The planned Brazilian radon survey – concepts and particular challenges

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Challenges

Brazil is a large country (> area of the EU), 200 mill inhabitants. High diversity of factors which control the radon potential and indoor Rn:

Geology: controls the RP. In Brazil several "Rn prone" geological types, such as plutonite or structures with secondary U mineralization

Climate: influences building styles and living habits (ventilation)

Sociology: Population density, urbanisation: influences the design of a survey, logistics and organisation, access to and communication with stakeholders (affected people, authorities, construction industry, scientific community, media,…). Differences in education, social statuts, trust in authorities (possibility of cooperation) … Factors to be considered in planning logistics.

All together: difficulties to generate representative samples.

Administrative aspects: sampling, detector evaluation, QA, communication decentralized to different degrees, reqire careful planning and coordinatation.

Rationale & background

Rn = serious health risk; Idea for a Brazilian Rn survey, under discussion for a few years; BSS (IAEA, EU), WHO, ICRP guidelines and recommendations.

variability of some factors which control indoor Rn and / or which have to be considered in designing a large-scale survey
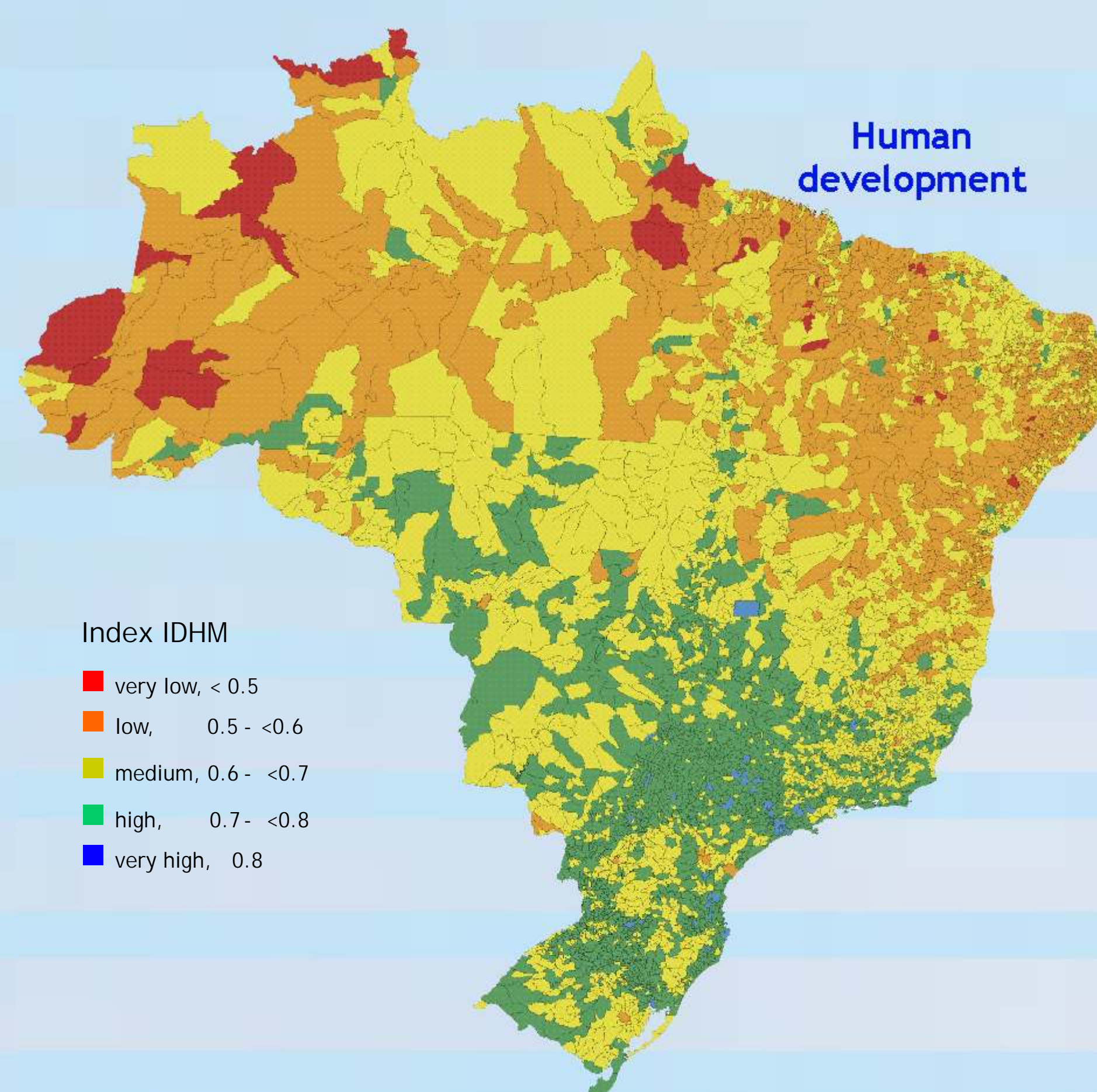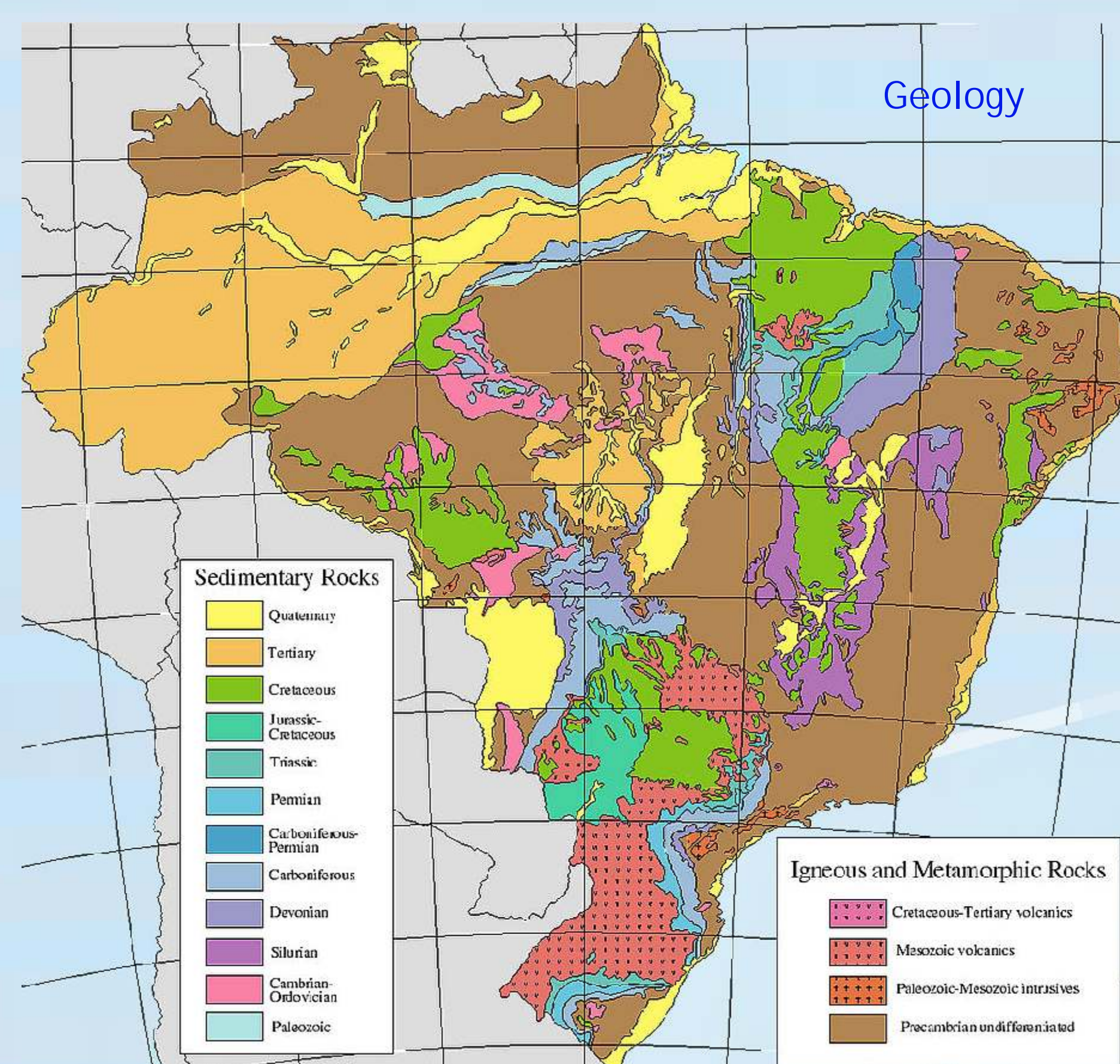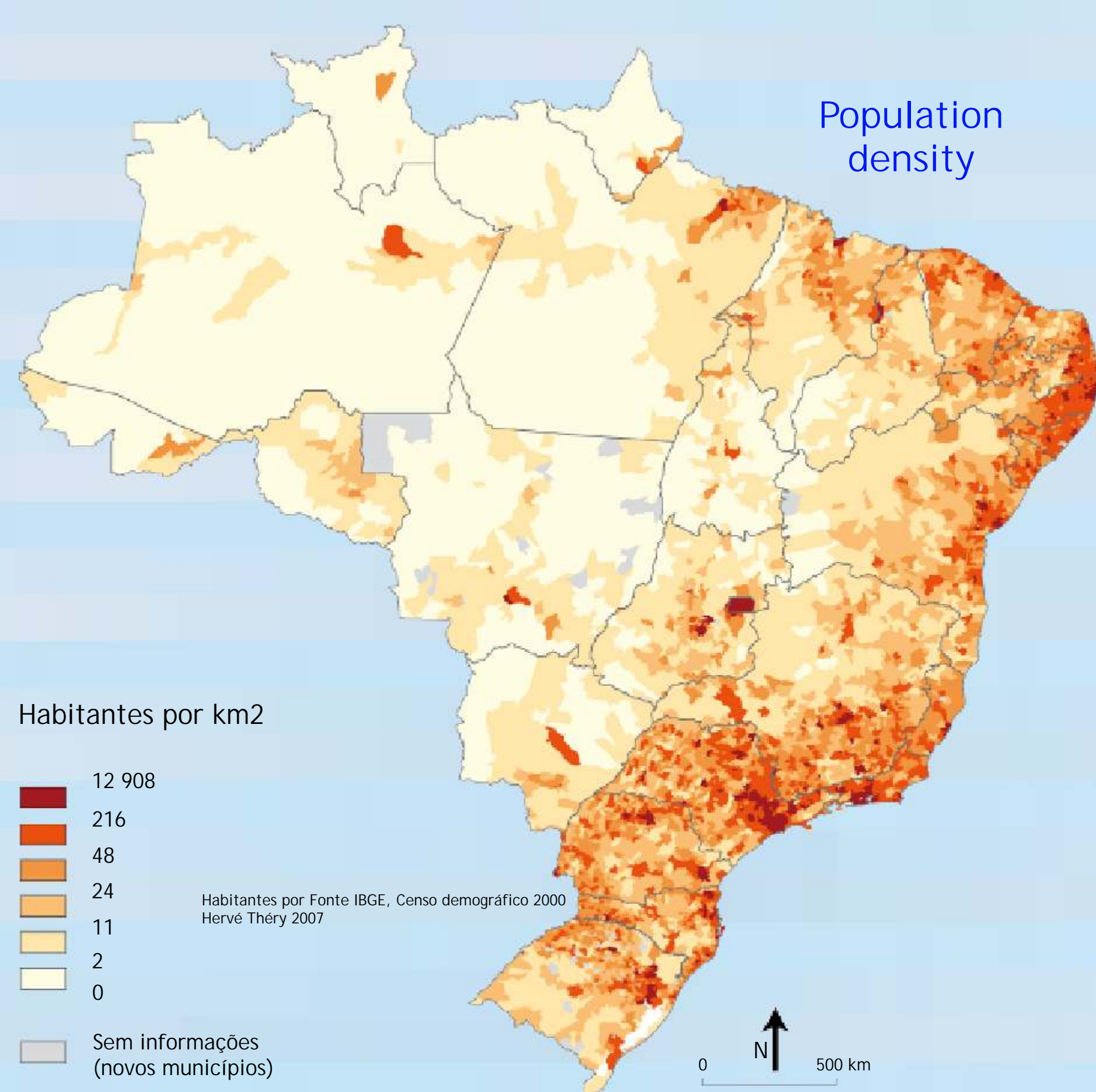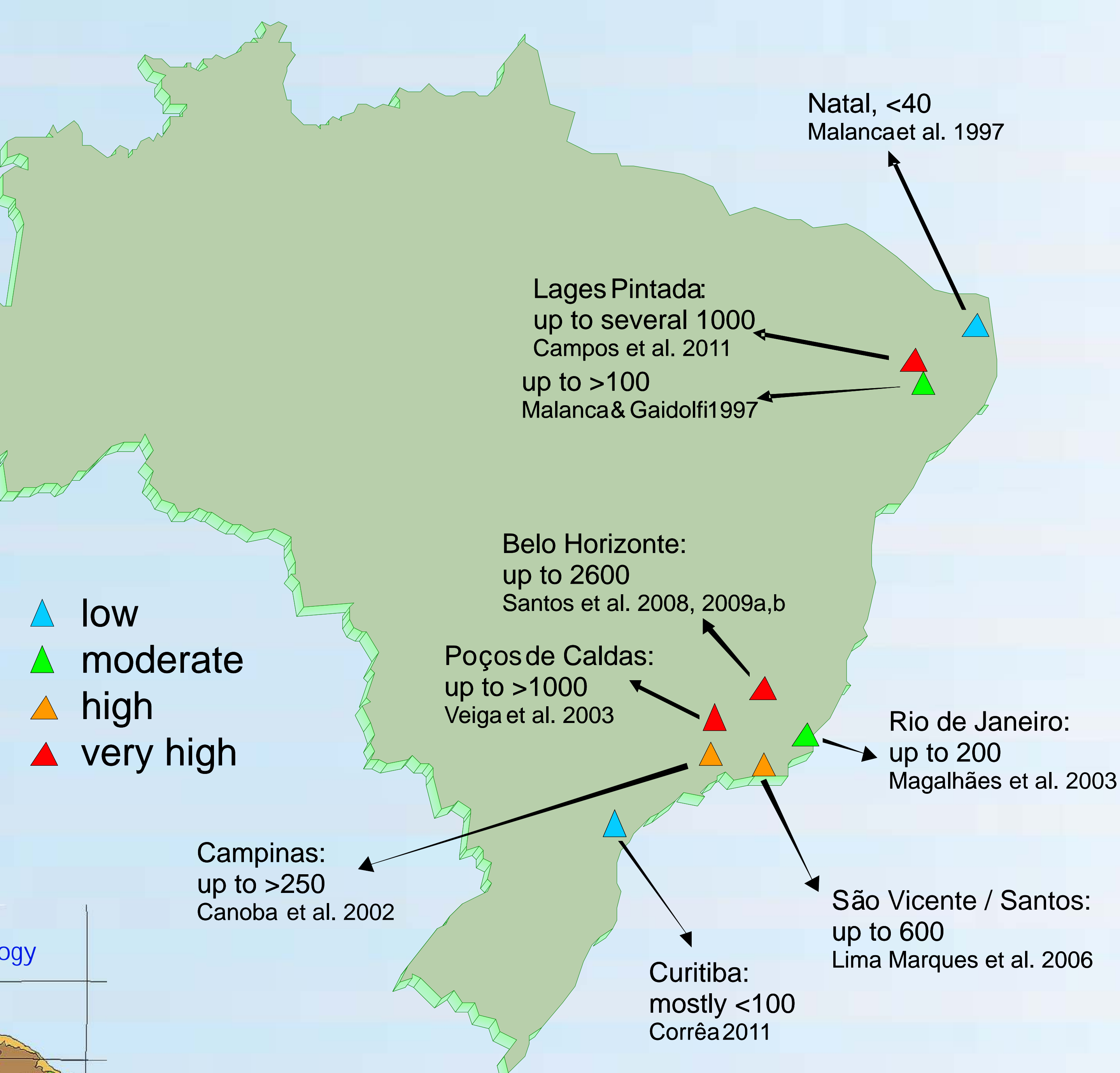
Current knowledge

several local / regional indoor Rn surveys, elevated levels were found in some cases.

Elements and steps of a survey

Identification of targets, i.e. which quantity (or quantities) shall be assessed;

Design of a monitoring survey which is capable to achieve the targets;

Natal, <40
Malanca et al. 1997

Lages Pintada:
up to several 1000
Campos et al. 2011
up to >100
Malanca & Gaidolfi 1997

Belo Horizonte:
up to 2600
Santos et al. 2008, 2009a,b

Poços de Caldas:
up to >1000
Veiga et al. 2003

Rio de Janeiro:
up to 200
Magalhães et al. 2003

△ low
△ moderate
△ high
△ very high

Campinas:
up to >250
Canoba et al. 2002

São Vicente / Santos:
up to 600
Lima Marques et al. 2006

Curitiba:
mostly <100
Corrêa 2011

Population density

Habitantes por km2

12 908
216
48
24
11
2
0

Sem informações
(novos municípios)

Habitantes por Fonte IBGE, Censo demografico 2000
Hervé Théry 2007

N   500 km

Geology

Sedimentary Rocks
Quaternary
Tertiary
Cretaceous
Jurassic-Cretaceous
Triassic
Permian
Carboniferous-Permian
Carboniferous
Devonian
Silurian
Cambrian-Ordovician
Paleozoic

Igneous and Metamorphic Rocks
Cretaceous-Tertiary volcanics
Mesozoic volcanics
Paleozoic-Mesozoic intrusives
Precambrian undifferentiated

Logistics: detector deployment & collection, laboratories, coordination of activities, facilities for QA, communication with the public, in particular if high Rn levels are found, building a team of experts from different disciplines.

Evaluation and interpretation of results;

Auxiliary research, e.g. identification of Rn prone geologies, properties of regionally typical construction styles with respect to Rn, temporal behaviour,…

Response to the results must be prepared in time, in terms of advice to the public and to authorities.

Human development

Index IDHM
■ very low, < 0.5
■ low,   0.5 - <0.6
■ medium, 0.6 - <0.7
■ high,   0.7 - <0.8
■ very high,   0.8

Climate

Equatorial
Tropical Úmido
Tropical de Savanas
Semi-Árido
Árido
Tropical de Altitude
Subtropical Oceânico
Subtropical Continental

Consequences

Rn action plan must be prepared, including prevention (building codes), remediation (who pays?), education and training of professionals.

Recent activities

- 2nd Brazilian Rn seminary: last week!
- Pilot project, Poços de Caldas (geological anomaly, partly high Rn conc.)