7th INTERNATIONAL GEOLOGICA BELGICA MEETING 2021

The Effects of Belgian Crustal Geology and its Sedimentary Cover on Macroseismic Intensity Attenuation

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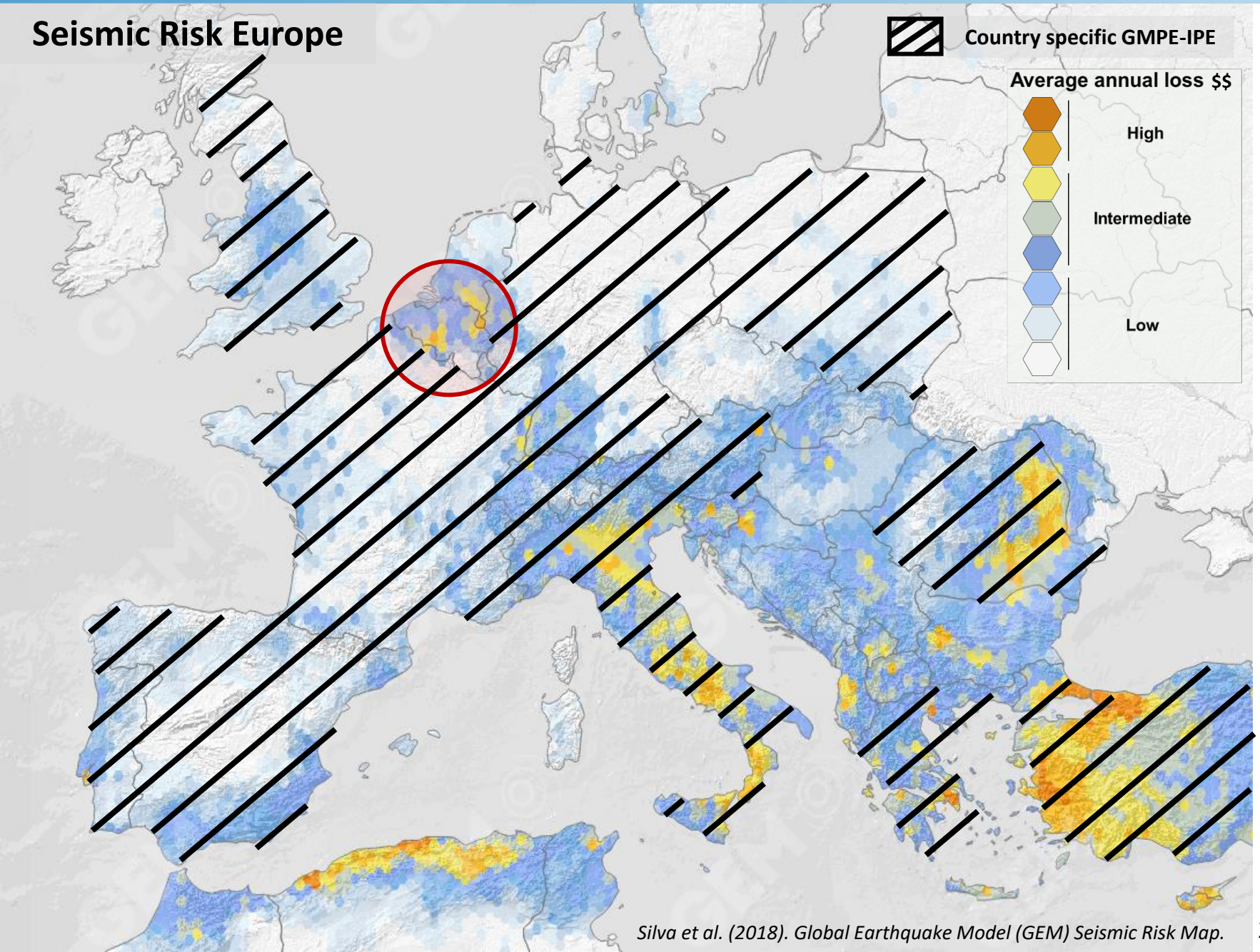
Session 11: Geophysics and seismology

17th of September 2021

PhD Introduction: Improving seismic risk estimations for Belgium



Silva et al. (2018). Global Earthquake Model (GEM) Seismic Risk Map.

Highest seismic risk in Northwestern Europe

? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

Belgian Ground motion attenuation characteristics

PhD!

Belgian Intensity Prediction Equation (IPE)

This presentation

"The Effects of Belgian Crustal Geology and its Sedimentary Cover on macroseismic intensity attenuation"

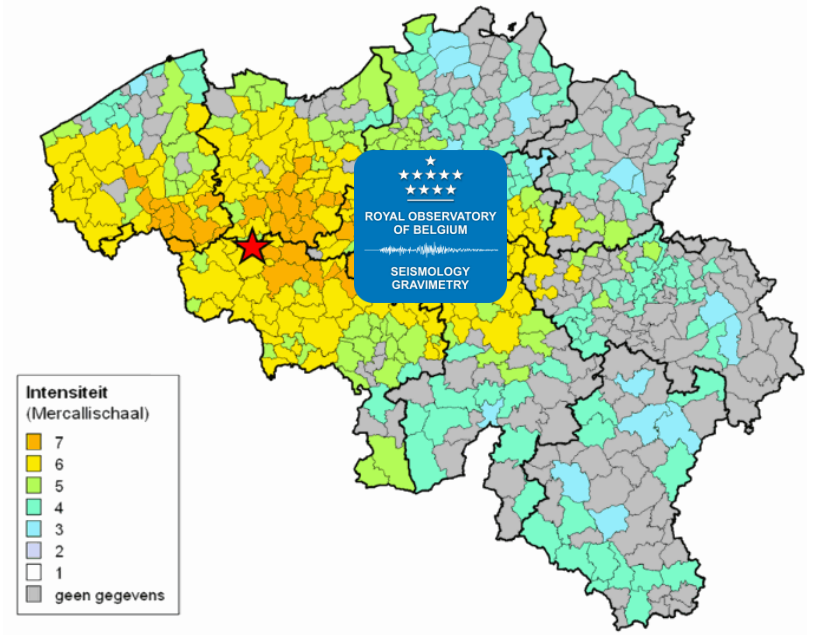
IPEs?

Macroseismic intensity:

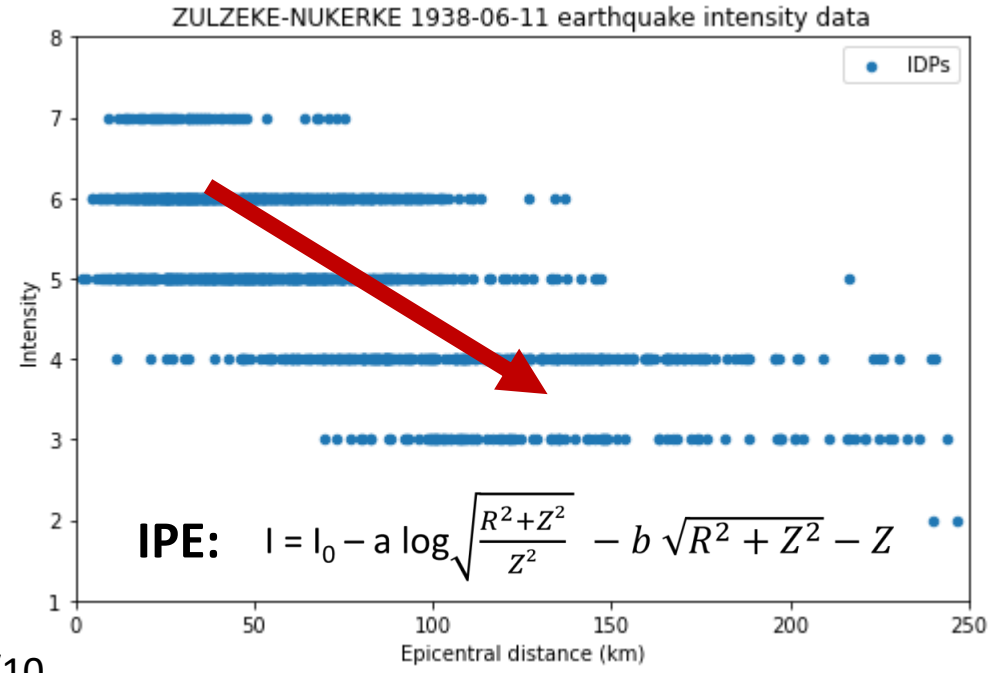
"Severity of seismic shaking based on observed effects"

The people

damage reports



EMS-98 Intensity	Felt
I	Not felt
II-III	Weak
IV	Light
V	Moderate
VI	Strong
VII	Very strong
VIII	Severe
IX	Violent
X+	Extreme



Why no instrumental data?

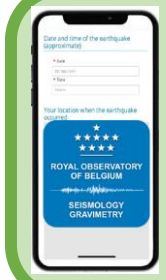
25 seismometers

Since 1898

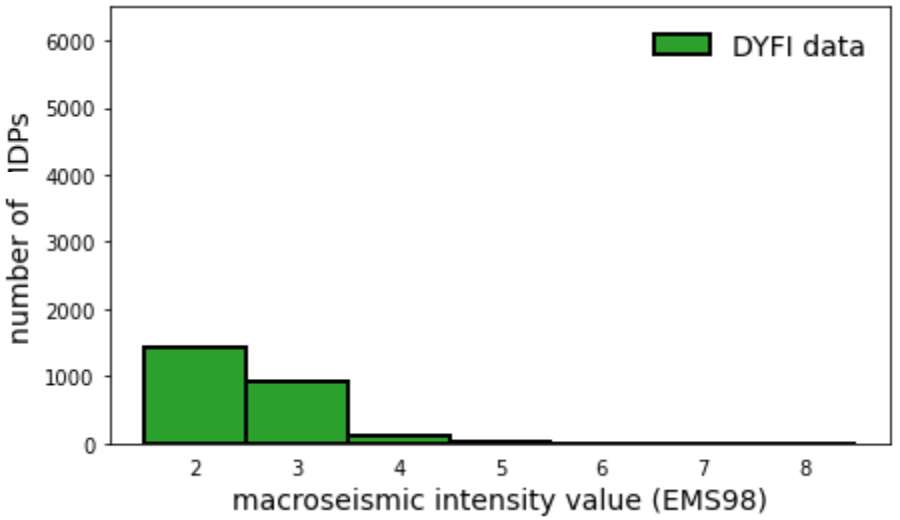
> 11.5 million people

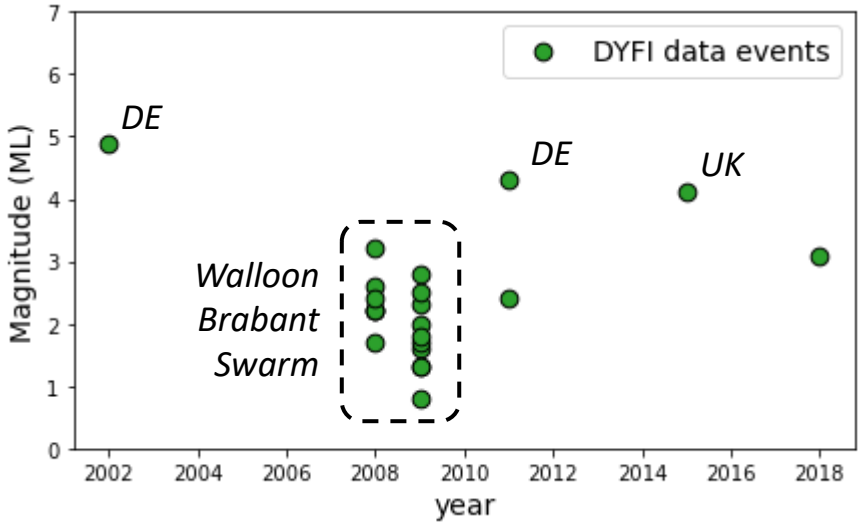
Since 801 AD

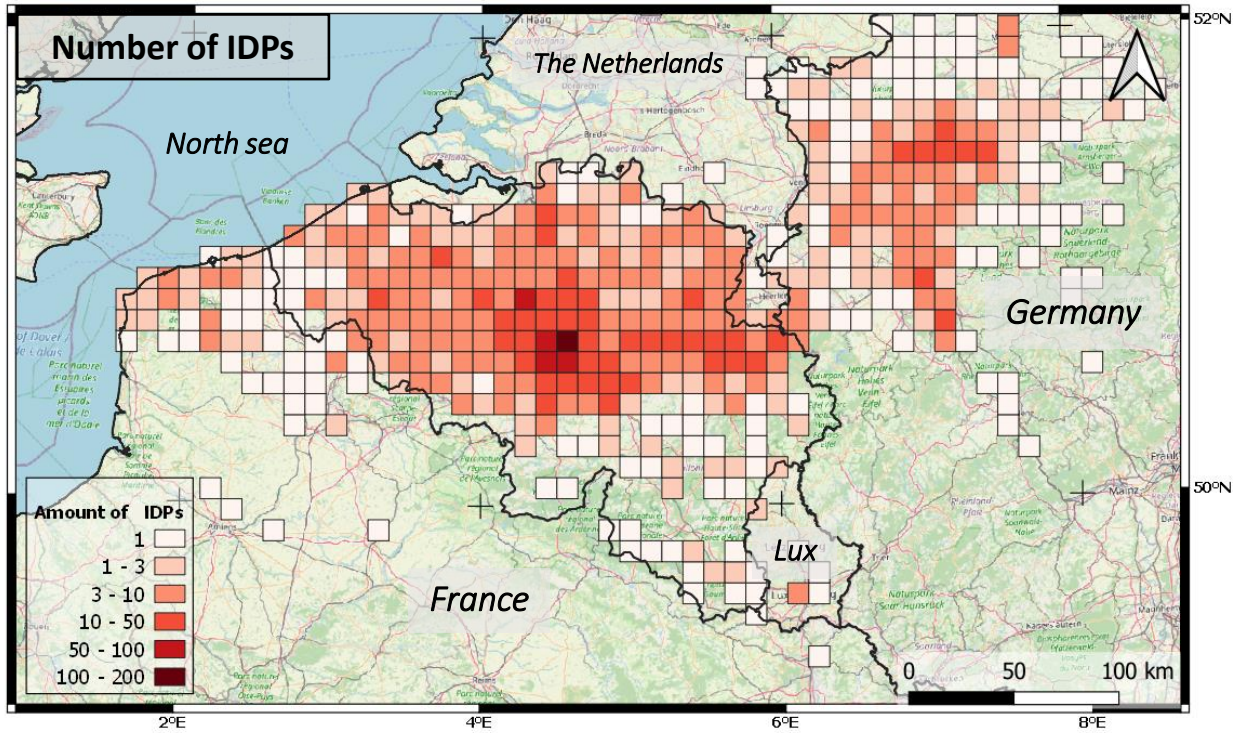
macroseismic intensity data types



"Did You Feel It?"
Intensity Data
DYFI
Since 2002



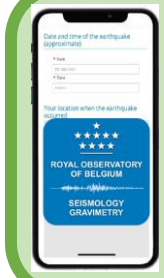




ROYAL OBSERVATORY OF BELGIUM
SEISMOLOGY GRAVIMETRY

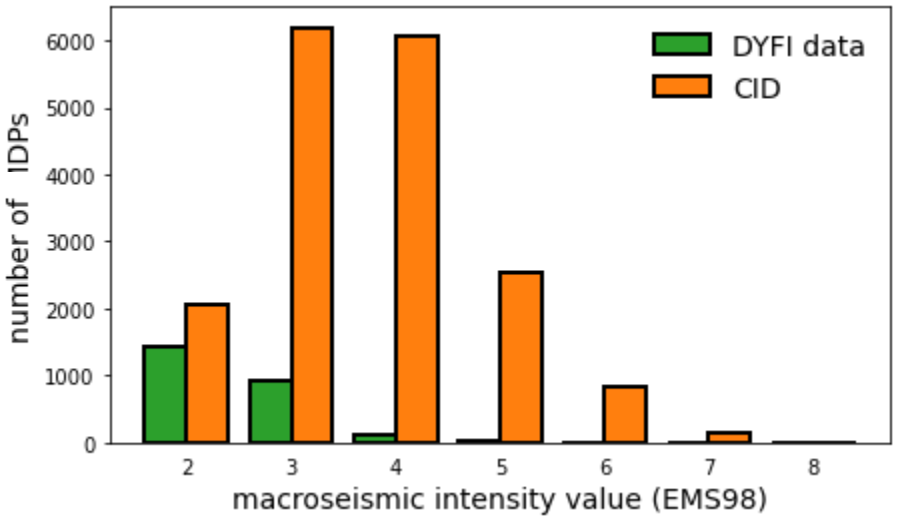
Note: Only data of selected events is shown

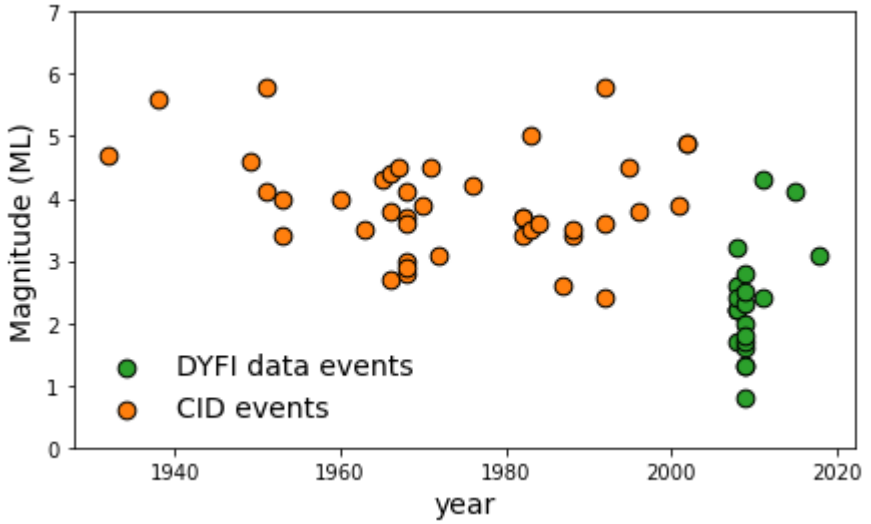
macroseismic intensity data types

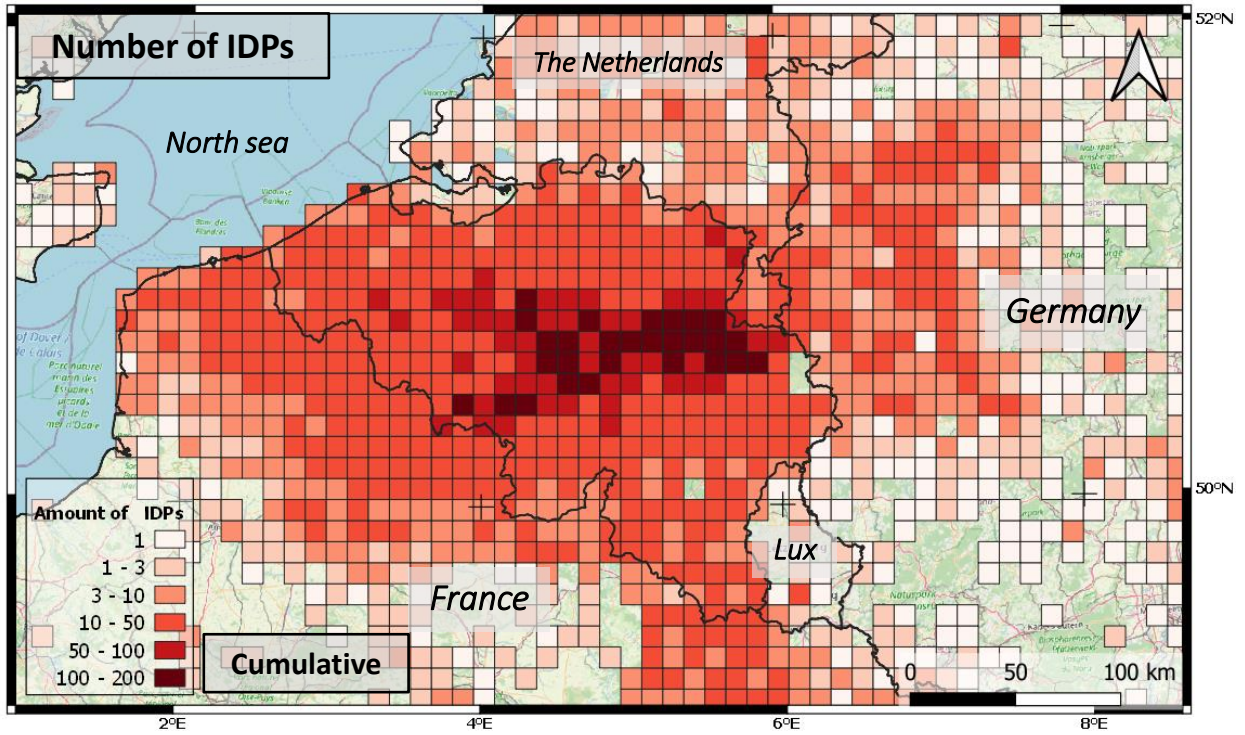


"Did You Feel It?"
Intensity Data
DYFI
Since 2002

Communal
Intensity Data
CID
Since 1932







ROYAL OBSERVATORY OF BELGIUM
SEISMOLOGY GRAVIMETRY

100 ans 1921–2021

BCSF RENASS

brgm · EDF · IRSN · SISFRANCE · MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

Note: Only data of selected events is shown

macroseismic intensity data types

"Did You Feel It?"
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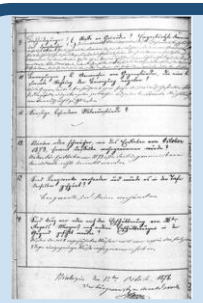
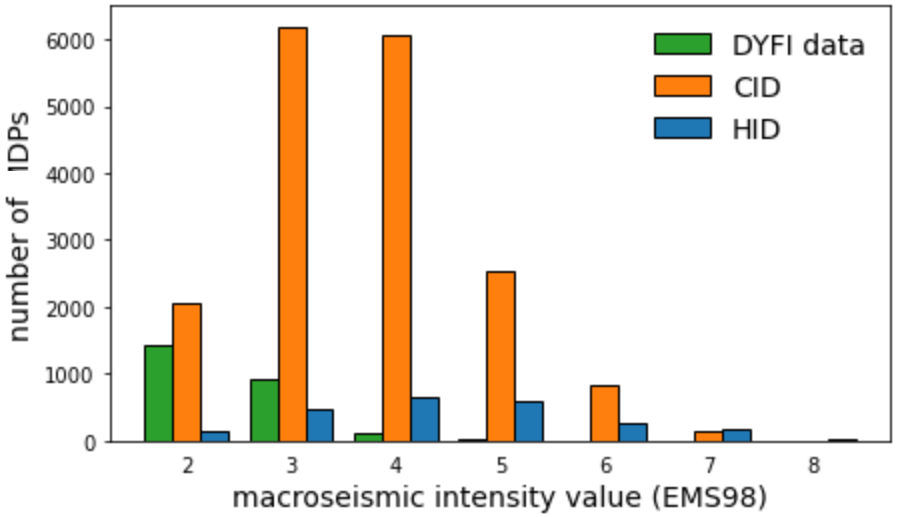
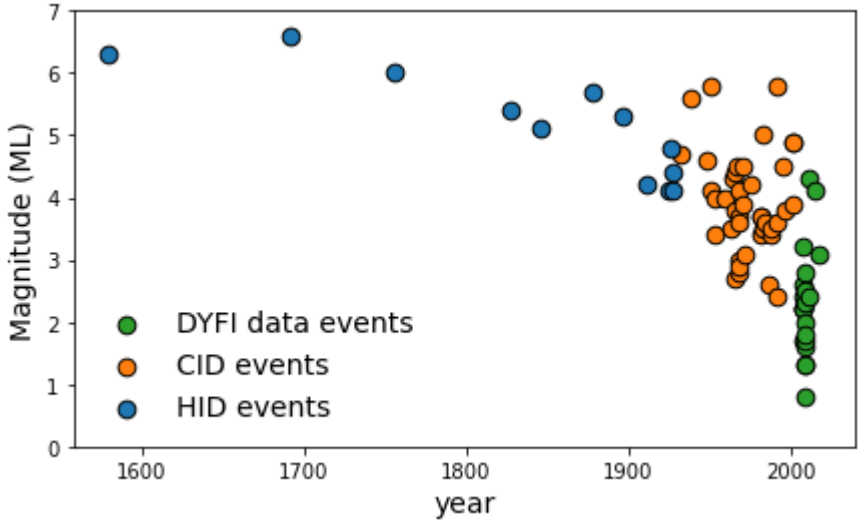


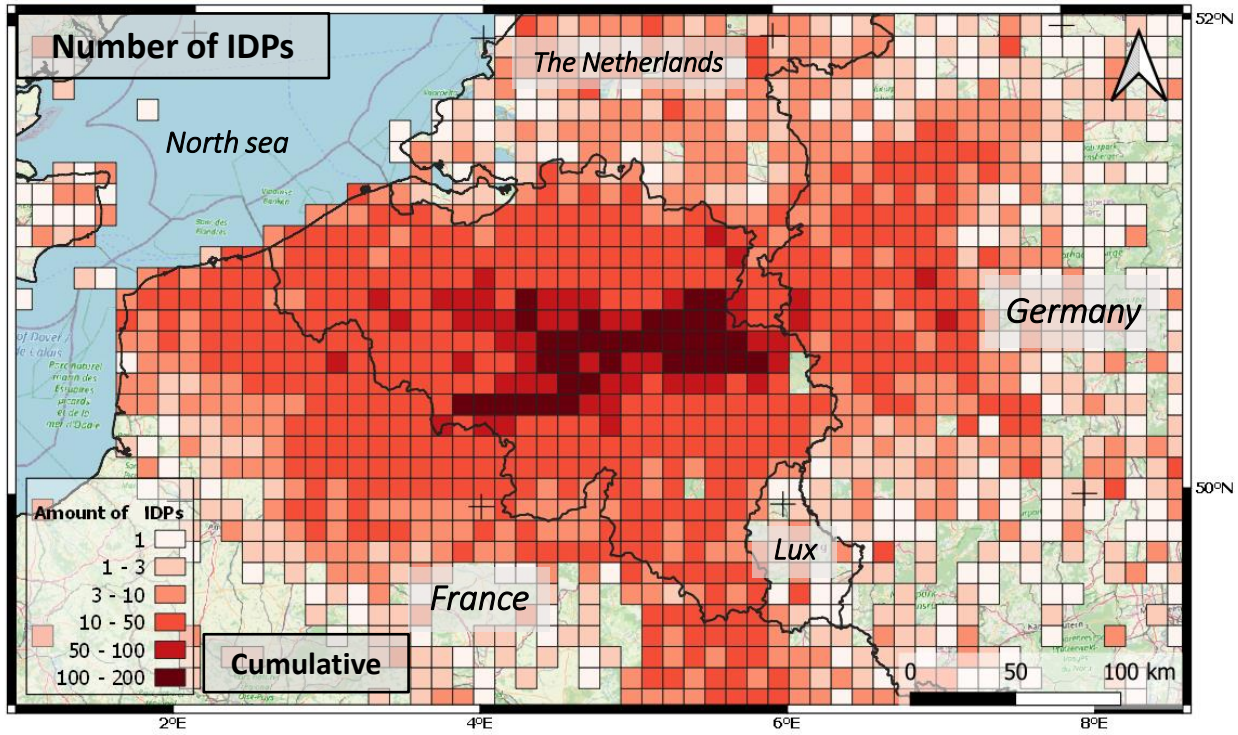
Historical
Intensity Data
HID
801-1932

Total IDPs selected: ~20,000



Total events selected: 82





ROYAL OBSERVATORY OF BELGIUM
SEISMOLOGY GRAVIMETRY

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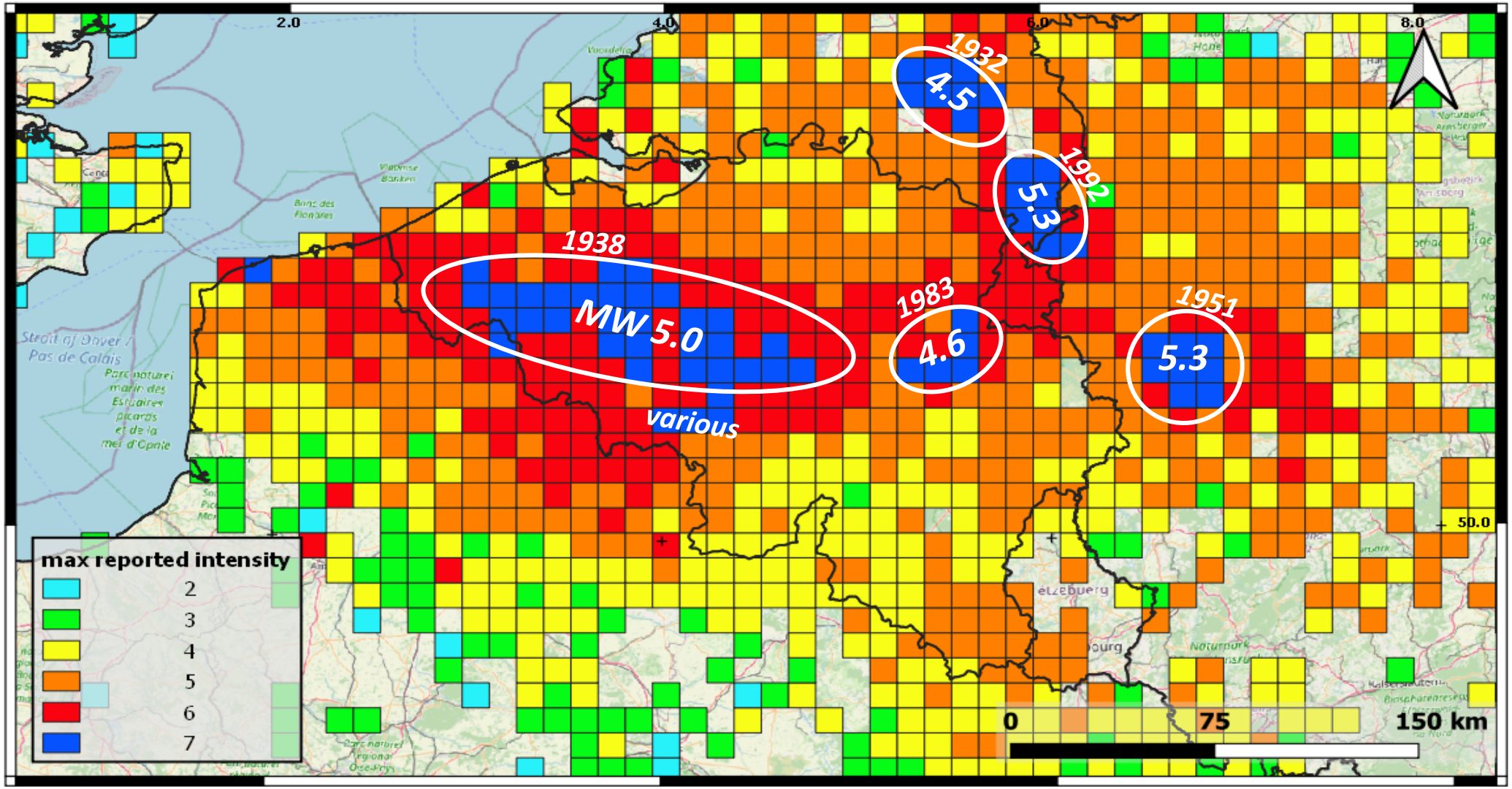
Note: Only data of selected events is shown

Maximal observed intensity

1932-present



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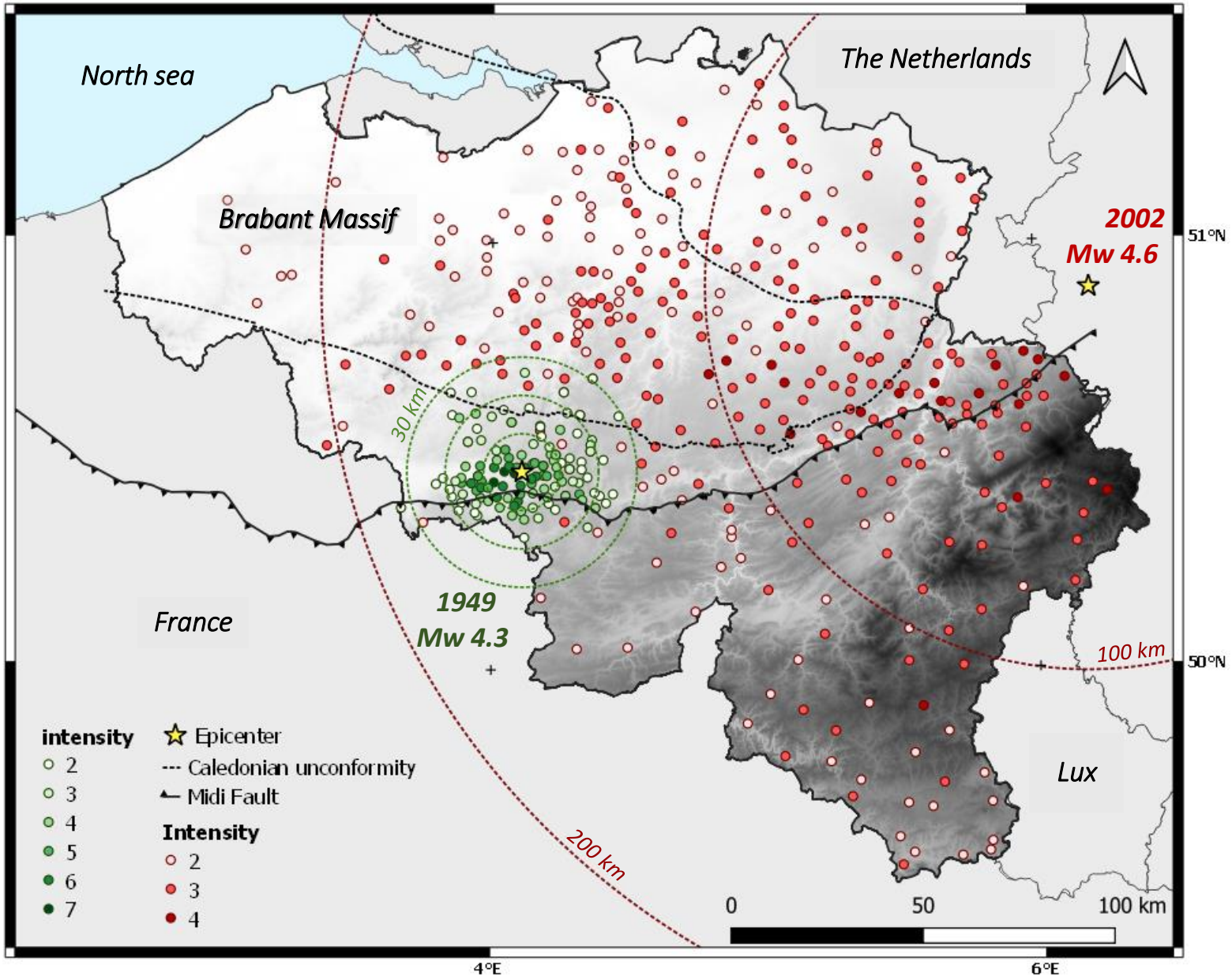


1949 Havré event

- Mw 4.3
- 3.2 km depth
- ~30 km radius
- Imax = 7

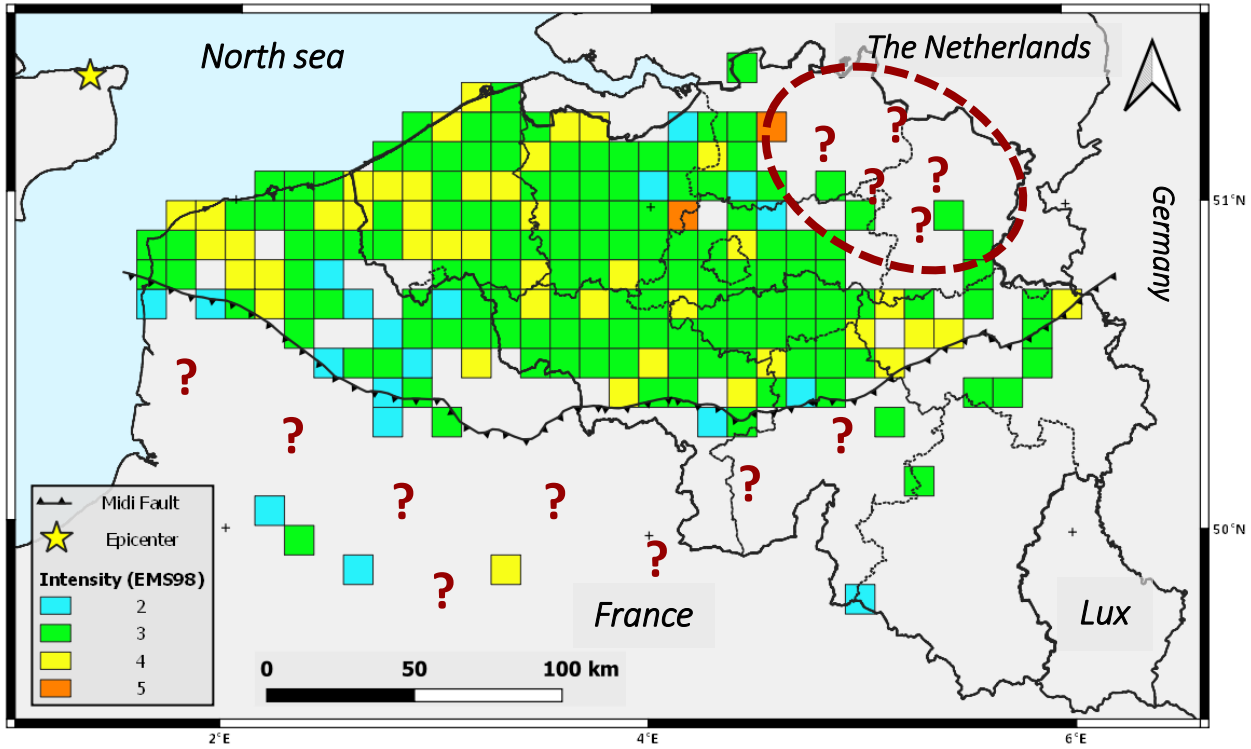
2002 Eschweiler-Alsdorf

- Mw 4.6
- 16.4 km depth
- ~200 km radius
- Imax = 6

→ Hainaut → Next presentation

→ Various factors to influence regional intensity attenuation

2015 Ramsgate ML 4.1



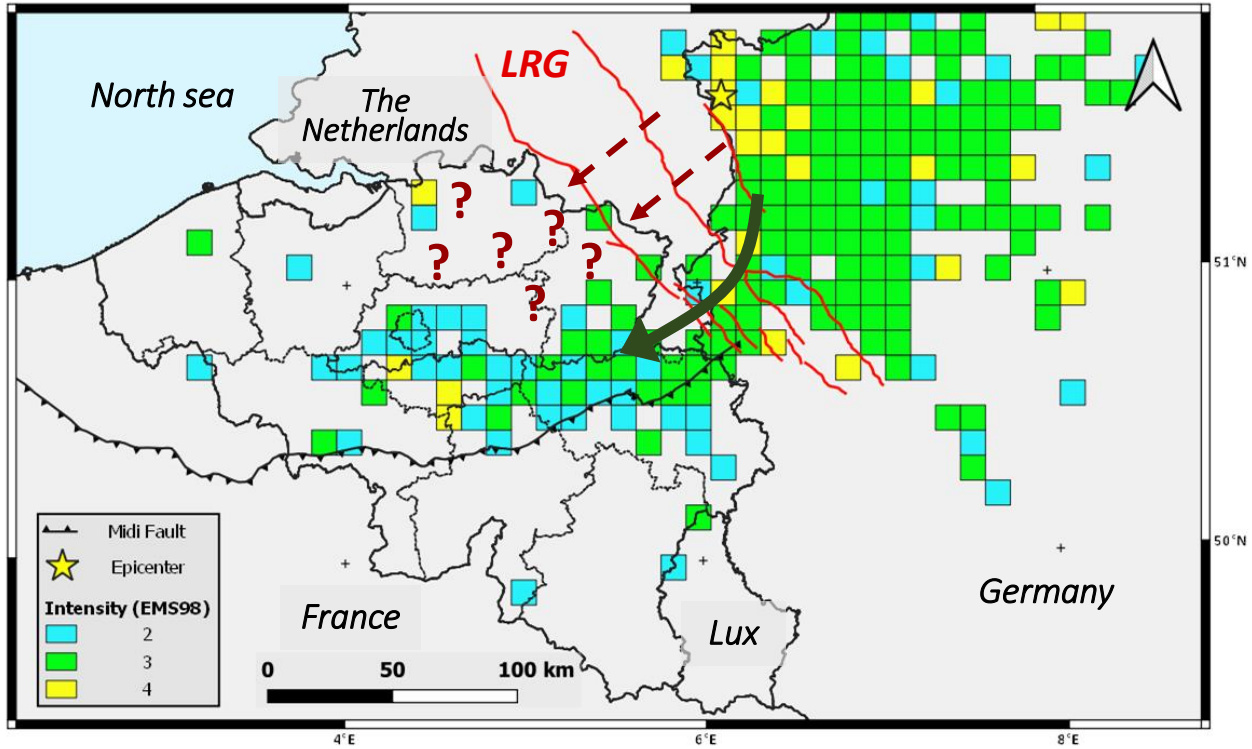
North of Midi Fault:

- ***Event felt by large amount of the population***

South of Midi Fault:

→ Barely any felt reports

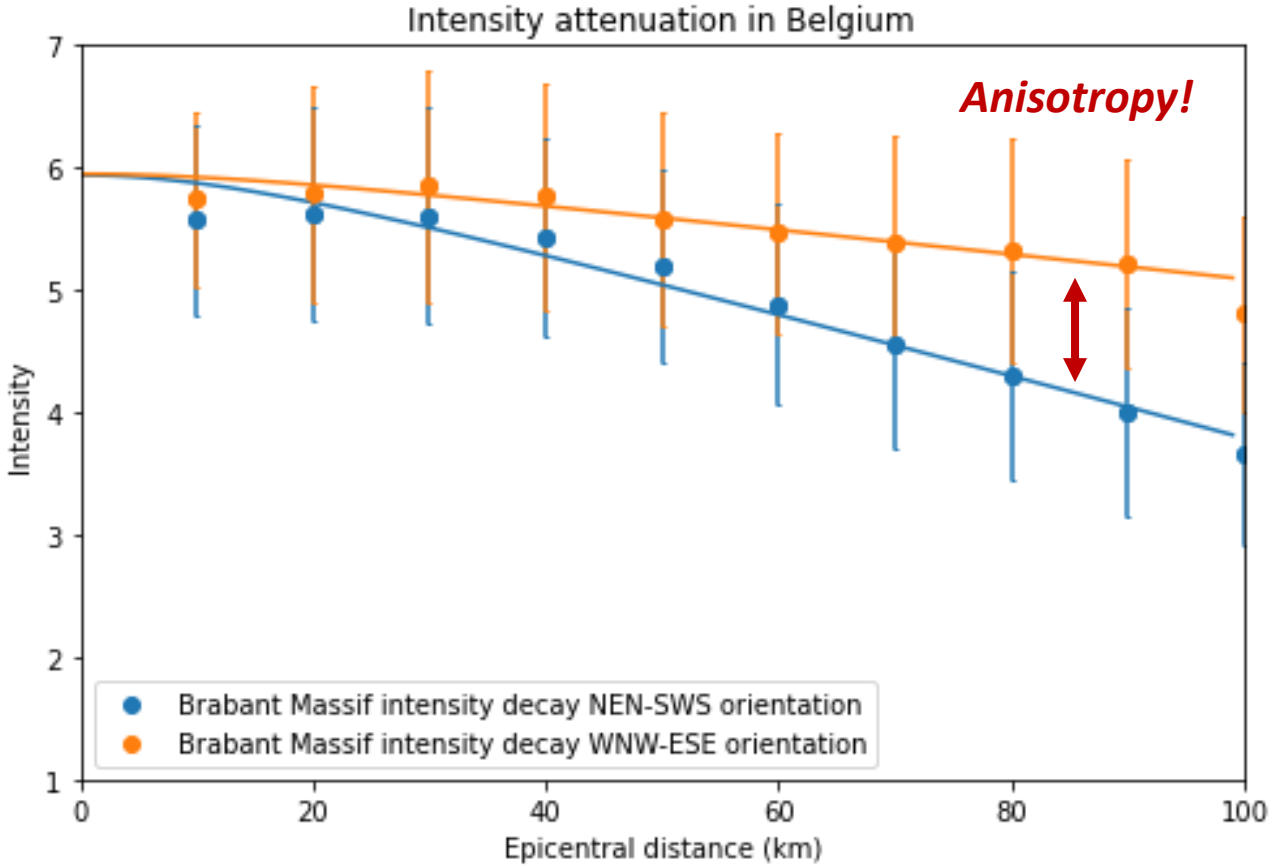
2011 Goch ML 4.3

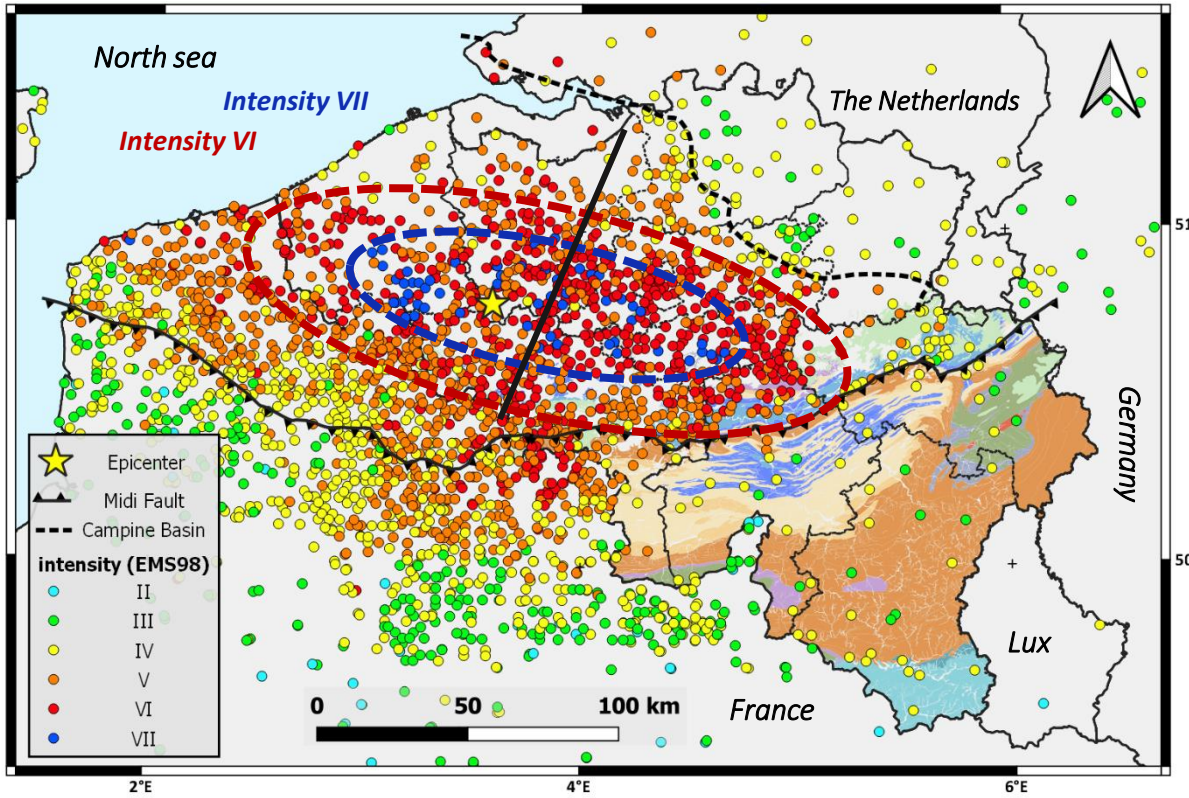


blockade of direct ground motion transfer to northeastern Belgium

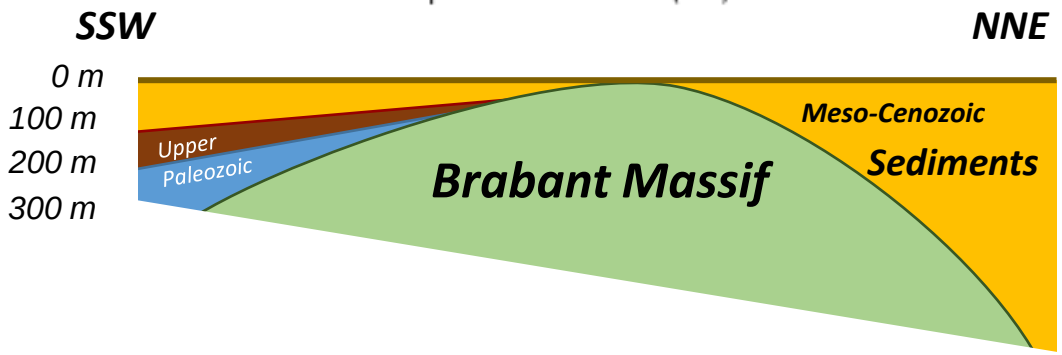
→ Lower Rhine Graben

→ Campine basin?





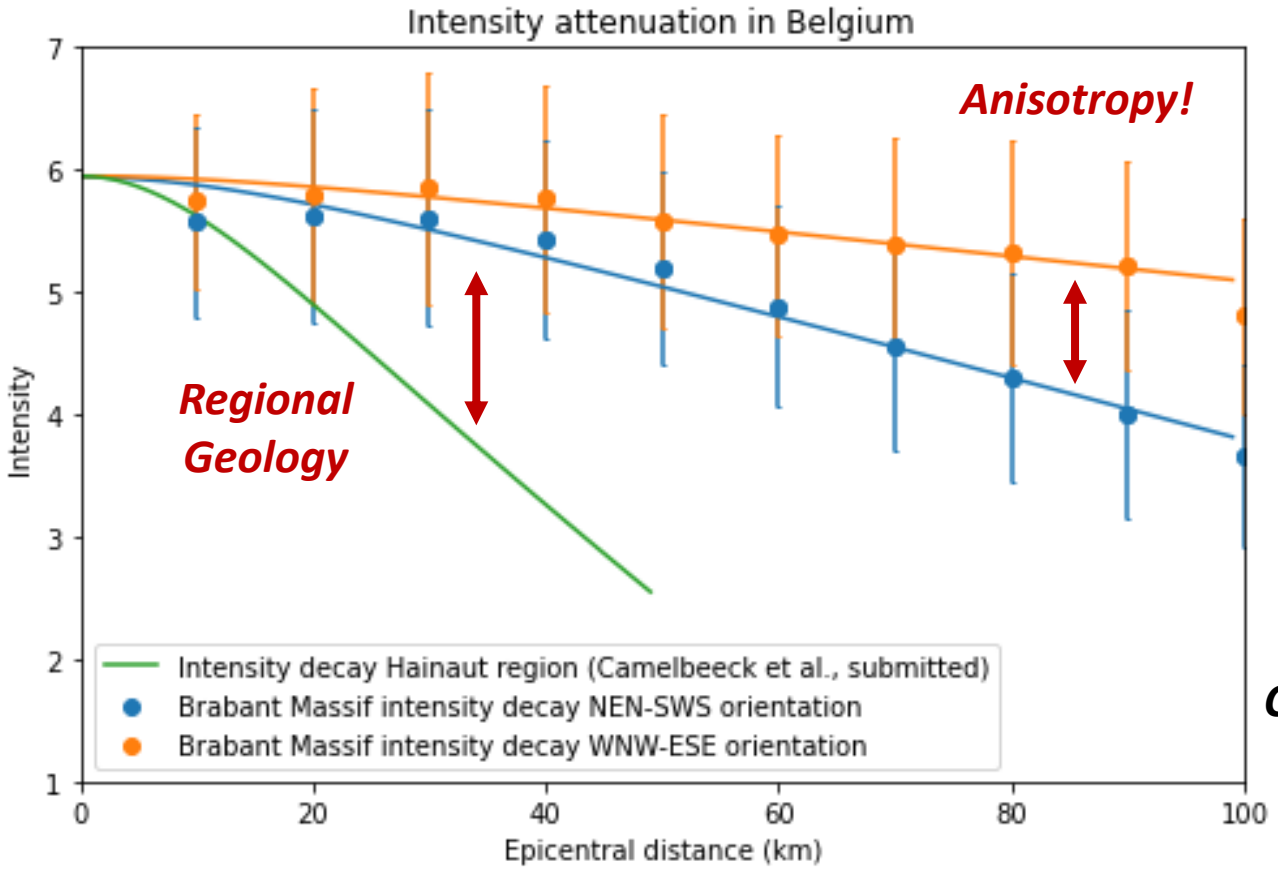
1938 event MW 5.0

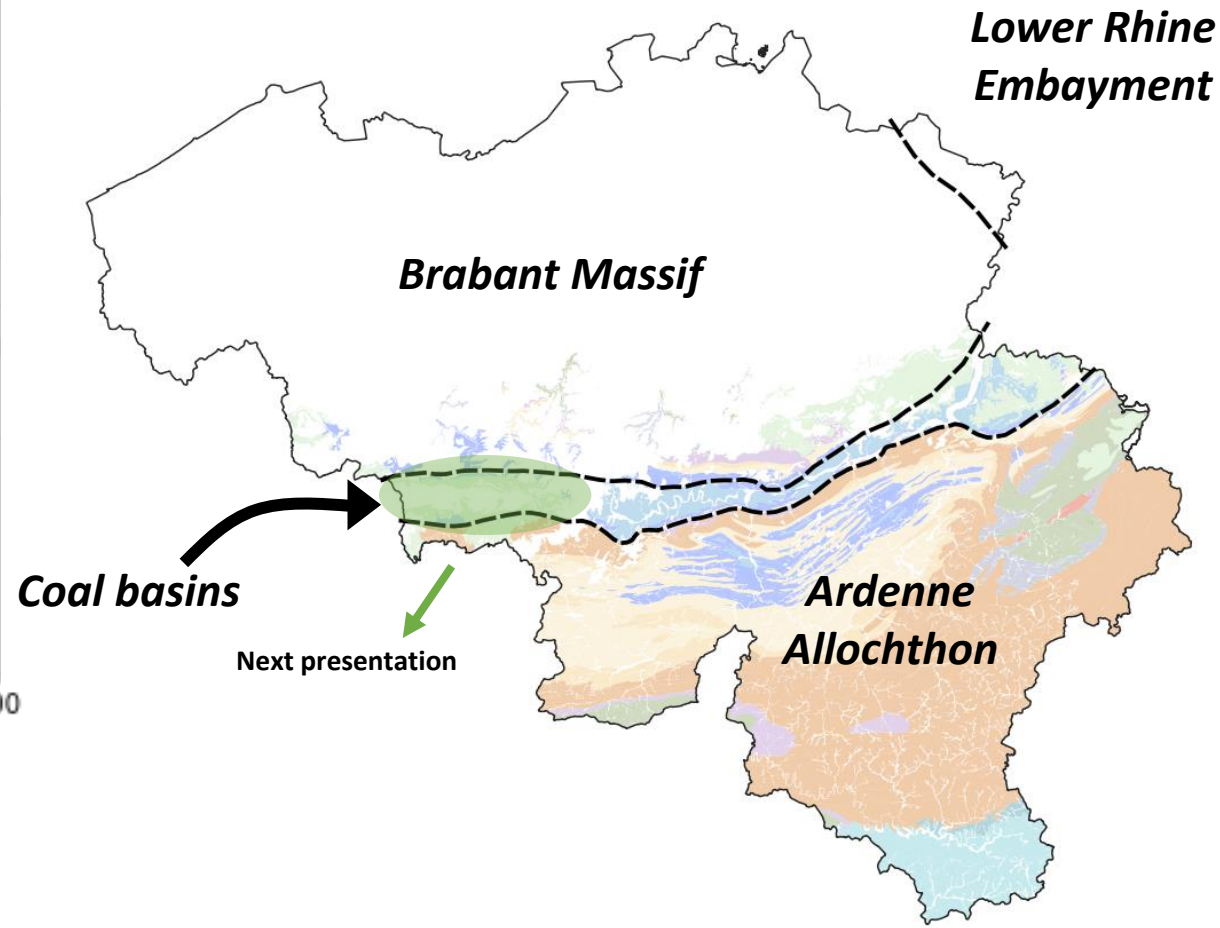


General IPE equation:

Bedrock depth

$$I = I_0 - a \log \sqrt{\frac{R^2+Z^2}{Z^2}} - b\sqrt{R^2+Z^2} - Z \cdot c\,dD$$





Belgian IPE

4 ground motion attenuation gradients

4 characteristic regions

Impact

→ Ground motion attenuation characteristics
→ Highlighting regional amplification
→ Improved seismic risk assessment

Coming soon!!

Real-time intensity predictions in Belgium!