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Avaliação e Gestão de Perigosidades e Risco Ambiental

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A GIS LANDSLIDE DATABASE OF NORTHERN

PORTUGAL SUPPORTED BY DOCUMENTAL SOURCES

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Structure of presentation

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- The development of natural disasters databases is crucial for risk management, because it allows improving systems of indicators on disaster risk and vulnerability at national and sub-national scales.

- The analysis of social, economic and environmental impact of disasters needs to be transferred to decision-makers and integrated in land use management and civil protection policies in order to prevent and mitigate future disaster losses.

- **Landslide databases** are essential to assess landslide hazard and risk. However, landslide databases may have different spatial resolution associated with different goals, scale and data capture methods.

- Limitations related with spatial resolution and data capture procedures of landslide databases need to be considered when data is transferred and applied by end-users.

- The basic information on past damaging landslides occurred in Portugal from 1900 to 2008 can be found in the academic work performed at national scale by Quaresma (2008).

- At the regional scale, a landslide database was made for the North Region of Portugal (**Northern Portugal Landslide database – NPLD**) including the complete landslides occurrences identified exploring documental sources for the period lasting from 1900 to 2010.

The main objectives of this work are the following:

1. To present the methodology used to construct the Northern Portugal Landslide Database (NPLD).

1. To present the temporal and spatial distribution of landslides included in the NPLD, in the period 1900-2010.

1. To assess the main damages caused by landslides in the North of Portugal in the period 1900-2010.

1. To compare the NPLD with a National Landslide Database and to discuss the degree of completeness and the temporal and spatial accuracy of landslide distribution within different databases.

1. To discuss the advantages and limitations of landslides databases supported by documental sources.

- Data collection was exclusively based on documental sources (Fig. 1) for the period lasting from 1900 to 2010.
- Documental sources were analyzed in order to identify and georeference **the total set of reported landslide occurrences.**
- Road maps, rail road maps and the Google Earth were used as additional tools to support the location of slope movements.
- Landslides were mapped over topographic maps (1:25 000 scale) with a point in the centroid of the rupture zone.
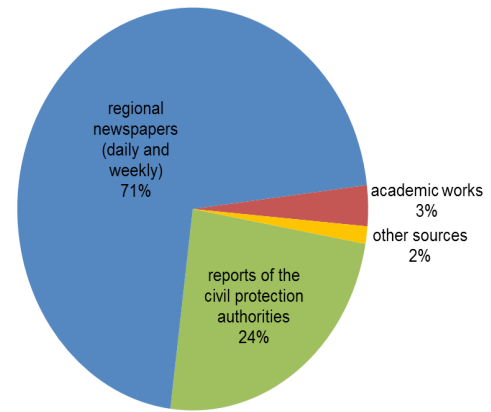

Pie chart:
- regional newspapers (daily and weekly) 71%
- reports of the civil protection authorities 24%
- academic works 3%
- other sources 2%

Fig. 1 – Documental sources of the NPLD

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□ The NPLD includes the following information for each landslide occurrence:

- ID
- Date and hour of occurrence
- Location, x y coordinates
- Landslide type
- Data source
- Number of fatalities
- Number of injuries
- Number of homeless
- Disruptions in rail circulation
- Disruptions in road circulation
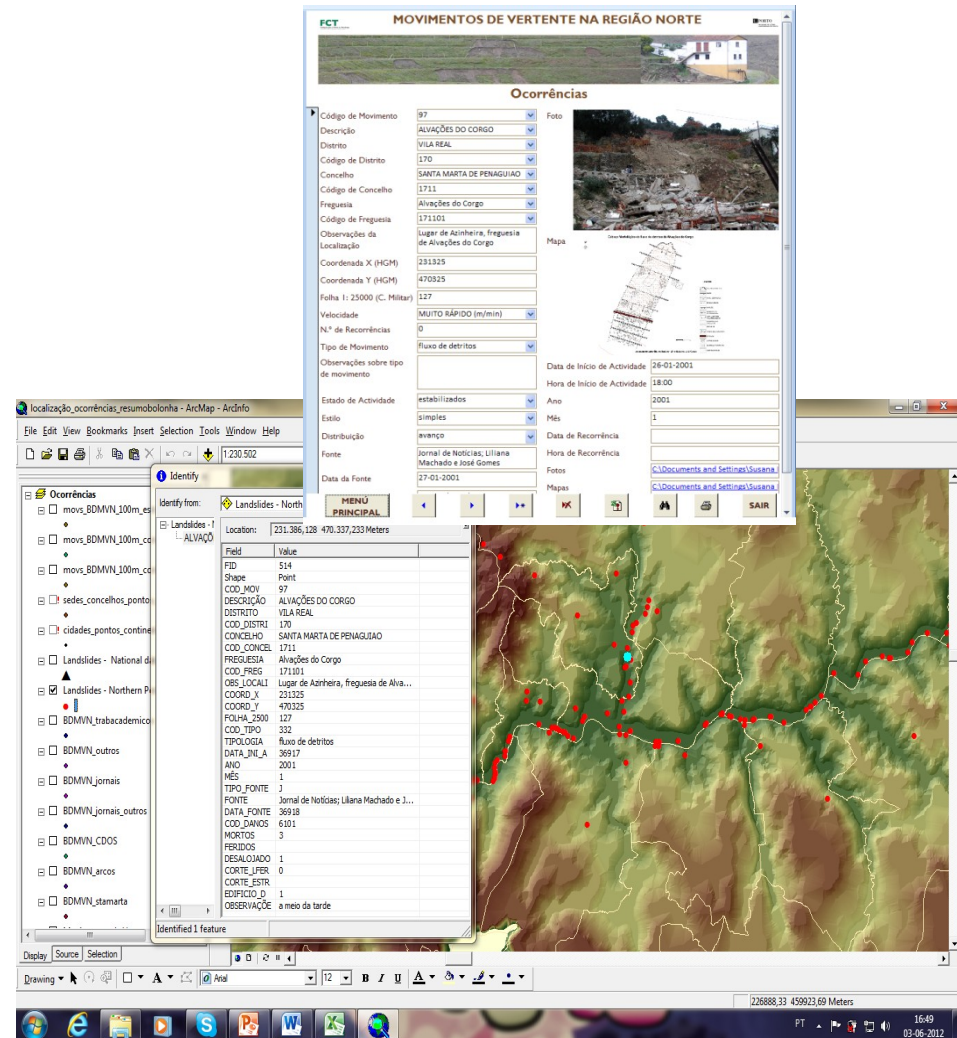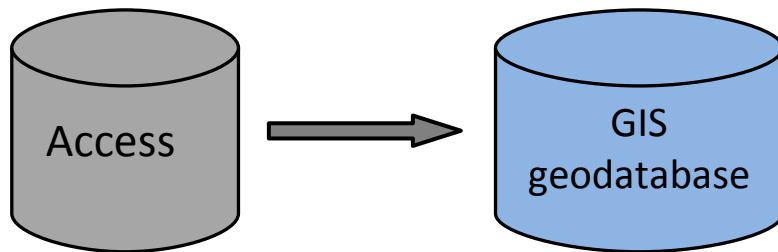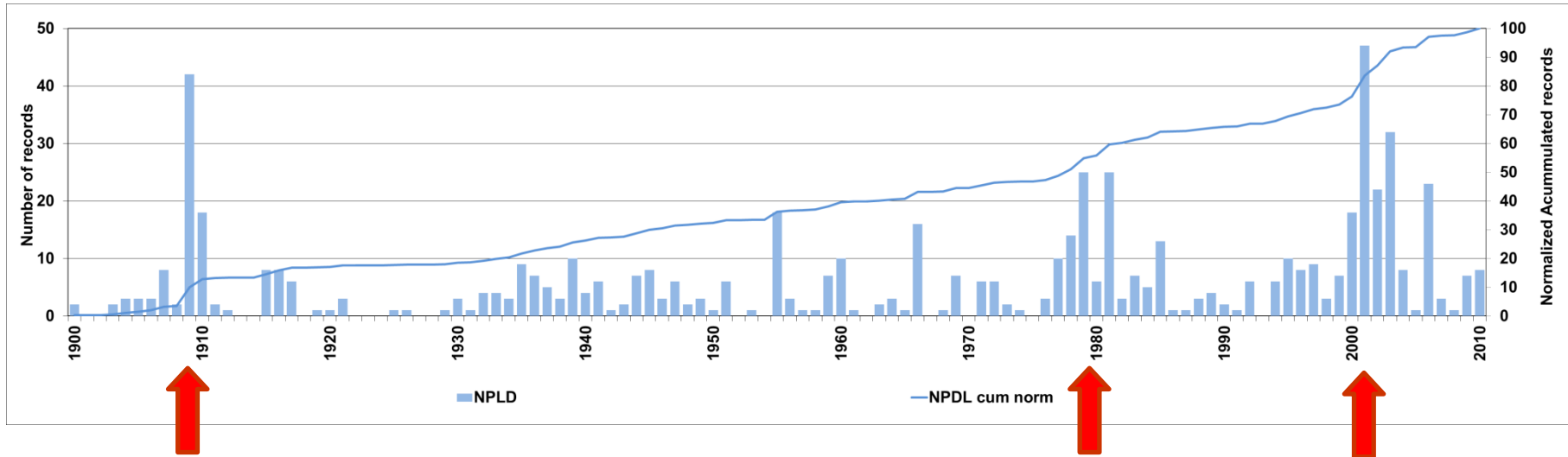- Number of affected buildings.

Access → GIS geodatabase

Fig. 2 – Example of the NPLD in GIS

□ Annual distribution
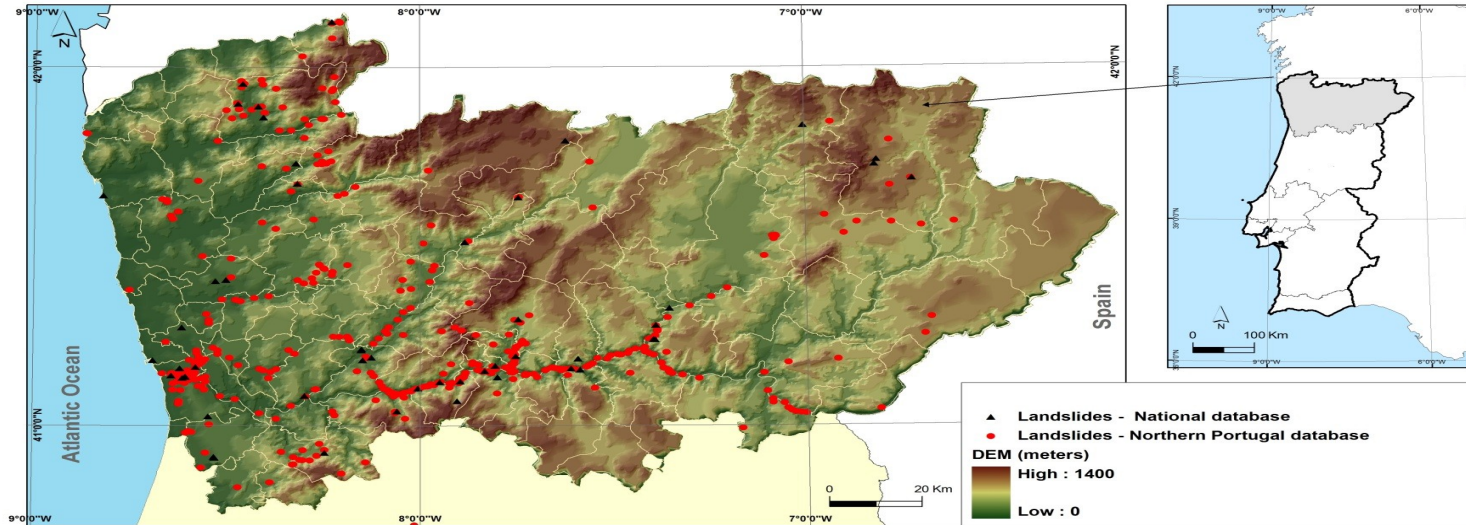
The NPLD has 643 landslide occurrences

□ Monthly distribution
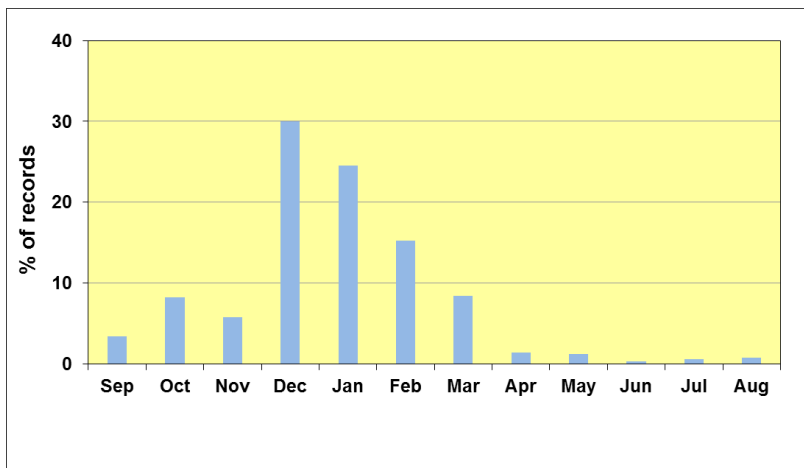
□ 3 Periods of high landslide activity:
- · 1909 – 1910
- · 1978 – 1985
- · 2000 – 2006

□ More than 70% of landslides occurred in late autumn and winter rainy months, mainly in December (31%) and January (25%).

78% of the landslides are georeferenced in the centroid of the landslide rupture zone.

- Landslides are located mainly along the Douro valley and in the Oporto metropolitan area.
- Rock falls and debris flows are the most frequent landslides.

1900 – 2010

- Social consequences registered in NPLD: 136 deaths, 173 injuries and 460 homeless;

- More than half of the landslides caused disruptions in railroad or road circulation (38% correspond to line closures and 13% to road block).

What is the degree of completeness and the temporal and spatial accuracy of landslide distribution within different databases ?

- Spatial and temporal distribution of landslides within NPLD was compared with a national database of landslide damaging events (Quaresma, 2008). This database was originally made for the period 1900-2008 and was further updated until 2010.

- This database was based only on **daily national newspaper** news reporting **landslides that have generated fatalities, injuries, missing people, homeless or evacuated people**.

- It was made a selection of NPLD landslides that caused fatalities, injuries or homeless people to ease compare the regional and national landslide databases.
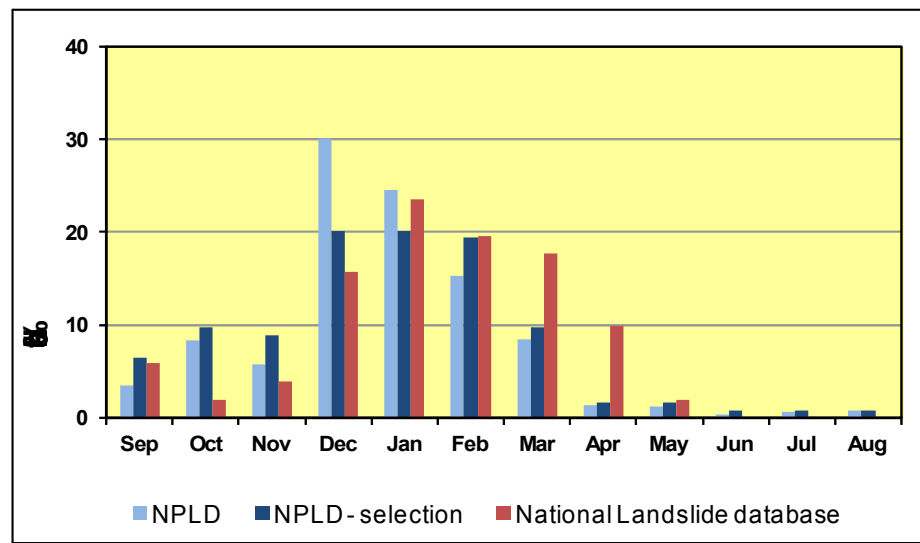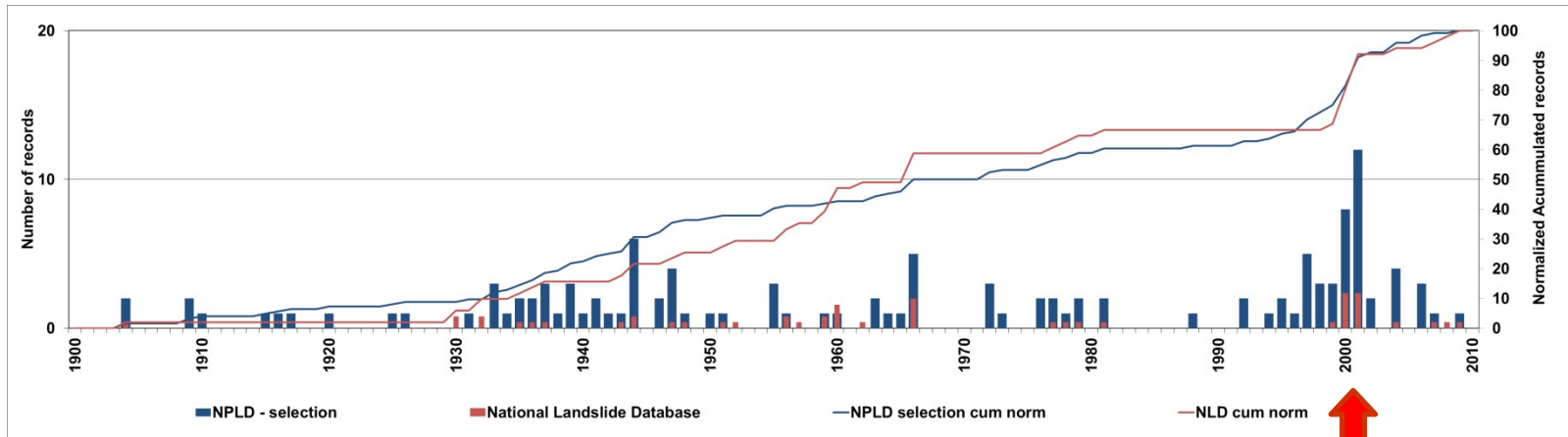
What is the degree of completeness and the temporal and spatial accuracy of landslide distribution within different databases ?

Completeness refers to the proportion of landslides shown in the inventory compared to the real (and most of the times unknown) number of landslides in the study area (Guzzetti et al., 2012).

	NPLD	NPLD - selection	National Database
Period	1900-2010	1900-2010	1900-2010
Main Sources	Regional newspapers (daily and weekly)	Regional newspapers (daily and weekly)	National newspaper (daily)
Nr. landslides	643	124	51
Landslides/year	5.6	1.1	0.5
Nr georeferenced landslides	501	124	51
Georeferencing	Point (centroid of landslide)	Point (centroid of landslide)	Point (nearest toponymy)
Criteria for landslide inventory	All landslides	Landslides that caused fatalities, injuries and homeless	Landslides that caused fatalities, injuries, missing people, homeless and evacuated people
Nr. deaths	136	136	88
Nr. injuries	173	173	91
Nr. homeless	460	460	264

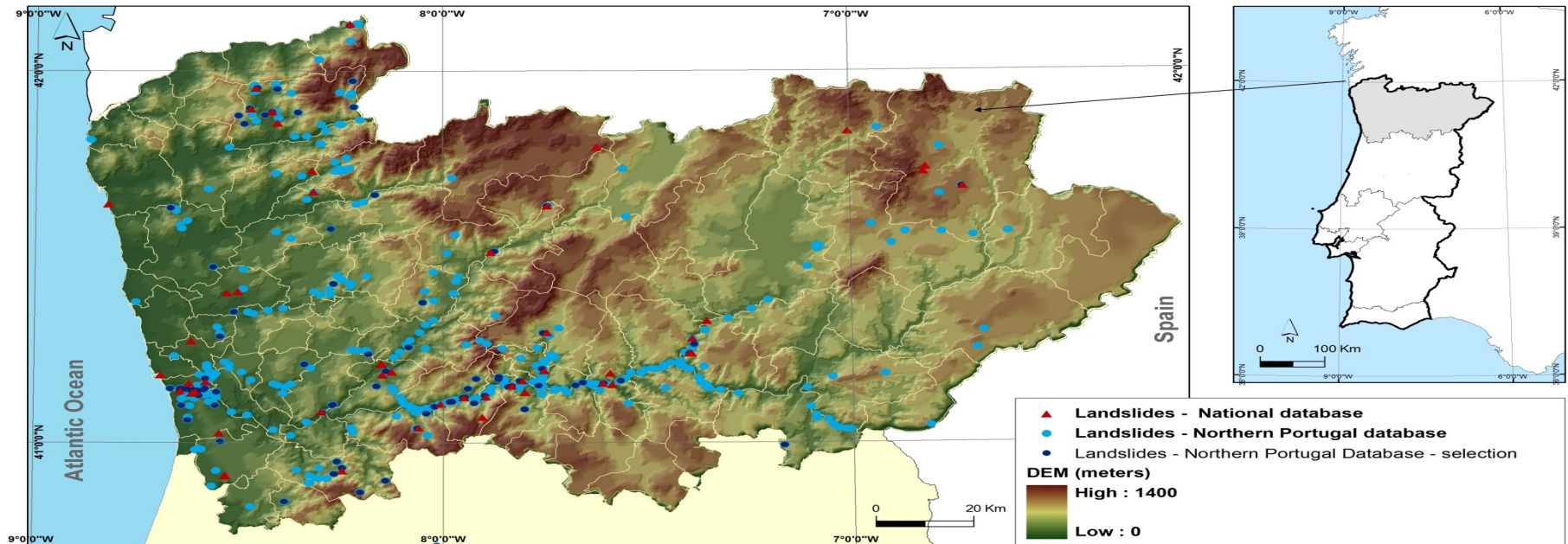**What is the degree of completeness and the temporal and spatial accuracy of landslide distribution within different databases?**

·The National Landslide database has 51 landslides;

·The NPLD selection has 124 landslides.

What is the degree of completeness and the temporal and spatial accuracy of landslide distribution within different databases ?

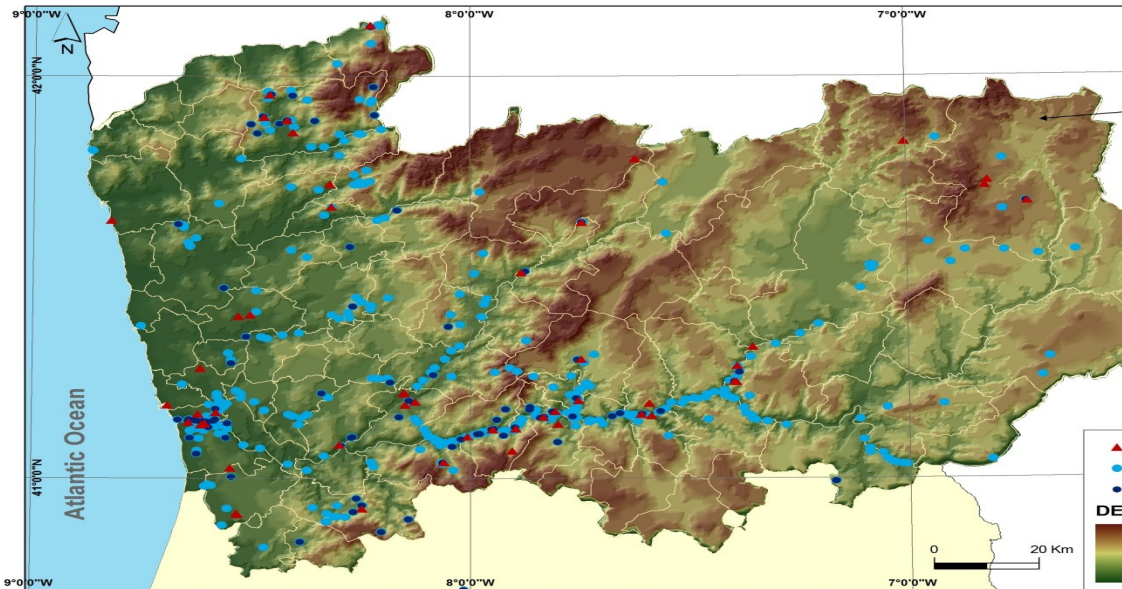What are the **advantages** and limitations of landslides databases supported by documental sources?


Main advantages:

- Small-scale, synoptic inventories (1:200,000) (Guzzetti et al., 2012);

- Gives a quick view of damaging landslides in temporal and spatial dimensions at regional scale;

- Allow to locate old landslides without current morphological evidences;

- Adjusted to identify landslide risk zones.

What are the advantages and limitations of landslide databases supported by documental sources?
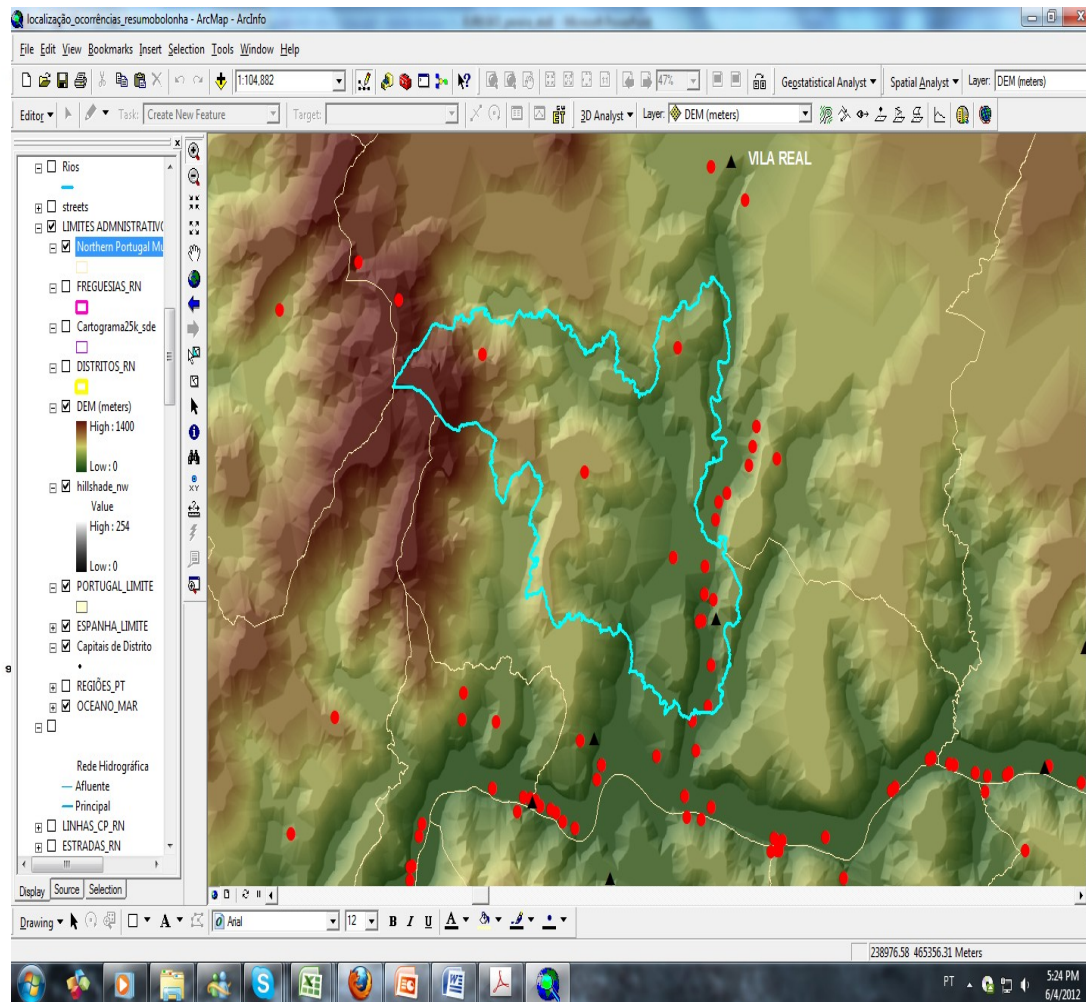


Santa Marta de Penaguião Council (70 km2)

· **14 landslides in NPLD (4 debris flows, 2 rock falls and 7 undefined type landslides)**

· **1 landslide in the   National Landslide   database (1 debris flow)**

What are the advantages and limitations of landslides databases supported by documental sources?
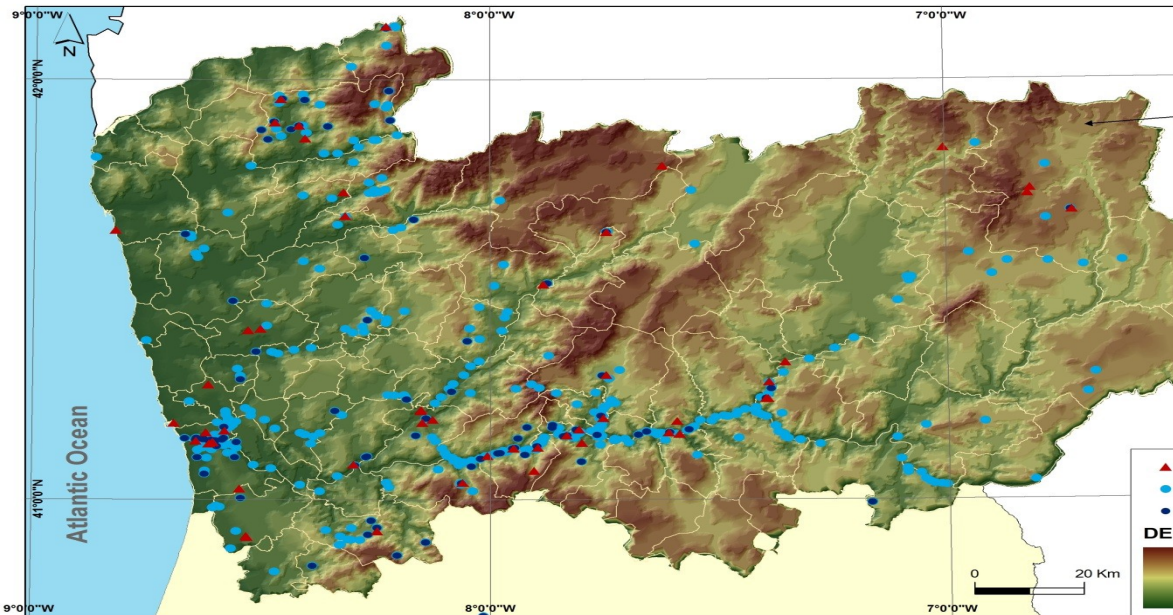

Santa Marta de Penaguião Council (70 km2)

734 shallow translational landslides, 88 falls and 8 debris flows inventoried with detailed field geomorphological survey (2005-2009)
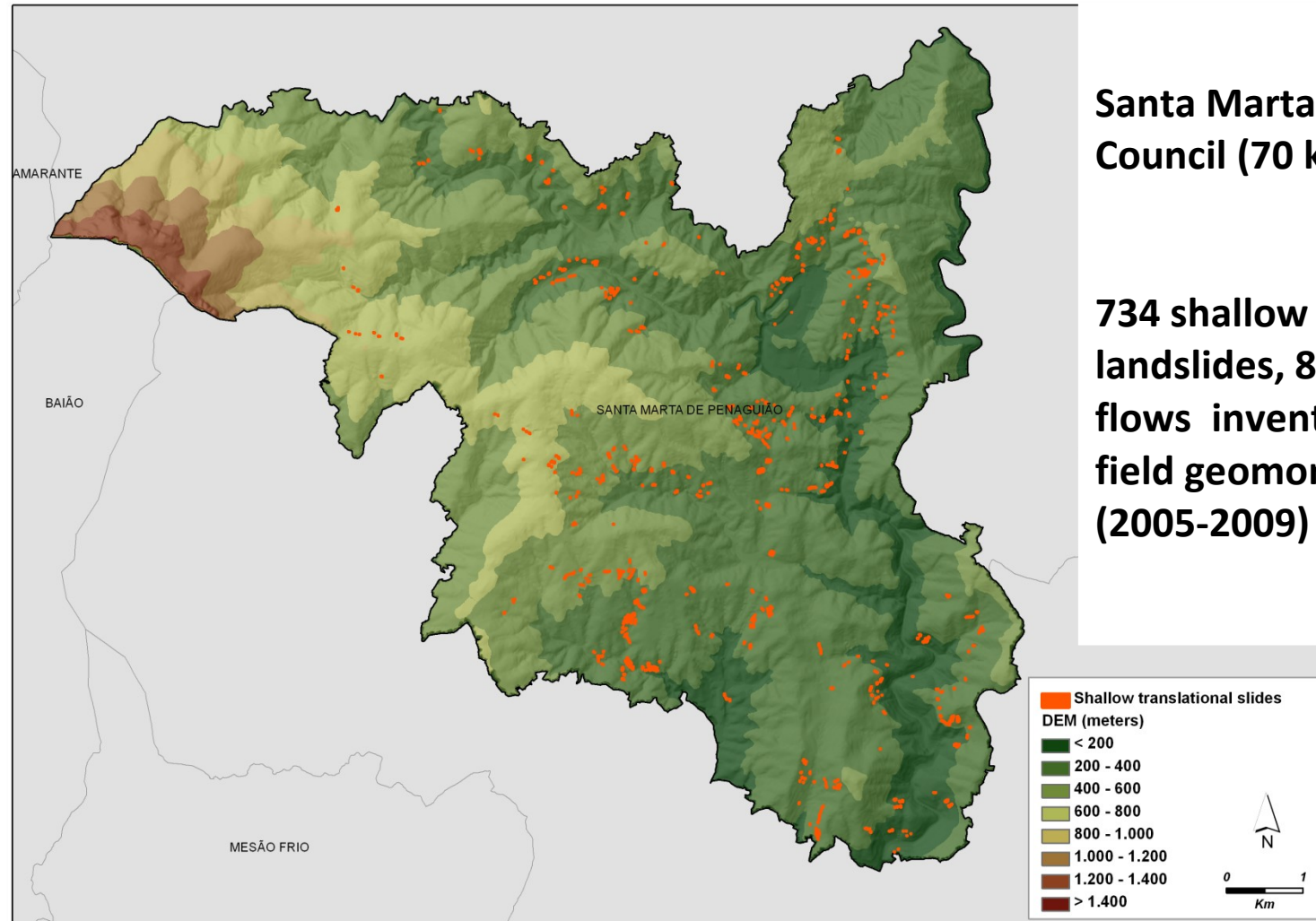
What are the advantages and limitations of landslides databases supported by documental sources?

Main limitations:

- Low geographical accuracy in landslide location;

- Uncertainty in landslide type and landslides boundaries.

- Only landslides that caused damages and disruptions are reported;

- It is not a complete landslide inventory!
  So, it is not recommended to use such inventories in landslide susceptibility assessment at basin or municipality scale.

- The general trend of landslides occurrence in the North Region of Portugal from 1900 to 2010 shows an increase number of cases starting in 2000.

- Temporal distribution of landslides is strongly associated with wet months reflecting the rainfall triggering of slope movements.

- Although the NPLD theoretically includes all landslides, in practice the spatial distribution of landslides reflects the pattern of landslides that generated direct damages in population (e.g. fatalities, injuries, homeless), buildings and infra-structures (e.g. road, railroads).

- Therefore, landslide inventories based in documental sources can be easily transferred to emergency planning stakeholders and can be used to assess societal risk.

- Nevertheless, these landslide inventories are not enough complete to

THANK YOU FOR YOUR ATTENTION!!