GIS Role and Use in the Hurricane Katrina

(Final Draft)

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Abstract

ArcGIS has many applications in different fields. One of its used is to document evolution of the devastating hurricane Katrina in New Orleans area in 2005. This term paper will illustrate how GIS combined with other information analysis tools can process complex data sets. Also impact and benefits of the GIS applications. How GIS works to avoid another katrina

Introduction

Geographic Information System (GIS) is defined as an information system that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data, in order to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records also it can be used in natural disaster for rescue purposes.

GIS can also be defined as a system of hardware, software, data, people, organization and institutional arrangements for collecting, storing, analyzing, and disseminating information about areas of the earth.

Hurricanes are the costliest natural disasters in the United States. Understanding both hurricane frequencies and intensities is a topic of great interest to meteorologists, decision makers and the general public alike.

A hurricane is a type of tropical cyclone. Tropical cyclones are classified as follows: Tropical Depression (maximum sustained winds of 38 mph); Tropical Storm (maximum sustained winds of 39-73 mph), and Hurricane (maximum sustained winds of 74 mph or higher). Often the Saffir-Simpson Hurricane Scale shown in Table 1 is used to describe hurricane category. For instance, a hurricane of Category 5 has winds 156 mph and up and, it is expected to produce complete roof failure on many residences and industrial buildings. Some complete buildings and small utility facilities can be destroyed. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas is required.

Table 1. Saffir/Simpson Hurricane Scale [Simpson, R.H. (1974)].

Scale Number (Category)	Central Pressure (Millibars)	Central Pressure (Inches)	Winds (Mph)	Surge (Feet)	Damage
1	> 979	> 28.91	74-95	4 to 5	Minimal
2	965-979	28.50-28.91	96-110	6 to 8	Moderate
3	945-964	27.91-28.47	111-130	9 to 12	Extensive
4	920-944	27.17-27.88	131-155	13 to 18	Extreme
5	< 920	< 27.17	> 155	> 18	Catastrophic

Table 1: Saffir-Simpson Hurricane Scale

Hurricane Katrina was one of the deadliest hurricanes in American history. It was the eleventh named storm, fifth hurricane, third major hurricane, and second Category 5 hurricane of the 2005 Atlantic hurricane season, and was the sixth-strongest Atlantic hurricane ever recorded. This paper presents a background in hurricane climatology, advances in hurricane forecast, Katrina's evolution and the impact in New Orleans area.

The hurricane season for the Atlantic Basin (the Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico) lasts from 1 June to 30 November. The peak of the season is from mid-August to late October, which correlates with the period of maximum sea surface temperature (SST) over Atlantic Area where hurricanes are formed. However, deadly hurricanes can occur anytime during the hurricane season (Figure 1). Hurricanes formation and their tracks depend on the time of year and different areas of the country have high risk during different months. Track patterns can vary considerably from year to year, and this aspect remains difficult to predict (Figures 2).

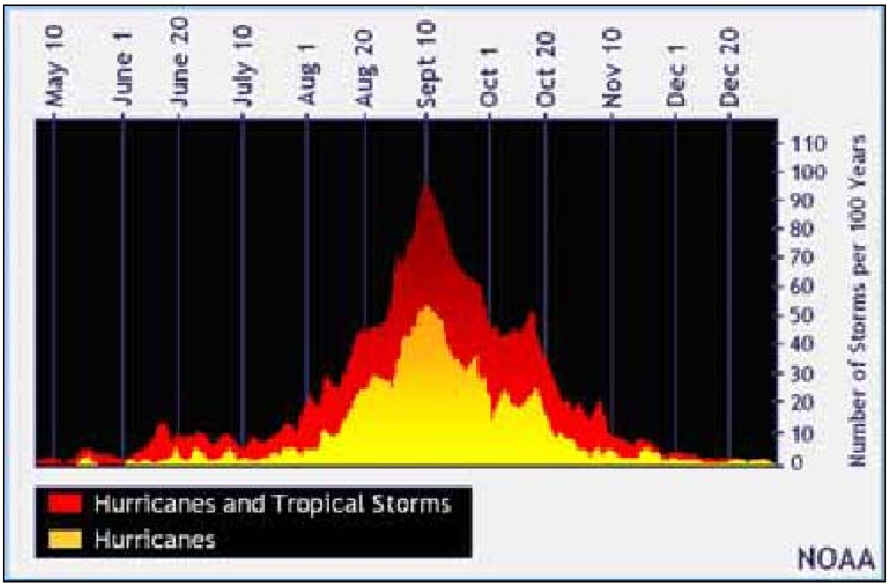

Figure 1: Seasonal distribution of hurricanes and tropical storm.
(Source: NOAA/National Hurricane Center).

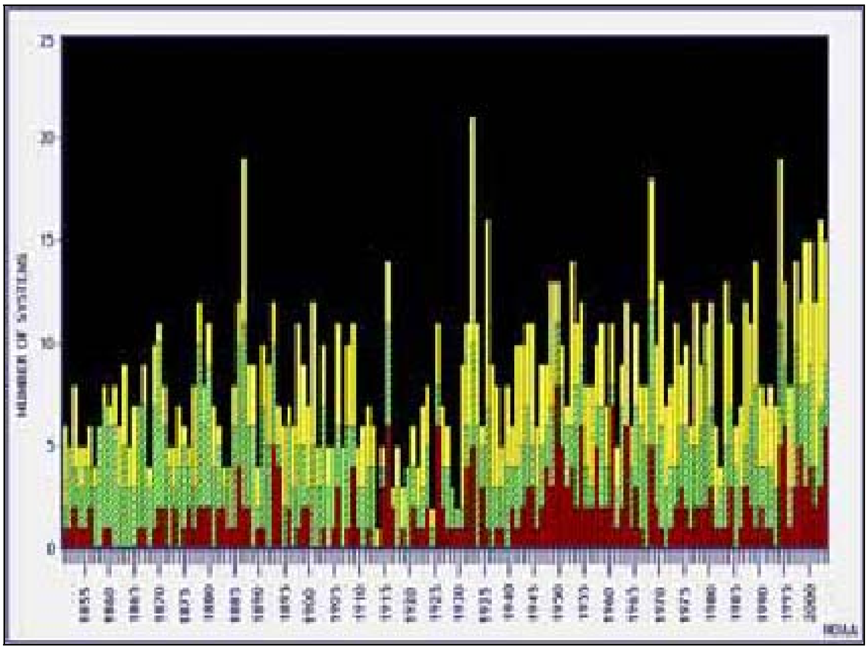

Figure 2: Bars depict number of named systems (open/yellow), hurricanes hatched/green), and category 3 or greater (solid/red), for the time interval 1886-2004.
(Source: NOAA/National Hurricane Center).

Objectives

The objective of this term paper is to presents a background in hurricane climatology, advances in hurricane forecast, Katrina's evolution and the impact in New Orleans area.

Illustrate ArcGIS applications to analyze the demographic data in New Orleans and determine factors that could contribute to difficulty in rapid and total evacuation of population from the flooded area.

Methodology of Study

Research indicates that there is no strong correlation between storm activity early in the hurricane season and activity in the rest of the period. Over many years, hurricanes have cycles of greater and lesser activity and current models are showing progress in the ability to forecast annual tropical storm and hurricane evolution. However, there are currently no models to make long-range predictions of the specific locations where hurricanes might strike. In this sense, for practical purposes, short term forecast (days) remains critical for predicting the track and intensity, and for disaster management.

Figure 3 shows the zones of origin and tracks of hurricanes for the month of September. The figure only depicts average conditions, and hurricanes can originate in different locations and travel much different paths from the average.

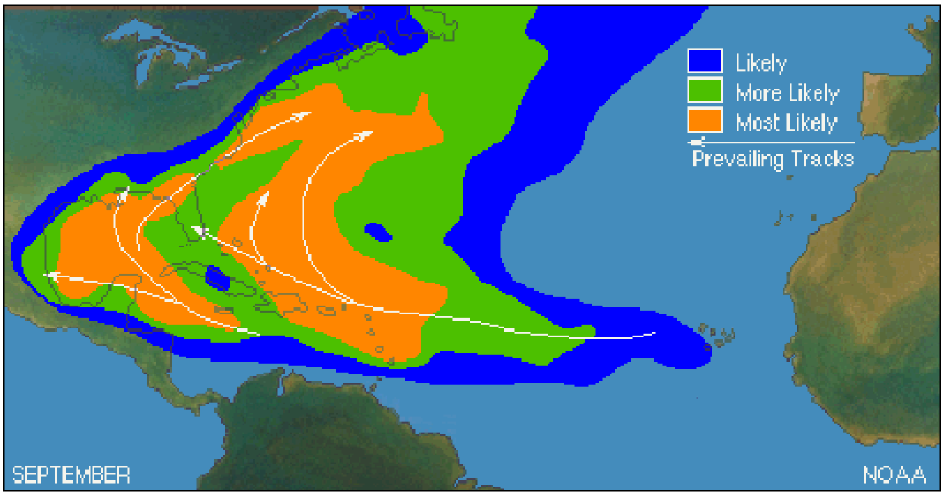

Figure 3: The zones of origin and tracks for September, one of the most active months during the hurricane season. (Source: NOAA/National Hurricane Center).

Hurricanes form in areas of high sea surface temperature (SST) values, which are illustrated below in Figure 4 for month August (climatic values, from the National Weather Service - NWS). The correlation between variations of SST and hurricane formation is not simple, but studies show that in 2005 there were positive anomalies of SST in Atlantic region coinciding with very intense tropical storms activity. From Figure 5 we note that the highest SST values are located in east tropical Pacific, and in fact, only 11% of the world's tropical cyclones develop in Atlantic.

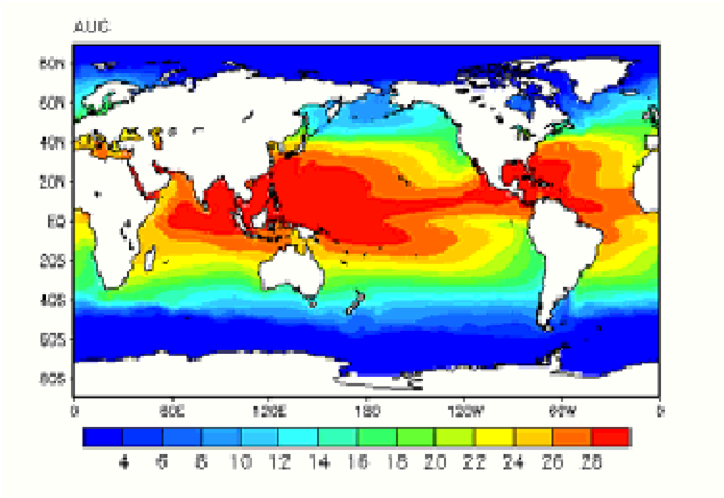

Figure 4: Sea surface temperature (SST) can enhance hurricane intensity (climatic values for August). Notice the high SST in the Gulf of Mexico. The temperature units on the color bar are in Celsius degrees. (Source: NWS Climate Prediction Center).

Hurricane Prediction Resources

The hurricane forecast is conducted by the National Ocean and Atmosphere Administration (NOAA) National Hurricane Center -Tropical Prediction Center. In the same time, significant research effort by NASA, NOAA, NCAR, universities, and other agencies is focused on understanding the mechanism of hurricane formation and evolution. Satellite, radar, aircraft, soundings, and surface data are used to monitor the development and evolution of tropical cyclones and hurricanes. Such data is also used in numerical models to forecast detailed evolution of the cyclone. Results from models and observations are used operationally to inform the decision makers and the public. It have seen significant progress in hurricane forecast in the last two decades, and the accuracy of hurricane parameters (especially track and intensity) continues to improve with the advance in computer power and observational systems (Figure5).

Due to natural volatility in tropical cyclone track characteristics, annual errors can vary significantly from year to year. In some of the past 20 years the average forecast errors have departed from the long-term trend line by as much as 50%. The number of storms each year can also vary greatly, and climate numerical models are used to link this variability to fundamental physical causes of the atmosphere – ocean global system. A series of specialized tools have been produced to address the forecast, data analysis, and results dissemination. The complexity of hurricane data combined with their impact on economical and social factors provides an example where GIS is used in various aspects of data analysis and disaster management.

Figure 5: Annual average model track errors for Atlantic basin tropical cyclones
for the period 1994-2005, for a homogeneous selection of "early" models.
Legend shows various models used in evaluation. (Source: NOAA/National Hurricane Center).

Latest National Hurricane Center Update on Katrina for August 29, 2005: At 10 a.m. CDT the center of Hurricane Katrina moved ashore near the Louisiana-Mississippi border. The center of Hurricane Katrina was located near the mouth of the Pearl River about 35 miles east-northeast of New Orleans, Louisiana and about 45 miles west-southwest of Biloxi, Mississippi. Katrina is moving toward the north near 16 mph, and maximum sustained winds are near 125 mph, with higher gusts. Katrina is now a Category Three hurricane. Coastal storm surge flooding of 15 to 20 feet above normal tide levels along with large and dangerous battering waves can be expected near and to the east of the center. Rainfall totals of 5 to 10 inches with isolated maximum amounts of 15 inches are possible along the path of Katrina across the gulf coast and the Tennessee valley. A few tornadoes are possible over portions of southern and eastern Mississippi, southern and central Alabama, and the western Florida panhandle today. This information was derived from the National Hurricane Center website.

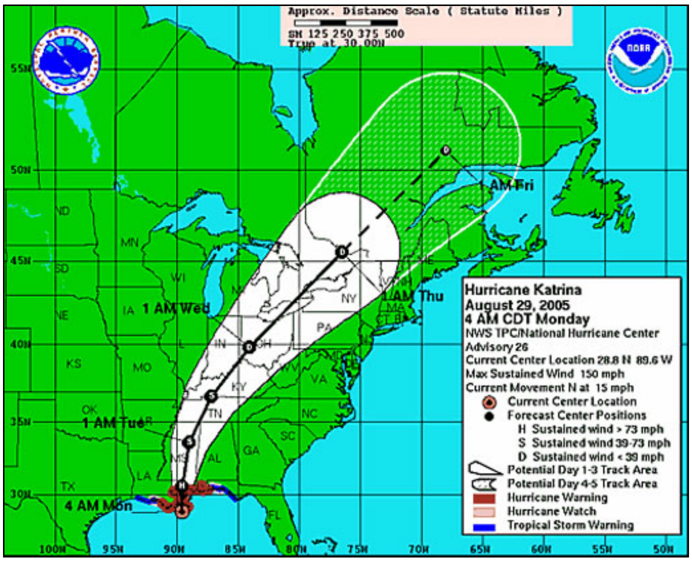

Figure 6: shows Katrina's predicted path for the next three to five days.
(dated August 28, 2005) from the National Hurricane Center

The Tropical Rainfall Measuring Mission (TRMM) is a joint mission between NASA and the Japan Aerospace Exploration Agency (JAXA) designed to monitor and study tropical rainfall. Credit: NASA/JAXA. They keep updating images of Hurricane Katrina as the shown below in figure 7.

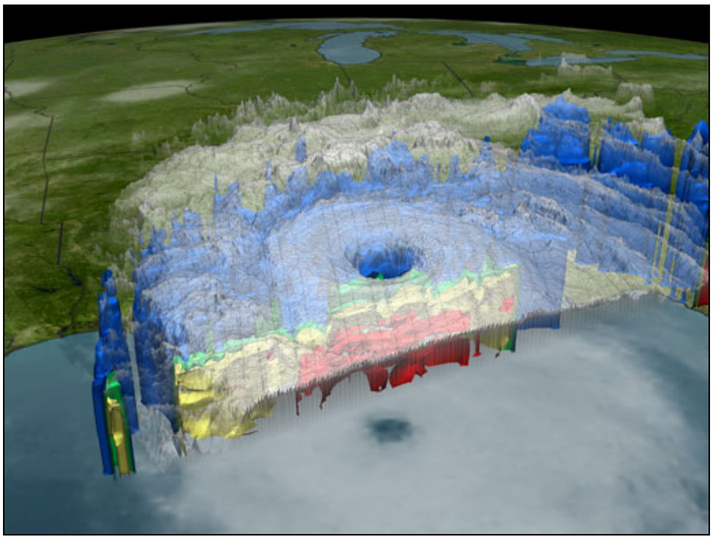

Figure 7: Image of Hurricane Katrina on Sunday, August 28, 2005 at 5:30 PM EDT (21:33 UTC) as seen by the Tropical Rainfall Measuring Mission (TRMM) satellite's PR (Precipitation Radar), VIRS (Visible Infrared Scanner), TMI (Tropical Microwave Imager) and the GOES spacecraft.

TRMM looks underneath of the storm's clouds to reveal the underlying rain structure. Blue represents areas with at least 0.25 inches of rain per hour. Green shows at least 0.5 inches of rain per hour. Yellow is at least 1.0 inches of rain and red is at least 2.0 inches of rain per hour.

Initial Steps Prior to ArcGIS Applied

On August 29, 2005, Hurricane Katrina ripped through the central Gulf Coast of the United States leaving in its path a wave of despair and destruction. As the need for outside help was apparent, groups such as GISCorps were solicited to provide various services to the operations of recovery and damage assessment in Mississippi. GISCorps volunteers from around the country rushed to the area in four waves to provide predominately their map-making skills to the various agencies involved in the response and recovery effort. These maps provided support to these efforts by allowing them to be carried out in a faster and more efficient manner. Many lessons were learned from this experience, but most importantly, that GIS is a valuable tool and the data needed to utilize GIS to its full potential should be available and incorporated into disaster plans before a crisis occurs.

Founded in 2003, GISCorps, a subsidiary of the Urban and Regional Information Systems Association (URISA), is a volunteer-based organization that provides short-term GIS services to underprivileged communities around the world. The intention of GISCorps volunteers is to implement "the URISA vision of advancing the use of geospatial technologies with missions that provide GIS expertise for humanitarian relief, economic development, sustainable development, indigenous capacity building, aboriginal rights, health and education" .

After the hurricane hit, Talbot Brooks, a volunteer from the Center for Interdisciplinary Geospatial Information Technologies program at Delta State University, called upon GISCorps as a service provider. He contacted Shoreh Elhami, chair and co-founder of GISCorps, to organize the immediate deployment of volunteers to assist with recovery efforts. The GIS community was eager to assist with the operation and more than 500 volunteers filled out application forms to assist in the effort (www.giscorps.com). Because they were called upon suddenly, the GISCorps volunteers were unaware of what exact services were needed and consequently, each had very different experiences based upon: the immediate needs in the various coastal counties of Mississippi; their role in the response; duration of deployment; services provided; and location.

Many volunteers from around the country were deployed in four installments from August 31, 2005, about a week after the storm hit, through September 26. Ideal volunteers included those with “enough GIS experience to work effectively in an emergency situation; have expertise in map production, performing analysis, data management, etc.; and have expertise in disaster management and working with GPS equipment” (www.giscorps.com). Included in this wide variety of volunteers were Twyla McDermott, a strategic technology planner and GIS manager from City of Charlotte Office of Strategic Technology Planning and Lucia Barbato from Texas Tech University. They were both involved in the damage assessment and recovery efforts in Mississippi. Lucia, a volunteer with the second deployment, arrived in Wiggins, a small community in Stone County, Mississippi, on September 13 after being notified of the need for volunteers on September 11. She was involved in assisting various agencies such as the Federal Emergency Management Agency (FEMA) and the Army Corps of Engineers in damage assessment operations through database and map creation projects.

Along with these volunteers with extensive GIS experience, community members and local graduate students played an extremely important role by taking part in the damage assessment, recovery, and response efforts through extensive data collection and the creation of maps.

GISCorps volunteers assisted agencies at the national, state, and local levels. The Mississippi Emergency Management Agency (MEMA) was in charge of operations due to states rights issues; therefore, actions of the National Guard, FEMA, and other agencies were delegated through MEMA. MEMA had an Emergency Operations Center with emergency service functions split into categories such as Public Works, Operations, Health, and Energy. Because GIS had no set designation, it was classified as part of the Operations service function. The purpose of this operations center was to solve problems through coordination among the various functions. GIS volunteers were able to create six operation divisions for their geospatial information technologies (GIT) activities in order to complete delegated tasks more efficiently and independently.

While some volunteers were working in this more organized environment, others such as Lucia Barbato were working from a makeshift office in an old train depot in Wiggins, Mississippi (Barbato, personal communication, 2/28/06). Regardless of location and resources, the GISCorps volunteers were all working towards a common goal of assisting agencies including FEMA, MEMA, the Army Corps of Engineers, Navy Seabees, and the Red Cross to undertake their damage assessment and recovery operations more quickly and efficiently. This was done by applying the tool of GIS through data development, map creation, and technical support.

Description of ArcGIS Application

Prior to landfall, several GIS applications were completed such as a HAZUS, a modeling tool used to assess damages from natural hazards, as well as predicting storm surges and tree fall. However, this was not done by GISCorps' volunteers since they did not arrive until one week after landfall. Rather, it was done by Talbot Brooks and some of his colleagues.

Because GISCorps arrived one week after Hurricane Katrina hit, they were not working on GIS applications in the true sense of the term. That is to say, they did not create a specific tool to meet a desired function. As mentioned earlier, they applied GIS tools, or geospatial technologies, to do some relatively straightforward analysis and significant map generation. Nevertheless, their contributions were extremely valuable.

When the volunteers first arrived, they were unsure of what to expect and ultimately, they responded to what was needed in the moment. The Emergency Operations Center's purpose was to solve problems, to make operations happen, and to coordinate. When they became aware of an issue, the representatives from each function would get together to solve that problem. Because of the nature of this work, the purpose and role of the GIS applications was very fluid and dynamic. Therefore, the GISCorps focused on both immediate post-disaster work as well as recovery applications.

In many of these applications, they used Core ArcGIS, specifically spatial analyst and they also did extensive geocoding. The breadth of the applications was extensive. For example, they assisted with the translation of street addresses to latitude/longitude and the mapping of these grids for search and rescue operations. They also looked at population density and prioritized search grids. They created a missing-persons database and provided the subsequent mapping (See Appendix). They also focused on mapping services for public safety. They would update maps every four to six hours which provided locations for shelter, food, and water distribution points. They would distribute these maps to the Emergency Operations Center, the National Guard, FEMA, and MEMA. Other mapping services focused on damage assessments, public works, hazardous materials, energy, transportation routing, and communication improvements. They also coordinated data sharing among agencies. And still, this list is not exhaustive. It was apparent how many map products they actually provided: within a two week period, they used four plotters practically around-the-clock, and used nearly 5,000 feet of plotter paper.

Three particular applications: “blue-roofs” community relations, damage assessments, and cell phone coverage maps are described in more detail below.

“Blue-Roofs” Community Relations

A FEMA chapter from Chesapeake, VA was located in Stone County, Mississippi on a community relations mission. Their mission was to notify community members of resources available including “blue roofs”, which were to be installed by the Army Corps of Engineers. “Blue-roofs” are blue plastic tarps that are tacked onto damaged roofs to provide temporary protection until a permanent roof can be rebuilt. FEMA planned to go door-to-door on a Sunday morning to inform the community about the availability and to assess the need for these resources. Someone mentioned it would be difficult to find people at home on a Sunday morning and suggested FEMA visit churches in the community. GISCorps used information from local phone books to map the locations of the churches in the community. FEMA was able to visit 19 churches and give a positive first impression by meeting the community on their territory.

GISCorps further assisted the “blue-roofs” program by helping to organize the Army Corps of Engineers’ efforts at collecting applications for blue roofs. Community members were required to sign up to receive the assistance and in order to be eligible, all trees needed to be removed from the roof. GISCorps provided grid maps with address information to allow the ACE to organize their efforts at doing inspections and collecting applications.

Damage Assessment Using Geocoded Addresses

In this application, GISCorps volunteers used the address database from the local 911 office to create a map to help with recovery efforts. The addresses were geocoded and spatially joined with a grid to create a mapbook. Volunteers were able to use this map to navigate the area by using the grid to go door-to-door and to assess damage. The grid was organized according to volunteer fire department zones (eight zones). The grid showed address and street ranges in order to facilitate the damage assessment in a county of 4,000 people.

Each point on the grid represented an address and as volunteers visited the points, they collected attribute information which was then inserted into an Access database. FEMA used these grids to collect information and used the road maps made by GISCorps to reach people in an area that otherwise would have been very difficult to navigate.

Using the grid style maps to navigate the area and to collect attribute information allowed the process to go much more smoothly. FEMA was able to organize the houses that had been visited and to assess damage to each of these houses. For example, lists could be made of houses with trees still on the roofs, and a team could then be sent to remove the tree. The database could be constantly updated to show the progress being made and what work still needed to be done. There was a "planning wall" at the office that showed what sectors were finished and where volunteers were to go next.

Of interest is where the data for these maps came from. County postal workers in the area were given checklist cards with name, address, and attribute information. The postal workers went door-to-door collecting the information which was put into the Access database.

Cell Phone Coverage Maps

In this particular application, GISCorps volunteers provided information about improvements in communication during response and recovery by making cellphone coverage maps. They worked with a representative from Nextel and the executive director from CellSoft to have cell phone technicians collect the latitude/longitude when they put up a cell tower. The Nextel representative and CellSoft director would then contact GIS volunteers. With this information, the GIS specialists would map crude buffers around the tower to determine where the coverage would extend.

Analysis of Data

As with many crisis situations, challenges with data decreased the efficiency of the GIS applications. "Access to the most accurate, current, reliable and trusted data was the binding agent to provide geospatial analysis and mapping as well as the key element in demonstrating the power of GIS technology to emergency response agencies that had little familiarity with all things geospatial".

The lack of data in some locations was a problem and decreased efficiency. Some counties, such as Jackson County, had ample data including parcel and boundary information, while other counties like Stone County had gaps in their data. This made some GIS applications more challenging than others. For example, GIS applications were easier when they were "conveying conditions at a large scale, such as road closures and locations of emergency shelters". But as the applications were used for more localized operations such as search and rescue and damage assessment, this lack of data became increasingly challenging. Other issues with the data included the standards, organization, and documentation of the data.

Impact and Benefits of the GIS Applications

As Talbot Brook so aptly put it, "A picture is worth 1000 words. A map is a picture". Although the geospatial techniques that were used could be perceived as simple, they were very instrumental in helping local, state, and national agencies to be more efficient, effective, and organized in their response, recovery, and damage assessment efforts. In this way, the legacy of the GISCorps volunteers remains with the communities in the rural counties of Mississippi. The work also demonstrates that GIS applications will continue to make a difference in emergency situations.

Even though some counties were more data-rich than others, because the GIS applications were being used for lifesaving activities, they were helpful to everyone; they did not favor one individual over another. The storm itself was a big equalizer, given its geographic and spatial extent. For example, both those with and without means needed to be rescued. And while poorer individuals' homes along the coast may have been destroyed, their property values have since tripled or even quadrupled.

GIS Works to Avoid Another Katrina

U.S. Army Corps of Engineers uses Bentley Systems Project Wise to evaluate hurricane protection and flood damage reduction systems in New Orleans.

One year ago today, Hurricane Katrina struck the coasts of Louisiana, Mississippi and Alabama. Destruction continued long after the hurricane passed, as breaches in the floodwalls and levees of New Orleans flooded the city, leaving behind the area's greatest loss of life and property damage in recorded history. The failure of the city's flood-protection system left serious questions about why it failed and how to protect New Orleans and other cities in the future.

Answering those questions falls to the USACE (U.S. Army Corps of Engineers), which launched the IPET (Interagency Performance Evaluation Task Force) in October 2005. This team of engineers and scientists includes representatives from federal, state and local agencies as well as academia and private industry. The huge task of finding answers begins with IPET's Data Collection and Management team, which is charged with collecting information about the conditions before and after Hurricane Katrina, including construction and maintenance of the flood-protection system. This information serves as the key resource for evaluating the current system and determining the necessary changes for improvement.

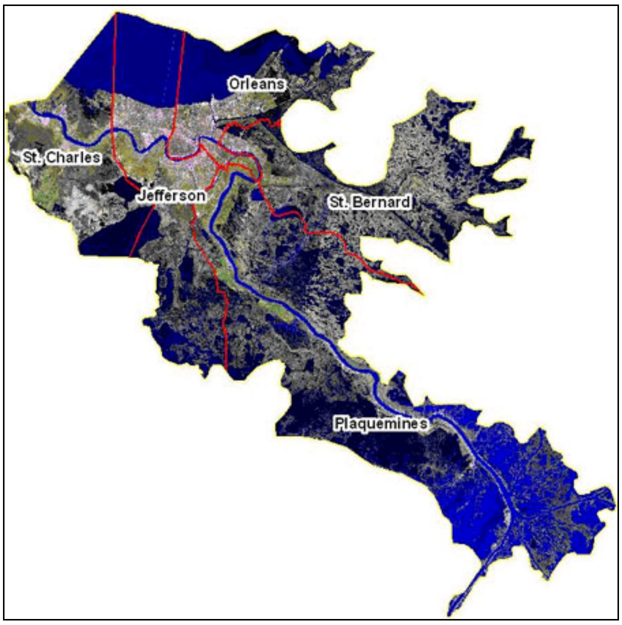

Figure 8: IPET's principal area of interest in Southern Louisiana.

Managing the Data

To manage the heterogeneous data required for the evaluation, IPET created a data repository, based on existing corporate frameworks and standard. Data were stored within frameworks that best fit the type of data for example, GIS, large datasets and unstructured data. Bentley Systems Project Wise software provided the integrating mechanism to manage the overall data environment.

Unstructured data, such as PDF, DOC, JPG, TXT and PPT files, as well as engineering design files (DGN) is stored in a Microsoft SQLServer database managed by ProjectWise. GIS data including the hurricane protection system (levees, pumping stations and floodwalls), breach locations, roads, water bodies, parish boundaries, levee districts, digital elevations and high water marks is stored in an Oracle SDO database registered through ArcSDE. Large datasets including LIDAR and elevation models, DEM (digital elevation model) datasets derived from the LIDAR data, and imagery are stored in the large datasets component on a terabyte server, with metadata and geospatial extents of each dataset stored in an Oracle SDO database to provide search capability.

Because time was of the essence, IPET took advantage of a prior enterprise license agreement between the USACE and Bentley, wherein Bentley provides software training and consulting services. IPET estimates that this ability to move quickly saved the USACE thousands of dollars and months of time because the software could be installed and used quickly without a lot of customization.

"ProjectWise provided an out-of-the-box capability to store and manage multiple types of documents/datasets and the metadata associated with that data," explains Denise Martin, IPET Data Management coleader. "It also provided a delivery and access control mechanism such that users could access the data in a variety of ways."

The team used ProjectWise software for overall data management by integrating the data stored in the three components such that users may access all datasets from one central application without having to know which data is stored in which component. More than 12,000 documents/datasets are now in the repository.

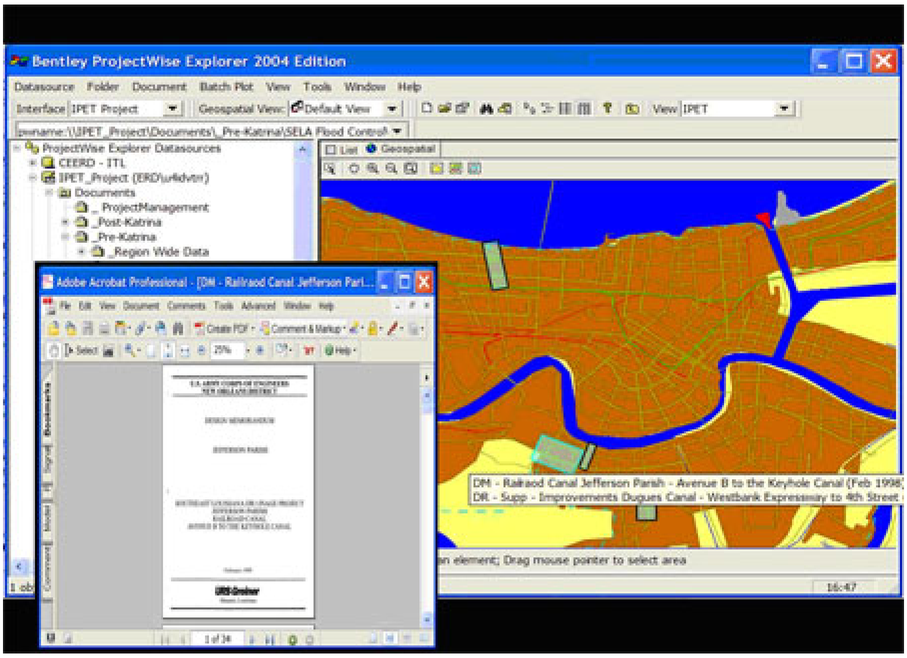

Figure 9: The Project Wise Explorer application's geospatial functionality.

Providing Access

For IPET, accessing the data was just as important as organizing it. The team used ProjectWise Explorer desktop application and the ProjectWise Web Explorer application to support engineers, scientists, lawyers, politicians and government officials with access to information stored in the repository.

The team organized the information as pre-Katrina and post-Katrina data to assist in searching. Geospatial extents for many of the documents/datasets were defined so users can search for data in a specific geographic location. Attribute value lists are provided for some of the metadata attributes to facilitate searching by attribute fields.

IPET finished its preliminary report earlier this year, and USACE is continuing its analysis of the extensive amount of data collected. With hurricane season upon us, that data becomes increasingly valuable as the USACE looks for answers to keep coastal regions safe.

Review of Literature

GIS is powerful for analyzing spatial data, used widely throughout universities, research centers, governmental agencies, and private industry. The ability of GIS technology to integrate and relate different spatial data types (biophysical, geophysical, socioeconomic, etc.) from different sources, to analyze these data, and to present results has led to GIS being a common tool across many organizations. The meteorological data type has been missing, including but not limited to atmospheric measurements, weather forecasts and analyses. In 2001, the National Center for Atmospheric Research (NCAR) developed a GIS Initiative as an interdisciplinary effort to foster collaboration, and spatial data interoperability. The GIS Initiative aims to promote the use of GIS as analysis and an infrastructural tool in atmospheric research and to distribute atmospheric and climate data to GIS users. Spatial data interoperability is a key to interdisciplinary research and decision-making within the atmospheric and GIS communities. In this context, the development of an Atmospheric Data Model is one of the first steps in achieving interoperable data sets. Atmospheric data cover a very large array of data objects, in a variety of data formats. The ultimate goal of an ArcGIS Atmospheric Data Model is to represent each of these data objects in a uniform manner, allowing their superposition and combined analysis in the ArcGIS desktop environment.

The Atmospheric Special Interest Group (SIG) was formed in 2003 and established a dialog between ESRI and the atmospheric sciences community about data representation issues. The Atmospheric SIG focused on two areas: temporal data management and improved raster data support. This involves the development of Network Common Data Format (NetCDF) converters for ingesting data into ArcGIS, and developing combined support for NetCDF, HDF, and GRIB formats through a single API. Significant progress is seen in various areas of GIS use with weather and climate data. Examples include the use of GIS with radar data, climate data, weather warnings, watershed modeling, weather-related business problems, hydro meteorological applications. The list of applications is longer and software tools were developed to address various aspects of GIS use with weather data for practical applications

In addition to applications that use weather and climate data, other GIS applications were developed to be used with population evacuation and hurricane disaster management. US Corps of Engineers working with Federal Emergency Management Agency (FEMA) after hurricane Katrina, employed GIS in various projects: assessment of post-disaster damage; rescuing and recovering; building temporary homes; removing debris, pumping floodwater; identify impacted communities. USGS National Wetlands Research Center use remote sensing and GIS to analyze land-water change caused by Katrina and Rita hurricanes, and future work includes hurricane recovery, and restoration of land. Another significant area of GIS application is in connection with population evacuation models. The hurricane and evaluation (HURREVAC) program uses GIS in formation to correlate demographic data with shelter locations and their proximity to evacuation routes to improve evacuation decisions. Significant GIS effort is also ongoing for rebuilding after Katrina related projects, in which multiple disciplines and agencies are involved.

Case Studies

Case study is Hurricane Katrina, US.

Study Area

New Orleans, US.

Tools of Study

ArcGIS software and Microsoft SQLServer database managed by ProjectWise.

Conclusion

Even though, the GISCorps did not know what to expect in terms of the extent and severity of hurricane damage, they were able help recovery teams to coordinate their work plans and efforts. Community needs should drive solutions. GIS services work better in a participatory and sharing environment. Lucia stated that “they would have been fine without us,” but that their assistance allowed the tasks of damage assessment by FEMA, repair work by Navy Seabees, and work by the Army Corps of Engineers to be completed with more speed and efficiency. GISCorps volunteers, with their unique and different experiences, left a legacy of simple maps, portable reports and meaningful data for the communities and agencies in the rural counties of Mississippi.

Summary

This paper presents the GIS role and use in hurricane Katrina. It started with an in introduction of GIS and hurricane.

After that it presents the Methodology of Study, Hurricane prediction resources, Initial steps prior to ArcGIS applied. Next, it presents Description of ArcGIS applications, Analysis of data, Impact and benefits of the GIS applications, GIS works to avoid another Katrina

Also it present Review of Literature, location of Study Area, Tools of Study, finally I wrote Conclusion and Recommendations.

Recommendations

Future Direction, Needs and Changes to GIS Activities

Many recollections from real-time experiences from GISCorps volunteers revealed recommendations for changes in emergency operations that reflect the future direction and needs of the GISCorps and the communities they serve in crisis situations. Attention to human capital; changes in data management and information sharing; and enhanced GIS applications are the focus for improving GIS activities in the future.

Human Capital

With Hurricane Katrina recovery efforts in Mississippi, GIS efforts "needed an organizational structure to leverage the wealth of available skills to make the technology delivery". In response, a lead team of Talbot Brooks, Dick Kotapish, Lake County, Ohio GIS Department, and Craigen Knox, Mississippi Department of Environmental Quality planned a command structure with the following functional areas: operational management, logistics, data development, mapping and county EOC resource deployments. This organization chart was successful and in the future, organizational structure should continue to receive attention.

In the future as in the present, volunteers need to be diverse, have a professional appearance, be mentally and physically tough, and have the technical skills, knowledge, aptitude and perseverance to apply geospatial tools in an emergency situation. Future deployment needs strong leaders to establish control, leverage people, balance workloads and assignments, and manage group dynamics. Layers of management also need to be minimized to facilitate rapid information sharing.

Data Management

As mentioned earlier, McDermott believes that “access, availability, documentation and organization, intergovernmental coordination, and content standards” for data gathered and used is necessary (2006). More metadata needs to be created in the future and given a higher priority to make work more efficient. Standards need to be established for both data management and availability, as well as current and complete infrastructure, emergency service, and utility data. As far as other lessons that were learned, Lucia mentioned that cooperation with the government agency responsible for providing post-storm imagery would have been appreciated. GISCorps did not receive new imagery data and needed updated data for better damage assessment to pay attention to coastal areas. They desperately needed imagery to know, for example, where tree damage had occurred and to identify open spaces.

Information Sharing

Working with the community made the GISCorps successful in their mission. GISCorps was absorbed into the community because they made an effort to attend all community meetings and empower the local communities through maps and data. Understanding the community’s expectations and target audience of the maps was a valuable lesson to learn. GISCorps needed to be able to work with anyone that came into the project and to be flexible with what they had to do and to the needs of the various groups they were assisting. Successful information sharing within the community such as this should be continued into the future. However, more attention needs to be given to intergovernmental coordination in order to increase the efficient flow of data and other business processes.

Enhanced GIS Applications

While the opportunities for GIS applications seem infinite, there are two that GIS specialists feel would have improved recovery capabilities tremendously. First, a good future project would be to identify where the elderly live to allow for easier evacuation or rescue efforts in future emergencies. In addition, fully implementing a United States National Grid System (USNG) would be a standardized tool that would be extremely useful for locating persons, places, and points of interest. Currently, the lack of awareness about the USNG is preventing its use on a widespread basis.

To further enhance GIS applications, alternative and reliable power-supplies are needed for work continuity and to prevent work shortages, time losses, and losses of computer files. Additionally, a source for cell phones, laptops, batteries, plotters, and data are needed in a crisis.

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Attachments

- Last Known Positions of Missing Persons (as reported through MEMA, 4 Sept 05).
- Power outages September 1 to 8, 2005. Data from EPA's, Entergy, MSPCO, TVA.
- Planning Wall at the GISCorps Office.
- NASA earth science spacecraft observe the birth and intensification of deadly category 5 Hurricane Katrina.
- Power point presentation of this paper.