

IPMET WEB GIS APPLICATION FOR SEVERE WEATHER ALERT AND DECISION SUPPORT

Jaqueline Murakami Kokitsu

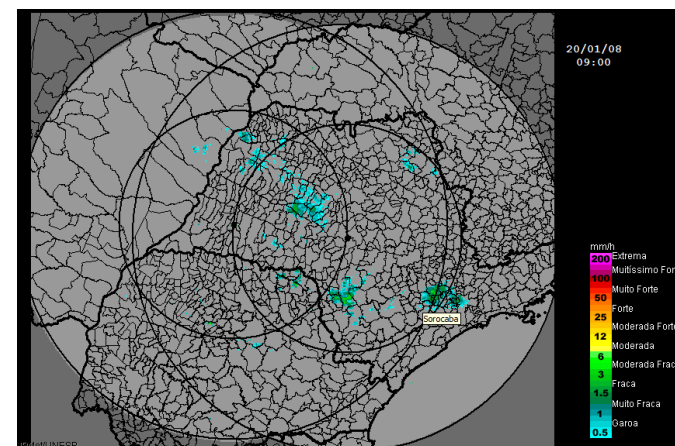


Instituto de Pesquisas Meteorológicas - IPMet
Universidade Estadual Paulista - Unesp



IPMet/Unesp

- Meteorological Research Institute
- C-band radar installation in 1974 (1st in Brazil)
- Weather Monitoring and Nowcasting
 - Two S-Band Doppler radars
 - TITAN – Thunderstorm Identification, Tracking, Analysis and Nowcasting
- Special Users:
 - Civil Defense, Police, Fire and City officials
- Products are available on IPMet website
 - <http://www.ipmet.unesp.br>
 - Weather Forecasts and Alerts
 - Radar, Satellite, Station data
 - Numerical Models, Meteograms



unesp UNIVERSIDADE ESTADUAL PAULISTA "JULIO DE MESQUITA FILHO" Câmpus de Bauru

IPMet - Instituto de Pesquisas Meteorológicas

Instituição
Cadastro
Imagem do Radar
Boletim do Radar
Previsão do Tempo
Previsão Cidades
Previsão Numérica
Estação Meteorológica
Serviços
Observador Voluntário
Sistema de Alerta
Estações do Ano
Pesquisas
Banco de Dados
Seiba Mais
Sites Relacionados
Fale Conosco
Como chegar

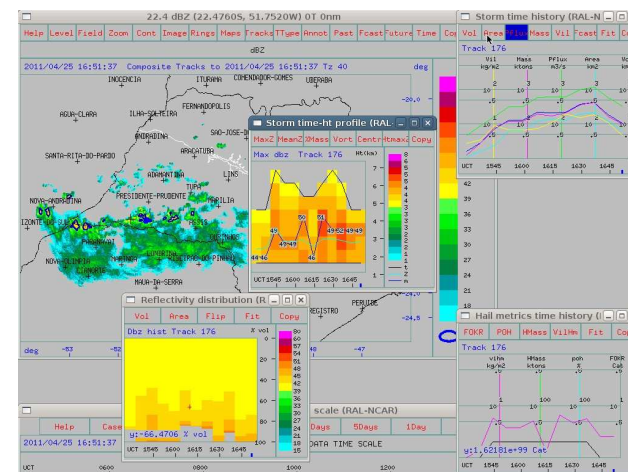
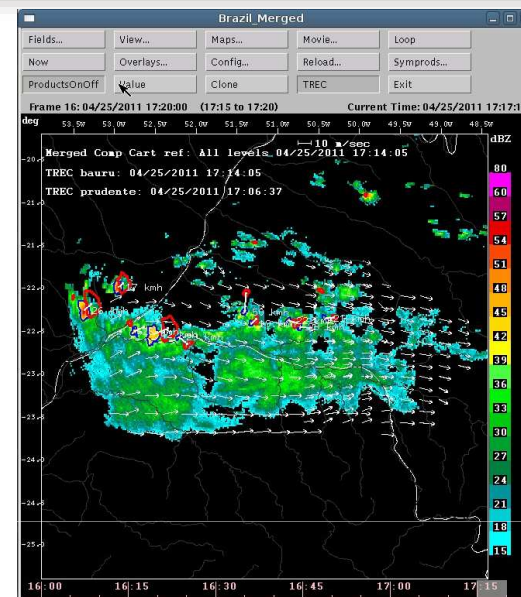
Boletim do Radar
21 de dezembro de 2011, horário: 14h13min (Horário de Verão)
Chuva no IPMet - Arquivos Especiais
Alerta de Tempo
Possibilidade de chuva forte com granizo: ITRAPINA
Possibilidade de tempestade severa: BALBINOS, GUARANTA, PIRAJUI, PONGAI, REGINOPOLIS, URU
Possibilidade de chuva forte com granizo: ANHEMBI, PIRACICABA
Possibilidade de tempestade severa: BOCAINA, JAU

Estação Meteorológica Bauru
Observação das 14:15h
Temperatura: 21.6 °C
Umidade: 32 %
Login Usuário
Cadastro

Características das estações
Deseja agendar uma visita?
Qualidade do ar em Bauru
Tempo em Destaque
Perfil do vento em Bauru
Alertas de tempestade
Endereço
Estrada Municipal José Sandrin, s/n Chácara Bauruense

TITAN

- <http://www.rap.ucar.edu/projects/titan>
- TITAN training at NCAR in 2005
- IPMet started deploying nowcasts in 2006
- TITAN courses in Brazil:
 - SIPAM, SIMEPAR, CPPMet/UFPel, SIRMAL/UFAL, CPTEC/INPE, CINDACTA
- TITAN support by e-mail:
 - 3DSA/Greece, Turkish State Meteorological Service, Royal Meteorological Institute of Belgium
 - ELAT/INPE, USP, UFPa
- International TITAN Users Workshop - 2009
 - Organization: NCAR, IPMet and SIPAM
 - Belém/PA
 - USA, Australia, South Africa, China, Senegal



TITAN at IPMet

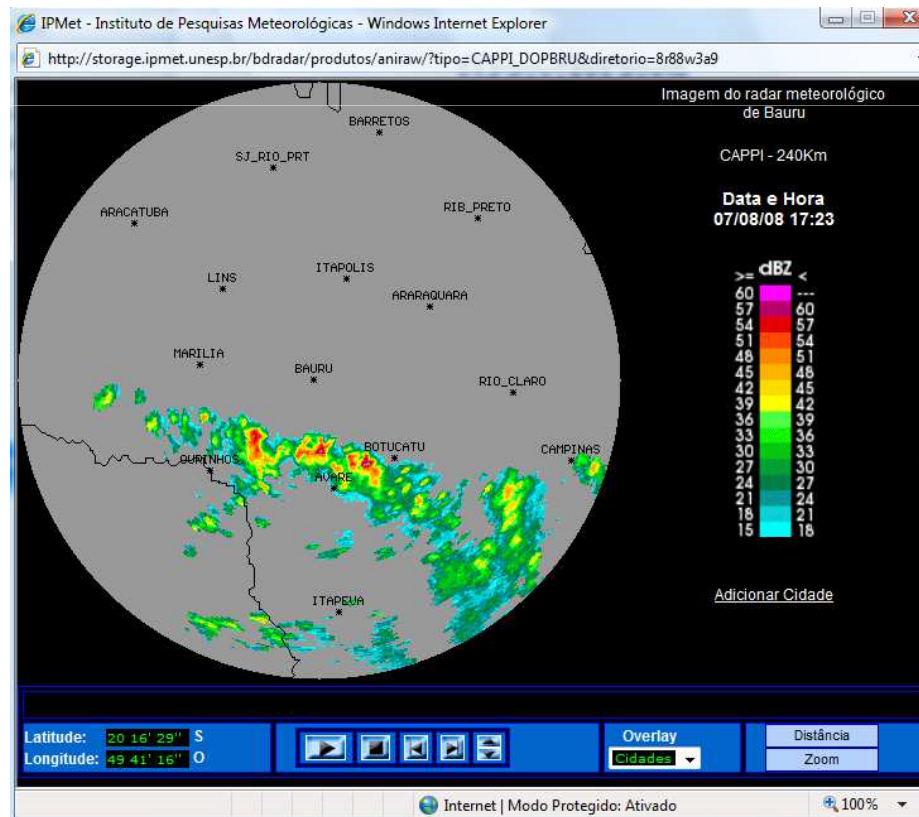
- Polar radar data conversion to TITAN Cartesian files (MDV format):
 - 240 range, 16 sweeps, 250m bin spacing
 - 750mx750mx750m cartesian grid spacing
 - 640x640x26 grid points (480km x 480km x 20km)
- Multiple radar merging
- Filter applications: Anomalous Propagation and Bright Band Removal
- Combining lightning and radar data
- TITAN storm characteristics:
 - Reflectivity threshold ≥ 40 DBZ
 - Minimum storm size: 16 km^3
 - Storm base threshold ≥ 2 km
- TREC
- Ingestion of Satellite, Lightning and Weather Station data
- TITAN data exporting:
 - TITAN grid data are converted to ARC ASCII Grid format
 - TITAN vector data are converted to XML format

Web GIS Weather Application

- Automatic system for issuing weather alerts based on TITAN outputs.
- Our forecasters warn about a severe radar cell but sometimes a not so strong cell may cause a severe damage depending on the place it happen. Emergency management people usually know their risk areas.
- Designed to reach users who are at risk:
 - E.g., the Civil Defense of Bauru will be warned about potential severe weather events occurring within its area of interest.
- Improvements on the visualization interface to attend user requests.
- Interface for integration, visualization and analysis of weather and geographic data using Web GIS resources.
 - Allowing the visualization of TITAN storms and nowcasts and other weather data together with geographic data.
- Available to users since April/2011

Before TITAN and Web GIS application

- Weather warnings were disseminated to our special users by means of telephone calls and website messages.
- Users had access to radar products through our internet Javascript visualization tool.



Weather Alert System

- Users need to be registered to get access to the system
- Registered users receive training in meteorology, analysis and interpretation of IPMet products
- The system provides a Web GIS tool where registered users can draw their monitoring or risk areas

Administrativo de Usuários
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15:00 38

CADASTRADOS
Habilitar/Excluir Cadastros

USUÁRIOS HABILITADOS
Consultar Usuário
Alterar Usuário
Remover Usuário
Incluir IP
Habilitar/Desabilitar e Consultar Senha

USUÁRIOS REMOVIDOS
Consultar/Reabilitar Usuário

RELATÓRIOS E E-MAIL
Relatórios de Usuários
Relatório de Imagem
Sistema de E-mail

Controle

Gerar Boletins
Enviar Arquivo
Recuperar Retorno
Depósito Bancário
Visualizar Depósitos
Relatório (FUNEP)
Pagamentos
Gerar 2ª via(teste)

Novos Cadastros
Cadastrar Plano
Editar/Consultar Planos
Cadastrar Produto
Editar/Consultar Produto
Planos e Produtos
Administrador
Página Inicial
Alterar Senha
Logout

Nome: Defesa Civil de Ithaja
Endereço: Alameda Pernambuco, 440
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Cidade: Ithaja, Sorocaba
CEP: 13308-000
Fone: (13) 3742-6080
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Tipo de Pessoa: Jurídica
CPF/CNPJ: 097546480001-04
Inscrição Estadual:
E-mail: ihtrancato@yahoo.com.br
Site:
Contato: Gilmar Batista Soares
Plano: LIVRE_B

Nome: Defesa Civil de Sorocaba
Endereço: Av. Angélica, Jardim Meninas, 2048
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CPF/CNPJ: 066340440001-74
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E-mail: inesp@sorocaba.sp.gov.br
Site: www.sorocaba.sp.gov.br
Contato: Departamento de Defesa Civil
Plano: LIVRE_B

IPMet - Instituto de Pesquisas Meteorológicas - Mozilla Firefox

Arquivo Editar Exibir Histórico Favoritos Ferramentas Ajuda

Mais visitados Primeiros passos Últimas notícias

IPMet - Instituto de Pesquisas Meteorológicas

Menu

- Produtos
- Dados cadastrados
 - Alterar dados Cadastrais
 - Segunda Via de Boletins
 - Adicionar Área de alerta
 - Logout

Início Adicionar área

Mapa

Base Layer
Estados
Overlays
Cidades
Cidades Municipais
Desenhos
Áreas Cadastradas

Mover Desenhos Apagar
Apagar Gravadas Salvar

Ferramentas

Procurar: Procurar Cidade

Cidade	Sex	Sáb	Dom
Bauri-SP	☀	☀	☀
São Paulo-SP	☀	☀	☀
Presidente Prudente-SP	☀	☀	☀
São José do Rio Preto-SP	☀	☀	☀
Ribeirão Preto-SP	☀	☀	☀
Araçuaia-SP	☀	☀	☀

UNESP - Universidade Estadual Paulista "Júlio de Mesquita Filho"
IPMet - Instituto de Pesquisas Meteorológicas

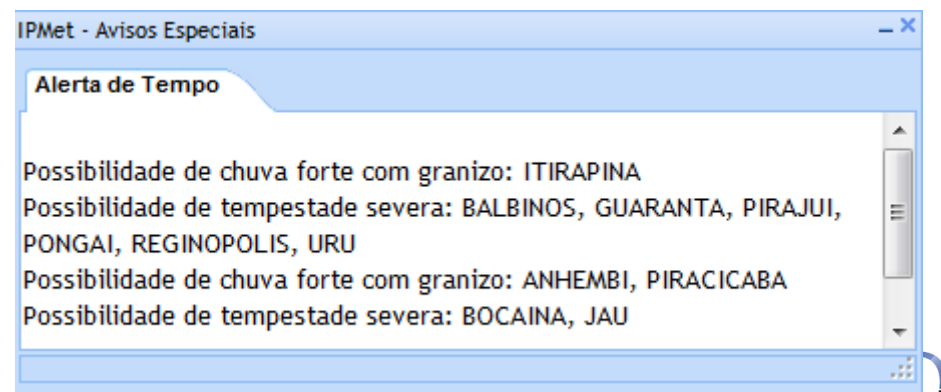
Concluído

Computing Risk Alerts

- Case studies of known severe thunderstorms are conducted in order to establish certain storm risk alert thresholds.
- These risk thresholds are associated with TITAN storm properties and are used to generate maps indicating severe weather areas.
- Alert categories currently in operation:
 - Heavy Rainfall (Storm Intensity level > 2)
 - Hailstorm (Hail probability > 80%)
- GIS analysis tools compute the overlapping of the alert areas with other geographic layers, such as municipality contours and user risk areas.

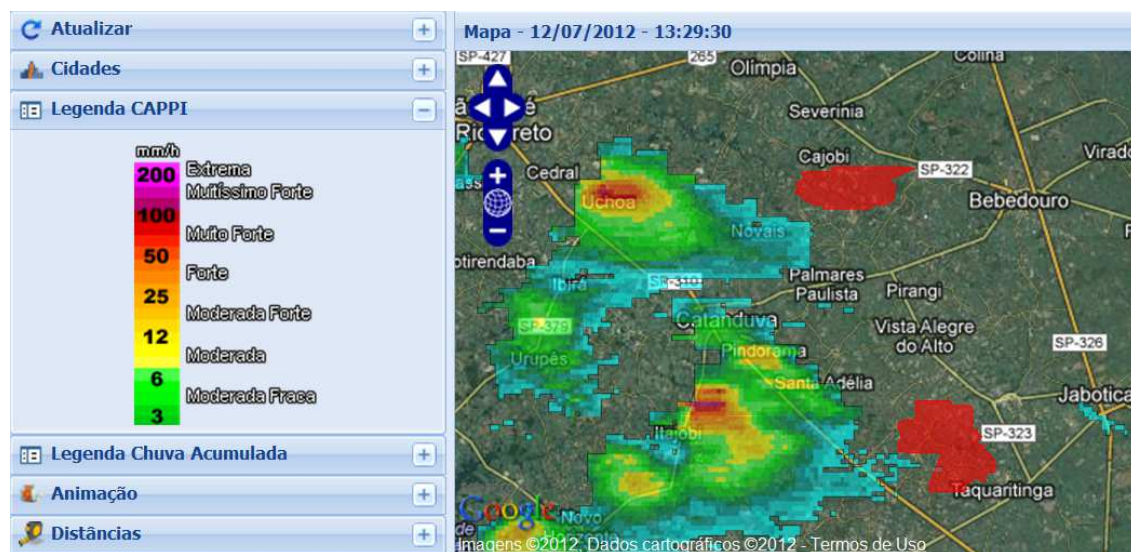
Weather Warning Dissemination

- Weather warnings specifying the city/location affected and the severe event to happen in the next 30 minutes are automatically disseminated to:
 - IPMet web page
 - IPMet Twitter
 - User e-mails
- The process is performed at each 7.5 minutes
- Alert areas can be visualized together with weather and geographic data by means of the Web GIS interface.



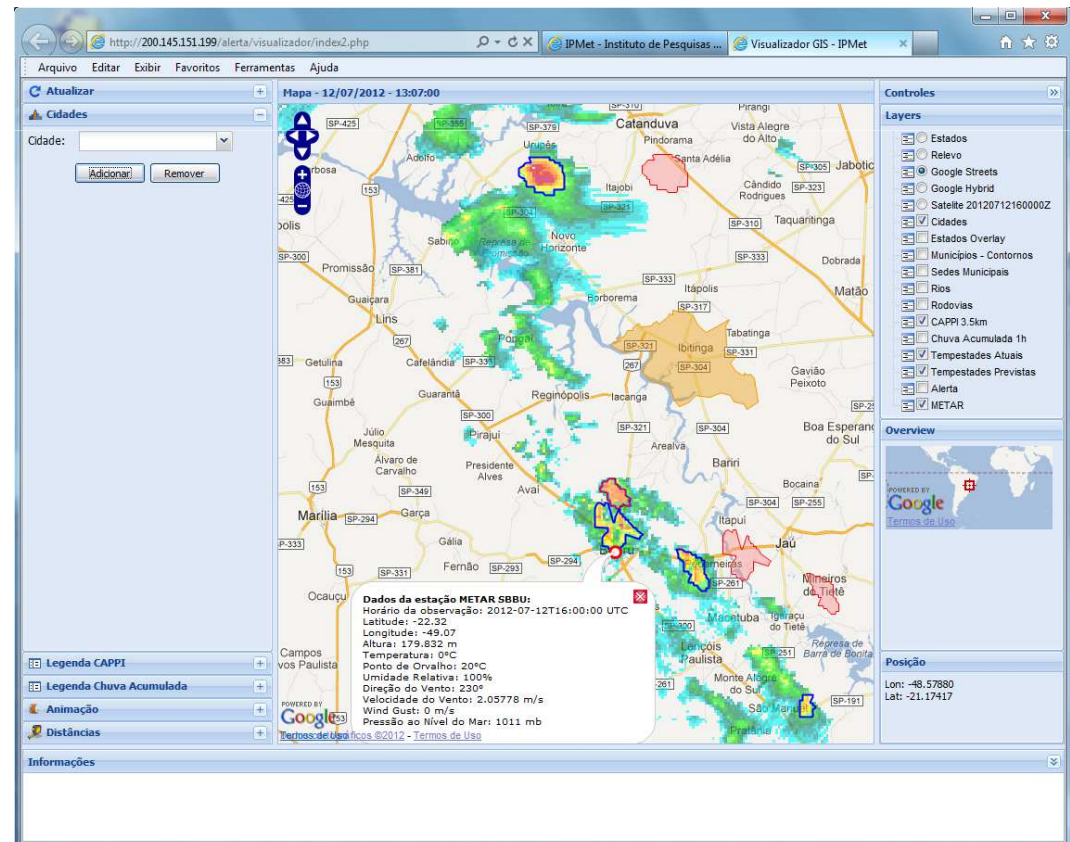
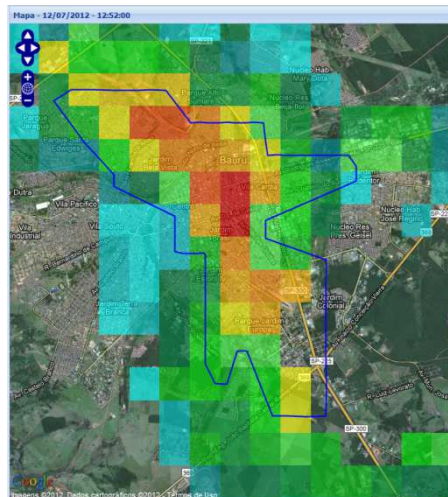
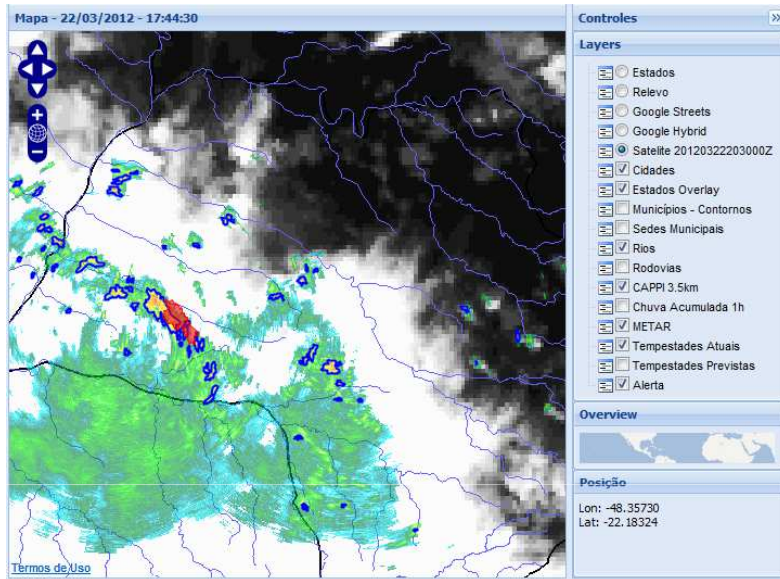
Weather Visualization Interface

- Interactive Web GIS interface for real-time data sharing and integration of various data.
 - Weather Alert Areas, Radar Products (CAPPI, Accumulated Rainfall), TITAN Storms and Nowcasts, Satellite, Weather Station, Lightning and Numerical Model data can be viewed together with Google Maps, Topography, Land Use, Roads, Rivers and other geographical maps
- The capacity of combining these data into an interactive interface allows the view of a critical situation at a glance, providing a readily risk and impact analysis.



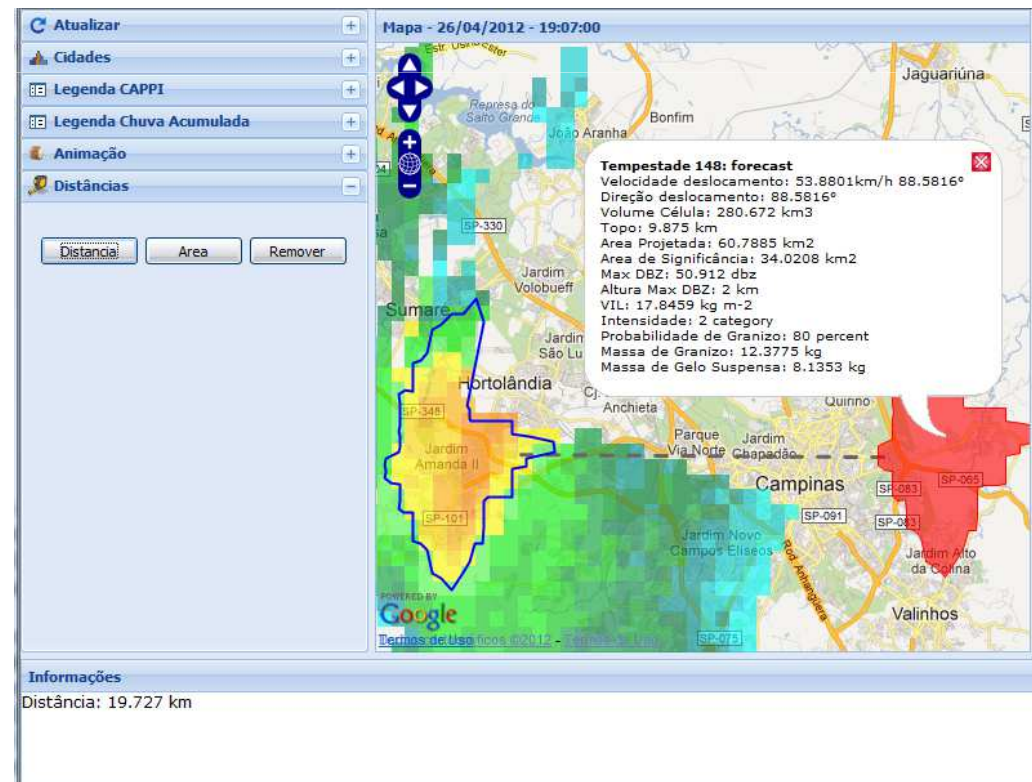
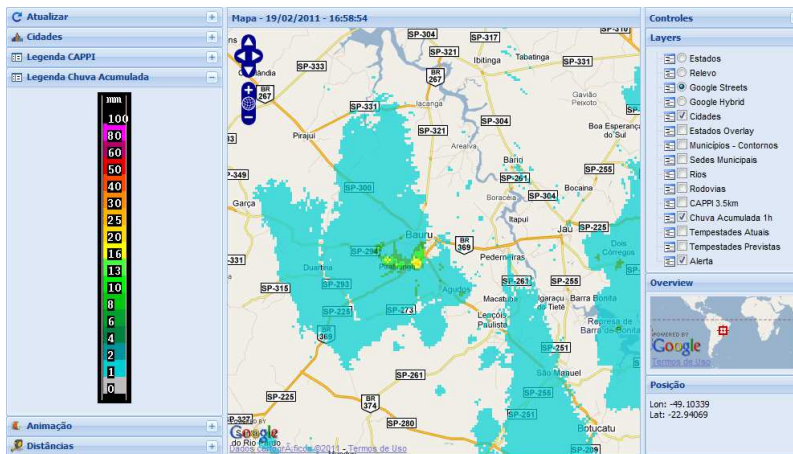
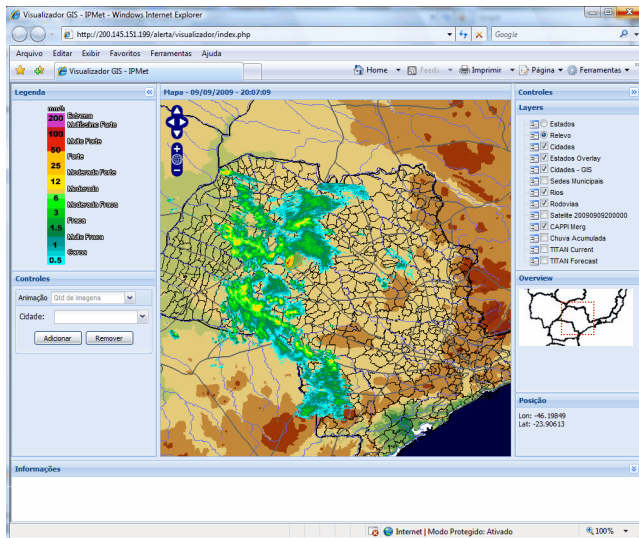
The Web GIS Interface

- It is possible to zoom, pan, insert or delete layers, locate cities, calculate areas and distances, animate, change the underlay and get more information about a given data by clicking on them.



The Web GIS Interface

- Developed using Open Source and Open Geospatial Consortium (OGC) compliant software: PostgreSQL/PostGIS as the database, MapServer to provide web mapping services and MapFish, a web 2.0 application framework which uses ExtJS and OpenLayers



User Training and Feedback

- Civil Defense, Fire, Police and City Officials receive training at IPMet. Since 2007, 38 courses were conducted and more than 400 people received training.
- In order to improve the system it is necessary to know and study the severe weather events that occurred in the region covered by our radars. The feedback from our users, reporting their severe events and the evaluation of the system performance are very useful to adjust the system settings and to define new products and alert categories to be developed.



Civil Defense Events Database

IPMet - Instituto de Pesquisas Meteorológicas - Windows Internet Explorer

http://simpat2/index.php

unesp UNIVERSIDADE ESTADUAL PAULISTA "JÚLIO DE MESQUITA FILHO" Reitoria

IPMet - Instituto de Pesquisas Meteorológicas

SIMPAT Sistema Integrado de Monitoramento, Previsão e Alerta de Tempestades para as Regiões Sul-Sudeste do Brasil

Busca no banco de dados da Defesa Civil

Data Início: 01 01 2000

Data Fim: 11 08 2008

Fenômeno: Tornado

Dano: Ferido(s)

Estado: Todos

Cidade:

Consultar

► Clique Aqui para fazer download destes dados no formato txt.

Fonte: Defesa Civil
Data do evento: 01/10/2001
Hora: 17h15
Localização: Apucarana - PR
Fenômeno(s): Ventos fortes/vendaval, Chuvas fortes, Tornado e Ciclone
Dano(s): Sem informação
Total de Vítimas: 120

Fonte: Defesa Civil
Data do evento: 05/02/2004
Hora: 21h30
Localização: Juquiá - SP
Fenômeno(s): Tornado
Dano(s): Inundações Graduais, Alagamentos e Desabamentos/Rachadura/Danos em Imóveis

Fonte: Defesa Civil
Data do evento: 24/05/2005
Hora: 21h23
Localização: Ibiúna - SP
Fenômeno(s): Ventos fortes/vendaval, Chuvas fortes e Tornado
Dano(s): 5 Ferido(s) , 1 Vítima(s) fatal(is) e Desabamentos/Rachadura/Danos em Imóveis
Total de Vítimas: 6

Fonte: Defesa Civil
Data do evento: 24/05/2005
Hora: tarde e noite
Localização: Atibaia - SP
Fenômeno(s): Ventos fortes/vendaval, Chuvas fortes e Tornado
Dano(s): Desabriado(s). Desalojado(s). Transbordamento de Rios e Córreos.

- Civil Defense events related to natural disasters which happened in the state of São Paulo are being included in our web database and is available to all users.
- Data since 1980.
- Source of information for the severe event case studies and researches
- Allows queries about severe weather events and their damages.
- Returns the date, time, city, event, damages and number of victims.

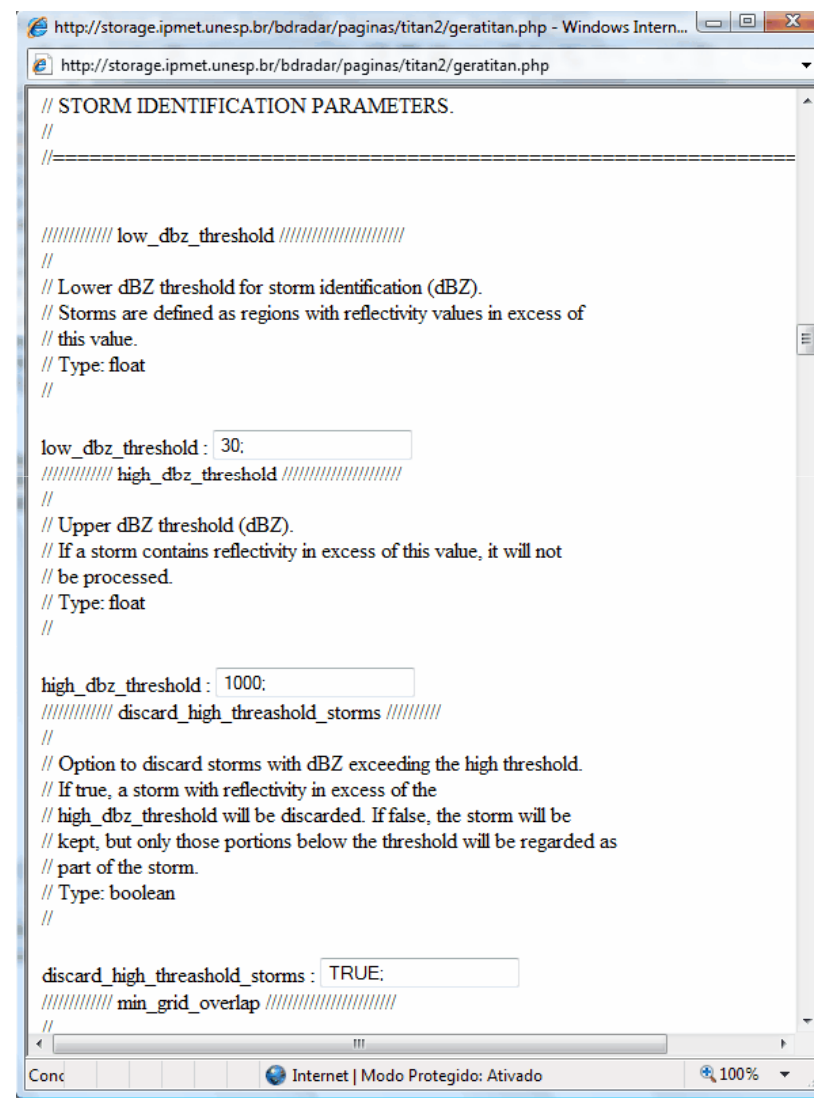
Web-Based Radar Database System for Research

- Radar data are on-line available and are easily accessed through the Internet
- Radar raw data can be downloaded in different formats
- Radar products can be visualized on the Web
- Radar data are being stored automatically in our database in realtime
- TITAN applications can be executed via Web
- IPMet radar database is available for everyone who wants to use them for research purposes



Web Radar Database

- Users choose the time interval of the data they want to study
- Possibility of running Titan application on the individual radar or on the merged field
- Window to edit TITAN application parameter files
- The process will run in background, user will receive an e-mail when it finishes
- The output can be seen through the web GIS visualization interface



```
// STORM IDENTIFICATION PARAMETERS.
//
//-----
//
// low_dbz_threshold
//
// Lower dBZ threshold for storm identification (dBZ).
// Storms are defined as regions with reflectivity values in excess of
// this value.
// Type: float
//
low_dbz_threshold : 30;
//
// high_dbz_threshold
//
// Upper dBZ threshold (dBZ).
// If a storm contains reflectivity in excess of this value, it will not
// be processed.
// Type: float
//
high_dbz_threshold : 1000;
//
// discard_high_threshold_storms
//
// Option to discard storms with dBZ exceeding the high threshold.
// If true, a storm with reflectivity in excess of the
// high_dbz_threshold will be discarded. If false, the storm will be
// kept, but only those portions below the threshold will be regarded as
// part of the storm.
// Type: boolean
//
discard_high_threshold_storms : TRUE;
//
// min_grid_overlap
//
```


Conclusion

- TITAN software helped IPMet to improve the weather service offered to users.
- A Web GIS-based application has enhanced IPMet weather data dissemination by including TITAN nowcasts and by offering GIS tools for analysis, integration and visualization of weather data.
- The facility to include and visualize user risk areas and receive automatic warnings 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 work: Improving the nowcasting technique.

Thanks!