17.6 WEBMAP CALCULATOR: IMS BASED TOOLS FOR INTRA AND INTER-LAYER CALCULATIONS AND COMPARISONS

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1. INTRODUCTION

Pacific Marine Environmental Laboratory has created internet map servers (IMS) in support of oceanographic data access. Map servers work well to display and query data. They also work well for making maps available to the public. Sophisticated users have requested increased functionality in the map server applications, including the ability to perform inter and intra layer calculations with layers of data served in the map server. These tools allow users to select layers, define equations for calculations and send requests to a back-end server for computation. This method takes advantage of server-side scripting to create batch text files and uses Java and JSP scripting to perform computations. Display of the results is via an overlay or new shapefiles in the map servers.

This paper details the current implementation of WebMap Calculator. It further describes the next generation of this system that will provide increased functionality in a Motion Tracking IMS.

2. BACKGROUND

NOAA's Pacific Environmental Laboratory (PMEL) has created Internet Map Servers (IMS) to provide web based access to a variety of GIS applications within PMEL and other NOAA Laboratories. The RACEBASE IMS, created for the National Marine Fisheries Service's Alaska Fisheries Science Center (AFSC), displays a 20 year time series of fisheries survey data, oceanographic data and physical data such as coastlines. A prototype inundation modeling map server created for the Tsunami Inundation Mapping Effort (TIME) at PMEL provides tsunami inundation maps for the City of Seattle. The maps include maximum current speeds, maximum wave heights, census data and City of Seattle infrastructure data. Current versions of the map servers allow for data exploration, querying and the visualization of disparate data sets in one view.

As scientists have started to make use of the map servers, questions of how to expand IMS functionality has been a source of discussion. Emergency managers have identified the need to make on-the-fly calculations based upon modeled or real emergencies. Various users have asked if the map server technology be extended to perform back-end calculations between and on the displayed layers Examples that were discussed by scientists at NOAA included taking fisheries catch data and calculating the average catch for all trawls in a month. Another example would be to locate the areas where the water temperature is above 5 degrees Centigrade and calculating the catch in the defined areas. For the Tsunami map server, a desired calculation involves selecting the area where the inundation depth is greater than 2 meters and the current speed is over 0.5 m/sec and calculating the affected population based on the data in a census data layer. These functions are available in a standard version of ArcView or ArcGIS with a geoprocessing extension, but not available via the map server.

As developers work with map server technology, increasing customization of the map server software and interfaces are seen in applications. With the addition of the geoprocessing functions available in desktop systems to an IMS application, the potential user community for these applications will be broadened to include modelers and scientists,

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who have traditionally gone to other software packages to create and display their results. The modular Web Map Calculator architecture and tools will allow others to implement the tools in applications for a variety of analyses.

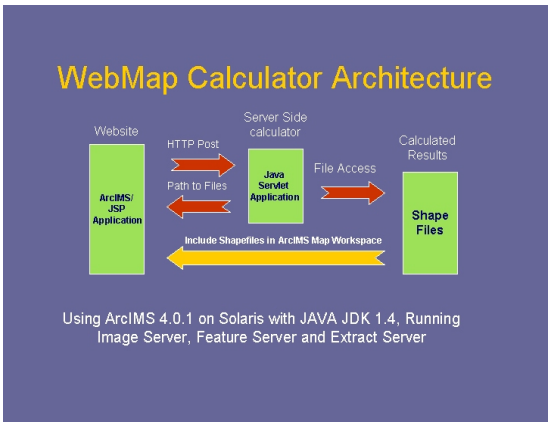

Fig. 1.WebMap Calculator Architecture

3. IMPLEMENTATION

The TIME Seattle Inundation Map Server (TSIMS) served as the first test of the Web Map Calculator. The TIME program creates projects from tsunami inundation model output for use by emergency managers in five states (Washington, Oregon, Hawaii, Alaska and California). The GIS component of the project involves ingesting base layer data from municipalities, NOAA's observational data and model output. The TIME suite of products includes static maps, animations and data reports that are produced from GIS analyses. The use of the Map Server brings frequently updated live maps to the emergency management community.

The Seattle prototype map server contains baseline layers of topography, shorelines and areas of steep slopes and liquefaction zones for the City of Seattle. The inundation results are gridded fields of maximum tsunami height or maximum current velocity at a 300m resolution. Initially, gridded fields were represented by polygons with the centroid value equaling the gridded field value for display in ArcIMS 3.0. With the release of ArcIMS 4.0.1, IMS sites are able to display grids and perform simple map functions with gridded data.

Web Map Calculator Prototype

Fig. 2 Tsunami Map Server

The functioning of the Web Map Calculator back end is invisible to the user. The user is presented with a web page with introductory text and a view of downtown Seattle. Census tract data are colored by population during the day or night and elevation information for the area is shown. An HTML form is displayed giving the user the option to generate a new shapefile that shows the area and population affected by a wave height of a specified height at a specified time of day. The request is sent to the JAVA backend calculator for geoprocessing on-the-fly. The resulting shapefile is either presented the user in a new map service or delivered to the user for use another application.

Fig. 3 Web Map Calculator front end

The resulting polygons are seen below.

Fig. 4 Census tracts affected by an inundation event

Toolkits to be added

The Tsunami Inundation Map Calculator gave the developers good foundation to begin developing geoprocessing routines and to explore the customization options in ArcIMS using JAVA technology. The need by the scientific and emergency management community for more enhanced features is apparent. Development of these tools makes the introduction and acceptance of map servers in the scientific community easier. As we continue to work on this project, we are planning to add several new toolkits for other projects within the NOAA community.

For example, NMFS would like to implement intra layer calculations between fisheries datasets and physical oceanography datasets such as salinity and temperature. The National Marine Mammal Laboratory at NMFS could use the tools to query satellite tracked mammal tracklines to determine swimming speeds and distance traveled within a certain time frame. These tools exist in many GIS applications, but the ability to create on the fly calculations, especially with real time data has not been fully explored.

We will also be explore using ArcEngine and JAVA to provide similiar functionality in a non-Map Server application. These tools may also be applied to NOAA's NowCoast Map Server (http://nowcoast.noaa.gov). The use of ArcEngine and JAVA 3D may allow us to create enhanced visualization fo GIS datasets.

4.0 Conclusions

Java/JSP was best fit for this application as it provides a good method to giving users extended functionality within a IMS application. Using JAVA/JSP allows for easier sharing of source code to other line offices within NOAA.

Standard algorithms and scenarios that can be made available to first responders to aid in the rapid analysis of data during a crisis are vital. Using a web based form to implement these in a map server is useful in the disaster management and planning. Using evolving web services to disseminate this information will be helpful. As a part of this, we will build a better geoprocessing back end with more types of analyses and more robust analysis tools. All of these applications will make map servers more useful, and attractive, to emergency managers and other scientists.

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6.0 REFERENCES

For more information about the Pacific Marine Environmental Laboratory, please visit the PMEL home page at http://www.pmel.noaa.gov

For more information about the TIME project, please visit the TIME homepage at http://www.pmel.noaa.gov/tsunami/time/.

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