



CAP in BRAZIL

Merging Meteorological and Disaster Alerts

Osvaldo Moraes – CEMADEN

A changing climate can lead to changes in extremes



Impacts of weather and climate extremes depend on: Nature and severity of the event, exposition and vulnerability

-The National System for Natural Disasters Prevention is basically composed by integrated actions developed in **three centers** of the government federal level:

- **National Institute of Meteorology (INMET)**, linked to the Ministry of Agriculture
- **National Centre for Monitoring and Early Warning of Natural Disasters (CEMADEN)**, which is a center of the Ministry of Science, Technology and Innovation (MCTI), and
- **The National Centre for Disaster and Risk Management (CENAD)**, linked to the Ministry of National Integration (MI)

INMET is the national institution responsible by weather forecast

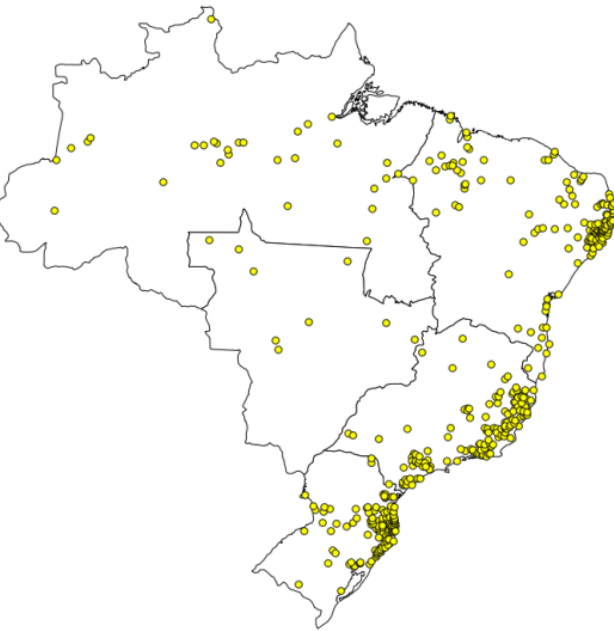
CEMADEN implements, on national level, the **continuous monitoring of adverse hydro meteorological and climate conditions, which may trigger processes that produce imminent risk of natural disasters occurrence.** Based on data and information of pluviometers, fluviometers and meteorological radars, CEMADEN **analyses and issues early warning of risks of geodynamic processes of landslides and hydrological alerts associated to floods and impacts of severe droughts.**

The early warnings are reported to **CENAD**, which retransmits them to the state and municipal departments of Civil Defense.

Distribution of natural disasters in Brazil

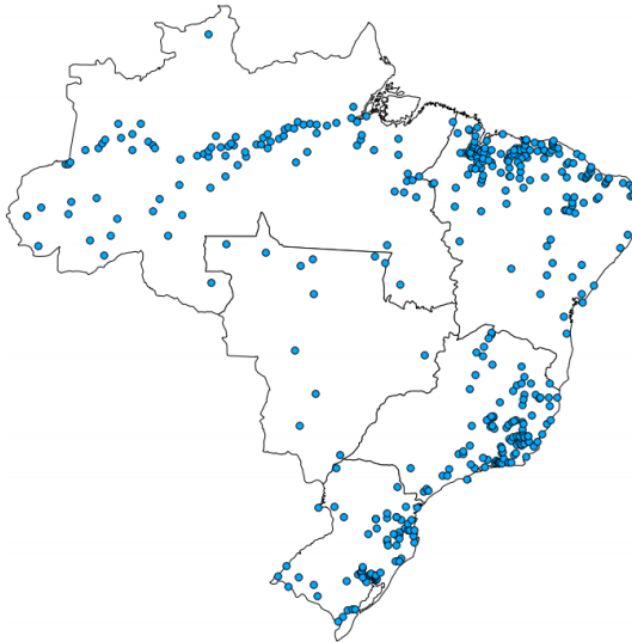
Flashfloods

Enxurrada (436)



Floods,

Inundação (426)



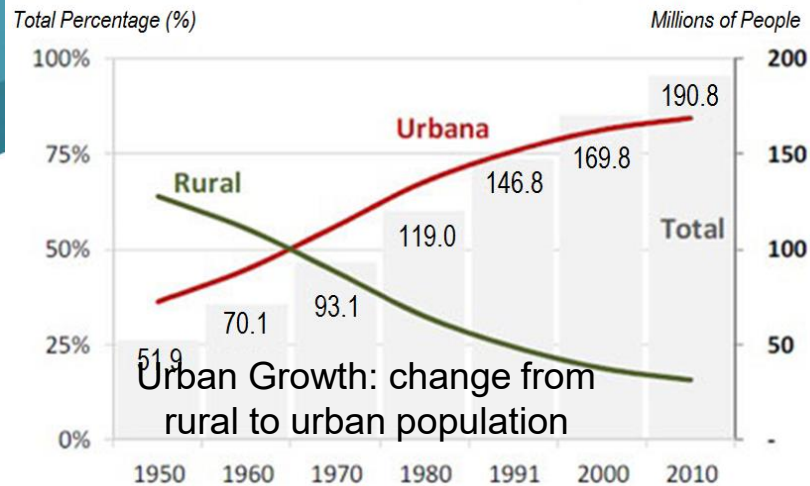
Landslides

Deslizamento (268)

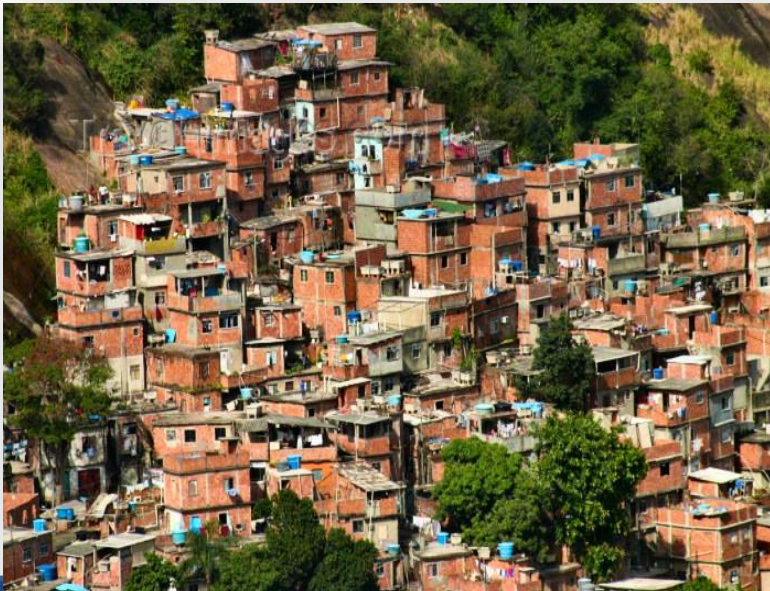


Source: Brazilian Ministry of Planning, 2014

Underlying Drivers of Disaster Risk



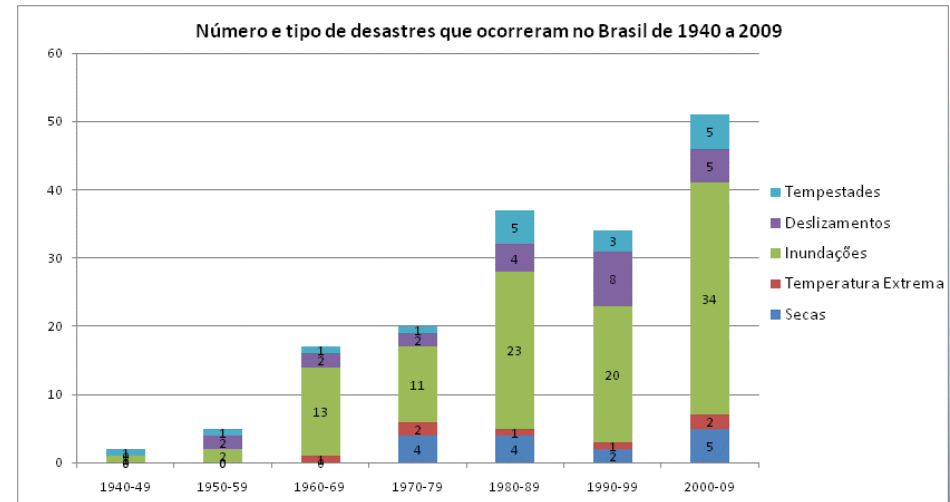
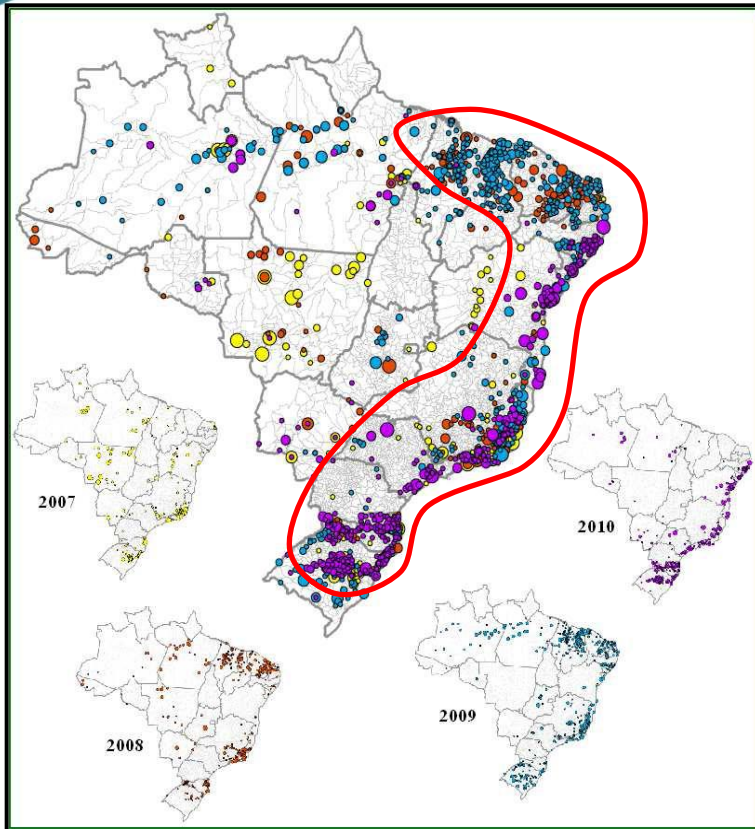
Natural disaster of 11-12 January 2011 in the mountains west of Rio: over 900 fatalities and a catalyst to DRR policies focused on prevention → Creation of CEMADEN



Over 5 million people mostly poor and vulnerable living in areas of high disaster risk in Brazilian cities

Significant increase of the risk

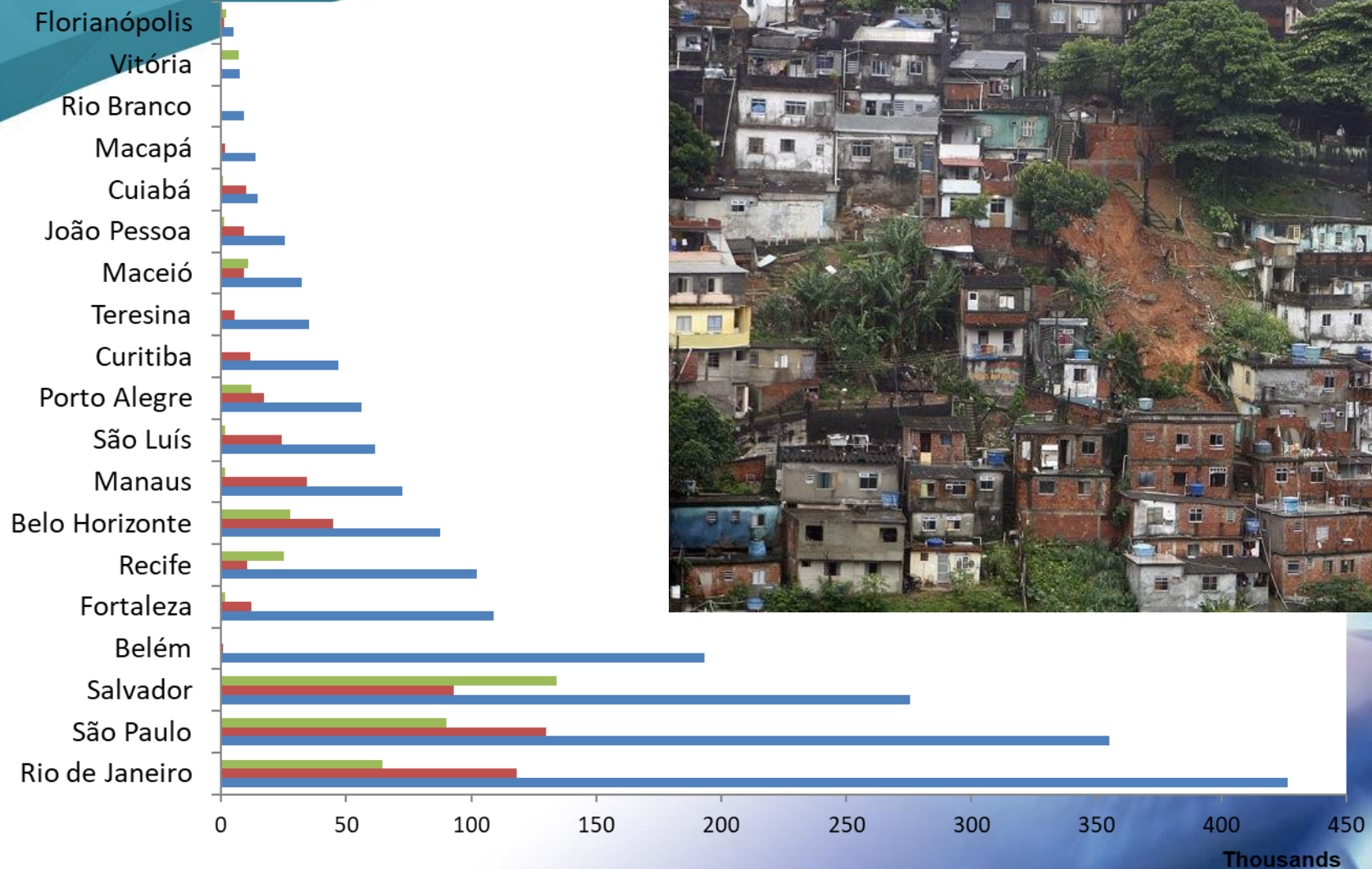
Evolution of Natural Disasters in Brazil



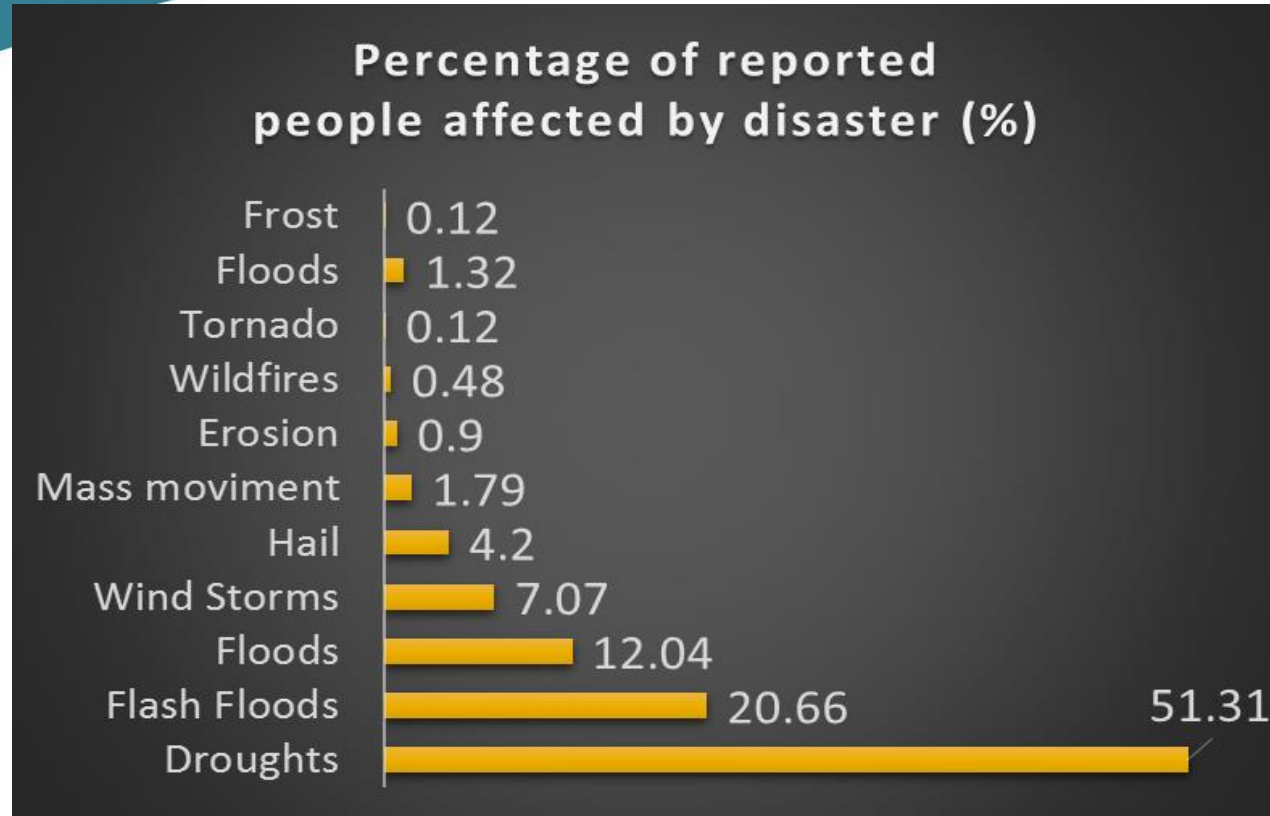
Fonte: Defesa Civil Nacional e MPOG

RISK = SUSCEPTIBILITY X EXPOSURE

slums and squatter settlements in unsafe hillslopes (IBGE, 2013)



Disasters in Brazil



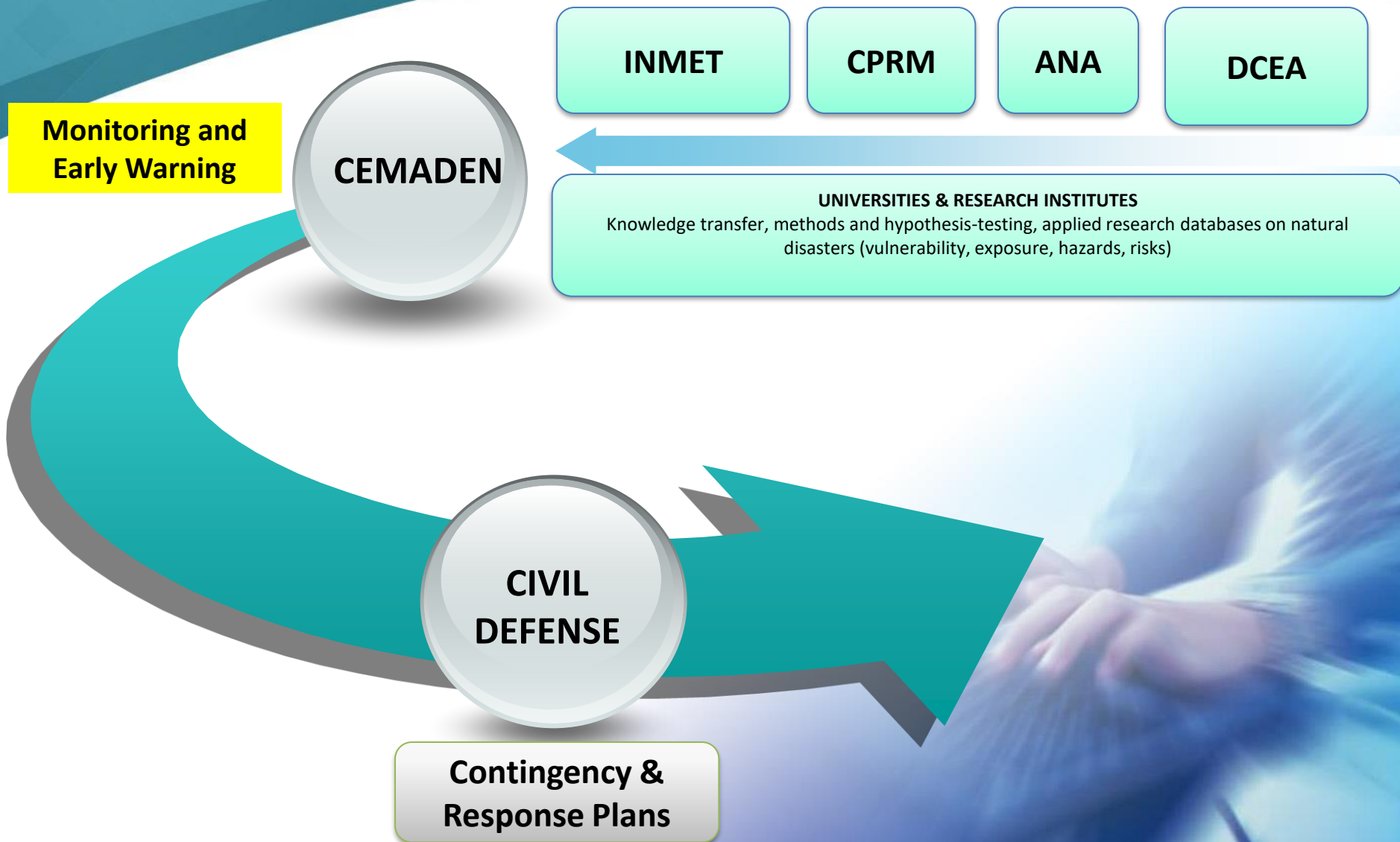
Landslides and flashfloods accounts by more than 90% of fatalities!

Post-2011 DRR Policy in Brazil: A Paradigm Shift

National Plan for Risk Management and Response to Disasters



The National Strategy



CEMADEN: Towards an interdisciplinary perspective

- **Understanding**:
 - ✓ Where is each type of hazard likely to be presented and why?
 - ✓ What scientific principles govern the process responsible for the disaster?
 - ✓ How often do these hazards develop into disasters?
 - ✓ How can each type of disaster be predicted and/or mitigated?
 - ✓ What different type of data need to be collected?
- **Forecasting**: how to include emerging data in forecasting models and systems?
- **Alerting**: how to issue warnings in face of uncertainties?

RISK

$$R = H \times \left[\left(\frac{V}{C + E} \right) - M \right]$$

How to engage citizens?

How to communicate risks?

H = Hazard (flood; drought; landslides; etc.)

V = Vulnerability (social; physical; economical; technological; cultural; ecological; etc.)

C = Protection Capacity

E = Education

M= Mitigation

PLEASE DO NOT LOOK THIS “EXPRESSION” AS AN EQUATION

Meteorological Warning issued on 27/11/17

NECESSARY BUT NOT SUFFICIENT



WHY ?

EVENT IS NOT A DISASTER

DISASTER IS THE IMPACT

INMET

Warning of: Chuvas Intensas. Severity level: **Perigo Potencial**
Event: Chuvas Intensas
Start: 27/11/2017 13h0min
End: 28/11/2017 10h30min
Institution: Instituto Nacional de Meteorologia

Potential Risks:
INMET publica aviso iniciando em: 27/11/2017 13:00. Chuva entre 20 e 30 mm/h ou até 50 mm/dia, ventos intensos (40-60 Km/h). Baixo risco de curto-circuito elétrico, queda de galhos de árvores, alagamentos e de descargas elétricas.

Instructions:

- Evite o uso de aparelhos de vento: (não se abrigue sob árvores, pois há leve risco de queda e de descarga elétrica e não use veículo próximo a torres de transmissão e placas de propaganda).
- Evite usar aparelhos eletrônicos ligados à tomada.
- Obtenha mais informações junto à Defesa Civil (telefone 199) e ao Corpo de Bombeiros (telefone 193).

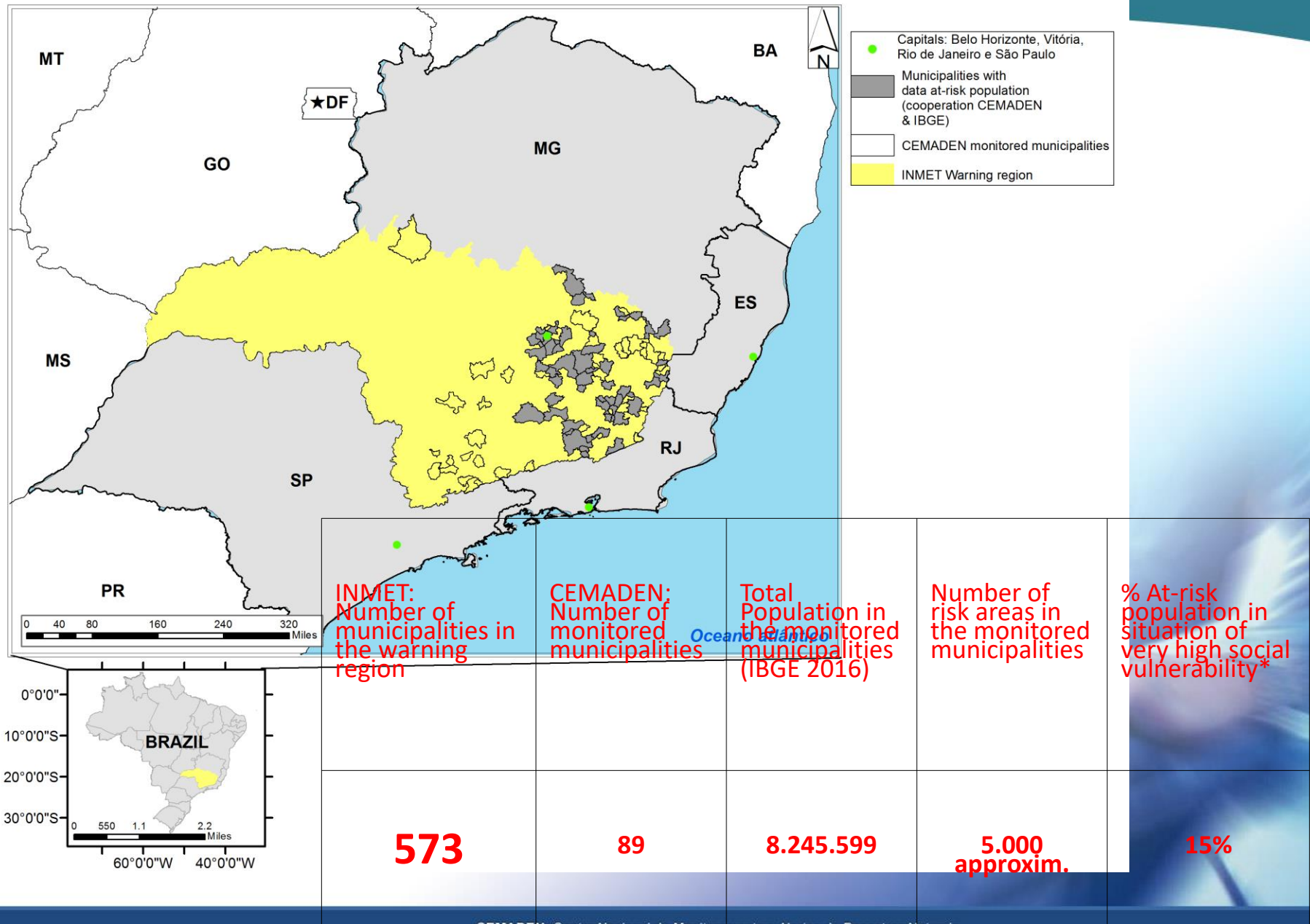
Cities:
Adrianópolis - MG (3100104), Araxá - MG (3100203), Belo Horizonte - MG (3100102), Belo Horizonte - MG (3100101), Águas de Caldas - MG (3100100), Alfândega - MG (3100807), Alvorada - MG (3101201), Alagoinhas - MG (3101300), Almeida - MG (3101401), Alencar - MG (3101501), Alencar - MG (3101601), Alfredo V... see more

Affected area:
Aviso para as áreas: Triângulo Mineiro/Alto Paranaíba, Central Mineira, Vale Do Rio Doce, Metropolitana De Belo Horizonte, Zona Da Mata Mineira, Campo Das Vertentes De Minas, Oeste Mineiro, Sul/Sudoeste Mineiro, Noroeste Mineiro

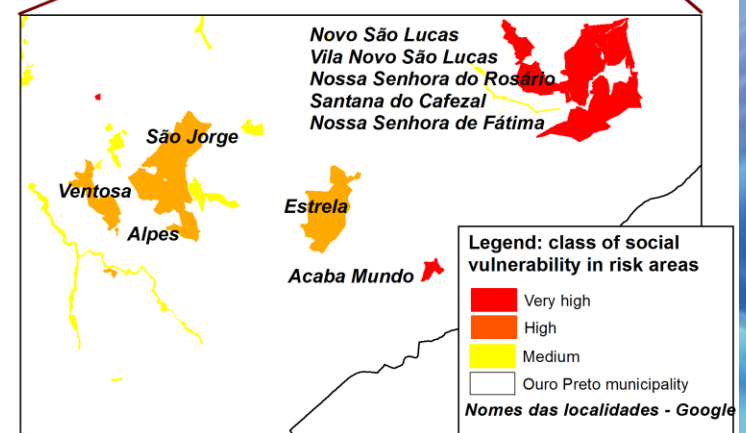
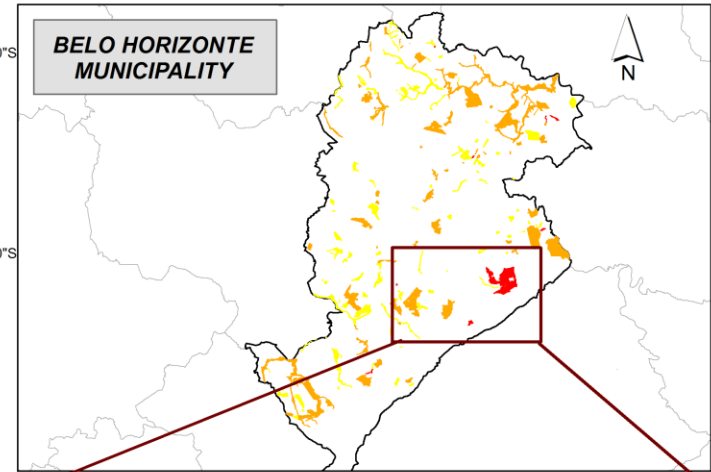
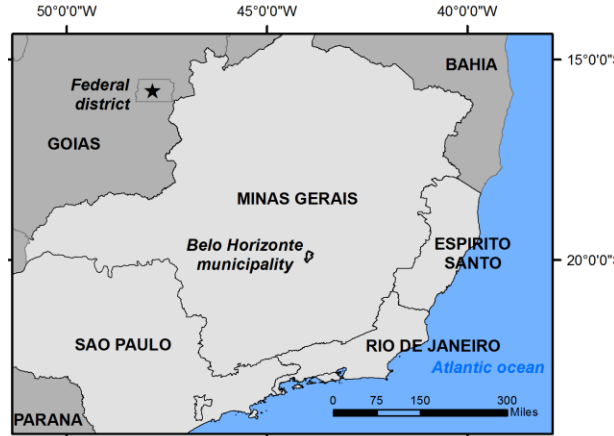
Legenda



INMET warned regions & CEMADEN monitored municipalities



Social vulnerability at Belo Horizonte in areas susceptible to landslides



CEMADEN & IBGE cooperation: demographic census 2010	At-risk Population (people living in 5.084 risk areas)		Number of houses in the risk areas	Children	Elderly	At-risk population & class of social vulnerability		
	Women	Men				Very high	High	Medium
BELO HORIZONTE MUNICIPALITY	391.444		112.979	36.100	31.153	40.186	250.853	100.405
	203.900	187.544						

ALERTA

ALERTA N°	ABERTO EM	ATUALIZADO EM	MUNICÍPIO	UF
1750/2017 Abertura	28/11/2017 18h16		BELO HORIZONTE	MG

TIPO DE EVENTO/NÍVEL:

ENXURRADA / MODERADO
INUNDAÇÃO / MODERADO

Cenário de Risco:

Possibilidade de ocorrência de enxurrada em áreas urbanas com alta declividade, onde o escoamento superficial é concentrado e com alta energia de transporte.
Possibilidade de ocorrência de inundação brusca em córregos e canais que cortam o município.

Situação Atual:

Área de instabilidade atuando sobre o município.

Tendência:

Continuidade de chuva com possibilidade de chuva nas próximas horas.

Recomendações:

Atenção às áreas de risco mapeadas PMBH 2014 e 2010. Estima-se que 3.696 pessoas em 924 moradias estejam expostas ao risco alertado. Atenção especial às áreas de risco de inundação aos córregos da região do Taquaril, Olhos D'Água, do Jatobá, do Barreiro e Arrudas.

Ações de Proteção e Defesa Civil recomendadas pelo CENAD:

Em caso de alerta de risco de nível MODERADO não se descarta a possibilidade do fenômeno alertado e, caso ocorra, espera-se impacto moderado para a população. Recomendam-se ações previstas no plano de contingência, tais como: sobreaviso das equipes municipais, etc.

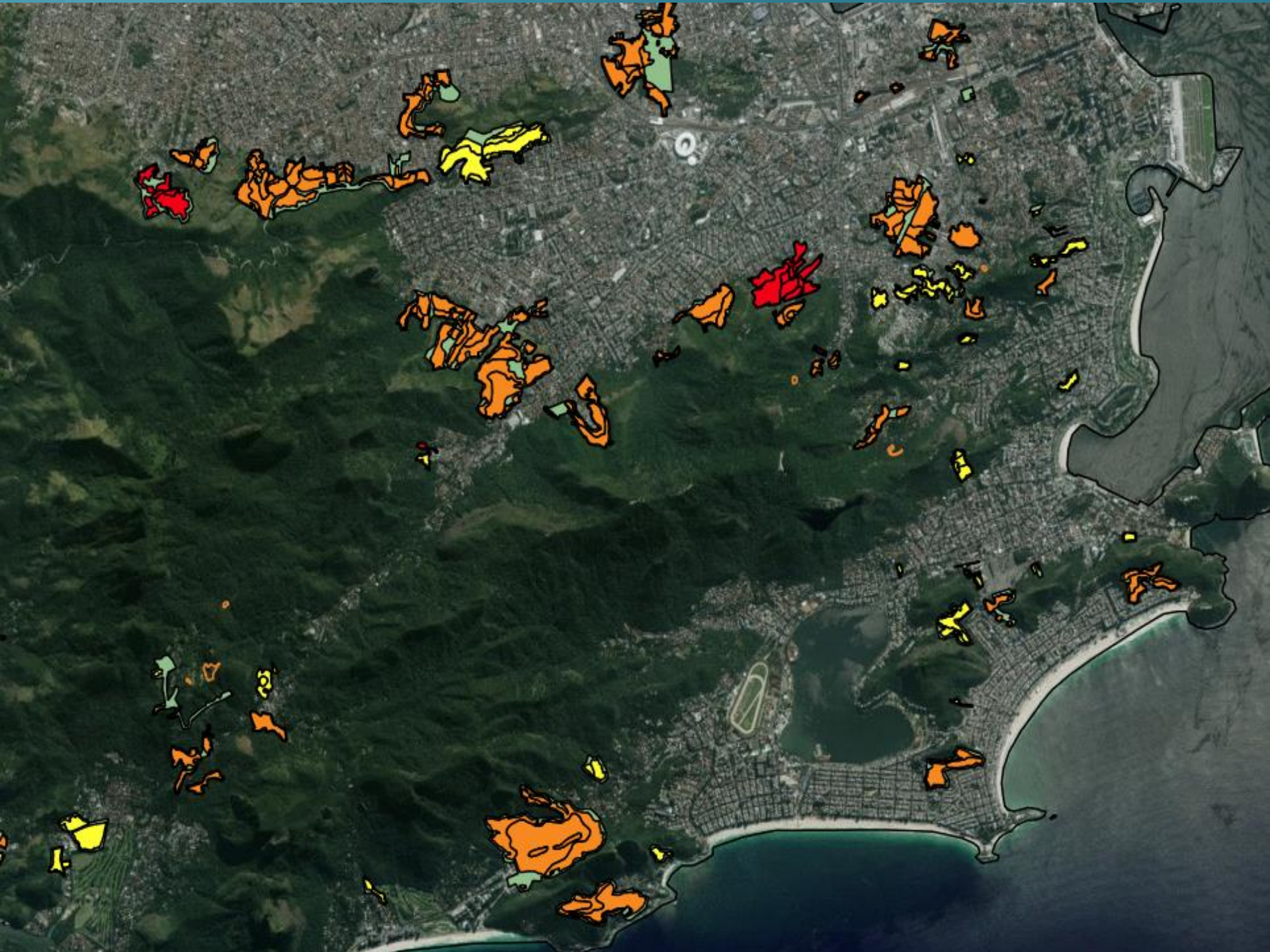
Para constante melhoria dos alertas emitidos pelo Cemaden, solicita-se o preenchimento do breve questionário no link: <http://www.cemaden.gov.br/ocorrencias/index.php>

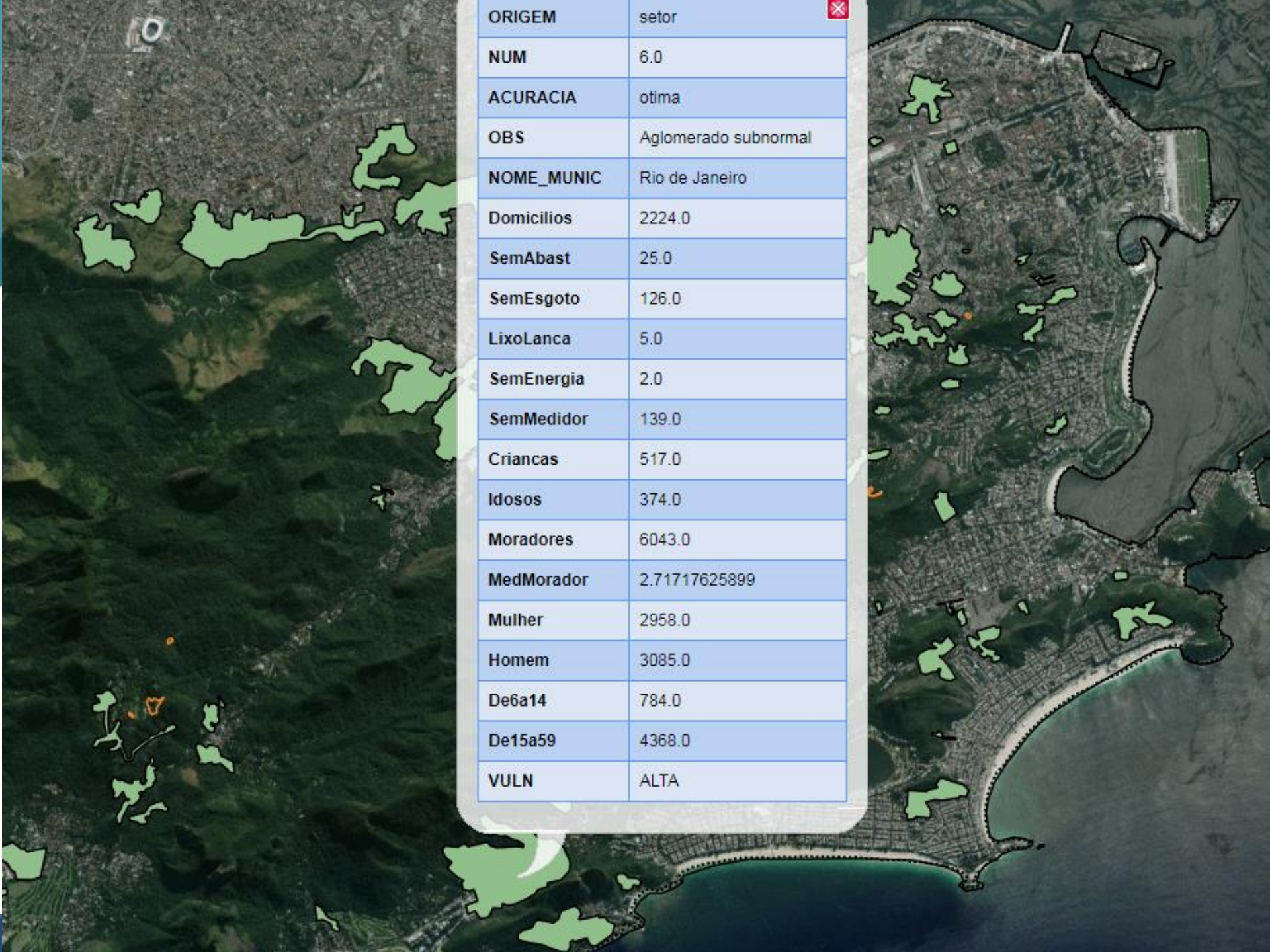
Para a Previsão de Risco Geo-Hidrológico, elaborada diariamente pelo Cemaden, acesse o link: <http://www.cemaden.gov.br/categoria/riscos-geo-hidrologicos/>

**“Flood and Flashflood Warning”
issued on 28/11/17; start at 18:16;
continuously updated**

**persons and houses that
could be affected**

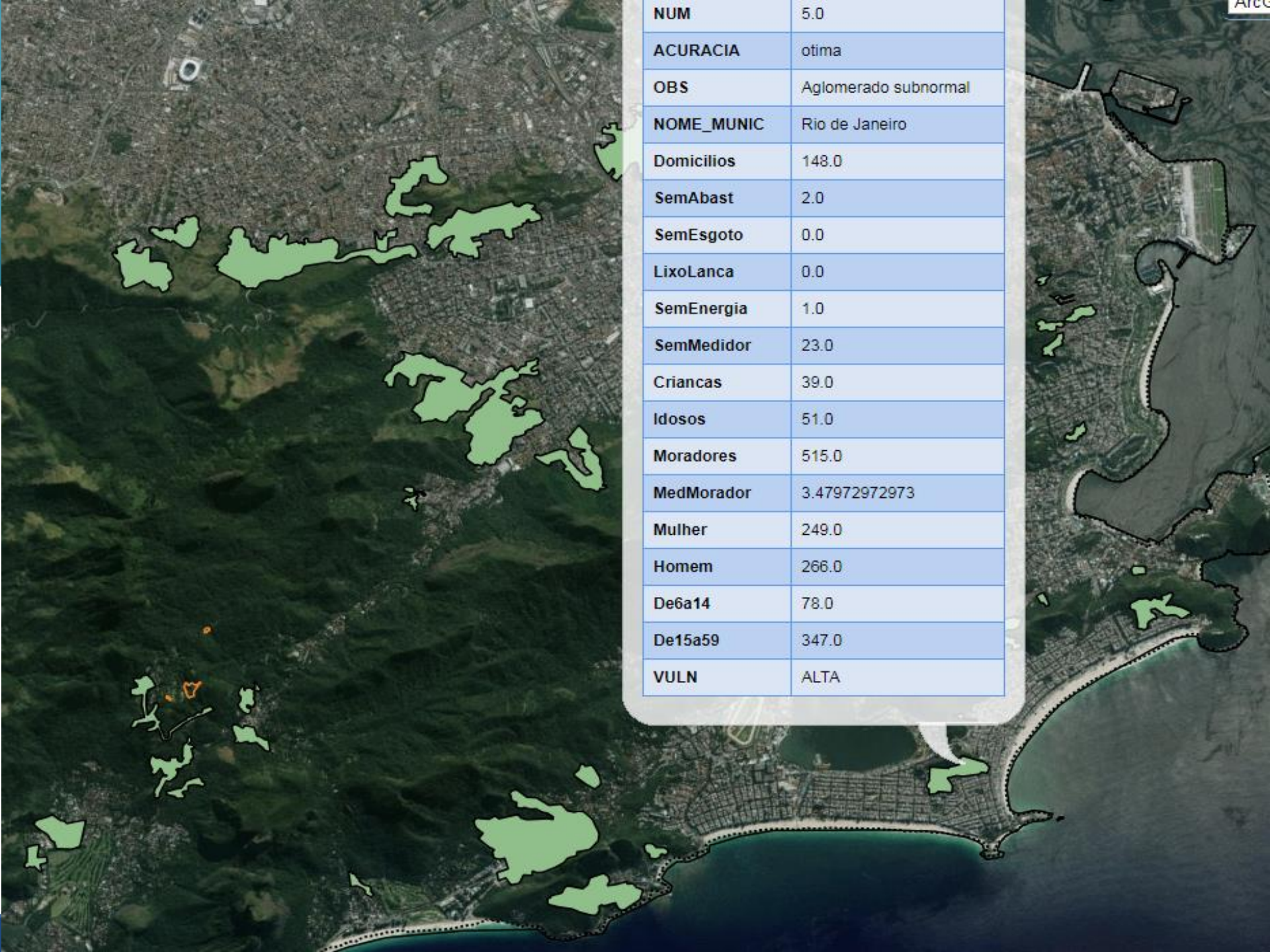
and city districts





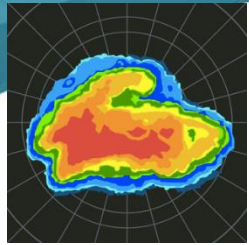
A satellite map of Rio de Janeiro, Brazil, showing the city's urban layout, green spaces, and coastal areas. The map is overlaid with a semi-transparent white box containing a data table. The table lists various socio-economic and demographic indicators for a specific area in Rio de Janeiro. The background map shows the city's grid, parks, and the bay. Green areas are highlighted on the map, possibly indicating specific zones of interest. The table is titled 'ORIGEM' and 'setor' and contains 20 rows of data.

ORIGEM	setor
NUM	6.0
ACURACIA	otima
OBS	Aglomerado subnormal
NOME_MUNIC	Rio de Janeiro
Domicilios	2224.0
SemAbast	25.0
SemEsgoto	126.0
LixoLanca	5.0
SemEnergia	2.0
SemMedidor	139.0
Crianças	517.0
Idosos	374.0
Moradores	6043.0
MedMorador	2.71717625899
Mulher	2958.0
Homem	3085.0
De6a14	784.0
De15a59	4368.0
VULN	ALTA

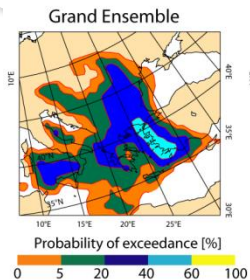


NUM	5.0
ACURACIA	ótima
OBS	Aglomerado subnormal
NOME_MUNIC	Rio de Janeiro
Domicilios	148.0
SemAbast	2.0
SemEsgoto	0.0
LixoLanca	0.0
SemEnergia	1.0
SemMedidor	23.0
Crianças	39.0
Idosos	51.0
Moradores	515.0
MedMorador	3.47972972973
Mulher	249.0
Homem	266.0
De6a14	78.0
De15a59	347.0
VULN	ALTA

Basic protocol for issuing alert



Meteorology



Construction of the risk scenario
for impact

Hidrology



and/or

Geotechnical

construction of the risk scenario
for the physical event

CAP – Meteorological Warning (issued by INMET)

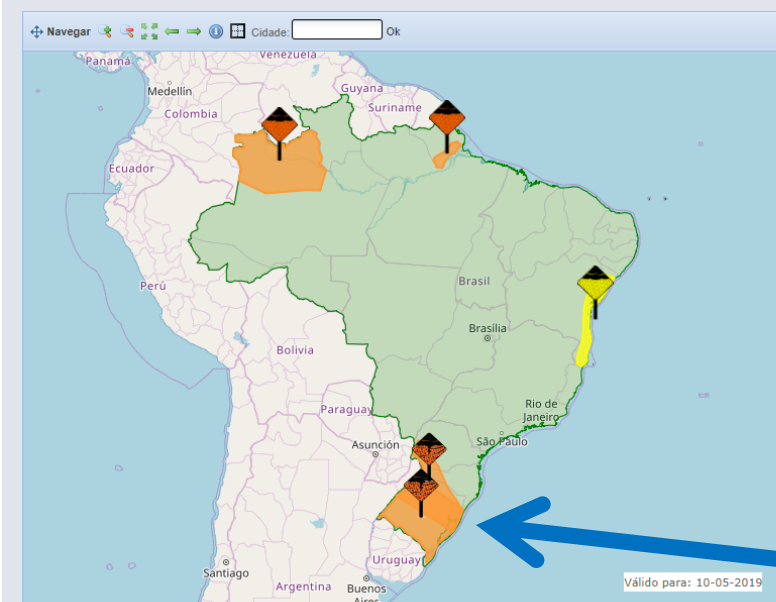
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Visualization of the CAP Meteorological Warnings (issued by INMET)

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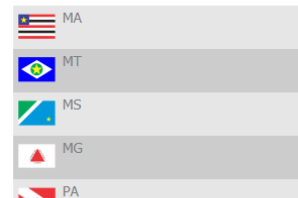
Home



Avisos meteorológicos: **Brasil**

Avisos Hoje (5)

Avisos Futuros (4)



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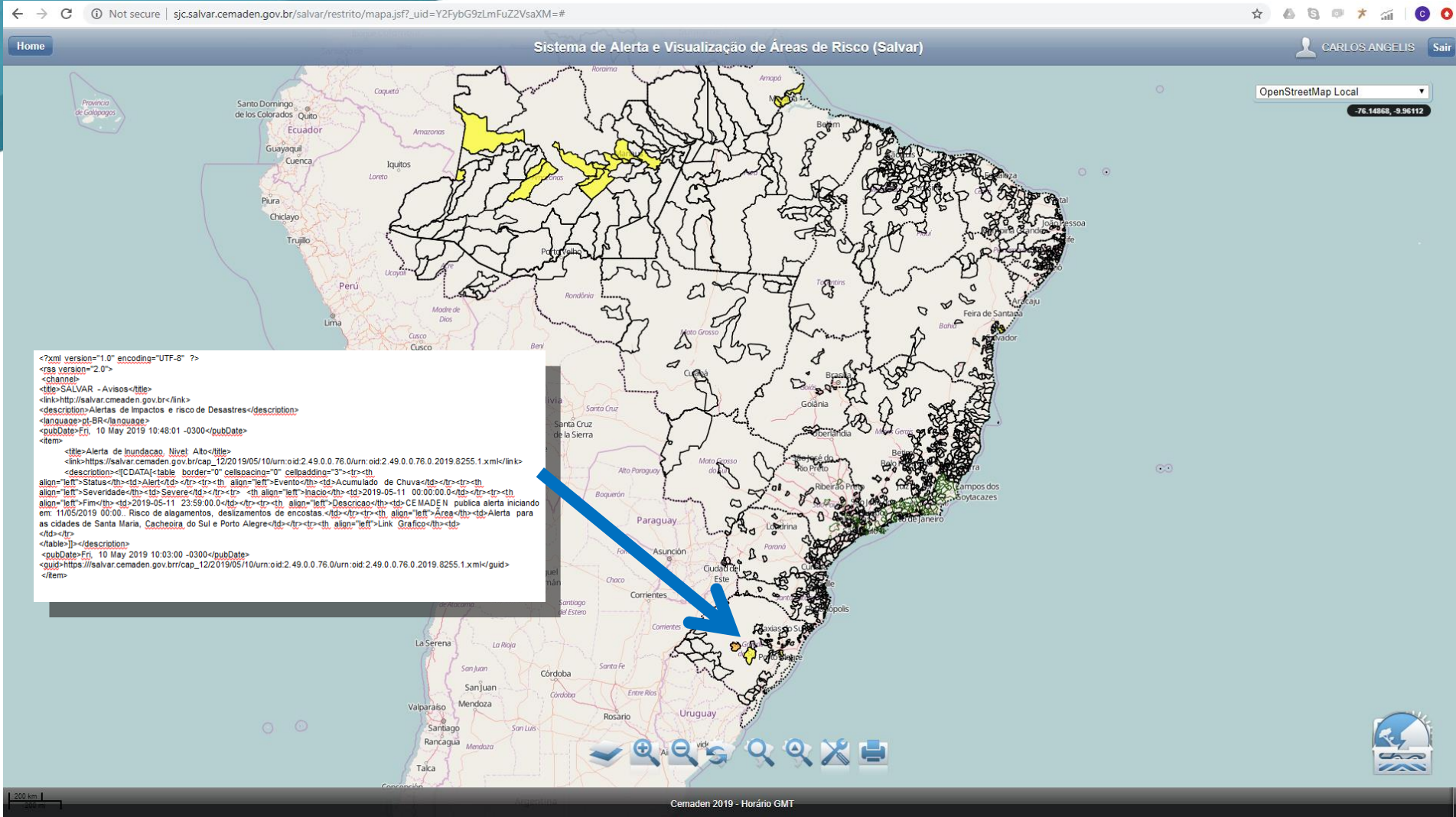
Alert-AS - Centro Virtual para Avisos de Eventos Meteorológicos

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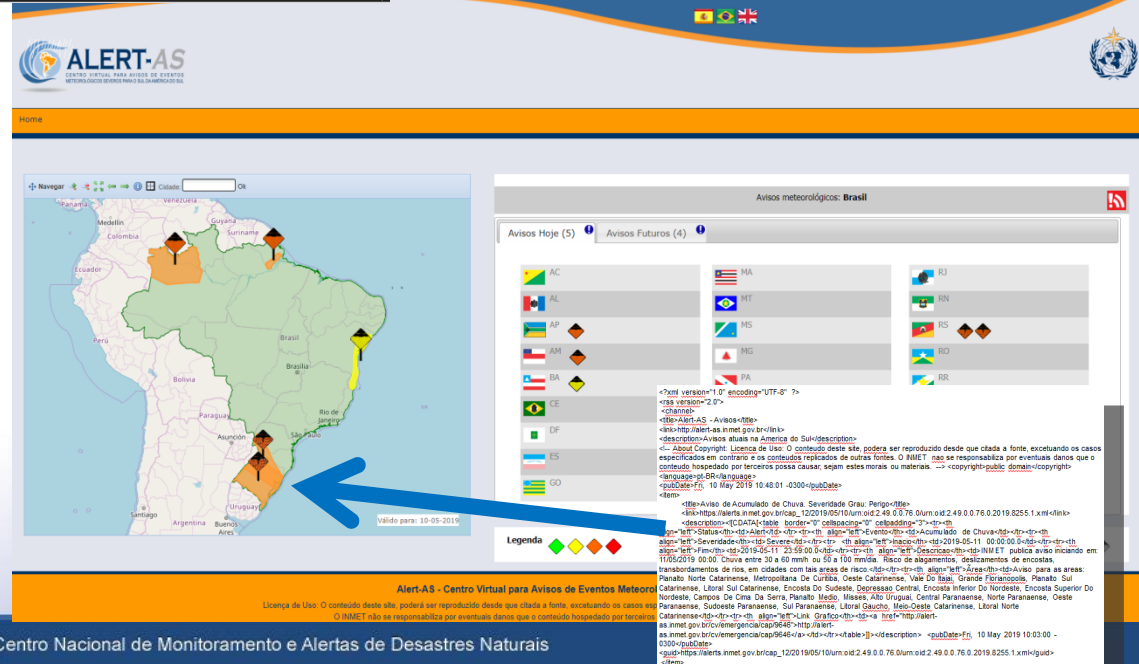
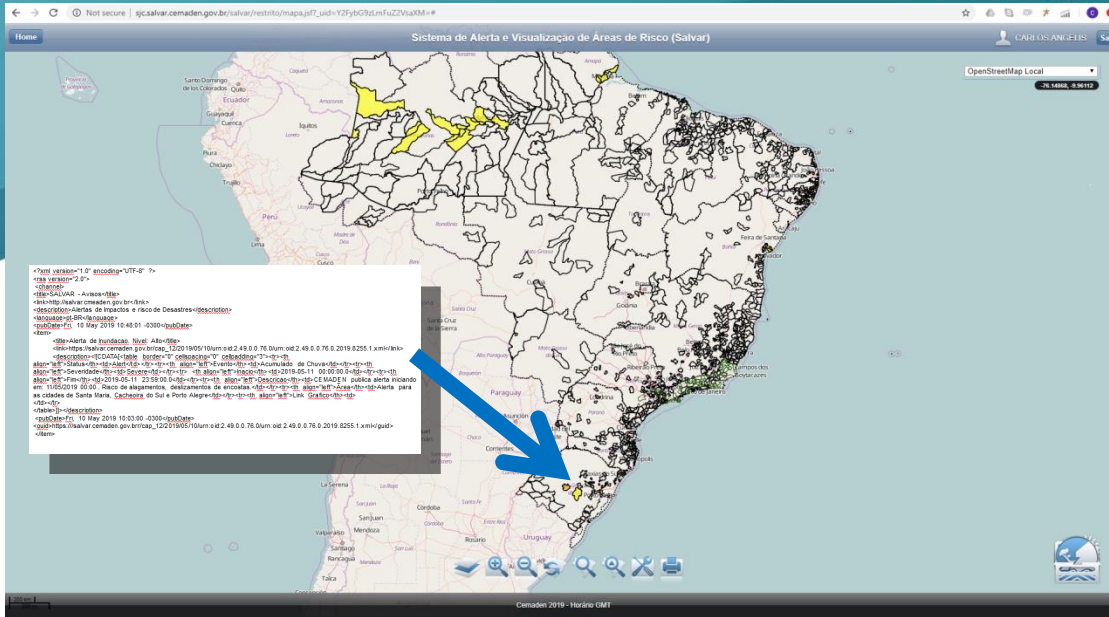
CAP – Impact Warnings (issued by CEAMDEN)

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Visualization of the CAP Impact Alert (issued by CEMADEN)



Visualization of the CAP Meteorological Warning and Impact Alert (issued by INMET/CEMADEN for GMAS)





Thank you for your attention

osvaldo.moraes@cemaden.gov.br