



Analysing spatial distribution of damaging floods and mass movements in Portugal from 1865 to 2010 (DISASTER database): geographical factors, weather types and human impacts

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Main issues

Brief description of DISASTER database

Some general results of DISASTER database

Identifying spatial patterns for flood events

Floods in the Lisbon region and Tagus valley

Brief description of DISASTER database

Hydro-geomorphologic occurrences

4 research groups

2 dozens of researchers

11 (+5) newspapers used

146 years surveyed (1865-2010)

145 344 copies of newspapers analyzed

Spatial distribution of damaging floods and mass movements in Portugal from 1865 to 2010

Brief description of DISASTER database

1865

1907/1908

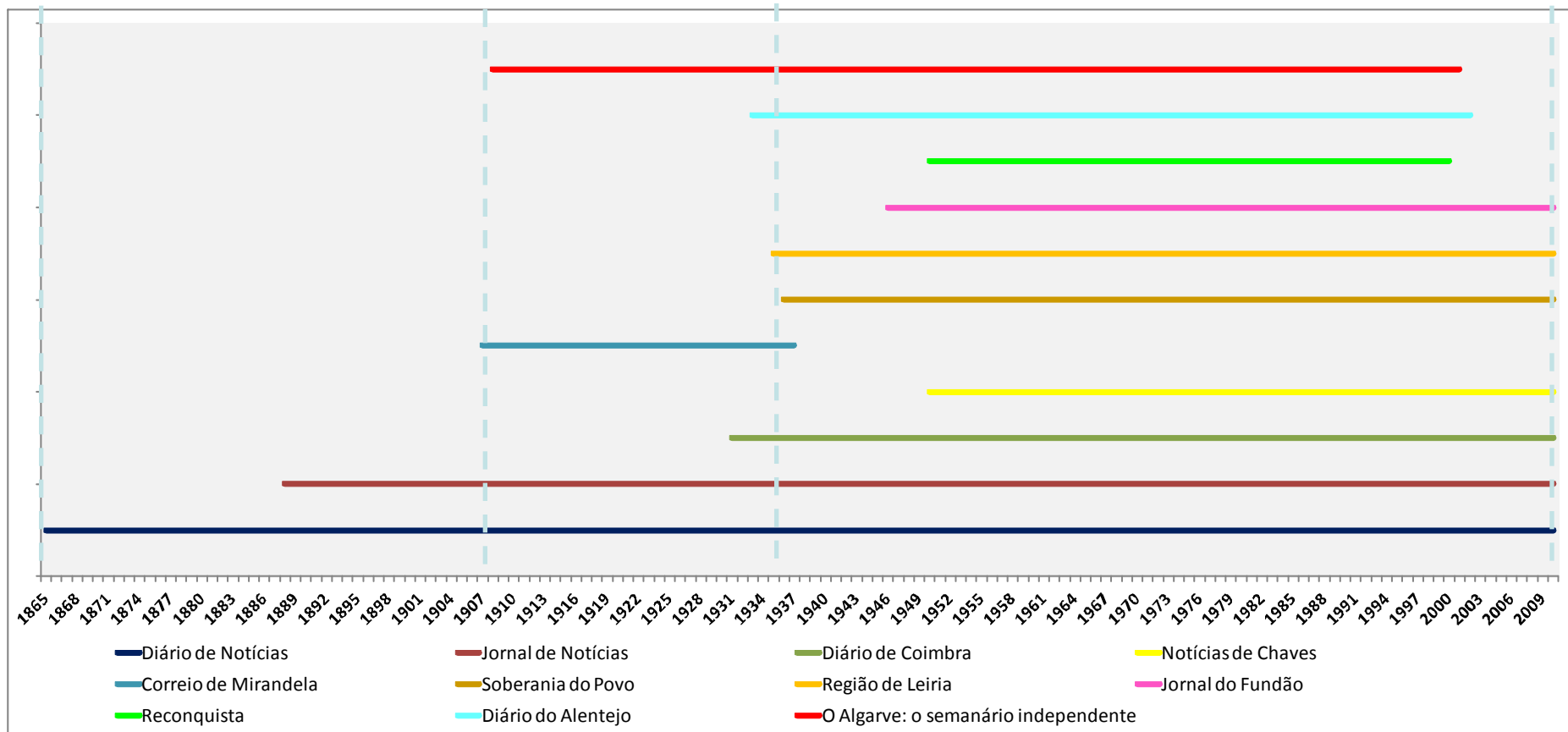
1936

2010

1-2 Newspapers

4 Newspapers

7- 10 Newspapers



Brief description of DISASTER database

Criteria for registration of “occurrences” in the database

Local geographically identifiable affected by flood or slope mass movement **with dead, injured, disappeared, displaced or evacuated**, regardless of the number of affected persons.

<http://riskam.ul.pt/disaster/>

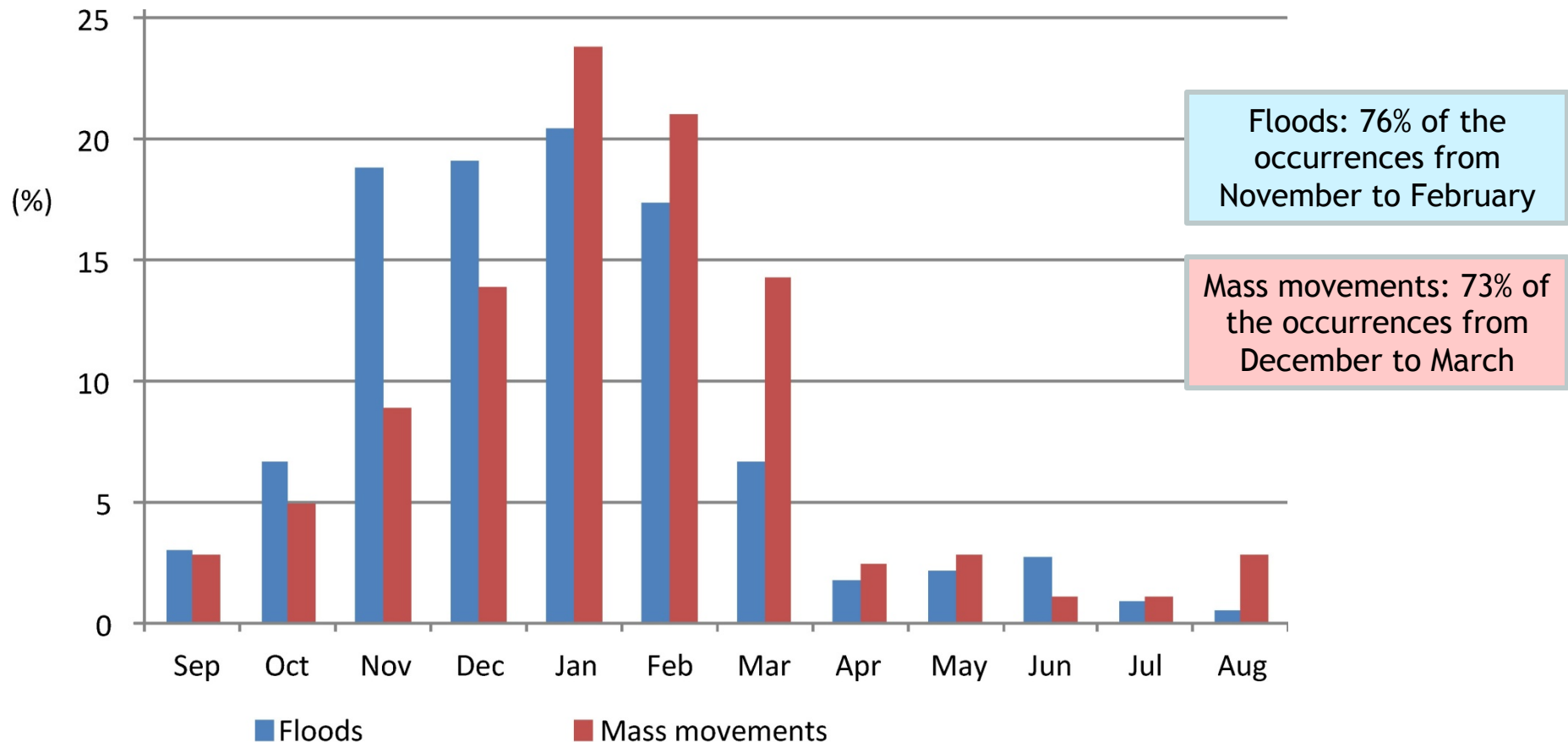
Some general results of DISASTER database

Number of occurrences and people affected by type of impact

Number of	Floods		Mass movements	Total
	N	%		
Occurrences	1622	85,2	281	1903
Dead	1071	81,8	239	1310
Evacuated	13372	94,2	819	14191
Displaced	40283	96,3	1561	41844

Some general results of DISASTER database

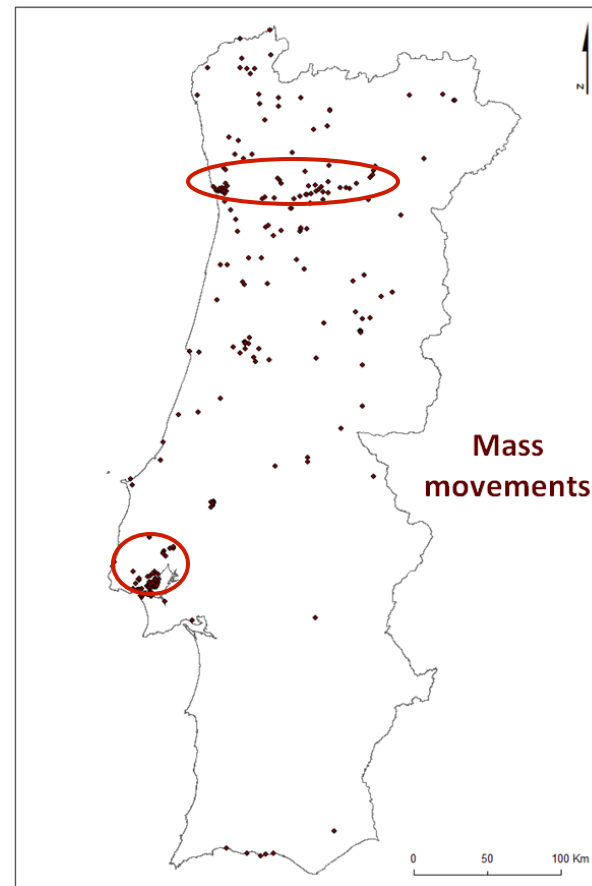
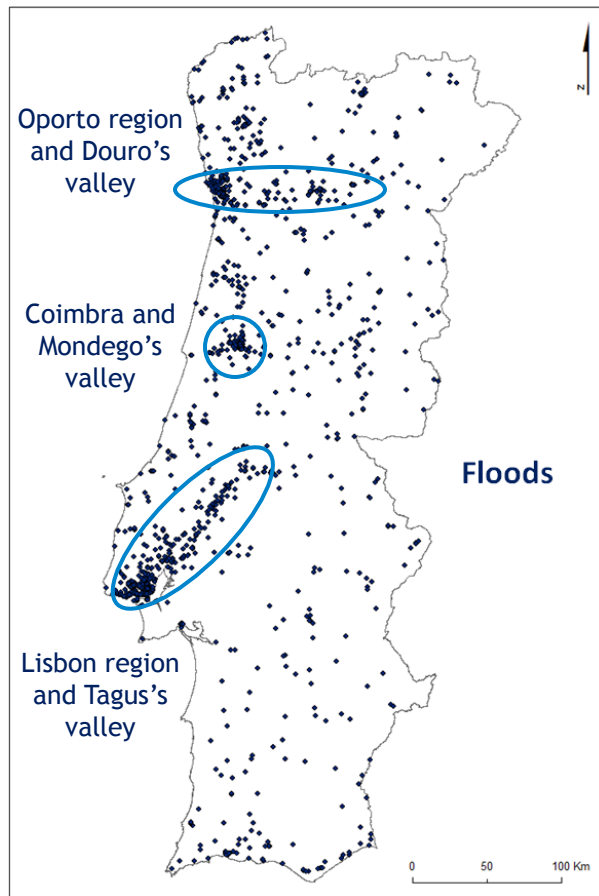
Monthly frequency of floods and mass movements (1865 to 2010) in mainland Portugal



Spatial distribution of damaging floods and mass movements in Portugal from 1865 to 2010

Some general results of DISASTER database

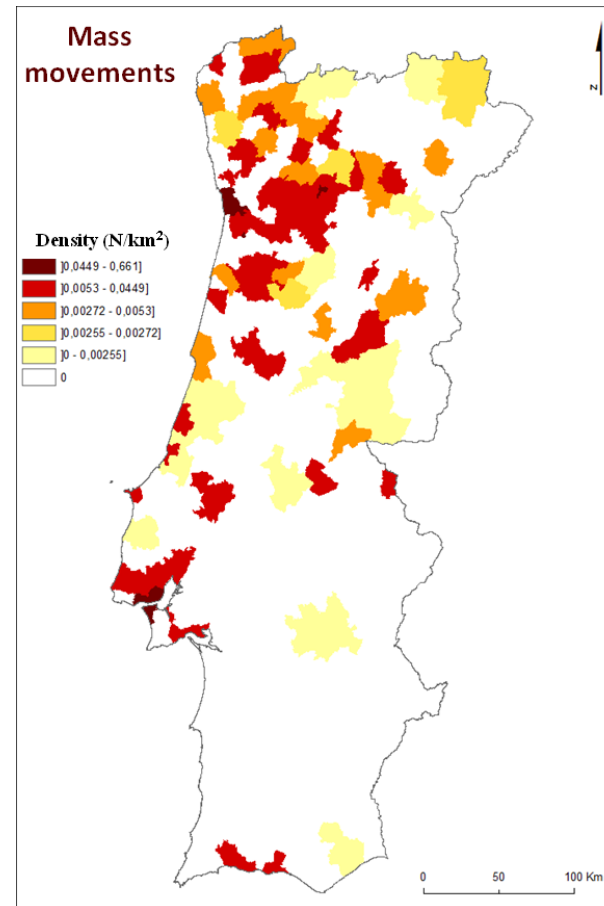
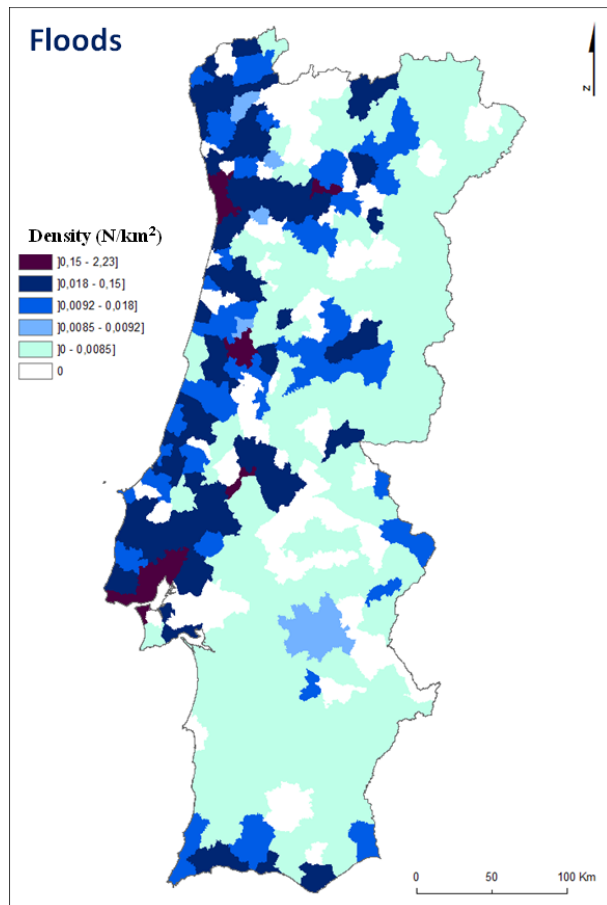
Spatial distribution of floods and mass movements occurrences (1865 to 2010) in mainland Portugal



Spatial distribution of damaging floods and mass movements in Portugal from 1865 to 2010

Some general results of DISASTER database

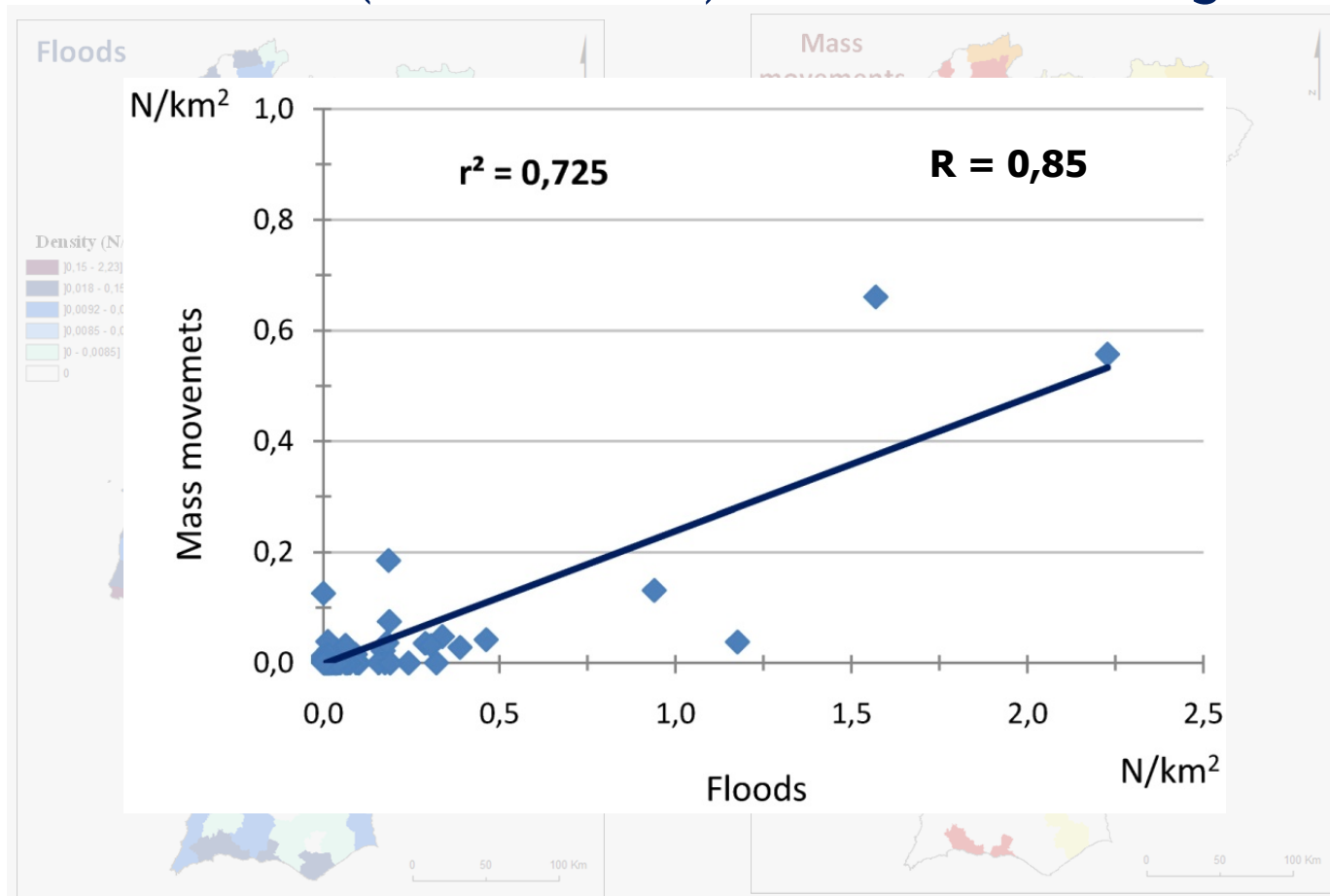
Spatial distribution of floods and mass movements occurrences (1865 to 2010) in mainland Portugal



Spatial distribution of damaging floods and mass movements in Portugal from 1865 to 2010

Some general results of DISASTER database

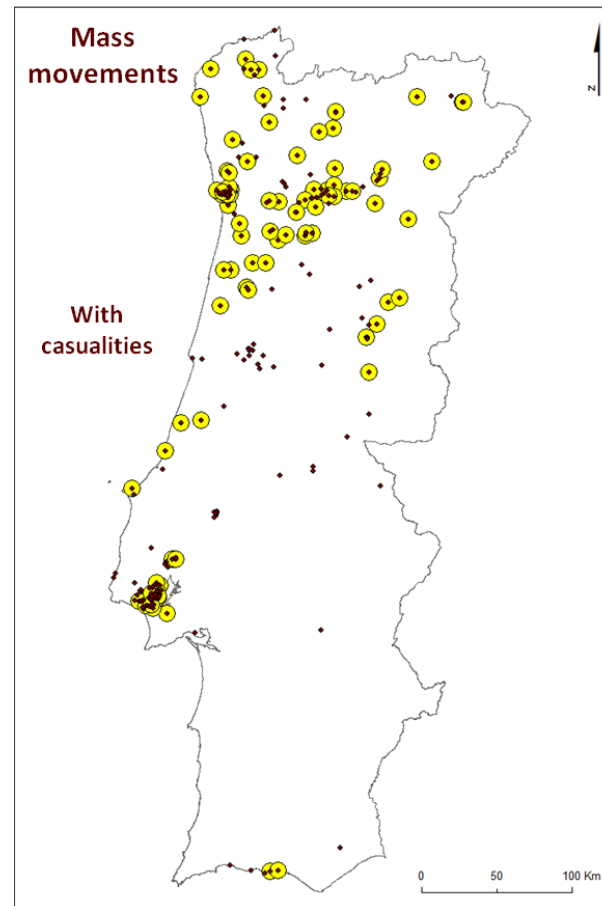
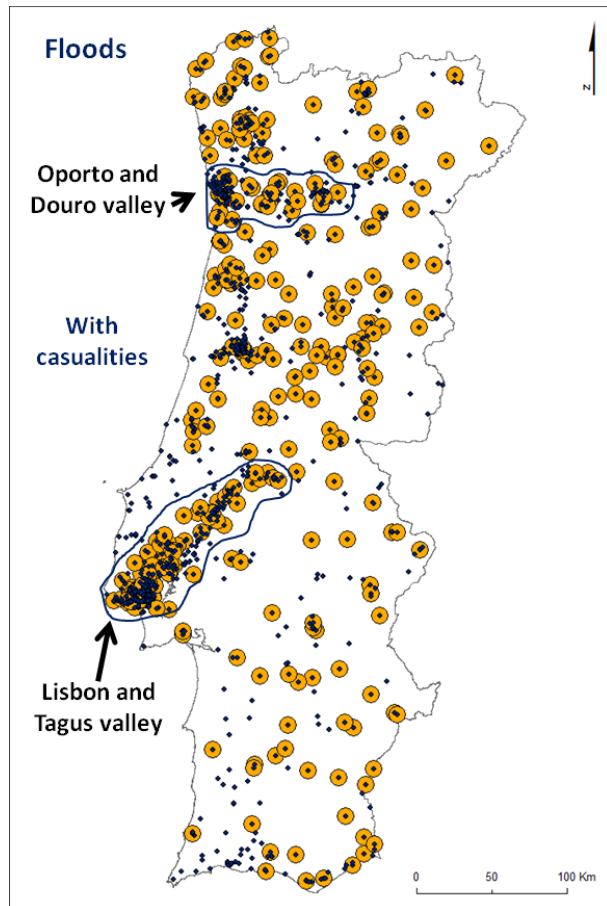
Spatial distribution of floods and mass movements occurrences (1865 to 2010) in mainland Portugal



Spatial distribution of damaging floods and mass movements in Portugal from 1865 to 2010

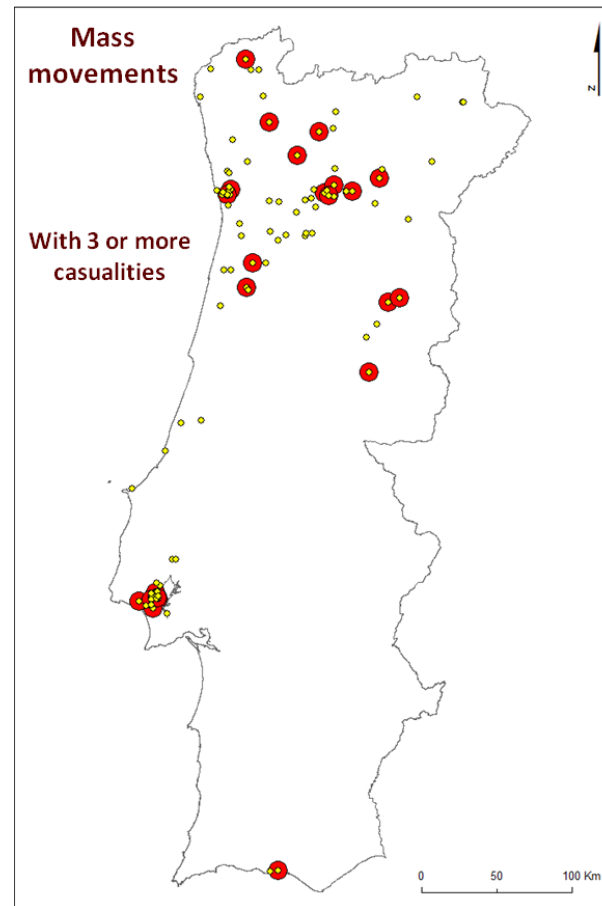
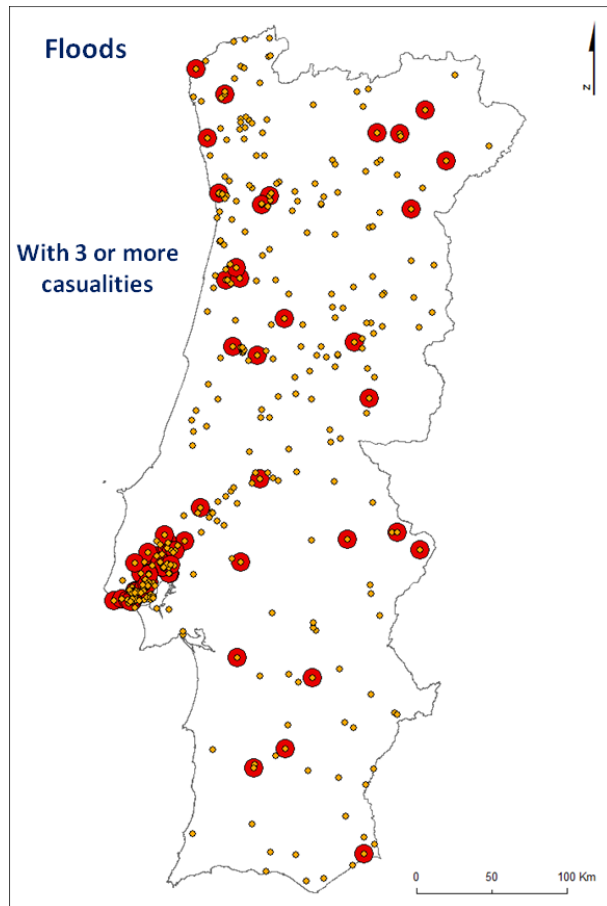
Some general results of DISASTER database

Spatial distribution of deadly occurrences related to floods and mass movements (1865 to 2010) in mainland Portugal



Some general results of DISASTER database

Spatial distribution of occurrences with 3 or more dead related to floods and mass movements (1865 to 2010) in mainland Portugal



Identifying spatial patterns for flood events

Several spatial flood distribution patterns

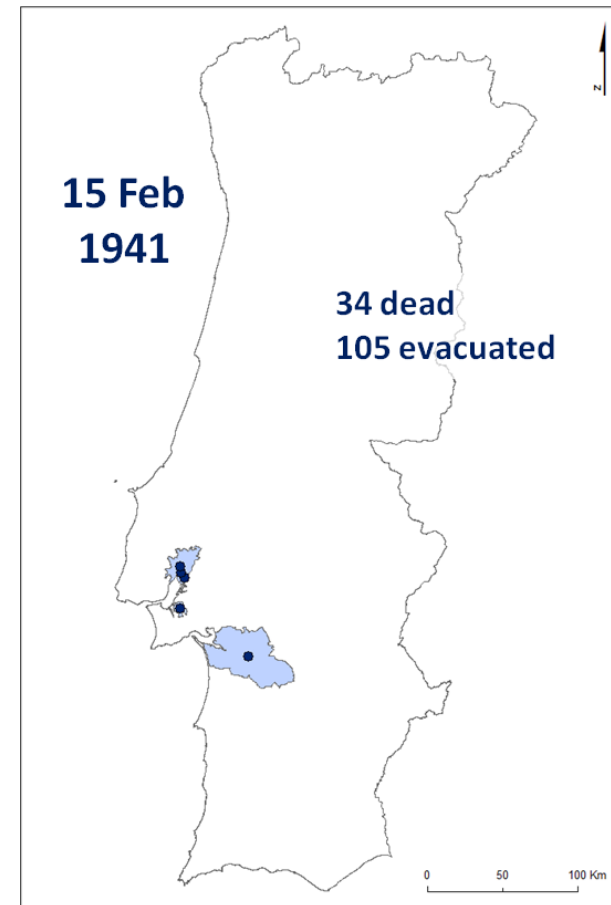
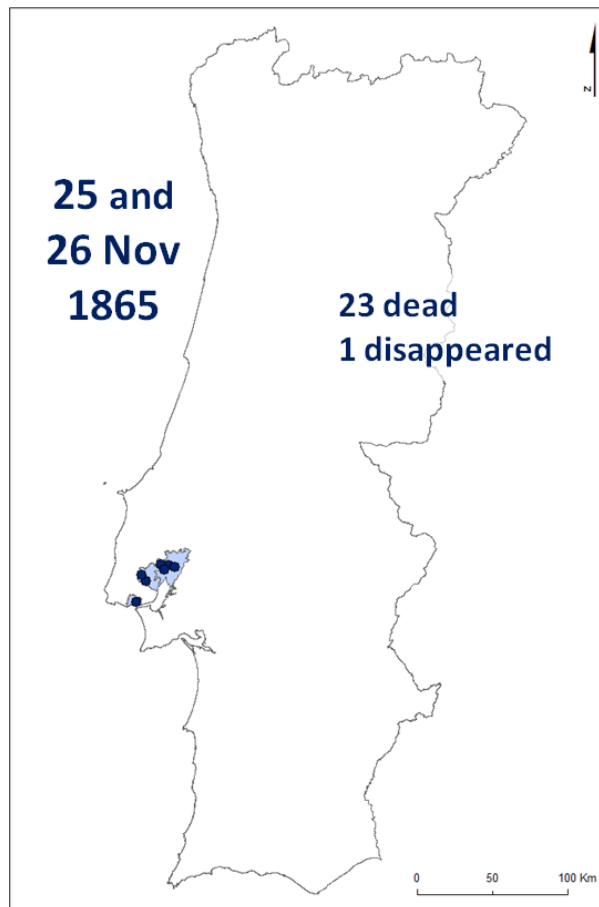
- different atmospheric circulation types;
- type of drainage basins affected and characteristic geographic distribution;
- sort and intensity of the impacts on human life.

The most important flood spatial patterns:

- **Type I:** very concentrated events, along small areas (**sub-type I.A**) or linear trajectories (**subtype I.B**); very convective depressions; flash floods;
- **Type II:** linear distribution along the main rivers; very long rainfall periods; successive surface frontal zones; progressive floods;
- **Type III:** mixed pattern; floods along the main rivers occur simultaneously with located and more or less disperse flash floods;
- **Type IV:** a regional spatial pattern (north, centre, northwest, etc.), more or less disperse; very active surface frontal zones.

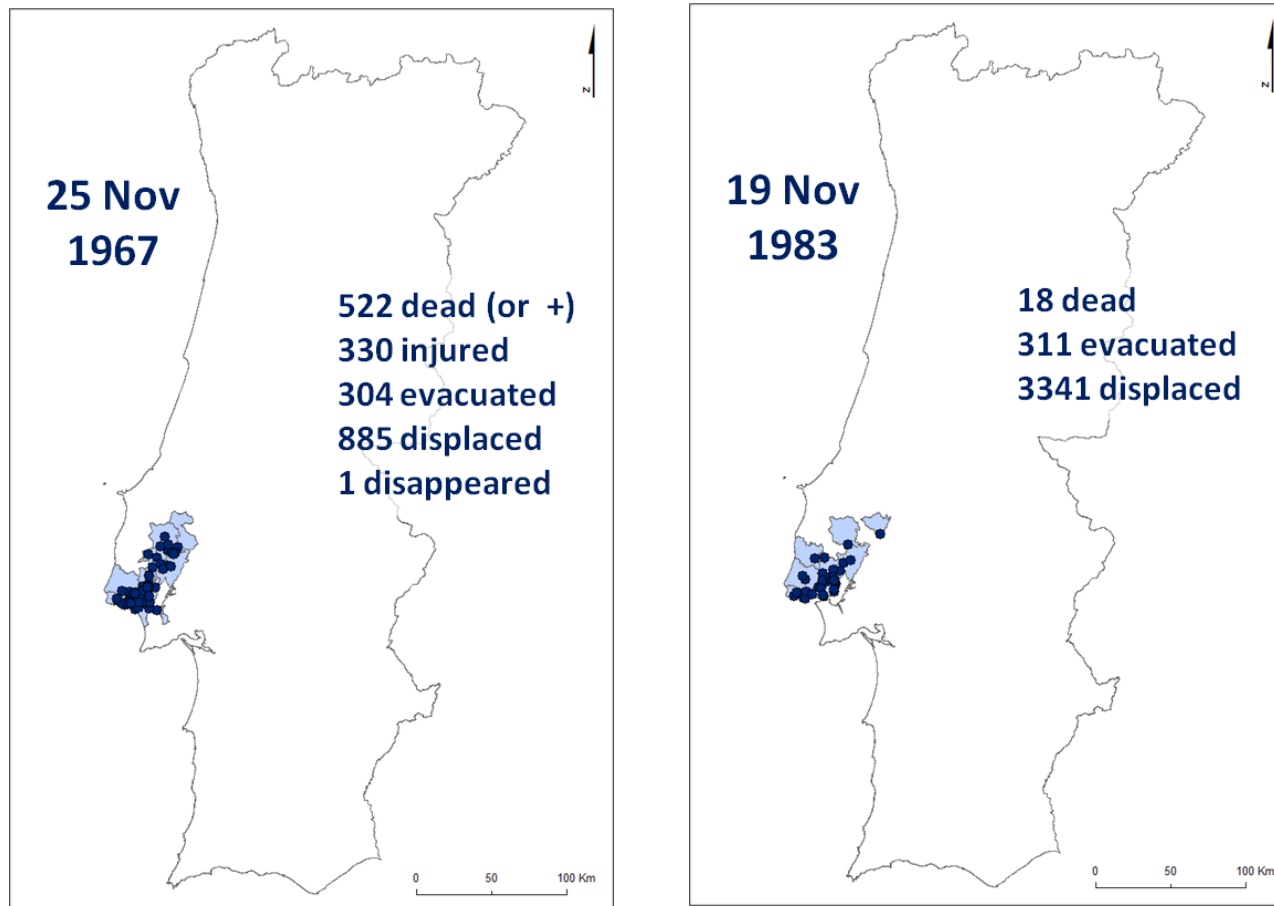
Identifying spatial patterns for flood events

Concentrated flood pattern (Subtype I-A)



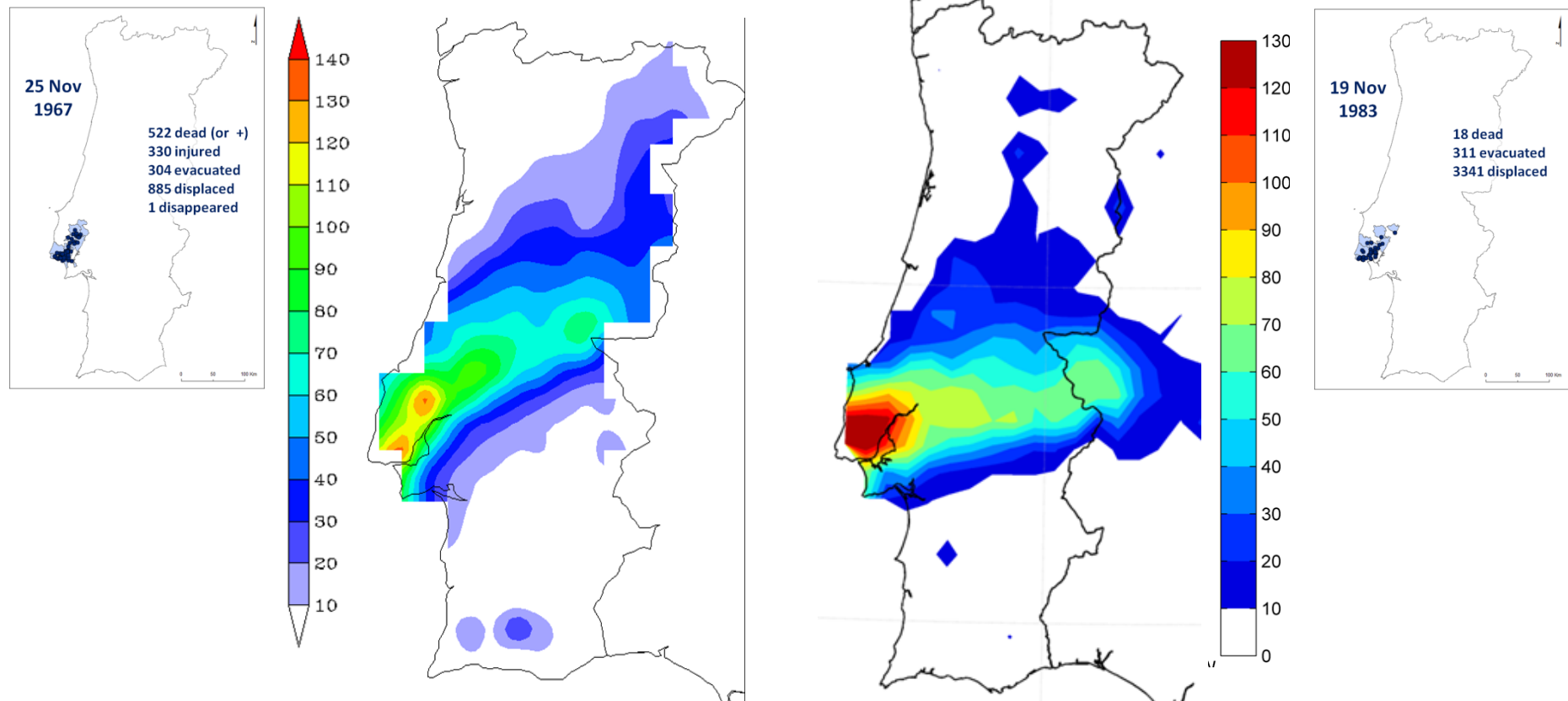
Identifying spatial patterns for flood events

Concentrated flood pattern (Subtype I-A)



Identifying spatial patterns for flood events

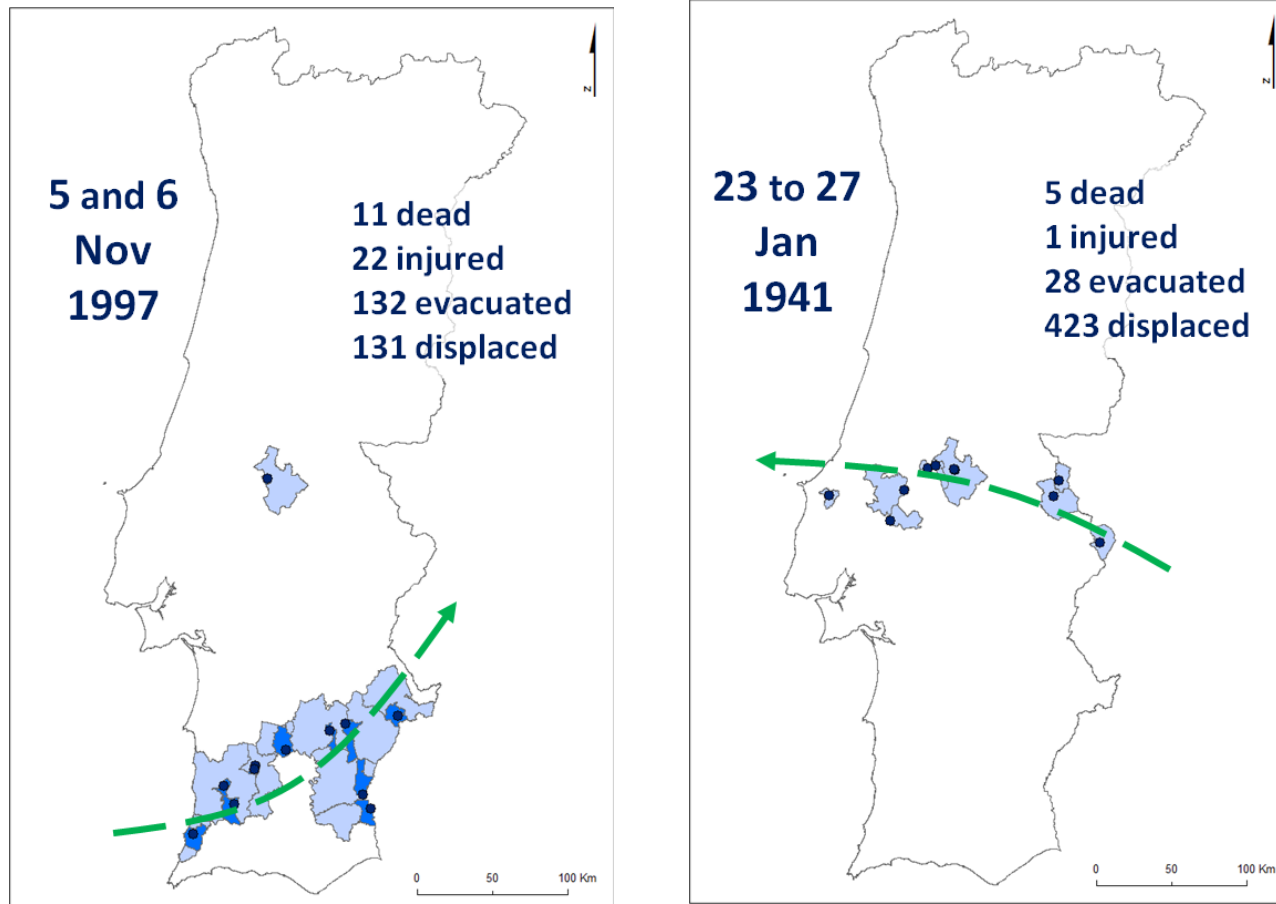
Concentrated flood pattern (Subtype I-A)



Belo Pereira et al. (2011)

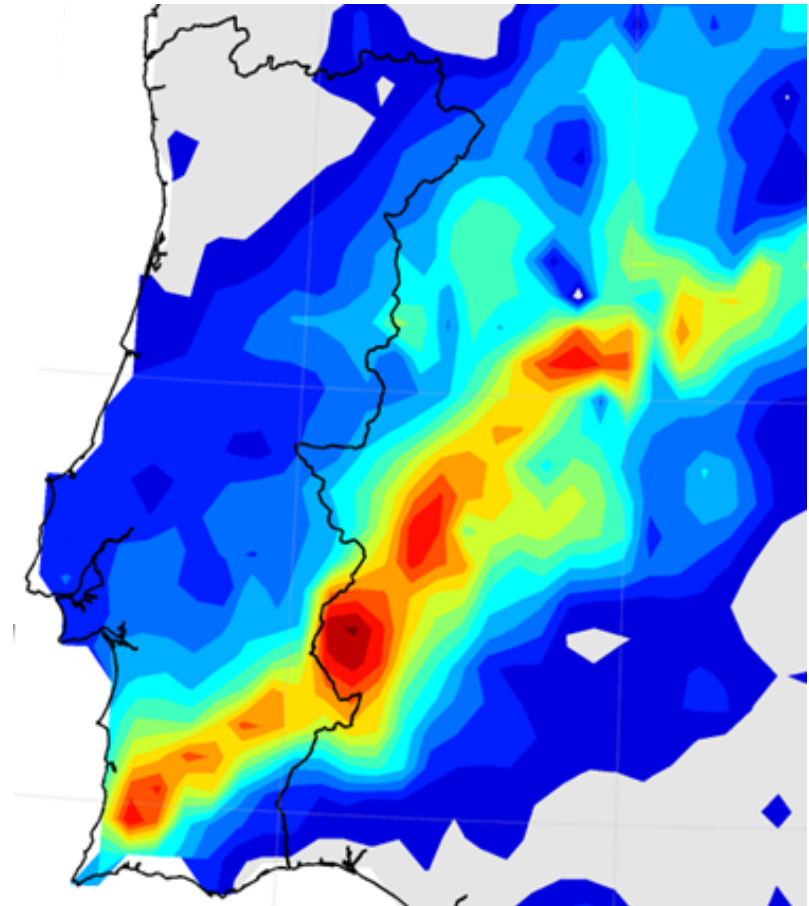
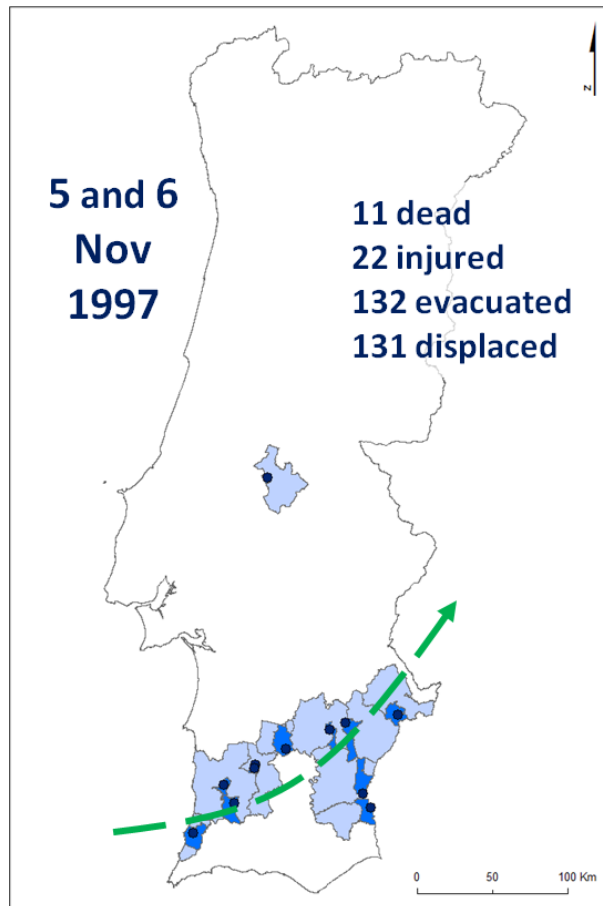
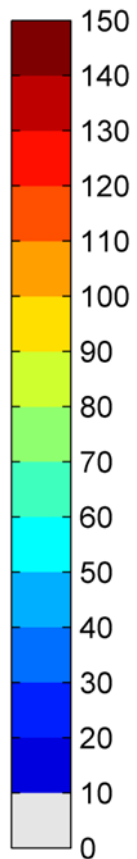
Identifying spatial patterns for flood events

Concentrated flood pattern with linear trajectory (Subtype I-B)



Identifying spatial patterns for flood events

Concentrated flood pattern with linear trajectory (Subtype I-B)



Identifying spatial patterns for flood events

Concentrated flood pattern

Short duration (1 day)

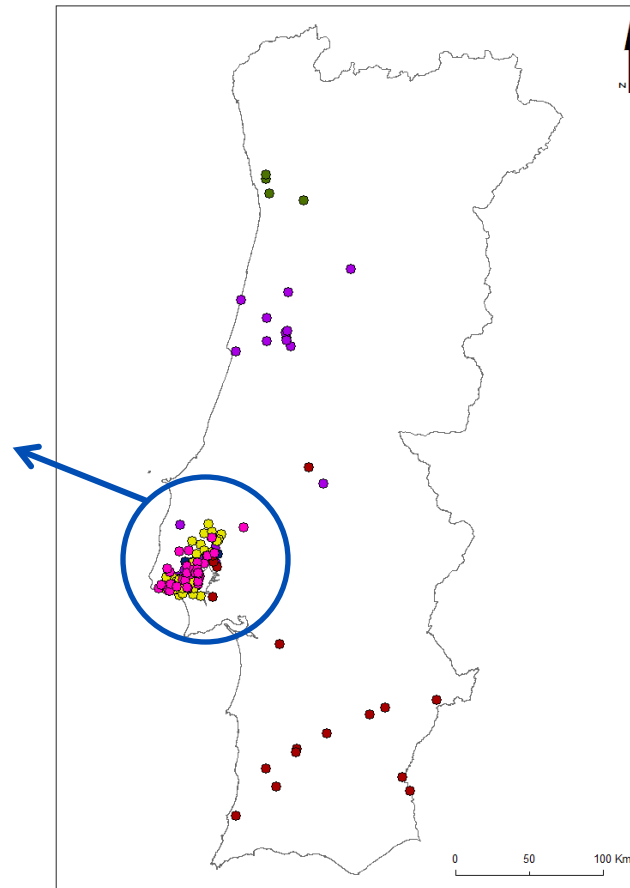
Spatially circumscribed ($< 2500 \text{ km}^2$)

Very common in Lisbon region

Mostly in November

Strong intensity

Slope mass movements?!



Main events

25 and 26 Nov

20 Nov 1937

15 Feb 1941

18 Nov 1945

25 Nov 1967

19 Nov 1983

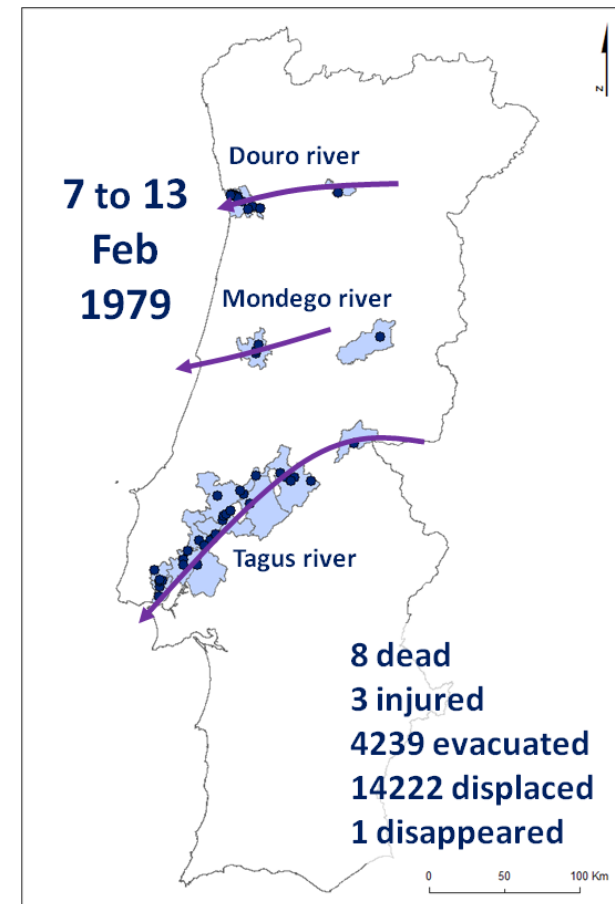
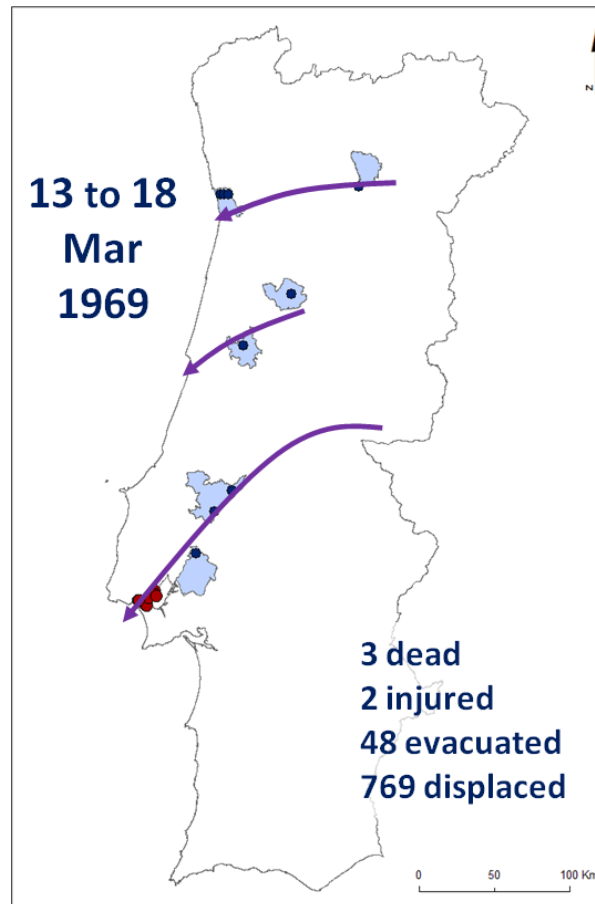
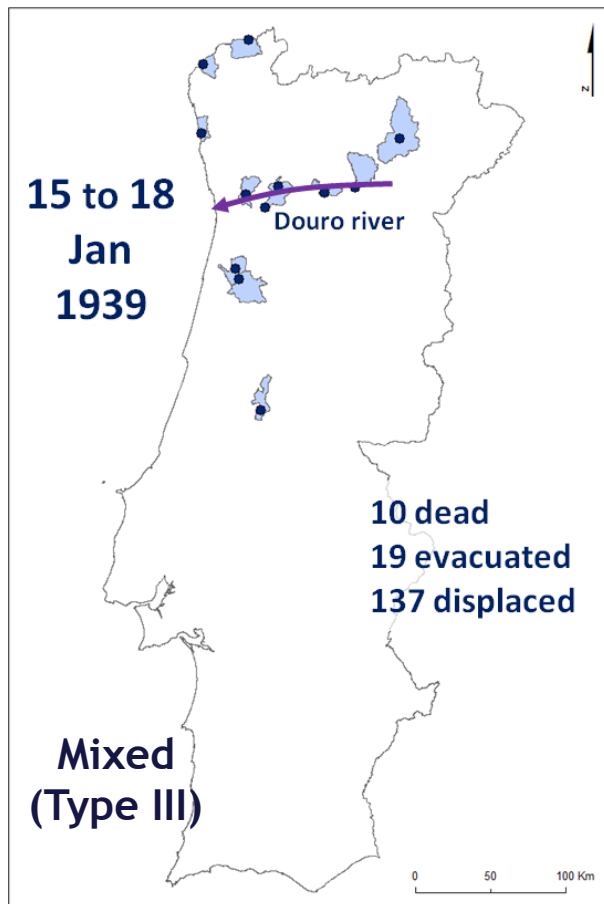
5 e 6 Nov 1997

4 Mar 2001

2 and 3 Jan 2003

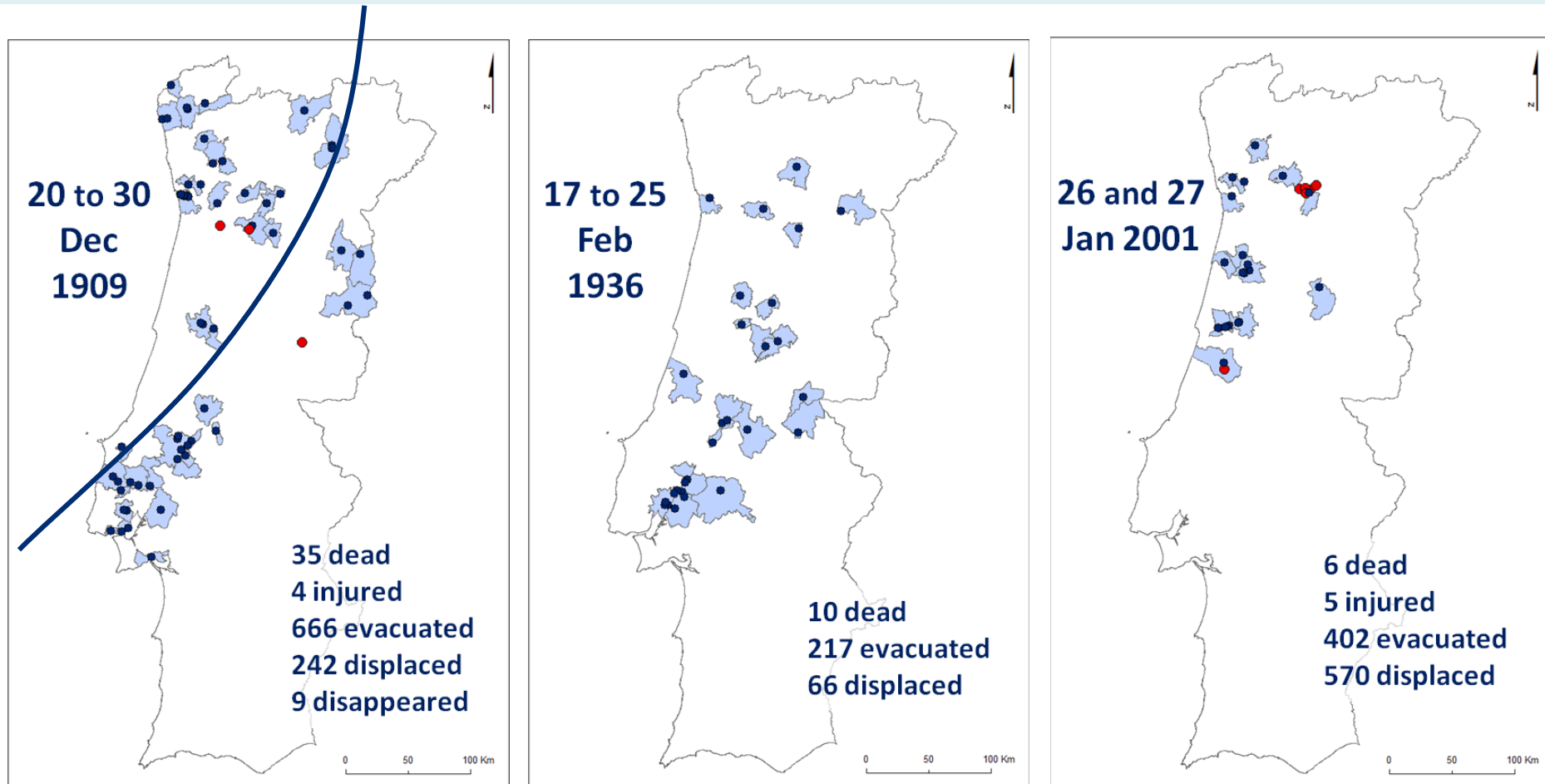
Identifying spatial patterns for flood events

Floods associated to large rivers (Type II)



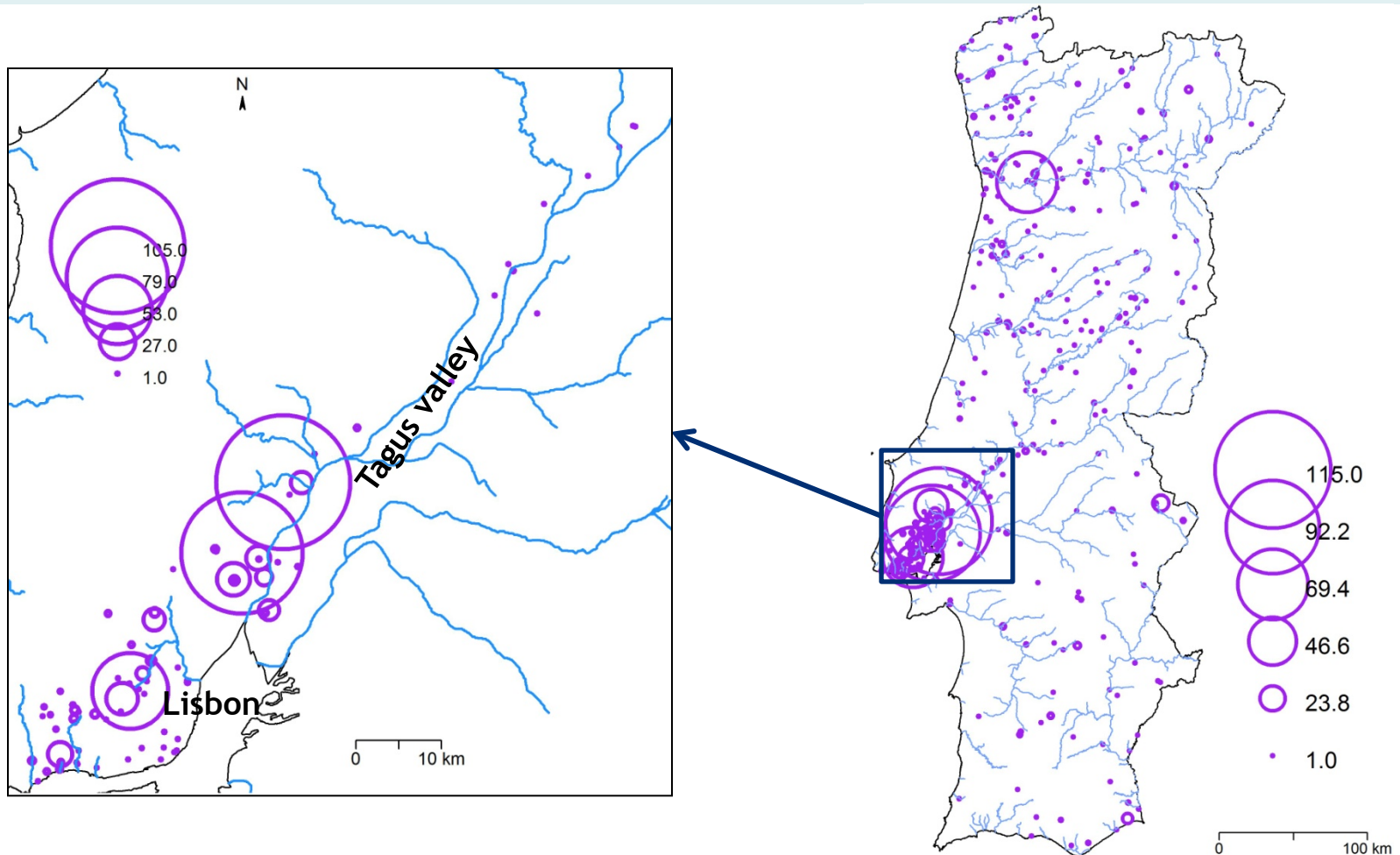
Identifying spatial patterns for flood events

Scattered flood pattern (Type IV)



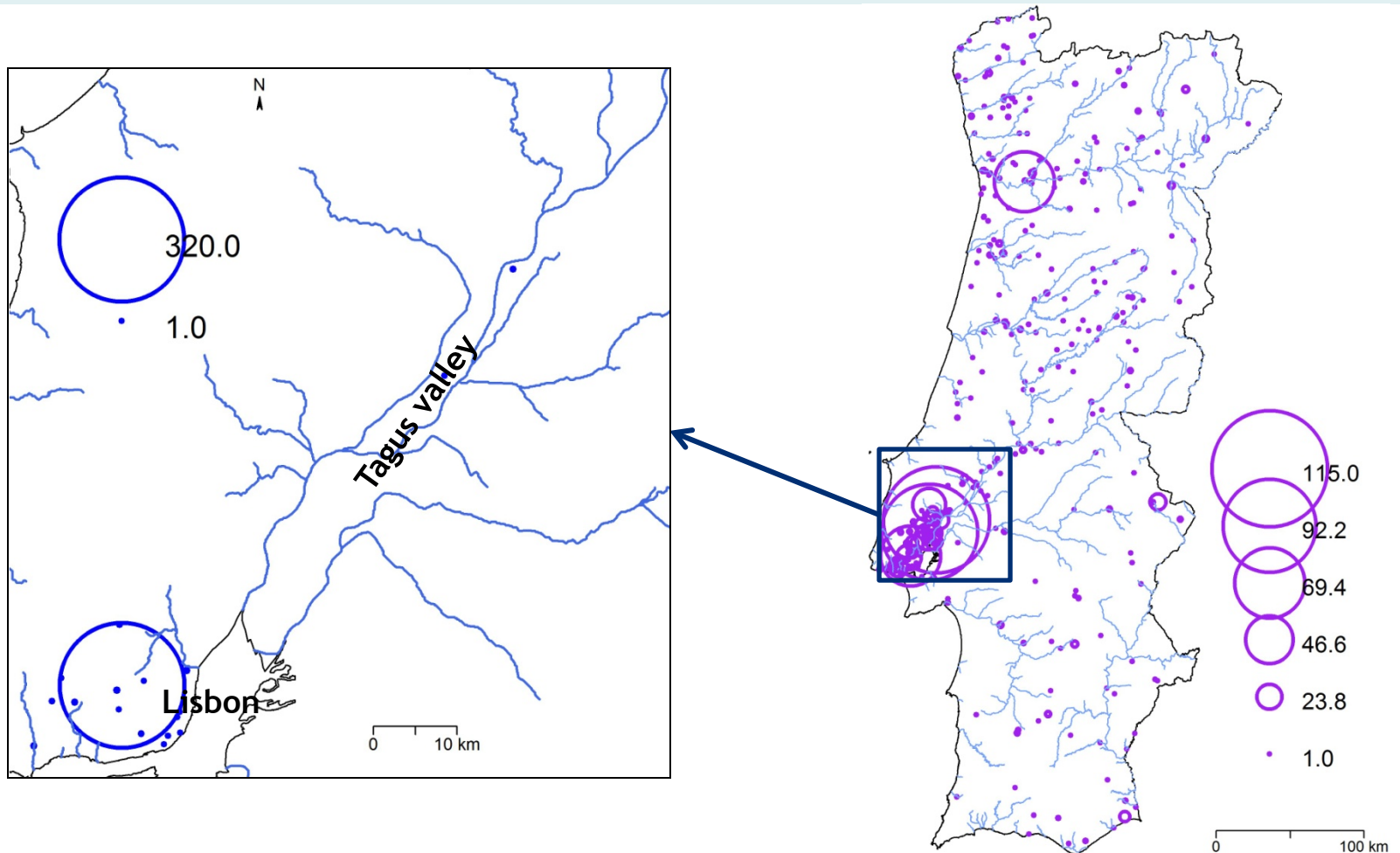
Floods in the Lisbon region and Tagus valley

Number of dead (1865 - 2010)



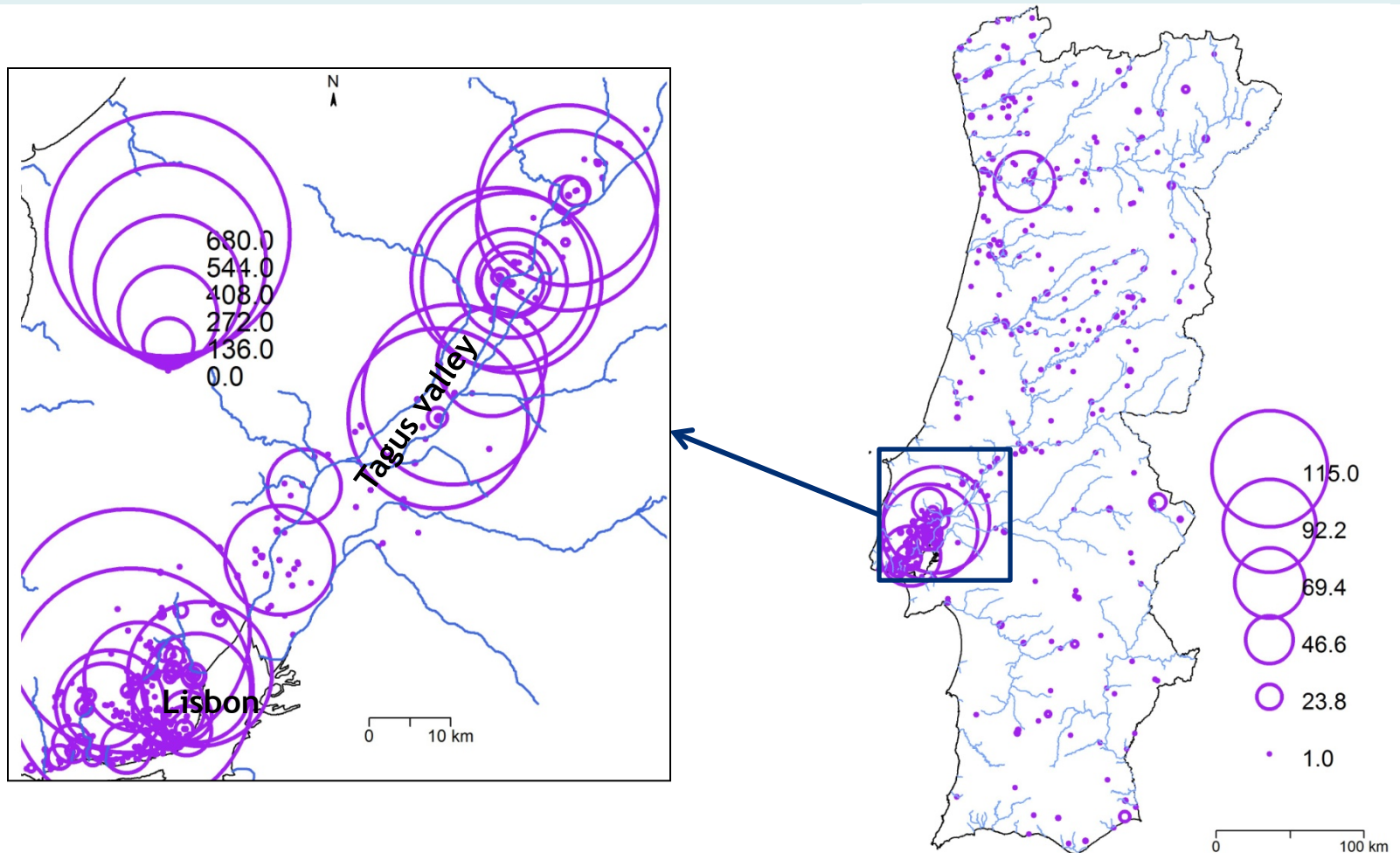
Floods in the Lisbon region and Tagus valley

Number of injured (1865 - 2010)



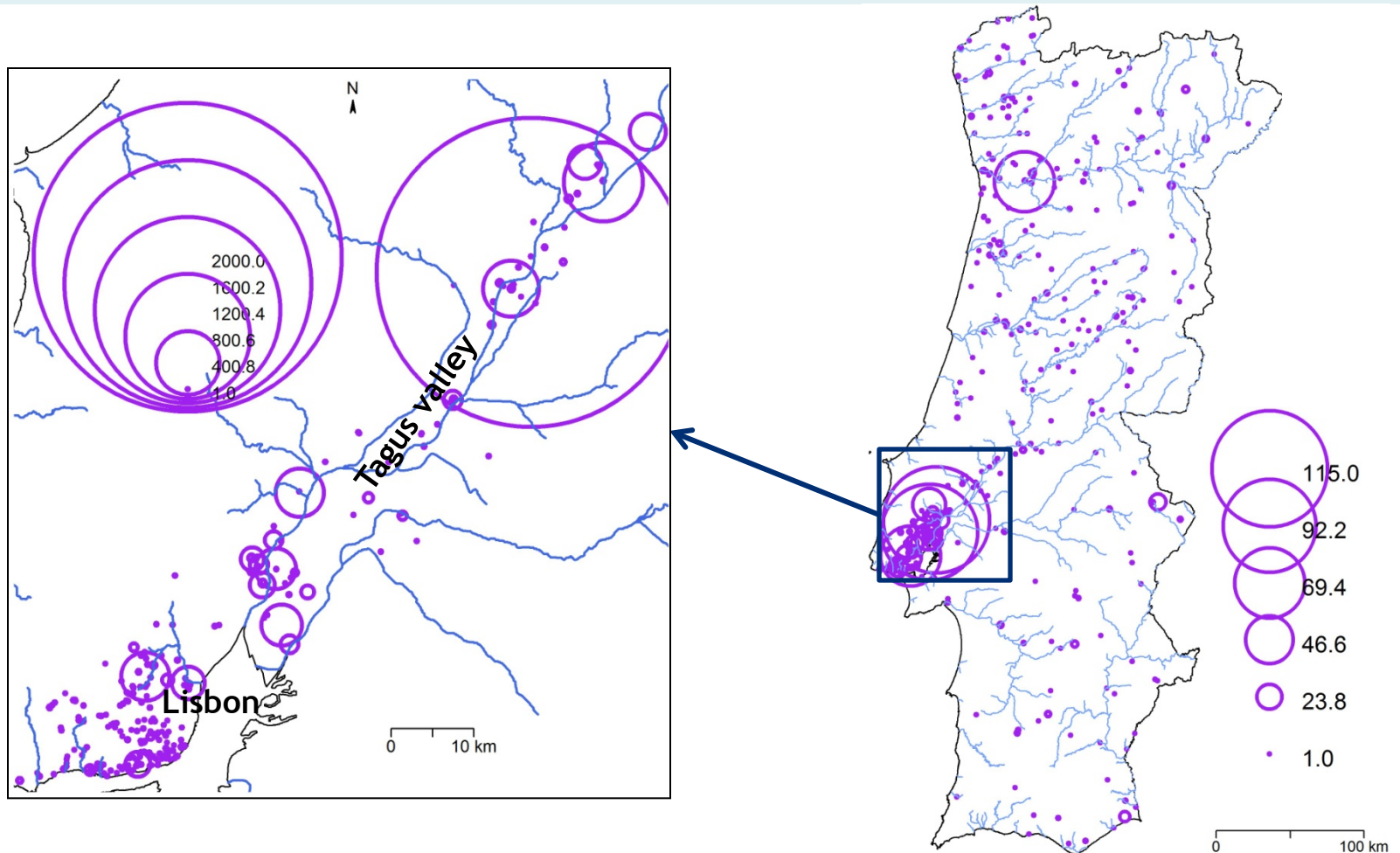
Floods in the Lisbon region and Tagus valley

Number of displaced (1865 - 2010)



Floods in the Lisbon region and Tagus valley

Number of evacuated (1865 - 2010)



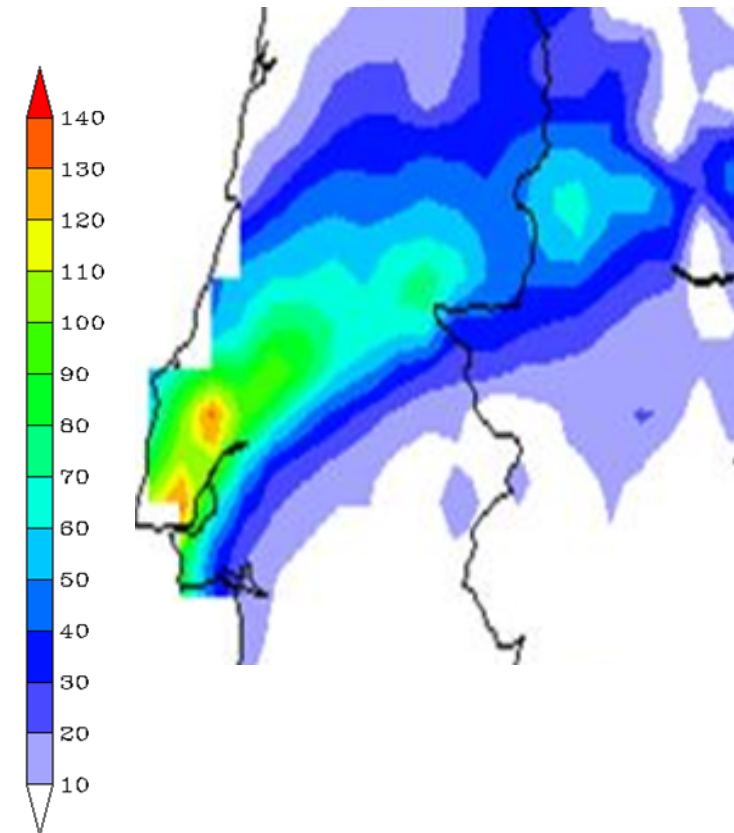
Spatial distribution of damaging floods and mass movements in Portugal from 1865 to 2010

Floods in the Lisbon region and Tagus valley

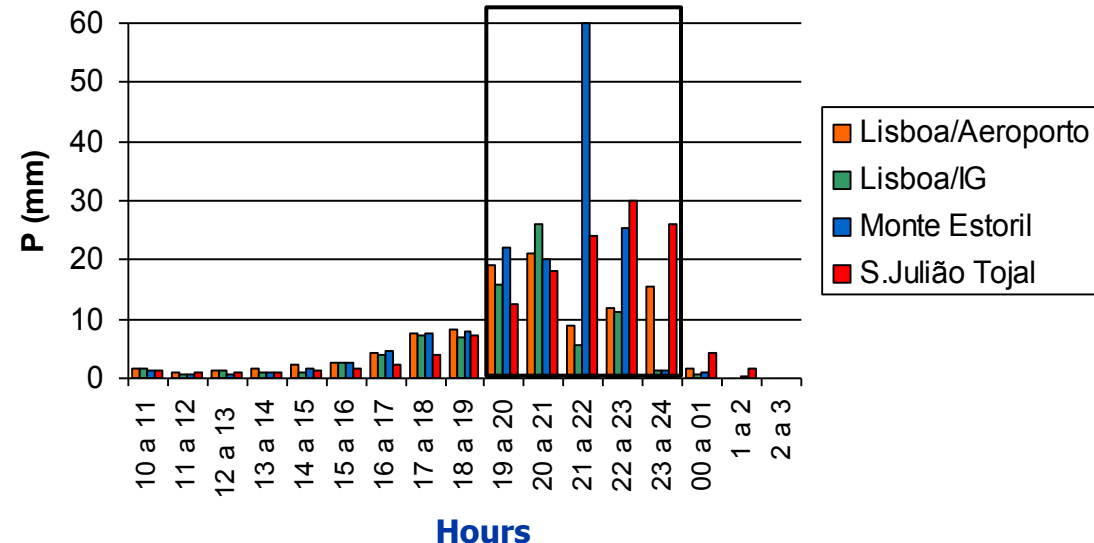
The flash flood of 25/26 November 1967

Triggering factor of floods:
heavy rainfall in five hours.

↓
from 19 to 24h of day 25



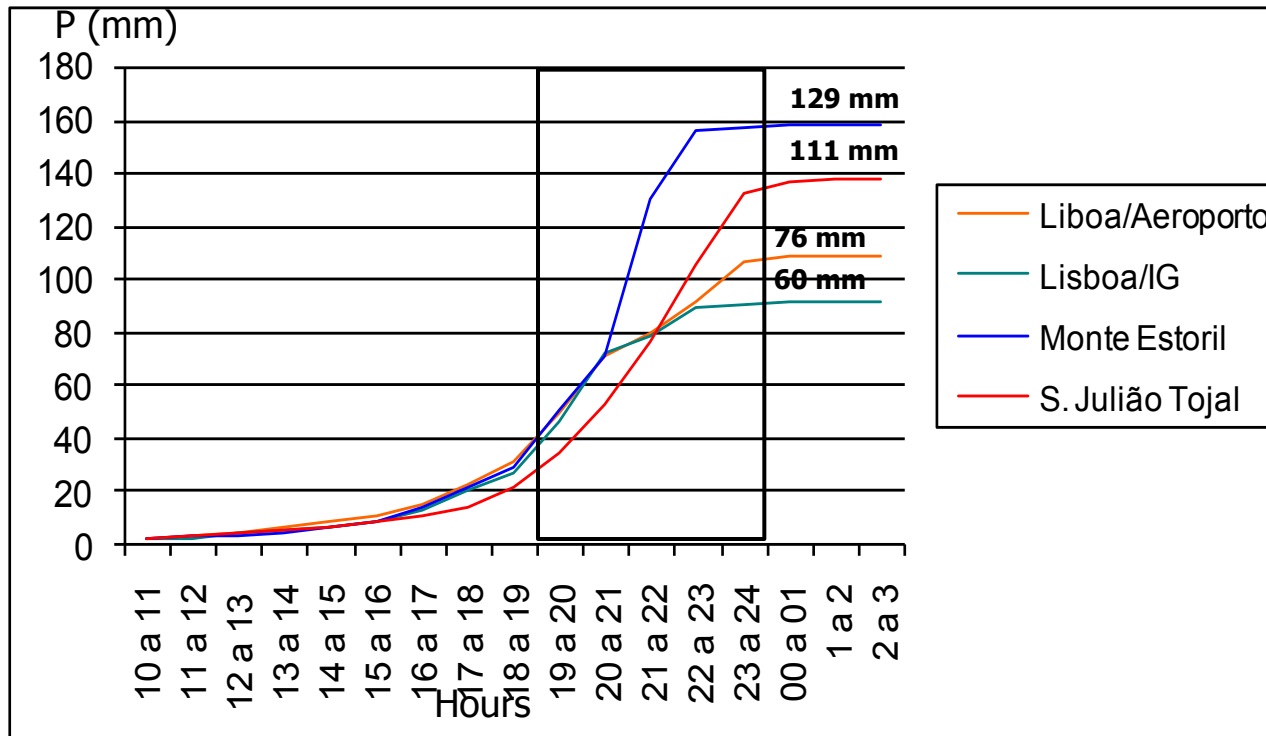
Hourly rain



Floods in the Lisbon region and Tagus valley

The flash flood of 25/26 November 1967

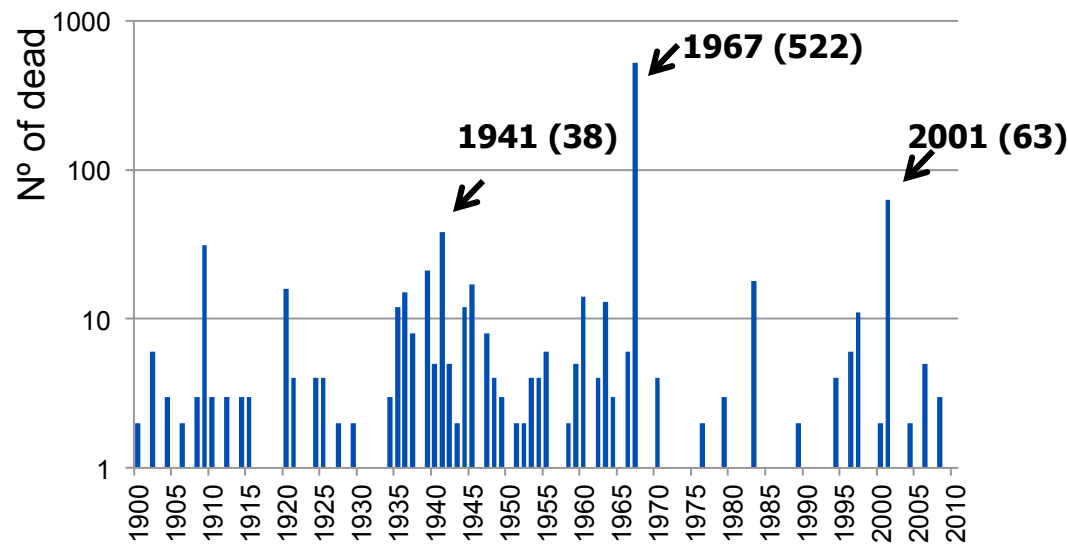
Accumulated rain (10h of day 25 to 03h of day 26)



The flood was a duration of about 6h: from 20h of day 25 to 02h of day 26

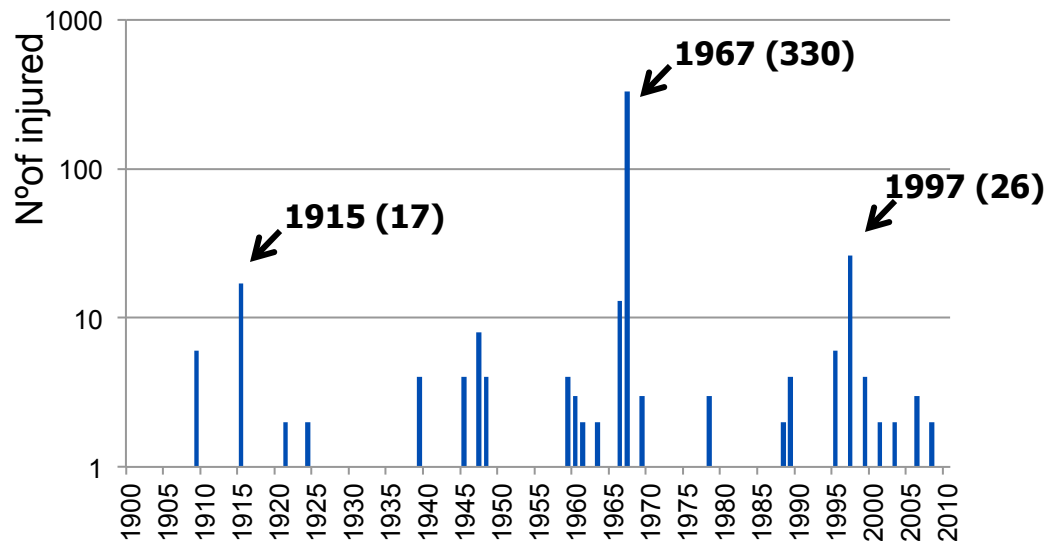
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Floods in the Lisbon region and Tagus valley

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Thank you for your attention!

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