IPMet Web GIS Application for Severe Weather Alert and Decision Support

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ABSTRACT

This work describes the Web-based GIS application under development at IPMet focused on issuing automatic severe weather warnings and visualizing meteorological and other geo-referenced data for situational awareness and decision support.

1. INTRODUCTION

IPMet provides weather monitoring and warning services based on the operation of its S-Band radars and on the execution of TITAN software. TITAN (Dixon&Wiener, 1993) performs storm identification in volumetric radar data, calculates their properties, tracks the cells and provides nowcasting information.

TITAN data sets combined with Geographic Information System (GIS) tools have provided ways to develop an application for issuing automatic weather warnings and for visualizing multiple data sets by means of the Internet. Weather warning areas, real time radar products, such as CAPPI and Accumulated Rainfall, TITAN storms and nowcasts, satellite, weather station, lightning and numerical model data can be viewed together with topography, land use, roads, river basins and other geographical layers. The ability to combine these layers into one interactive interface allow the view of a critical situation at a glance, providing a more readily risk and impact analysis.

2. SYSTEM CHARACTERISTICS

The system has been developed using Open Source and Open Geospatial Consortium (OGC) compliant software: PostGres/PostGIS as the database, MapServer to provide web mapping services and MapFish, a web 2.0 application framework which users ExtJS and OpenLayers.

This application is designed to assist both the forecasters as the agents of the emergency services by offering an easy-to-use interface which incorporates user specific information.

Civil defense, fire, police and city officials receive free training on meterology and on analysis and use of IPMet products. The system provides a Web GIS tool where each user can draw the areas which are more susceptible to disasters resulting from natural phenomena. These risk areas are saved in the spatial database and are presented as layers in the visualization interface. Besides, users can receive e-mails alerting when a severe weather is expected to happen in their risk areas.

External weather data are transferred to IPMet via FTP or Unidata Internet Data Distribution (IDD) feed. Some of these real time data are sent to the TITAN system. TITAN data exporting tools allow grid data (radar, satellite and model data) to be converted to a non-proprietary GIS ASCII format, known as ARC ASCII Grid. TITAN vector data (lightning, weather station and storm polygons) are exported to XML files and converted to GeoJSON serialized format. Topography, rivers, roads, state and municipality border maps are stored into the PostGIS spatial database, as well as user's risk areas.

Case studies of severe thunderstorms are conducted in order to establish certain storm risk alert thresholds. These statistical indicators are associated with TITAN storm

properties and may be used to generate maps indicating severe weather areas. Severe thunderstorm and hailstorm alert categories are currently in operation. The weather warning is issued when a forecasted storm cell has the FOKR index greater than 2 and when the hail probability is above 80%. GIS analysis tools compute risk areas and perform the overlapping of these warning areas with other geographic layers such as municipality contours and user risk areas. Automatic warning messages are created and disseminated to IPMet web page and Twitter and to registered user's e-mails.

Fig 1: IPMet weather warnings on Twitter.

The weather visualization and data integration application provides an interactive interface where the user can zoom, pan, insert or delete layers, locate cities, calculate distances and areas, animate, change the underlay. Furthermore, the user can get more information about a given data by clicking on them.

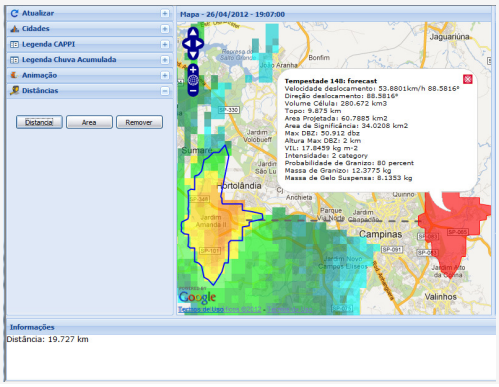

Fig 2: TITAN storm and its forecasted position for the next 30 minutes. Storm properties. Distance calculator. Google map underlay.

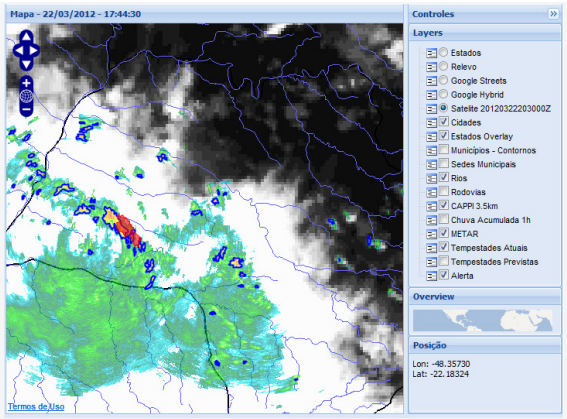

Fig 3: Radar CAPPI, TITAN storms, alert area (in red), rivers and satellite.

3. CONCLUSION

The ability to combine TITAN data with GIS has provided ways to develop a severe weather alert system that can help to mitigate weather related damages. The visualization application is an interactive Web GIS platform for real-time data sharing and integration of various weather data with geographic information. The facility to include and visualize user's risk areas and receive alerts in the occurrence of severe weather events in these areas is useful in providing situational awareness and decision support to emergency management and other critical users.

Future works involve the inclusion of other nowcasting techniques and the addition of new alert categories, such as flooding and landslide warnings.

4. REFERENCES

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PostGIS: http://www.postgis.org
MapServer: http://mapserver.gis.umn.edu
MapFish: http://mapfish.org
OpenLayers: http://openlayers.org