Data and Web Services: When to Use, How to Use, Why to Use

Jen Boulware, Kyle Draganov, and John Ulmer

The Baldwin Group at the
NOAA Coastal Services Center

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Overview

- **Web Services Primer**

  John Ulmer

- **Geospatial Data and Web Services**

  Kyle Draganov and Jen Boulware

- **Practical Data Modeling for Web Services**

  John Ulmer

- **Web Services in an IOOS Context**

  John Ulmer

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Web Services Primer

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Overview

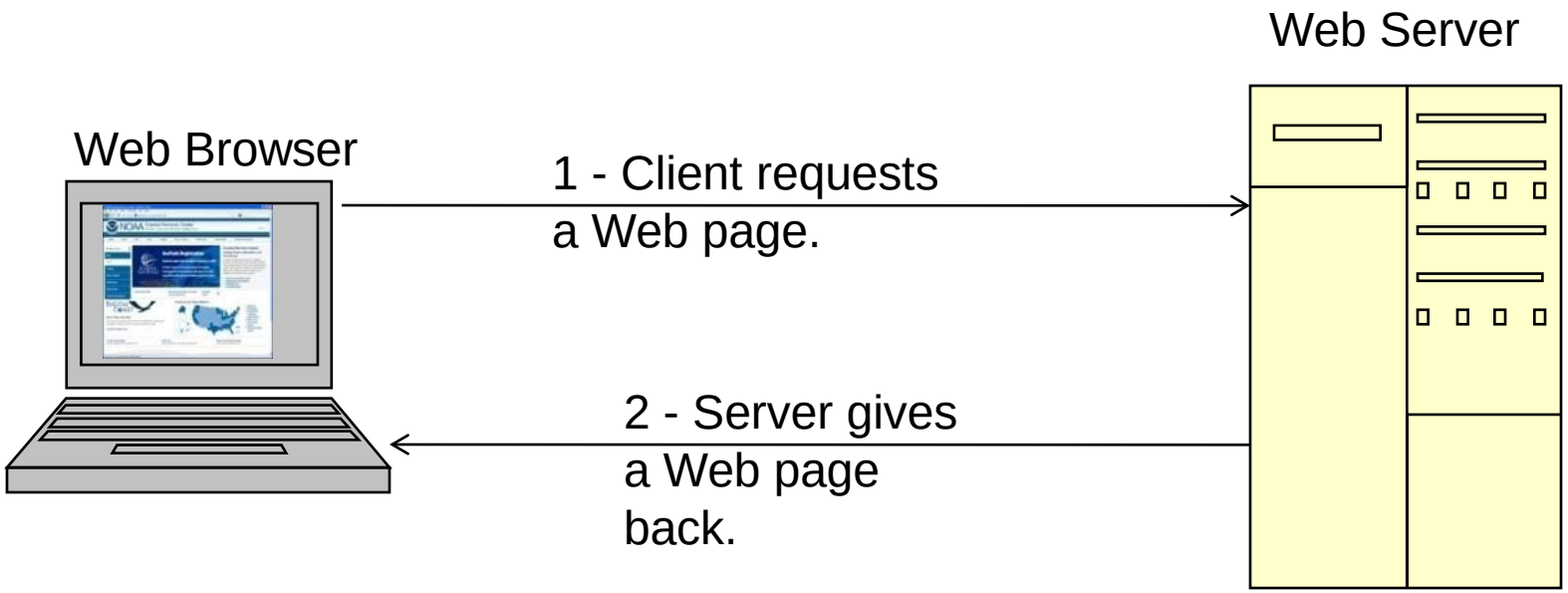
Introduction

The View from 30,000 feet

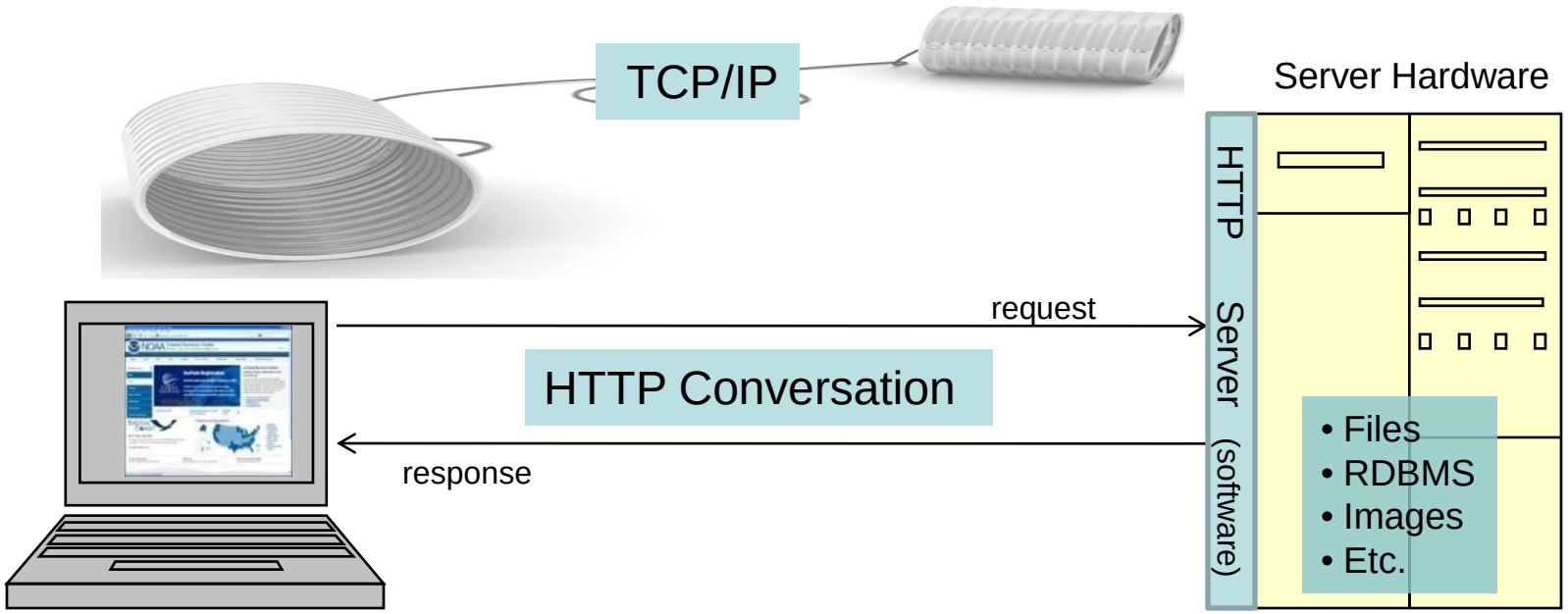
Quickly into a little detail . . .

SOAP and REST?

Requests and Responses



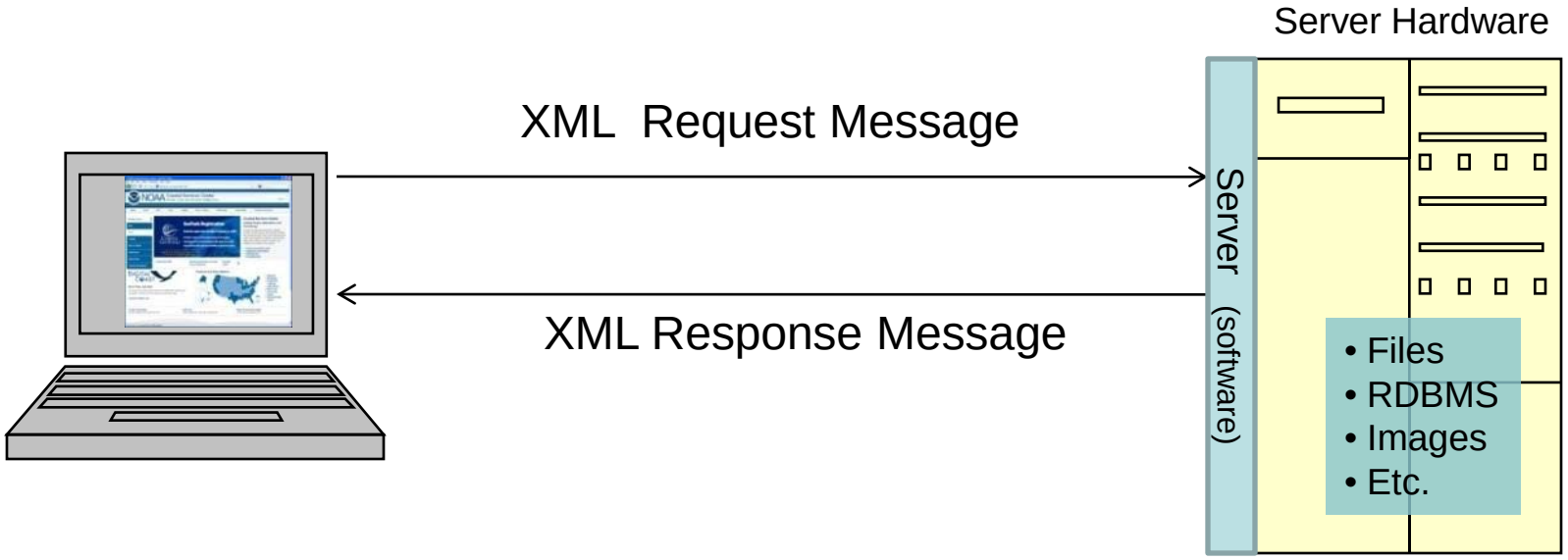
Communication Layers



IP Address:
221.74.147.217

IP Address:
123.45.3.145

Web Services



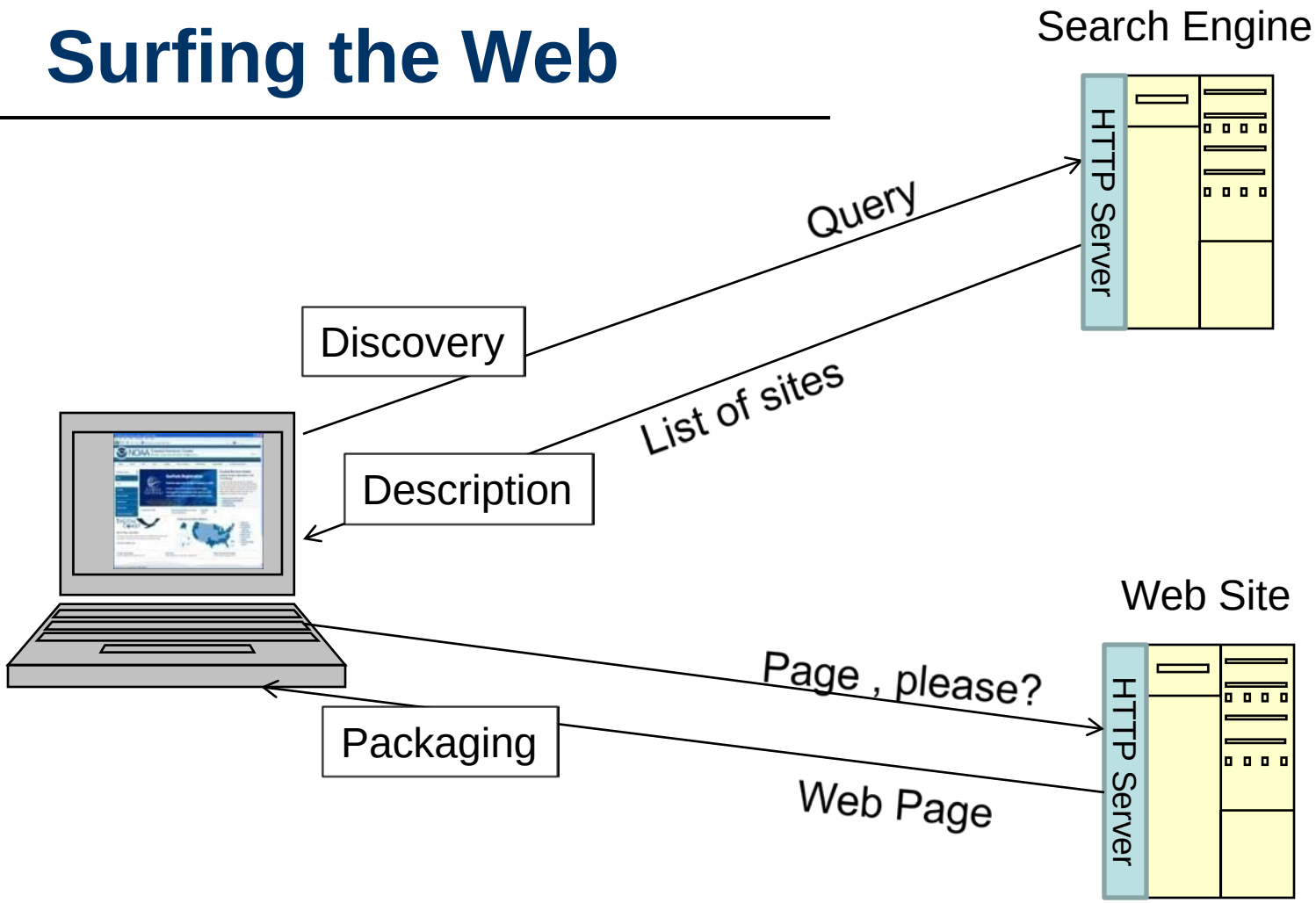
Web Services – The Functional Stack

Function	Description
Discovery	What potentially relevant resources exist?
Description	What does each resource look like?
Packaging	How does the resource package its response to the client?
Transport	What rule sets apply to the request and response behaviors?
Network Infrastructure	Wires, optical fiber, switches, modems, etc.

Surfing the Web

Function	Description
Discovery	Search engine of choice
Description	Site description in search engine results list
Packaging	Generally HTML
Transport	TCP/IP + HTTP

Surfing the Web



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Why SOAP/XML?

A Web Service should be ***self describing*** and ***discoverable***.

-The SOAP specifications provide for these requirements and more.

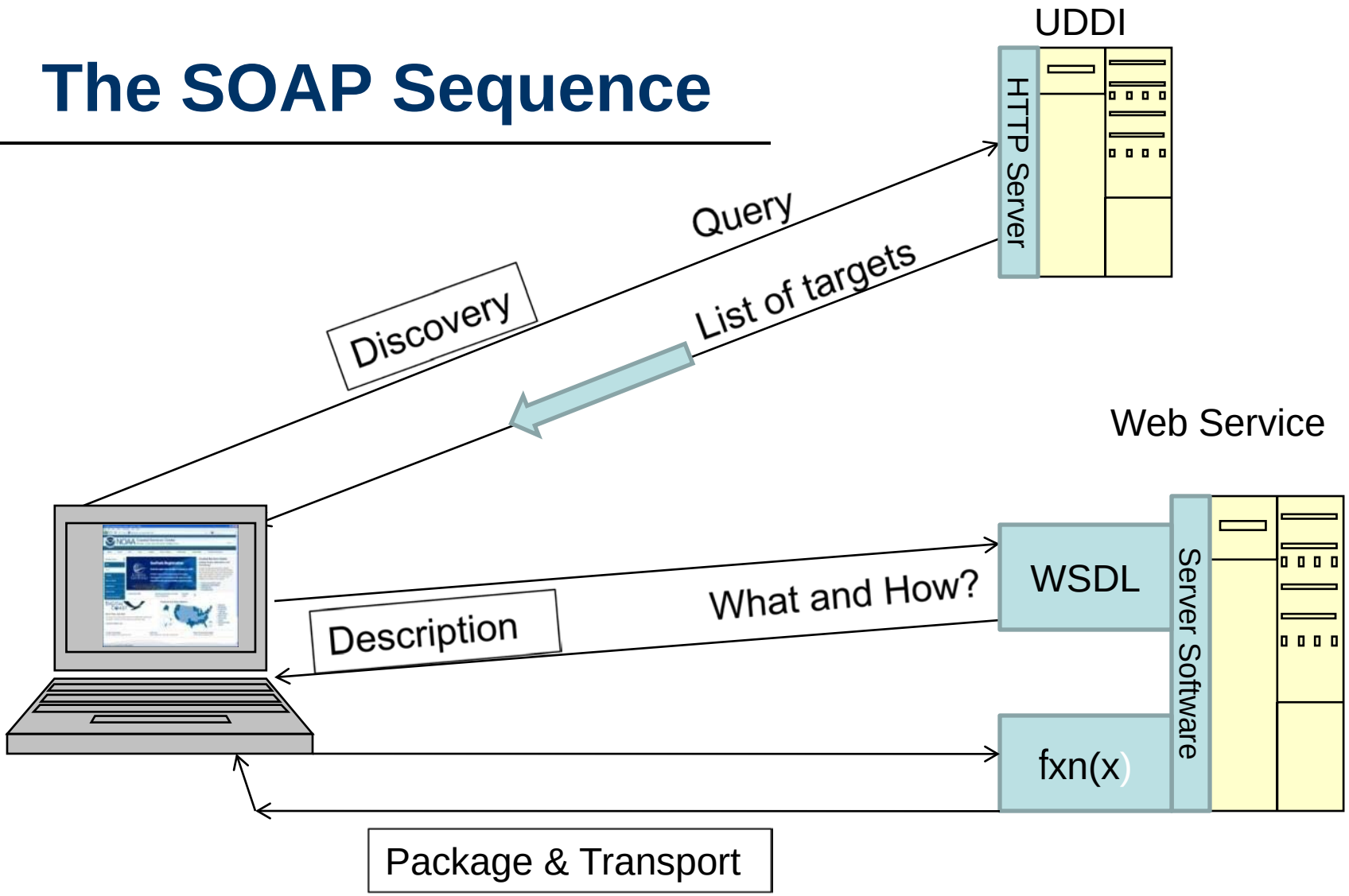
- In the REST model you get to build from the (HTTP) ground up.

In general, the specifications underlying the REST model are human centric where the SOAP model is application or service centric.

SOAP/XML

	SOAP – Simple Object Access Protocol
Discovery	UDDI – Universal Description, **Discovery**, and Integration
Description	UDDI & WSDL – Web Service **Description** Language
Packaging	XML – requires schema design (data modeling)
Transport	TCP/IP + SOAP – Offers several layers of error checking handling

The SOAP Sequence



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SOAP/XML – The Dark Side

- The UDDI specification is onerous and very infrequently fully implemented.
- You just about have to be a programmer to use a SOAP service. Your browser won't do.
- It is all XML. Unless you're a machine, you won't want to read it.

REST

- Avoids much of the complexity of SOAP. No UDDI. No WSDL
- Are much less well defined or specified by any significant standards body

	REST – Representational State Transfer
Discovery	Not specified. Community must agree on or build some form of registry of target servers. Google, Yahoo, dogpile?
Description	Not defined. Community must agree on some strategy to support service descriptions.
Packaging	Highly variable
Transport	HTTP (*usually)*

GeoSpatial Data and Web Services

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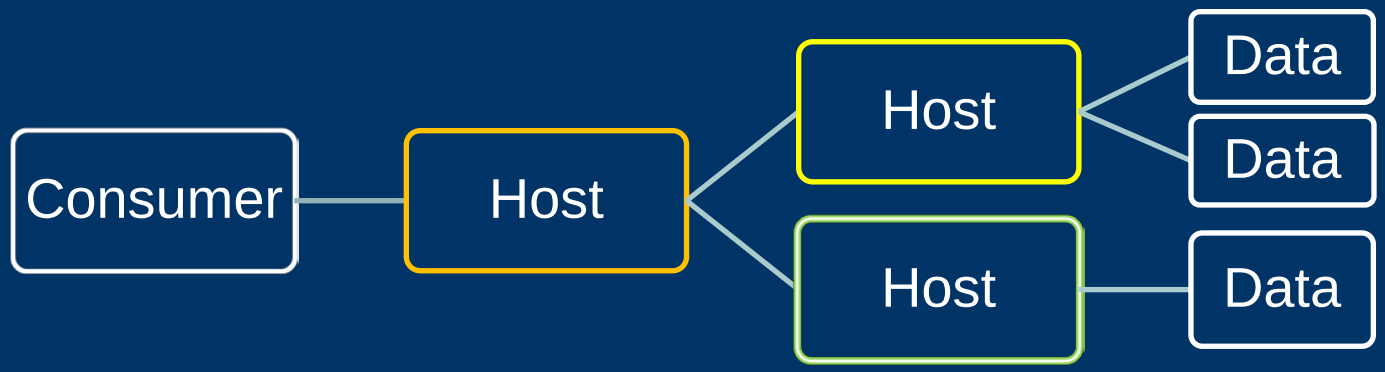
What are geospatial web services?

- **Geospatial Web Services – distributed, interoperable geospatial data and functionality**
  - Consuming – Accessing other peoples data
  - Hosting – Providing an interface to access your data



What are geospatial web services?

- **Geospatial Web Services can be:**
  - Simple XML based web services with geospatial context
    - SOAP
    - REST
    - geoRSS
  - Data/Map Services for use in GIS Analysis
    - ESRI ArcIMS/ArcServer maps services, Arc Web Services
    - OGC services (WMS, WFS, GML, KML)
  - Geospatial mapping API's
    - Google Maps
    - ESRI ArcGIS JavaScript/FLEX API's
    - MetaCarta OpenLayers
    - MS Virtual Earth
  - Even FTP…

Simple XML based web services with geospatial context

Geospatial Data and Web Services

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Simple XML based web services
with geospatial context

SOAP

Simple Object Access Protocol

COOPS Waterlevels - opendap.co-ops.nos.noaa.gov/axis/

NOAA CSC Implementation with RSS output

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http://opendap.co-ops.nos.noaa.gov/axis/

CO-OPS waterlevels

Web Services

This is a listing of on-line data that is accessible through Web Services and it is provided by the Center for Operational Oceanographic Products and Services.

Water Level

Preliminary Data

Six Minute Data	WSDL	SOAP Request	SOAP Response	JAVA Client	Try me
One Minute Data	WSDL	SOAP Request	SOAP Response	JAVA Client	Try me

Verified Data

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Wind	WSDL	SOAP Request	SOAP Response	JAVA Client	Try me

Tide Predictions

High Low Tide Pred	WSDL	SOAP Request	SOAP Response	JAVA Client	Try me
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Currents Data

Water Velocity	WSDL	SOAP Request	SOAP Response	JAVA Client	Try me

Active Stations

Active Stations	WSDL	SOAP Request	SOAP Response	JAVA Client	Try me

Harmonic Constituents

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Harmonic Constituents	WSDL	SOAP Request	SOAP Response	JAVA Client	Try me

Done

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http://opendap.co-ops.nos.noaa.gov/axis/services/WaterLevelVerifiedHourly?wsdl

WSDL


```
<?xml version="1.0" encoding="UTF-8"?>
  <wsdl:definitions targetNamespace="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl"
xmlns:intf="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:wsdlsoap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <!--WSDL created by Apache Axis version: 1.4
Built on Apr 22, 2006 (06:55:48 PDT)-->
    <wsdl:types>
     <schema elementFormDefault="qualified" targetNamespace="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl"
xmlns="http://www.w3.org/2001/XMLSchema">
      <element name="Parameters">
        <complexType>
          <sequence>
            <element name="stationId" type="xsd:string"/>
            <element name="beginDate" type="xsd:string"/>
            <element name="endDate" type="xsd:string"/>
            <element name="datum" type="xsd:string"/>
            <element name="unit" type="xsd:int"/>
            <element name="timeZone" type="xsd:int"/>
          </sequence>
        </complexType>
      </element>
      <complexType name="Data">
        <sequence>
          <element name="timeStamp" type="xsd:string"/>
          <element name="WL" type="xsd:double"/>
          <element name="sigma" type="xsd:double"/>
          <element name="I" type="xsd:int"/>
          <element name="L" type="xsd:int"/>
        </sequence>
      </complexType>
      <complexType name="item">
        <sequence>
          <element maxOccurs="unbounded" name="item" type="impl:Data"/>
        </sequence>
      </complexType>
      <element name="WaterLevelVerifiedHourlyMeasurements">
        <complexType>
          <sequence>
            <element name="data" type="impl:item"/>
          </sequence>
        </complexType>
      </element>
    </schema>
  </wsdl:types>
  <wsdl:message name="getWaterLevelVerifiedHourlyResponse">
    <wsdl:part element="impl:WaterLevelVerifiedHourlyMeasurements" name="WaterLevelVerifiedHourlyMeasurements"/>
  </wsdl:message>
  <wsdl:message name="getWaterLevelVerifiedHourlyRequest">
    <wsdl:part element="impl:Parameters" name="Parameters"/>
  </wsdl:message>
  <wsdl:portType name="WaterLevelVerifiedHourlyPortType">
    <wsdl:operation name="getWaterLevelVerifiedHourly" parameterOrder="Parameters">
      <wsdl:input message="impl:getWaterLevelVerifiedHourlyRequest" name="getWaterLevelVerifiedHourlyRequest"/>
      <wsdl:output message="impl:getWaterLevelVerifiedHourlyResponse" name="getWaterLevelVerifiedHourlyResponse"/>
    </wsdl:operation>
  </wsdl:portType>
  <wsdl:binding name="WaterLevelVerifiedHourlySoapBinding" type="impl:WaterLevelVerifiedHourlyPortType">
    <wsdlsoap:binding style="document" transport="http://schemas.xmlsoap.org/soap/http"/>
    <wsdl:operation name="getWaterLevelVerifiedHourly">
      <wsdlsoap:operation soapAction=""/>
      <wsdl:input name="getWaterLevelVerifiedHourlyRequest">
        <wsdlsoap:body use="literal"/>
      </wsdl:input>
      <wsdl:output name="getWaterLevelVerifiedHourlyResponse">
        <wsdlsoap:body use="literal"/>
      </wsdl:output>
    </wsdl:operation>
  </wsdl:binding>
  <wsdl:service name="WaterLevelVerifiedHourlyService">
    <wsdl:port binding="impl:WaterLevelVerifiedHourlySoapBinding" name="WaterLevelVerifiedHourly">
      <wsdlsoap:address location="http://opendap.co-ops.nos.noaa.gov/axis/services/WaterLevelVerifiedHourly"/>
    </wsdl:port>
  </wsdl:service>
</wsdl:definitions>
```


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```
<?xml version="1.0" encoding="UTF-8"?>
  <wsdl:definitions targetNamespace="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl" xmlns:apachesoap="http://xml.apache.org/xml-soap"
xmlns:impl="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl"
xmlns:intf="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
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     <schema elementFormDefault="qualified" targetNamespace="http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl"
xmlns="http://www.w3.org/2001/XMLSchema">
      <element name="Parameters">
        <complexType>
          <sequence>
            <element name="stationId" type="xsd:string"/>
            <element name="beginDate" type="xsd:string"/>
            <element name="endDate" type="xsd:string"/>
            <element name="datum" type="xsd:string"/>
            <element name="unit" type="xsd:int"/>
            <element name="timeZone" type="xsd:int"/>
          </sequence>
        </complexType>
      </element>
      <complexType name="Data">
        <sequence>
          <element name="timeStamp" type="xsd:string"/>
          <element name="WL" type="xsd:double"/>
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          <element name="I" type="xsd:int"/>
          <element name="L" type="xsd:int"/>
        </sequence>
      </complexType>
      <complexType name="item">
        <sequence>
          <element maxOccurs="unbounded" name="item" type="impl:Data"/>
        </sequence>
      </complexType>
      <element name="WaterLevelVerifiedHourlyMeasurements">
        <complexType>
          <sequence>
            <element name="data" type="impl:item"/>
          </sequence>
        </complexType>
      </element>
     </schema>
    </wsdl:types>
    <wsdl:message name="getWaterLevelVerifiedHourlyResponse">
     <wsdl:part element="impl:WaterLevelVerifiedHourlyMeasurements" name="Wate
    </wsdl:message>
    <wsdl:message name="getWaterLevelVerifiedHourlyRequest">
     <wsdl:part element="impl:Parameters" name="Parameters"/>
    </wsdl:message>
    <wsdl:portType name="WaterLevelVerifiedHourlyPortType">
     <wsdl:operation name="getWaterLevelVerifiedHourly" parameterOrder="Parameters">
       <wsdl:input message="impl:getWaterLevelVerifiedHourlyRequest" name="getWaterLevelVerifiedHourlyRequest"/>
       <wsdl:output message="impl:getWaterLevelVerifiedHourlyResponse" name="getWaterLevelVerifiedHourlyResponse"/>
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    </wsdl:portType>
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       </wsdl:output>
     </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="WaterLevelVerifiedHourlyService">
     <wsdl:port binding="impl:WaterLevelVerifiedHourlySoapBinding" name="WaterLevelVerifiedHourly">
       <wsdlsoap:address location="http://opendap.co-ops.nos.noaa.gov/axis/services/WaterLevelVerifiedHourly"/>
     </wsdl:port>
    </wsdl:service>
  </wsdl:definitions>
```


```
xmlns="http://www.w3.org/2001/XMLSchema">
      <element name="Parameters">
        <complexType>
          <sequence>
            <element name="stationId" type="xsd:string"/>
            <element name="beginDate" type="xsd:string"/>
            <element name="endDate" type="xsd:string"/>
            <element name="datum" type="xsd:string"/>
            <element name="unit" type="xsd:int"/>
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          </sequence>
        </complexType>
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      <complexType name="Data">
        <sequence>
          <element name="timeStamp" type="xsd:string"/>
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          <element name="sigma" type="xsd:double"/>
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        </sequence>
      </complexType>
```


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CO-OPS waterlevels

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http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/samples/request.xml

CLIENT SENDS THIS XML TO SERVER


```
<?xml version="1.0" encoding="UTF-8" ?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Body>
        <water:getWaterLevelVerifiedHourly xmlns:water="http://opendap.co-
    ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl">
            <stationId>8454000</stationId>
            <beginDate>20051201</beginDate>
            <endDate>20051201</endDate>
            <datum>MLLW</datum>
            <unit>0</unit>
            <timeZone>0</timeZone>
        </water:getWaterLevelVerifiedHourly>
    </soapenv:Body>
</soapenv:Envelope>
```

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http://opendap.co-ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhighlow/samples/response.xml

SERVER REPLIES WITH THIS XML


```
<?xml version="1.0" encoding="utf-8" ?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<soapenv:Body>
<WaterLevelVerifiedHourlyMeasurements xmlns="http://opendap.co-
    ops.nos.noaa.gov/axis/webservices/waterlevelverifiedhourly/wsdl">
 <data>
      <item>
          <timeStamp>2006-02-01 00:00:00.0</timeStamp>
           <WL>0.975</WL>
           <sigma>0.0</sigma>
           <I>0</I>
           <L>0</L>
      </item>
      <item>
           <timeStamp>2006-02-01 01:00:00.0</timeStamp>
            <WL>1.478</WL>
            <sigma>0.0040</sigma>
           <I>0</I>
           <L>0</L>
       </item>
      -
      -
      -
    </data>
  </WaterLevelVerified HourlyMeasurements>
 </soapenv:Body>
</soapenv:Envelope>
```


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Tide Predictions vs Observations for Charleston, SC - Windows Internet Explorer

http://csc-s-maps-92-d:8080/waterlevels/charts/tidechart_48_file.jsp?stationID=8665530&stationname=Charleston&state=SC

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Tide Predictions vs Observations for Charleston, SC

Page Tools

Tide Predictions vs Observations for Charleston, SC

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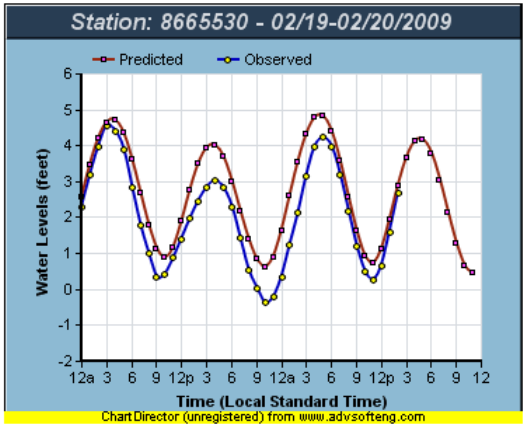
Date

Title

Charleston Water level at 14:00 (LST): 2.672 ft (MLLW)



100%

SOAP

What you should know about SOAP?

Hosts	Consumers
Well defined structure	Data you need might only be available via SOAP
Integrated into .net	Some publishers don't have clean xml
Might be more complex than some users can handle	Requires a messaging client software to interact with server
Seems to be declining as more REST services become available	Try Soapclient.com's generic SOAP client for testing

REST

REpresentational State Transfer

Google Geocode REST API

http://code.google.com/apis/maps/documentation/geocoding/index.html

Sign up for an API key
Create a KML Sitemap

Geocoding Service
Developer's Guide

Maps API
Home Page
Documentation

Maps API for Flash
Home Page
Documentation

Mapplets Maps API
Home Page
Documentation

Static Maps API
Developer Guide

Google Maps API Premier

Includes enterprise licensing and support

Geocoding

What is Geocoding?
Geocoding Requests
Geocoding Responses
JSON
XML and KML
CSV
Viewport Biasing
Country Code Biasing
Geocoding Accuracy

What is Geocoding?

Geocoding is the process of converting addresses (like "1600 Amphitheatre Parkway, Mountain View, CA") into geographic coordinates (like latitude 37.423021 and longitude -122.083739), which you can use to place markers or position the map. The Google Maps API Geocoding Service provides a direct way to access a geocoder via an HTTP request.

Note: the geocoding service may only be used in conjunction with displaying results on a Google map; geocoding results without displaying them on a map is prohibited. For complete details on allowed usage, consult the Maps API Terms of Service License Restrictions.

This service is designed for geocoding static (known) addresses using a REST interface, for placement of application content on a map. For dynamic geocoding of user-defined addresses (for example, within a user interface element), consult the documentation for the JavaScript Client Geocoder or the Maps API for Flash Client Geocoder.

Geocoding is a time and resource intensive task. Whenever possible, pre-geocode known addresses (using the Geocoding Service described here or another geocoding service), and store your results in a temporary cache of your own design.

Geocoding Requests

You may access the Google Maps API Geocoding Service directly over HTTP. To access the geocoder, send a request to http://maps.google.com/maps/geo? with the following parameters in the URL:

- `q` (*required*) — The address that you want to geocode.
- `key` (*required*) — Your API key.
- `sensor` (*required*) — Indicates whether or not the geocoding request comes from a device with a location sensor. This value must be either `true` or `false`. (Note that devices with sensors generally perform their own geocoding by definition; therefore, most geocoding requests to the Maps API Geocoding service should set `sensor` to `false`.)
- `output` (*required*) — The format in which the output should be generated. The options are `xml`, `kml`, `csv`, or (default) `json`. (For more information, see Geocoding Responses below.)
- `oe` (*optional* but strongly encouraged) — The output encoding format of the response. It is recommended that you set this output encoding explicitly to `utf8` unless you have specific requirements to handle other encoding types.
- `ll` (*optional*) — The {latitude,longitude} of the viewport center expressed as a comma-separated string (e.g. "ll=40.479581,-117.773438"). This parameter only has meaning if the `spn` parameter is also passed to the geocoder. (For more information see Viewport Biasing below.)
- `spn` (*optional*) — The "span" of the viewport expressed as a comma-separated string of {latitude,longitude} (e.g. "spn=11.1873,22.5"). This parameter only has meaning if the `ll` parameter is also passed to the geocoder. (For more information see Viewport Biasing below.)
- `gl` (*optional*) — The country code, specified as a ccTLD ("top-level domain") two-character value. (For more information see Country Code Biasing below.)

Note: The `gl` and `spn,ll` viewport parameters will only influence, not fully restrict, results from the geocoder.

In this example, we request the geographic coordinates of Google's headquarters:

```
http://maps.google.com/maps/geo?q=1600+Amphitheatre+Parkway,+Mountain+View,+CA&output=json&oe=utf8&sensor=t
```

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REST

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Google Geocode REST API

http://code.google.com/apis/maps/documentation/geocoding/index.html

http://maps.google.com/maps/geo?q=2234+South+Hobson+Ave,+Charleston,+SC&output=kml&oe=utf8&sensor=false&key=your_api_key

```
<?xml version="1.0" encoding="UTF-8" ?>
<kml xmlns="http://earth.google.com/kml/2.0"><Response>
  <name>2234 South Hobson Ave, Charleston, SC</name>
  <Status>
    <code>200</code>
    <request>geocode</request>
  </Status>
  <Placemark id="p1">
    <address>2234 S Hobson Ave, North Charleston, SC 29405, USA</address>
    <AddressDetails Accuracy="8" xmlns="urn:oasis:names:tc:ciq:xsdschema:xAL:2.0">
        <Country>
                <CountryNameCode>US</CountryNameCode>
                <CountryName>USA</CountryName>
                <AdministrativeArea>
                    <AdministrativeAreaName>SC</AdministrativeAreaName>
                    <Locality>
                        <LocalityName>North  Charleston</LocalityName>
                        <Thoroughfare><ThoroughfareName>2234 S Hobson Ave</ThoroughfareName></Thoroughfare>
                    <PostalCode><PostalCodeNumber>29405</PostalCodeNumber></PostalCode>
                </Locality>
                </AdministrativeArea>
        </Country>
</AddressDetails>
   <ExtendedData>
        <LatLonBox north="32.8514752" south="32.8451800" east="-79.9360520" west="-79.9423472" />
    </ExtendedData>
    <Point><coordinates>-79.9391996,32.8483276,0</coordinates></Point>
  </Placemark>
</Response>
</kml>
```


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REST

REpresentational State Transfer

Google Geocode

http://code.google.com/apis/maps/documentation/geocoding/index.html

http://maps.google.com/maps/geo?q=2234+South+Hobson+Ave,+Charleston,+SC&output=kml&oe=utf8&sensor=false&key=your_api_key

Geocode result in **maps.google.com**

2234 South Hobson Ave, Charleston, SC - Google Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://maps.google.com/maps?f=q&source=s_q&hl=en&geocode=&q=http:%2F%2Fmaps.google.com%2Fmaps%2Fgeo%3Fq%3D2234%2BSou

CO-OPS waterlevels web services

Web Images Maps News Video Gmail more ▾

kyle.draganov@gmail.com | My Profile | Help | Web History | My Account | Sign out

Google Maps

http://maps.google.com/maps/geo?q=2234+South+Hobson+Ave,+Charles

Search Maps

Show search options

Find businesses, addresses and places of interest. Learn more.

Get Directions | My Maps

View in Google Earth | Print | Send | Link

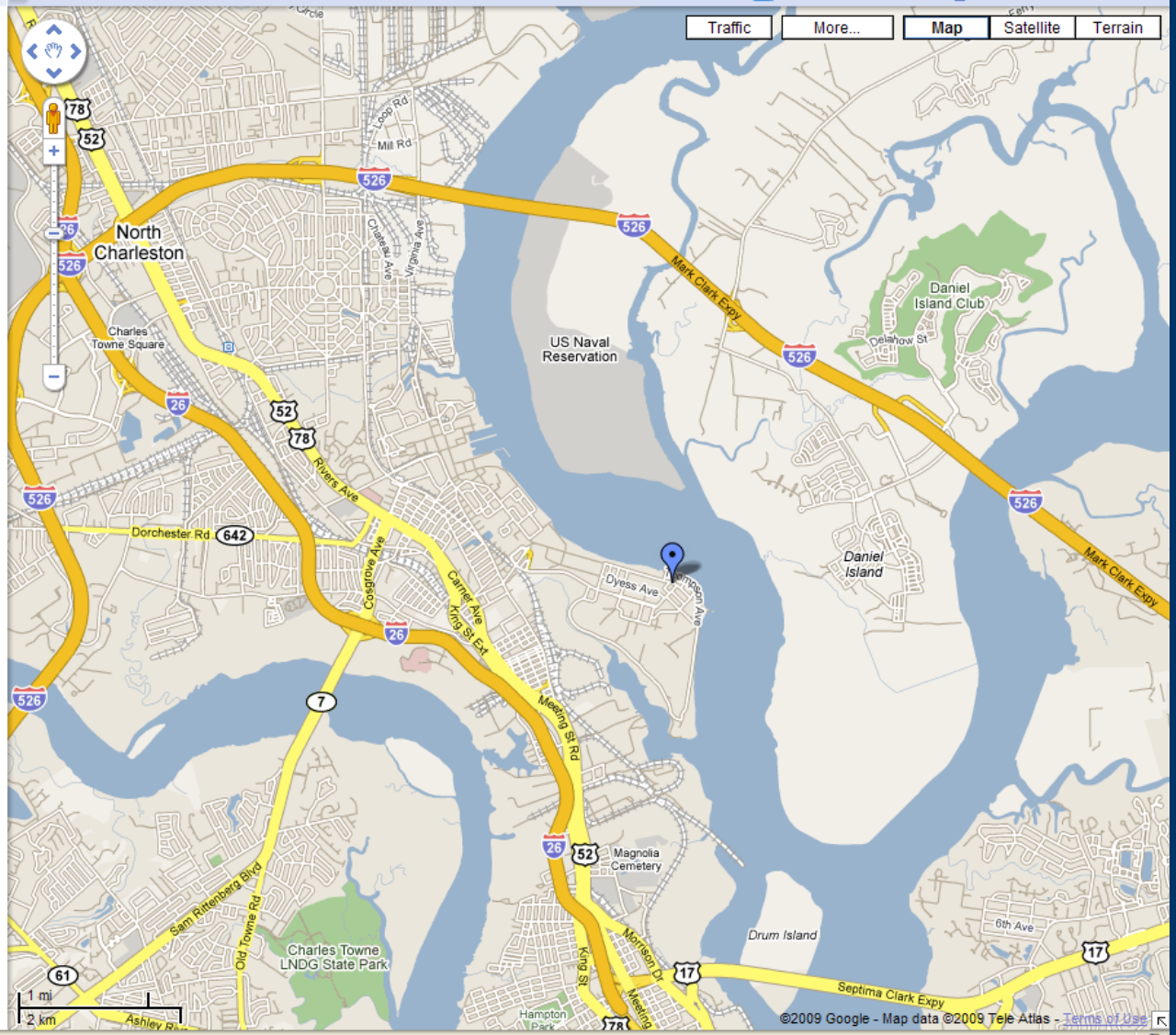
Save to My Maps

2234 South Hobson Ave, Charleston, SC

Displaying content from maps.google.com

The content overlaid onto this map is provided by a third party, and Google is not responsible for it.

Traffic | More... | Map | Satellite | Terrain



Done

REST

REpresentational State Transfer

ESRI ArcGIS Server

http://resources.esri.com/arcgisserver/index.cfm?fa=samples

Folder: / - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://sampleserver1.arcgisonline.com/arcgis/rest/services

CO-OPS waterlevels web services

ArcGIS Services Directory

Home Help | API Reference

Folder: /

View Footprints In: Google Earth

Folders:

- Demographics
- Elevation
- Locators
- Louisville
- Network
- Petroleum
- Portland
- Specialty
- WaterTemplate

Services:

- Geometry (GeometryServer)

Done

Folder: Demographics - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://sampleserver1.arcgisonline.com/ArcGIS/rest/services/Demographics

CO-OPS waterlevels web services

ArcGIS Services Directory

Home > **Demographics**

Help | API Reference

Folder: Demographics

View Footprints In: Google Earth

Services:

- Demographics/ESRI_Census_USA (MapServer)
- Demographics/ESRI_Population_World (GPServer)
- Demographics/ESRI_Population_World (MapServer)

Done

Demographics/ESRI_Census_USA (MapServer) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://sampleserver1.arcgisonline.com/ArcGIS/rest/services/Demographics/ESRI_Census_USA/MapServer

hotel rates san diego

ArcGIS Services Directory

Home > Demographics > ESRI_Census_USA (MapServer)

Help | API Reference

Demographics/ESRI_Census_USA (MapServer)

View In: ArcMap ArcGIS Explorer ArcGIS JavaScript Google Earth

View Footprint In: Google Earth

Service Description: This service presents various population statistics from Census 2000, including total population, population density, racial counts, and more. The map service presents statistics at the state, county, block group, and block point levels.

Map Name: Layers

Layers:

- Census Block Points (0)
- Census Block Group (1)
- Counties (2)
  - Coarse Counties (3)
  - Detailed Counties (4)
- states (5)

Description: This service presents various population statistics from Census 2000, including total population, population density, racial counts, and more. The map service presents statistics at the state, county, block group, and block point levels.

Copyright Text: US Bureau of the Census: http://www.census.gov

Spatial Reference: 4269

Single Fused Map Cache: false

Intial Extent:

XMin: -185.337909350544
YMin: -19.11255617006
XMax: -59.5254875059344
YMax: 108.400033537315
Spatial Reference: 4269

Full Extent:

XMin: -185.337909357176
YMin: 15.2049923322169
XMax: -59.5254874993028
YMax: 74.08248503559
Spatial Reference: 4269

Units: esriDecimalDegrees

Document Info:

- Title: **USCensus**

Done

ArcGIS JavaScript API: Demographics/ESRI_Census_USA - Mozilla Firefox

File Edit View History Bookmarks Tools Help

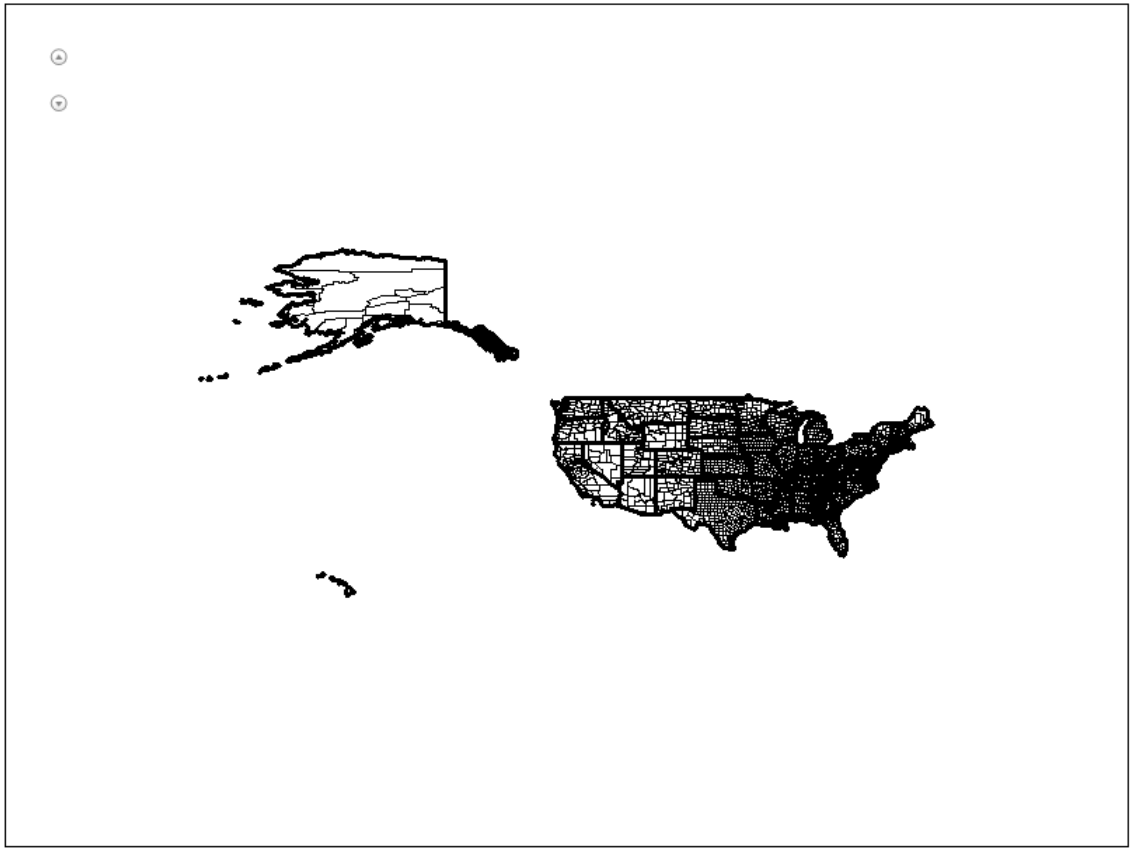
http://sampleserver1.arcgisonline.com/ArcGIS/rest/services/Demographics/ESRI_Census_USA/MapServer?f=jsapi

CO-OPS waterlevels web services

Demographics/ESRI_Census_USA (Map... | ArcGIS JavaScript API: Demogra...

ArcGIS JavaScript API: Demographics/ESRI_Census_USA

Built using the ArcGIS JavaScript API



Done

REST

What you should know about REST?

Hosts	Consumers
Less required structure than SOAP	Easier to access than SOAP
Requires the developer to pay more attention to documentation	Concise, no additional transport layer
More accessible to non-programmer users	Lacks standards support for security, but security is available

Simple XML based web services
with geospatial context

GeoRSS

Geospatial Really Simple Syndication

Hurricane Andrew GeoRSS

Hurricane Andrew 1992 - Windows Internet Explorer

http://krkinnan.members.winisp.net/samples/v5/georss/1992hurricaneandrew.xml

File Edit View Favorites Tools Help

Links IME - MIS shipslog Track-It! Web Deltek Time & Expense - Login

Hurricane Andrew 1992

Page Tools

Hurricane Andrew 1992

You are viewing a feed that contains frequently updated content. When you subscribe to a feed, it is added to the Common Feed List. Updated information from the feed is automatically downloaded to your computer and can be viewed in Internet Explorer and other programs. Learn more about feeds.

Subscribe to this feed

Displaying 45 / 45

All 45

Sort by:

Date

Title

Andrew 08/16/92 18:00

Tropical Depression, 25 mph, 1010 mb

Andrew 08/17/92 06:00

Tropical Depression, 30 mph, 1008 mb

Andrew 08/17/92 12:00

Tropical Storm, 35 mph, 1006 mb

Andrew 08/17/92 18:00

Tropical Storm, 35 mph, 1003 mb

Andrew 08/18/92 00:00

Tropical Storm, 40 mph, 1002 mb

Andrew 08/18/92 06:00

Tropical Storm, 45 mph, 1001 mb

Andrew 08/18/92 12:00

Tropical Storm, 45 mph, 1000 mb

Andrew 08/18/92 18:00

Tropical Storm, 45 mph, 1000 mb

Andrew 08/19/92 00:00

Done 100%

```
<?xml version="1.0" ?>
<rss version="2.0" xmlns:georss="http://www.georss.org/georss">
<channel>
<title>Hurricane Andrew 1992</title>

    <item>
        <title>Andrew 08/22/92 06:00</title>
        <description>Category 1 Hurricane, 65 mph, 994 mb</description>
        <georss:point>25.60 -67.00</georss:point>
    </item>
    <item>
        <title>Andrew 08/22/92 18:00</title>
        <description>Category 2 Hurricane, 95 mph, 969 mb</description>
        <georss:point>25.70 -69.70</georss:point>
    </item>
    <item>
        <title>Andrew 08/23/92 12:00</title>
        <description>Category 5 Hurricane, 145 mph, 933 mb</description>
        <georss:point>25.40 -74.20</georss:point>
    </item>
    <item>
        <title>Andrew 08/23/92 18:00</title>
        <description>Category 5 Hurricane, 150 mph, 922 mb</description>
        <georss:point>25.40 -75.80</georss:point>
    </item>
-
-
-
</channel>
</rss>
```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GeoRSS

Geospatial Really Simple Syndication

Hurricane Andrew GeoRSS

GeoRSS in maps.google.com

Hurricane Andrew 1992 - Google Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://maps.google.com/maps?f=q&source=s_q&hl=en&geocode=&q=http:%2F%2Fkrkinnan.members.winisp.net%2Fsamples%2Fv5%2Fgeorss

CO-OPS waterlevels web services

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kyle.draganov@gmail.com | My Profile | Help | Web History | My Account | Sign out

Google Maps

http://krkinnan.members.winisp.net/samples/v5/georss/1992hurricaneandr

Search Maps Show search options

Find businesses, addresses and places of interest. Learn more.

Get Directions My Maps

Print Send Link

Save to My Maps

Hurricane Andrew 1992

- Andrew 08/16/92 18:00
  Tropical Depression, 25 mph, 1010 mb
- Andrew 08/17/92 06:00
  Tropical Depression, 30 mph, 1008 mb
- Andrew 08/17/92 12:00
  Tropical Storm, 35 mph, 1006 mb
- Andrew 08/17/92 18:00
  Tropical Storm, 35 mph, 1003 mb
- Andrew 08/18/92 00:00
  Tropical Storm, 40 mph, 1002 mb
- Andrew 08/18/92 06:00
  Tropical Storm, 45 mph, 1001 mb
- Andrew 08/18/92 12:00
  Tropical Storm, 45 mph, 1000 mb
- Andrew 08/18/92 18:00
  Tropical Storm, 45 mph, 1000 mb
- Andrew 08/19/92 00:00
  Tropical Storm, 45 mph, 1001 mb
- Andrew 08/19/92 06:00
  Tropical Storm, 45 mph, 1002 mb
- Andrew 08/19/92 12:00
  Tropical Storm, 45 mph, 1005 mb
- Andrew 08/19/92 18:00
  Tropical Storm, 45 mph, 1007 mb
- Andrew 08/20/92 00:00
  Tropical Storm, 40 mph, 1011 mb
- Andrew 08/20/92 06:00
  Tropical Storm, 40 mph, 1013 mb
- Andrew 08/20/92 12:00
  Tropical Storm, 40 mph, 1015 mb
- Andrew 08/20/92 18:00
  Tropical Storm, 40 mph, 1014 mb
- Andrew 08/21/92 00:00
  Tropical Storm, 45 mph, 1014 mb
- Andrew 08/21/92 06:00
  Tropical Storm, 45 mph, 1010 mb
- Andrew 08/21/92 12:00
  Tropical Storm, 50 mph, 1007 mb
- Andrew 08/21/92 18:00
  Tropical Storm, 50 mph, 1004 mb
- Andrew 08/22/92 00:00
  Tropical Storm, 55 mph, 1000 mb

Traffic More... Map Satellite Terrain

Canada Hudson Bay Gulf of Mexico México Cuba Venezuela Colombia Brasil Perú Bolivia Paraguay Chile Argentina North Pacific Ocean South Pacific Ocean South Atlantic Ocean

1000 mi 2000 km

©2009 Google - Map data ©2009 Tele Atlas, MapLink/Tele Atlas, AND - Terms of Use

Done

GeoRSS

What you should know about GeoRSS?

Hosts	Consumers
Easy to develop	Consumable by lots of clients (Google maps, Yahoo maps, etc)
Supports simple data types (point, line, polygon) elevation is also available	Usable by lots of non-geo clients (iGoogle, Yahoo, browsers, etc)
Useful for displaying small scale temporal data	

Data & Map Services for use in GIS Analysis

Geospatial Data and Web Services

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Data & Map Services

ArcIMS Map Services

Consumed by ArcMap

NowCoast

http://nowcoast.noaa.gov

nowCOAST: GIS Mapping Portal to Real-Time Environmental Observations and NOAA Forecasts - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://nowcoast.noaa.gov/

embassy suites myrtle beach sc

noaa's nowCOAST

Web Mapping Portal to Real-Time Coastal Observations and NOAA Forecasts

Map Services | More Info | Instructions On/Off | @ Send Email

1) LOCATION → 2) INFORMATION → 3) VARIABLE → 4) TIME → 5) GO

-Select Location- | -Select Map Layer- | -Select Variable- | -Real Time-

GOES Visible Image: Tue Feb 17 9:45 AM EST (NESDIS)

Weather Radar Mosaic: Tue Feb 17 10:24 AM EST (NWS RIDGE)

ND 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 dBZ

Short Duration Warnings: Tue Feb 17 10:24 AM EST (NWS)

Extreme Wind | Flash Flood | Flood | Severe Thunderstorm | Special Marine | Tornado

Select 'Link to Data' and click on a warning polygon to obtain the warning bulletin

On-map data & imagery will be automatically refreshed every 4 minutes

Canada

United States

Mexico

Colombia

Venezuela

0 465 mi

Map Tools

tool help

Active Tool: Zoom In

Map Tools: Use the selection of Map Tools found below to navigate the nowCOAST map manually (instead of using pulldown menus above). The Link to Data, Identify, and Select by Rectangle tools can be used to retrieve information about stations or forecast zones in the 'active' Map Layer.

Zoom In | Zoom Out | Pan | Select by Rectangle | Identify | Print | Link to Data

Full Extent | Zoom Last | Zoom to Lat/Lon | Clear Selected | Query | Open Databrowser

Map Layers

Controls: Display | Active

Active Layer: Sea Surface Temperature

(Click on individual layer names below for more info on each)

On-Map Data, Imagery, Forecasts:

Automatic Refresh Every 4 Minutes

Observations - In-Situ Stations:

- Surface Meteorological/Ocean
  - Station ID
  - Air Temp (deg F)
  - Dew Point Temp (deg F)
  - Wind (knots)
  - Mean Sea Level Pressure (mb)
  - Visibility (miles)
  - Sea Surface Temp (deg F)
  - Significant Wave Height (feet)

Observations - Remote Sensors:

- Weather Radar Mosaic
- GOES Visible Image
- GOES IR Image

Analyses:

- Oceanographic
  - Sea Surface Temperature

Hazard Advisories, Watches, Warnings:

- Short Duration Warnings

Last Updated at: Tue Feb 17 10:24 AM EST

Forecasts - Gridded (CONUS only):

- Nat'l Digital Forecast Database (NDFD)

Last Updated at: Tue Feb 17 7AM EST

- Maximum Air Temperature
- Minimum Air Temperature
- Relative Humidity
- Surface Wind Speed
- Surface Wind Velocity (Barb)
- Surface Wind Velocity (Vector)
- Significant Wave Height
- Precipitation Amount

redraw map

Redraw Map Automatically

DOC > NOAA > NOS > OCS

Privacy Policy

Done

NowCoast.mxd - ArcMap - ArcView

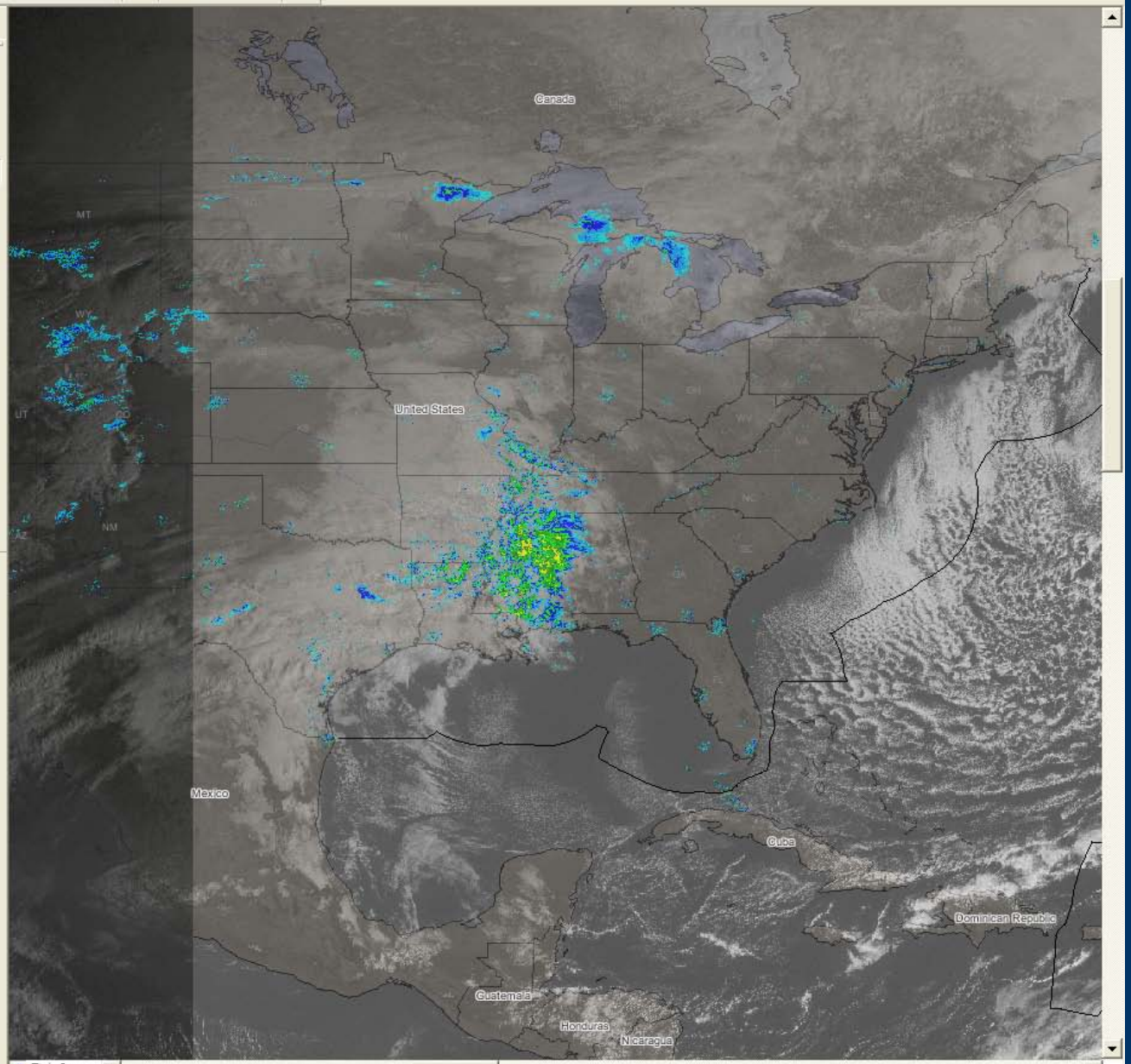
File Edit View Bookmarks Insert Selection Tools Window Help

1:20,340,301

Layers

- nowcoast
  - Station ID
  - Air Temp (deg F)
  - Dew Point Temp (deg F)
  - Wind (knots)
  - Mean Sea Level Pressure (mb)
  - Visibility (miles)
  - Sea Surface Temp (deg F)
  - Significant Wave Height (feet)
  - Meteorological
  - Oceanographic
  - River
  - Water Quality
  - Air Quality
  - Weather Radars
  - Wind Profilers
  - Upper Air Soundings
  - HF Radar Surface Currents
  - Web Cameras
  - Astronomical Tidal
  - Meteorological
  - Oceanographic
  - River
  - Surface Weather (WFO Zones)
  - Terminal Aerodrome Weather (TAF)
  - Surf Zone
  - Coastal and Offshore
  - High Seas
  - Harmful Algae Blooms Bulletins
  - Air Quality
  - Coastal Marine and Regional Weather
  - Regional Hydrometeorological
  - Offshore Marine Weather
  - Exclusive Economic Zone
  - National Marine Sanctuaries
  - US Cities
  - Airport Runway Footprints
  - US Interstates
  - Major Roads
  - Urban Areas Outline
  - Urban Areas Fill
  - NDFD Wind Barb 0 Hr Fcst - 1pt
  - NDFD Wind Barb 0 Hr Fcst - 5pt
  - NDFD Wind Barb 0 Hr Fcst - 10pt
  - NDFD Wind Barb 0 Hr Fcst - 15pt
  - NDFD Wind Barb 0 Hr Fcst - Polygon
  - NDFD Wind Barb 6 Hr Fcst - 1pt
  - NDFD Wind Barb 6 Hr Fcst - 5pt
  - NDFD Wind Barb 6 Hr Fcst - 10pt
  - NDFD Wind Barb 6 Hr Fcst - 15pt

Display Source Selection



Drawing Arial 10

-106.692 51.379 Decimal Degrees

ArcIMS Map Services

What you should know about ArcIMS Map Services?

Hosts	Consumers
Already publishing ArcIMS? Your work is done.	There are a lot of IMS sites out there that you can connect to
Do you want people using your maps on their maps?	Do the hosts want you connecting to them?
Are you keeping logs of map requests? Your weblogs won't count these requests.	If the host goes down and your re-hosting the data in ArcIMS, your mapservice will crash!

Data & Map Services

ESRI ArcGIS Online services

Consumed by ArcMap

http://resources.esri.com/arcgisonlineservices/

ESRI Street Maps

Terrain

Imagery

More

ArcGIS Online Resource Center - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://resources.esri.com/arcgisonlineservices/index.cfm?fa=content

ESRI Resource Centers

ArcGIS Online

Customer Care | Support | Careers

Login

Resources Gateway | Data | Help | Blog

Free Maps | Premium Maps | Premium Data | Imagery Maps | Street Maps | Content Viewer

Free Maps

Free maps are available to use in your ArcGIS applications. For commercial use of ArcGIS Online maps, you must buy a subscription. Learn more about using ArcGIS Online maps.

Basemaps

World Imagery

Description

World Street Map

Description

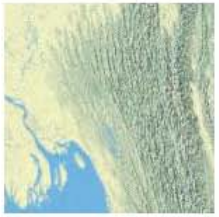
USA Topographic Maps

Description

World User Imagery

Description

World Physical Map



Description

World Shaded Relief Imagery

Description

Reference Maps

World Boundaries

Description

World Boundaries and Places

Description

World Boundaries and Places Alternate

Description

World Transportation

Description

World Elevation

Description

USA Elevation

Description

Done

Marietta
Dunwoody
Sandy Springs
Fulton County
Lilburn
DeKalb County
Gwinnett County
Tucker
Mountain
Smyrna
North Atlanta
North Druid Hills
Mableton
Cobb County
Druid Hills
North Decatur
Decatur
Atlanta
Candler-McAfee
Belvedere Park
Redan
Panthersville
East Point
College Park
Forest Park
Rex
Union City
DeKalb

Data & Map Services

What you should know about ArcGIS Online Services?

Hosts	Consumers
Are you re-publishing their data? Different prices for in-house and public apps.	Good quality map base data.
Using ArcIMS? If the server goes down, so does your mapservice.	Not as many data variation options as you might think.

Open Geospatial Consortium (OGC)

- Non-profit, international standards organization
- Develops standards for geospatial and location based services

- Thank OGC for the proliferation of WFS, WMS, GML, KML, and more…

OGC WFS

Web Feature Services

OpenLayers Consuming WFS

OpenLayers: OpenMNND - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://openlayers.org/dev/examples/openmnnd.html

CO-OPS waterlevels web se

This example shows the use of a WFS service rendered using the OpenLayers vector library.

This is an example that shows rendering a WFS service using OpenLayer vectors in the browser. The OpenLayers code will download the GML from the WFS service for each layer, parse it and create features using the OL vector library to draw the features on the map. For more information on the vector library, please visit vector support wiki. In this example there are 4 layers shown on the map. The base layer and parcel layer are created from a WMS serivce using the OpenLayers.Layer.WMS object. The streams, roads, and plat layers are drawn from a WFS service using the OpenLayers.Layer.WFS object.

Rendering WFS layers into vectors is possible, but you need to be cautions when showing the features on the map. Testing has shown that when you renderer more than 200 vectors in the browser the performance decreases dramatically. Also features that have a lot of vertices can cause performance issues. In this example the parcel layer is rendered as a WMS layer because at the time of developing this example there where a handful of features that had too many vertices to render without killing the browser resources. There are a number of properties that can be set for each WFS layer, such color and line weight using style properties such as strokeColor and strokeWidth. You can also get feature attributes from the WFS services using the extractAttribute property. View the source to see the example code.

- Streams: Feature Count 3
- Plat: Feature Count 48
- Roads: Feature Count 93
- **PLAT_NUM**: 1491
- **NAME_TITLE**: K.W.J. ESTATES
- ○ select road
- ◉ select polygon

Done

nter
OLOGY

OGC WFS

Web Feature Services

EPA WFS Layers

EPA Information Sources: GIS: EPA Geodata Web Services Help - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.epa.gov/geospatial/help.htm

CO-OPS waterlevels web se

URLs for those OGC WFS Web Services from "http://geodata.epa.gov/" include:

EPA Registered Facilities Services

- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/AFS_FS?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/NPL_FS?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/PCS_FS?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RCR_FS?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/TRI_FS?

EPA Waters Services

- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RADDetailedFeature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/WasteWaterFeature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_Layers_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_303d_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_305b_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_beach_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_cso_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_cwns_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_fish_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_grts_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_ndz_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_pcs_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_tmdl_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_tmdl_Feature?
- http://geodata.epa.gov/wfsconnector/com.esri.wfs.Esrimap/RAD_evt_wqs_Feature?

The OpenGIS Consortium published WMS (Web Mapping Service) Implementation Specification in 1999 and revised in 2000 and 2001. Here is the URL for the full documentation of the WMS Implementation Specification version 1.1.1 http://www.opengeospatial.org/docs/01-068r2.pdf.

Done

Data & Map Services

What you should know about WFS?

Hosts	Consumers
Good for hosting filtered sets of feature data	WFS is REST based
Can be really slow to serve unfiltered datasets	Do you really need the features, or just a map?
Provide the documentation about your service if you want it used.	WFS can be overkill in a lot of situations.
	WFS brings all visible data to the client.

Data & Map Services

OGC WMS

Web Map Services

The Marine Geoscience Data System (MGDS)

http://www.marine-geo.org/

Marine Geoscience Data System: Web Services - Mozilla Firefox

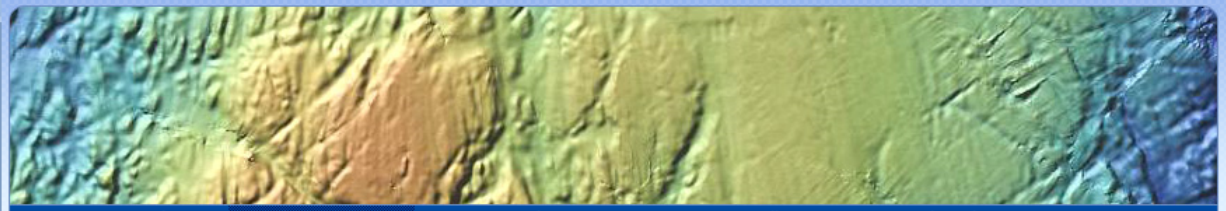
File Edit View History Bookmarks Tools Help

http://www.marine-geo.org/tools/web_services.php

CO-OPS waterlevels web services

MARINE GEOSCIENCE DATA SYSTEM

Search for Data



Home | About | Tools & Services | Data Portals | Partners | Contribute Data | Education

Web Services

We deliver catalogs, maps, and data through standard programmatic interfaces. We use the MapServer software platform as our backend. A variety of OGC-enabled clients are available, both freeware and commercial, including the User-friendly Desktop Internet GIS (uDig), GeoMapApp, Gaia, NASA World Wind, and ArcGIS.

- Open Geospatial Consortium (OGC) WxS Services
- Catalog Services
- Open Archives Initiative Protocol for Metadata Harvest (OAI-PMH)

Open Geospatial Consortium (OGC) WxS Services

WxS Services can be used for live access to many of our data holdings

- Our Web Map Service (WMS) allows any OGC-enabled client to create map imagery from our Global Multi-Resolution Topography (GMRT). Use one the following URLS to access these data:
  - Mercator

    http://www.marine-geo.org/services/wms?request=GetCapabilities&service=WMS&version=1.1.1
  - Masked Mercator (highlights multibeam tracks)

    http://www.marine-geo.org/services/wms_mask?request=GetCapabilities&service=WMS&version=1.1.1
  - South Polar Stereo

    http://www.marine-geo.org/services/wms_SP?request=GetCapabilities&service=WMS&version=1.1.1
  - Masked South Polar Stereo (highlights multibeam tracks)

    http://www.marine-geo.org/services/wms_SP_mask?request=GetCapabilities&service=WMS&version=1.1.1
- Our Web Feature Service (WFS) allows any OGC-enabled client to access our global catalog of station events (cores and dredges, camera tows, CTD stations, instrument deployments, etc.) and physical samples (biology, rock, sediment, fluid). Specify the following URL to your client:
  - Full WFS capabilities

Done

Data & Map Services

OGC WMS

Web Map Services

U.S. Marine Cadastre

Uses MGDS topobathy data sets

U.S. Marine Cadastre - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://csc-s-maps-q.csc.noaa.gov/MMC/viewer.html

CO-OPS waterlevels web services

FGDC MARINE BOUNDARY WORKING GROUP

U.S. Marine Cadastre

Project Home

Legend | Find | Results | Print | Help | Info

Zoom In

Select Area...

LAYERS

- All Layers
  - Core Data
    - Limit of '8(g) Zone'
    - Submerged Lands Act Boun
    - Hawaii Three Nautical Mile Li
    - Contiguous Zone
    - Territorial Sea
    - Exclusive Economic Zone
    - Shoreline (1:20,000)
    - National Estuarine Research
    - National Marine Sanctuaries
    - Coastal National Forests
    - Coastal National Park Service
    - Coastal Indian Lands
    - Coastal National Wildlife Refu
    - Minerals Management Servic
    - Outer Continental Shelf Leas
    - Minerals Management Servic
    - Unofficial Limit of '8(g) Zone
    - Unofficial Submerged Lands
  - Critical Data
  - Base Layers

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NOAA Coastal Services Center

Privacy policy
Questions or Comments? Contact CSC
Updated on February 21, 2008

Transferring data from csc-s-maps-q.csc.noaa.gov...

Data & Map Services

What you should know about WMS?

Hosts	Consumers
Relatively easy to host with ESRI or MapServer and others	REST based
Might not provide enough access to data for some users needs	Better for big datasets than wfs
	Can give you a map (and data behind features on request)

Data & Map Services

OGC KML

Keyhole Markup Language

National Weather Service Data

http://www.srh.noaa.gov/gis/kml/

National Weather Service GIS Data Links - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.srh.noaa.gov/gis/kml/

National Weather Service GIS Data Links

NWS KML/KMZ Links

weather.gov

Site Map | News | Organization | Search Enter Search Here Go

Local weather forecast by "City, St"
City, St Go

RSS Feeds XML

Watches/Warnings
Current
By State/County
UV Alerts
more...

Observations
Doppler Radar
Satellite
Snow Cover
Surface Weather
Observed Precip
more...

Forecasts
By Local Office
Graphical
Aviation Weather
Marine Weather
Hurricanes
Severe Weather
Fire Weather
Numerical Models
Statistical Models
more...

Text Messages
By State
By Message Type
National

Climate
Past Weather
Predictions

Weather Safety
Weather Radio
Hazard Assessment
StormReady
TsunamiReady
more...

Education/Outreach
Brochures
NOAA Education Page
Teacher's Aides
more...

Information Center
Tsunamis
Publications
more...

Contact Us
FAQ
Comments

National Weather Data in GIS formats

National Weather Service GIS survey

he National Weather Service produces several data sets that are available in formats available to import into Geographic Information Systems (GIS). GIS is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. It takes the numbers and words from the rows and columns in databases and spreadsheets and puts them on a map.

Following resources will help you view these GIS files.

NASA World Wind viewer (latest version 1.4 released February 14, 2007) - free download from NASA

GoogleEarth viewer - KML file format support - free download from Google.com

ESRI's ArcGIS Explorer - KML file format support - free download from ESRI.com

FME (Feature Manipulation Engine) that converts data in one format to another - KML file format support - (Purchase) - download from Safe.com

The following links will either provide kml/kmz/shape files, will link you to a page with these type of files, or displays info in a GIS viewer.

Current Weather

Watches & Warnings
Current Weather Warnings
Flash Flooding - Basins and Streams

Doppler Radar
Real Time Radar
Radar Locations

Surface Observations
Metar Obs
RAWS Obs
APRSWXNET Obs
MesoWest Obs
Other Surface Obs

Satellite
Infrared | Loop
Visible | Loop
Water Vapor | Loop

Remote Gages
River Gages: Observed
Snow Gages: w/ labels | w/o labels

Great Lakes
Wave Height
Ice
Water Temperature

Surface Fronts
Past and Present Synoptic Features

Forecasts

Your Local Weather Forecast

Your Local Weather Graphical Forecast

MOS Guidance

GFS Meteograms

GOES Sounding Skew-T

Tulsa area: Max | Min | POP

River Gage Forecasts

Past Weather

Doppler Radar
NWS Radar archive data

Normals, Means, Extremes
NCDC Climate Atlas of the United States
NCDC GIS Portal

Severe Weather
Storm Reports: Tornado, Wind and Hail
1950-2006 Database of Tornado, Large Hail, and Damaging Wind Reports

Rain/Snowfall
CoCoRaHS Observations
NOHRSC Snow Data

Hurricanes
Past Atlantic Storm Tracks
Past East Pacific Storm Tracks

Fire Weather

Current Spot Forecast Sites

Fire Weather Categorized Observations

MODIS fires

IMET Locations

Additional Info

Coastal Estuarine Bathymetry

nowCOAST web mapping portal

U.S. Dept. of Commerce
National Oceanic and Atmospheric Administration

Disclaimer
Information Quality

Privacy Policy
Freedom of Information Act

Done

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RMATION, AND TECHNOLOGY

OGC KML

Keyhole Markup Language

Large Datasets? Use KML Regions

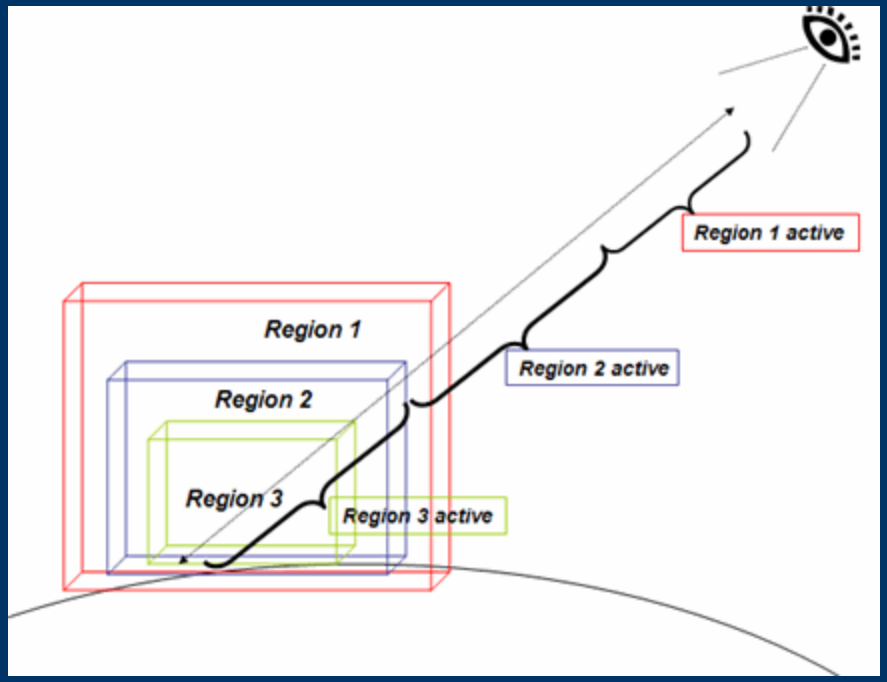
Tiles2KML

Arc2Earth

Google Regionator

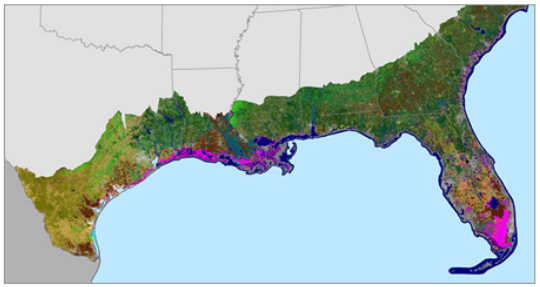
Data & Map Services

KML Regions



NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Gulf Coast Land Cover



The Gulf of Mexico, which was formed over 300 million years ago, borders five U.S. coastal states: Texas, Louisiana, Mississippi, Alabama, and Florida. There are only speculations about the origin of the Gulf. A few of these theories, as documented by the Gulf of Mexico Foundation, state that the Gulf is a flooded continental crust, an ocean basin that has undergone rifting, or an ancient sea created when separate continents formed a single land mass. The allure of the Gulf's ocean breezes, white sandy beaches, and turquoise blue water brings millions of visitors to its shores year-round. Moreover, the Gulf of Mexico is a valuable economic, recreational, and environmental resource for those who live along its borders.

For this project, the NOAA Coastal Services Center created land cover and change data for the Gulf of Mexico region according to Coastal Change Analysis Program (C-CAP) standards. Products include land cover for 1996, 2001, and 2005, as well as change products that identify the changes documented between these dates. Land cover and land cover change information for northern Florida is anticipated to be complete by the summer of 2007.

In response to Hurricane Katrina, the NOAA Coastal Services Center created land cover and change data for the areas impacted by Hurricane Katrina in the Gulf of Mexico region according to Coastal Change Analysis Program (C-CAP) standards. This 2006 C-CAP land cover data product complements the Gulf of Mexico C-CAP land cover products for 1996, 2001, and 2005.

Project Data

Period

Texas, Louisiana, Mississippi, Alabama, Florida (Western Panhandle): 1996-2001-2005

Florida: 1996-2001

Description

Land cover and land cover change data were produced for the U.S. Gulf of Mexico coastal region using 30 meter resolution Landsat Thematic Mapper and Landsat Enhanced Thematic Mapper satellite imagery.

Download Data

Texas

- Download Texas 1996 Land Cover Data *42.65 megabytes*
- Download Texas 2001 Land Cover Data *42.53 megabytes*
- Download Texas 2005 Land Cover Data *43.38 megabytes*
- Download Texas 1996 - 2001 Land Cover Change Data *48.98 megabytes*
- Download Texas 2001 - 2005 Land Cover Change Data *50.73 megabytes*

Louisiana

- Download Louisiana 1996 Land Cover Data *14.63 megabytes*
- Download Louisiana 2001 Land Cover Data *14.28 megabytes*
- Download Louisiana 2005 Land Cover Data *15.32 megabytes*

Land Cover Analysis - Gulf Coast Land Cover - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.csc.noaa.gov/crs/lca/gulfcoast.html

- Download Texas 2005 Land Cover Data *43.38 megabytes*
- Download Texas 1996 - 2001 Land Cover Change Data *48.98 megabytes*
- Download Texas 2001 - 2005 Land Cover Change Data *50.73 megabytes*

Louisiana

- Download Louisiana 1996 Land Cover Data *14.63 megabytes*
- Download Louisiana 2001 Land Cover Data *14.28 megabytes*
- Download Louisiana 2005 Land Cover Data *15.32 megabytes*
- Download Louisiana 1996 - 2001 Land Cover Change Data *17.88 megabytes*
- Download Louisiana 2001 - 2005 Land Cover Change Data *18.62 megabytes*

Mississippi

- Download Mississippi 1996 Land Cover Data *11.25 megabytes*
- Download Mississippi 2001 Land Cover Data *10.73 megabytes*
- Download Mississippi 2005 Land Cover Data *11.52 megabytes*
- Download Mississippi 1996 - 2001 Land Cover Change Data *16.02 megabytes*
- Download Mississippi 2001 - 2005 Land Cover Change Data *14.59 megabytes*

Alabama

- Download Alabama 1996 Land Cover Data *15.28 megabytes*
- Download Alabama 2001 Land Cover Data *14.90 megabytes*
- Download Alabama 2005 Land Cover Data *15.81 megabytes*
- Download Alabama 1996 - 2001 Land Cover Change Data *20.65 megabytes*

Florida

- Download Florida 1996 Land Cover Data *40.8 megabytes*
- Download Florida 2001 Land Cover Data *40.9 megabytes*
- Download Florida 1996 - 2001 Land Cover Change Data *51.6 megabytes*

Florida (Western Panhandle)

- Download Florida 2005 Land Cover Data *6.14 megabytes*
- Download Florida 2001 - 2005 Land Cover Change Data *7.70 megabytes*

Other Available Regional Data

- Coastal Louisiana Land Cover Change Project Data

Complete information about the data processing procedures can be found in the metadata file that accompanies the downloaded data.

Go to the Regional Data Page

NOAA Coastal Services Center
2234 South Hobson Avenue
Charleston, SC 29405-2413
843-740-1200 (phone) • 843-740-1224 (fax)

Directions to the NOAA Coastal Services Center

United States Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Serivice

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Contact the NOAA Coastal Services Center

USA.gov Government Made Easy

Done

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Land Cover - Data - Digital Coast - NOAA Coastal Services Center - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.csc.noaa.gov/digitalcoast/data/landcover.html

NOAA Coastal Services Center

DIGITAL COAST

Home Data Tools Training In Action

Data

Land Cover

About the Data

Land cover maps document how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types. By comparing land cover maps over a period of time, users can also document land use trends and changes. The data is derived from remotely sensed imagery, which is the most efficient means of getting land cover data for a large region.

The Coastal Change Analysis Program (C-CAP) has developed a baseline of land cover, or C-CAP data, for the nation's coastal zone.

Data Standards

NOAA works with the U.S. Geological Survey (USGS) and other federal programs to produce a consistent, comprehensive land cover database for the nation. Data products are produced through automated, repeatable procedures and utilize standard data sources.

Get Data Now

C-CAP in Google Earth

Select Download Google Earth

For Additional Information

www.csc.noaa.gov/crs/lca/ccap.html

- Related Tools
- Related Training
- Digital Coast In Action

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Get Data Now

C-CAP in Google Earth

Florida Download Google Earth

Download Florida KMZ

For Additional Information

www.csc.noaa.gov/crs/lca/ccap.html

- Related Tools
- Related Training
- Digital Coast In Action

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Data

Land Cover

About the Data

Land cover maps
impervious surface
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Data Standards

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Get Data Now

C-CAP in Google Ea

Florida

Download Florida

For Additional Infor

www.csc.noaa.go

▶ Related Tools

Training

oast In Action

Opening fl.kmz

You have chosen to open

fl.kmz

which is a: KMZ file

from: http://www.csc.noaa.gov

What should Firefox do with this file?

Open with Google Earth (default)

Save File

Do this automatically for files like this from now on.

OK Cancel

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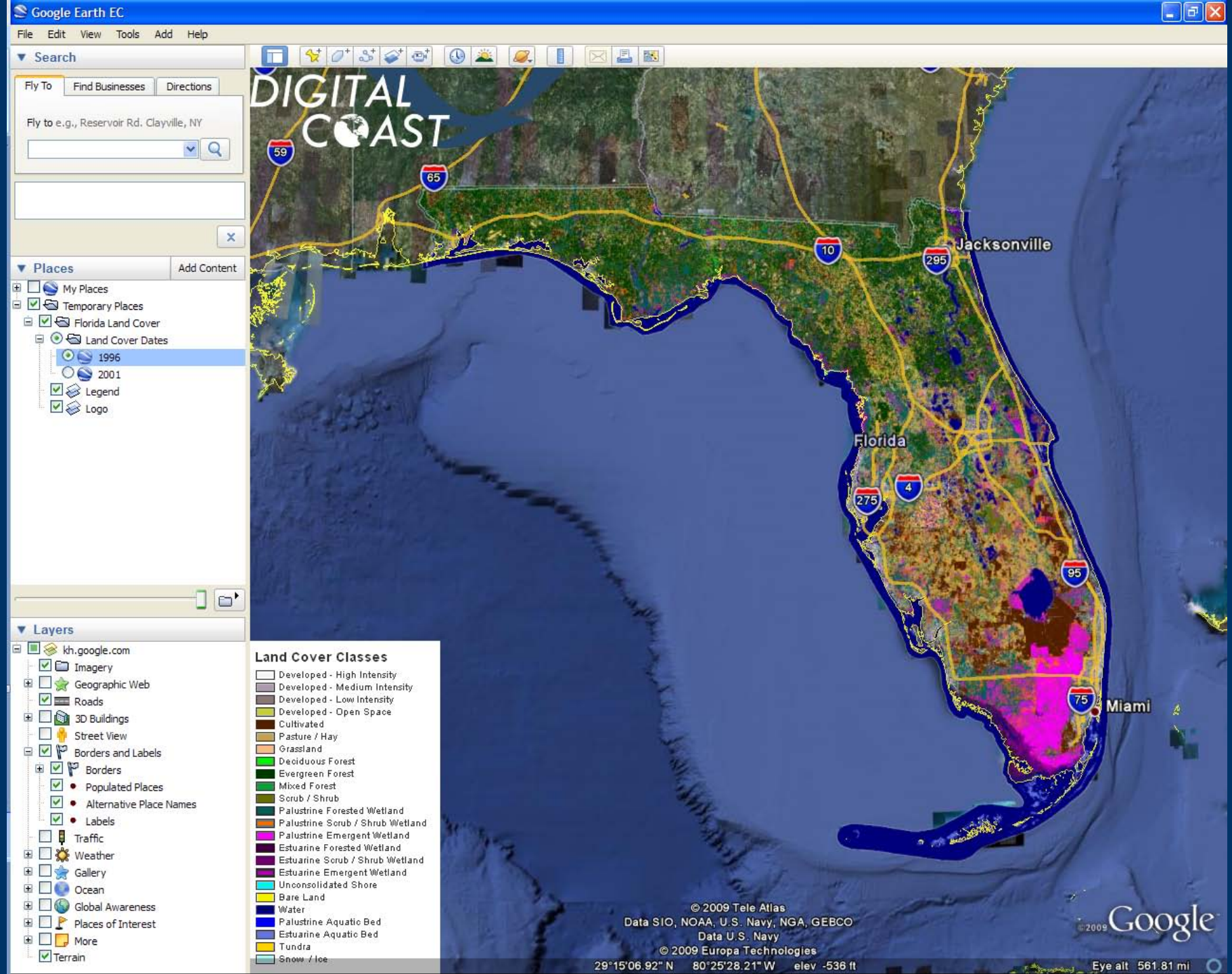
Done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Search
Fly To
Find Businesses
Directions
Fly to e.g., Reservoir Rd. Clayville, NY
Places
Add Content
My Places
Temporary Places
Florida Land Cover
Land Cover Dates
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2001
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Logo
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3D Buildings
Street View
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Borders
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Alternative Place Names
Labels
Traffic
Weather
Gallery
Ocean
Global Awareness
Places of Interest
More
Terrain
DIGITAL COAST
Jacksonville
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Miami
59
65
10
295
4
275
95
75
Land Cover Classes
Developed - High Intensity
Developed - Medium Intensity
Developed - Low Intensity
Developed - Open Space
Cultivated
Pasture / Hay
Grassland
Deciduous Forest
Evergreen Forest
Mixed Forest
Scrub / Shrub
Palustrine Forested Wetland
Palustrine Scrub / Shrub Wetland
Palustrine Emergent Wetland
Estuarine Forested Wetland
Estuarine Scrub / Shrub Wetland
Estuarine Emergent Wetland
Unconsolidated Shore
Bare Land
Water
Palustrine Aquatic Bed
Estuarine Aquatic Bed
Tundra
Snow / Ice
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Eye alt 561.81 mi
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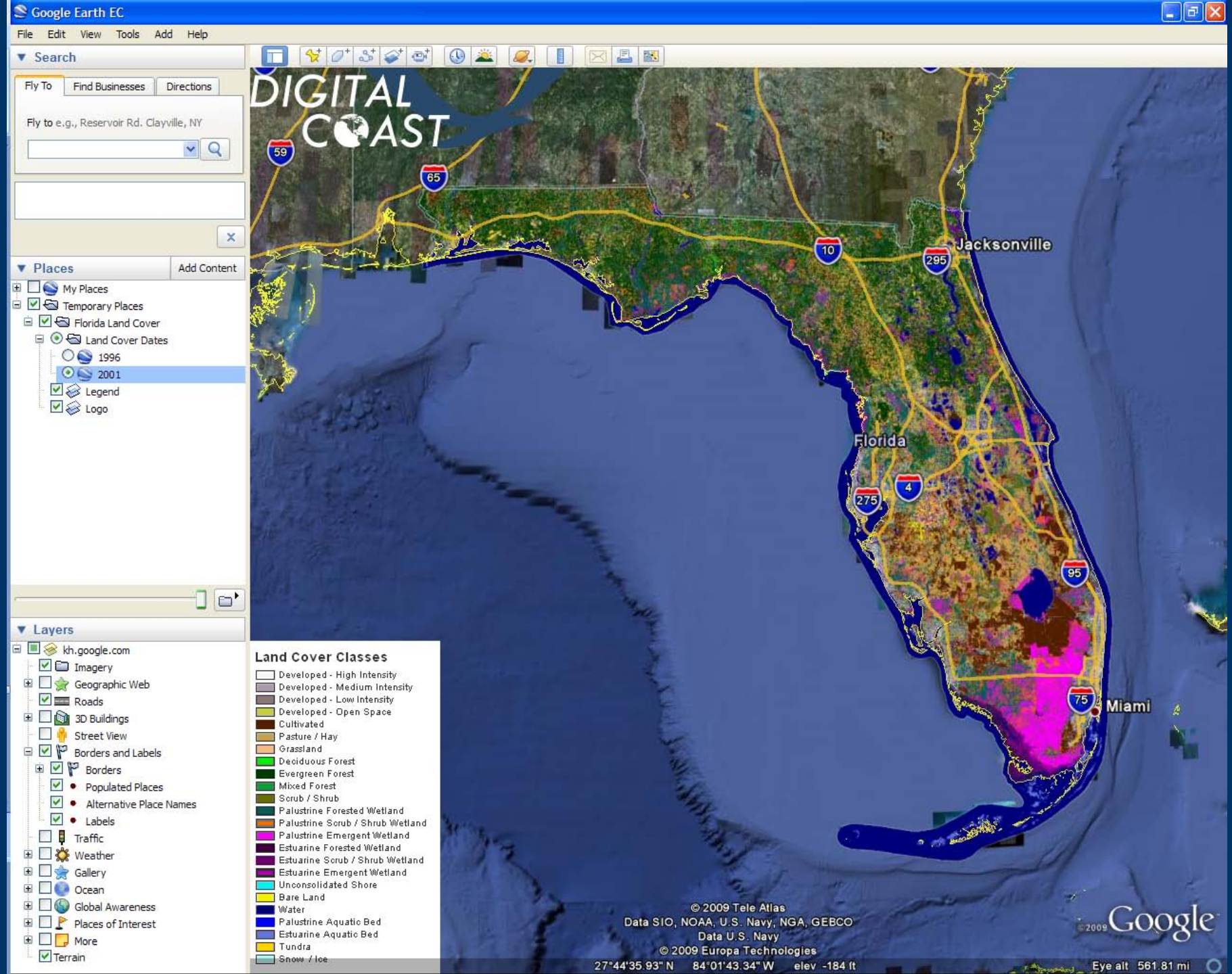
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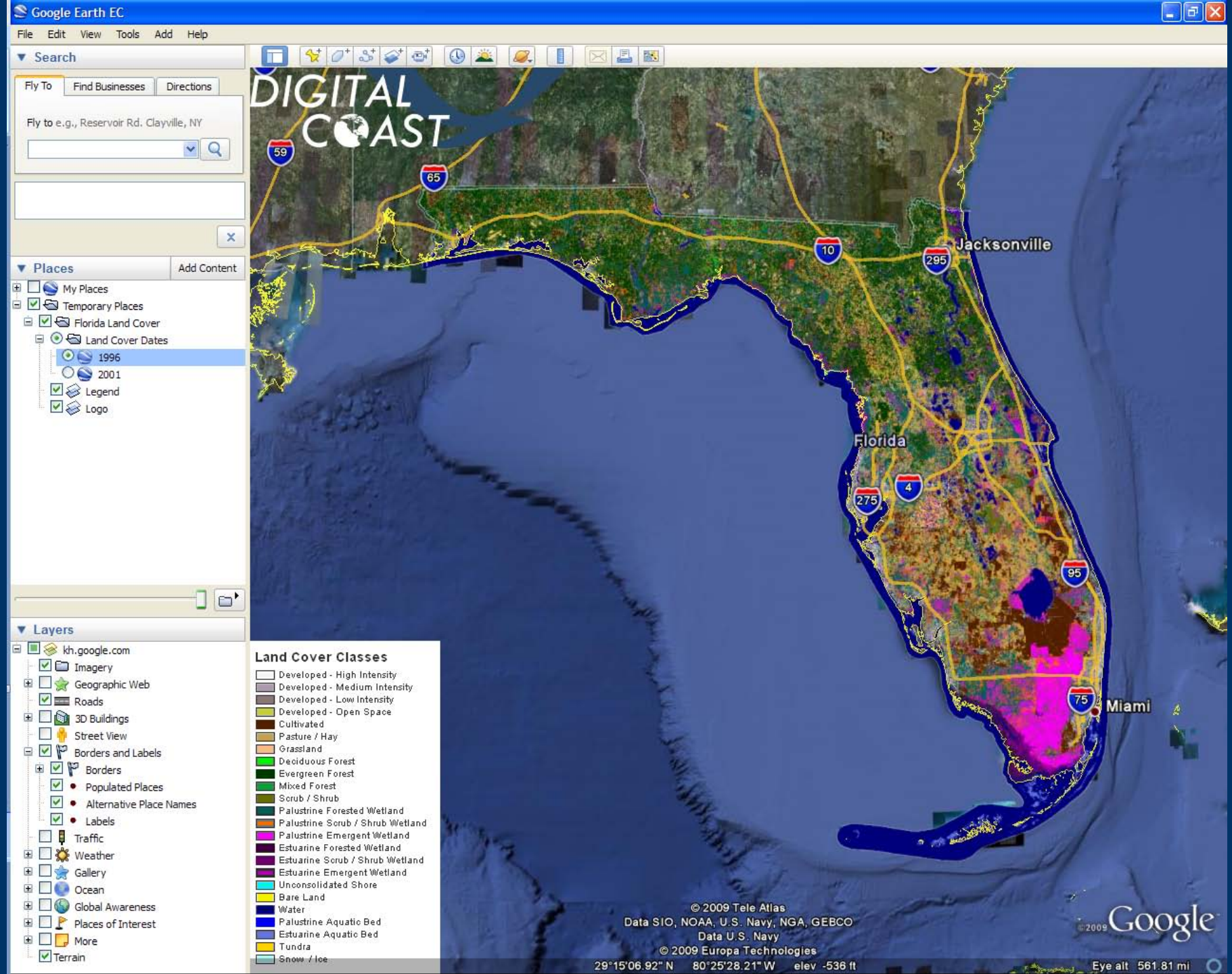
Google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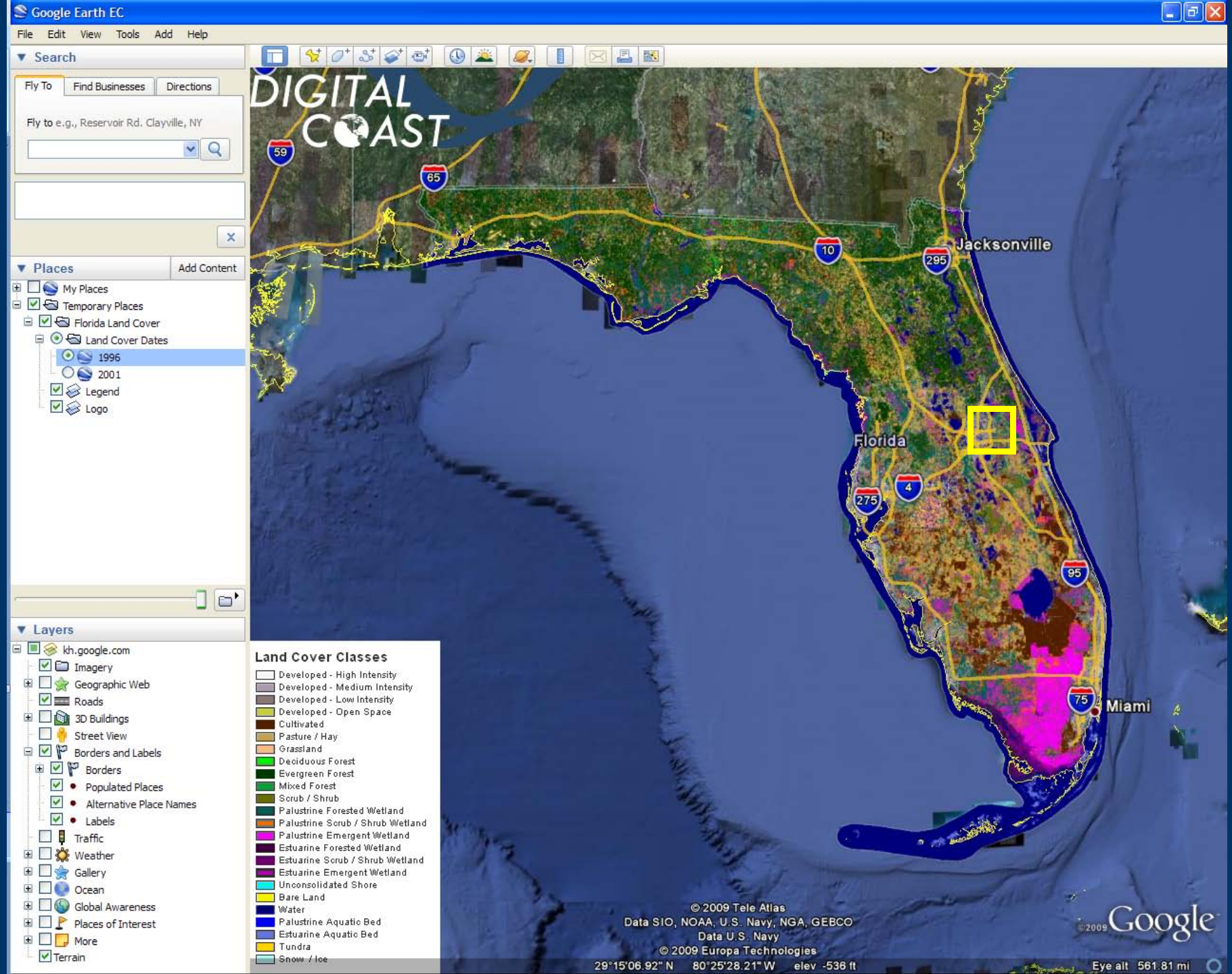
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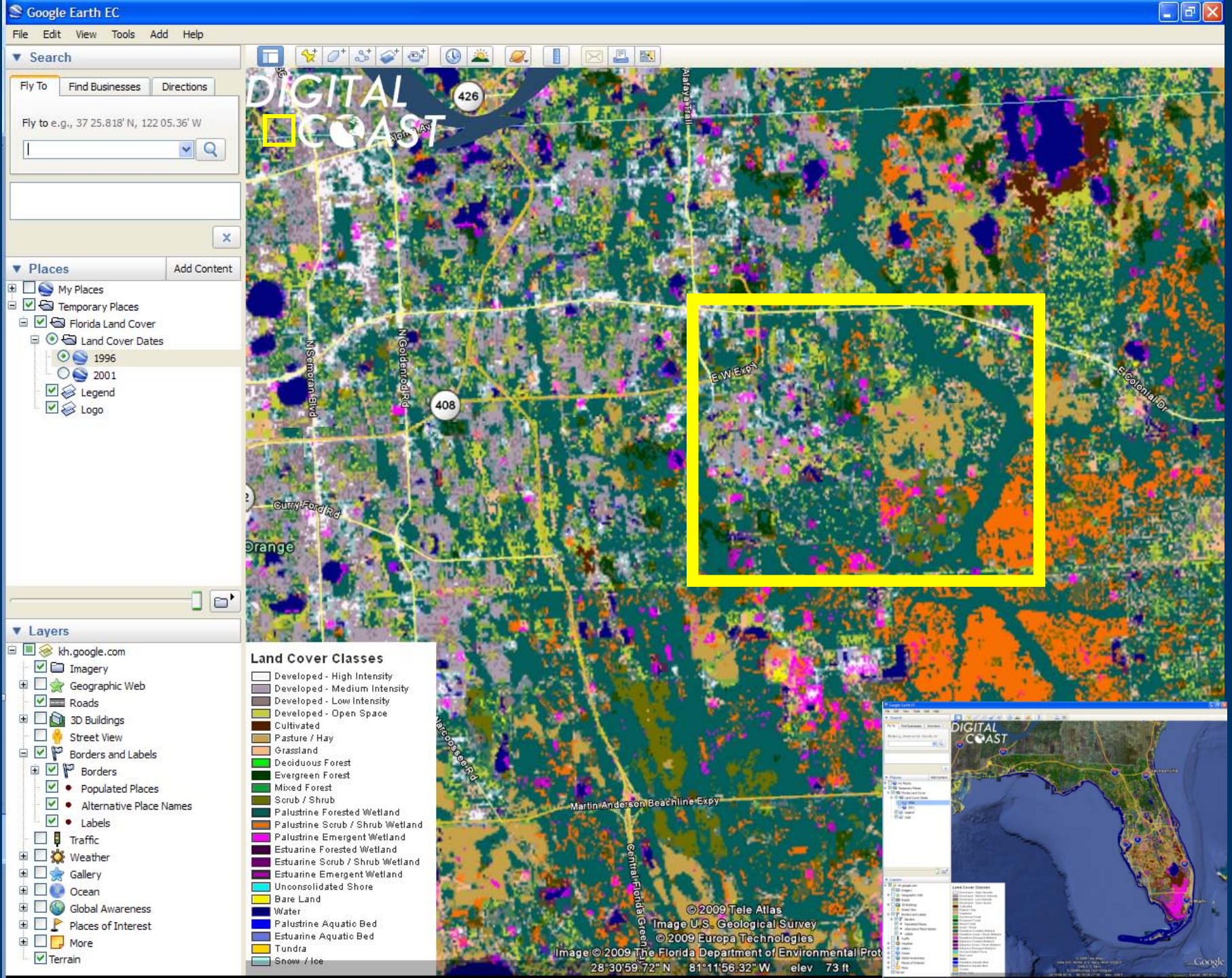
Cultivated
Pasture / Hay
Grassland
Deciduous Forest
Evergreen Forest
Mixed Forest
Scrub / Shrub
Palustrine Forested Wetland
Palustrine Scrub / Shrub Wetland
Palustrine Emergent Wetland
Estuarine Forested Wetland
Estuarine Scrub / Shrub Wetland
Estuarine Emergent Wetland
Unconsolidated Shore
Bare Land
Water
Palustrine Aquatic Bed
Estuarine Aquatic Bed
Tundra
Snow / Ice
© 2009 Tele Atlas
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Data U.S. Navy
© 2009 Europa Technologies
29°15'06.92" N 80°25'28.21" W elev -536 ft
Eye alt 561.81 mi
Google


Google Earth EC
File Edit View Tools Add Help
Search
Fly To
Find Businesses
Directions
Fly to e.g., 37 25.818' N, 122 05.36' W
Places
Add Content
My Places
Temporary Places
Florida Land Cover
Land Cover Dates
1996
2001
Legend
Logo
Layers
kh.google.com
Imagery
Geographic Web
Roads
3D Buildings
Street View
Borders and Labels
Borders
Populated Places
Alternative Place Names
Labels
Traffic
Weather
Gallery
Ocean
Global Awareness
Places of Interest
More
Terrain
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N Semoran Blvd
N Goldenrod Rd
E W Expy
E Colonial Dr
Curry Ford Rd
Orange
Martin Anderson Beachline Expy
Central Florida Greeway
Land Cover Classes
Developed - High Intensity
Developed - Medium Intensity
Developed - Low Intensity
Developed - Open Space
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Grassland
Deciduous Forest
Evergreen Forest
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Palustrine Aquatic Bed
Estuarine Aquatic Bed
Tundra
Snow / Ice
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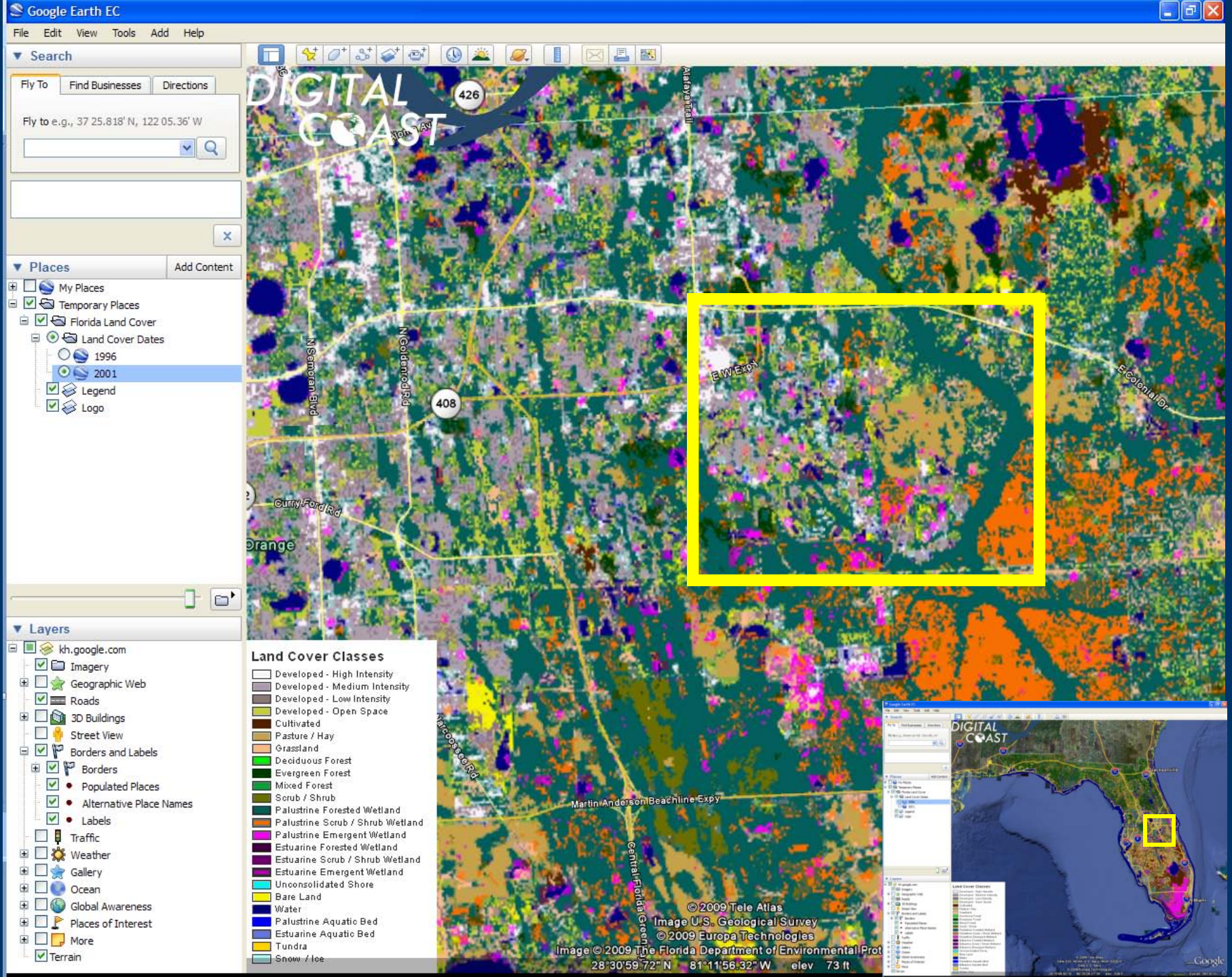
Image U.S. Geological Survey
© 2009 Europa Technologies
Image © 2009 The Florida Department of Environmental Prot
28°30'59.72" N 81°11'56.32" W elev 73 ft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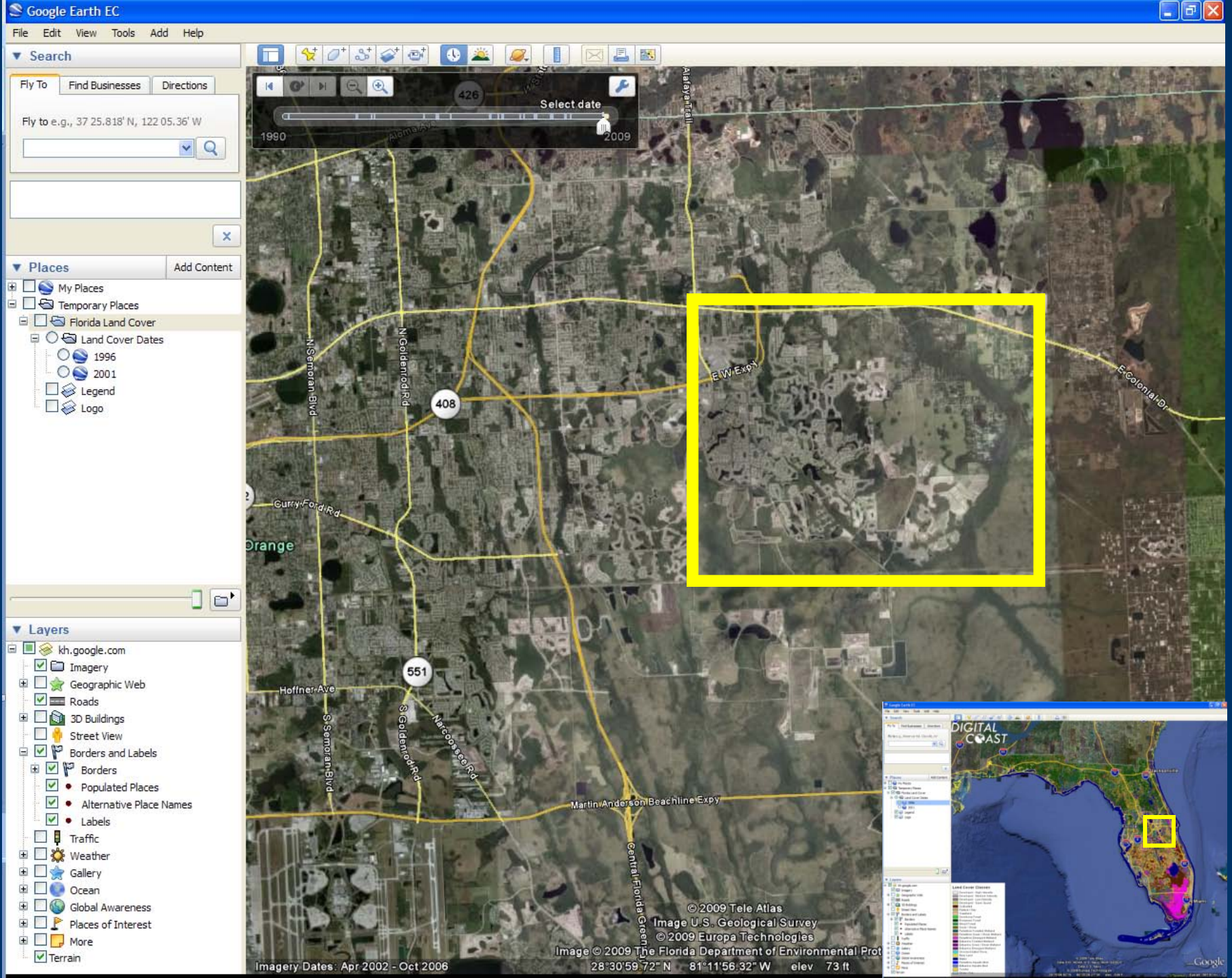
© 2009 Europa Technologies
Image © 2009 The Florida Department of Environmental Prot
28°30'59.72" N 81°11'56.32" W elev 73 ft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S Goldenrod Rd
Narcoossee Rd
Martin Anderson Beachline Expy
Central Florida Greeway
Alafaya Trail
Aloma Ave
DIGITAL COAST
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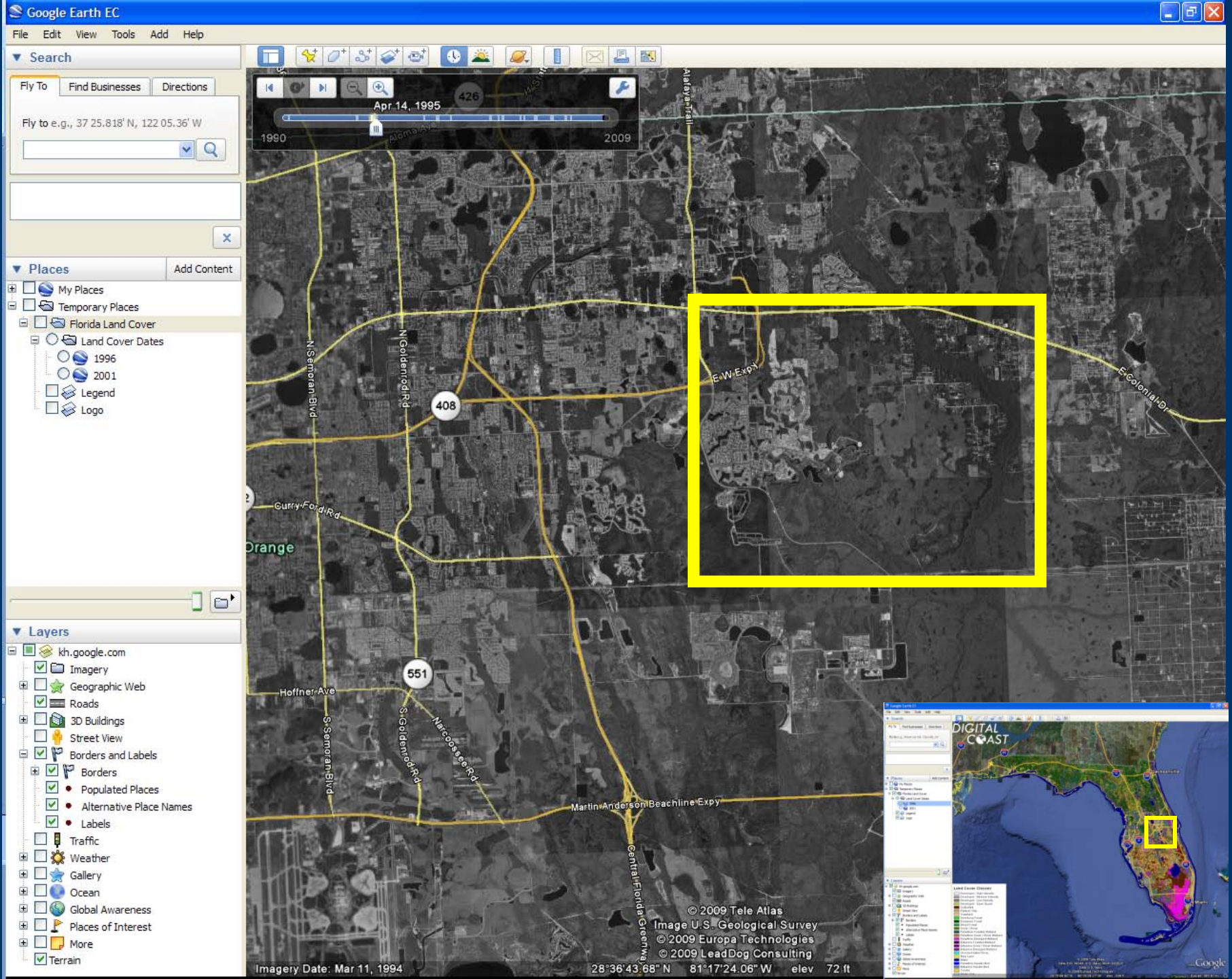
Imagery Dates: Apr 2002 - Oct 2006
28°30'59.72" N 81°11'56.32" W elev 73 ft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S Goldenrod Rd
Narcoossee Rd
Martin Anderson Beachline Expy
Central Florida Greeway
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Image U.S. Geological Survey
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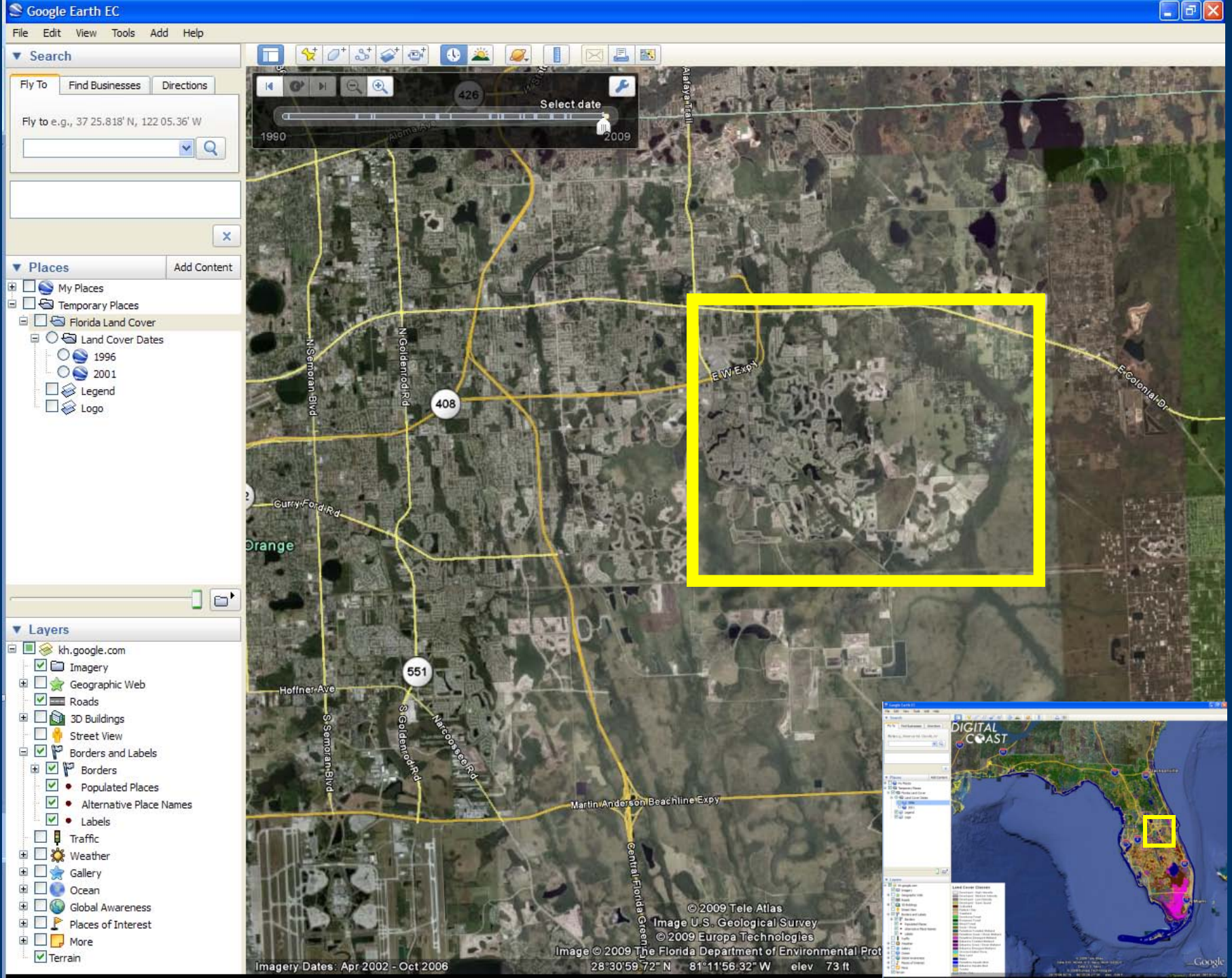
© 2009 LeadDog Consulting
Imagery Date: Mar 11, 1994
28°36'43.68" N 81°17'24.06" W elev 72 ft
DIGITAL COAST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Imagery Dates: Apr 2002 - Oct 2006
28°30'59.72" N 81°11'56.32" W elev 73 ft

Data & Map Services

What you should know about KML?

Hosts	Consumers
Simple file based data, easy as pie to host	Data can be plugged into Google Maps directly
KML data can be indexed by Google	KML is everywhere
Big datasets can be slow to serve, use Regions	ESRI does not read directly, but they'll convert it to personal gdb for you

Geospatial
Application Programming Interfaces (APIs)

Geospatial Data and Web Services

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

Geospatial APIs

Application Programming Interface

- Not a programming language
- A set of functions or routines built on an existing language
- Most Geo APIs today are built on JavaScript

Google Maps & API

maps.google.com - My Maps

Google Maps API

Google Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://maps.google.com/

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Google Maps

Search Maps Show search options

Find businesses, addresses and places of interest. Learn more.

Get Directions My Maps

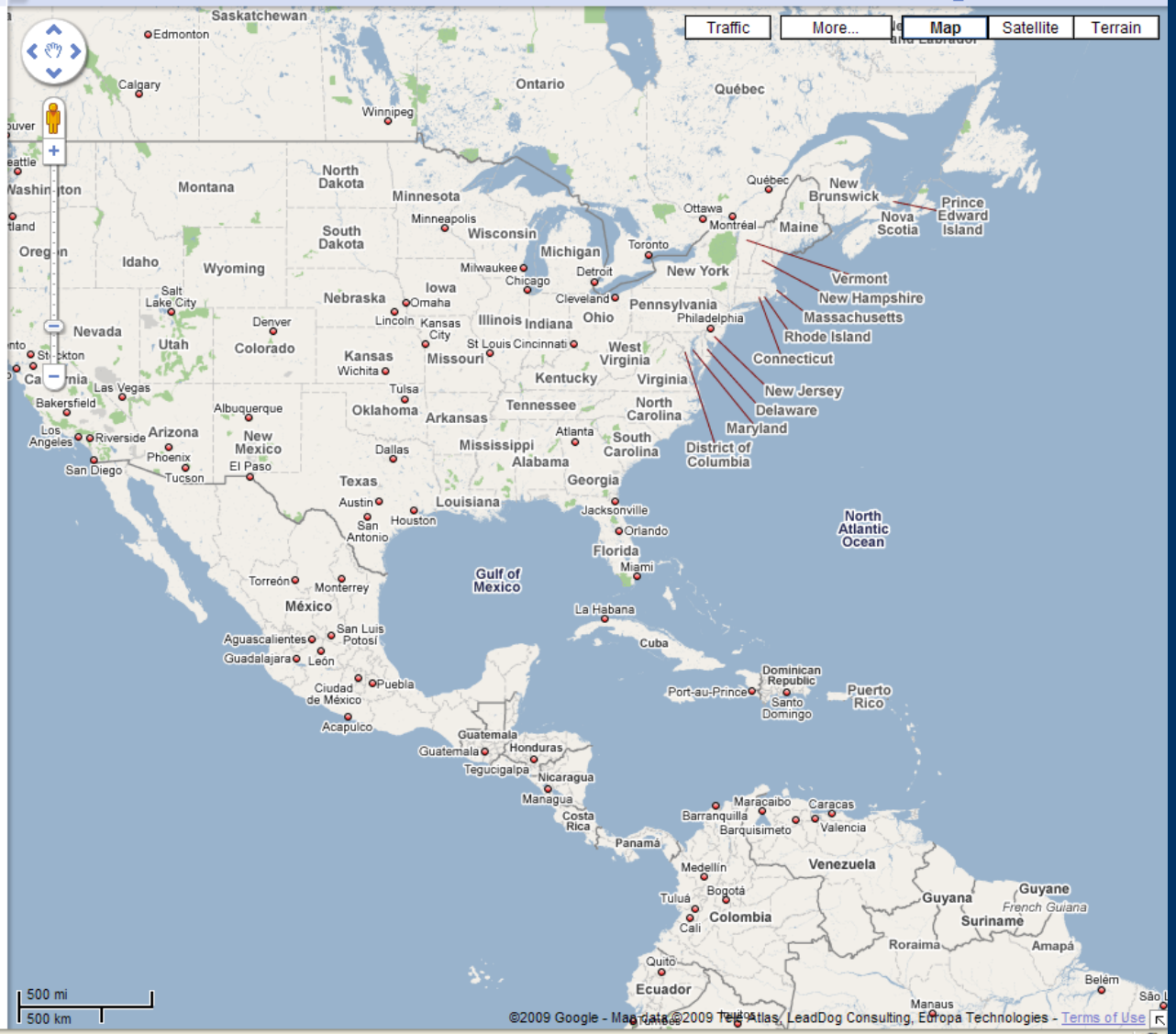
New! Explore the ocean in Google Earth 5.0.

Set default location

Put your business on Google Maps
Display your ads on Google Maps

Print Send Link

Traffic More... Map Satellite Terrain



Done

Google Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://maps.google.com/

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Google Maps

Search Maps Show search options

Find businesses, addresses and places of interest. Learn more.

Get Directions My Maps

Create new map - Browse the directory

Created by me

- [x] **Charleston Waterlevels** Public

Created by others

- [ ] Warning Decision Support System
- [ ] NOAA Estuarine Bathymetry
- [ ] Hurricane Katrina
- [ ] NSIDC Information
- [ ] guiWeather Tropical Weather Maps
- [ ] Carpool Search
- [ ] Geotrends

Collaborate Edit

Charleston Waterlevels

Click on icon for waterlevel charts

0 views - Public

Created on Jan 27 - Updated Jan 30

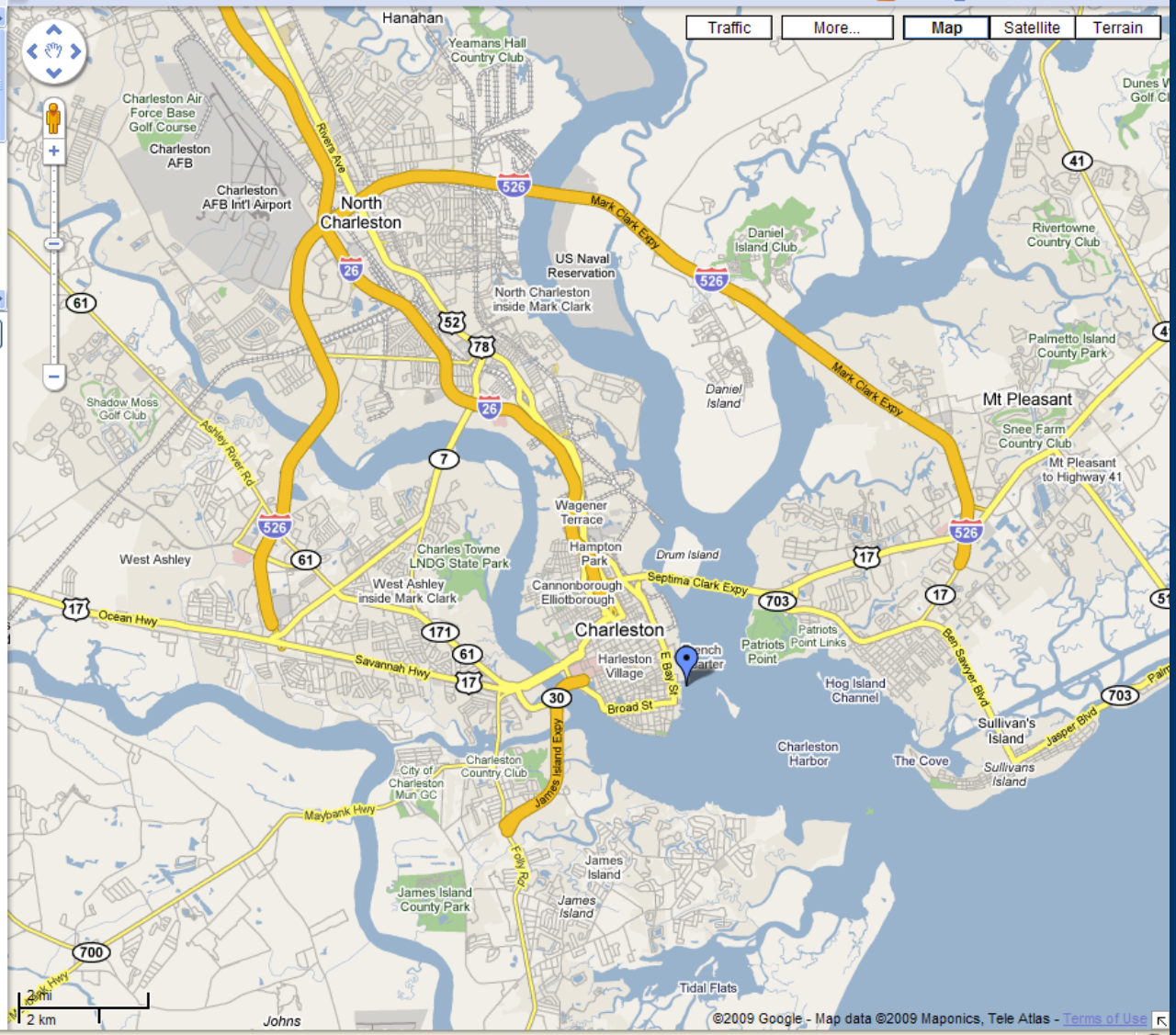
By Kyle

Rate this map - Write a comment

Charleston Harbor Waterlevels

RSS Print Send Link

Traffic More... Map Satellite Terrain



Done

Google Maps - Mozilla Firefox

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Create new map - Browse the directory

Created by me

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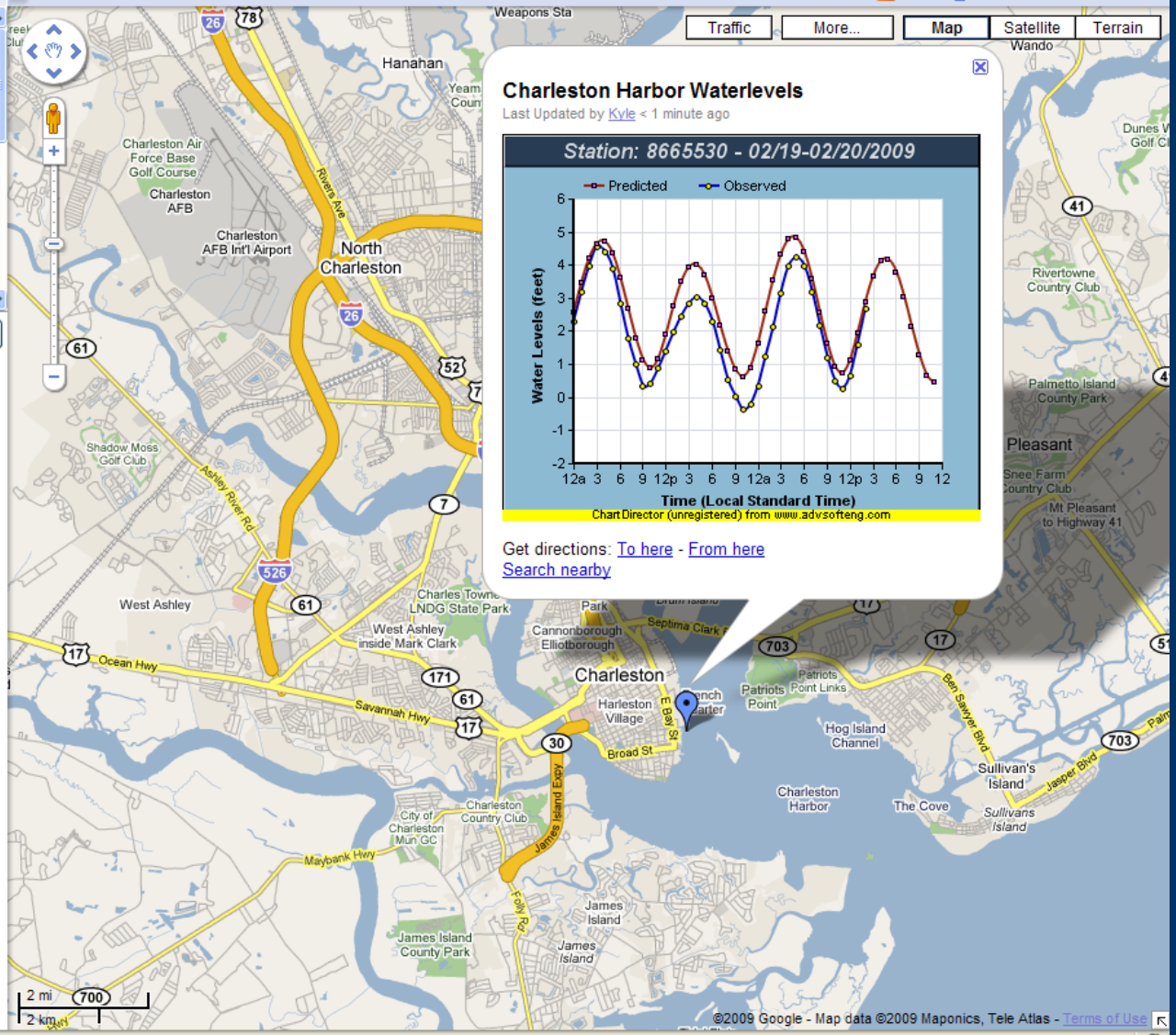

Done

Charleston Harbor Waterlevels - Google Maps - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://maps.google.com/

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Google Maps

Charleston Harbor Waterlevels | Search Maps | Show search options

Find businesses, addresses and places of interest. Learn more.

Get Directions | My Maps

Text View | Map View

Results **1-10** of about **21** for **Harbor Waterlevels** near **Charleston, S Carolina**

Did you mean: Charleston Harbor ***Water Levels***

A National Oceanic & Atmospheric - more info »
2234 S Hobson Ave, North Charleston, SC - (843) 740-1200
Write a review
"One application of this extension has been to illustrate landfill in the New York **harbor** to create the

User-created content for **Harbor Waterlevels**

B Charleston **Harbor Waterlevels** - more info »
charleston **waterlevels** ...
Charleston Waterlevels - maps.google.com
More user-created content near **Charleston** »

City of Charleston - more info »
FL 3, 75 Calhoun St, Charleston, SC - (843) 724-3765
Write a review
"They believe that special programs combining a sailing trip in Charleston **Harbor** with an educational experience are some of the best possible uses of the clubs ..." scribd.com

D Forestry Department - more info »
2730 Savannah Hwy, Charleston, SC - (843) 769-7006
Write a review
"Upstream of each weir, **water levels** were measured at six-minute intervals by a water level recorder and an automatic datalogger. An additional recorder was ..." frymulti.com

E Charleston County Board-Election - more info »
4367 Headquarters Rd, Charleston, SC - (843) 744-8683
Write a review
"However, the the closeness of the moon, astronomically high tides have brought the **water levels** to just below the road. the tide has become, well, astronomical! ..." scribd.com

F Charleston County Council - more info »

RSS | Print | Send | Link

Traffic | More... | Map | Satellite | Terrain

Charleston AFB
Charleston AFB Int'l Airport
North Charleston
US Naval Reservation
North Charleston inside Mark Clark
Daniel Island Club
Daniel Island
Mt Pleasant
Snee Farm Country Club
Shadow Moss Golf Club
Wagener Terrace
Hampton Park
Drum Island
Charles Towne LNDG State Park
West Ashley
West Ashley inside Mark Clark
Cannonborough Elliotborough
Charleston
Harleston Village
Patriots Point
Patriots Point Links
Hog Island Channel
Sullivan's Island
Sullivans Island
The Cove
Charleston Harbor
Charleston Country Club
City of Charleston Mun GC
James Island County Park
James Island
Tidal Flats
Johns Island
Charleston Executive Airport
Lighthouse Creek Inlet
Mark Clark Expy
Septima Clark Expy
Savannah Hwy
Ocean Hwy
Maybank Hwy
Broad St
Ashley River Rd
Main Rd
Folly Rd
James Island Expy
Ben Sawyer Blvd
Jasper Blvd
2 mi
2 km

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Window Coverings Gallery - hdspd.com/advancedwindowfashions - Contact for a free gift! Advanced Window Fashions - Mt. Pleasant, Sponsored Link

Done

Geospatial APIs

GoogleMaps & API

maps.google.com - My Maps

Google Maps API
http://code.google.com/apis/maps/

Google Maps API - Google Code - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://code.google.com/apis/maps/

Google Code

Search

e.g. "ajax apis" or "open source"

English ▼ | Site Directory

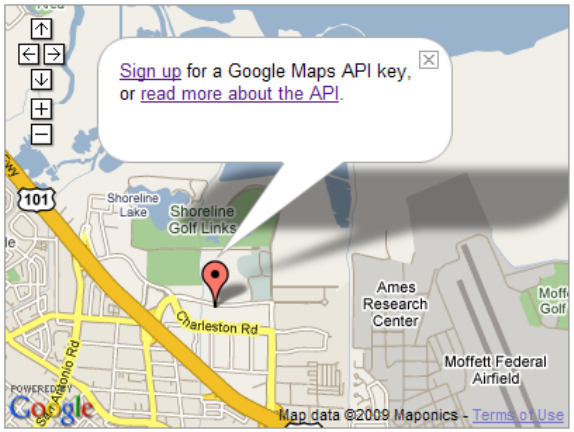
Google Maps API

Home Docs FAQ Articles Blog Group Terms

What is the Google Maps API?

The Google Maps API lets you embed Google Maps in your own web pages with JavaScript. The API provides a number of utilities for manipulating maps (just like on the http://maps.google.com web page) and adding content to the map through a variety of services, allowing you to create robust maps applications on your website.

New! Support for Google Map Maker map tiles in the Maps API!



How do I start?

1. Sign up for a Google Maps API key.
2. Read the Maps API Concepts.
3. Check out some Maps API Examples.
4. Read the Maps API Reference.

Featured Video

Watch other Maps API presentations

The Maps API is a free service, available for any web site that is free to consumers. Please see the terms of use for more information.

To use the Maps API on an intranet or in a non-publicly accessible application, please check out Google Maps for Enterprise.

Google Geo Developers Blog

Google New York City Geo APIs Hackathon
Feb 23, 2009

Posted by Mano Marks, Geo APIs Team March 5th, from 3-9pm, Google will be hosting a Google Geo APIs hackathon at ou...

Map Maker for Developers
Feb 19, 2009

Posted by Lalitesh Katragadda and Lior Ron, Map Maker Team Since June 2008, thousands of passionate users have been...

Hola, Allo, Olá, Здравствуйте! Maps API Developers!

Community

Community

Need examples of Markermanager with turning stuff on and off

Does anyone know of some examples where markermanager is used and checkboxes or links turn layers on and off?

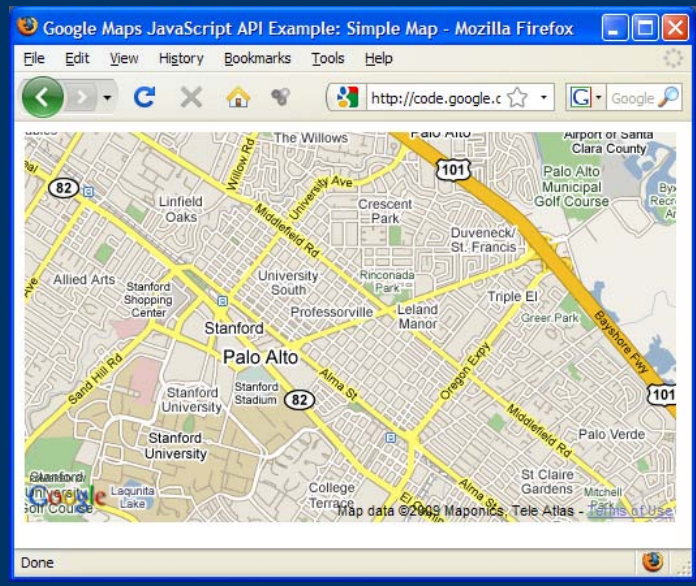
How to run a map from inside a form tag that runsat server in asp.net

Hi, currently working on my honours project in asp.net and hit a snag in my maps api part. my website uses masterpa...

servidor caido de google maps

Done

```
<!DOCTYPE html "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
 <head>
    <meta http-equiv="content-type" content="text/html; charset=utf-8"/>
    <title>Google Maps JavaScript API Example</title>
    <script src="http://maps.google.com/maps?file=api&amp;v=2&amp;key=abcdefg&sensor=true_or_false"
    type="text/javascript"></script>
    <script type="text/javascript">
            function initialize() {
                if (GBrowserIsCompatible()) {
                    var map = new GMap2(document.getElementById("map_canvas"));
                    map.setCenter(new GLatLng(37.4419, -122.1419), 13);
                    map.setUIToDefault();
                }
            }
    </script>
 </head>
 <body onload="initialize()" onunload="GUnload()">
    <div id="map_canvas" style="width: 500px; height: 300px"></div>
</body>
</html>
```



Microsoft Virtual Earth

Virtual Earth Interactive SDK

http://dev.live.com/virtualearth/sdk/

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
    <html xmlns="http://www.w3.org/1999/xhtml">
 <head>
    <meta http-equiv="content-type" content="text/html; charset=utf-8"/>
    <title></title>
    <script type="text/javascript" src="http://dev.virtualearth.net/mapcontrol/mapcontrol.ashx?v=6.2"></script>

    <script type="text/javascript">
        var map = null;

        function GetMap()
        {
           map = new VEMap('myMap');
           map.LoadMap();
        }
    </script>
 </head>
 <body onload="GetMap();">
    <div id='myMap'
          style="position:relative; width:400px; height:400px;"></div>

</body>
</html>
```

Geospatial Data and Web Services

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

The Virtual Earth Interactive SDK - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://dev.live.com/virtualearth/sdk/

Virtual Earth Interactive SDK

Home > Services > Virtual Earth > SDK

Show Me | Source Code | Reference | Learn More

I want to:

- Show a map
  - Show the default map
  - Show a specific map
  - Use a callback
  - Show this map in 3D
  - Show traffic
- Control the map
- Show/hide controls
- Use default shapes
- Customize shapes
- Use shape layers
- Import data into shape layers
- Use custom tile layers
- Find information (basic)
- Find information (advanced)
- Get a multi-point route and directions
- Use birdseye images
- Work with 3D maps
- Use events and callbacks
- Get map info

NEW
What's new in the latest release?

© 2008 Microsoft Corporation. All rights reserved. | Post a question on the Virtual Earth Forum.

Read dev.virtualearth.net

Geospatial APIs

What you should know about Microsoft Virtual Earth API?

Hosts
Birdseye view imagery
Microsoft isn’t going anywhere
Browser based development testing sandbox

Geospatial APIs

MetaCarta OpenLayers

OpenLayers Samples

OpenLayers with Google Chart API

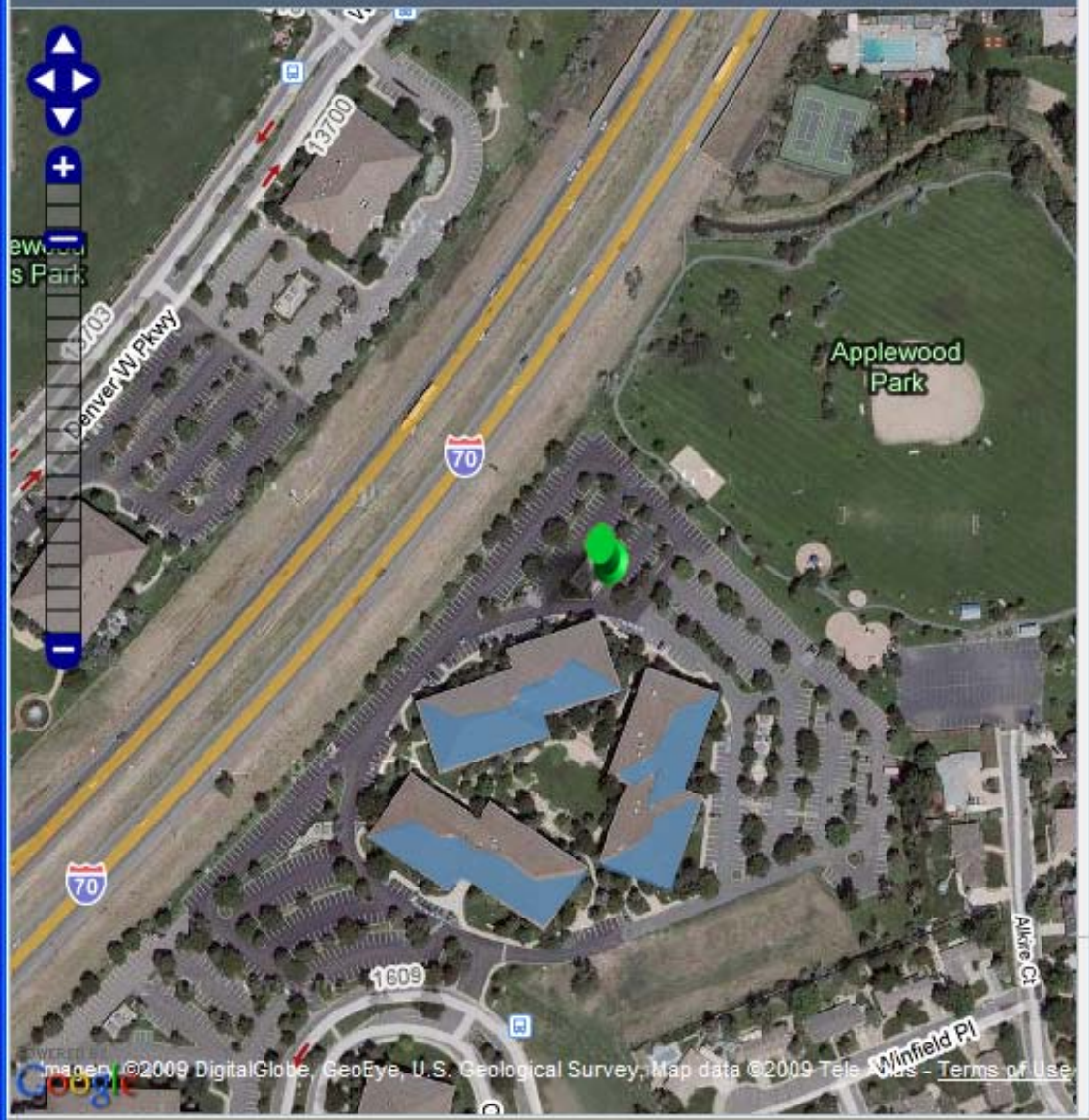
```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
    <html xmlns="http://www.w3.org/1999/xhtml">
 <head>
    <meta http-equiv="content-type" content="text/html; charset=utf-8"/>
    <title></title>
    <script src="http://openlayers.org/dev/examples/OpenLayers.js"></script>
    <script type="text/javascript">
        map = new OpenLayers.Map('map');
        map.zoomToMaxExtent();
    </script>
 </head>
 <body onload="init();">
    <div id="map" class="smallmap"></div>
</body>
</html>
```

In My Backyard (IMBY) - National Renewable Energy Laboratory - Mozilla Firefox

http://mercator.nrel.gov/imby/

In My Backyard - National Renewable Energy Laboratory (NREL)

Pan Clear Map



Options

To estimate the solar electricity you can produce, follow the steps below.

Step 1. Draw your system.

Use the zoom tool on the left of the map, if needed. Click the Draw button, and draw your solar array on the map. Click to add a new points. Double-click to stop drawing.

Draw

If you make a mistake, click the Clear Map button at the top of the map to start over.

Step 2. Adjust the inputs.

Based on the size and location of your system IMBY suggests these inputs. To change these values, enter your information in the fields below. Help

Size (kW):	132.23
Derating:	0.8
Tilt angle (°):	40
Azimuth angle (°):	180
Data year:	Typical

Step 3. Estimate your production.

Run

Done

In My Backyard (IMBY) - National Renewable Energy Laboratory - Mozilla Firefox

http://mercator.nrel.gov/imby/

Summary | PV Generation Profile

Payback

The form below shows the values used to estimate the payback for this system. help

Size (kW):	132.23
Rebates ($):	45000
Tax Credits ($):	2000
Cost/W ($):	8.3
Initial Cost ($):	1096898
After Incentives ($):	1049898
Payback (years):	51

Re-calculate

System Inputs

Modify the inputs below to run another simulation

Size (kW):	132.23
Derating:	0.8
Tilt angle (°):	40
Azimuth angle (°):	180
Data year:	Typical

Re-run Simulation

System Outputs

This tables shows the amount of electricty (kWh) generated by this system each month, and the dollar amount that those values translate into.

Month	Output (kWh)	Value* ($)
January	16701.786	1613.66
February	16562.188	1600.17
March	19262.405	1861.06
April	18205.971	1758.99
May	20819.313	2011.48
June	18028.463	1741.84
July	16643.712	1608.05
August	17288.628	1670.36
September	18745.871	1811.15
October	15165.152	1465.2
November	12549.661	1212.5
December	14209.19	1372.84
Annual	204182.34	19727.31

*Value based on a electric rate of $0.1/kWh

To save these results, choose the Export Results button at the bottom right corner of this window.

Load

Now compare your estimated solar electricity production with your electricity consumption.

Step 1. Select a load profile.

You may select a sample profile or upload your own custom load profile.

(A) Use a sample load profile.

Choose a city from the drop-down box below.

Sample Profile: Select...

or

(B) Upload a load profile.

Click the Upload File button below. Then browse to locate your load profile document.
For help click here

Upload

Step 2. Run load profile

Run

Imagery ©2009 DigitalGlobe, GeoEye, U.S. Geological Survey, Map data ©2009 Tele Atlas - Terms of Use

Export Results | Close

Done

Geospatial APIs

MetaCarta OpenLayers

OpenLayers Samples

OpenLayers with Google Chart API

thematicmapping.org - Mozilla Firefox

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http://thematicmapping.org/openlayers/piecharts_geojson_google_chart.php

thematicmapping.org

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Thematic Mapping with OpenLayers

| Proportional Symbols | **Pie Charts** | Choropleth |

Population, 2005

| GeoJSON (Google Chart) |

Population numbers from UNdata

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Done

Geospatial APIs

What you should know about MetaCarta OpenLayers API?

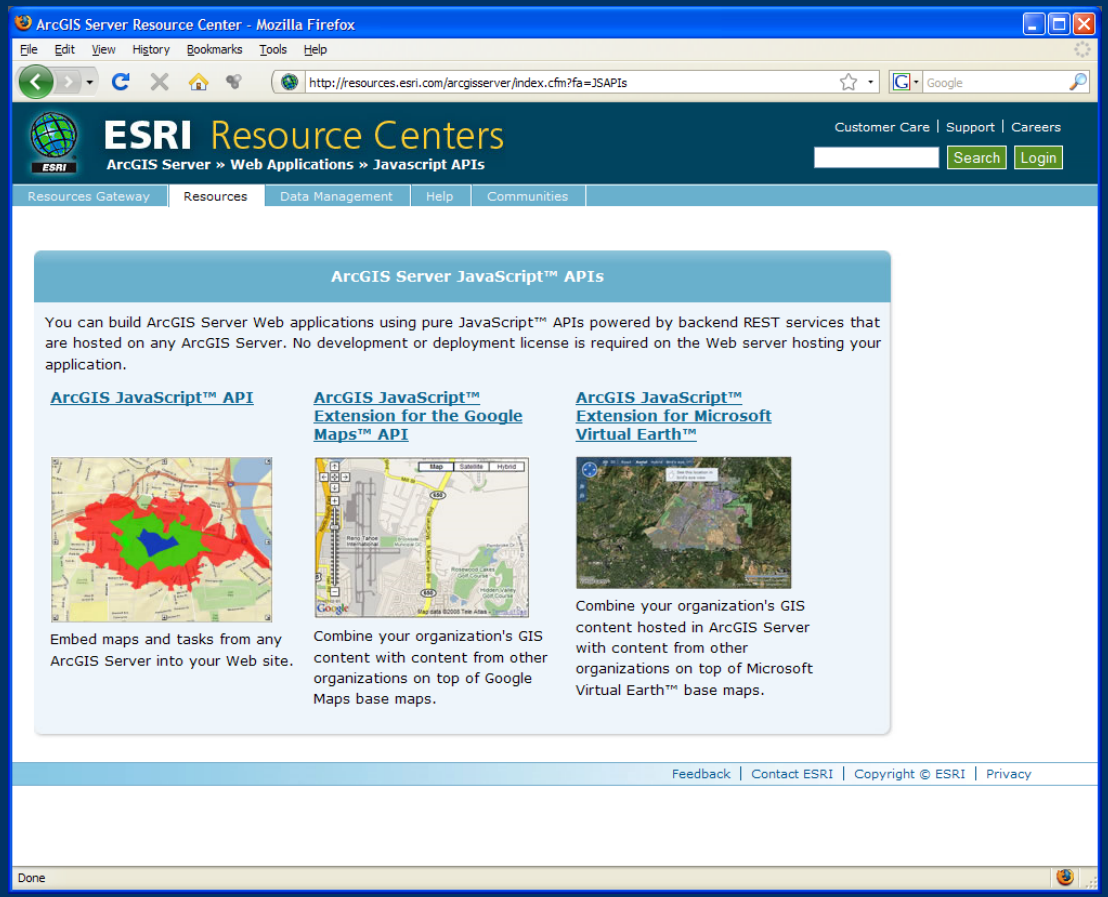
Hosts
Can use most of the other companies api basedata
A lot of functionality for a web based mapping api
OpenLayers is picking up excitement

Geospatial APIs

ESRI ArcGIS Server

JavaScript API

http://resources.esri.com/arcgisserver/index.cfm?fa=JSAPIs



Geospatial Data and Web Services

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```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
    <html xmlns="http://www.w3.org/1999/xhtml">
 <head>
    <meta http-equiv="content-type" content="text/html; charset=utf-8"/>
    <title></title>
    <script src="http://openlayers.org/dev/examples/OpenLayers.js"></script>
    <script type="text/javascript">
    dojo.require("esri.map");
    var myMap, myTiledMapServiceLayer;
    function init() {
        myMap = new esri.Map("mapDiv");
        myTiledMapServiceLayer = new esri.layers.ArcGISTiledMapServiceLayer
    ("http://server.arcgisonline.com/ArcGIS/rest/services/ESRI_StreetMap_World_2D/MapServer");
       myMap.addLayer(myTiledMapServiceLayer);
    }
   dojo.addOnLoad(init);
    </script>
 </head>
 <body onload="init();">
    <div id="mapDiv"
          style="width:900px; height:600px; border:1px solid #000;">
    </div>
</body>
</html>
```

Geospatial Data and Web Services

Geospatial APIs

What you should know about JavaScript API?

Hosts
Free to host the API
You need ArcServer to host your data, if you have ArcIMS now you probably have the license to run server
Google Maps-like interface is more intuitive to users than ArcIMS templates
Client-side inclusion of external data makes for a more reliable client
Performance seems to be faster and more stable than ArcIMS (At first look)
Extensions available for Google Maps, Microsoft Virtual Earth

Geospatial APIs

What you should know about GoogleMaps API?

Hosts
Can consume kml, wms, georss, text, json
A lot of sample code available (see a Google Map, click view source)
Do you want end users knowing how you're doing what you're doing
Do you want end users knowing where your data is coming from
Based on javascript, pretty easy to code
* Most of the accuracy issues have been dealt with *

Summary

Geospatial Web Services:

- XML Web Services with Geospatial Context
- Data & Map Services for Use in GIS Analysis
- Geospatial Mapping API's

Practical Data Modeling for Web Services

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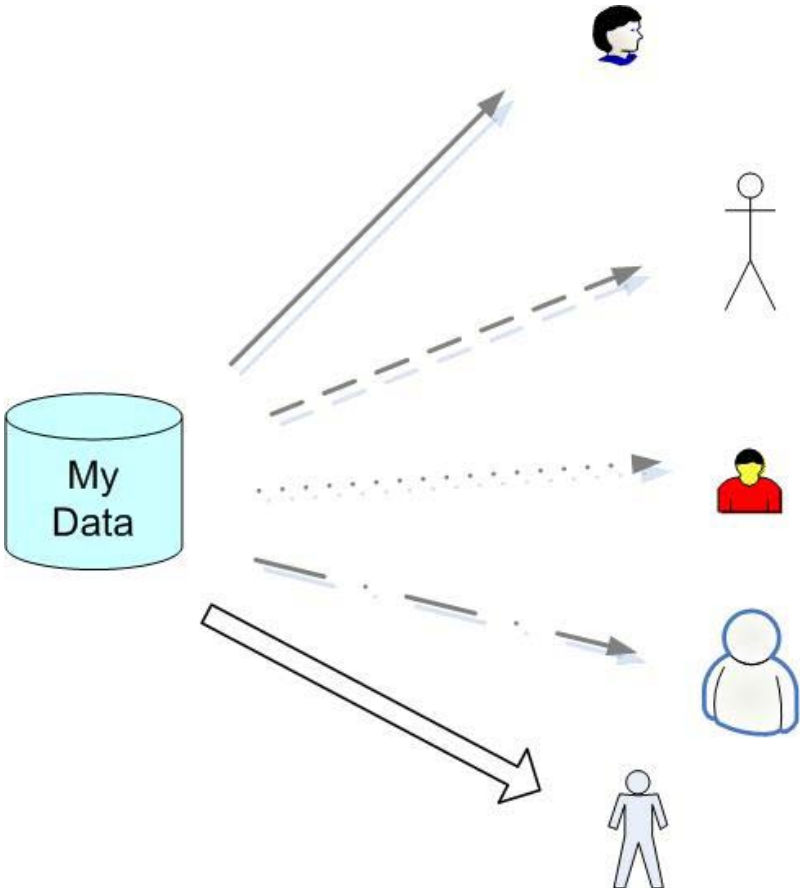
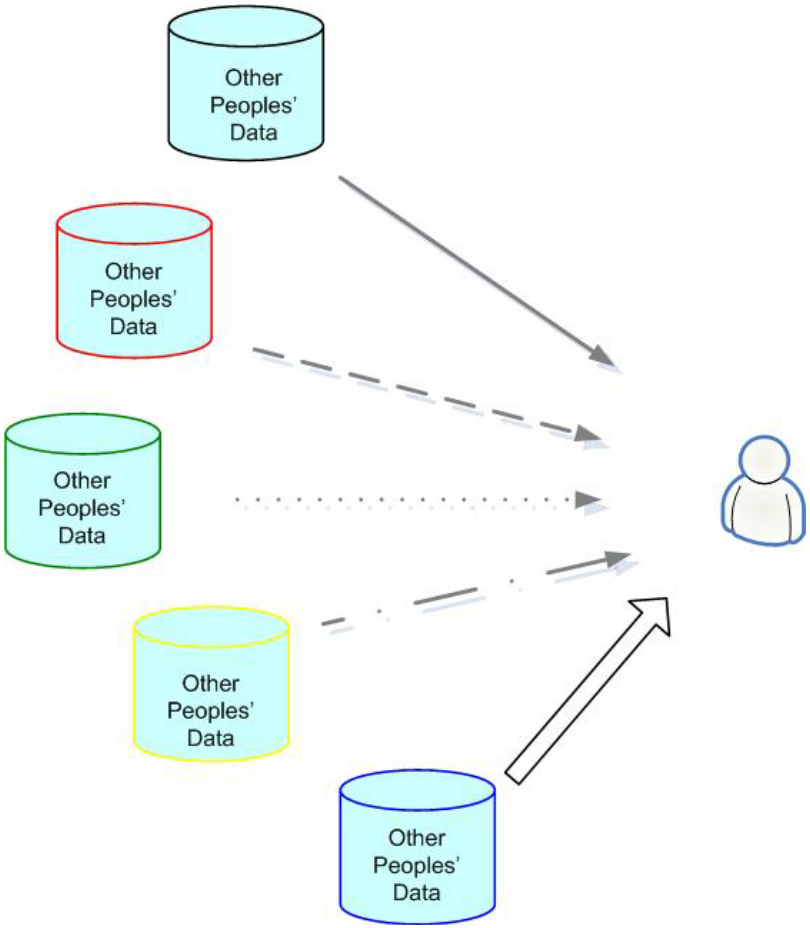
Data Model – Bases for Interoperability

	Latitude	Longitude		?	?	?	

Data Provider Perspective



Data Consumer Perspective



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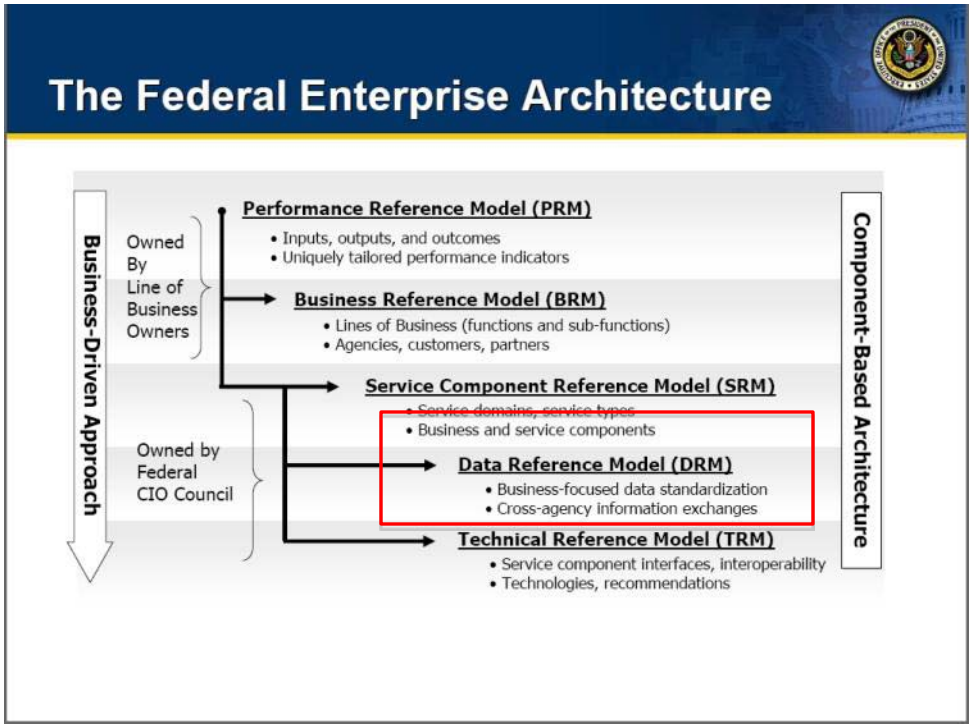
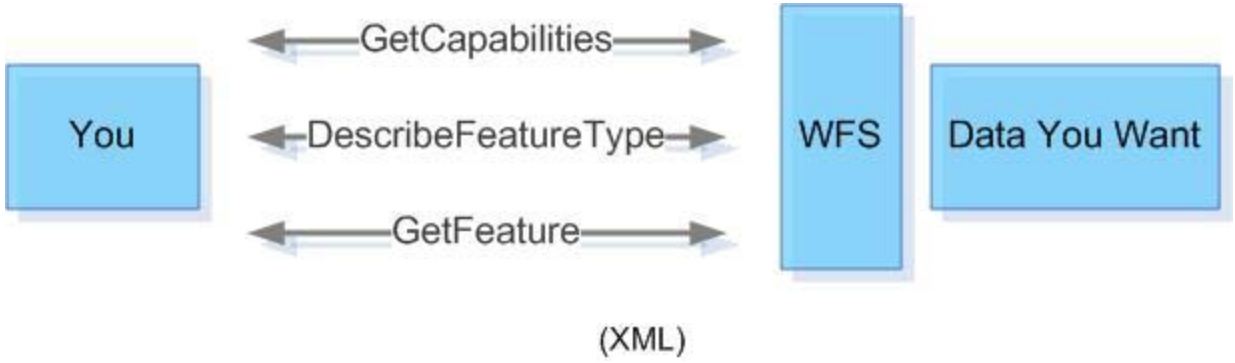
Common Interoperability Challenges

Taxonomy of Data – Semantic/Syntactic

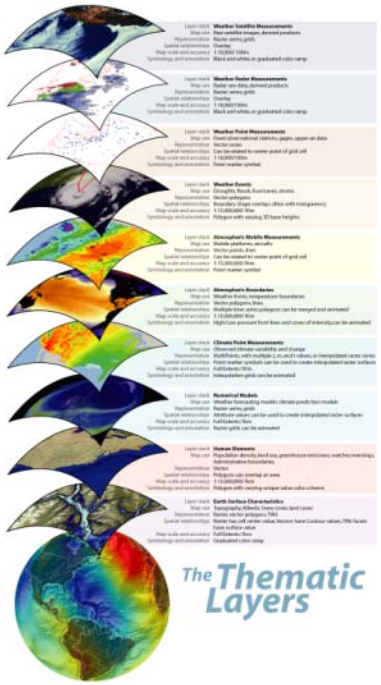
Data Transport Infrastructure – (API and format)

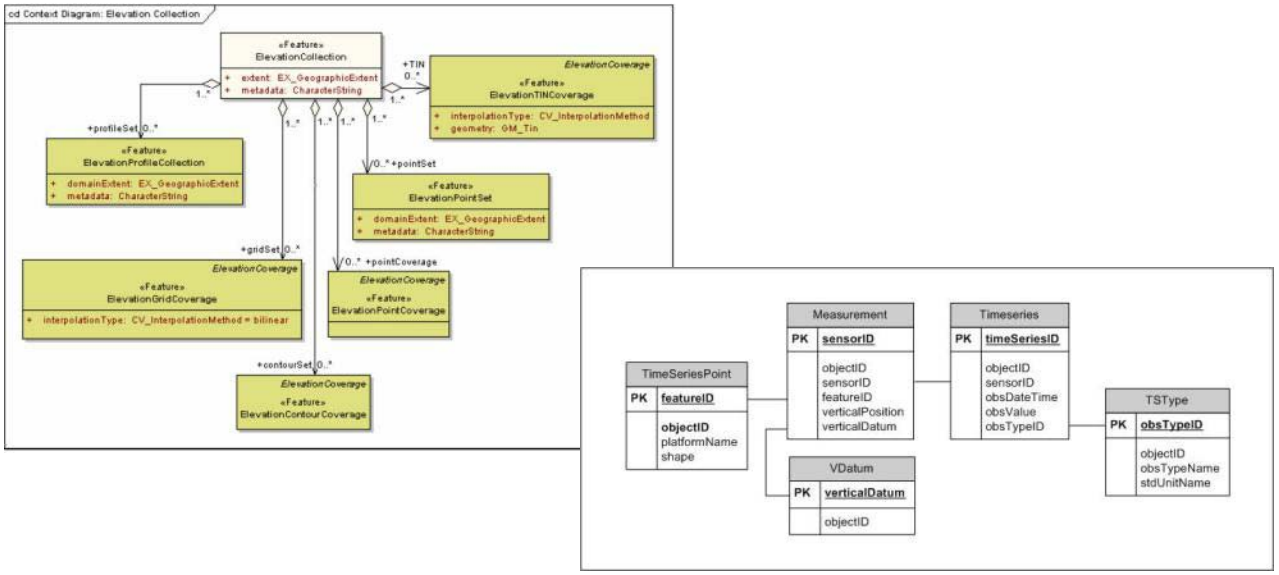


Web Service != Interoperability



What Is a Data Model?





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Data Model Characteristics

Strong

Project Models:	CO-OPS, IOOS
Community Models:	CUAHSI, S-100, ArcMarine
Web Service Models:	Feature, Coverage, JSON
Spatial Models:	Geometries (all kinds)
RDBMS Model:	Tables, Relationships

Weak

#1 Start with a strongly typed data model

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Data Models for Different Purposes

#2 Tune your data model to the situation

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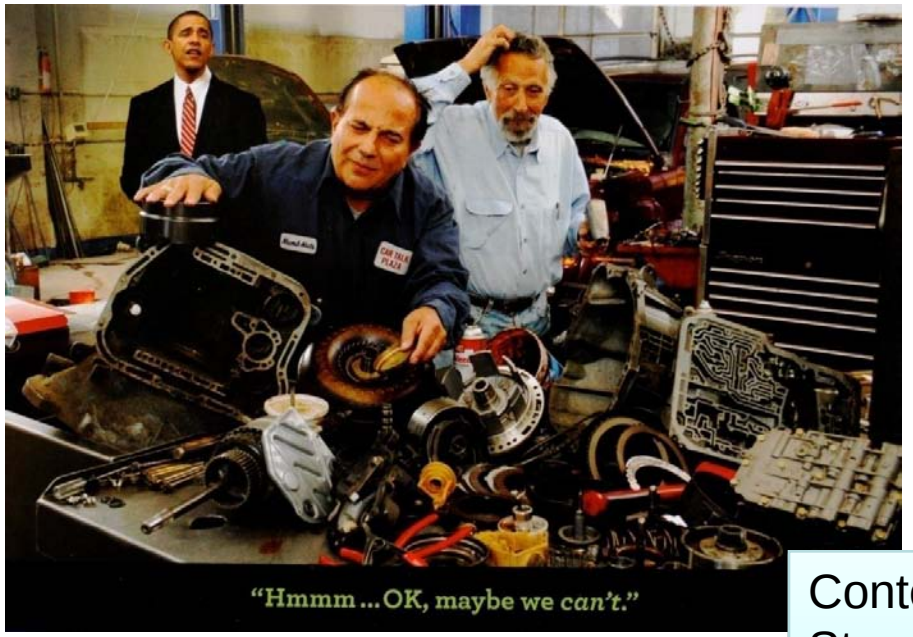
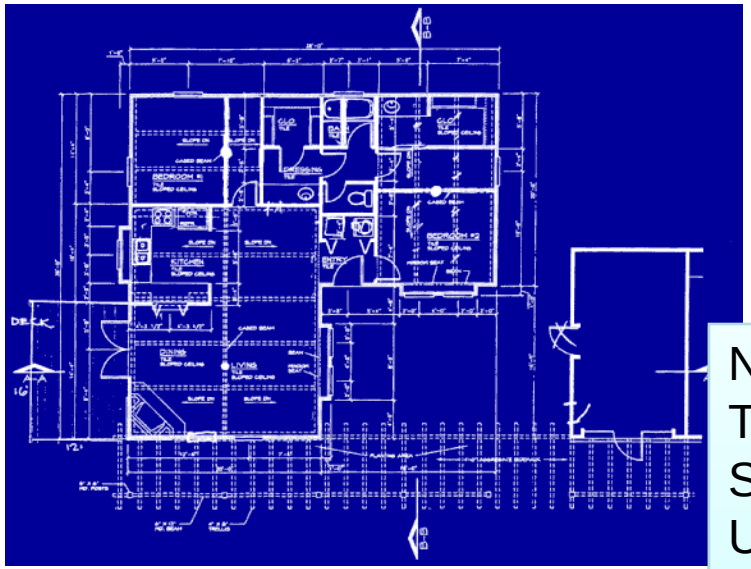
1.0 Data Model – Parts



Content
Structure
Format

Content Requirements



Name
Type
Size
Units
Obligation
Domain

#3 Define your content standard early

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Standards Organizations

Internal Organization for Standards (ISO TC211)

191 15	Metadata
191 11	Spatial Reference
8601:2004	Date / Time
6709:2008	Point Locations

Open Geospatial Consortium

Universal Resource Names

GML Simple Dictionaries

Catalogue Services

…many more

#4 Use ISO and OGC when possible

Federal Geographic Data Committee

Cadastral
Orthoimagery
Elevation
Geodetic Control
Government Units
Hydrography
Transportation

Metadata
….and more

#5 FGDC standards are a good starting point

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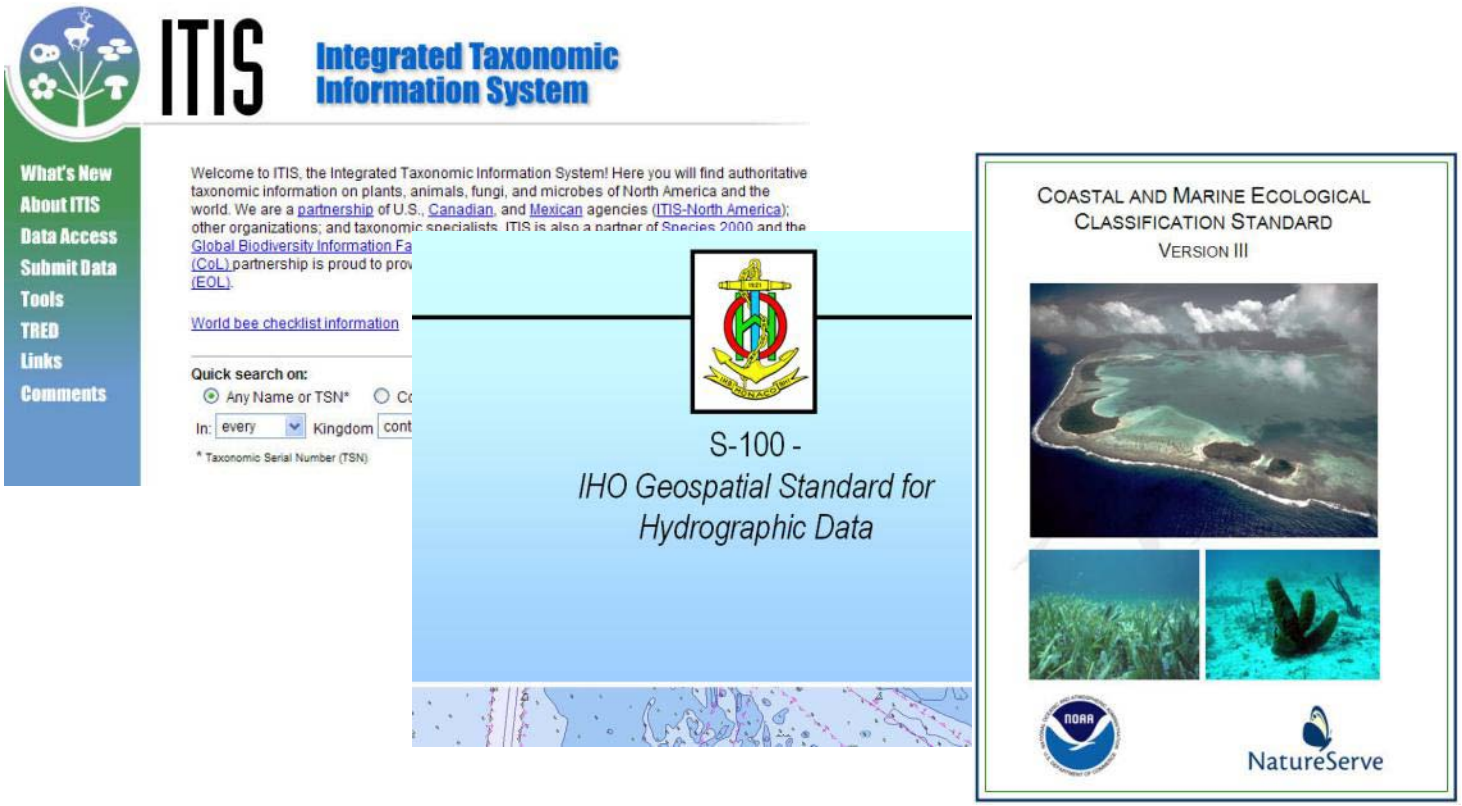
Community Content Standards



#6 Work with well defined communities

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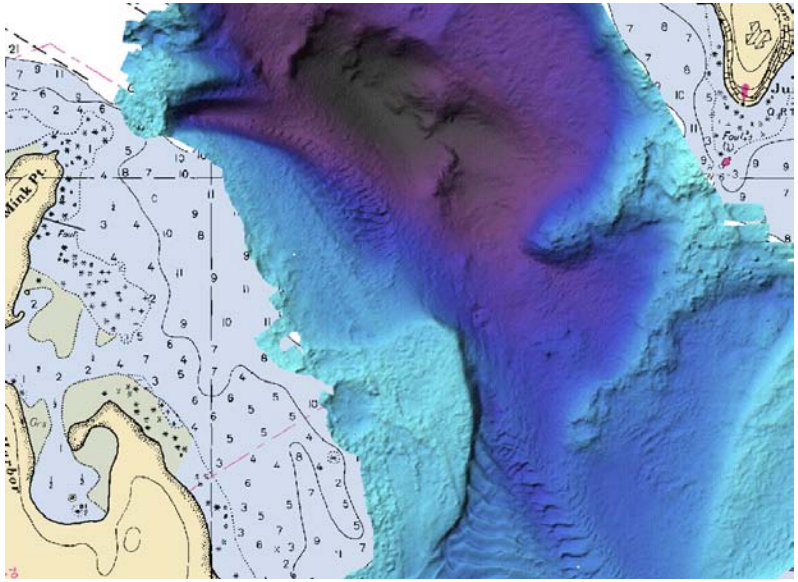
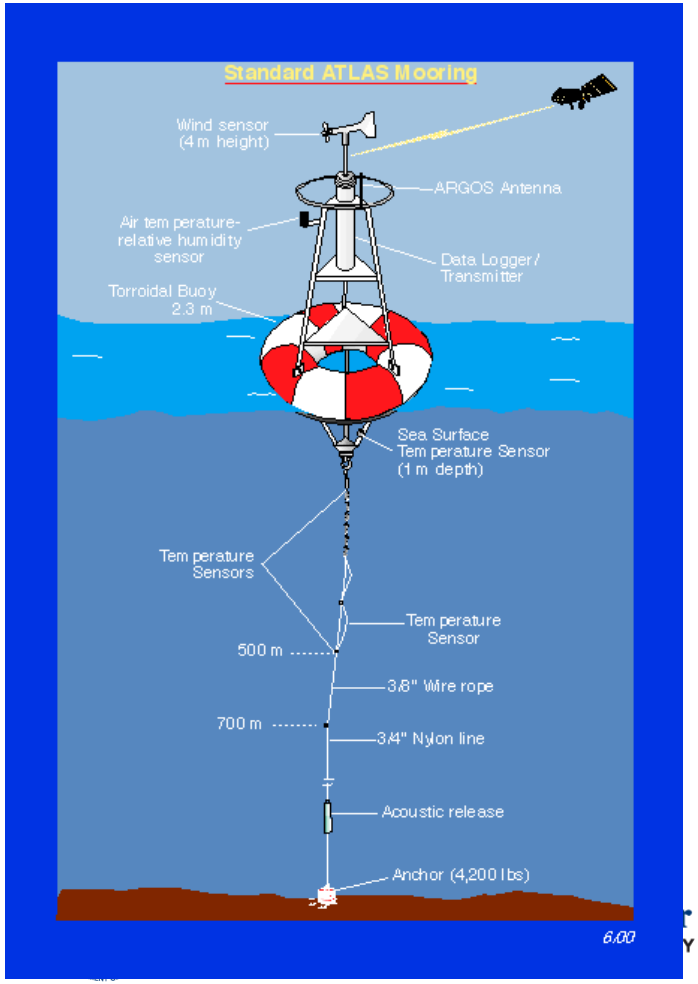
2.0 Data Structures

Spatial Attributes

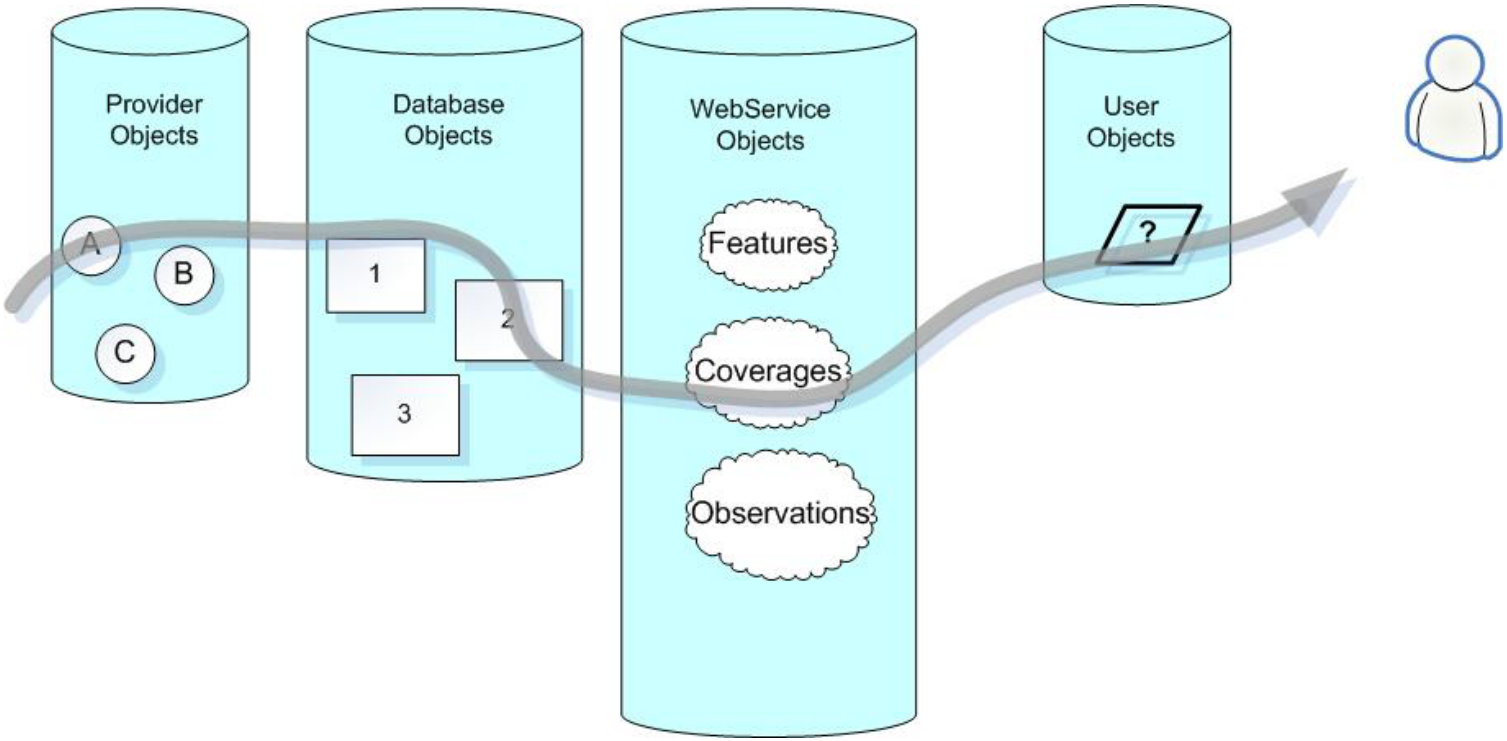


Non-Spatial Attributes



#7 Use common geometry types

Type Mapping



#8 Data types determine the web service

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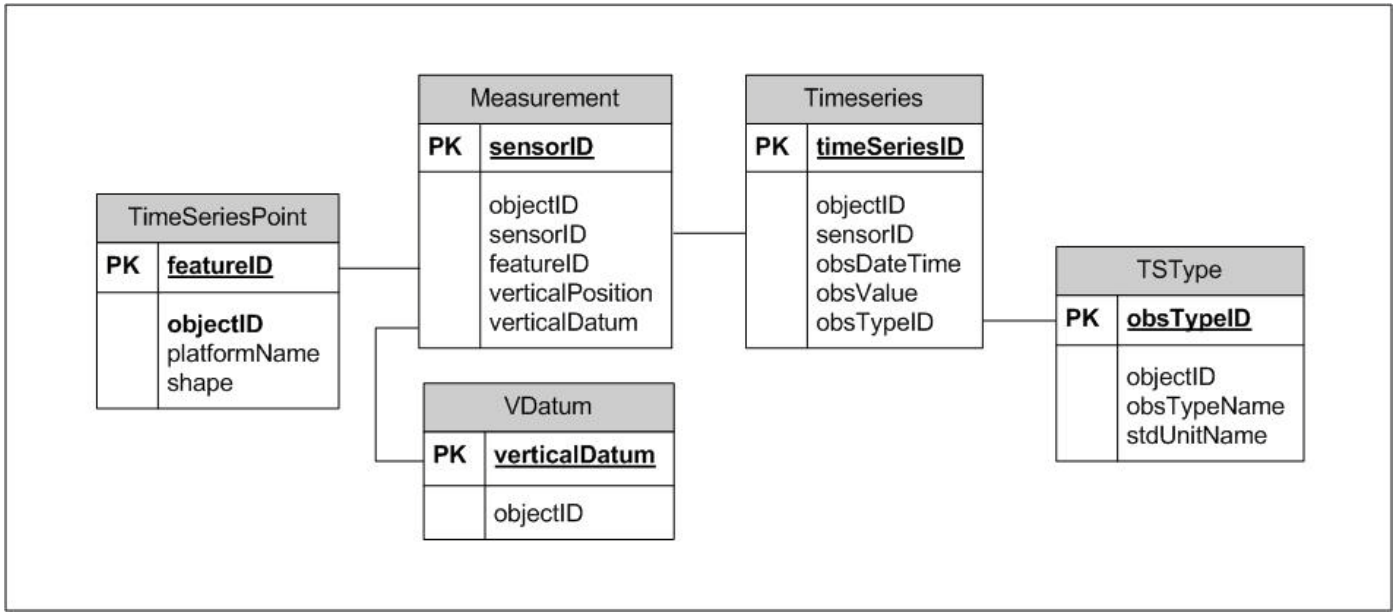
Database Modeling



#9 Maintain an independent storage architecture

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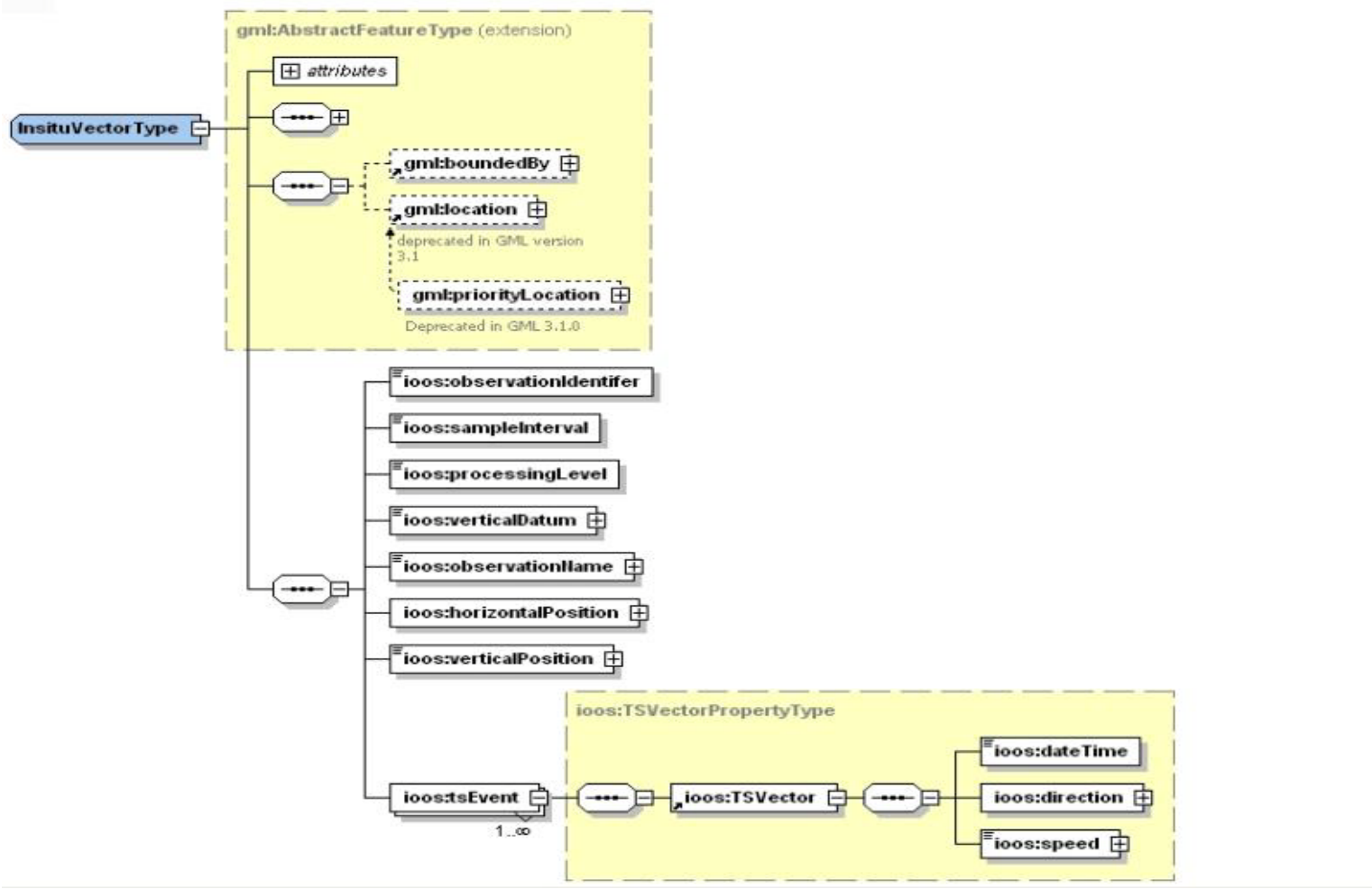
Web Service Data Modeling



#10 Objects should reflect real world phenomena

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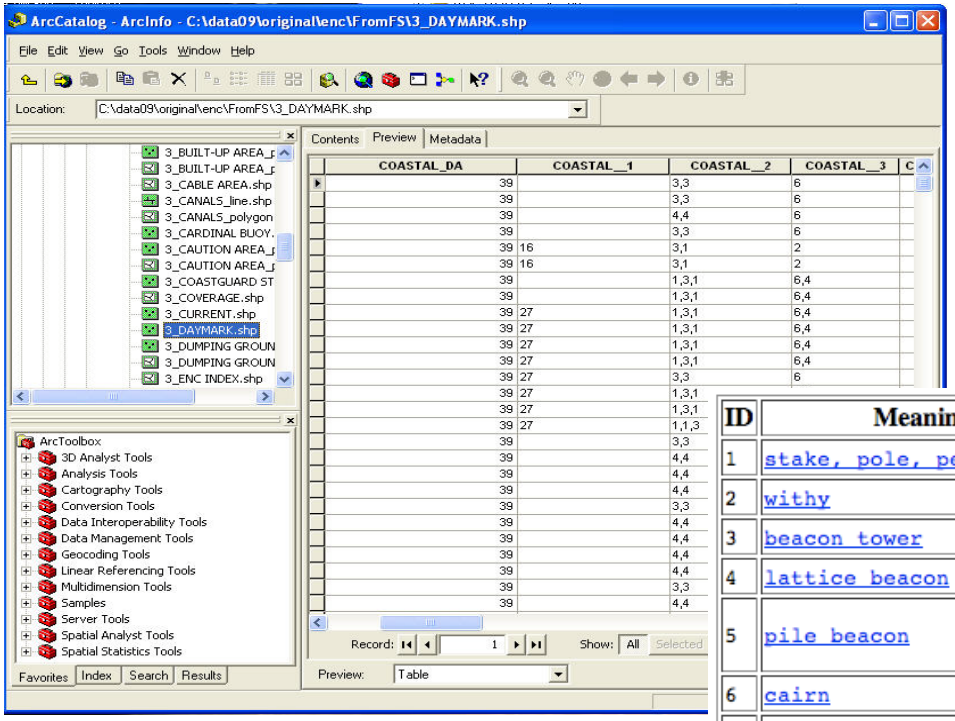
Optimize for Users



COASTAL_DA	COASTAL__1	COASTAL__2	COASTAL__3
39		3,3	6
39		3,3	6
39		4,4	6
39		3,3	6
39	16	3,1	2
39	16	3,1	2
39		1,3,1	6,4
39		1,3,1	6,4
39	27	1,3,1	6,4
39	27	1,3,1	6,4
39	27	1,3,1	6,4
39	27	1,3,1	6,4
39	27	3,3	6
39	27	1,3,1	
39	27	1,3,1	
39	27	1,1,3	
39		3,3	
39		4,4	
39		4,4	
39		4,4	
39		3,3	
39		4,4	
39		4,4	
39		4,4	
39		4,4	
39		3,3	
39		4,4	

ID	Meaning	INT 1	M-4
1	stake, pole, perch, post	IQ 90	456.1
2	withy	IQ 92	456.1
3	beacon tower	IQ 110	456.4
4	lattice beacon	IQ 111	456.4
5	pile beacon		
6	cairn	IQ 100	456.2; 7
7	buoyant beacon		459.1

#11 Account for end user tool requirements

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3.0 Data Encodings

XML Dialect

Schema

Generate XML

Geography Markup Language

```
<gml:featureMember>
 <gml:Point>
     <gml:pos>38.93141667 -74.90672222</gml:pos>
    </gml:Point>
```

GML Profiles by Restriction

Simple Features Profile
KML
GeoRSS

GML Profiles by Extension

Observation & Measurement
Sensor ML
Climate Science ML

#12 Use GML profiles when possible

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Schema = Template

#13 Avoid making a custom schema

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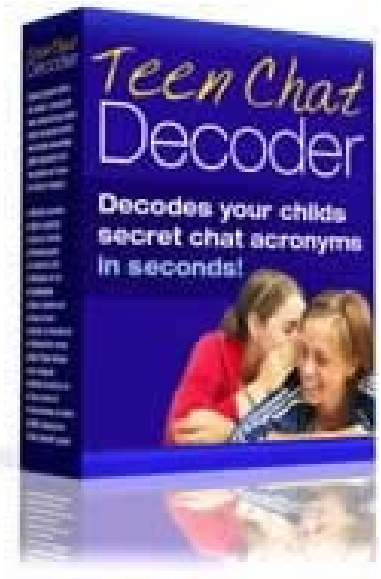
Helping Users Decode Your Data



COTS translators (ArcGIS, Excel, MatLab)

XML/GML libraries

Extensible Stylesheet Language Transformations

#14 Tune your model for easy decoding

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Recommendations

#1	*Start with a strongly typed data model*
#2	*Tune your data model to the situation*
#3	*Define your content standard early*
#4	*Use ISO and OGC when possible*
#5	*FGDC standards are a good starting point*
#6	*Work with well defined communities*
#7	*Use common geometry types*
#8	*Data types determine the web service*
#9	*Maintain an independent storage architecture*
#10	*Objects should reflect real world phenomena*
#11	*Account for end user tool requirements*
#12	*Use GML profiles when possible*
#13	*Avoid making a custom schema*
#14	*Tune your model for easy decoding*

Web Services in an IOOS Context

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Overview

Introduction

Revisit the Web Services Primer

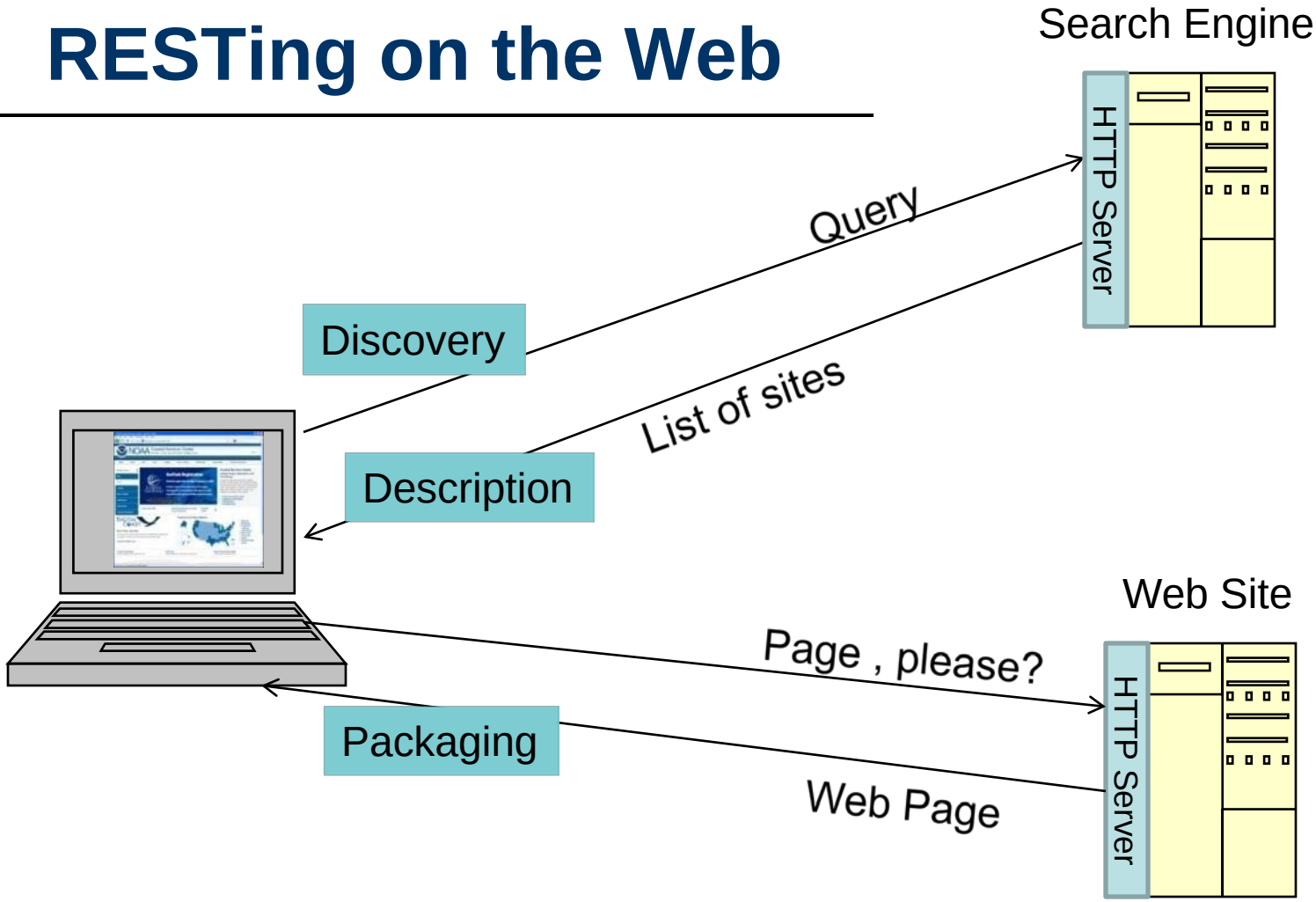
IOOS – What Is It?

The Coastal Services Center

Data Transport Laboratory

Lessons Learned?

RESTing on the Web



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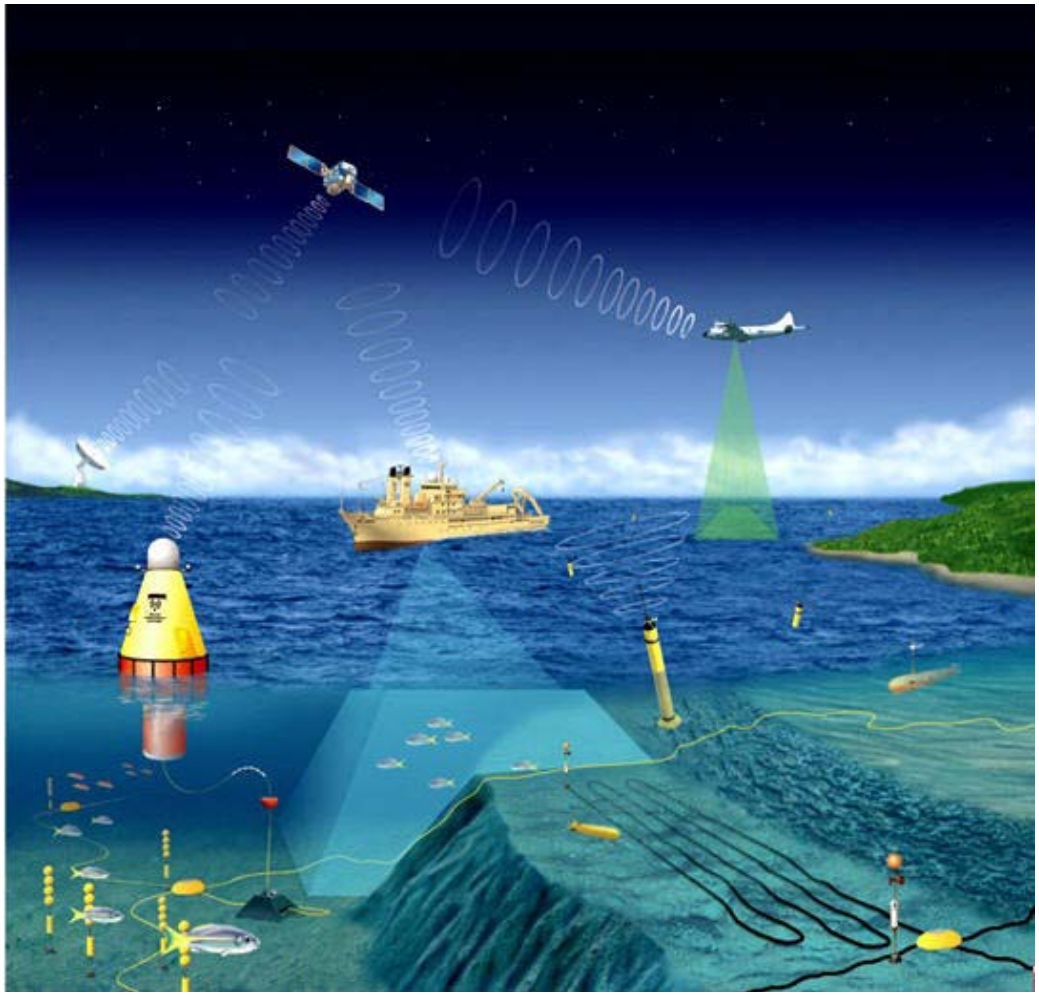
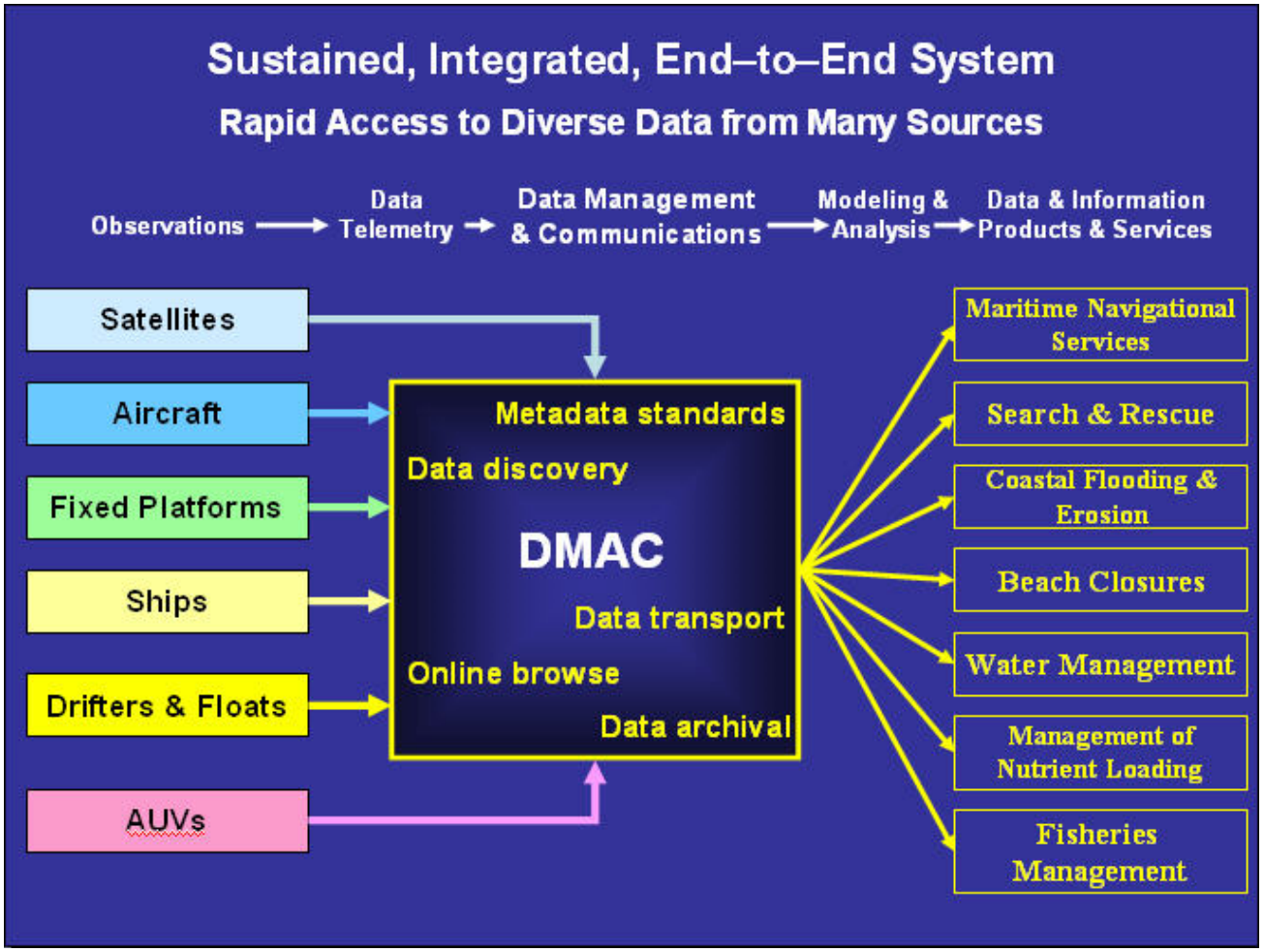
Integrated Ocean Observing System (IOOS)



IOOS is a system of systems that routinely and continuously provides quality-controlled data and information on current and future states of the oceans and Great Lakes from the global scale of ocean basins to local scales of coastal ecosystems. It is a multidisciplinary system designed to provide data in forms and at rates required by decision makers to address seven societal goals. (*www.ocean.us/what_is_ioos*)

Data Management and Communications (DMAC) defines the data transport strategy, architecture, and specifications.



(*www.ocean.us/what_is_ioos*)

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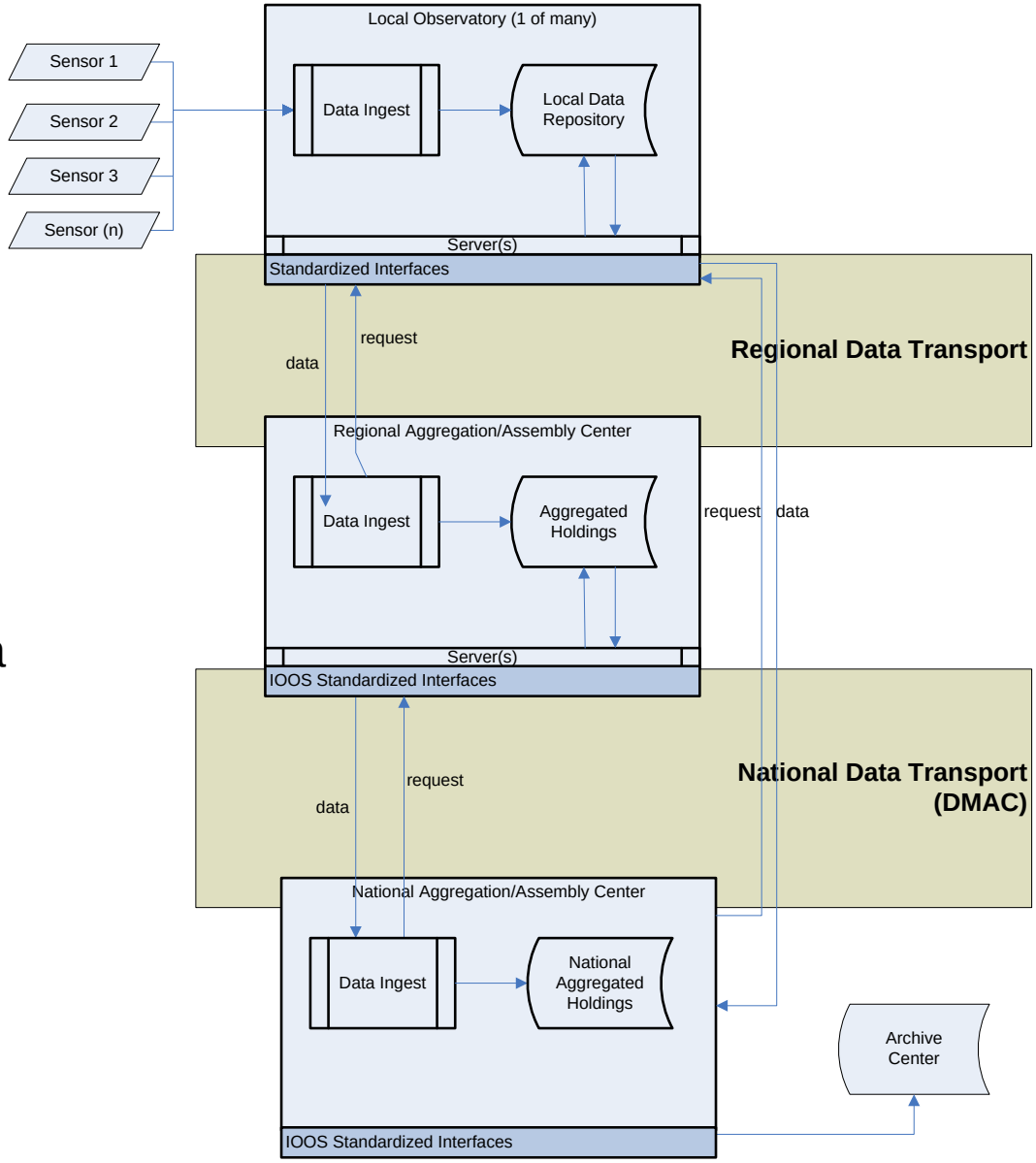
CSC Data Transport Laboratory (DTL)

- DMAC guidance is evolving, but incomplete.
- Data providers are left to try to anticipate and choose appropriate technologies.
- The aim of the DTL is to foster a convergence of data transport implementation practices among IOOS partners resulting in a consistent set of SOA interfaces to their data holdings.
- The DTL is an objective testing facility for candidate technologies.
- For more on the DTL, see *www.csc.noaa.gov/DTL/.*

DTL Use Context

- SOA-based approach
- Handling in-situ physical and chemical data
- Facilitates transport between a data collection facility (i.e. a local observatory) and an aggregation facility.
- Should be minimally invasive to data collection facilities systems and processes.
- Focuses on non-federal data providers



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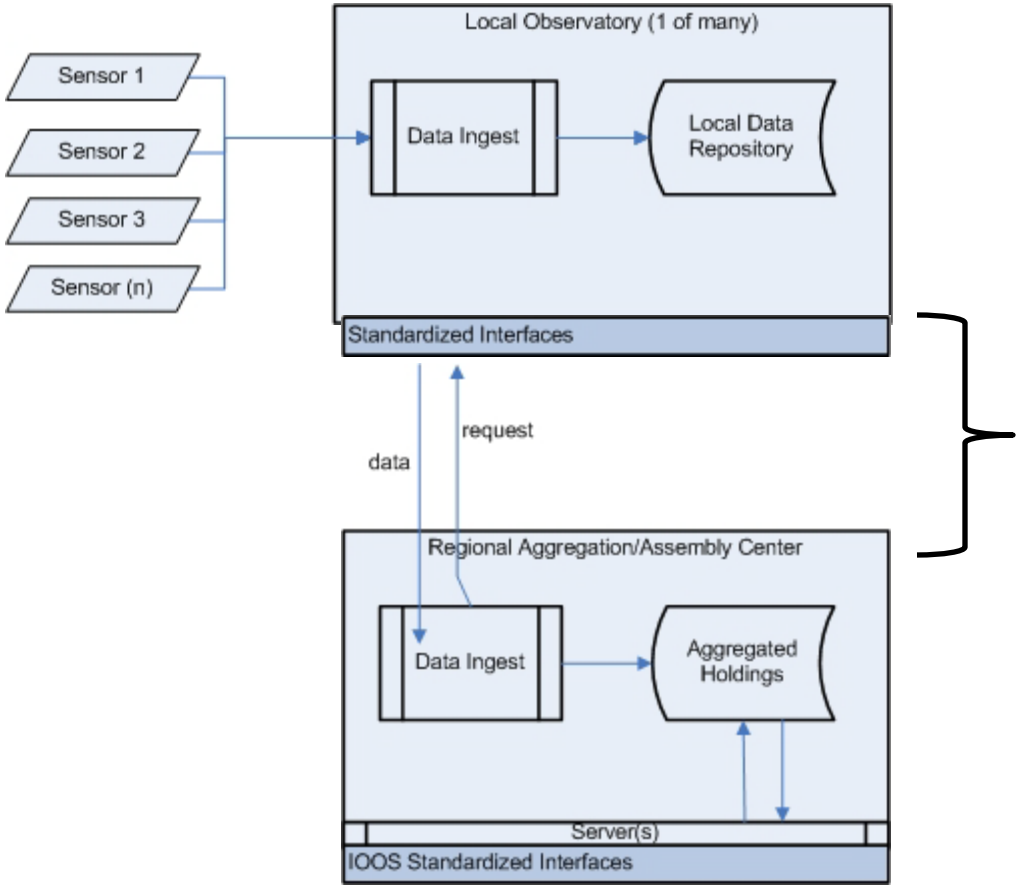
Use Context



Regional
Data Transport

DTL Project 1: OPeNDAP + netCDF + CF

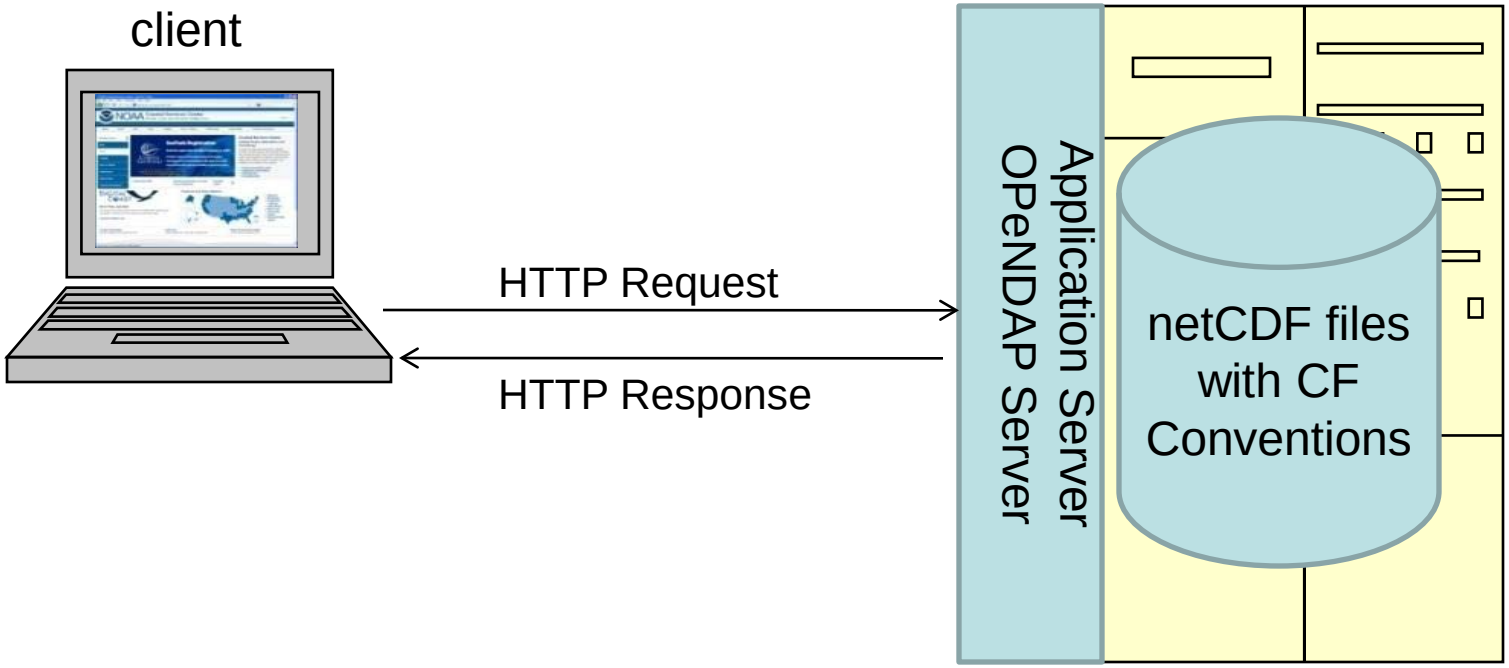
- OPeNDAP, or the Open-source Project for a Network Data Access Protocol, has been a significant data-sharing technology in the oceanographic community. See *www.opendap.org*.

- netCDF (network Common Data Form) is a set of software libraries and machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data.

- The Climate Forecast (CF) conventions define metadata that provide a definitive description of what the data in each variable represents, and the spatial and temporal properties of the data. This enables users of data from different sources to decide which quantities are comparable, and facilitates building applications with powerful extraction, re-gridding, and display capabilities.

- Recently adopted by the DMAC Standards Process.

DTL Project 1: OPeNDAP + netCDF + CF



Demo - http://dods.ndbc.noaa.gov/thredds/dodsC/data/stdmet/32488/32488h9999.nc.html (.das)(.dds)

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Mozilla Firefox

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http://dods.ndbc.noaa.gov/thredds/dodsC/data/stdmet/32488/32488h9999.nc.c

Dictionary.com

OPeNDAP Dataset Query Form | http://dods.ndb...488h9999.nc.das

```
Attributes {
    time {
        String long_name "Epoch Time";
        String short_name "time";
        String standard_name "time";
        String units "seconds since 1970-01-01 00:00:00 UTC";
    }
    latitude {
        String long_name "Latitude";
        String short_name "latitude";
        String standard_name "latitude";
        String units "degrees_north";
    }
    longitude {
        String long_name "Longitude";
        String short_name "longitude";
        String standard_name "longitude";
        String units "degrees_east";
    }
    wind_dir {
        String long_name "Wind Direction";
        String short_name "wdir";
        String standard_name "wind_from_direction";
        String units "degrees_true";
        Int32 _FillValue 999;
    }
    wind_spd {
        String long_name "Wind Speed";
        String short_name "wspd";
        String standard_name "wind_speed";
        String units "meters/second";
        Float32 _FillValue 99.0;
    }
    gust {
        String long_name "Wind Gust Speed";
        String short_name "gst";
        String standard_name "gust";
        String units "meters/second";
        Float32 _FillValue 99.0;
    }
    wave_height {
        String long_name "Significant Wave Height";
        String short_name "wvht";
        String standard_name "significant_height_of_wave";
        String units "meters";
        Float32 _FillValue 99.0;
    }
    dominant_wpd {
        String long_name "Dominant Wave Period";
        String short_name "dpd";
        String standard_name "dominant_wave_period";
```

Done

Mozilla Firefox

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:p://dods.ndbc.noaa.gov/thredds/dodsC/data/stdmet/32488/32488h9999.nc.dds

Dictionary.com

OPeNDAP Dataset Query Form | http://dods.ndbc.n...32488h9999.nc.das | http://dods.ndb...488h9999.nc.dds

```
Dataset {
    Int32 time[time = 72];
    Float32 latitude[latitude = 1];
    Float32 longitude[longitude = 1];
    Grid {
     ARRAY:
        Int32 wind_dir[time = 72][latitude = 1][longitude = 1];
     MAPS:
        Int32 time[time = 72];
        Float32 latitude[latitude = 1];
        Float32 longitude[longitude = 1];
    } wind_dir;
    Grid {
     ARRAY:
        Float32 wind_spd[time = 72][latitude = 1][longitude = 1];
     MAPS:
        Int32 time[time = 72];
        Float32 latitude[latitude = 1];
        Float32 longitude[longitude = 1];
    } wind_spd;
    Grid {
     ARRAY:
        Float32 gust[time = 72][latitude = 1][longitude = 1];
     MAPS:
        Int32 time[time = 72];
        Float32 latitude[latitude = 1];
        Float32 longitude[longitude = 1];
    } gust;
    Grid {
     ARRAY:
        Float32 wave_height[time = 72][latitude = 1][longitude = 1];
     MAPS:
        Int32 time[time = 72];
        Float32 latitude[latitude = 1];
        Float32 longitude[longitude = 1];
    } wave_height;
    Grid {
     ARRAY:
        Float32 dominant_wpd[time = 72][latitude = 1][longitude = 1];
     MAPS:
        Int32 time[time = 72];
        Float32 latitude[latitude = 1];
        Float32 longitude[longitude = 1];
    } dominant_wpd;
    Grid {
     ARRAY:
        Float32 average_wpd[time = 72][latitude = 1][longitude = 1];
     MAPS:
        Int32 time[time = 72];
        Float32 latitude[latitude = 1];
        Float32 longitude[longitude = 1];
```

Done

OPeNDAP Dataset Query Form - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://dods.ndbc.noaa.gov/thredds/dodsC/data/stdmet/32488/32488h9999.nc.h

Dictionary.com

Tested on Netscape 4.61 and Internet Explorer 5.00.

Action: Get ASCII | Get Binary | Show Help

Data URL: http://dods.ndbc.noaa.gov/thredds/dodsC/data/stdmet/32488/32488h9999.nc?time[0:1:71]

Global Attributes:

```
institution: "NOAA National Data Buoy Center and Participators in
Data Assembly Center"
url: "http://dods.ndbc.noaa.gov"
quality: "Automated QC checks with daily manual QC"
conventions: "COARDS"
station: "32488"
```

Variables:

time: Array of 32 bit Integers [time = 0..71]

time: 0:1:71

```
long_name: "Epoch Time"
short_name: "time"
standard_name: "time"
units: "seconds since 1970-01-01 00:00:00 UTC"
```

latitude: Array of 32 bit Reals [latitude = 0..0]

latitude: 0:1:0

```
long_name: "Latitude"
short_name: "latitude"
standard_name: "latitude"
units: "degrees_north"
```

longitude: Array of 32 bit Reals [longitude = 0..0]

longitude: 0:1:0

```
long_name: "Longitude"
short_name: "longitude"
standard_name: "longitude"
units: "degrees_east"
```

wind_dir: Grid

time: 0:1:0 latitude: 0:1:0 longitude: 0:1:0

```
long_name: "Wind Direction"
short_name: "wdir"
standard_name: "wind_from_direction"
units: "degrees_true"
```

Done

Mozilla Firefox

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http://dods.ndbc.noaa.gov/thredds/dodsC/data/stdmet/32488/32488h9999.nc.asci

Dictionary.com

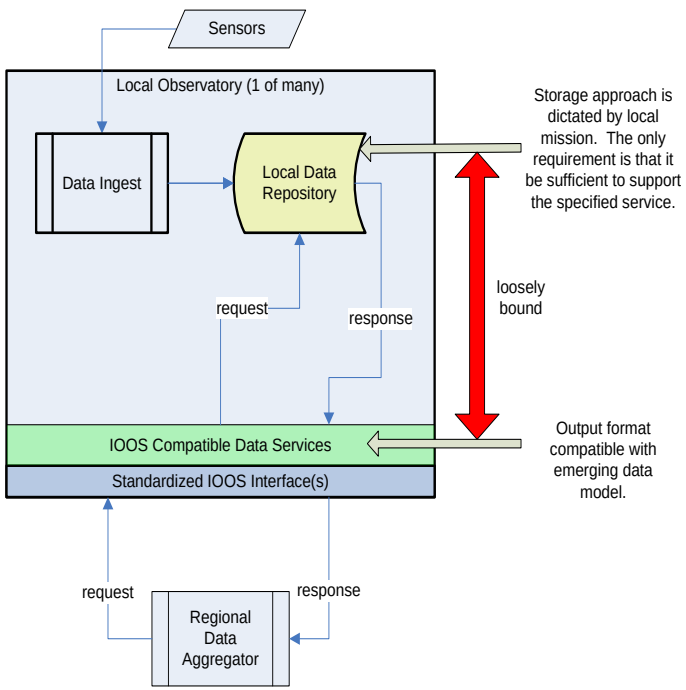
OPeNDAP Dataset Query Form | http://dods.ndbc....0][0:1:0][0:1:0]

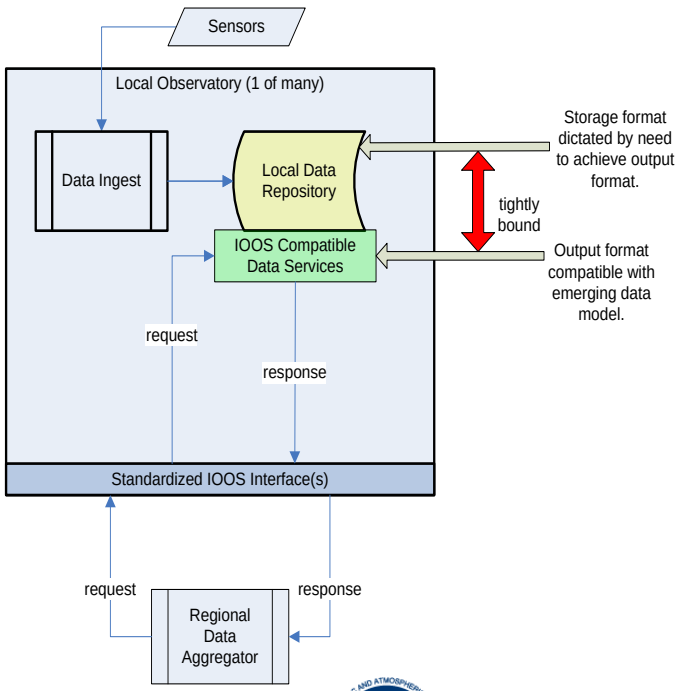
```
Dataset {
    Int32 time[time = 72];
    Float32 latitude[latitude = 1];
    Float32 longitude[longitude = 1];
    Grid {
     ARRAY:
        Int32 wind_dir[time = 1][latitude = 1][longitude = 1];
     MAPS:
        Int32 time[time = 1];
        Float32 latitude[latitude = 1];
        Float32 longitude[longitude = 1];
    } wind_dir;
} data/stdmet/32488/32488h9999.nc;
---------------------------------------------
time[72]
1229703000, 1229706600, 1229710200, 1229713800, 1229717400, 1229721000, 1229724600, 1229728200, 1229731800

latitude[1]
6.258

longitude[1]
-77.511

wind_dir.wind_dir[1][1][1]
[0][0], 999

wind_dir.time[1]
1229703000

wind_dir.latitude[1]
6.258

wind_dir.longitude[1]
-77.511
```

Done

OPeNDAP Findings

- **Pro**: Free and easily installed on supported operating systems
- **Pro**: Easily subset data on server side
- **Con**: The version 3 OPeNDAP servers are tightly coupled to the underlying data structure and semantics. As the data models evolve, the underlying data store will have to continuously evolve.*





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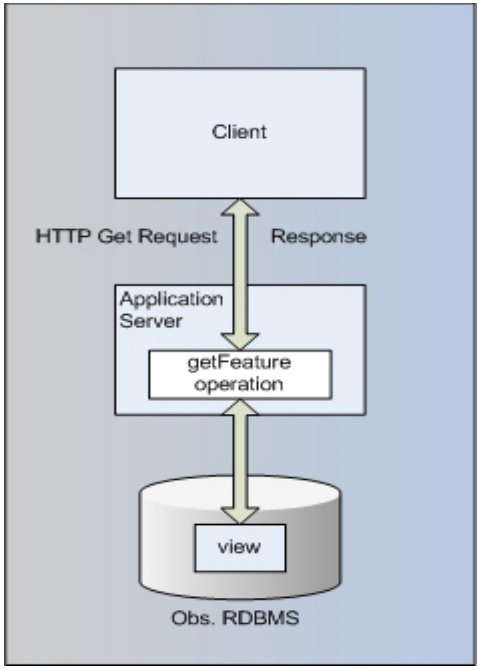
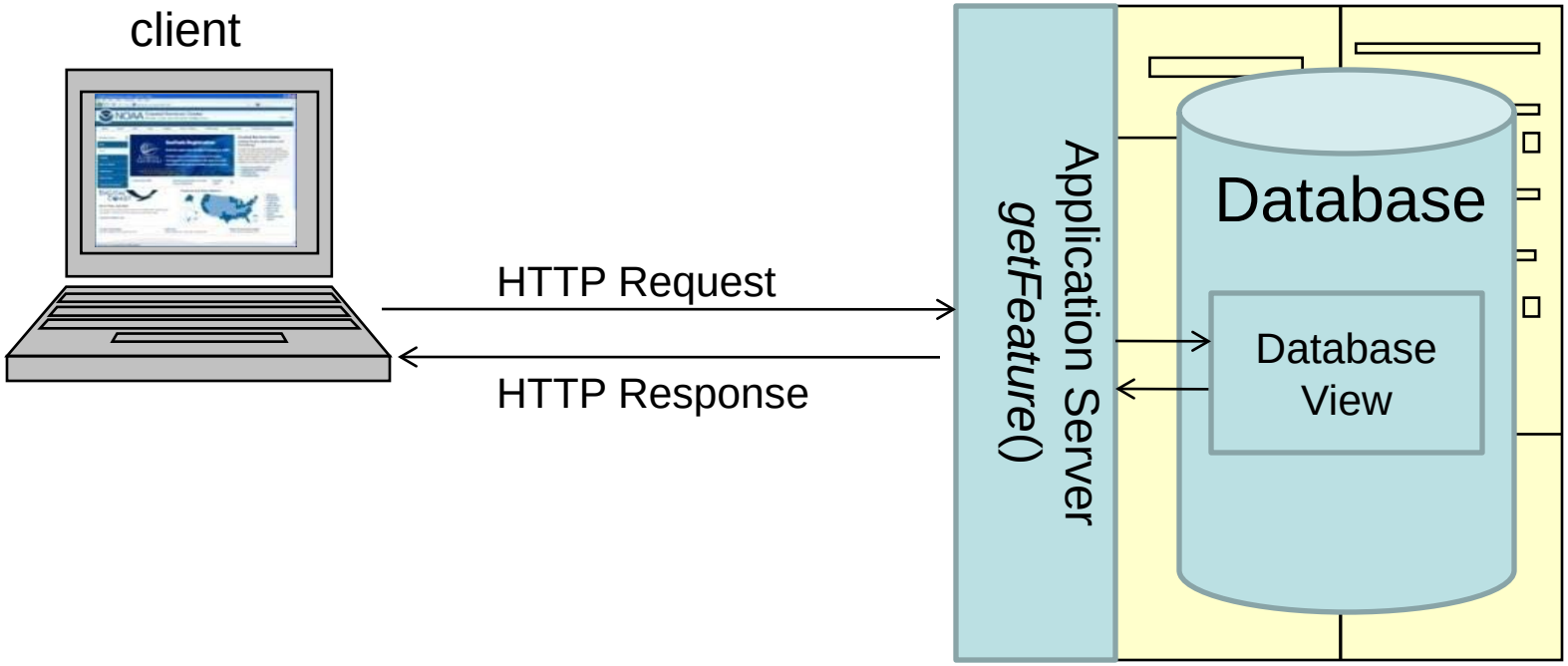
* Later versions of OPeNDAP servers add some flexibility.

DTL Project 4: OGC WFS/SFP + GML for Time Series In-situ Data (microWFS)

- WFS is a REST-based data transport specification that encodes results in GML.
- Geography Markup Language is an OGC XML dialect used to describe geographic features.
- Due to complexity, in order to facilitate use, the OGC created the Simple Feature Profile (SFP).
- The main emphasis of the project was to determine whether WFS/SFP could handle time series data.
- Neglected other WFS request types (getCapabilities, getFeatureType, etc.)



DTL Project 4: OGC WFS/SFP + GML for Time Series In-situ Data (microWFS)



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DTL Project 4 (microWFS): Demo

- **getFeature** returns data for that "feature" or sensor bounded by TIME and BBOX – http://csc-s-ial-p.csc.noaa.gov/cgi-bin/microwfs/microWFS.cgi?SERVICENAME=dtlservice&REQUEST=**getFeature**&SERVICE=microWFS&VERSION=1.1.0&OUTPUTFORMAT=text/xml;subType=gml/3.1.1/profiles/gmlsf/1.0.0/1&BBOX=-93.00,29.00,-95.00,30.00&TIME=2007-06-01T12:00Z,2007-06-01T14:00Z&TYPENAME=waterTemperature

- Input fields with typical input values for the microWFS were:
  - SERVICENAME=dtlservice
  - REQUEST=getFeature
  - SERVICE=microWFS
  - OUTPUTFORMAT=text/xml;subType=gml/3.1.1/profiles/gmlsf/1.0.0/1
  - VERSION=1.1.0
  - **BBOX=-93.00,29.00,-95.00,30.00**
  - **TIME=2007-06-01T12:00Z,2007-06-01T14:00Z**
  - **TYPENAME=waterTemperature**

Very simple form to hit the CSC DTL MicroWFS - Mozilla Firefox

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http://csc-s-ial-p.csc.noaa.gov/DTL/DTLProjects/microwfs/

Dictionary.com

Very simple form to hit the CSC DTL Perl microWFS

Target: csc-s-ial-p.csc.noaa.gov/cgi-bin/microwfs/microWFS.cgi	
-93.00,29.00,-95.00,30.00	BBOX: (max lon, min lat, min lon, max lat) in decimal degrees
2007-06-01T12:00Z,2007-06-01T14:00Z	TIME: (YYYY-MM-DD HH:MM,YYYY-MM-DD HH:MM)
waterTemperature	Observed Property
Submit Query	
Perl MicroWFS Documentation	

Done

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http://csc-s-ial-p.csc.noaa.gov/cgi-bin/microwfs/microWFS.cgi?SERVICENAME=

Dictionary.com

This XML file does not appear to have any style information associated with it. The document tree is shown below.


```
<!-- sample insitu time series record-->
-<!--
    Primary editor: Daniel Martin. Last updated 2007-05-09
  -->
-<gml:FeatureCollection xsi:schemaLocation="http://www.csc.noaa.gov/ioos http://www.csc.noaa.gov/ioos/schema/insituTimeSeries.xsd">
  -<gml:boundedBy>
    -<gml:Envelope srsName="urn:ogc:def:crs:EPSG:6.5:4326" srsDimension="2">
      <gml:lowerCorner>29.22 -94.4</gml:lowerCorner>
      <gml:upperCorner>29.73 -93.87</gml:upperCorner>
    </gml:Envelope>
  </gml:boundedBy>
  -<gml:featureMember>
    -<ioos:insituTimeSeries gml:id="ID5.17.1">
      <ioos:sensor codeSpace="urn:x-noaa:source:insitu:NFRA:2007a">SBPT2</ioos:sensor>
      <ioos:observationName codeSpace="urn:x-noaa:source:def:phyOcean:2007a">waterTemperature</ioos:observationName>
      <ioos:verticalDatum codeSpace="urn:x-noaa:def:verticalDatum"/>
      <ioos:verticalPosition uom="urn:x-noaa:def:uom:2007a:meter">0</ioos:verticalPosition>
     -<ioos:horizontalPosition>
      -<gml:Point>
        <gml:pos>29.73 -93.87</gml:pos>
      </gml:Point>
      </ioos:horizontalPosition>
     -<ioos:tsEvent>
      -<ioos:TSMeasurement>
        <ioos:obsDateTime>2007-06-01T12:00:00Z</ioos:obsDateTime>
        <ioos:observation uom="urn:x-noaa:def:noaa.units:2007a:Celsius">26.8</ioos:observation>
      </ioos:TSMeasurement>
      </ioos:tsEvent>
     -<ioos:tsEvent>
      -<ioos:TSMeasurement>
        <ioos:obsDateTime>2007-06-01T12:06:00Z</ioos:obsDateTime>
        <ioos:observation uom="urn:x-noaa:def:noaa.units:2007a:Celsius">26.8</ioos:observation>
      </ioos:TSMeasurement>
      </ioos:tsEvent>
     -<ioos:tsEvent>
      -<ioos:TSMeasurement>
        <ioos:obsDateTime>2007-06-01T12:12:00Z</ioos:obsDateTime>
        <ioos:observation uom="urn:x-noaa:def:noaa.units:2007a:Celsius">26.8</ioos:observation>
      </ioos:TSMeasurement>
```


Done

DTL Project 4 (microWFS): Findings

- **Pro**: the WFS employing the Simple Feature Profile and the GML-based XML schema handled in-situ time series data competently.
- **Pro**: for those partners with compatible database structures, creation of the necessary database view and installation of the server software was straightforward.
- **Pro**: both versions of the server software produced minimal response times, allowing for substantial data through put.

- **Con**: several partners either did not house their data in an RDBMS or their database structure was incompatible with the required database view.

Lessons Learned

- Consumers:
  - Know your options when using web services.
  - You will have to learn whatever method the host is providing.

- Hosts:
  - Consider your users and how they'll use your data.
  - Consider your user technical knowledge when deciding on a web services technology.
  - Design your web services for performance.
  - FTP is a completely valid method of providing data.
- Consider data providers and consumers in the data model development.
- Plan your data model to be independent of the data storage or sharing infrastructure.
- Strongly typing data is a cost-effective method to enhance interoperability.

Lessons Learned

- Adhere to classical SOA principles:
  - A well-designed data model for internal storage.
  - Data type appropriate data storage technology (file, RDBMS, spatially enabled RDBMS, etc.).
  - Employ separate complementary data storage and service layers.
  - Employ adequate yet minimally complex data transport formats.

- For dense or gridded data types such as imagery or model output, use OPeNDAP and/or WCS.

- For lighter point/value data types such as in-situ physical and chemical measurements, consider WFS or SOS.

- The difficult issues are often more cultural/social/administrative than technical.

- Invest in design and development of appropriate and effective storage solutions.