Cemaden
Centro Nacional de Monitoramento e Alertas de Desastres Naturais

CEMADEN

Brazilian Centre for Monitoring and Early Warnings of Natural Disasters

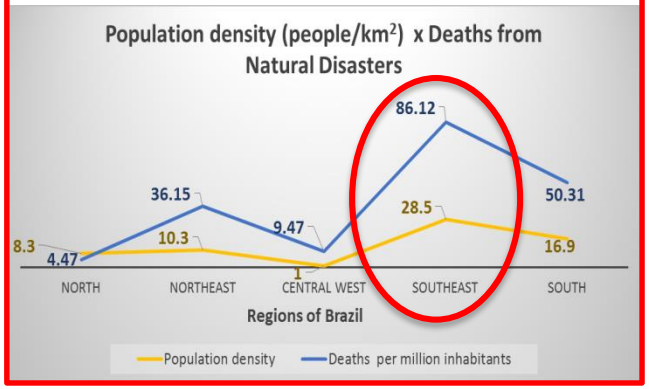
Background


¿SERÁ SUFICIENTE?
ESPERO QUE SEA SUFICIENTE.
SÍ, CREO QUE VA A SER SUFICIENTE.

Background

Distribution of disasters in Brazil

High mortality rate over SE Brazil

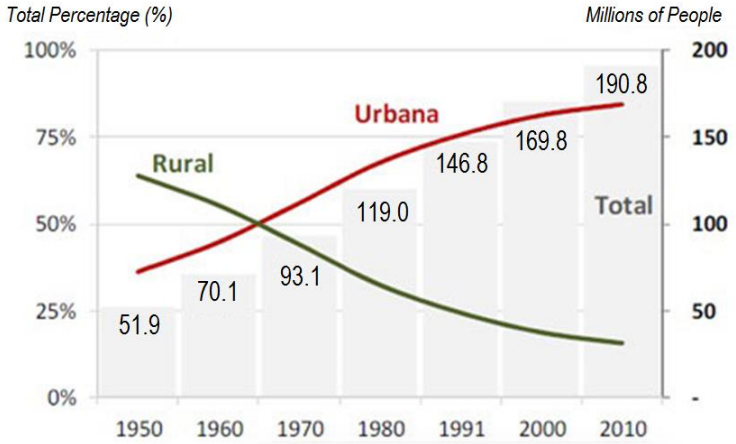


**Source: Brazilian Atlas of Natural Disasters 1991-2012*

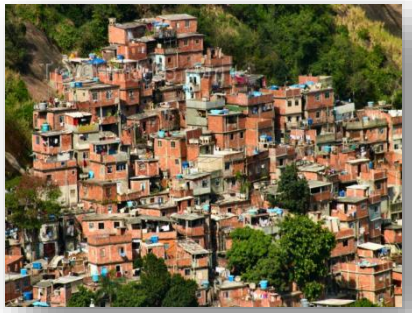
Underlying Drivers of Disaster Risk

Urban Growth:

Change from rural to urban population



Source: IBGE, 2010



Source: Brazilian Atlas of Natural Disasters 1991-2012

Over 5 million people living in areas of high disaster risk in Brazilian cities.

Disaster of **11-12 January 2011** in the west mountains of Rio de Janeiro: over **900 fatalities**

2011 > **Creation of CEMADEN**

Disasters

Disasters are signs of failures—failures of preparedness, response, and recovery.

Most often they are failures of long-term development and risk reduction planning.

They grow on underlying societal challenges such as inequality or poverty , termed "root causes" and "unsafe conditions."

(Wisner et al. 2004, World Bank and GFDRR 2012)

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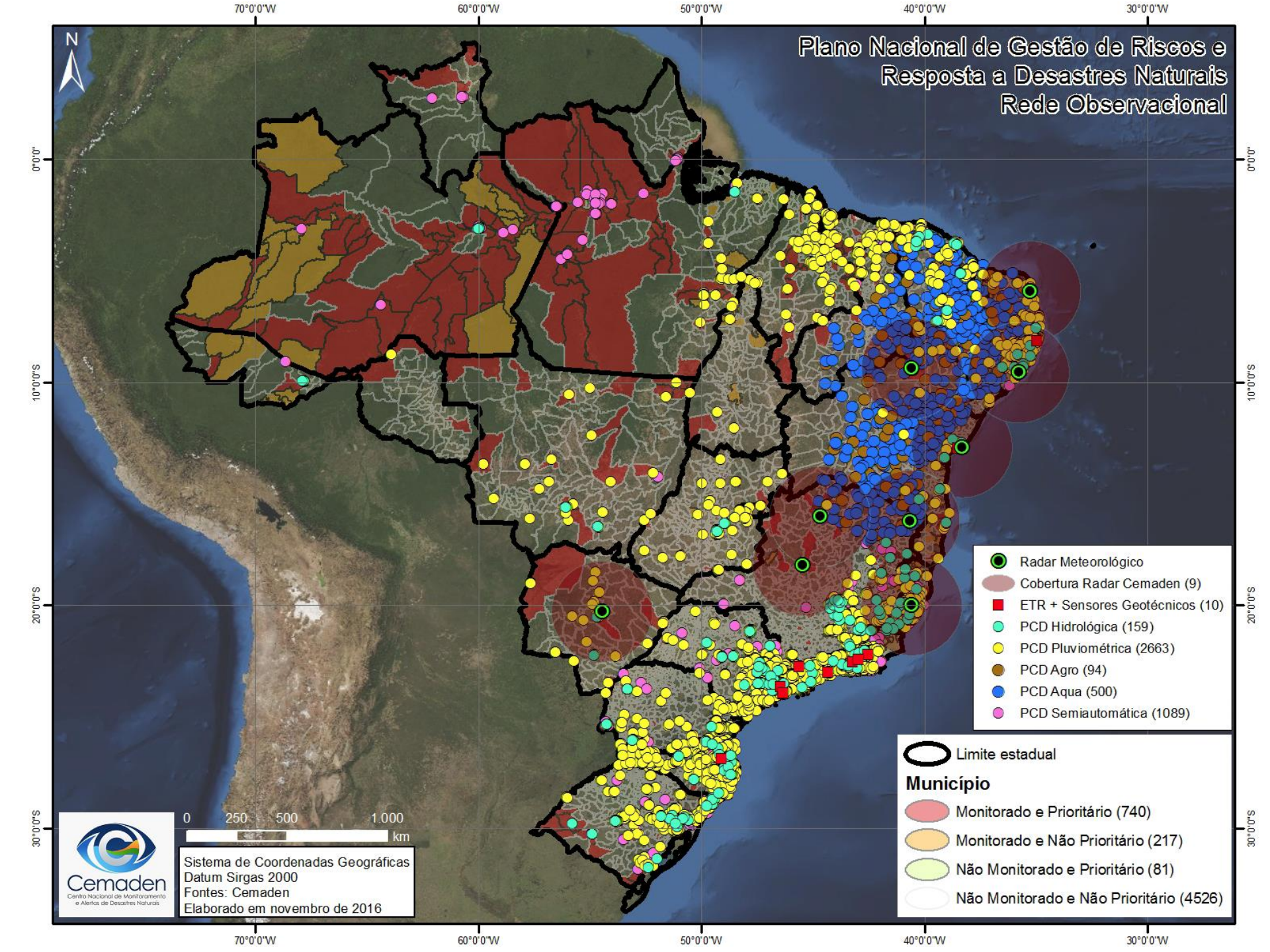
The past decades have been characterized by a shift toward more proactive disaster risk management and the efforts to reduce vulnerabilities with the objective to bring about sustainably developed and resilient communities.

National Centre for Monitoring and Early Warnings of Natural Disasters (Cemaden)

The Centre is responsible for the continuous monitoring of adverse hydro meteorological and climate conditions, which may trigger processes that produce risk of socio-environmental disasters occurrence on national level.

The Research Division relies on Permanent Doctors, Technologists and temporary qualified staff to promote scientific discussions and production.


Plano Nacional de Gestão de Riscos e Resposta a Desastres Naturais
Rede Observacional
N
70°0'0"W
60°0'0"W
50°0'0"W
40°0'0"W
30°0'0"W
0°0'0"
10°0'0"S
20°0'0"S
30°0'0"S
Radar Meteorológico
Cobertura Radar Cemaden (9)
ETR + Sensores Geotécnicos (10)
PCD Hidrológica (159)
PCD Pluviométrica (2663)
PCD Agro (94)
PCD Aqua (500)
PCD Semiautomática (1089)
Limite estadual
Município
Monitorado e Prioritário (740)
Monitorado e Não Prioritário (217)
Não Monitorado e Prioritário (81)
Não Monitorado e Não Prioritário (4526)
0 250 500 1.000
km
Sistema de Coordenadas Geográficas
Datum Sirgas 2000
Fontes: Cemaden
Elaborado em novembro de 2016
Cemaden
Centro Nacional de Monitoramento e Alertas de Desastres Naturais

Petrolina - PE

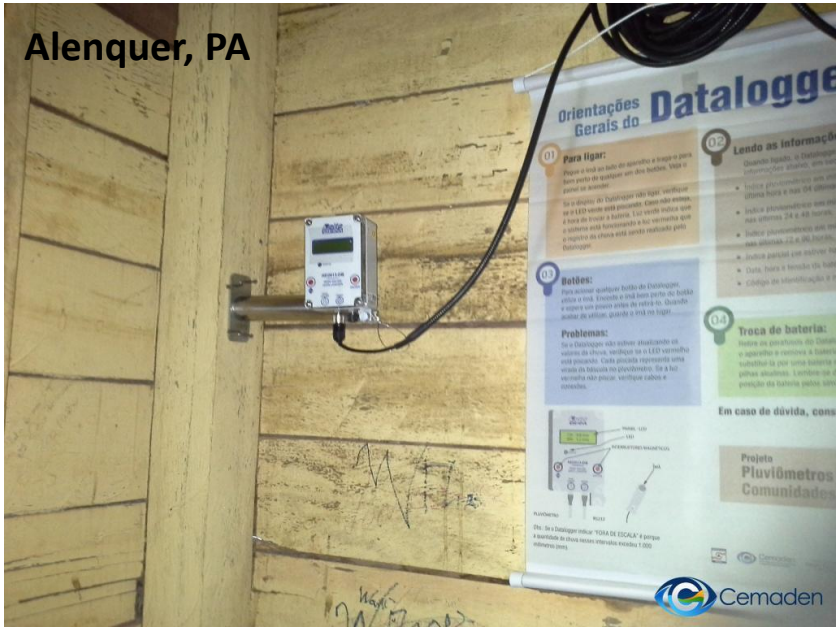
Jaraguari - MS

Salvador - BA

Maceió - AL

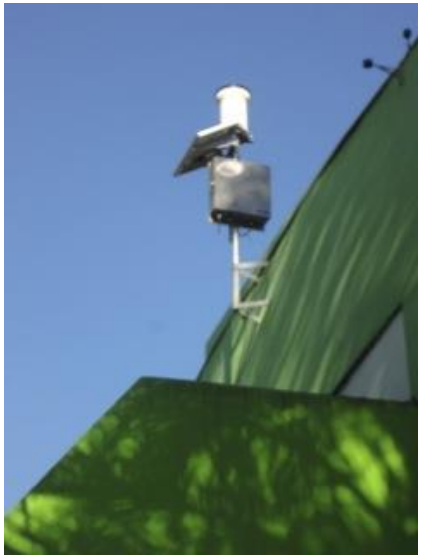
Natal - RN

Semi-automatic pluviometers



Automatic pluviometers

São José dos Campos – SP



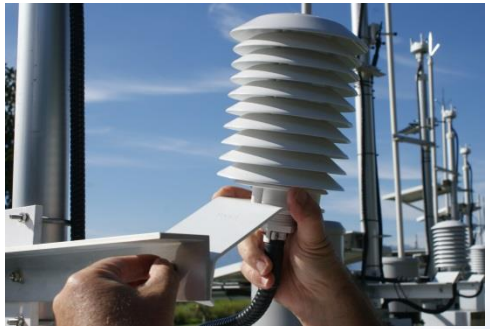
Brumadinho - MG

Muriaé - MG

Brumadinho - RS

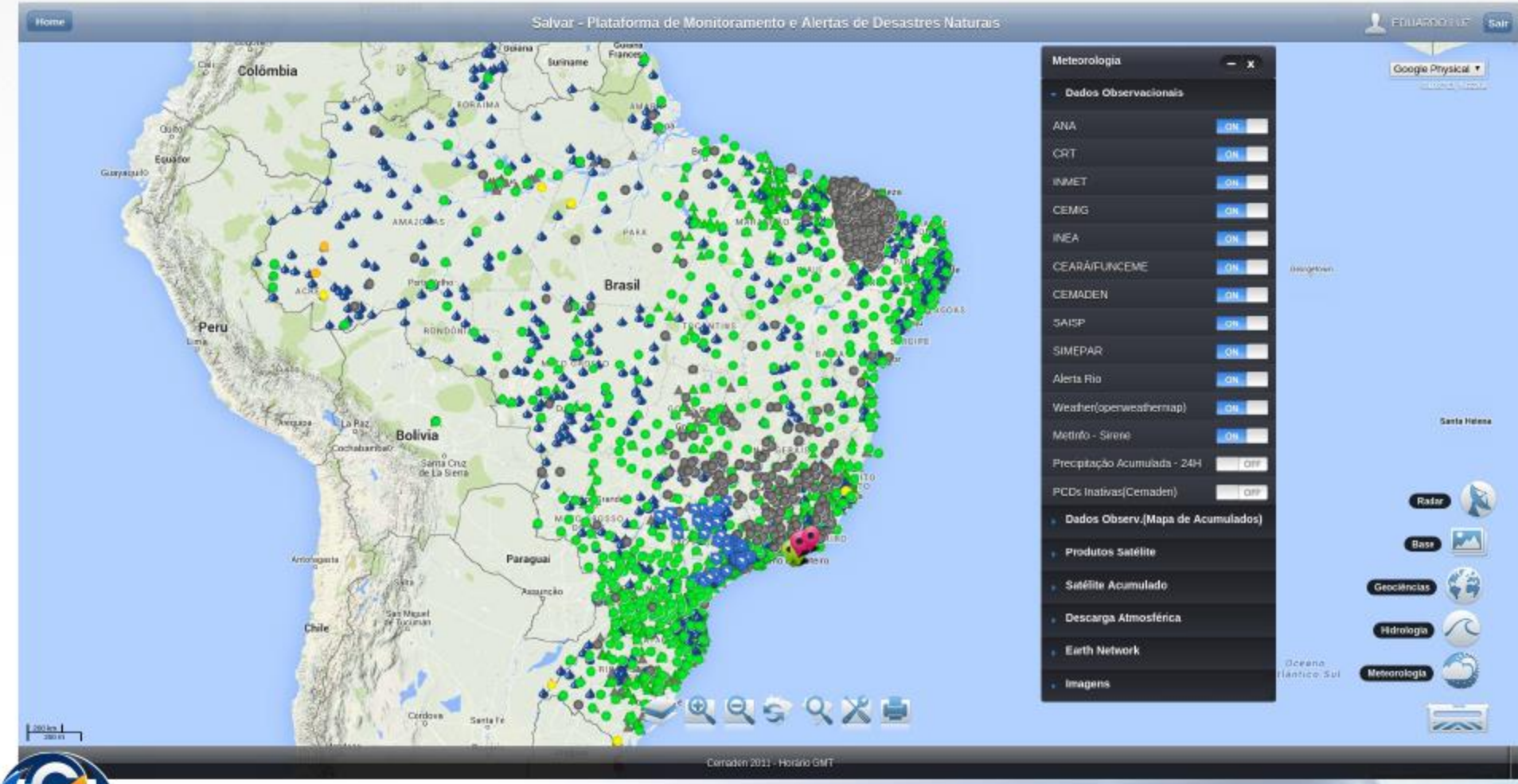
PCD ACQUA

PCD Agrometeorológica



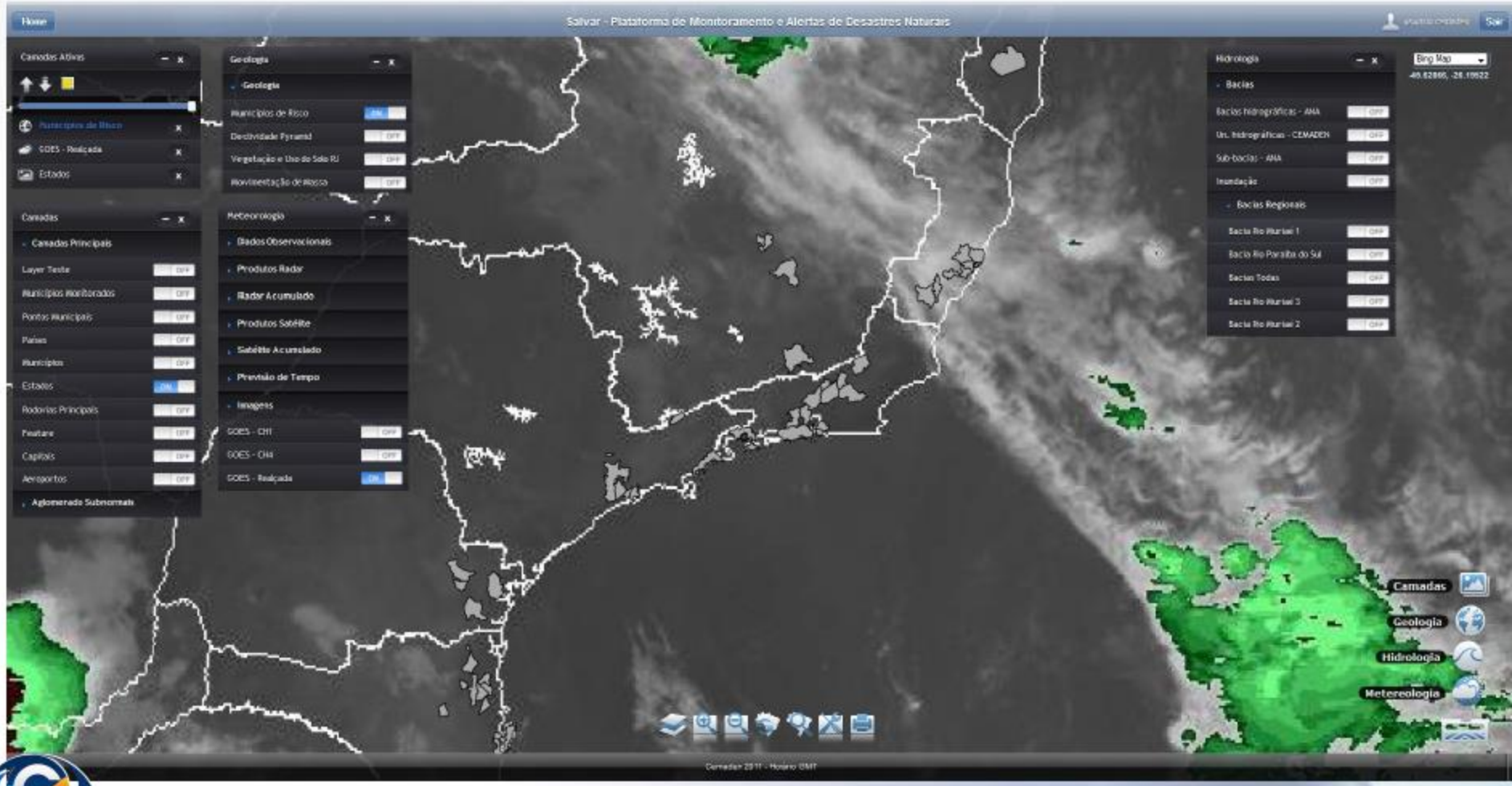
Informações de Estações

O Operador tem acesso a informações das estações do Cemaden e de parceiros.



Integração de Produtos

A integração de diferentes produtos é ponto forte da utilização do Salvar.



Main Research Areas

Hydrology

- ✓ Determination of rainfall thresholds for the occurrence of floods and flash floods
- ✓ Mathematical forecasting models for floods and flash floods
- ✓ Flood risk mapping
- ✓ Hydrologic forecasts using distributed hydrological models
- ✓ Probabilistic forecasts using hydrological models

Modeling Disasters

- ✓ Predictive Modeling based on data from computational intelligence techniques
- ✓ Disaster impacts on transportation infrastructure/Urban mobility

Meteorology

- ✓ Meteorological extremes – Identification of weather patterns that support distinction between ordinary and extraordinary precipitation events
- ✓ Subseasonal variability: dry Spells/Heat Waves – Application and validation of subseasonal predictions
- ✓ Improved estimation of rainfall (QPE) based on radar information
- ✓ Improvements in the parameterization of mesoscale atmospheric models

Disasters

- ✓ Monitoring and Warning Systems
- ✓ Disaster Risk Management
- ✓ Education for Disaster Frisk Reduction
- ✓ Community Rain gauges
- ✓ Disasters and Public Health
- ✓ Disasters and Urban Mobility/Transport infrastructure
- ✓ Perceptions, representations and practices concerning risk

Monitoring forests and wildfires

- ✓ Modeling and monitoring risks of forest fires
- ✓ Climate Extremes and forests
- ✓ Quantifying impacts of forest fires on ecosystems and communities

Agrometeorology

- ✓ Brazilian Semi-arid risk prediction of crop failure

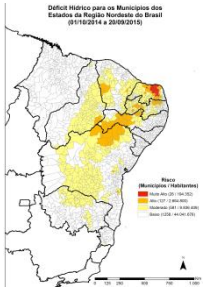
Geodynamics

- ✓ Geomorphological causes, geotechnical modeling and monitoring of slopes susceptible to debris flow
- ✓ Identifying critical breaking points for debris flow alert systems
- ✓ Installation and data analysis of fully robotic stations and Geo-sensors in pilot cities

Research lines in Cemaden

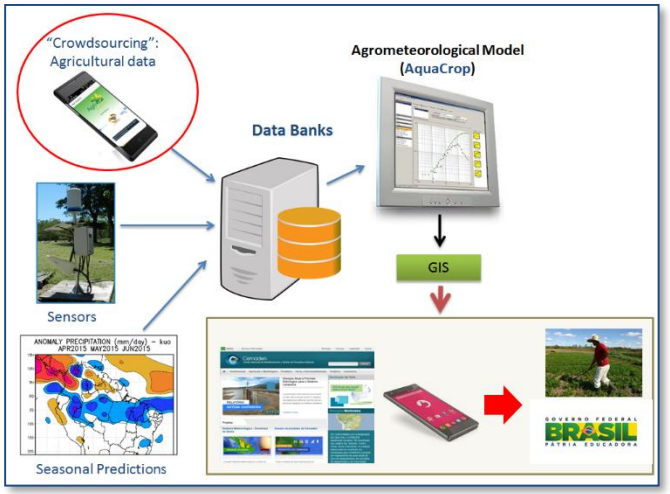
Crop failure prediction system

risk knowledge

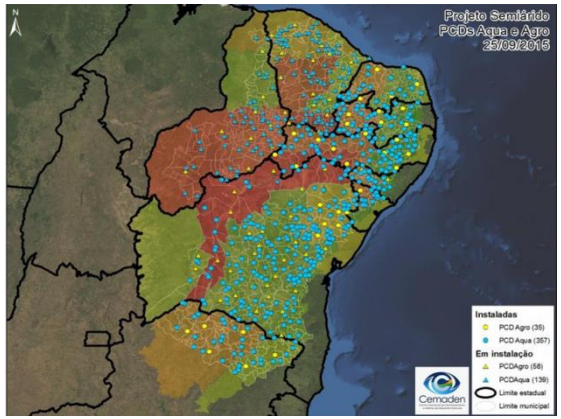


Ana Paula Cunha *Marcelo Zeri* *Sheila Brito* *Regina Alvalá*

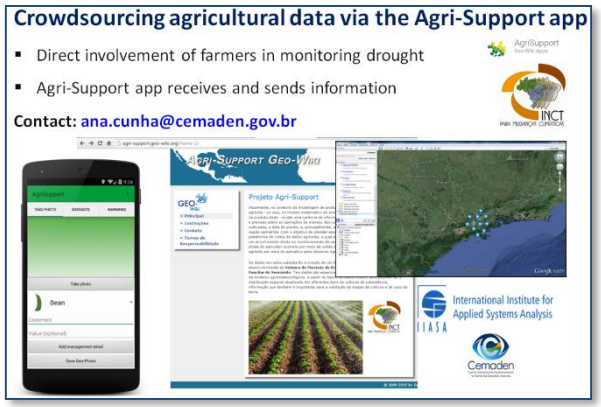
Crop Failure Prediction System



Network of agrometeorological stations



Crop Failure Prediction System



Crowdsourcing agricultural data

Research lines in Cemaden

Meteorological extremes
Subseasonal forecast

risk knowledge

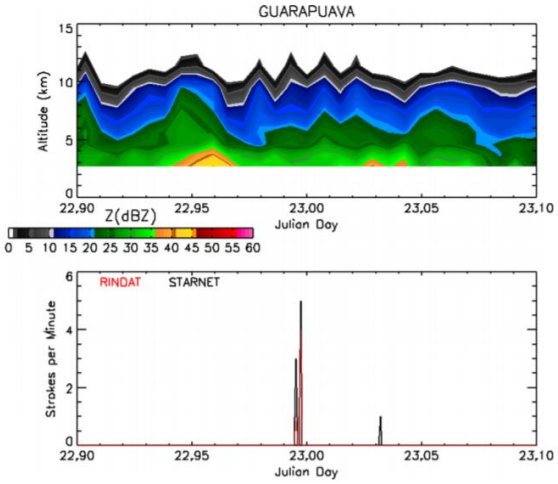
technical monitoring and warning service

Giovanni Dolif Neto

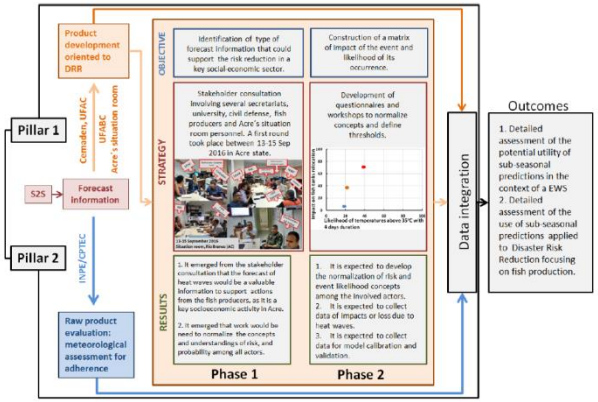
Christopher Castro

Meteorological extremes

Understanding and quantifying meteorological hazards



Dolif et al., Atmos Sci Let., 2015



Explores the potential of S2S as part of an early warning system for DRR

Research lines in Cemaden

Early warning system

risk knowledge	communication and dissemination of warnings

Sociocultural and environmental Vulnerabilities and Risk perception

Silvia Saito

Natural Disaster, risk perception and social networks

Victor Marchezini

Sociocultural dimensions of an early warning system

Luciana Londe

Socioenvironmental vulnerability and public health

Raingauges in Communities Project

- **Goal:** promote a **perception culture** of natural disasters in Brazil, directly involving at risk communities, strengthening local resilience.
- Purchase of **1375 semi-automatic rain gauges.**
- **Target audience:** community non-government organizations that work in natural disaster prevention.
- **Motivate communities** to self-organize and contact local authorities directly, quickly receiving guidance to protect themselves in high risk situations.

http://www.cemaden.gov.br/pluviometros-nas-comunidades/

Research lines in Cemaden

Education

communication and dissemination of warnings

Débora Olivato ***Rachel Trajber*** ***Patricia Matsuo***

Schools and comunity network for Preventing disasters

The Cemaden Educação has the objective of contributing to the development of risk disasters perception in the context of environmental education and sustainable and resilient society

Main goal

Create a **culture of natural disaster risk prevention** through environmental education, fostering sustainable and resilient communities. CEMADEN created the project in order to promote educational activities involving science, citizenship and sustainability.

Specific goals

- **Build** a disaster protection network with schools and communities;
- **Expand** the Rain gauges in Communities Project for formal education;
- **Share** knowledge about events that can cause social-environmental disasters;
- **Promote** collaborative management in communities vulnerable to disaster risk;
- **Contribute** with integrated educational policies to face disasters.

Contact: rachel.trajber@cemaden.gov.br

http://educacao.cemaden.gov.br/

Research lines in Cemaden

Geodynamic processes

technical monitoring and warning service

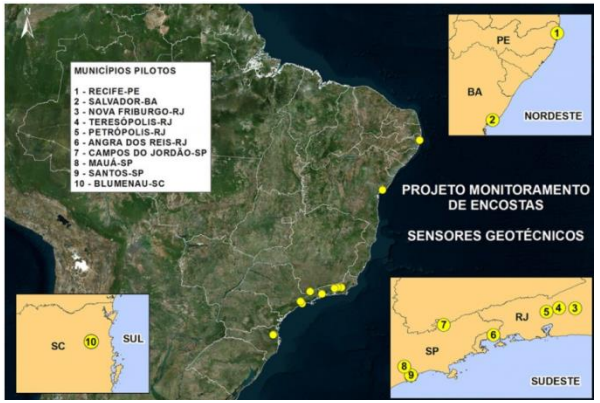
[Ângelo Consoni](#) [Rodolfo Mendes](#) [Márcio Andrade](#)

Geodynamic process aplied to Disasters

Geotechnical and climatic variables for an early warning system implementation

GIDES
Fortalecimento da Estratégia Nacional de Gestão Integrada de Riscos em Desastres Naturais

Aims to strengthen the Integrated Management on Risk Prevention and Response related to geological disasters, involving the major organs of the Brazilian Federal Government related to the theme



Monitoring slope stability

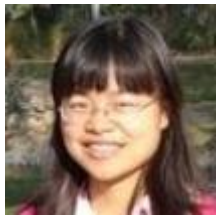
http://www.cemaden.gov.br/projeto-gides-eixo-monitoramento-e-alertas-cemaden/
http://www.cemaden.gov.br/projeto-monitoramento-de-encostas-para-prevencao-de-deslizamentos/

Research lines in Cemaden

Water supply system

technical monitoring and warning service





Karinne Leal ***Adriana Cuartas*** ***Rong Zhang***

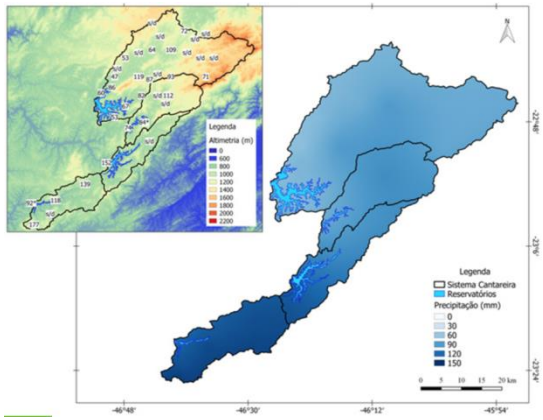
Water supply system in Brazil

Relatório do Sistema Cantareira

Relatório Três Marias

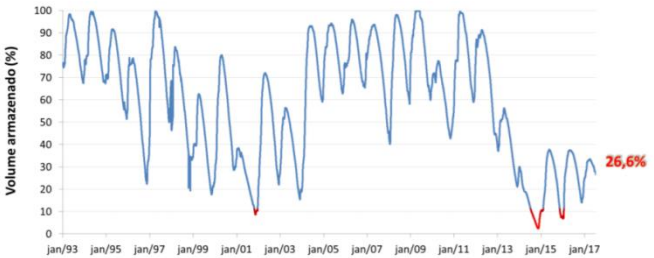
http://www.cemaden.gov.br/

Sao Paulo



Monitoring the *Cantareira System*

Minas Gerais



Monitoring hydro potential of *Tres Marias*

Research lines in Cemaden

risk knowledge

technical monitoring and warning service

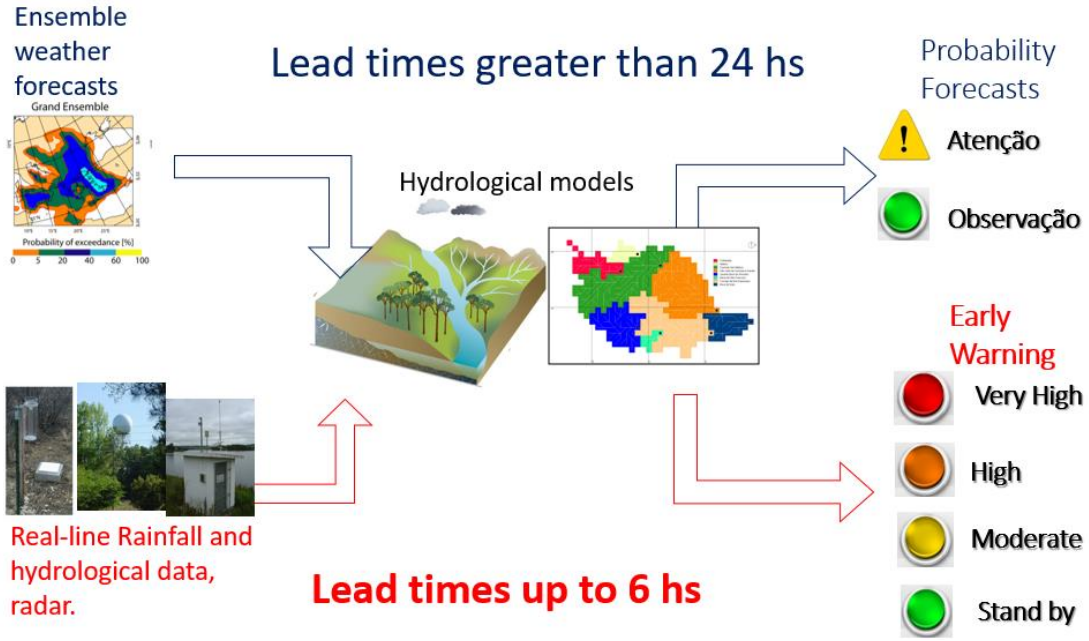
Hydrological modeling




Conrado Rudorff ***Márcio Moraes*** ***Rochane Caram*** ***Javier Tomasella***

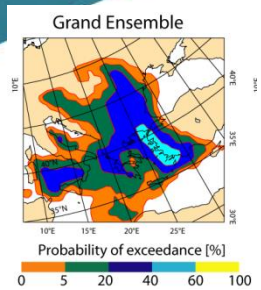
Hydrological extremes aplied to Natural Disasters

Monitoring, Model development and impact assessment of floods and flash floods

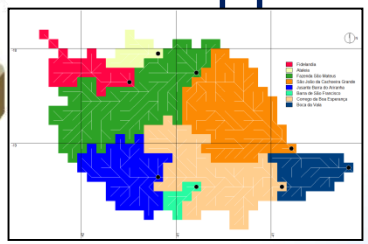


Warnings for floods

meteorological modelling



Hydrological Modeling



Atenção

Observação

Warnings

Muito Alto

Alto

Moderado

Observação

Pluviometers
radars
hydrological stations

Research lines in Cemaden

Modelling

technical monitoring and warning service

Integrated modelling aplied to Disasters

Glauston Lima

Computational intelligence applied to hydro meteorological data

Leonardo Santos

Computational and mathematical modelling for assessing infrastructure impacts

2014 Flood impacts in Porto Velhor, Rondonia

Research lines in Cemaden

Wildfires

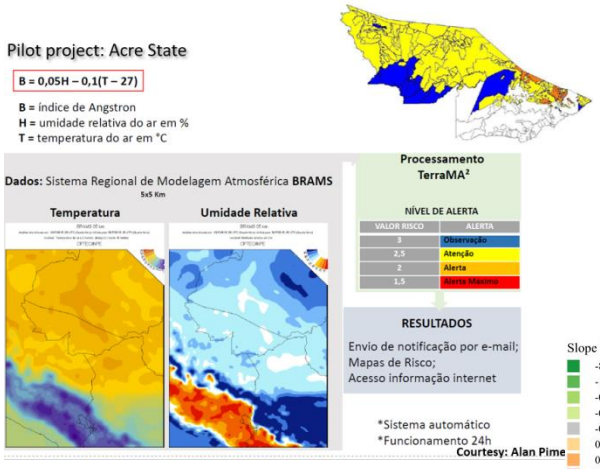
risk knowledge

technical monitoring and warning service

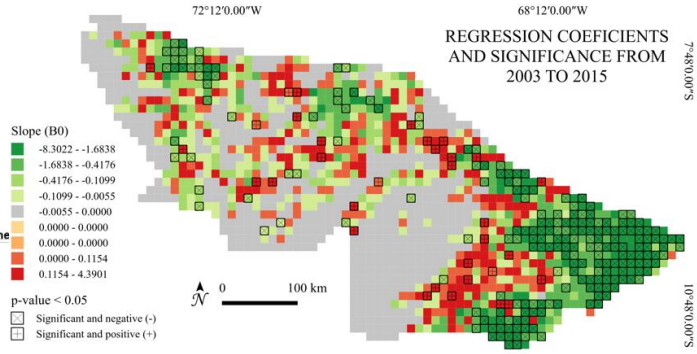
[Liana Anderson](#) [David Franca](#)

Drought impacts and wildfires in Amazonia

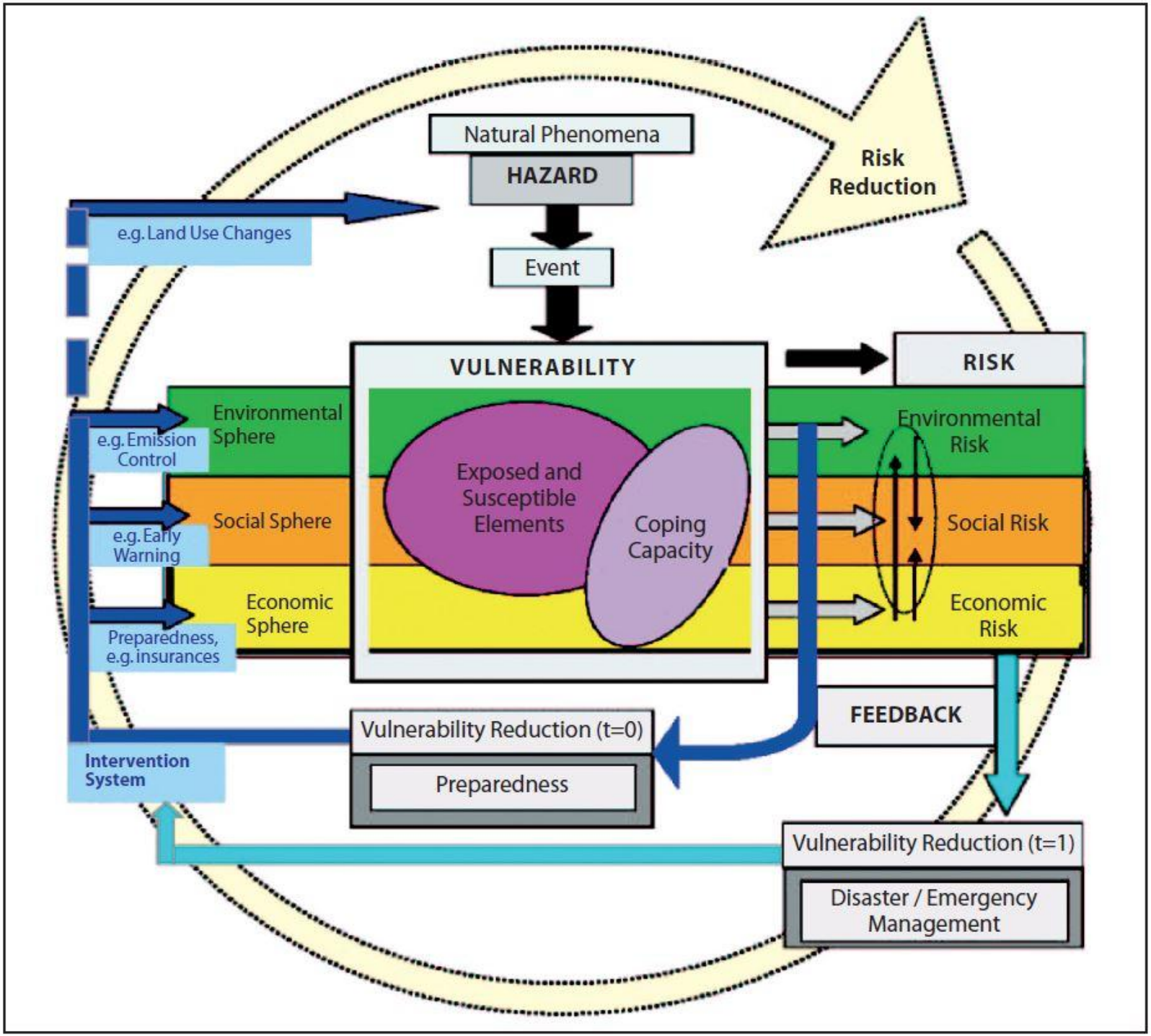
Acre state Pilot project: improving fire risk warning system



Current fire risk warning system



Spatially explicit model under development


Natural Phenomena
HAZARD
Event
Risk Reduction
e.g. Land Use Changes
VULNERABILITY
RISK
Environmental Sphere
Social Sphere
Economic Sphere
Exposed and Susceptible Elements
Coping Capacity
Environmental Risk
Social Risk
Economic Risk
e.g. Emission Control
e.g. Early Warning
Preparedness, e.g. insurances
FEEDBACK
Vulnerability Reduction (t=0)
Preparedness
Intervention System
Vulnerability Reduction (t=1)
Disaster / Emergency Management

How about you?

Please ask and tell us more:

luciana.londe@cemaden.gov.br

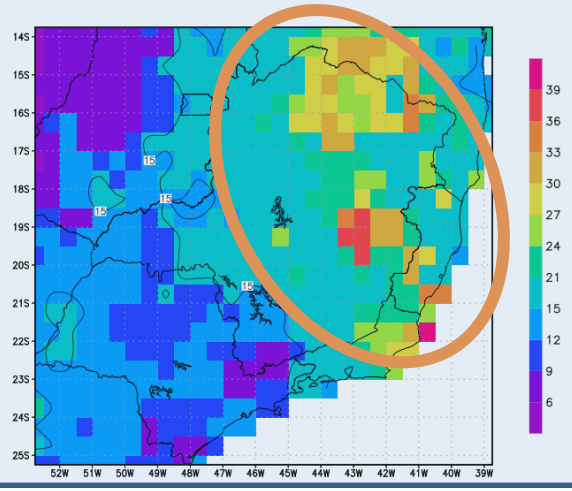
http://www.cemaden.gov.br/

The center is available for partnerships!

Área de pesquisa: Meteorologia

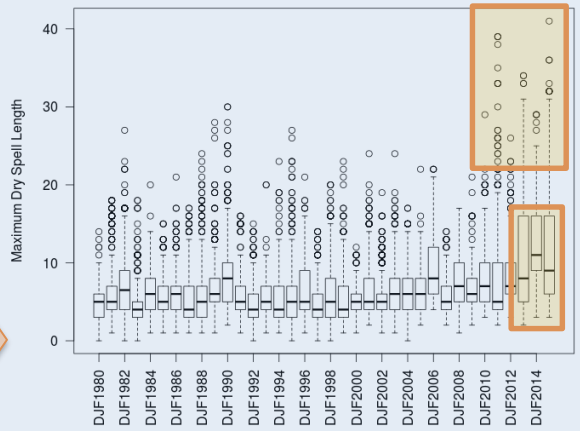
Linha de pesquisa - *Variabilidade Subsazonal: Veranicos/Ondas de calor*

Análise e caracterização dos veranicos no setor sudeste do Brasil



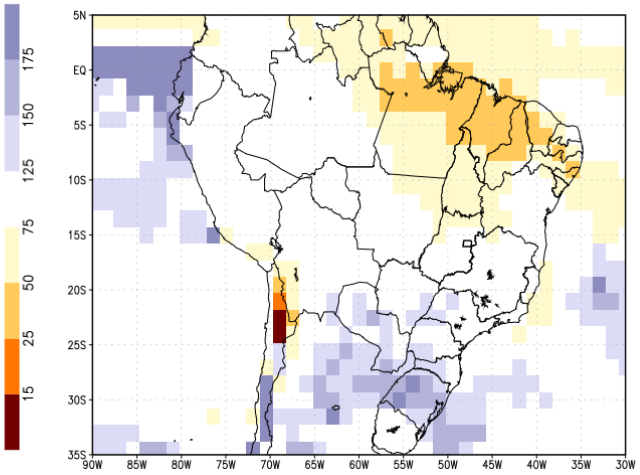
Identificação de áreas preferenciais para ocorrência de veranicos extremos

Investigação da variabilidade climática e mudanças nos padrões extremos



Aplicações e validação das previsões subsazonais

Investigação do potencial de aplicação de previsões para a 3 (terceira) e 4 (semana)



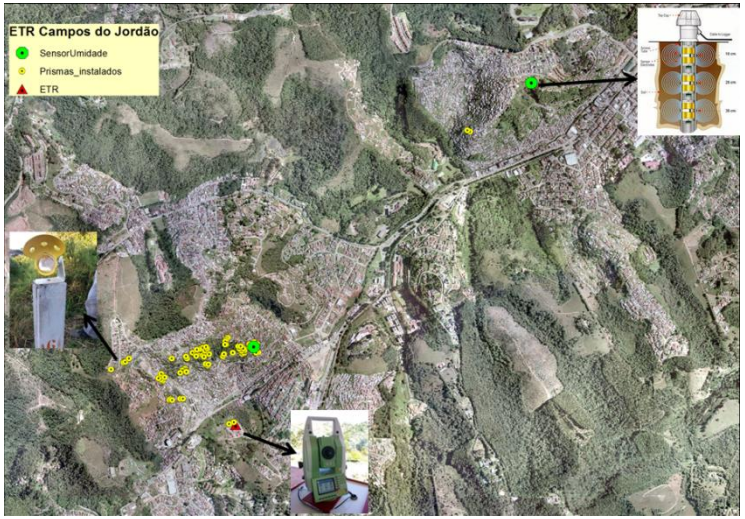
Contato: christopher.castro@cemaden.gov.br

Área de pesquisa: Geodinâmica

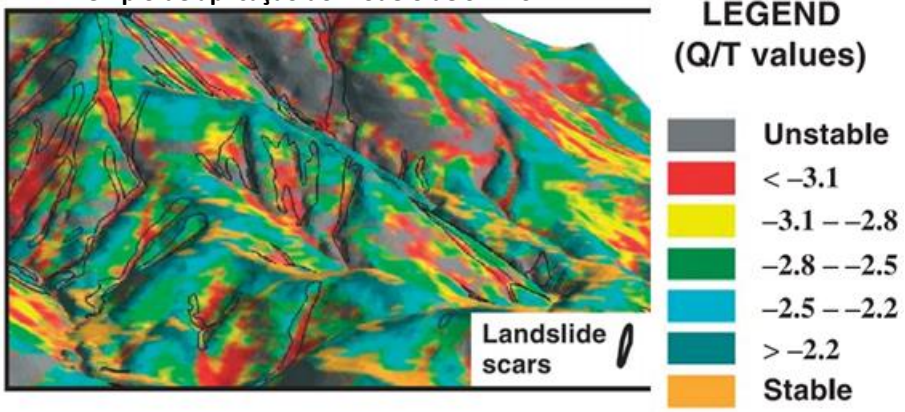
Linha de pesquisa: ***Condicionantes geomorfológicos, modelagem e monitoramento geotécnico de encostas suscetíveis a movimento de massa***

- **Definição de limiares críticos operacionais em sistemas de alertas a movimentos de massa**
- **Implantação e análise de dados de ETRs e PCDs-Geo em municípios pilotos**
- **Projeto GIDES - Gestão Integrada de Desastres de Sedimentos (JICA)**
- **Projeto CNPQ - Previsão de enxurradas inundações e movimentos de massa em encostas para prevenção de desastres naturais**

Monitoramento geotécnico em Campos do Jordão



Exemplo de aplicação do modelo de SHALSTAB



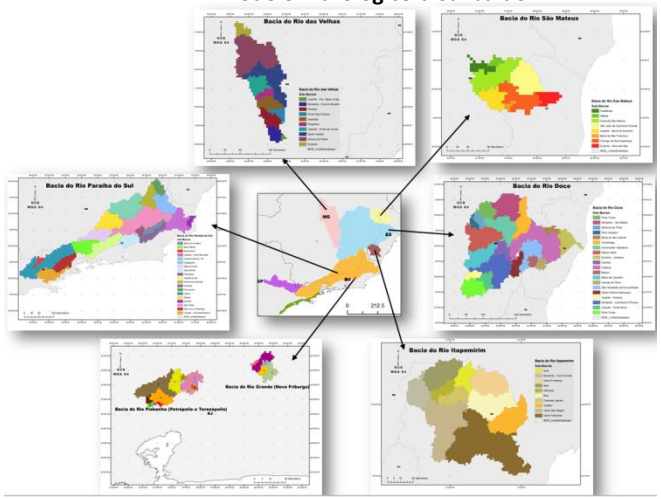
Contatos: marcio.andrade@cemaden.gov.br
rodolfo.mendes@cemaden.gov.br
angelo.consoni@cemaden.gov.br

Área de pesquisa: Hidrologia

Linhas de pesquisa:

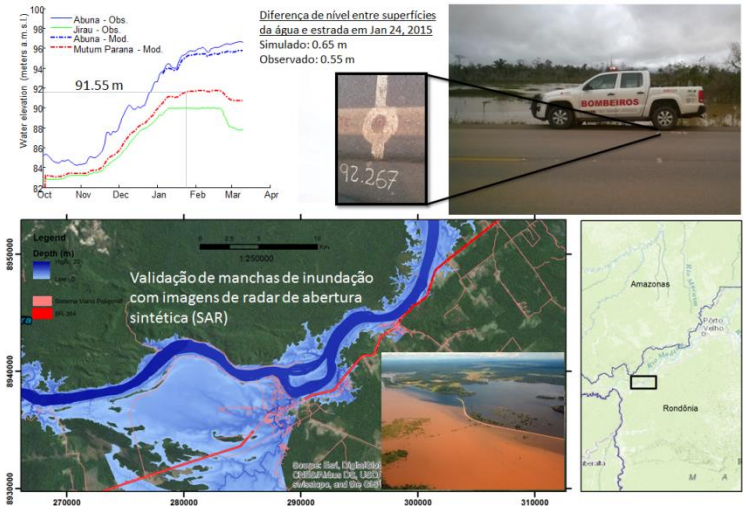
- **Determinação de limiares de precipitação aplicada à ocorrência de enchentes, inundações e enxurradas**
- **Modelos matemáticos de previsão de enchentes, inundações e enxurradas**
- **Sistemas de alertas baseados em modelos hidrológicos integrados à previsão meteorológica e dados de radar e satélite com 6 e 24 horas de antecedência**
- **Avaliação de ferramentas de modelagem hidrodinâmica para previsão de inundações em várzeas situadas em bacias de mesoescala no Brasil**
- **Desenvolvimento de sistema de previsão de risco de escassez hídrica**

Bacias hidrográficas que estão sendo modeladas, utilizando-se modelo hidrológico distribuído

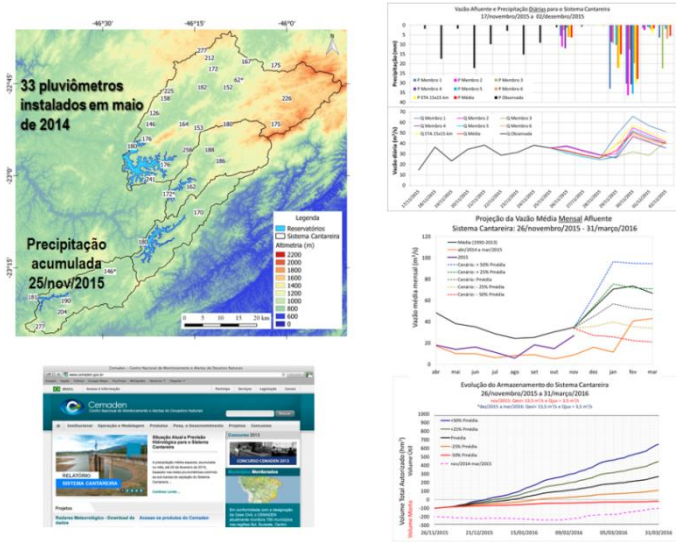


Área de pesquisa: Hidrologia

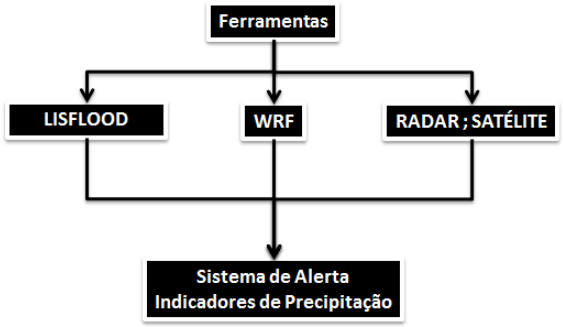
Sistemas de alerta de inundação de Porto Velho (RO)



Projeto de Monitoramento Sistema Cantareira



Sistema de previsão numérica de tempo aplicado ao monitoramento e alerta de eventos extremos de precipitação.



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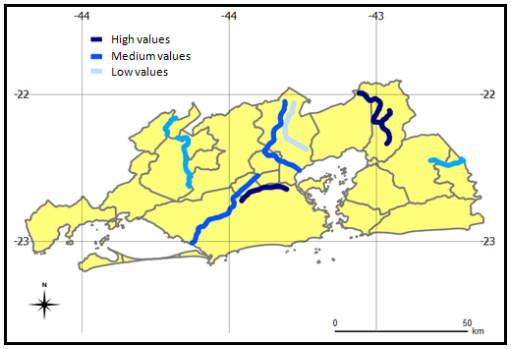
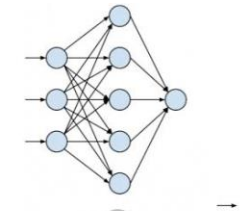
conrado.rudorff@cemaden.gov.br
diego.souza@cemaden.gov.br
marcio.moraes@cemaden.gov.br
rochane.caram@cemaden.gov.br

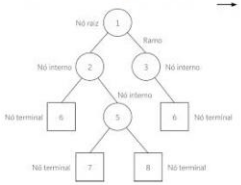
Área de pesquisa: Modelagem de desastres naturais

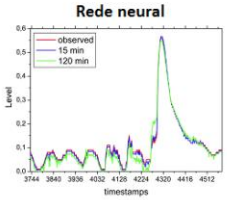
Linhas de pesquisa:

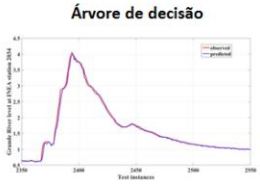
- **Modelagem preditiva baseada em dados utilizando técnicas de inteligência computacional**
- **Impactos de desastres naturais em infraestrutura de transporte/mobilidade urbana**











→ Nash > 0.97

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