

The Meeting of the Americas  
8 to 12 August 2010, Foz do Iguaçu, Brazil

# A Natural Disaster Monitoring and Warning System

## SISMADEN

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Instituto Nacional de Pesquisas Espaciais  
Divisão de Processamento de Imagens

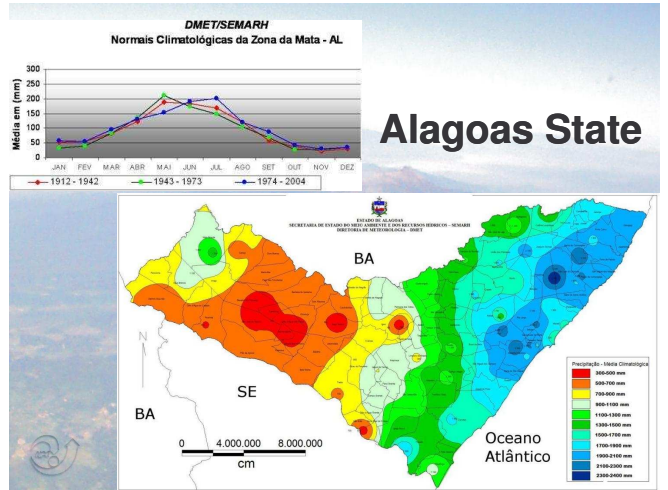
# Pernambuco and Alagoas June/2010

57 deaths  
95 municipalities

UOL Notícias - Fotos

Chuvvas no Nordeste

Imagem: 26 Jun 2010 - Imagem de satélite de uma região de várzea do município de Paratambém, no Estado de Pernambuco, após a passagem da chuva. (1) Imagem de satélite de uma região de várzea do município de Paratambém, no Estado de Pernambuco, após a passagem da chuva. (2) Imagem de satélite de uma região de várzea do município de Paratambém, no Estado de Pernambuco, após a passagem da chuva. (3) Imagem de satélite de uma região de várzea do município de Paratambém, no Estado de Pernambuco, após a passagem da chuva.



## 2010 06/18 06:00

Ministério da Ciência e Tecnologia

INPE

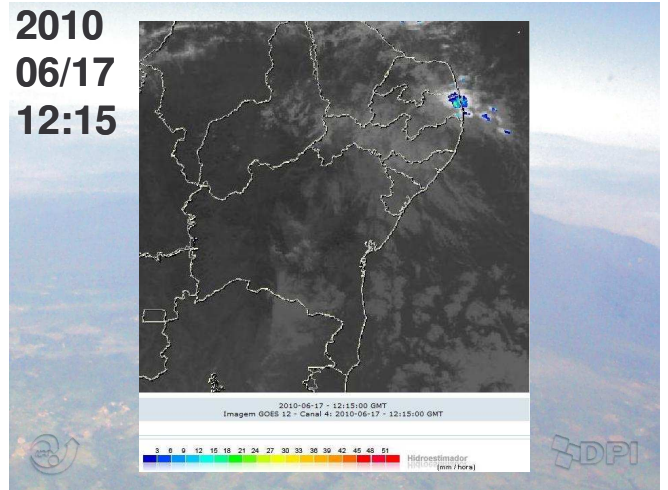
DBA

2010-06-18 - 06:00:00 GMT

Imagem GOES 12 - Canal 4: 2010-06-18 - 06:00:00 GMT

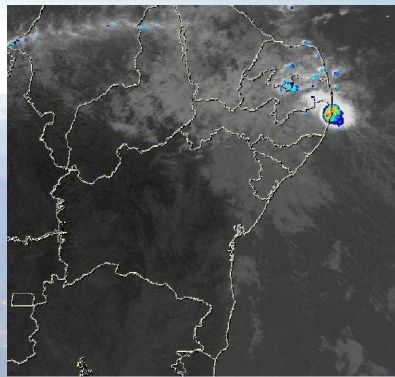
Hidroestimador (mm/hora)

3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51





2010  
06/17  
18:00

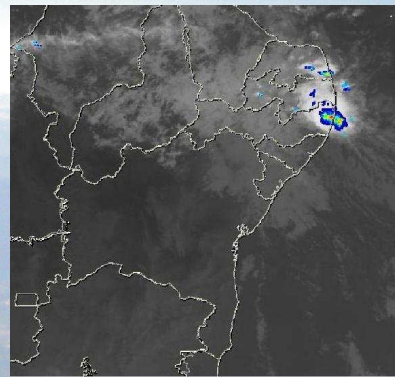


2010-06-17 - 18:00:00 GMT  
Imagem GOES 12 - Canal 4; 2010-06-17 - 18:00:00 GMT

Hidroestimador  
(mm/hora)



2010  
06/17  
20:00

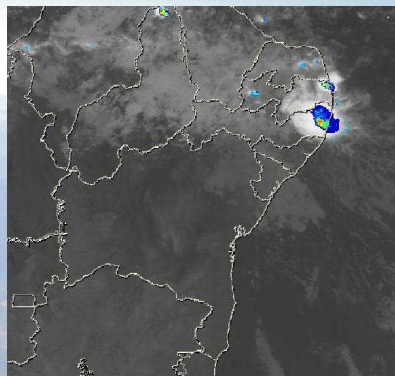


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Hidroestimador  
(mm/hora)



2010  
06/17  
22:00



2010-06-17 - 22:00:00 GMT  
Imagem GOES 12 - Canal 4; 2010-06-17 - 22:00:00 GMT

Hidroestimador  
(mm/hora)



2010  
06/17  
23:00

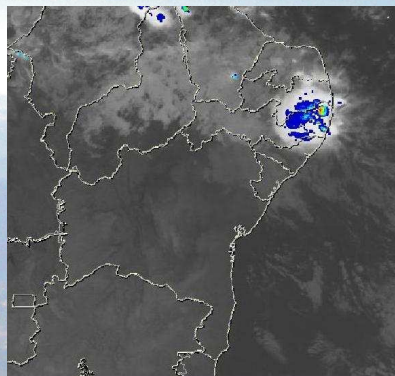


2010-06-17 - 23:00:00 GMT  
Imagem GOES 12 - Canal 4; 2010-06-17 - 23:00:00 GMT

Hidroestimador  
(mm/hora)



2010  
06/18  
00:15

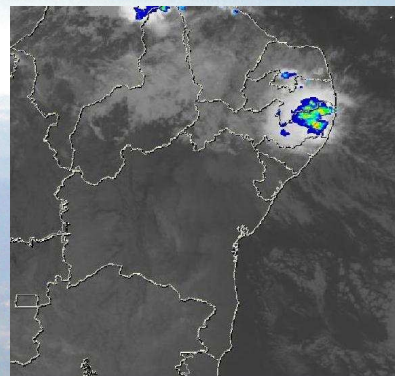


2010-06-18 - 00:15:00 GMT  
Imagem GOES 12 - Canal 4; 2010-06-18 - 00:15:00 GMT

Hidroestimador  
(mm/hora)



2010  
06/18  
02:00

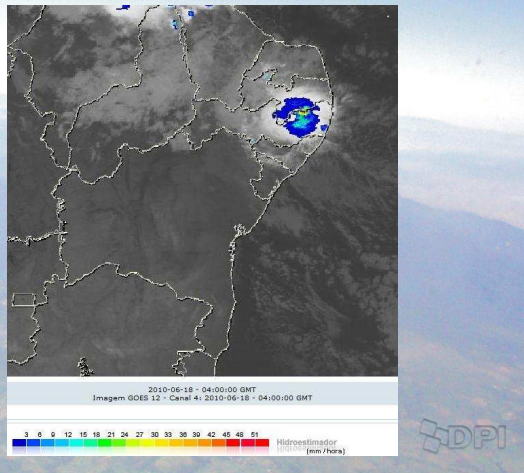


2010-06-18 - 02:00:00 GMT  
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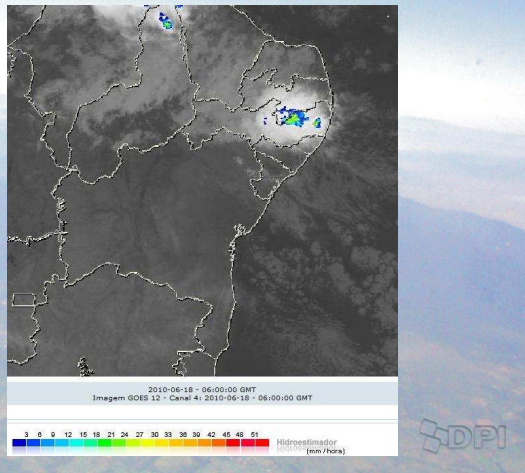
Hidroestimador  
(mm/hora)



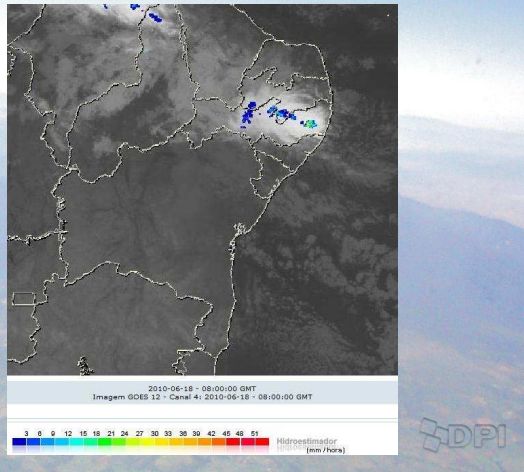
2010  
06/18  
04:00



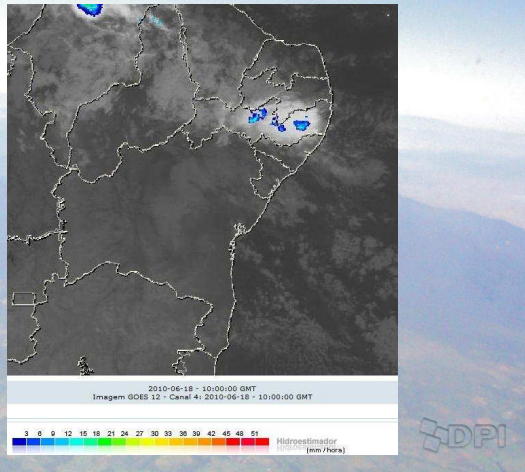
2010  
06/18  
06:00



2010  
06/18  
08:00



2010  
06/18  
10:00



### June/24/2010 IRS Image

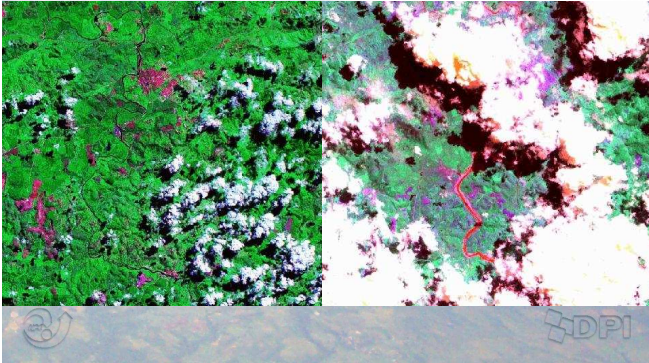
### May/24/2000 Landsat 7



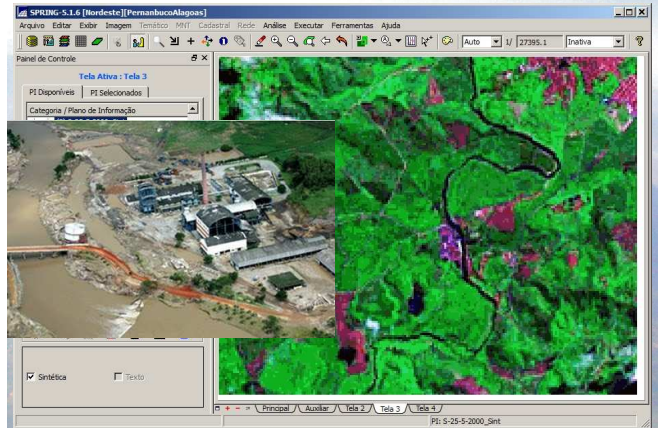
# União dos Palmares - AL

May/24/2000

June/24/2010



# Vulnerabilities



## Niterói, RJ – April/2010



[http://noticias.uol.com.br/album/100406rio\\_album.jhtm](http://noticias.uol.com.br/album/100406rio_album.jhtm)

## Jan/2010

Bananal - Angra dos Reis  
(Slide - Lopes, E.S.S.)



Morro da Carioca - Angra dos Reis



<http://noticias.r7.com/sao-paulo/noticias/centro-historico-de-sao-luiz-do-esta-mais-alagado-201010104.html>

Jan/2010  
São Luiz do Paraitinga, SP

<http://saoluizdoparaitinga.ox.com.br/oluguel-de-caisar-para-festival-da-cancao-brasileira-e-carnaval-2010-sao-luiz-do-paraitinga-10-36566759>

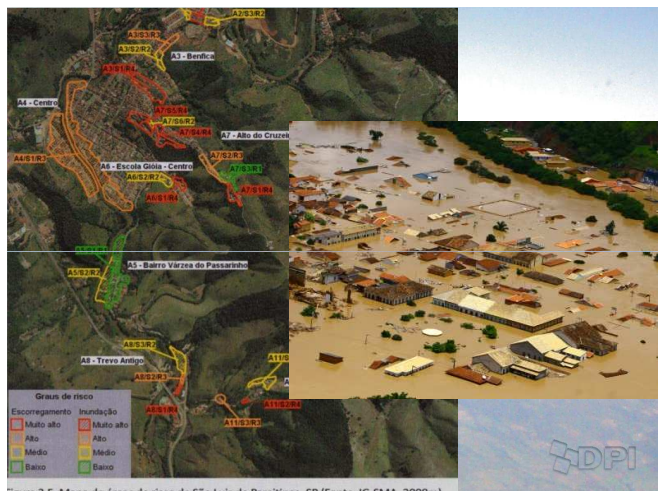


Figura 3.5. Mapa de áreas de risco de São Luiz do Paraitinga, SP (Fonte: IG-SMA, 2008m).

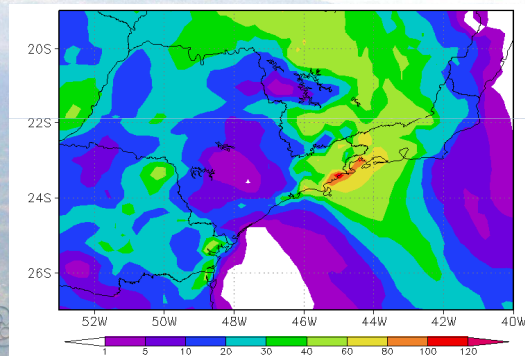


# Center for Weather Forecast and Climate Studies - CPTEC

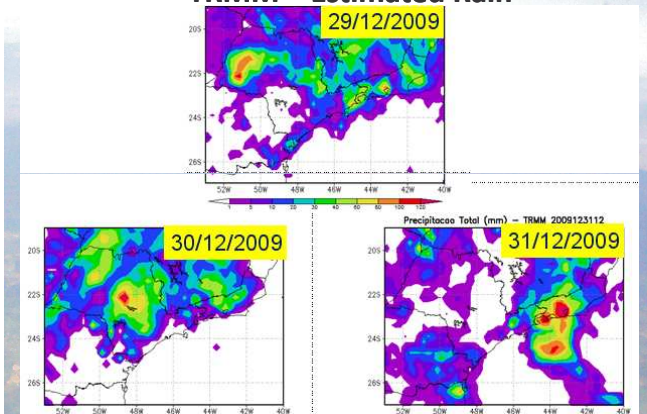


www.cptec.inpe.br

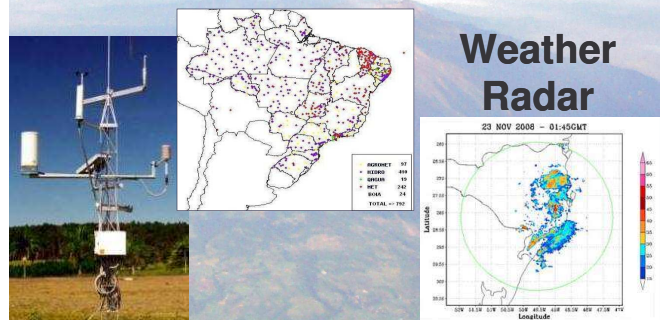
# Forecast 24h Total Precipitation Run Dec/31/2010 12:00 GMT for 01/Jan/2010 - Eta-20 km



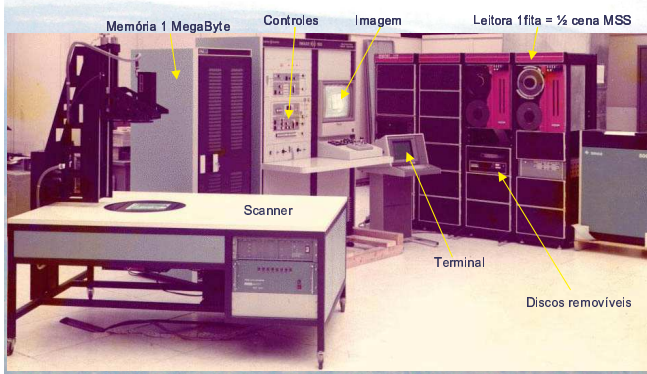
# Observations by Satellite TRMM – Estimated Rain



# Observation Data Collect Platform

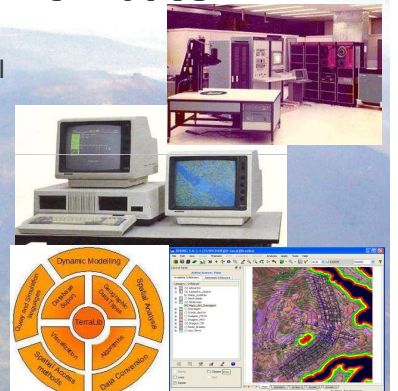


# Research and Development in Geoinformatics



# Research and Development in Geoinformatics

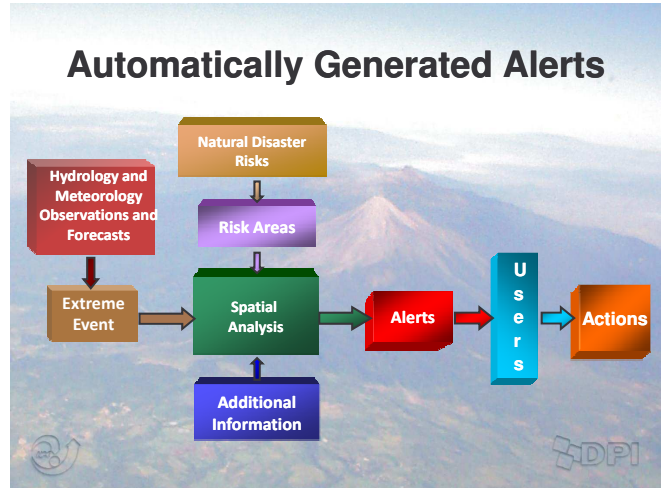
- 1974: I-100
- 1986: SITIM and SGI
- 1991: SPRING 1.0
- 1996: SPRING 3.0
- 2010: SPRING 5.1.6
- 2002: TerraLib 1.0
- 2007: TerraLib 3.0
- 2010: TerraLib 3.5





# Technological Support

Geographical database and manipulation by  
**TerraLib: [www.terralib.org](http://www.terralib.org)**



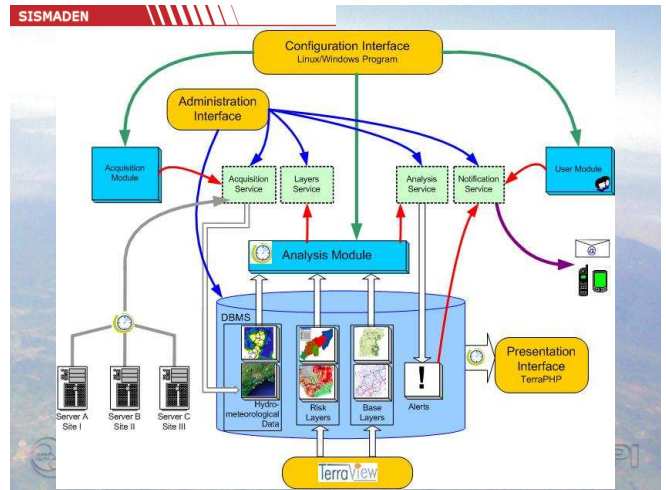
## SISMADEN Natural Disaster Monitoring and Alert System

Open Source Computational System based on service oriented architecture

Provides technological infrastructure to develop operational systems to manage alerts of environmental risks

Services:

- Data gathering and formatting
- Analysis by comparison with risk layers or by executing models
- Risk model edition for alerts
- Alert handling and management



## SISMADEN Natural Disasters Monitoring and Alert System

- Who are the users?
  - System Operators
    - Organization that monitor the possibility of disaster events
    - Operate on Administration and Configuration interfaces

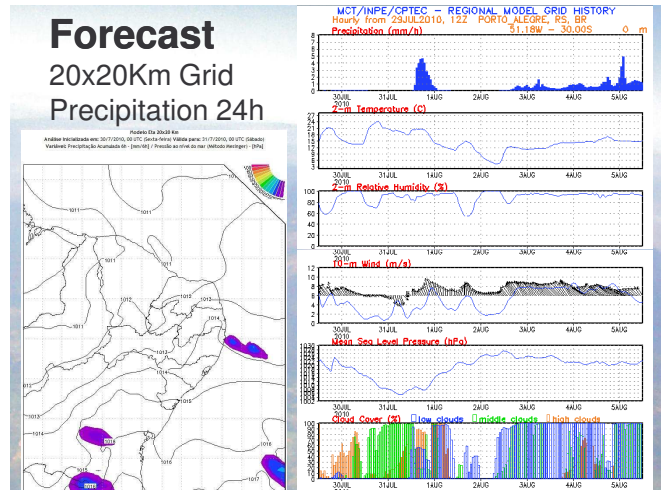
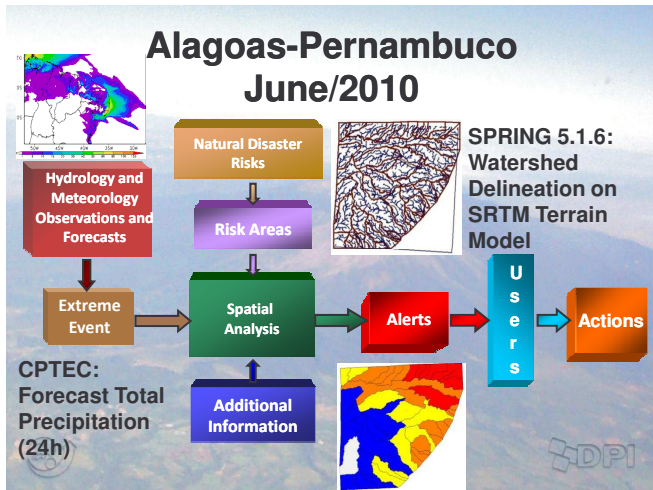
## SISMADEN Natural Disasters Monitoring and Alert System

- Who are the users?
  - Alert Clients
    - Representatives with authority to execute prevention and mitigation actions in disaster events
    - Receive alerts in http, e-mail, sms



<http://www.dpi.inpe.br/sismaden/english>

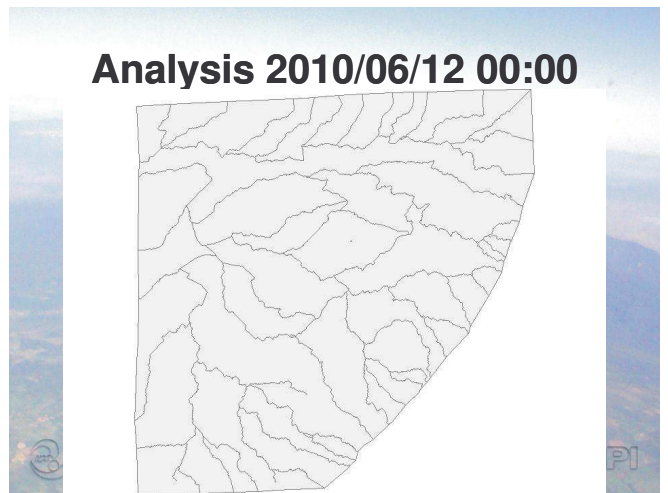
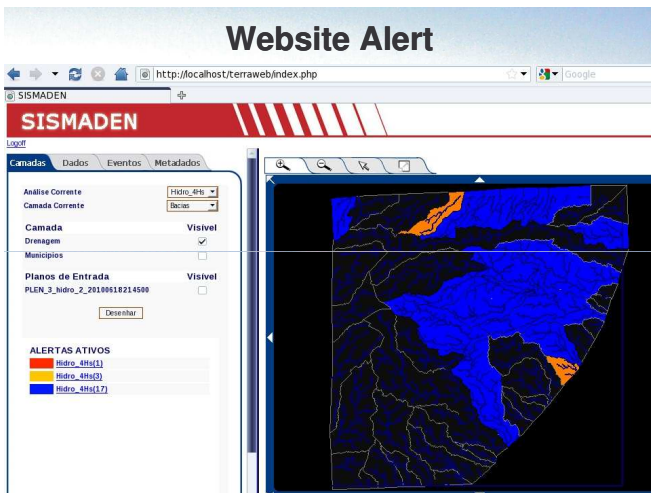
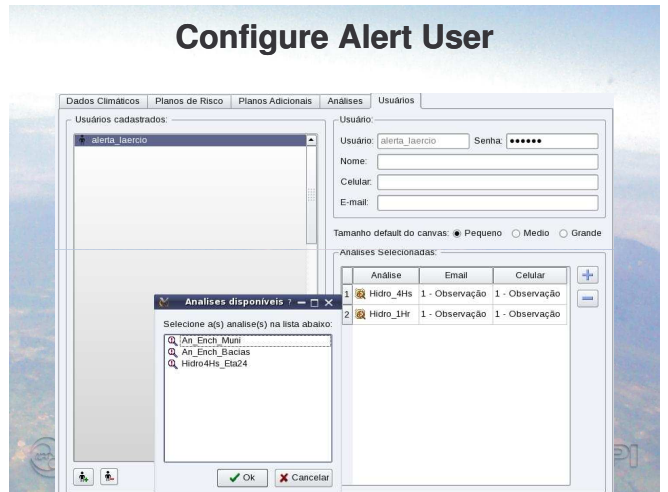
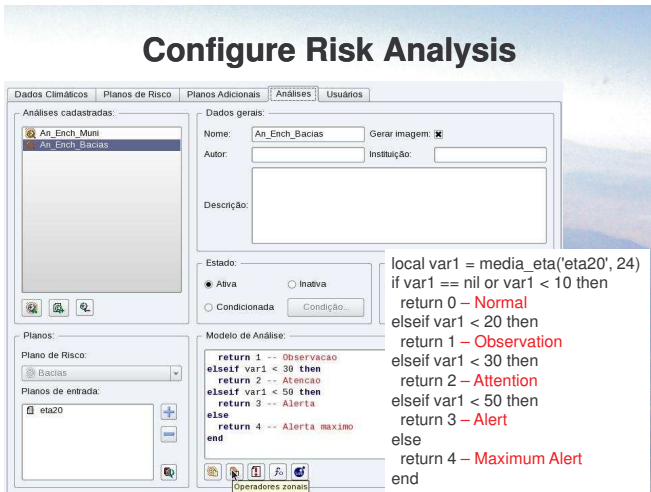
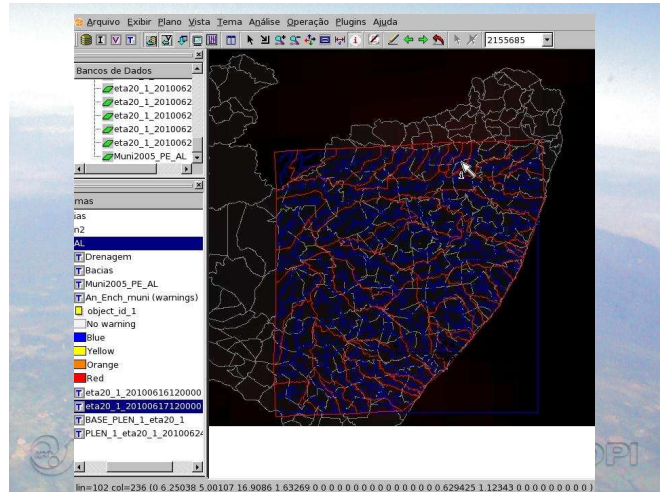
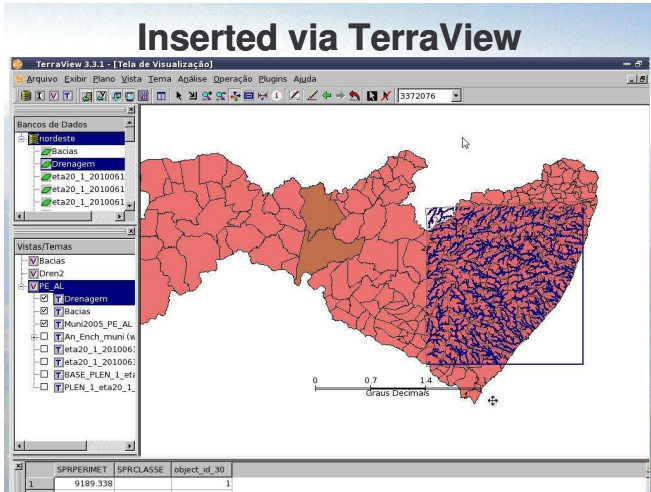
## Download



### Configure Climate Data

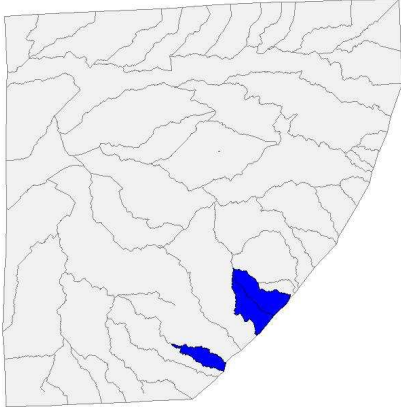
### Configure Risk Map Watershed from SRTM



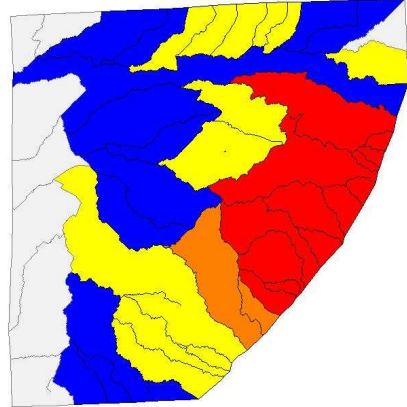




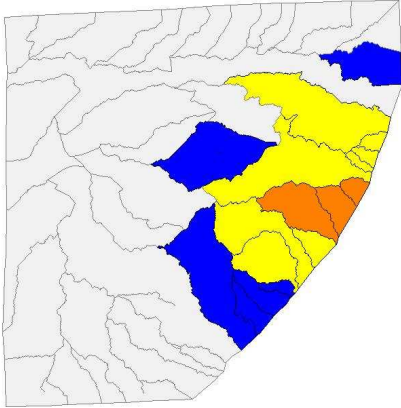
**Analysis 2010/06/12 12:00**



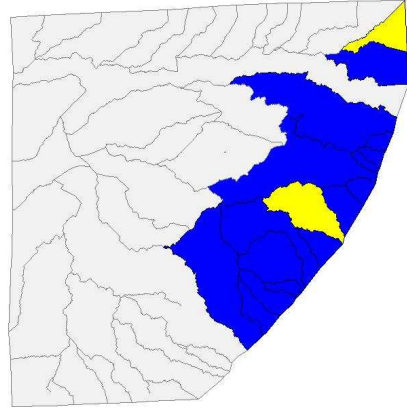
**Analysis 2010/06/13 00:00**



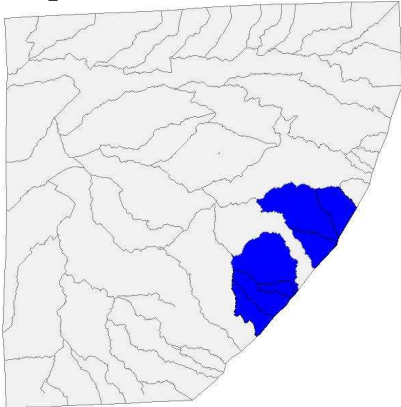
**Analysis 2010/06/13 12:00**



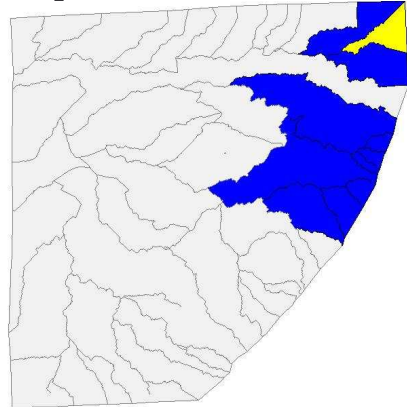
**Analysis 2010/06/14 00:00**



**Analysis 2010/06/14 12:00**

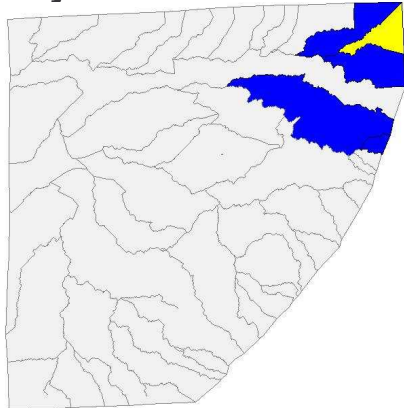


**Analysis 2010/06/15 00:00**

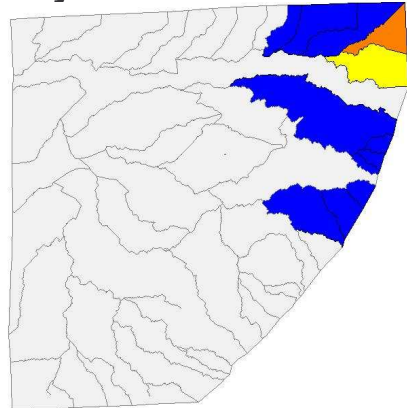




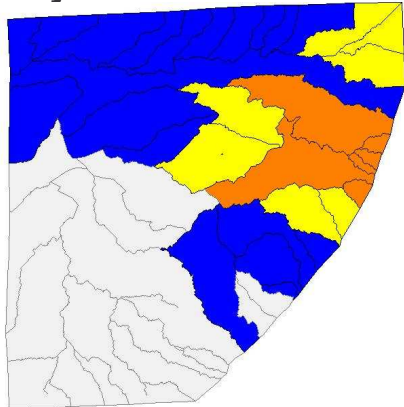
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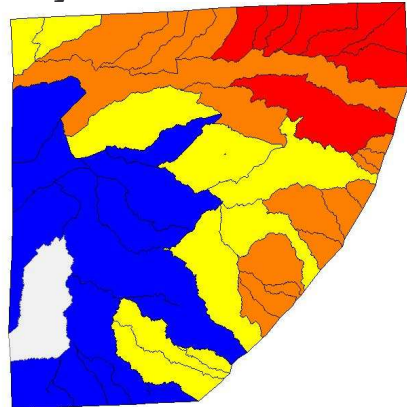
**Analysis 2010/06/16 00:00**



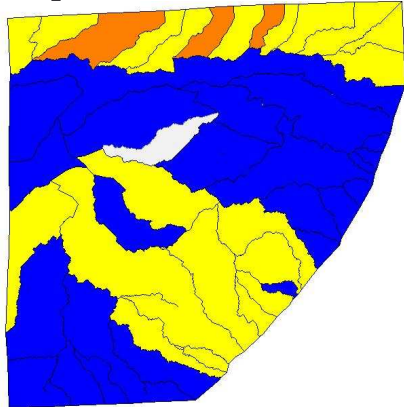
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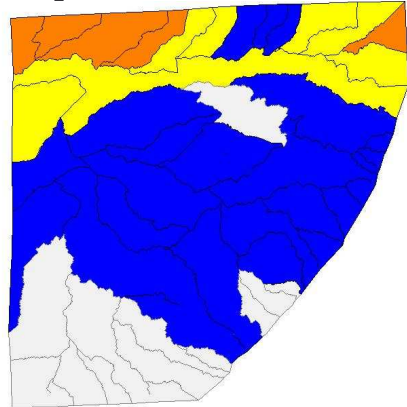
**Analysis 2010/06/17 00:00**



**Analysis 2010/06/17 12:00**

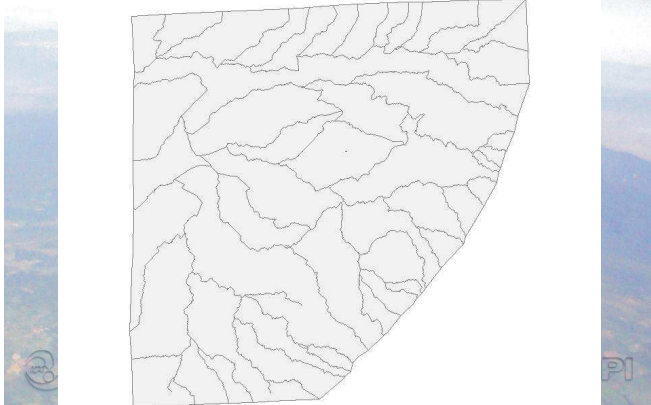


**Analysis 2010/06/18 00:00**

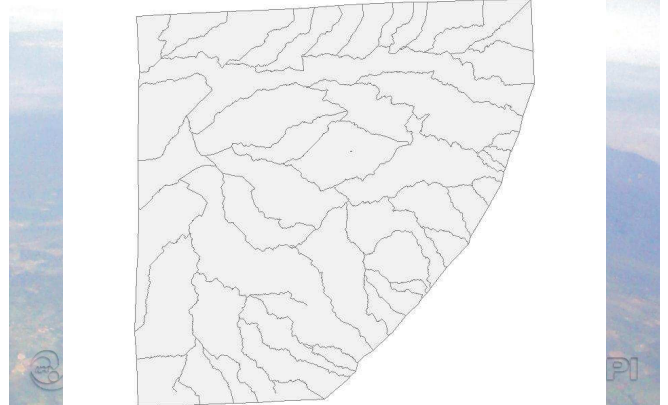




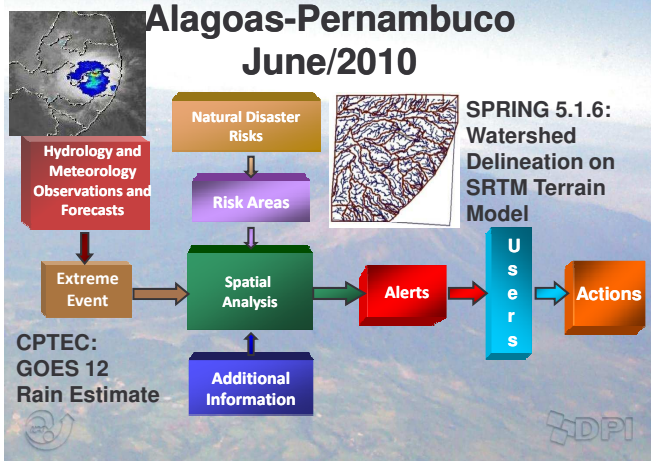
## Analysis 2010/06/18 12:00



## Analysis 2010/06/19 00:00



## Alagoas-Pernambuco June/2010



## Configure Climate Data Local Directory

Servidores cadastrados:  
 Servidor: Local  
 Descrição:  
 Parâmetros de conexão:  
 Endereço:  
 Porta: 0 Protocolo: File  
 Usuário: Senha:  
 Parâmetros de busca:  
 Servidor ativo Intervalo entre buscas de dados: 1min  
 Caminho base: /home/aismaden  
 Verificar conexão

## Configure Climate Data Setting Parameters

Dado: hidro  
 Nome: hidro  
 Tipo: Chuva prevista  
 Res. Esp.: 4 Km Prefixo: hidro  
 Freq. Atualiz.: 0.25 h Fuso Horário: -03:00  
 Descrição:  
 Localização:  
 Caminho: Hidro\_10a25jun  
 Máscara: S11216374\_%A%M%d%h%M.m bin Formato: GRADS  
 Parâmetros:  
 Arq. de Controle: racc.cd Multiplicador: 0.1  
 Tipo de Dados: Inteiro Ponto Flutuante Ordem: Automática  
 Num. Bandas: 1 Intervalo (min): 0  
 Bandas: Prefixo (bytes) / banda: 0 Sufixo (bytes) / banda: 0  
 Filtros: Filtro por data: Não Filtro por pré-análise: Não  
 Filtro por área: Sim Filtro por bandas: Não

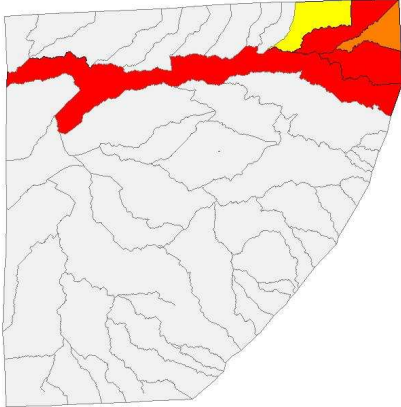
## Configure Risk Analysis

```

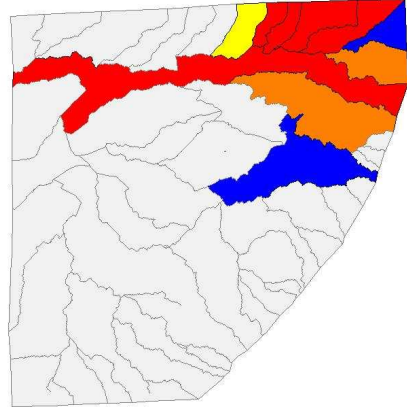
local var1 = 4*media('hidro')
if var1 == nil or var1 < 10 then
    return 0 - Normal
elseif var1 < 20 then
    return 1 - Observation
elseif var1 < 30 then
    return 2 - Attention
elseif var1 < 50 then
    return 3 - Alert
else
    return 4 - Maximum Alert
end
    
```



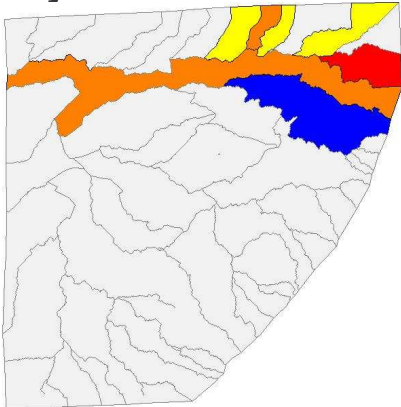
**Analysis 2010/06/17 22:00**



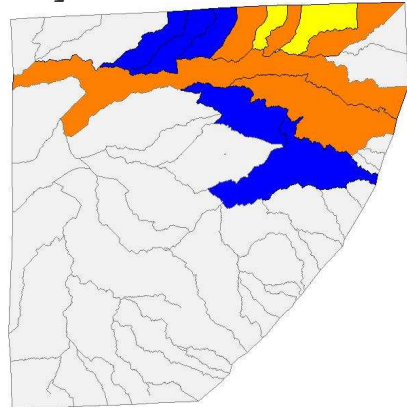
**Analysis 2010/06/17 23:15**



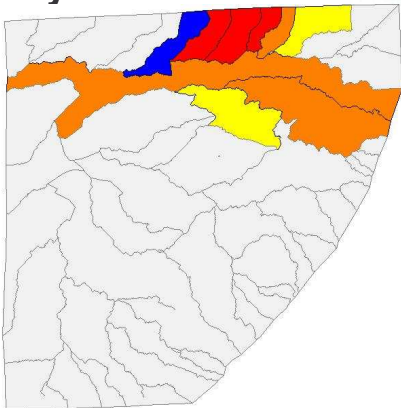
**Analysis 2010/06/18 01:15**



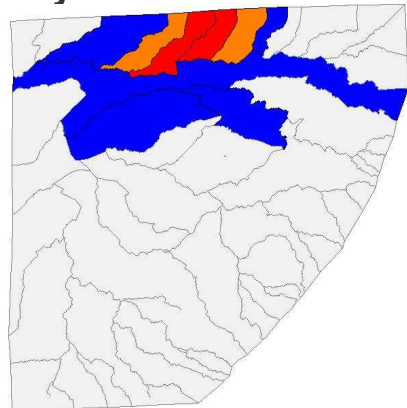
**Analysis 2010/06/18 02:15**



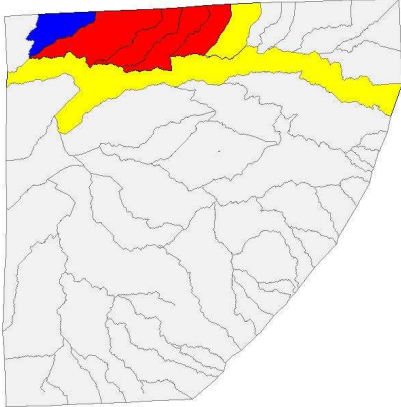
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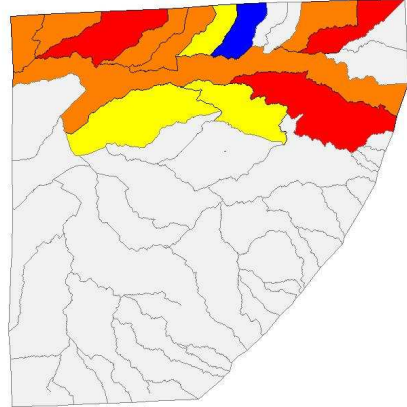
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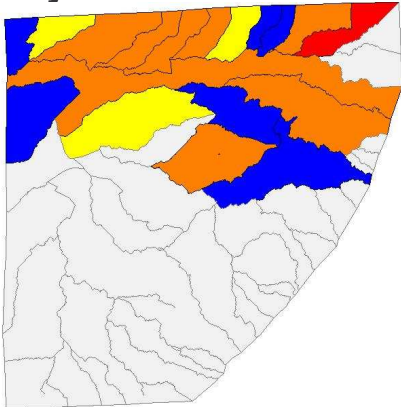
**Analysis 2010/06/18 05:15**



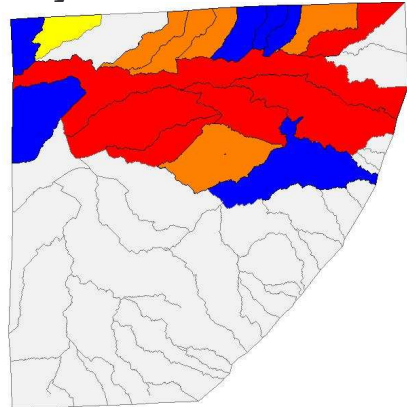
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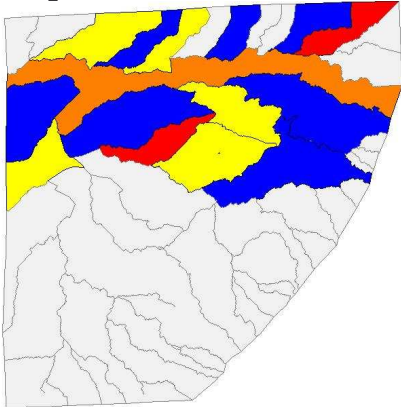
**Analysis 2010/06/18 07:15**



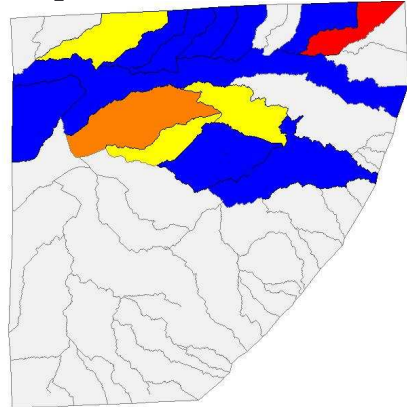
**Analysis 2010/06/18 08:15**



**Analysis 2010/06/18 09:15**

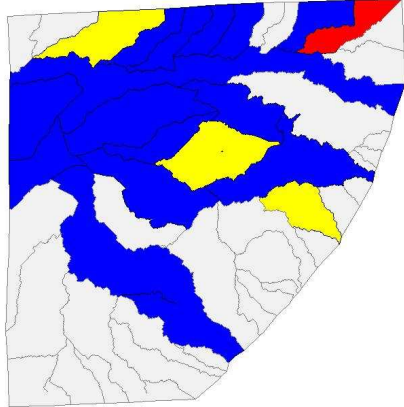


**Analysis 2010/06/18 10:00**

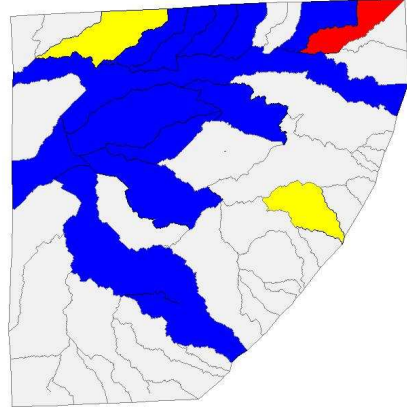




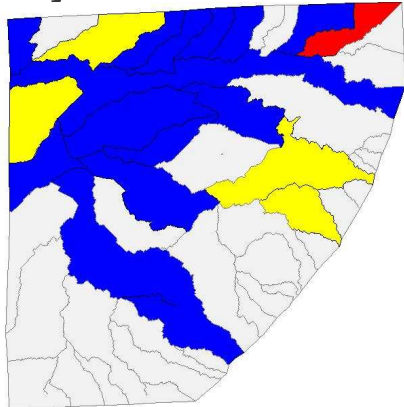
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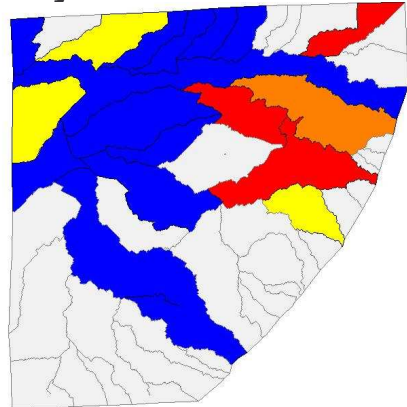
**Analysis 2010/06/18 12:15**



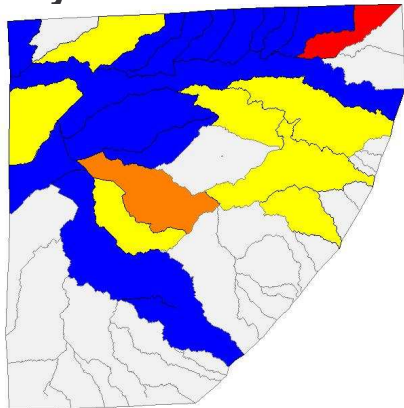
**Analysis 2010/06/18 13:15**



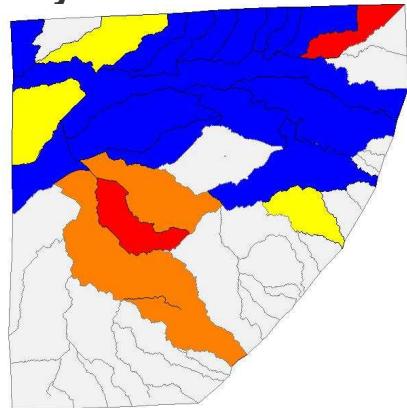
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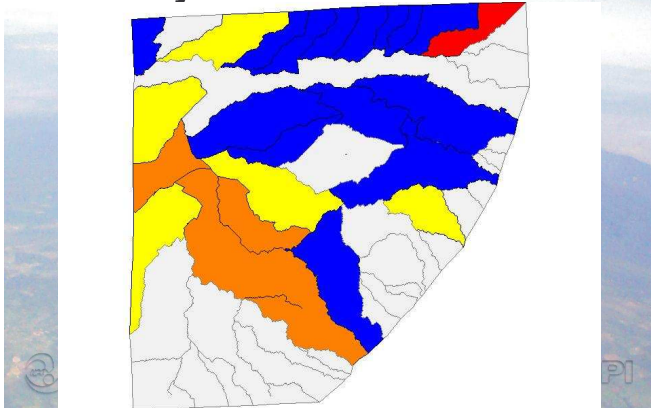
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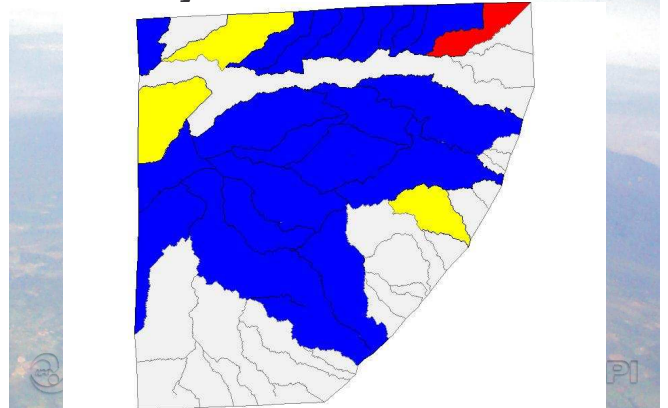
**Analysis 2010/06/18 16:00**



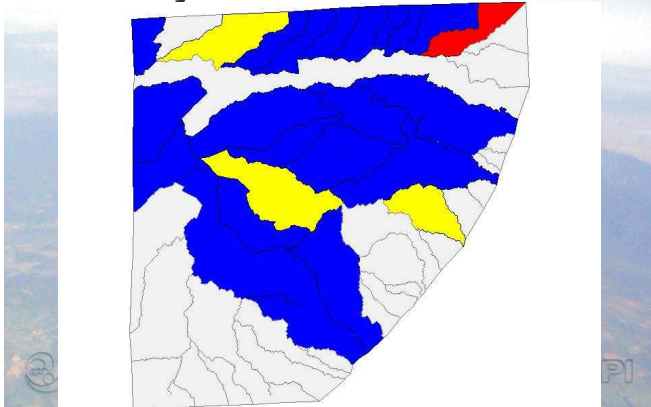
Analysis 2010/06/18 17:15



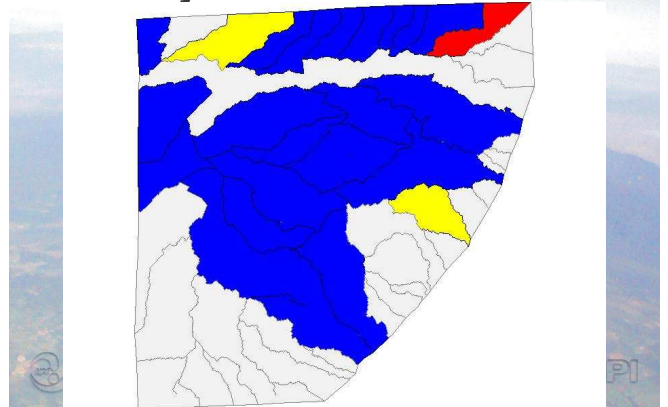
Analysis 2010/06/18 18:15



Analysis 2010/06/18 18:45



Analysis 2010/06/18 20:15



### Future Developments

- Inclusion of Dynamic Models - TerraME and TerraHidro (TerraLib family)
- Call to external models (FORTRAN programs, TITAN2D, Hydrologic models)
- Data validation - radar, PCD
- Alert model validation
- Operators for cumulative rain from observations – hydroestimator, radar

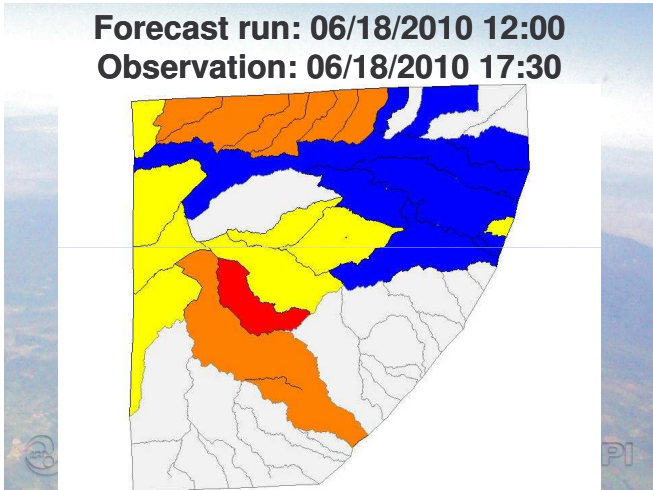
### Forecast and Observation

```

local var1 = 4 * media('hidro') -- soma total / area
local var2 = media_eta('eta20', 24) -- soma total 24h / area
local var3 = var1 + var2
if var3 == n11 or var3 < 10 then
return 0 -- Normal
elseif var3 < 20 then

```



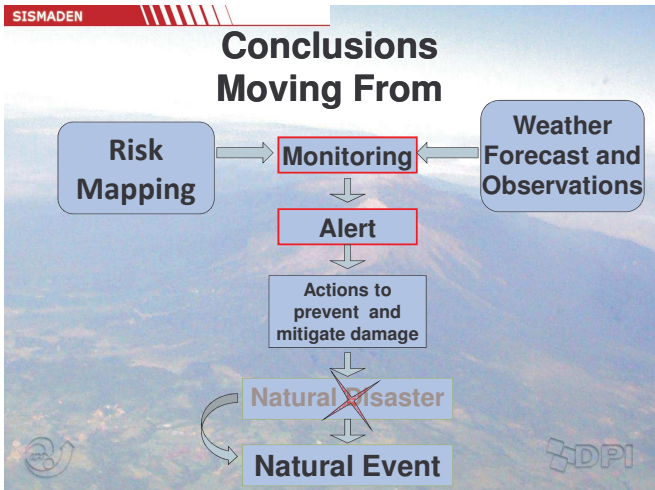
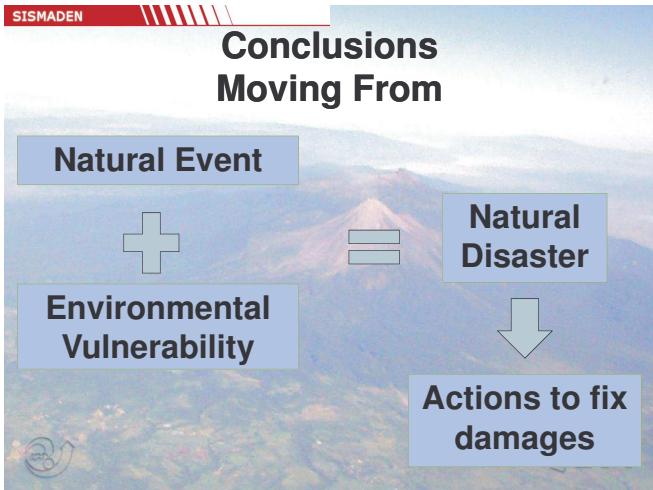


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## Conclusions

- Processes extremes captured by risk analyses
- Includes vulnerabilities
- Easy programming for non-programmers of input processing and risk analysis

**Data Access**



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<http://www.dpi.inpe.br/sismaden>

**TerraLib**  
<http://www.terralib.org>  
 laercio@dpi.inpe.br

