Automatic generation of self contained WebGIS sites using Open Sourse GIS

Olmo Zavala-Romero[1], Arsalan Ahmed[2], Eric P. Chassignet[3], Anke Meyer-Baese[1]

[1] Department of Scientific Computing, Florida State University, [2] Department of Computer Science, Florida State University, [3] Center of Ocean-Atmospheric Prediction Studies

Introduction

In the last couple of decades the amount of digital geospatial data have grown rapidly as a result of the number of satellites and the number of global positioning systems (GPS). To assist in the analysis and visualization of this new data, several Geographic information systems (GIS) as well as WebGIS sites have been developed. A good number of these applications are used to visualize scientific data on the Internet, like oceanographic, weather or climate data. These web sites share common features like being able to download data, obtain information from specific geospatial locations or overlap different layers into one map.

This work is a Java application, based on Java Servlets, that builds self contained WebGIS sites by dynamically creating HTML and JavaScript code. Each WebGIS site is easily configured using XML files. The data is displayed and serverd through map servers that complies with the Web Map Service (WMS), Web Coverage Service (WCS), and the Web Feature Service (WFS) standards like Geoserver, ncWMS, MapServer, ArcGIS Server, etc.

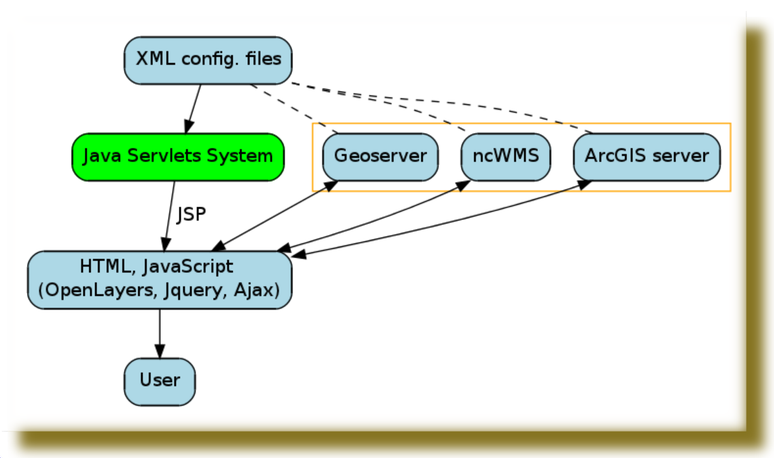
The web sites generated with this application already provide the following functionality to the user: visualize the data on Google Earth, download data in standard GIS formats (shape and GeoTiff files), visualize animations from netCDF data, generate vertical profiles and vertical transects, filter the visualized data by inserting queries using the Object Constrain Language (OCL), access data at specific geospatial locations and a nicely designed web user interface.

Architecture

The Open Geospatial Consortium has established a set of web protocols (WMS, WFS and WCS) for serving geospatial data across the web as images, XML files, shape files, plain text files and other formats.

This work configures the comunication, using the previously mentioned protocols, with online map servers by generating JavaScript code. It takes advantage of the Open Source JavaScript library **OpenLayers**, which makes extensive use of these protocols to serve and display georeferenced data over the internet.

The proposed process for creating WebGIS sites is the following. Obtain information about which layers are going to be displayed, the different texts that will be used like menus and titles, and from which map servers are these layers will be accessed, all these from XML files. This information is saved in a series of data structures: linked lists for the layers and trees for the menus. Finally, the system generates web pages, using Java Servlets and JSP's. This web pages have the proper configuration of OpenLayers to communicate directly between the user's machine and the map servers. The next diagram show the diferent actors involved in the process.



Acknowledgments

This system would not be possible without the following OpenSource libraries: OpenLayers, Geoserver and GDAL. Special thanks go to the Deep-C Consortium for sponsoring this project.

System configuration

Each WebGIS is configured with two files, one XML file and one Java properties file (txt file). In the Java properties file the user defines the **initial position of the map, the number of zoom levels, the maximum and minimum resolution of the map, and what is the extent of the map**. The XML file is used to define the **menus** (in different languages), the **layers** and their titles, and the url of the map servers where the layers are stored. This configuration can be splitted into more than one XML file for better organization. From these files a set of *Layer* objects are created. These objects relate with the menus by using two tree data structures as shown in figure [1] . The next text shows a basic example of a configuration file:

```
   <MenuConf xmlns:xsi=". . ." >
<!-- Defines the menus ids and the text to be displayed in different languages -->
      <MenuEntries>
         <MenuEntry ID="menuId" EN="Menu ENG" ES="Menu txt in spanish"/>
         <MenuEntry ID="menuId2" EN="Menu2 ENG" ES="Menu2 txt in spanish"/>
      </MenuEntries>
<!-- Defines the background layers, these maps are always visible below other layers -->
      <BackgroundLayers BBOX="-180,90,-90,180" server="http://...">
         <layer name="myBackground"/>
      </BackgroundLayers>
<!-- Defines the main layers of the map together with its title -->
      <MainLayers BBOX="-180,90,-90,180" server="http://...">
          <layer Menu="menuId,menuId" EN="Layer 1 English Title" ES="ESP " name="myMainLayer"/>
          <layer Menu="menuId,menuId2" EN="Layer 2 English Title" ES="ESP " name="my2ndMainLayer"/>
      </MainLayers>
<!-- Defines optional layers, these layers can be overlayed with each other and any main layer -->
      <VectorLayers BBOX="-180,90,-90,180" server="http://..." vectorLayer="true">
         <layer Menu="menuId" name="myOptionalLayer" selected="true" />
      </VectorLayers>
   </MenuConf>
```

This configuration will create a WebGIS site with one background layer, two base layers and one optional layer. The corresponding data structures genereted by the system are displayed in figure [1] . A screenshot of the menus created with this configuration is displayed on figure [2] .

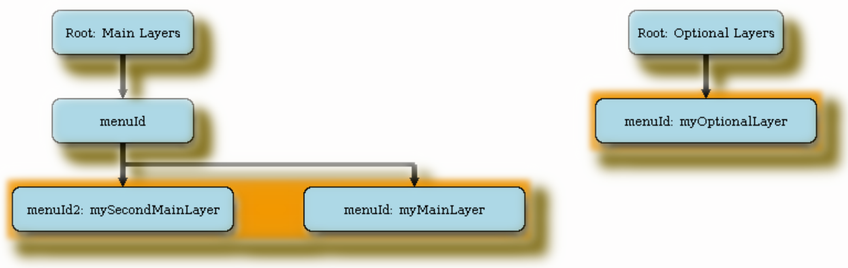


Fig 1. Objects created inside the system.

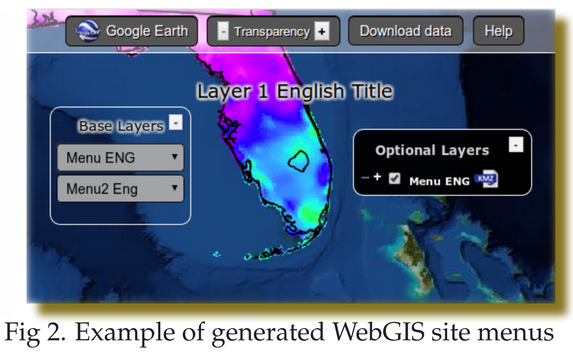
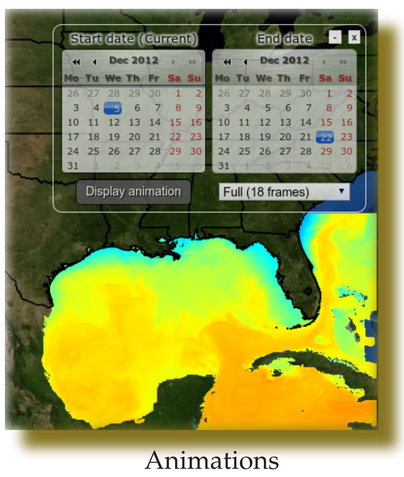


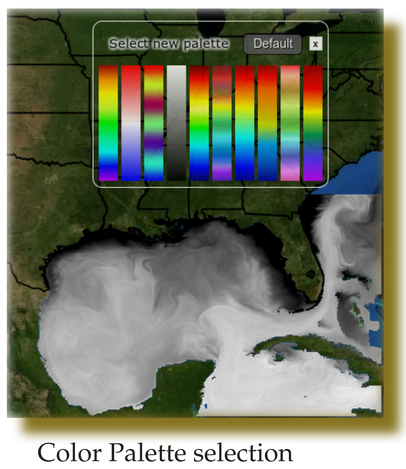
Fig 2. Example of generated WebGIS site menus

Results

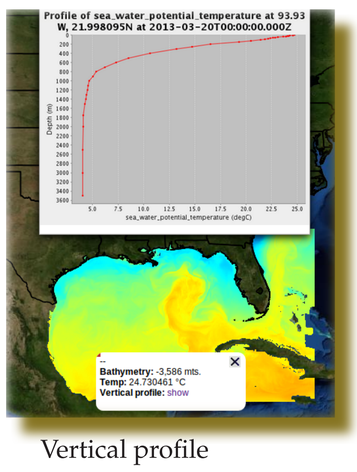
The following figures show the most important features that are being automatically configured by the system. The available features depend on the layer that is being displayed; for example, all the features related with time and depth are only availabe if the layer is being retrieved from netCDF files that contain 4D data.



Animations

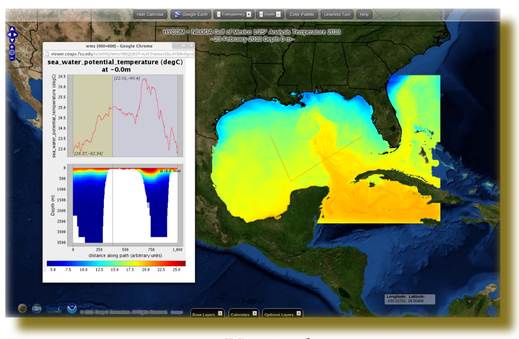


Color Palette selection

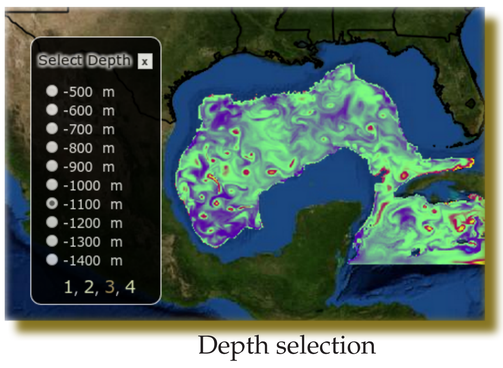


Vertical profile

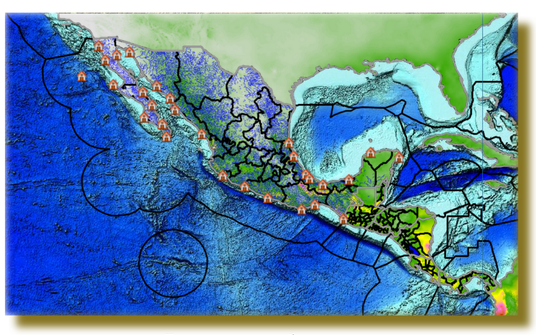
Top menu and draggable options



Vertical transects



Depth selection



Layer overlay

Google Earth display

Conclusion and future work

This software changes the standard approach for developing WebGIS sites by generating code automatically for the user rather than by a programmer, as a result of that, it allows non programmers to create sites by just configuring a set of XML files without writing a single line of code (Java or Javascript). This software can be used to visualize georeferenced data from many different sources, not only climatic or weather data, and it could become the standard software for building scientific WebGIS sites. As a future work we will keep adding more functionality that is important for the scientific community like creating animations from vertical transects or being able to download data in different formats. Aside from the new functionality some effort is being done to improve the displaying options, having an interface that works well on mobile devices as an example.