Case Study: Using the SISMADEN – Natural Disaster Monitoring and Alert System – in a Landslide event in Angra dos Reis, Brazil

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Background

→ Natural disasters have been the cause of losses for a long time, but their number and severity have been increasing lately.

→ The main factors:

  → Urbanization process: leading to human occupation of inappropriate land and increased vulnerability

  → Global climate change, which has increased the number of extreme weather events.

→ Landslides are natural geologic processes triggered by gravitational force, which moves large amounts of material, usually when this material is saturated by water. Therefore, where the natural landscape favors landslides, this region is occupied by humans, and there is enough precipitation, the result is a natural disaster.

→ **One solution to prevent or to minimize the extents of natural disasters is to implement a monitoring and alert system.**

SISMADEN
Natural Disaster Monitoring and Warning System

SISMADEN (software product) -> the platform where static risk maps are available, dynamic data is fetched from data servers, and the newly acquired dynamic data is analyzed considering the static risk maps.

If the analysis indicates that a predefined condition will occur and that this condition will trigger a natural disaster, **SISMADEN will send alerts to users.**

SISMADEN

Case Study:
Landslide event in Angra dos Reis, Brazil (2009/2010)

The case study presented in this study is a simulation of how SISMADEN would have been used to alert in the event of the landslides occurred during the night of December 31, 2009, in the municipality of Angra dos Reis, Brazil, in which 52 people were killed.

The main driver for these landslides was a precipitation of 142 millimeters in 24 hours period.
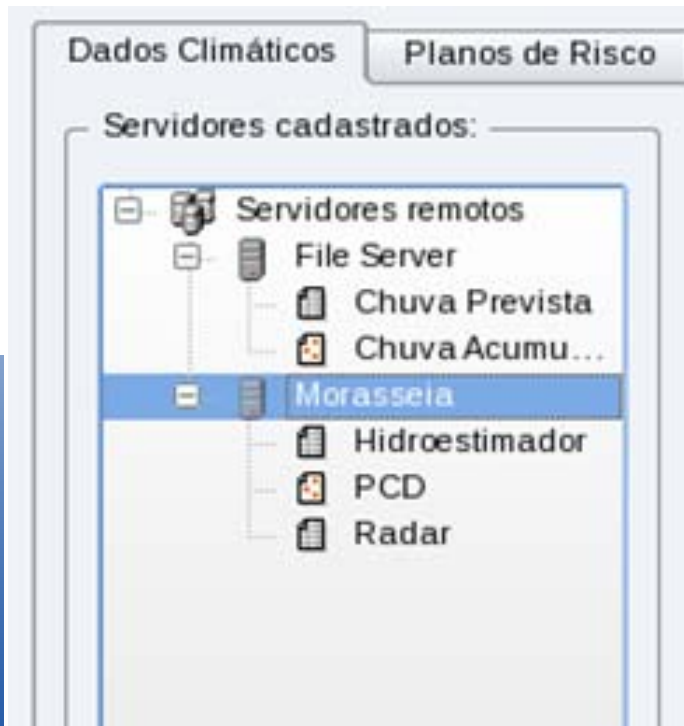
System Data Requirements

Dynamic data:

Hydroestimator information (precipitation is estimated based on meteorological satellite images), ground data collection platform, and weather forecast

Static data:
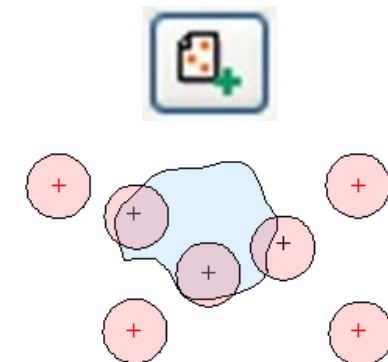
Risk maps

Additional maps

Climate Data– from CPTEC

Grid format (Binary, TIFF image, ASCII-text)
- Hydroestimator
- Lightning
- Weather Radar
- ETA – forecast model
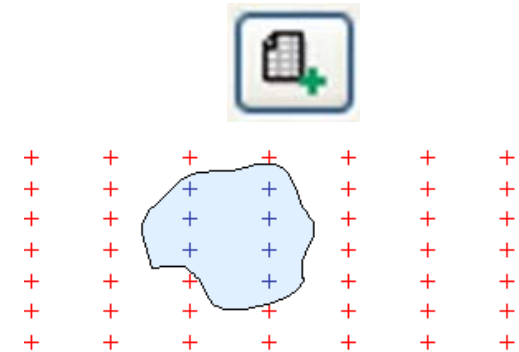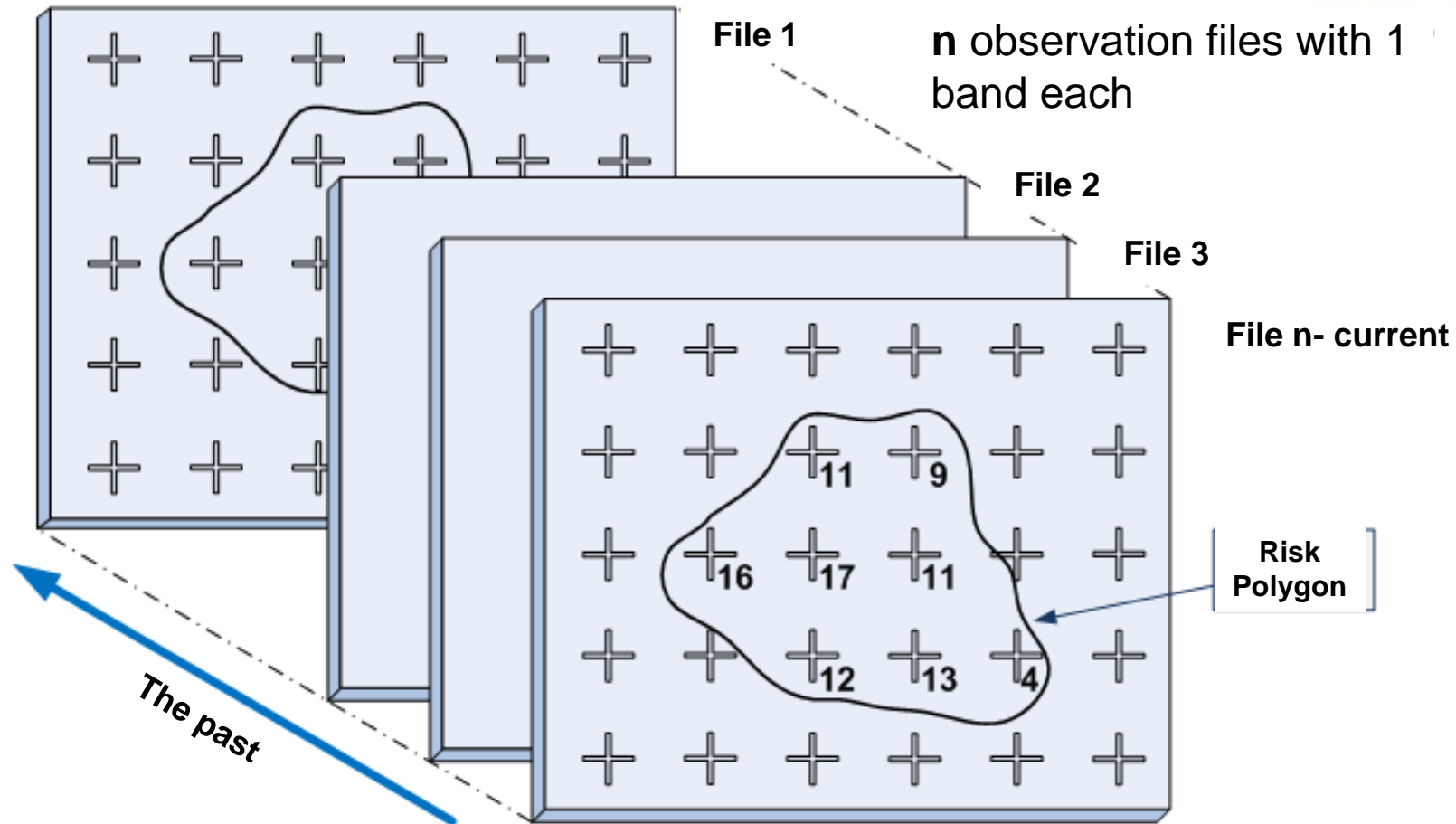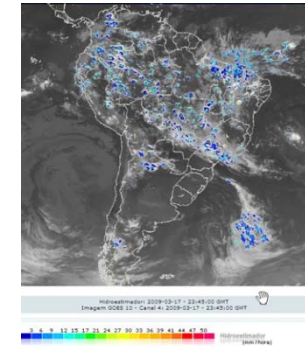
Points (ASCII-text)
•Data Collection Platforms

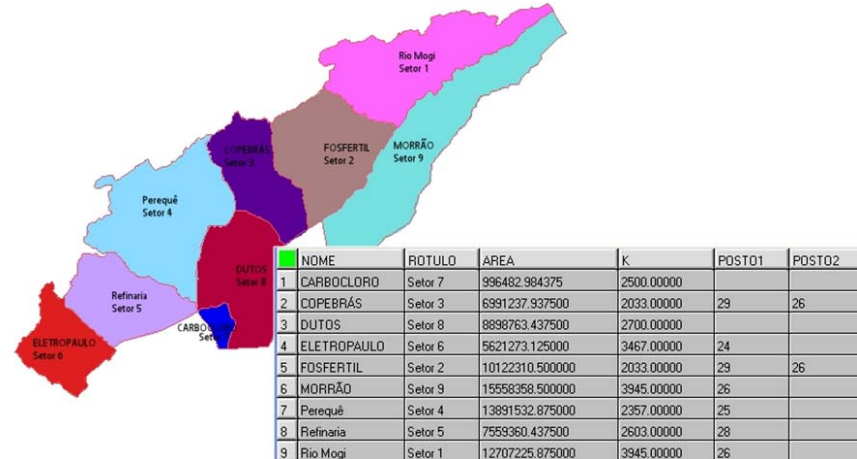# Example: Precipitation by satellite – Hydroestimator
GOES Imagery every 15 min
Available as mm/hour

File 1

n observation files with 1 band each

File 2

File 3

File n- current

The past

Risk Polygon

11   9

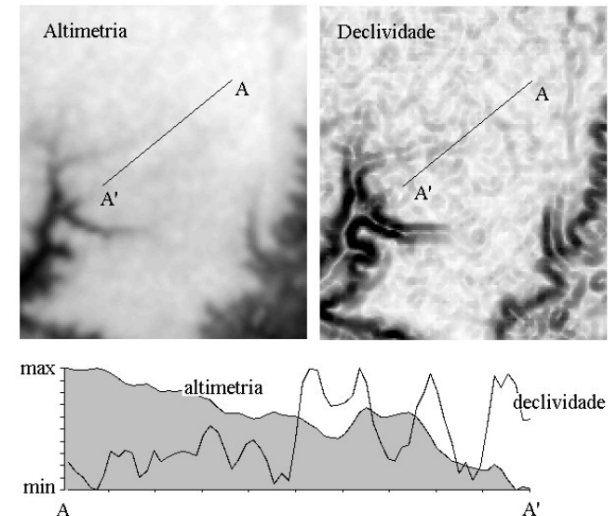16   17   11

12   13   4

Static Data (Risk Maps and Grids)

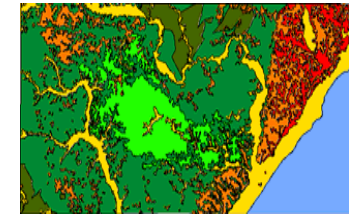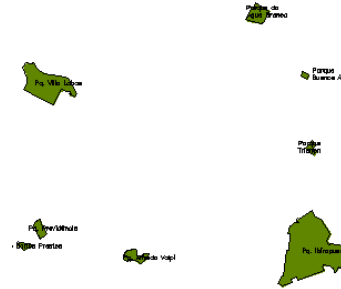Risk Maps: polygons with attributes

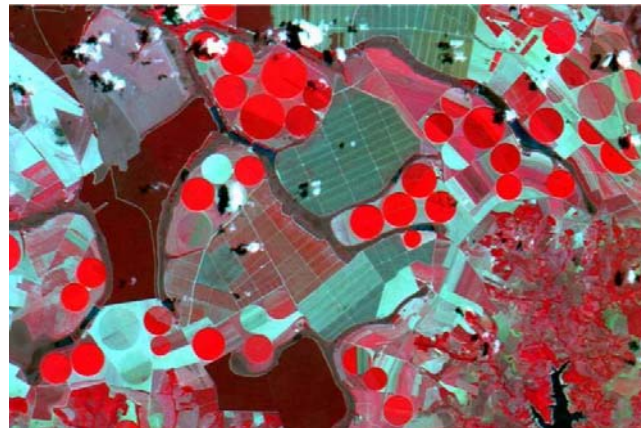Grids: Elevation, Slope

Inserted in the DB using: TerraView

Additional Maps (points, lines, polygons and grids)

Vector data – rivers, roads, pipelines, urban areas, ...

Raster (grids and background images)

CBERS-2 CCD, Minas Gerais, Brazil

Brasilia: HRC + CCD

Inserted in DB using : TerraView

Case Study:
Angra dos Reis – New Year 2009-2010

Morro da Carioca
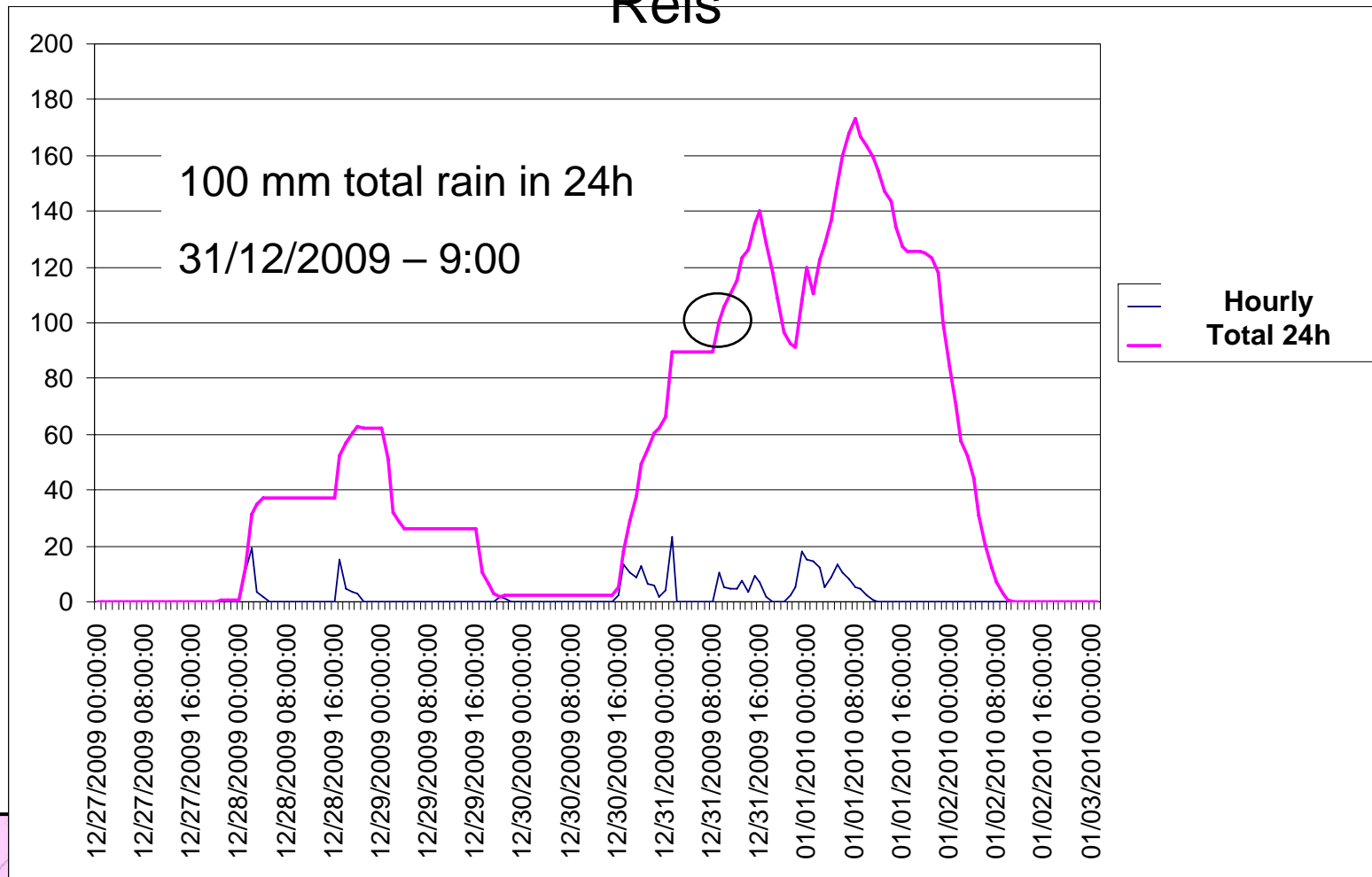Foto de 2010
Felipe Dana/AP

63 deaths in Rio de Janeiro State

21 deaths at Morro da Carioca and 32 deaths at Praia do Bananal
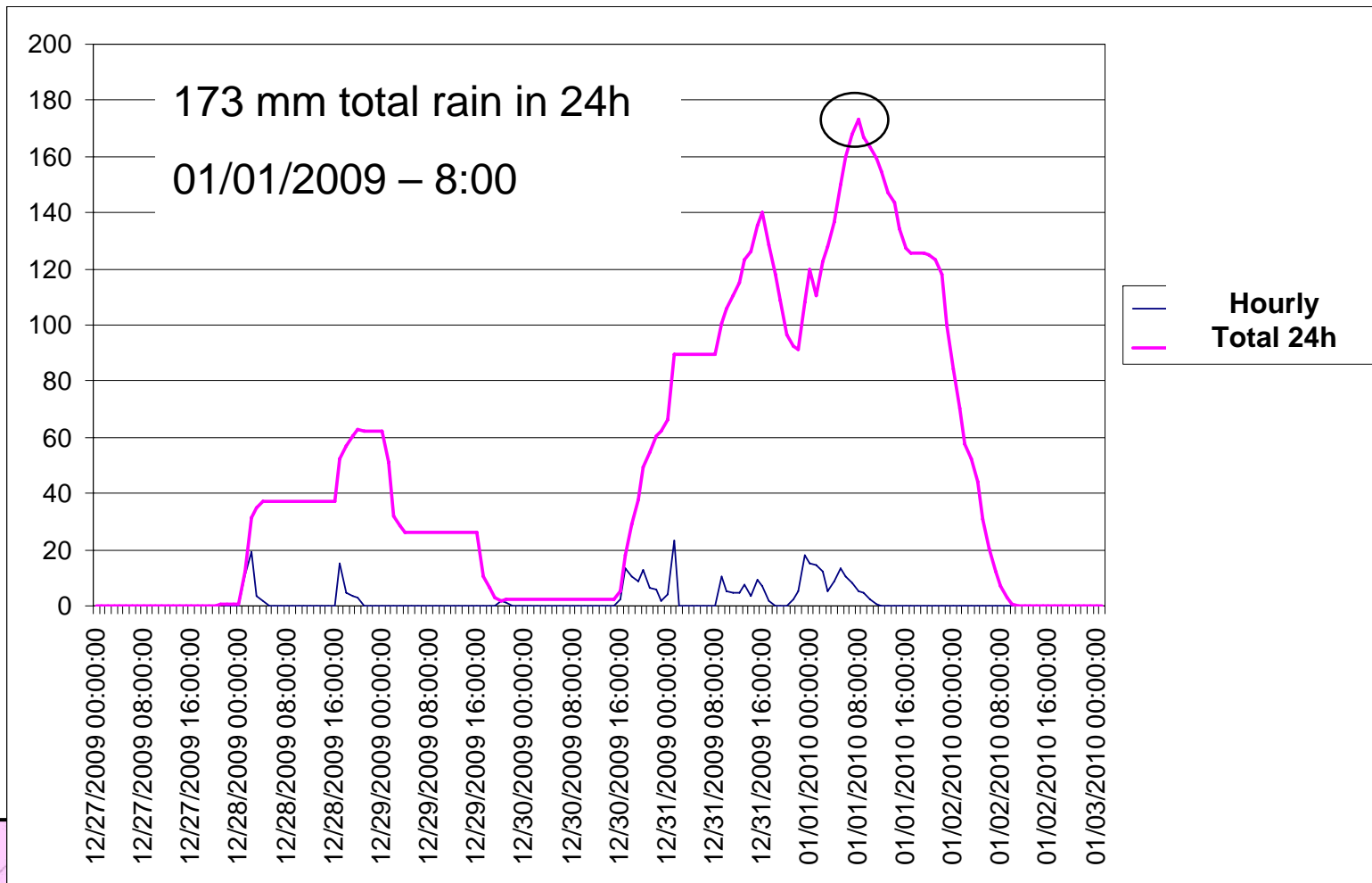
Observation Data: Pluviometer at Angra dos Reis

100 mm total rain in 24h

31/12/2009 – 9:00

Source: Eletronuclear

Pluviometer at Angra dos Reis

140 mm total rain in 24h

31/12/2009 – 16:00

Hourly
Total 24h

Source: Eletronuclear

Pluviometer at Angra dos Reis

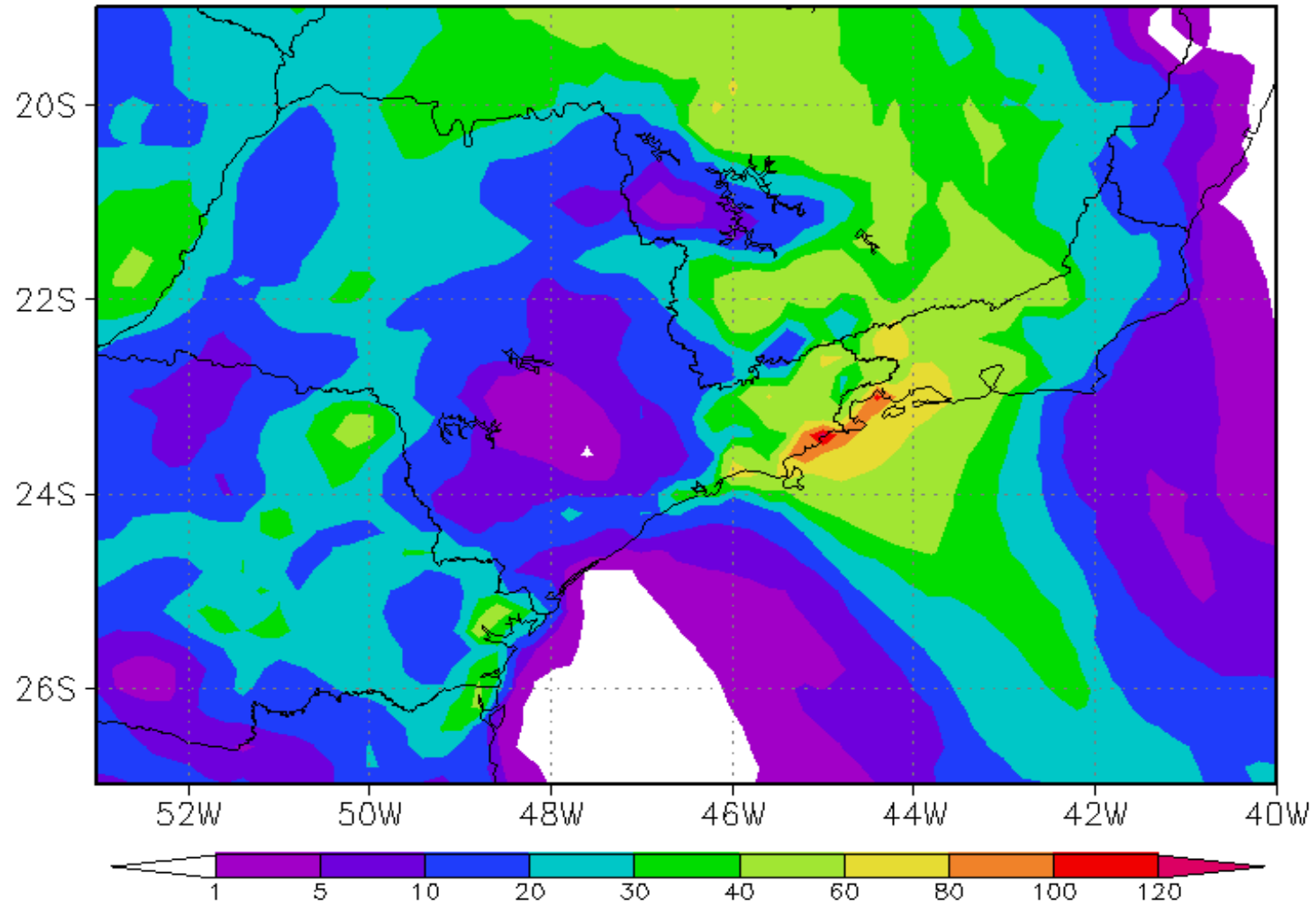173 mm total rain in 24h

01/01/2009 – 8:00

Hourly
Total 24h
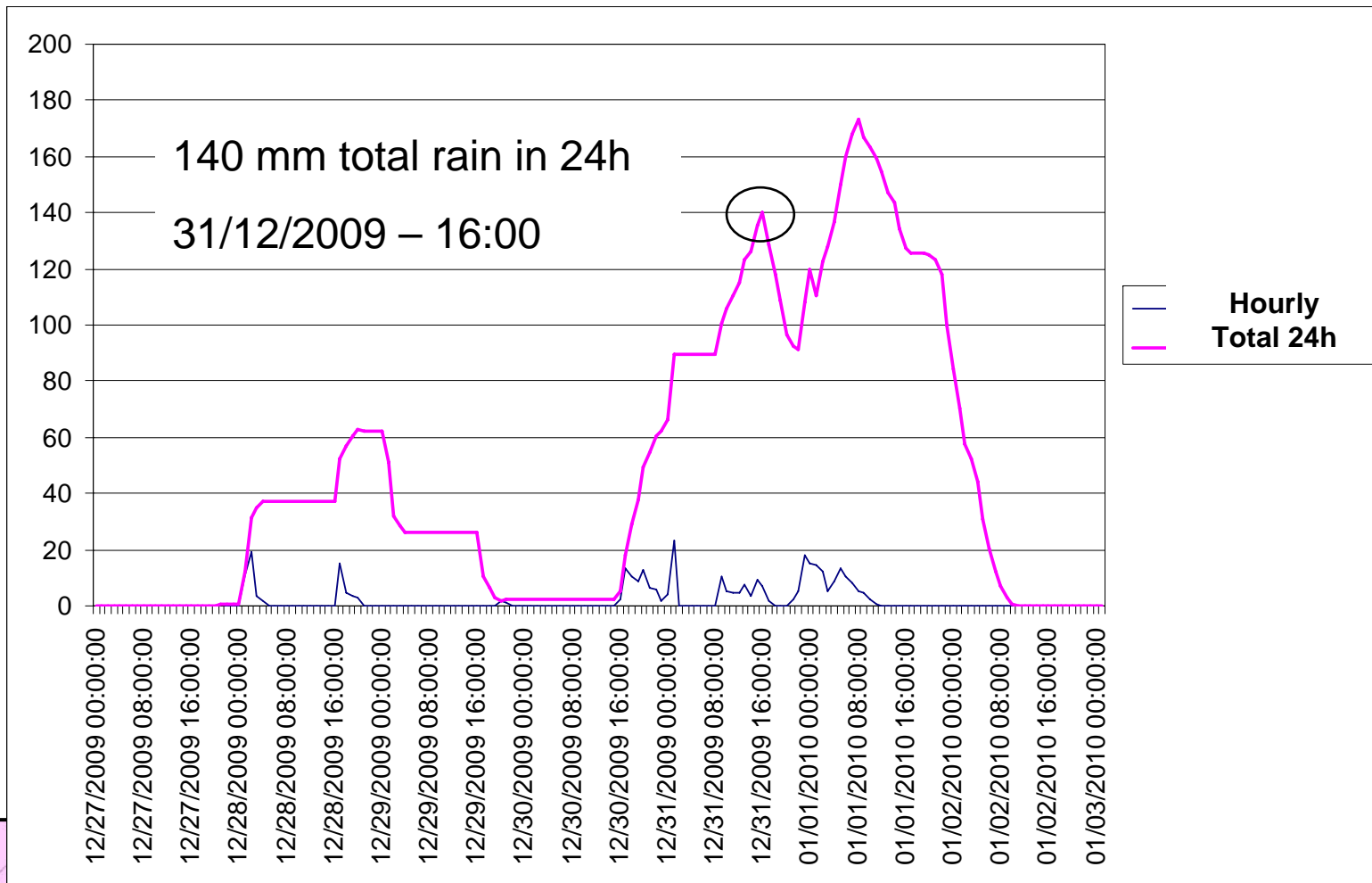
Source: Eletronuclear

**Forecast Data: Total rain in 24 hs forecasted for 01/JAN/2010 - ETA-20 km
24hs in advance
Red: total rain > 100 mm/day**
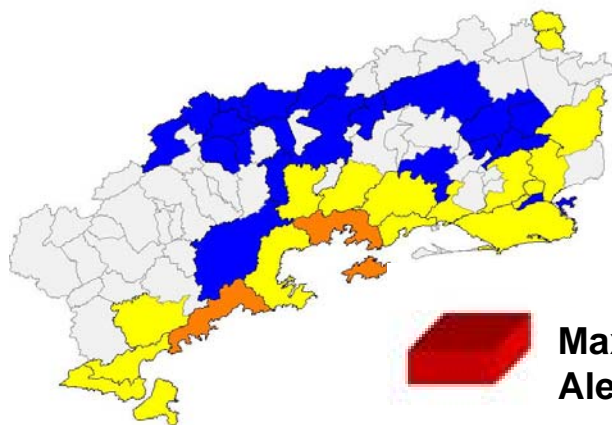
Final Product: Warning

Dear user,

There has been a change in the warning level of one or more zones in the risk map of a analysis associated to you. See below the full report of changes:

Analysis Name: Analise_Municipios_Hidroestimador

Risk Zones

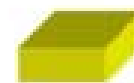| ID	Nome	Previous Warning Level	Current Warning Level
01	Angra dos Reis	2	3
02	Ilha Grande	2	3
03	Parati	1	2

Attached Image – 31/12/2009 – 14:00 h
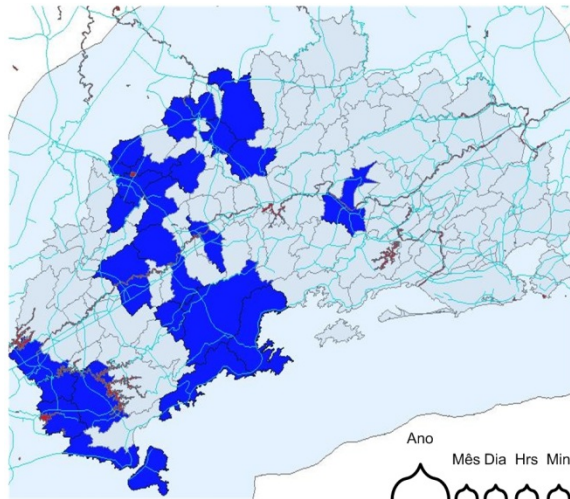
Maximum Alert

Alert

Attention

Observation

Results

SISMADEN

The results indicate that alerts can be emitted with up to four hours in advance for this type of natural disaster, using these dynamic data, and that SISMADEN is innovative software that can be easily configured to be used in providing early warning.
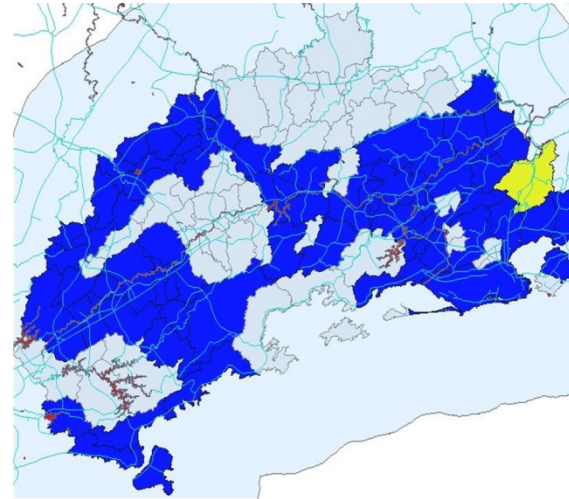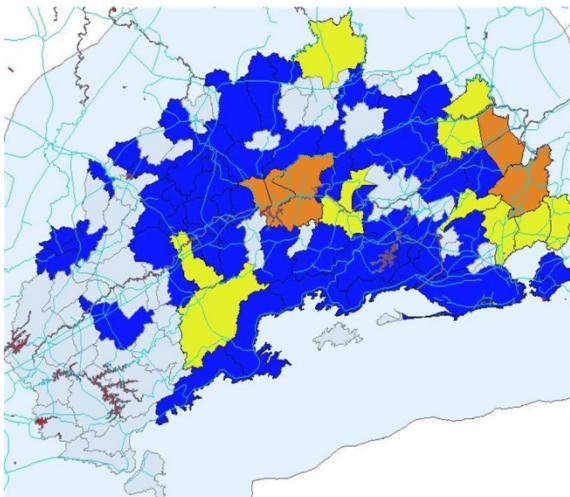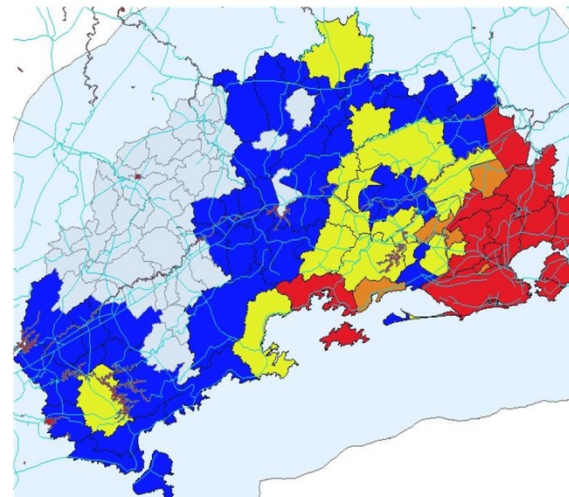
Conclusions

Análise Hidro24hrs ETA12hrs_200912290700

Análise Hidro24hrs ETA12hrs_200912292030

Análise Hidro24hrs ETA12hrs_200912300830

Análise Hidro24hrs ETA12hrs_200912310830

Gradual evolution of the number of warnings.

It is feasible to identify with 18 hours in advance the high risk (Maximum Alert in Red) for the Region municipalities, including Angra dos Reis.

Importance of the investment in monitoring natural disasters and defining risk maps.

Capability to overlay real time climate data with vulnerability data.

Thank you!

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