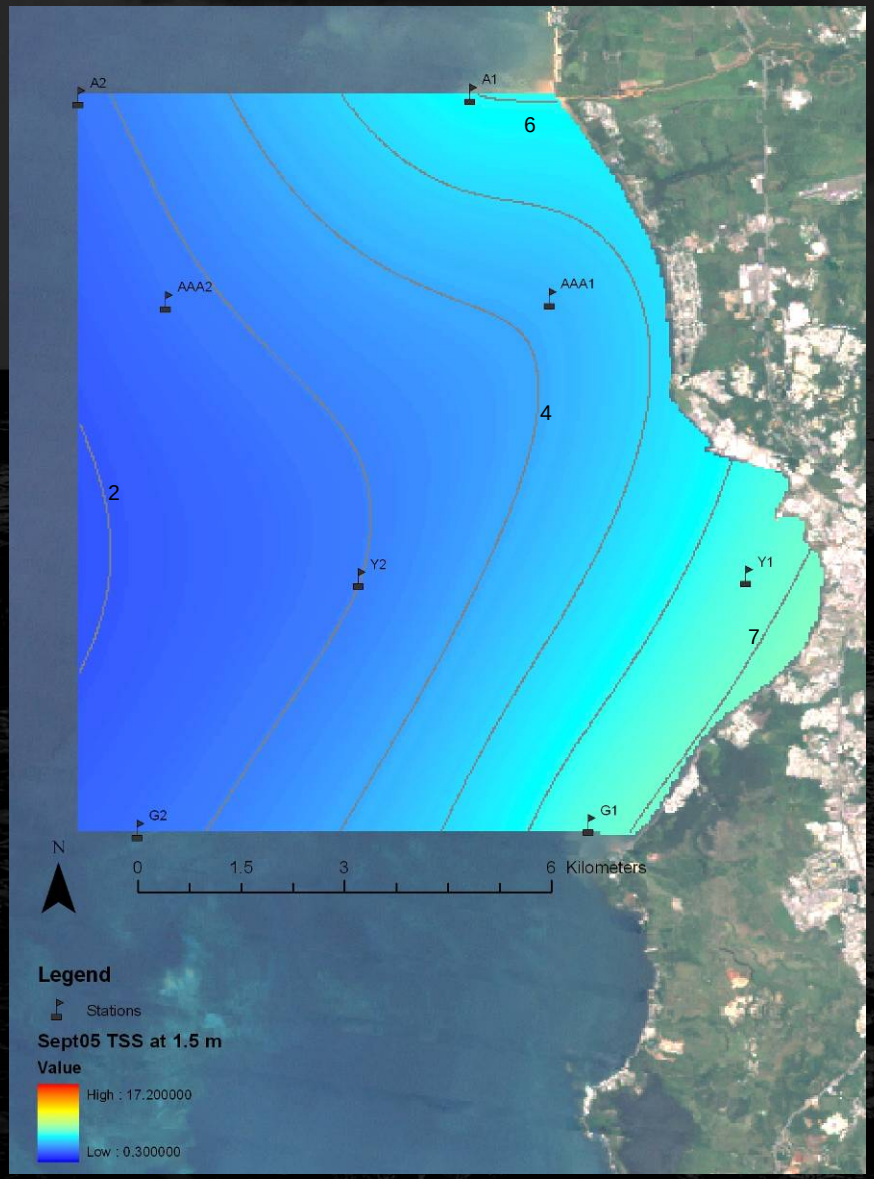
TSS estimated at 0.5 m



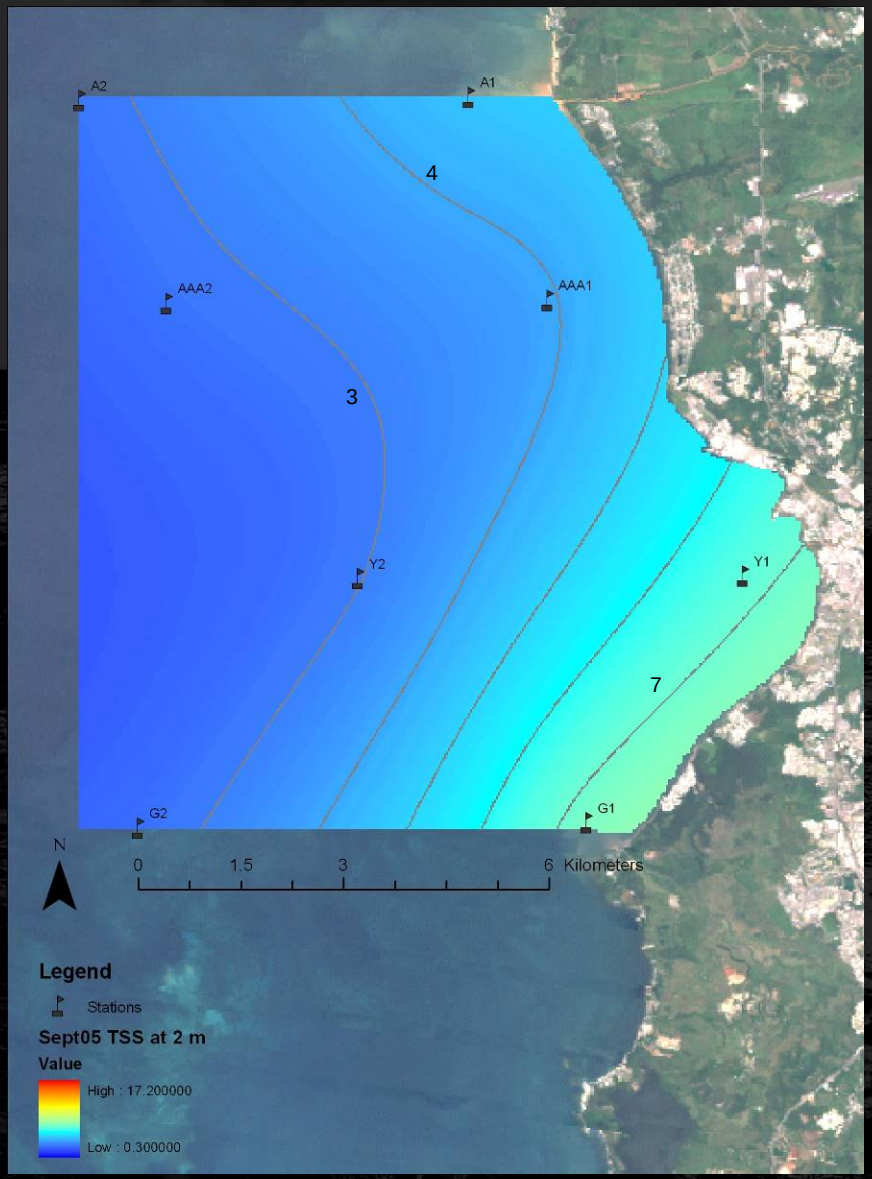
TSS estimated at 1 m



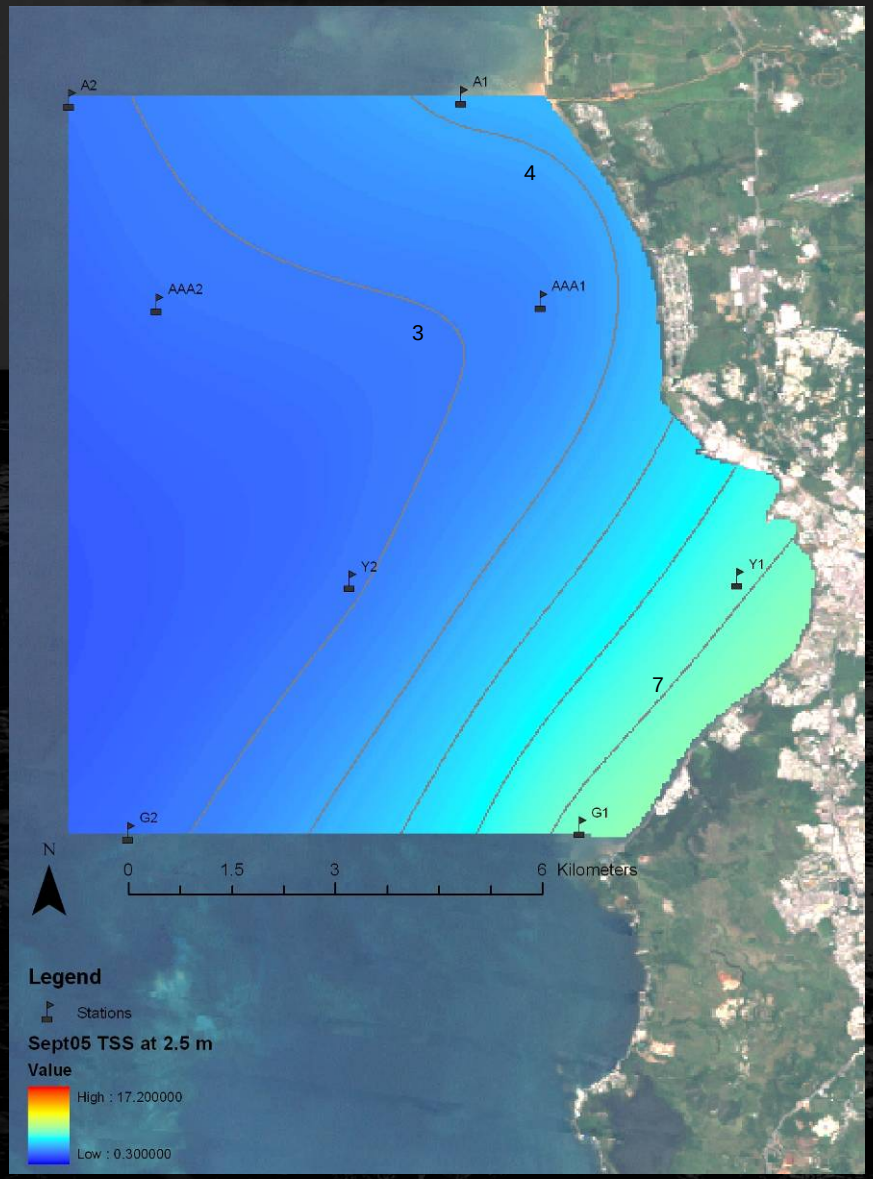
TSS estimated at 1.5 m



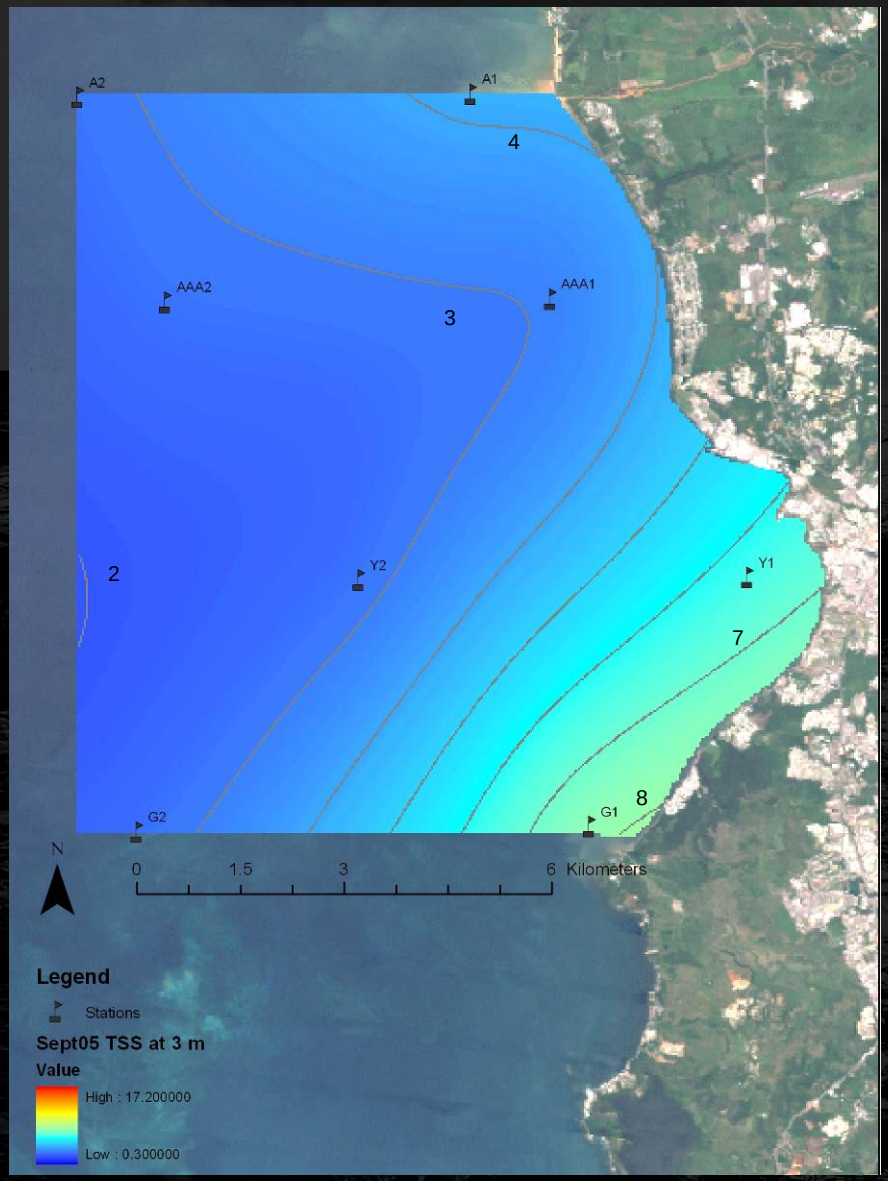
TSS estimated at 2 m



TSS estimated at 2.5 m

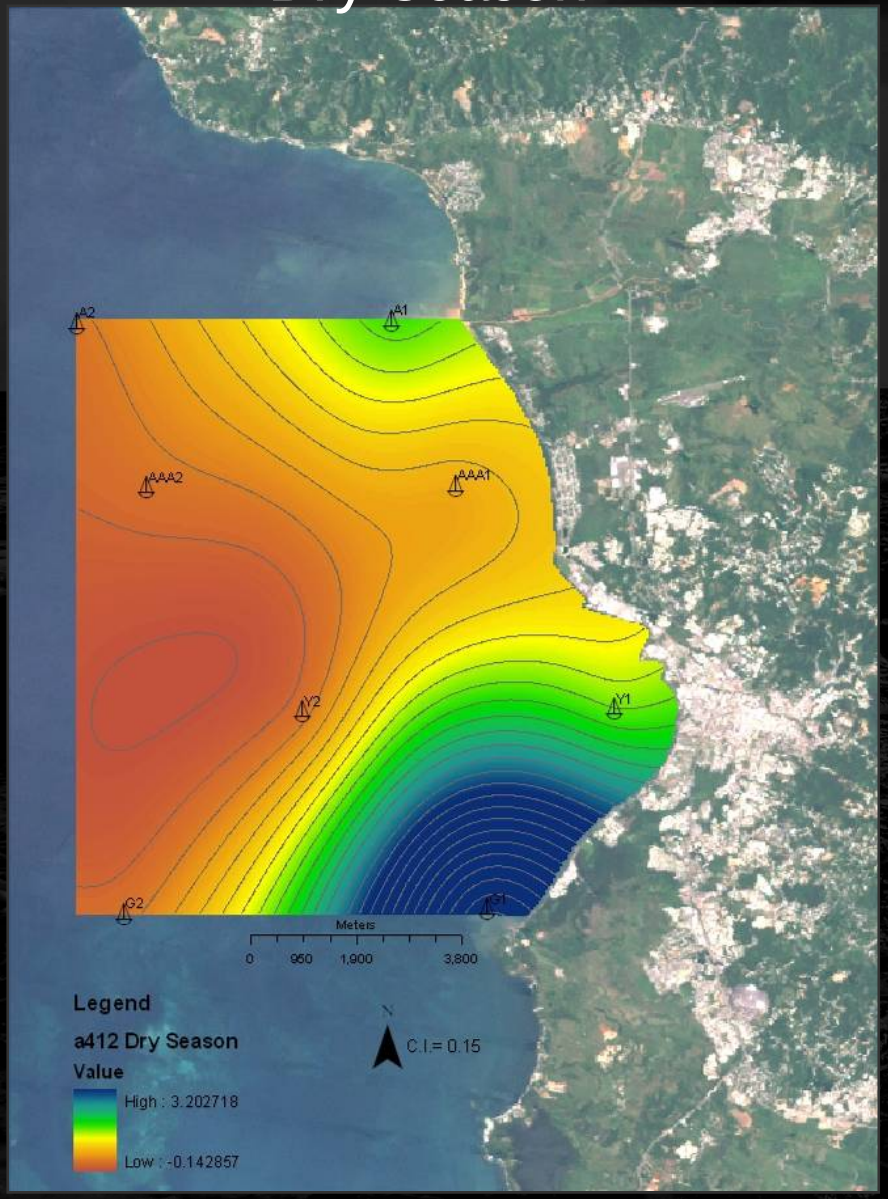


TSS estimated at 3 m

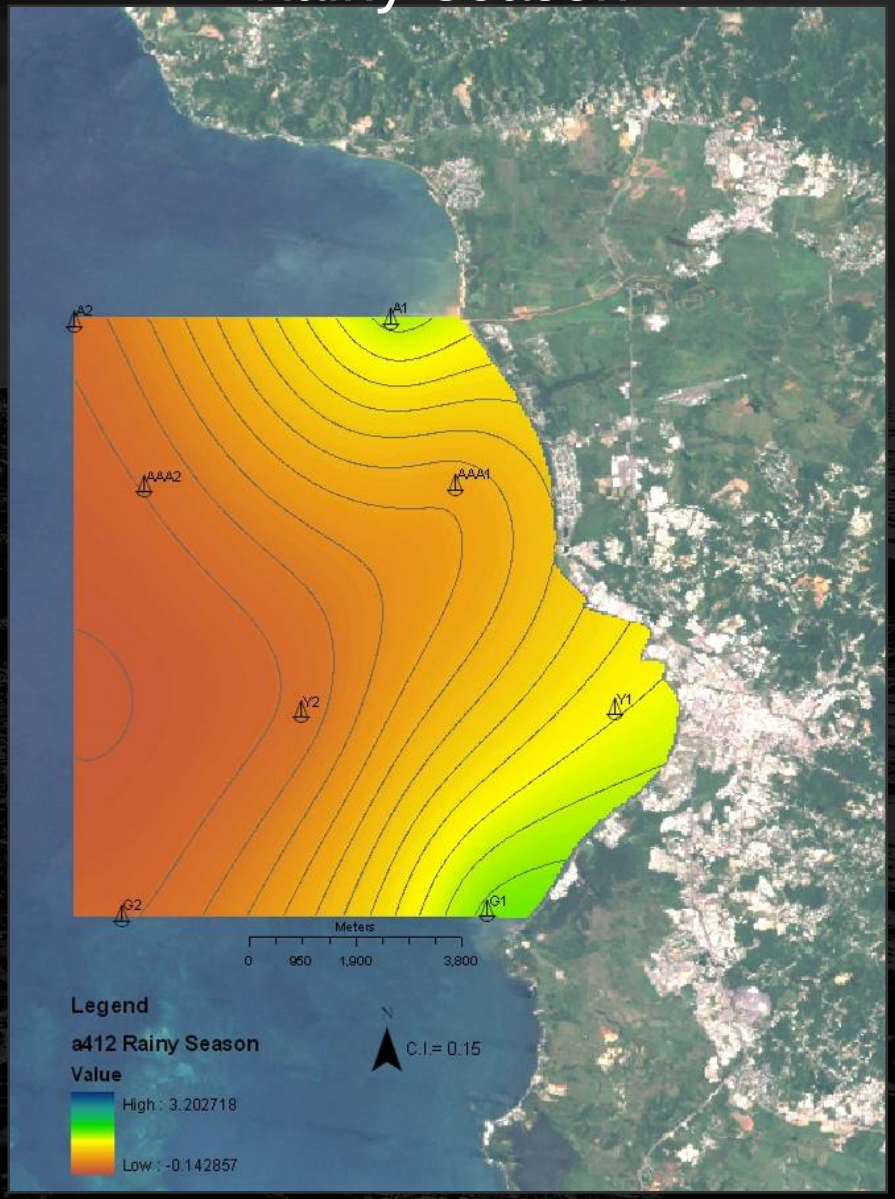


Absorption coefficient 412 nm

Dry Season



Rainy Season



GERSVIEW.UPRM.EDU

Mayagüez Bay database

ArcView
Info Projects

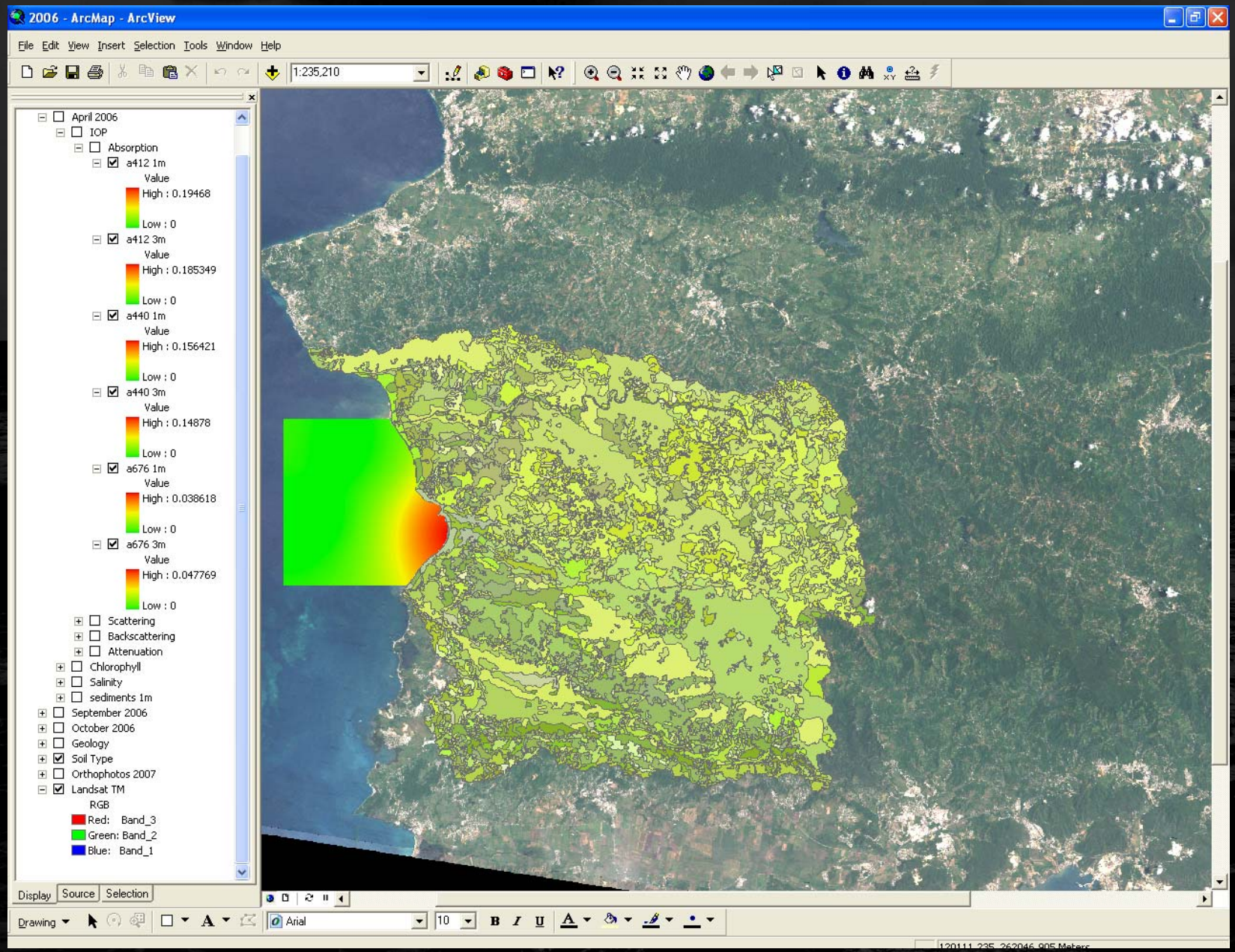
ArcIMS
Mapping Interface

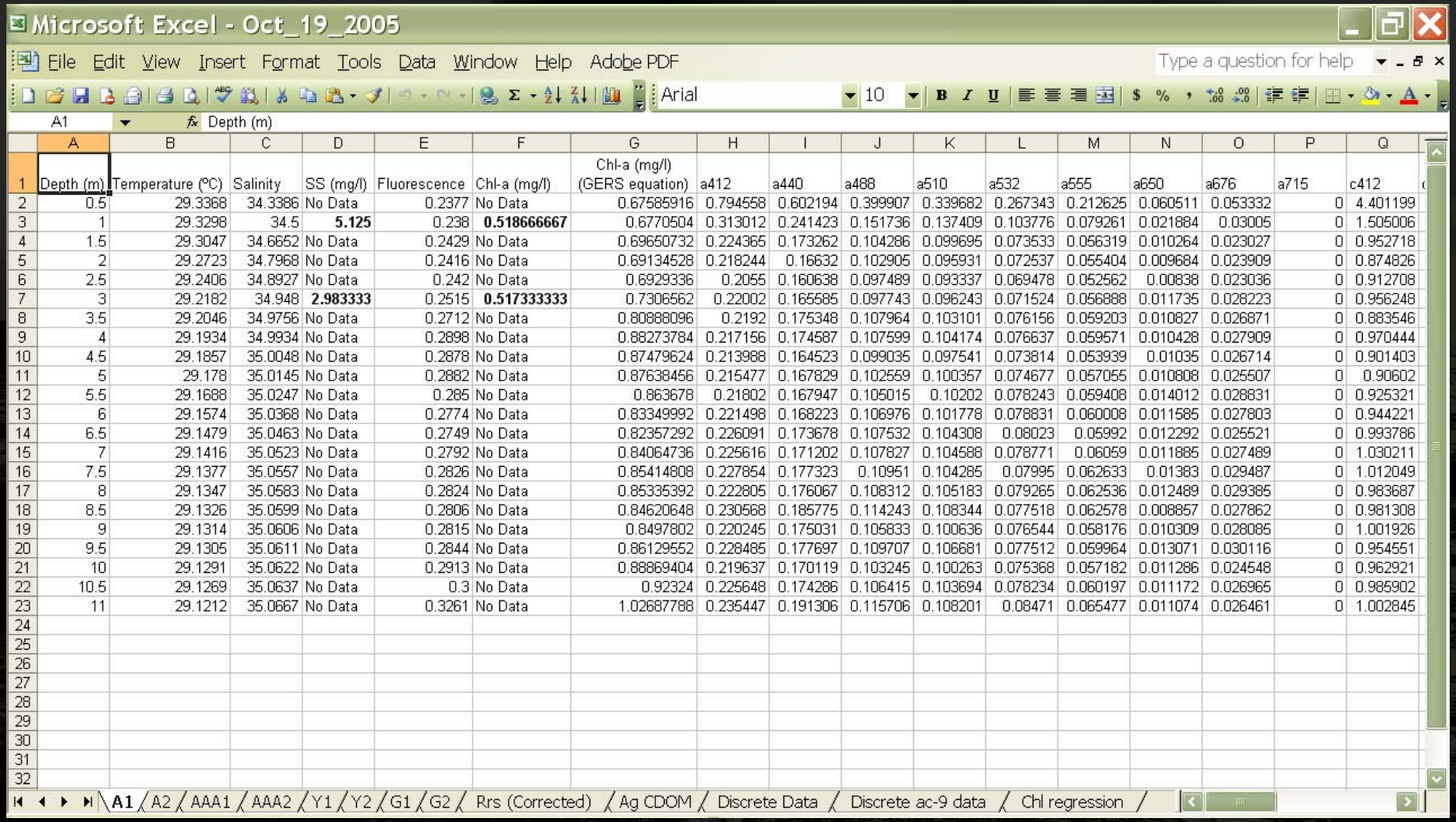
GERSVIEW

Mapping Interface
(World-Wide Users,
Researchers)


Questions ?

Data layers arrangement





Microsoft Excel - Oct_19_2005

File Edit View Insert Format Tools Data Window Help Adobe PDF

Type a question for help

Arial 10

A1 Depth (m)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Depth (m)	Temperature (°C)	Salinity	SS (mg/l)	Fluorescence	Chl-a (mg/l)	Chl-a (mg/l) (GERS equation)	a412	a440	a488	a510	a532	a555	a650	a676	a715	c412
2	0.5	29.3368	34.3386	No Data	0.2377	No Data	0.67585916	0.794558	0.602194	0.399907	0.339682	0.267343	0.212625	0.060511	0.053332	0	4.401199
3	1	29.3298	34.5	**5.125**	0.238	**0.518666667**	0.6770504	0.313012	0.241423	0.151736	0.137409	0.103776	0.079261	0.021884	0.03005	0	1.505006
4	1.5	29.3047	34.6652	No Data	0.2429	No Data	0.69650732	0.224365	0.173262	0.104286	0.099695	0.073533	0.056319	0.010264	0.023027	0	0.952718
5	2	29.2723	34.7968	No Data	0.2416	No Data	0.69134528	0.218244	0.16632	0.102905	0.095931	0.072537	0.055404	0.009684	0.023909	0	0.874826
6	2.5	29.2406	34.8927	No Data	0.242	No Data	0.6929336	0.2055	0.160638	0.097489	0.093337	0.069478	0.052562	0.00838	0.023036	0	0.912708
7	3	29.2182	34.948	**2.983333**	0.2515	**0.517333333**	0.7306562	0.22002	0.165585	0.097743	0.096243	0.071524	0.056888	0.011735	0.028223	0	0.956248
8	3.5	29.2046	34.9756	No Data	0.2712	No Data	0.80888096	0.2192	0.175348	0.107964	0.103101	0.076156	0.059203	0.010827	0.026871	0	0.883546
9	4	29.1934	34.9934	No Data	0.2898	No Data	0.88273784	0.217156	0.174587	0.107599	0.104174	0.076637	0.059571	0.010428	0.027909	0	0.970444
10	4.5	29.1857	35.0048	No Data	0.2878	No Data	0.87479624	0.213988	0.164523	0.099035	0.097541	0.073814	0.053939	0.01035	0.026714	0	0.901403
11	5	29.178	35.0145	No Data	0.2882	No Data	0.87638456	0.215477	0.167829	0.102559	0.100357	0.074677	0.057055	0.010808	0.025507	0	0.90602
12	5.5	29.1688	35.0247	No Data	0.285	No Data	0.863678	0.21802	0.167947	0.105015	0.10202	0.078243	0.059408	0.014012	0.028831	0	0.925321
13	6	29.1574	35.0368	No Data	0.2774	No Data	0.83349992	0.221498	0.168223	0.106976	0.101778	0.078831	0.060008	0.011585	0.027803	0	0.944221
14	6.5	29.1479	35.0463	No Data	0.2749	No Data	0.82357292	0.226091	0.173678	0.107532	0.104308	0.08023	0.05992	0.012292	0.025521	0	0.993786
15	7	29.1416	35.0523	No Data	0.2792	No Data	0.84064736	0.225616	0.171202	0.107827	0.104588	0.078771	0.06059	0.011885	0.027489	0	1.030211
16	7.5	29.1377	35.0557	No Data	0.2826	No Data	0.85414808	0.227854	0.177323	0.10951	0.104285	0.07995	0.062633	0.01383	0.029487	0	1.012049
17	8	29.1347	35.0583	No Data	0.2824	No Data	0.85335392	0.222805	0.176067	0.108312	0.105183	0.079265	0.062536	0.012489	0.029385	0	0.983687
18	8.5	29.1326	35.0599	No Data	0.2806	No Data	0.84620648	0.230568	0.185775	0.114243	0.108344	0.077518	0.062578	0.008857	0.027862	0	0.981308
19	9	29.1314	35.0606	No Data	0.2815	No Data	0.8497802	0.220245	0.175031	0.105833	0.100636	0.076544	0.058176	0.010309	0.028085	0	1.001926
20	9.5	29.1305	35.0611	No Data	0.2844	No Data	0.86129552	0.228485	0.177697	0.109707	0.106681	0.077512	0.059964	0.013071	0.030116	0	0.954551
21	10	29.1291	35.0622	No Data	0.2913	No Data	0.88869404	0.219637	0.170119	0.103245	0.100263	0.075368	0.057182	0.011286	0.024548	0	0.962921
22	10.5	29.1269	35.0637	No Data	0.3	No Data	0.92324	0.225648	0.174286	0.106415	0.103694	0.078234	0.060197	0.011172	0.026965	0	0.985902
23	11	29.1212	35.0667	No Data	0.3261	No Data	1.02687788	0.235447	0.191306	0.115706	0.108201	0.08471	0.065477	0.011074	0.026461	0	1.002845
24																	
25																	
26																	
27																	
28																	
29																	
30																	
31																	
32																	

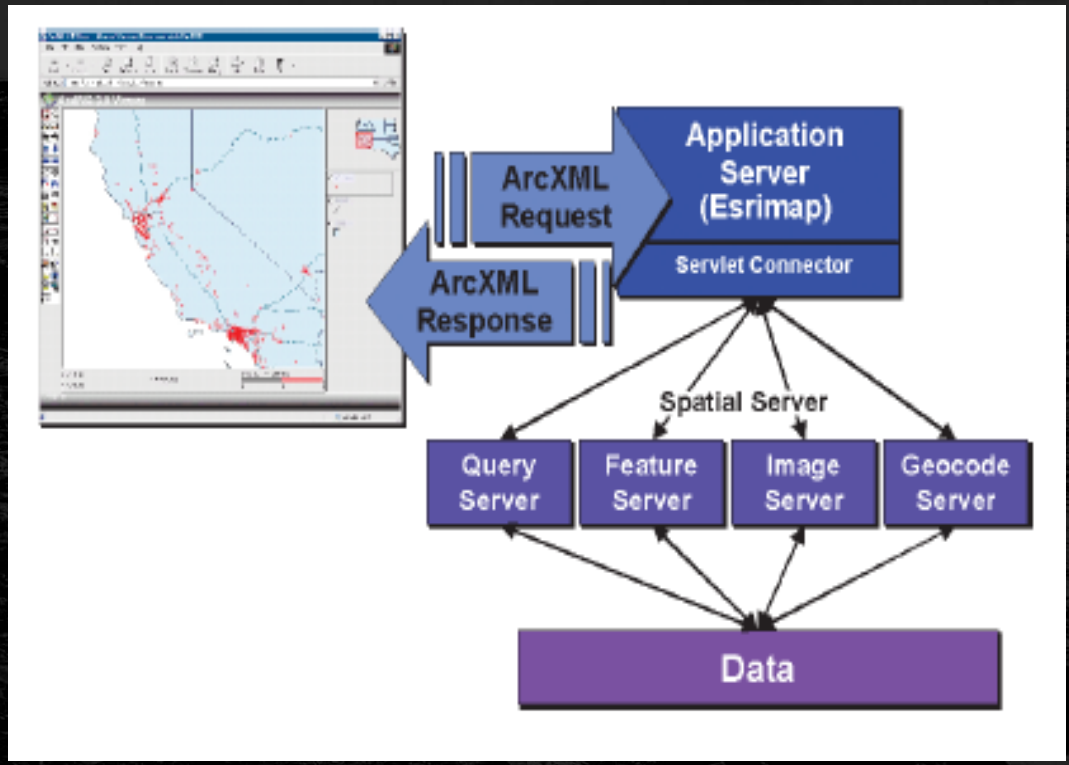
A1 / A2 / AAA1 / AAA2 / Y1 / Y2 / G1 / G2 / Rrs (Corrected) / Ag CDOM / Discrete Data / Discrete ac-9 data / Chl regression

After all necessary corrections data was summarized into databases

ArcIMS 9.1®

ArcIMS®

- Organizational application
- Map distribution and geographic information system (GIS) data on the Internet.
- Create easy-to-use, task-focused applications that use geographic content.
- Deliver dynamic maps and data via the Web.
- Share data with others to accomplish tasks.



Geological and Environmental Remote Sensing Laboratory
Department of Geology
University of Puerto Rico at Mayagüez

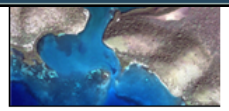
MAYAGÜEZ BAY DATABASE

Since the GERS Lab was founded an important effort has been done to better understand the dynamics of Mayaguez Bay. This open bay is located in the west coast of Puerto Rico and it is influenced by the discharge of the Añasco, Yaguez, and Guanajibo rivers. It has also been affected by anthropogenic activities produced by tuna factories (currently closed) and a sewage pipe (currently active). Oceanographic and bio-optical data have been collected along the bay during different seasons and years. We are posting here the processed data for your visualization and use. In case of any question please send an email to Fernando Gilbes Santaella at **fgilbes@uprm.edu**.

Click on the date to see the data collected during that day.

April 2001	February 2004	October 2005
October 2001	August 2004	December 2005
August 2002	March 2005	March 2006
February 2003	July 2005	April 2006
October 2003	August 2005	September 2006
January 2004	September 2005	October 2006

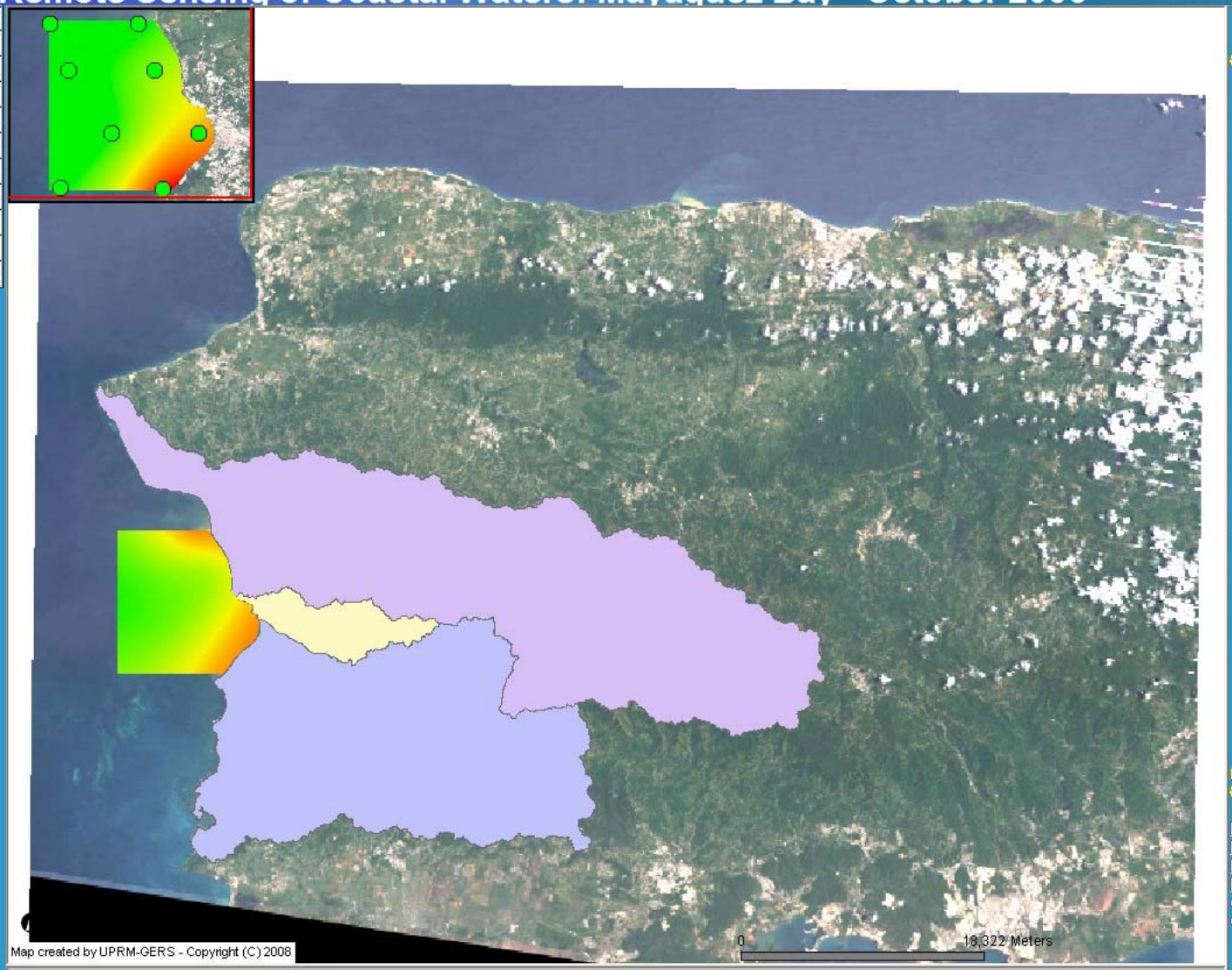
> Go back to GERS Lab Database



> See more information of the project

> Go to the Database

Remote Sensing of Coastal Waters: Mayaguez Bay - October 2006



October 2006 Layers

- Layers
  - October 2006
    - Data
    - Absorption
    - Attenuantion
    - Scattering
    - Backscattering
    - Chlorophyll
      - chla 1m
      - chla 3m
    - Salinity
    - Sediments
  - Ancillary Data
    - Elevations 30m
    - Rivers and Stre
    - Roads
    - Bathymetry co
    - Benthic Type
    - Yaguez waters
    - Guanajibo wate
    - Anasco watersh
    - Subwatershed
    - Soil Type
    - Geology
    - Study Area
  - Landsat TM

Refresh Map

Auto Refresh

Help:

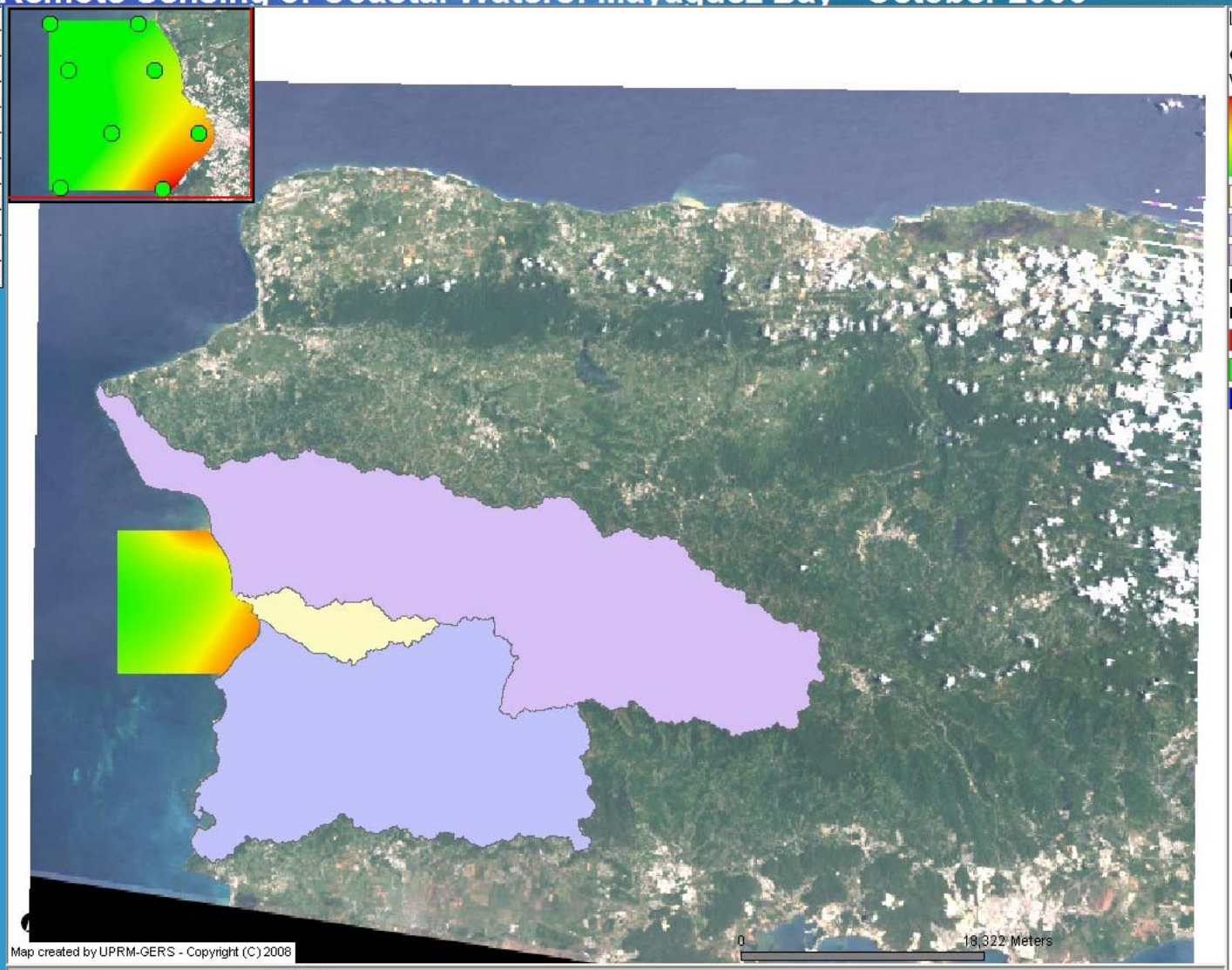
- A closed group, click to open
- An open group, click to close
- A map layer.
- A hidden group/layer, click to
- A visible group/layer, click to
- A visible layer, but not at this
- A partially visible group, click
- An inactive layer, click to mak
- The active layer.

oct_06_1m

STATION	DEPTH	TEMPERATUR	SALINITY	SS	FLUORESCEN	CHLA	a412	a440	a488	a510	a532	a555	a650	a676	a715	c412	c440	c488	c510	c532	c555
A1	1	28.4742	34.6222	7.95	0.2082	0.81909526	0	0	0	0	0	0	error value	error value	0	0	0	0	0	0	0

Identify

Remote Sensing of Coastal Waters: Mayaguez Bay - October 2006



oct_06_1m

STATION	DEPTH	TEMPERATUR	SALINITY	SS	FLUORESCEN	CHLA	a412	a440	a488	a510	a532	a555	a650	a676	a715	c412	c440	c488	c510	c532	c555
A1	1	28.4742	34.6222	7.95	0.2082	0.81909526	0	0	0	0	0	0	error value	error value	0	0	0	0	0	0	0

Identify