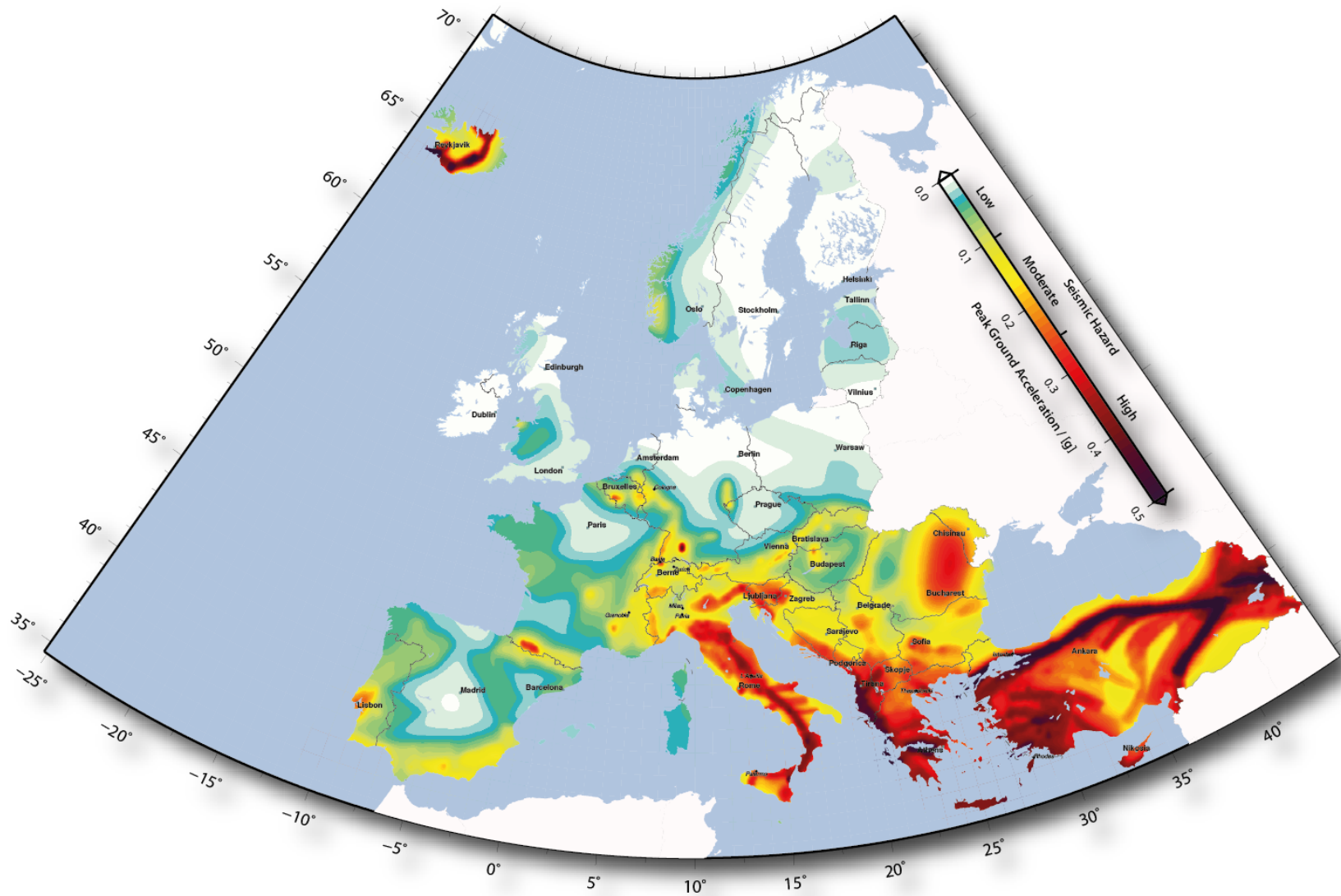


# NEW EARTHQUAKE DETECTIONS IN IRELAND FROM WAVEFORM TEMPLATE MATCHING

Pierre Arroucau, James Grannell, Sergei Lebedev, Chris J. Bean, Martin Möllhoff,  
Clare Horan, Tom Blake

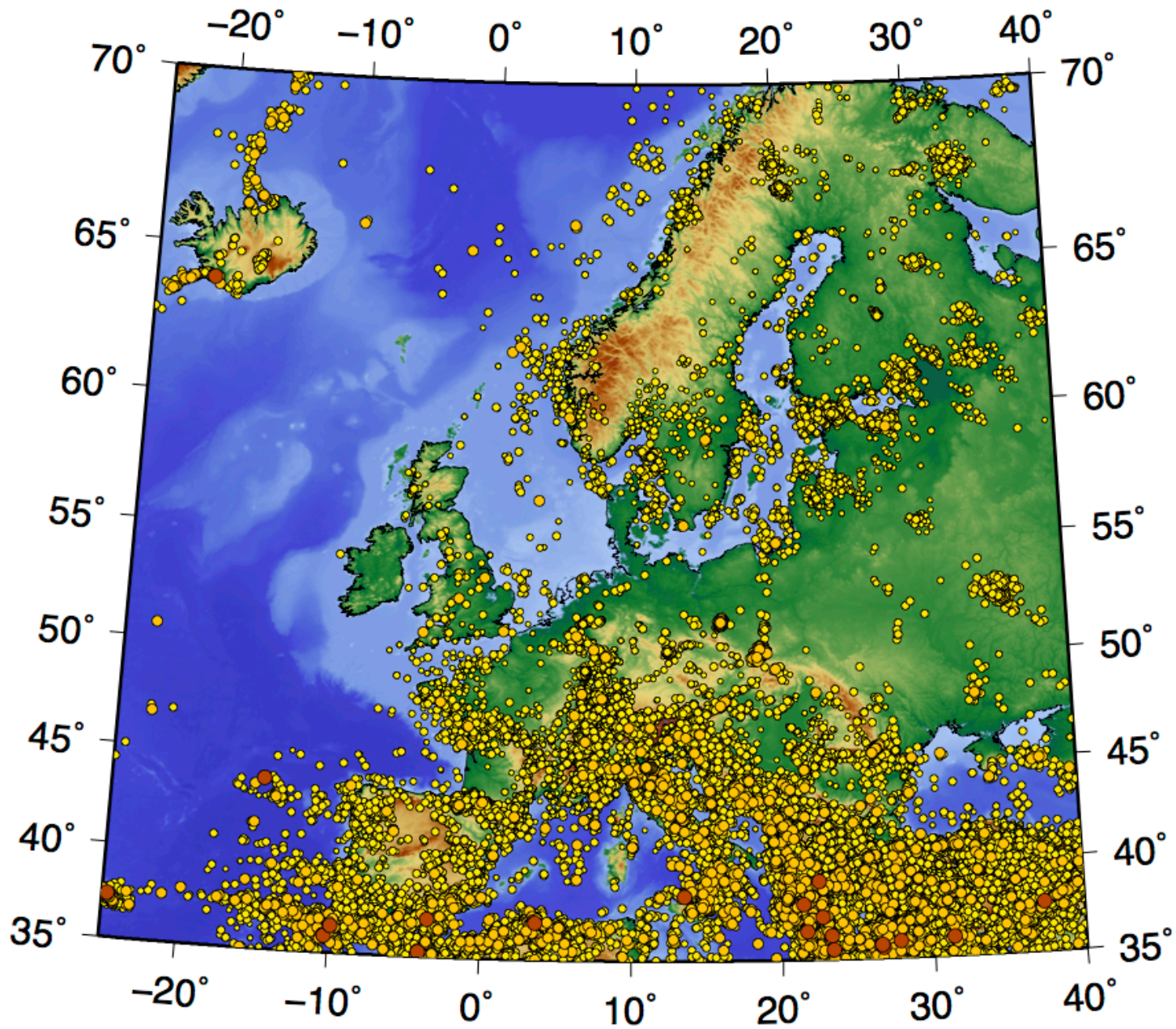
Reading, Thursday, April 6<sup>th</sup>, 2017





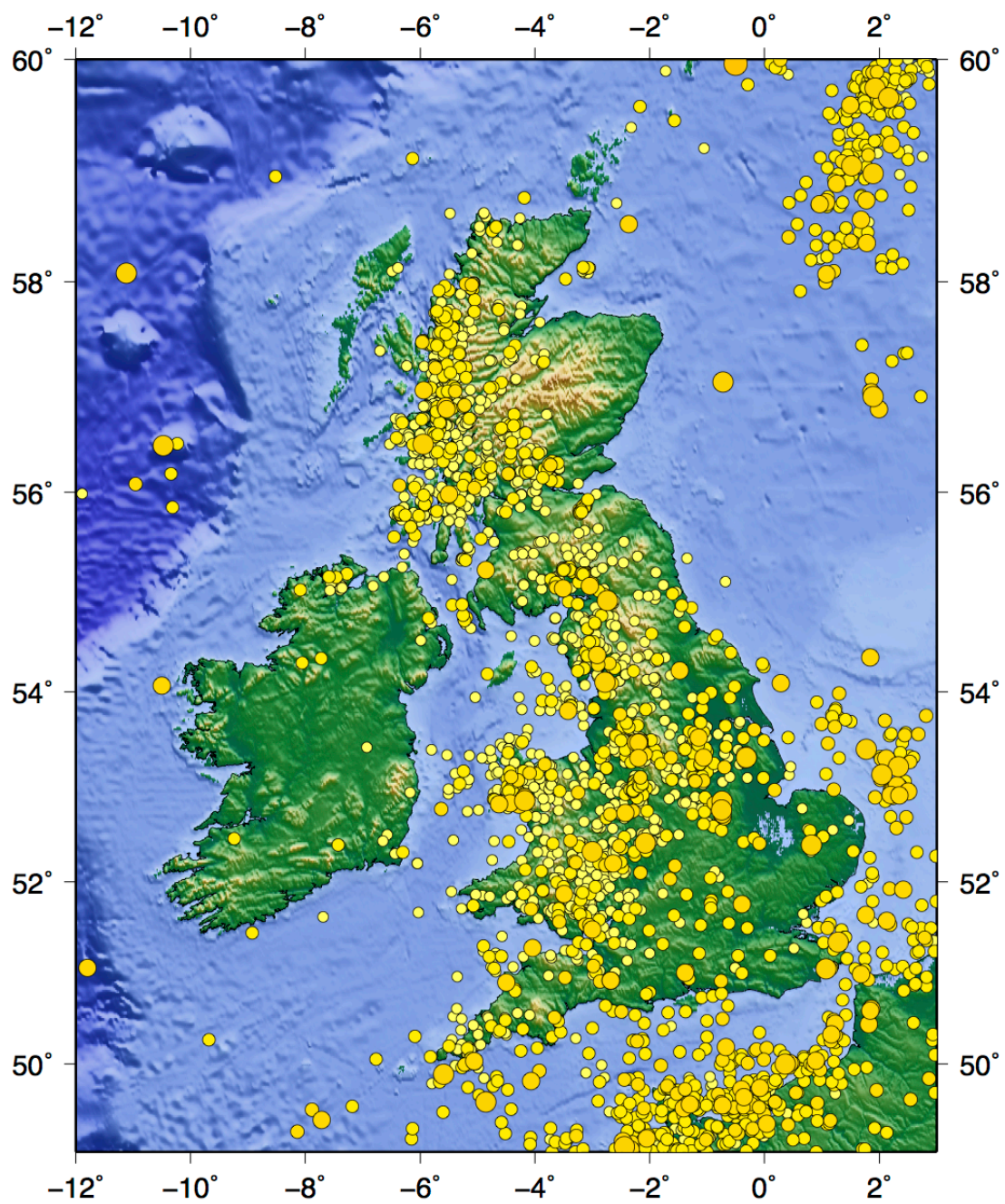
Seismic Hazard Map of Europe, Source: SHARE Database (Giardini et al., 2013)





Seismicity Map of Europe ( $M \geq 2.0$ , 2000-2014), Source: ISC Catalog

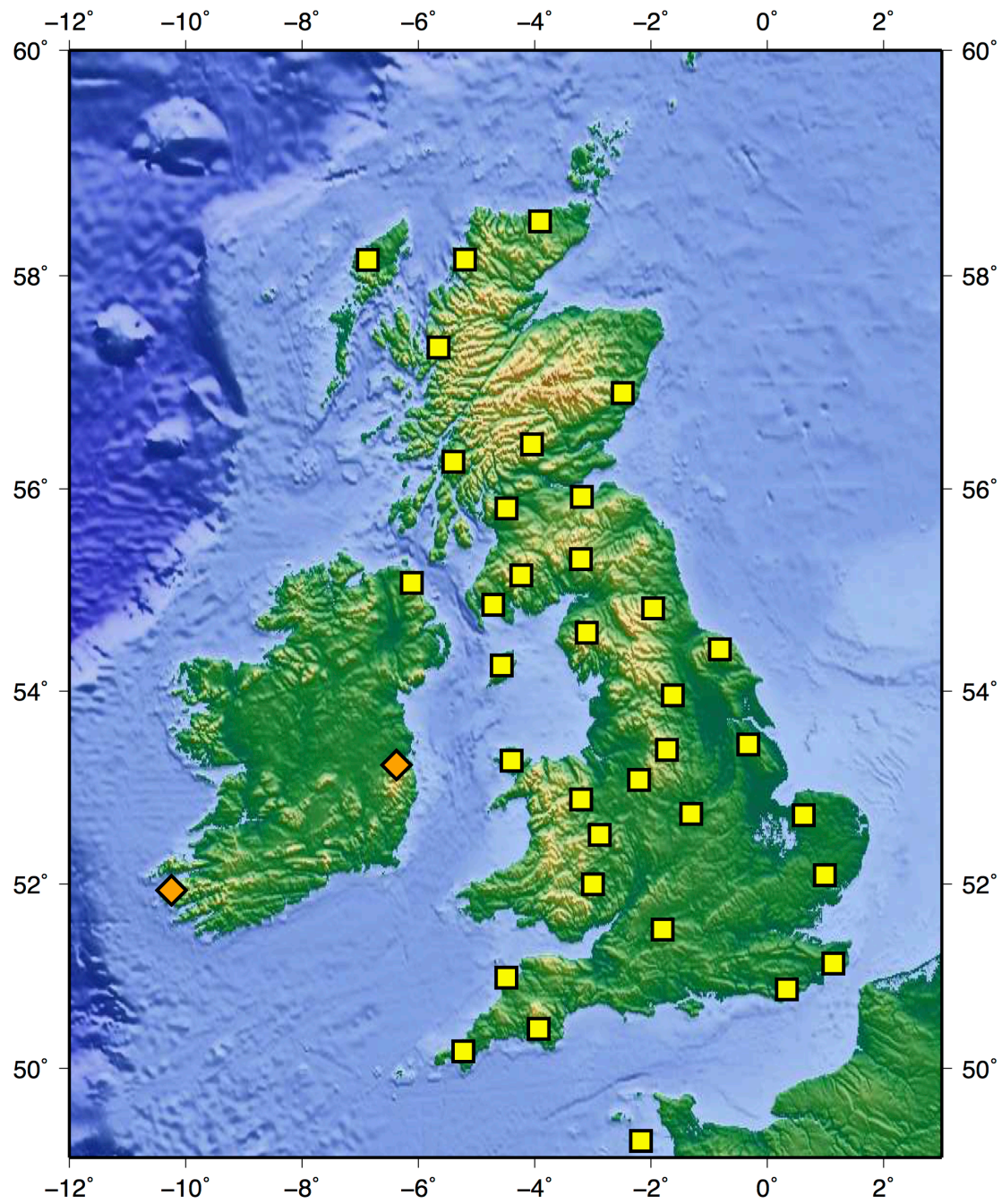
# BACKGROUND



Seismicity of Ireland and the UK (1980-2016) - Source: ISC Catalog

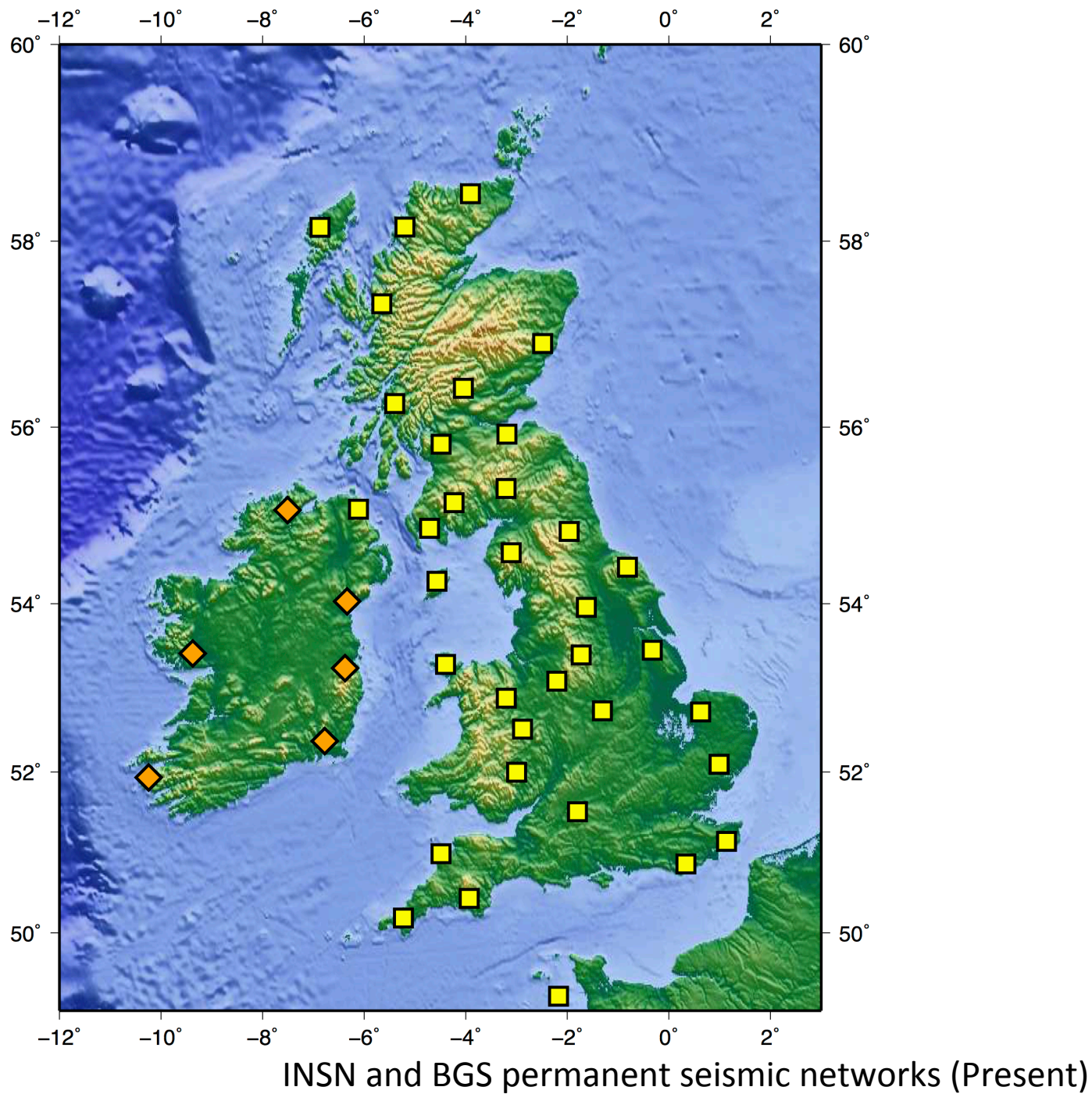


# STATION COVERAGE



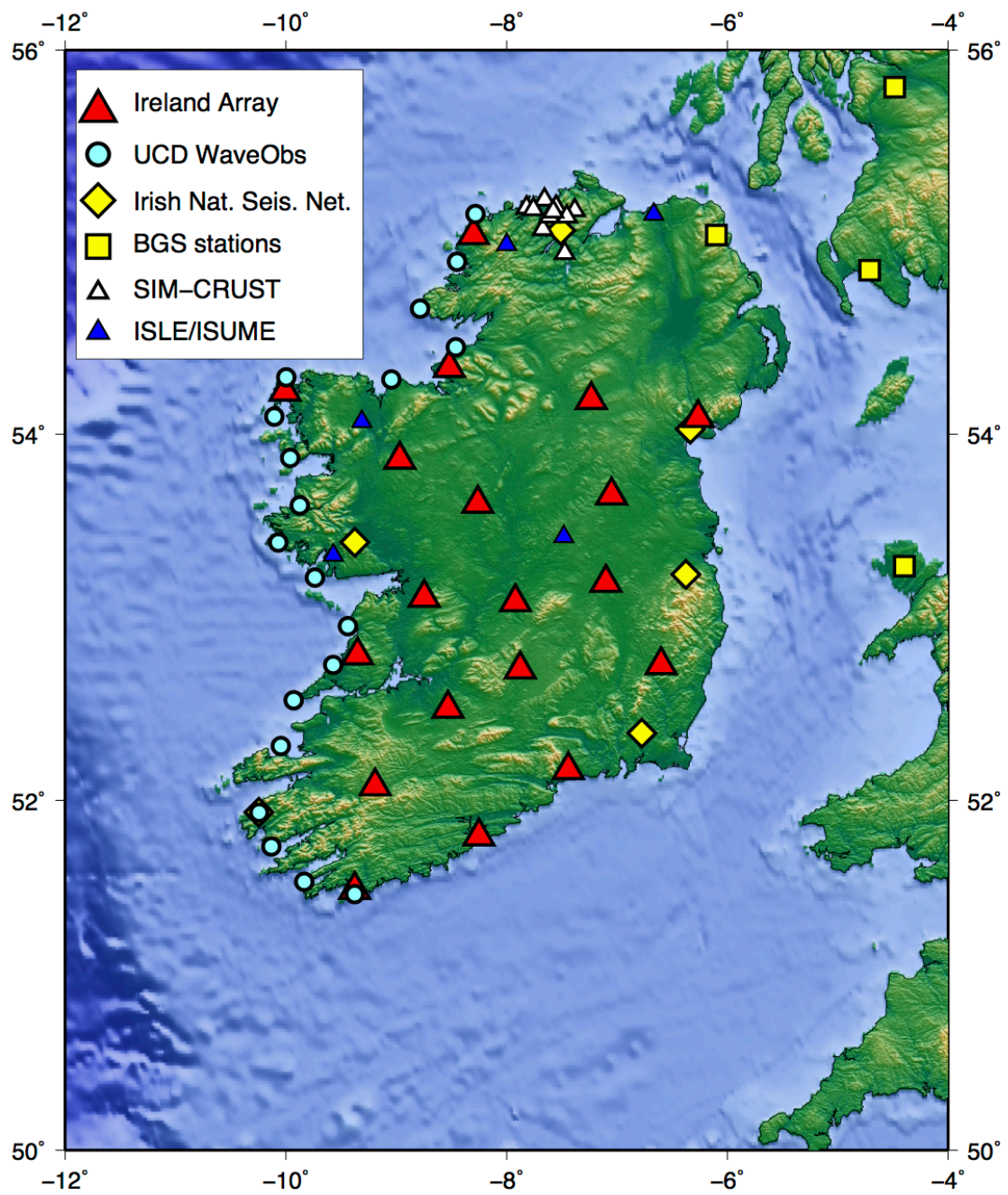
INSN and BGS permanent seismic networks (Before 2010)

# STATION COVERAGE

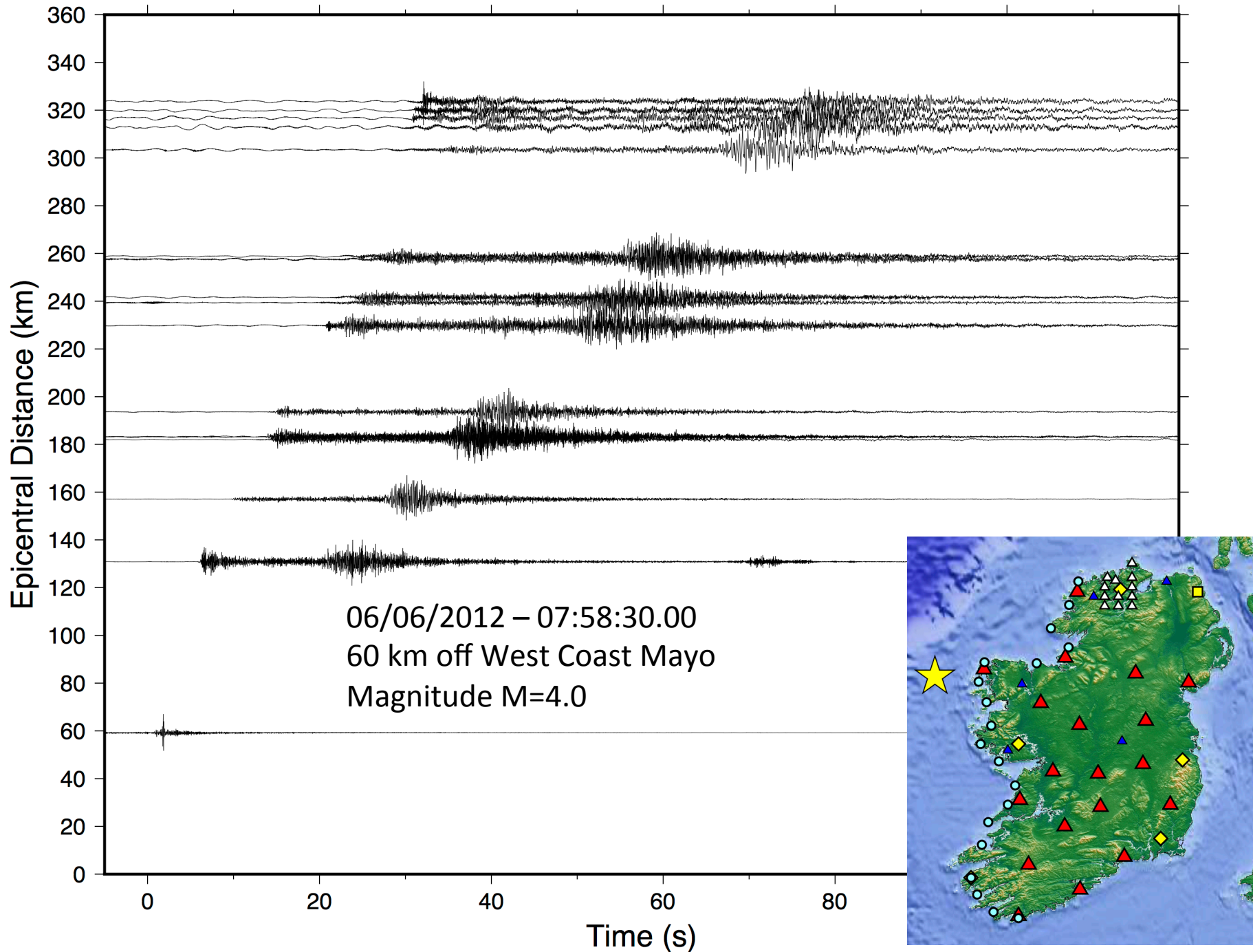




# STATION COVERAGE

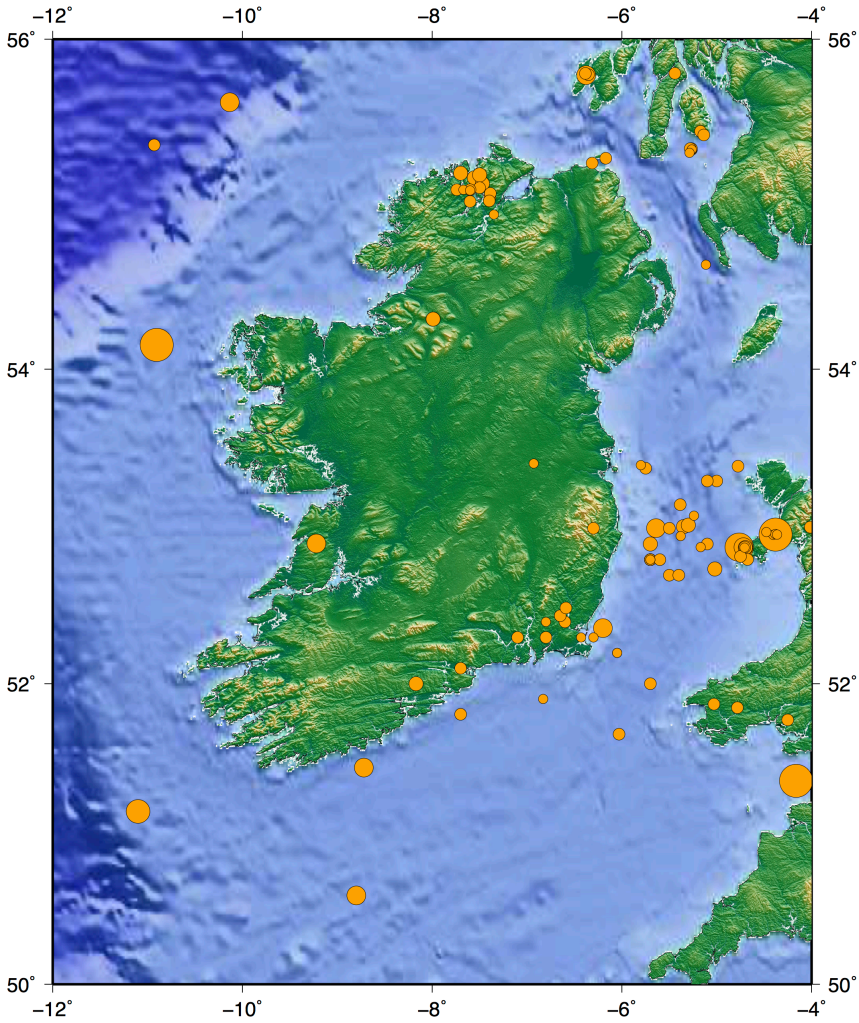


Permanent and temporary seismic networks (Present)

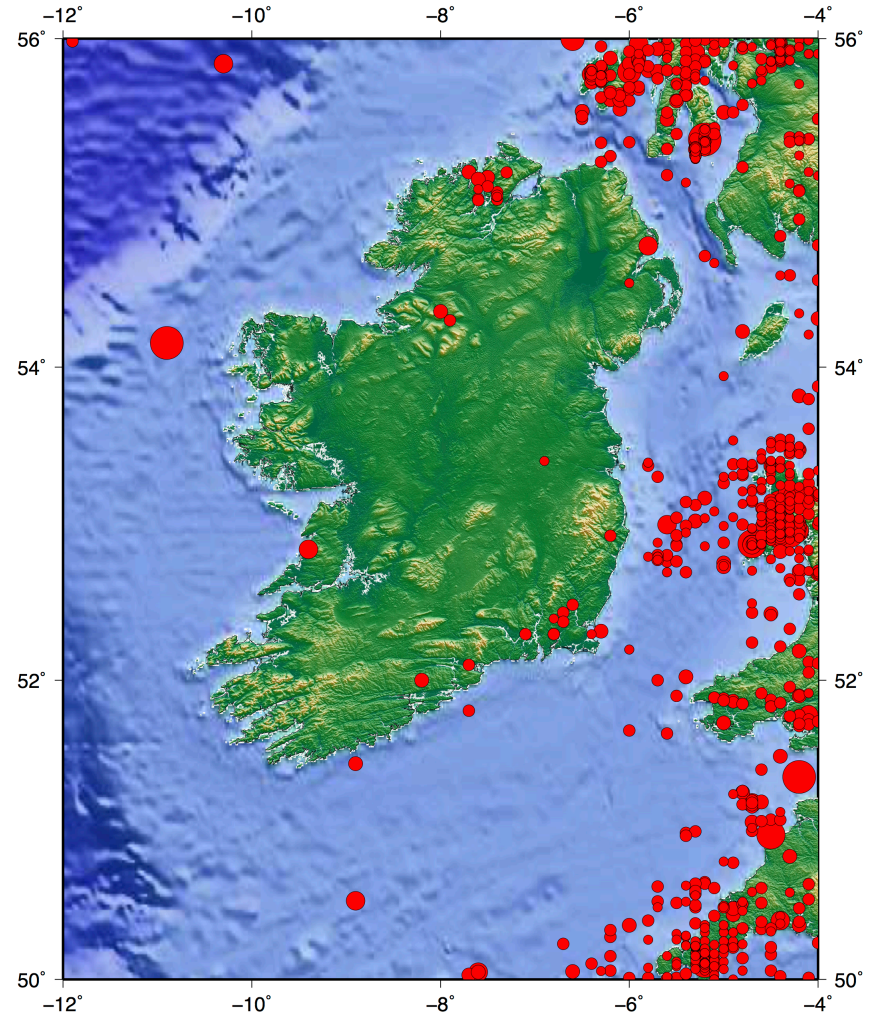




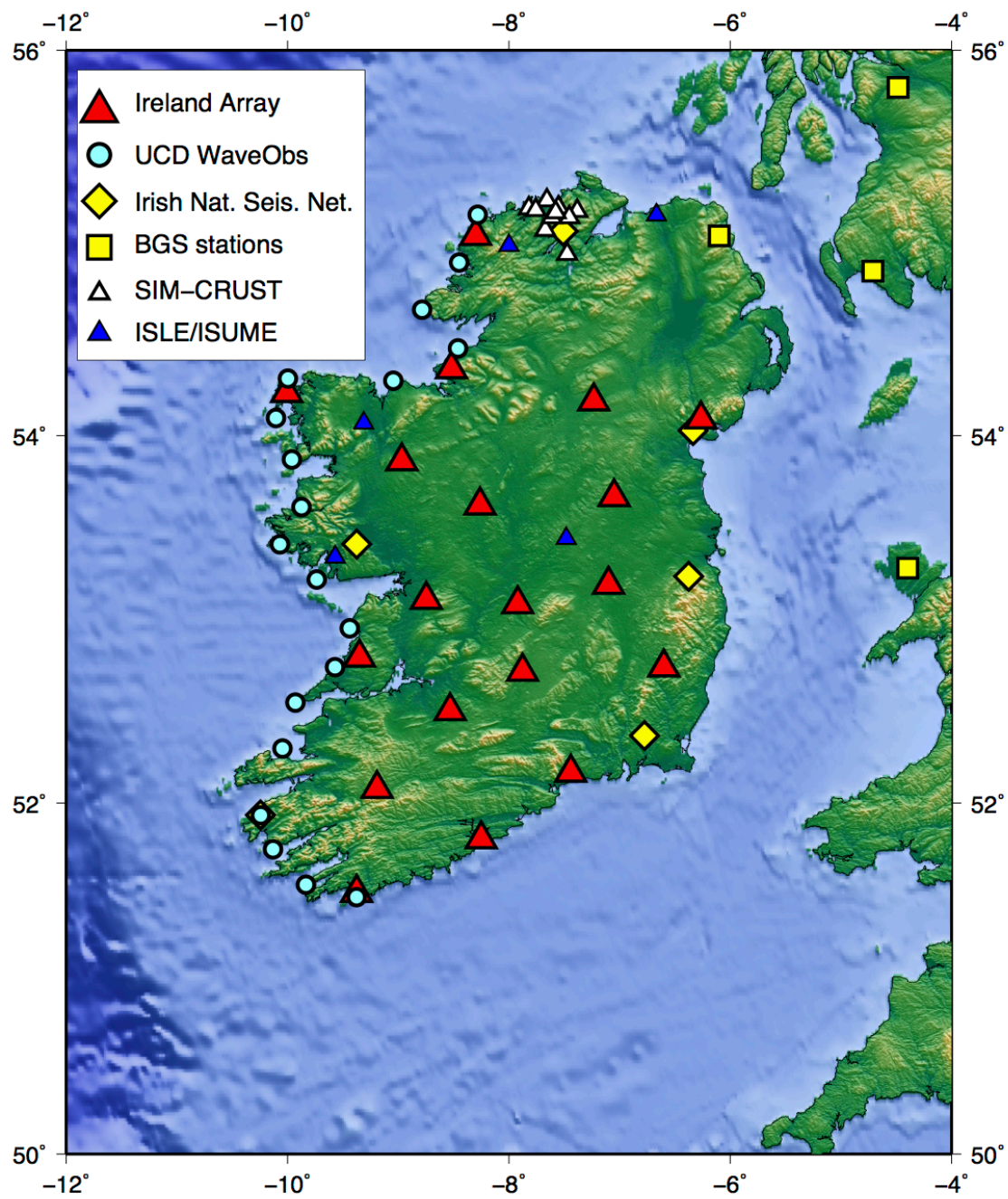
# EARTHQUAKE CATALOGS



INSN earthquake catalog (1980-2016)



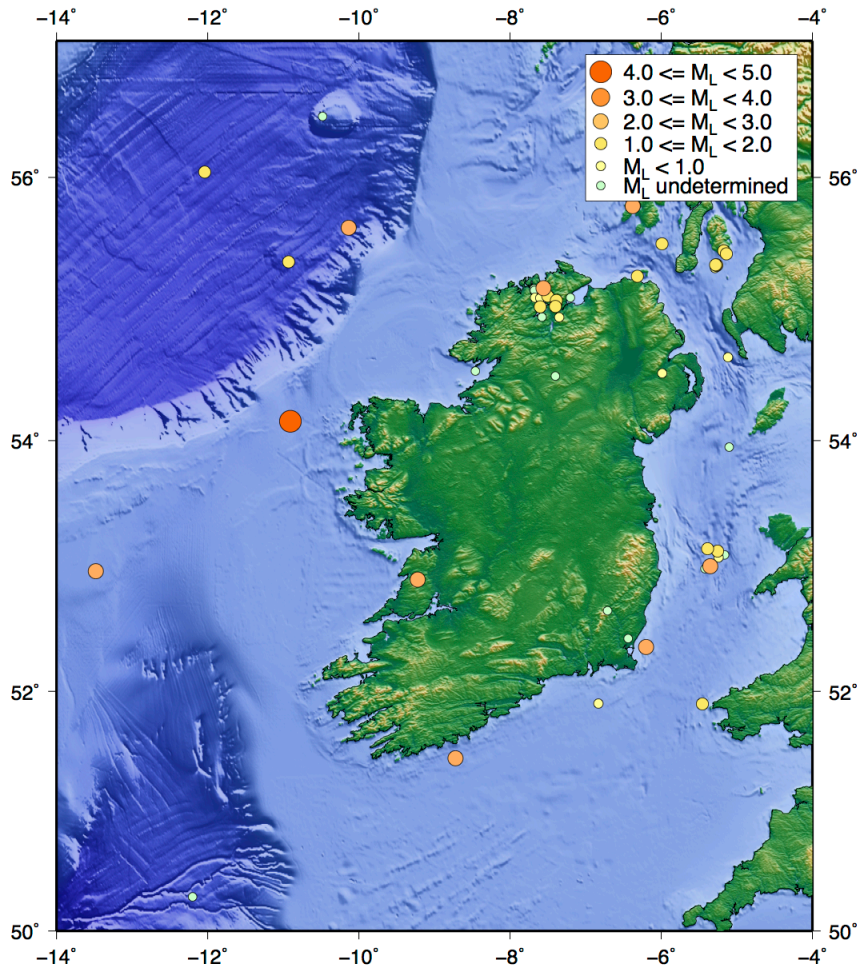
BGS earthquake catalog (1980-2016)



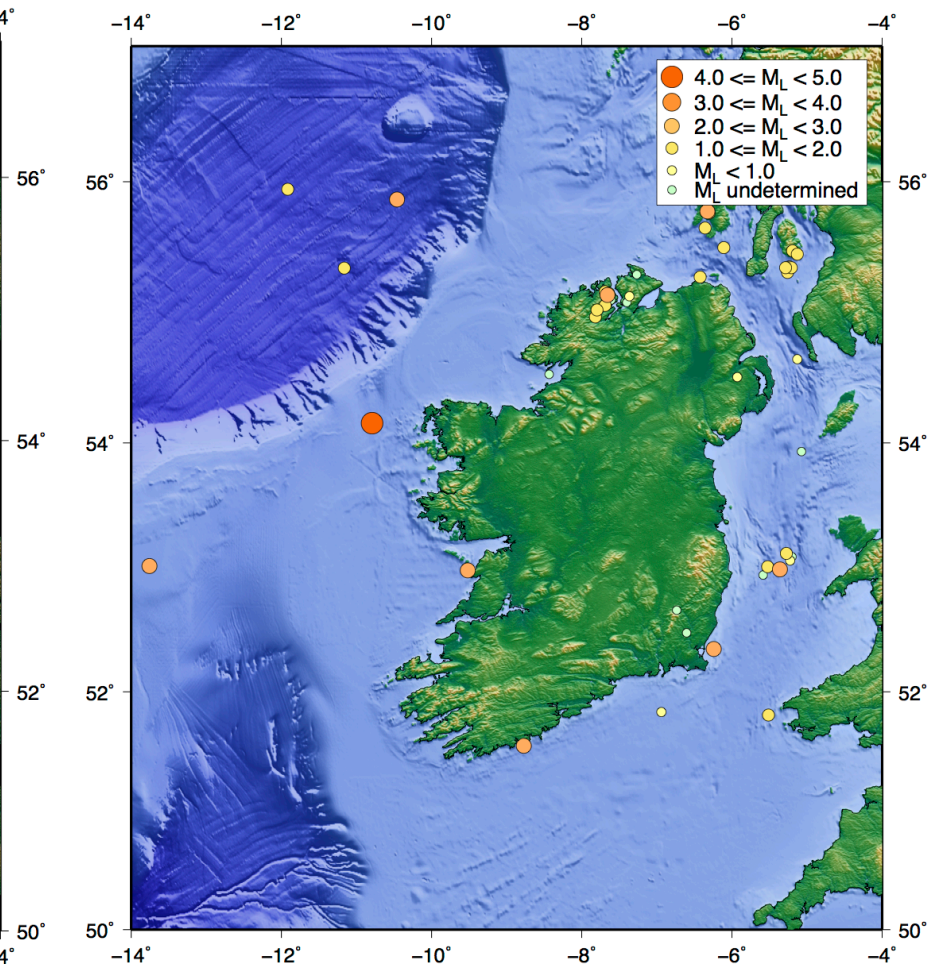
Can we use temporary array data to help characterize Ireland's seismicity?



# SEISMICITY RELOCATION

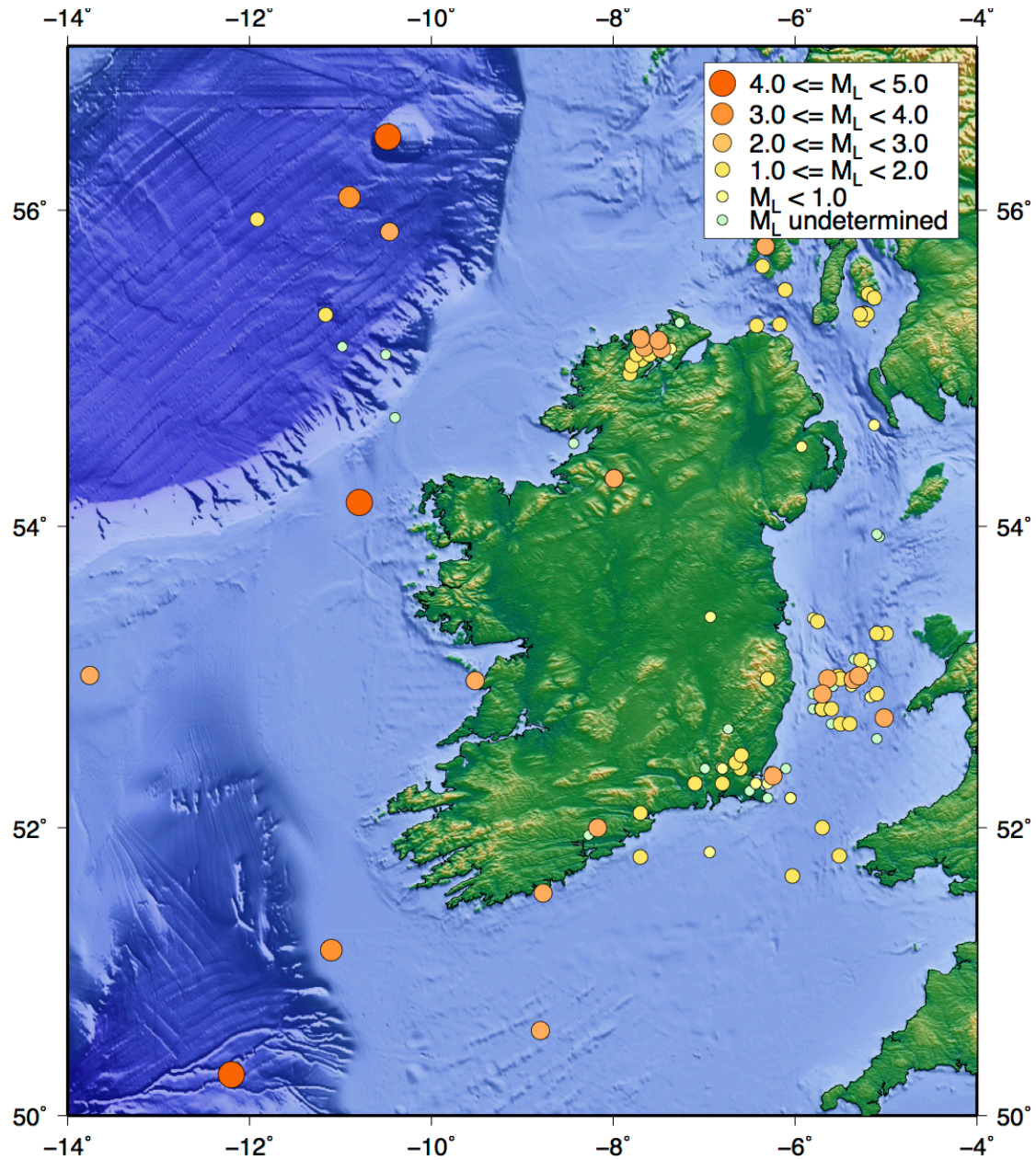


Old Catalog (2010-2016, 56 events)



Relocations (2010-2016, 56 events)

# A REVISED CATALOG OF SEISMICITY







# THE (ELUSIVE) SEISMICITY OF IRELAND

Pierre Arroucau, James Grannell, Sergei Lebedev, Chris Bean, Clare Horan, Tom Blake

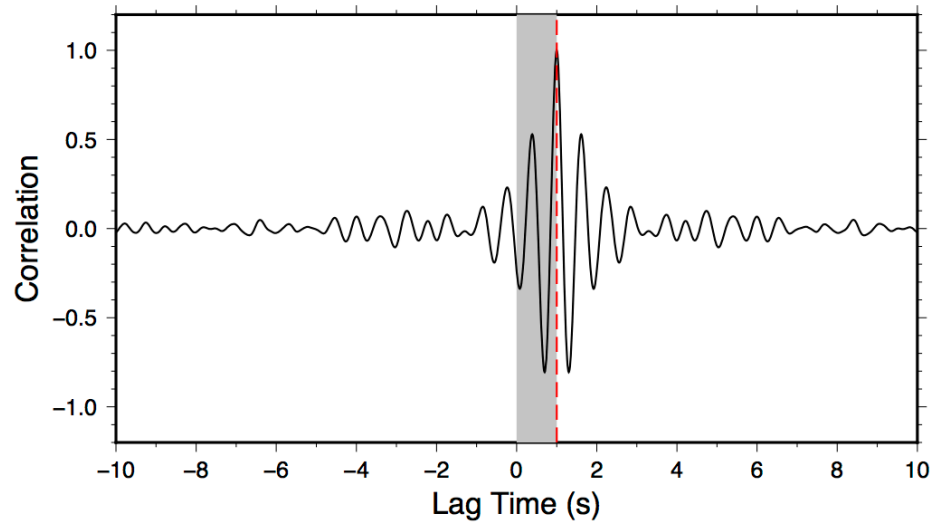
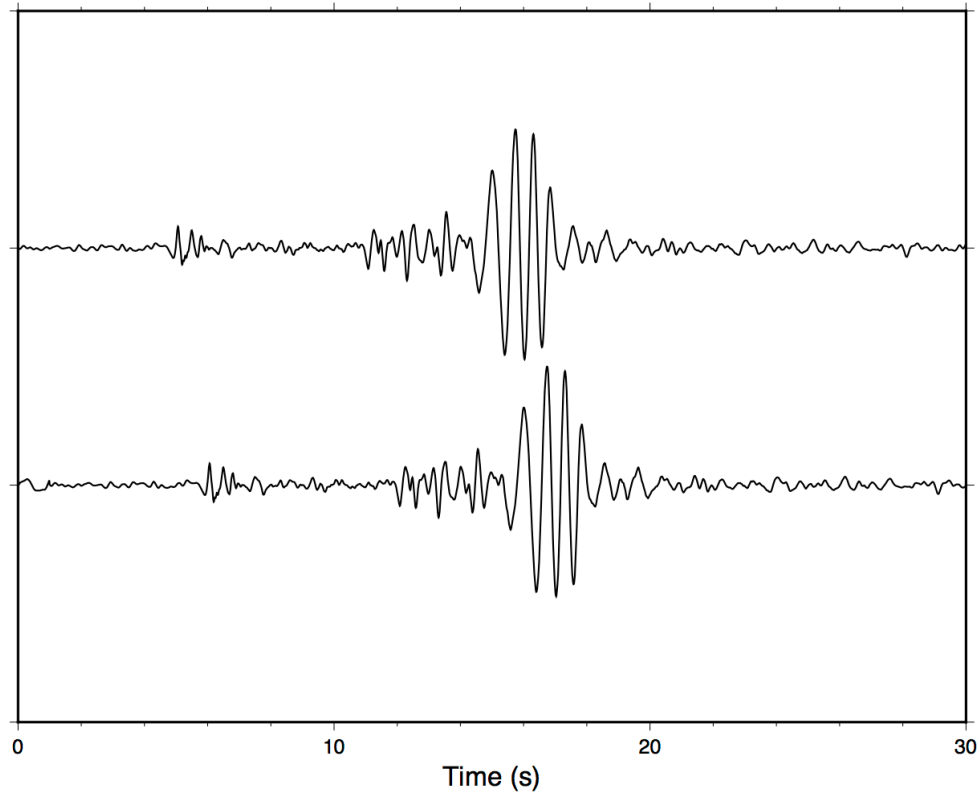
IGRM - Galway, February 20<sup>th</sup>, 2016



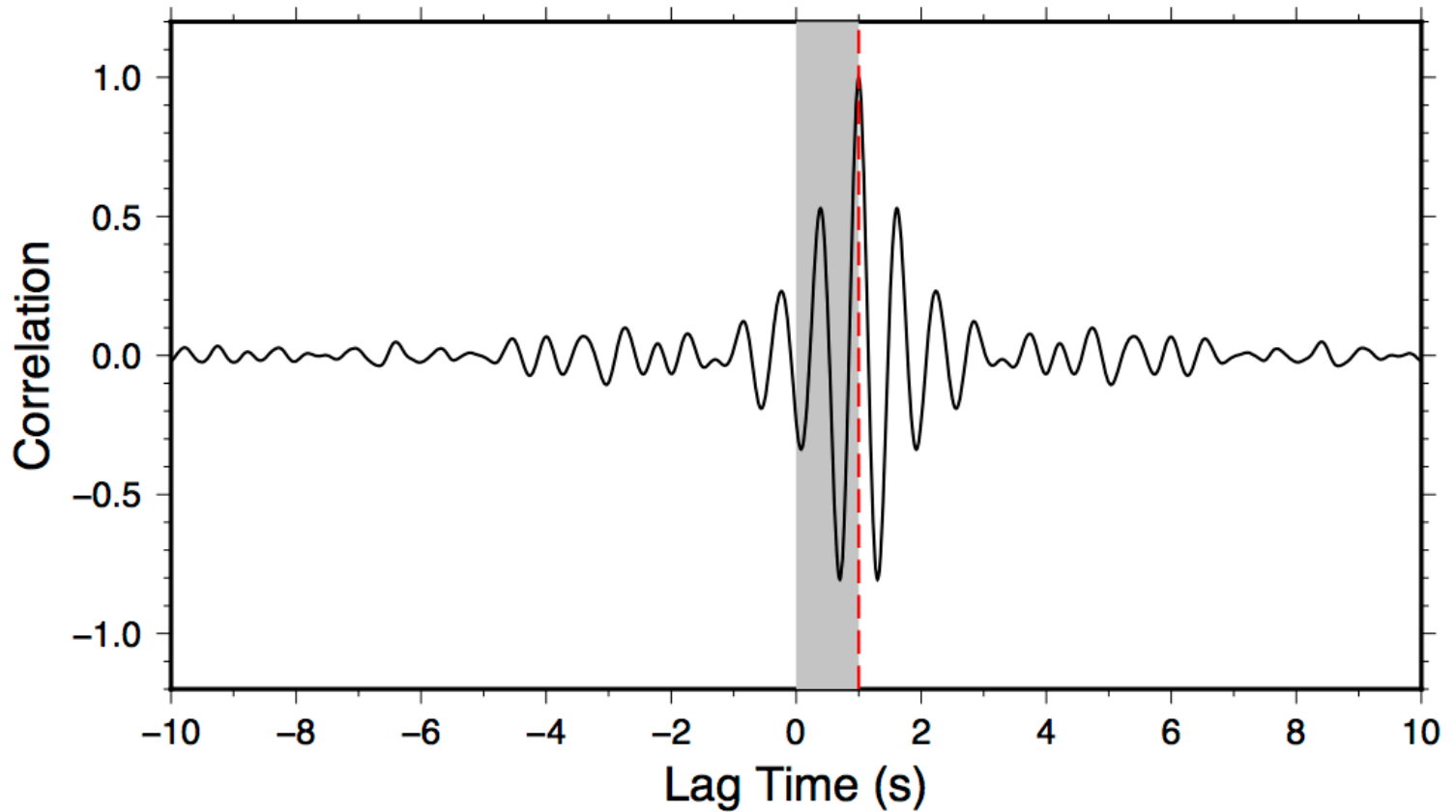
# THE (STILL ELUSIVE) SEISMICITY OF IRELAND

THE (STILL ELUSIVE BUT NOT SO MUCH IN FACT)  
SEISMICITY OF IRELAND

# DETECTION AND DISCRIMINATION WITH CROSS-CORRELATION



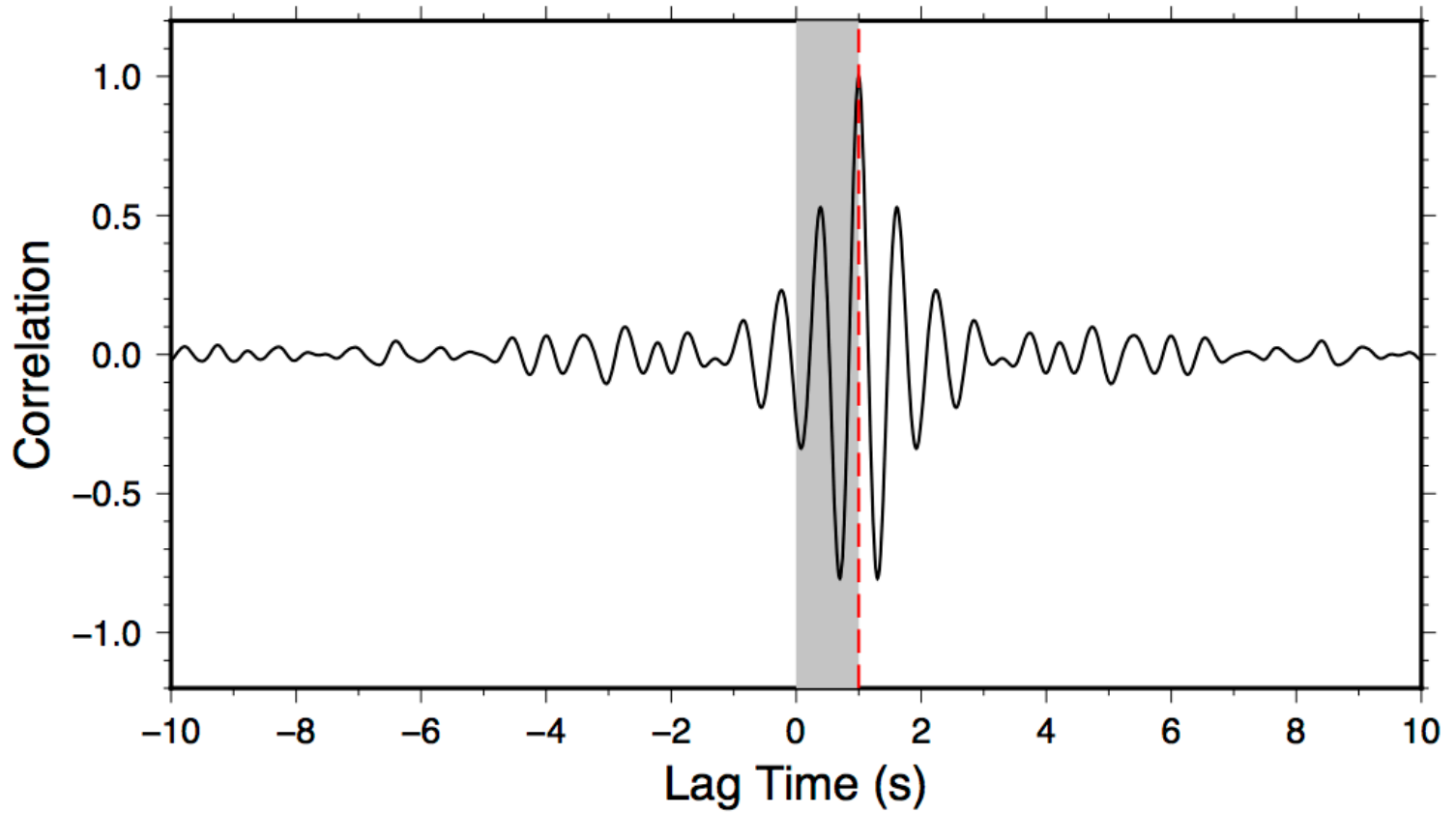
# DETECTION AND DISCRIMINATION WITH CROSS-CORRELATION



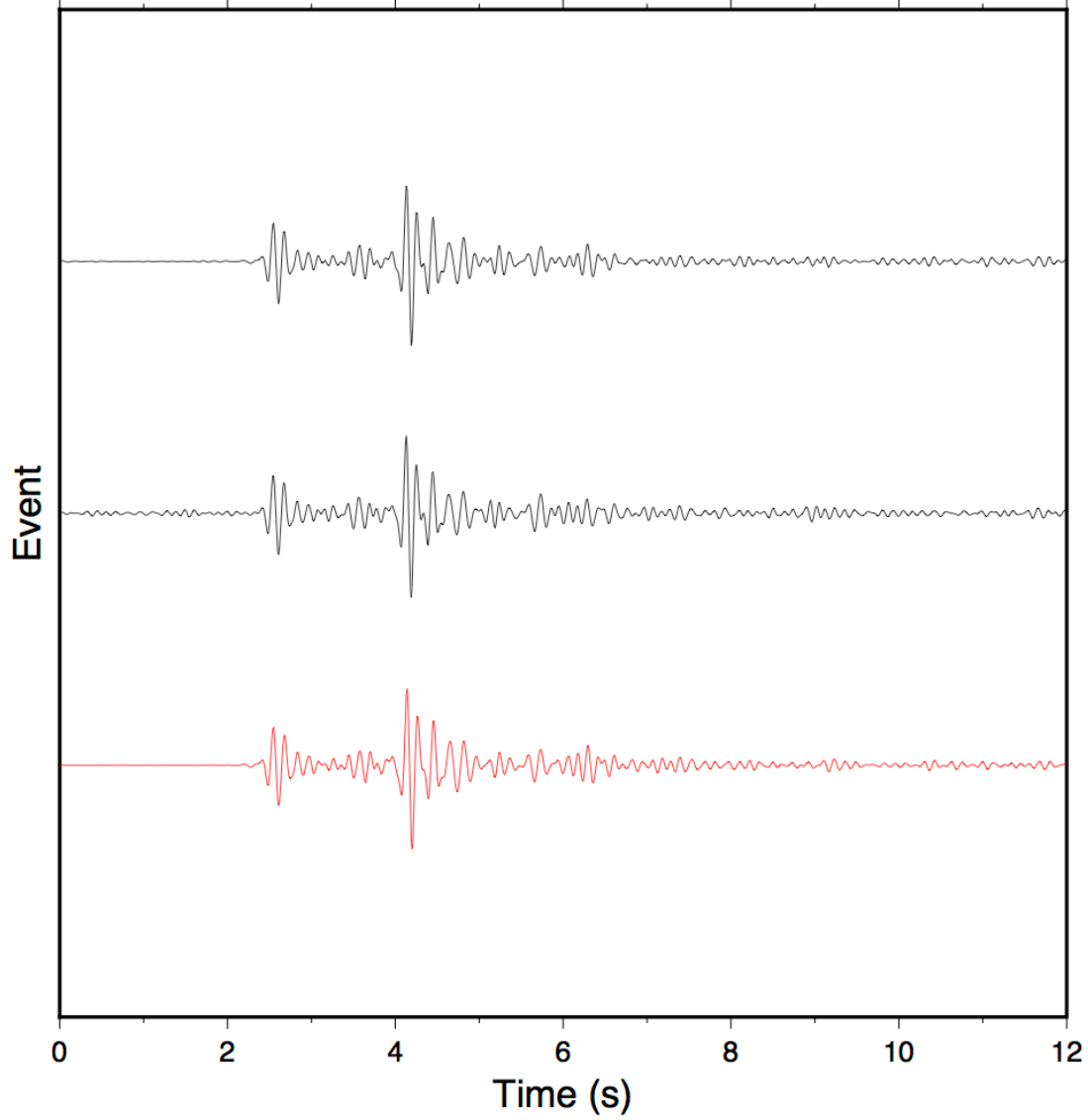
Repeating seismic events (natural or man-made) are expected to generate similar waveforms.

Cross-correlation can be used to identify such events.

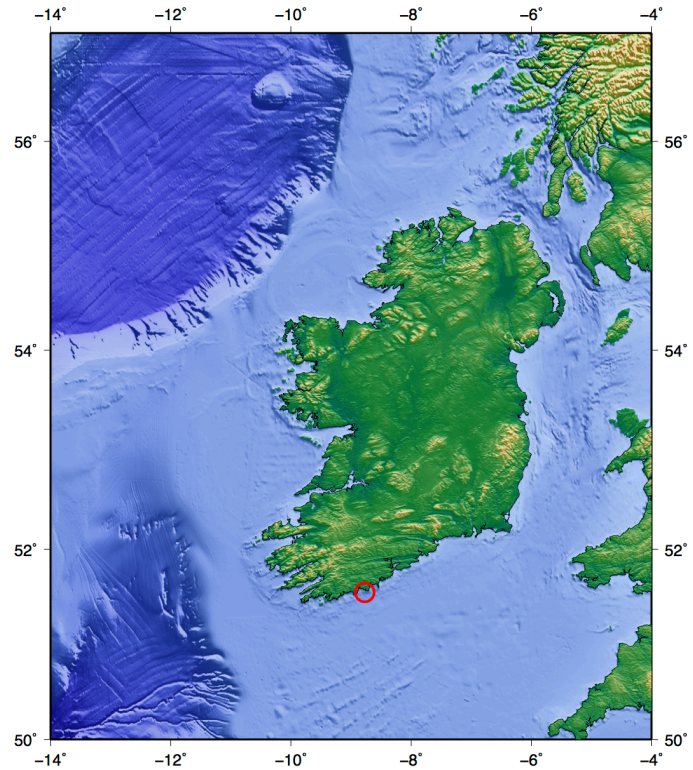
DETECTION AND DISCRIMINATION WITH  
CROSS-CORRELATION



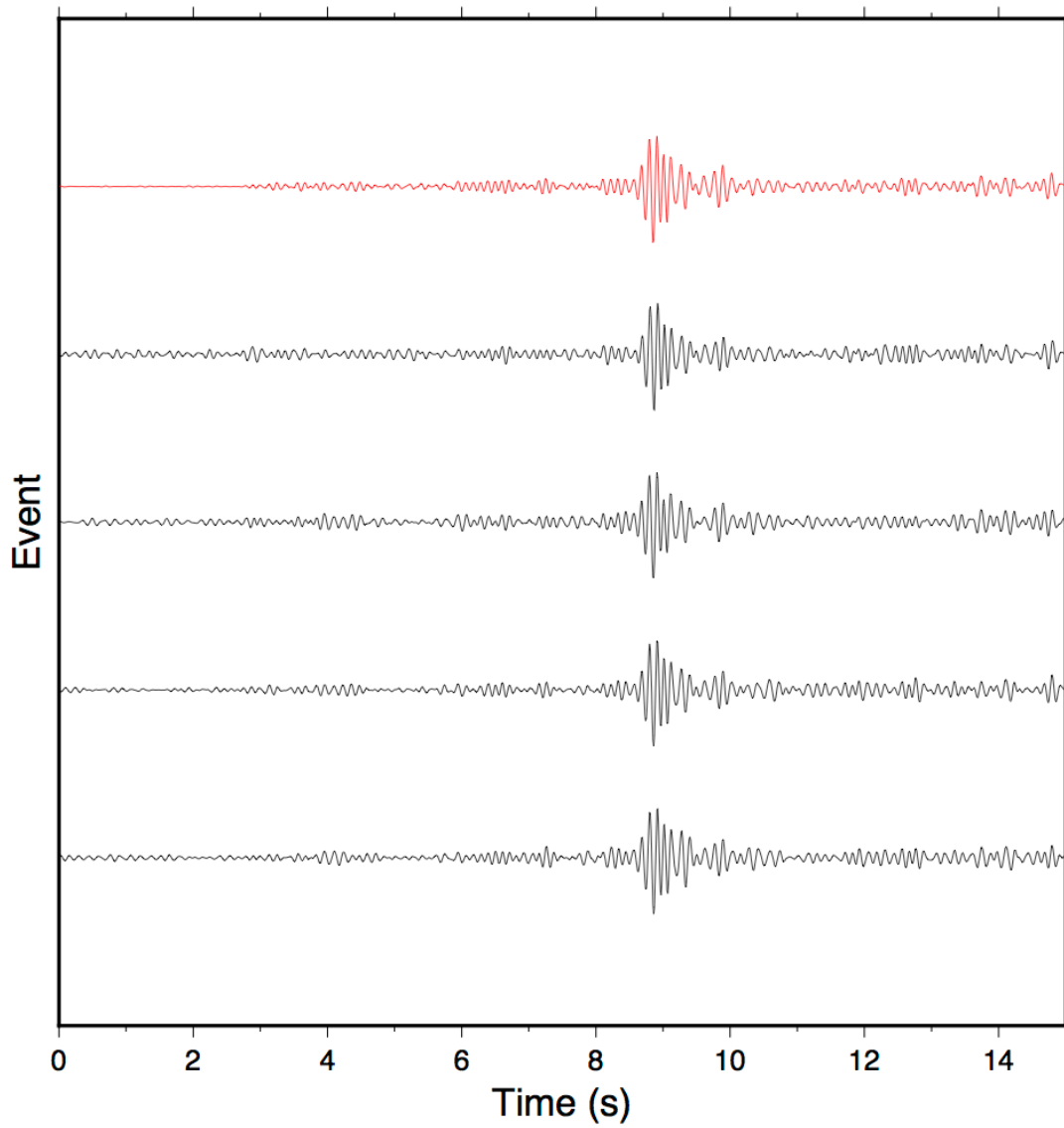
**218 new events**



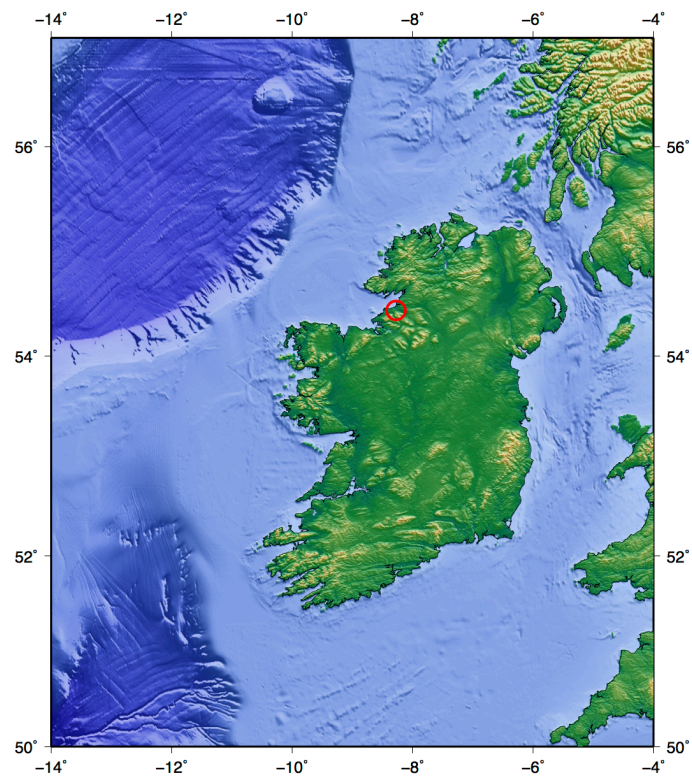
# Cork

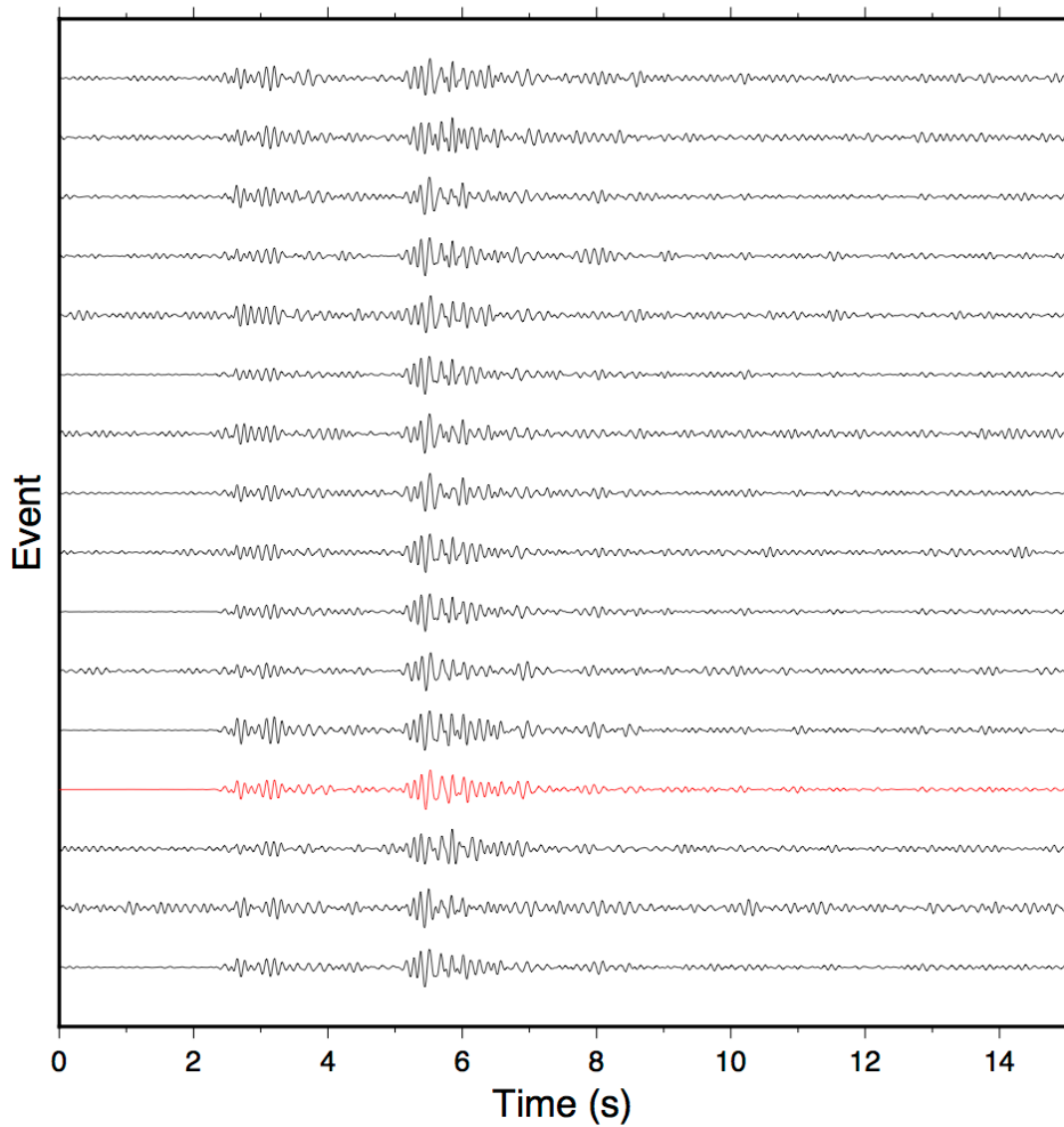




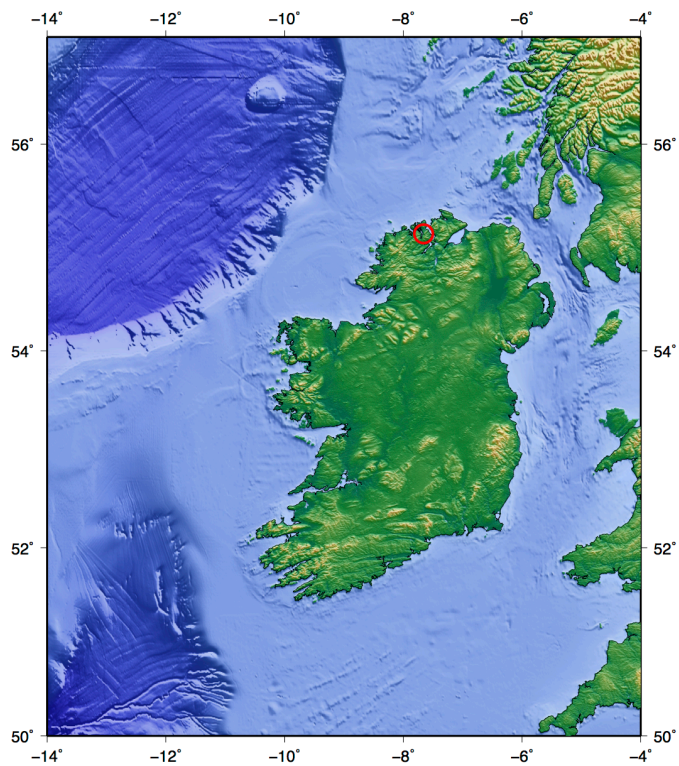


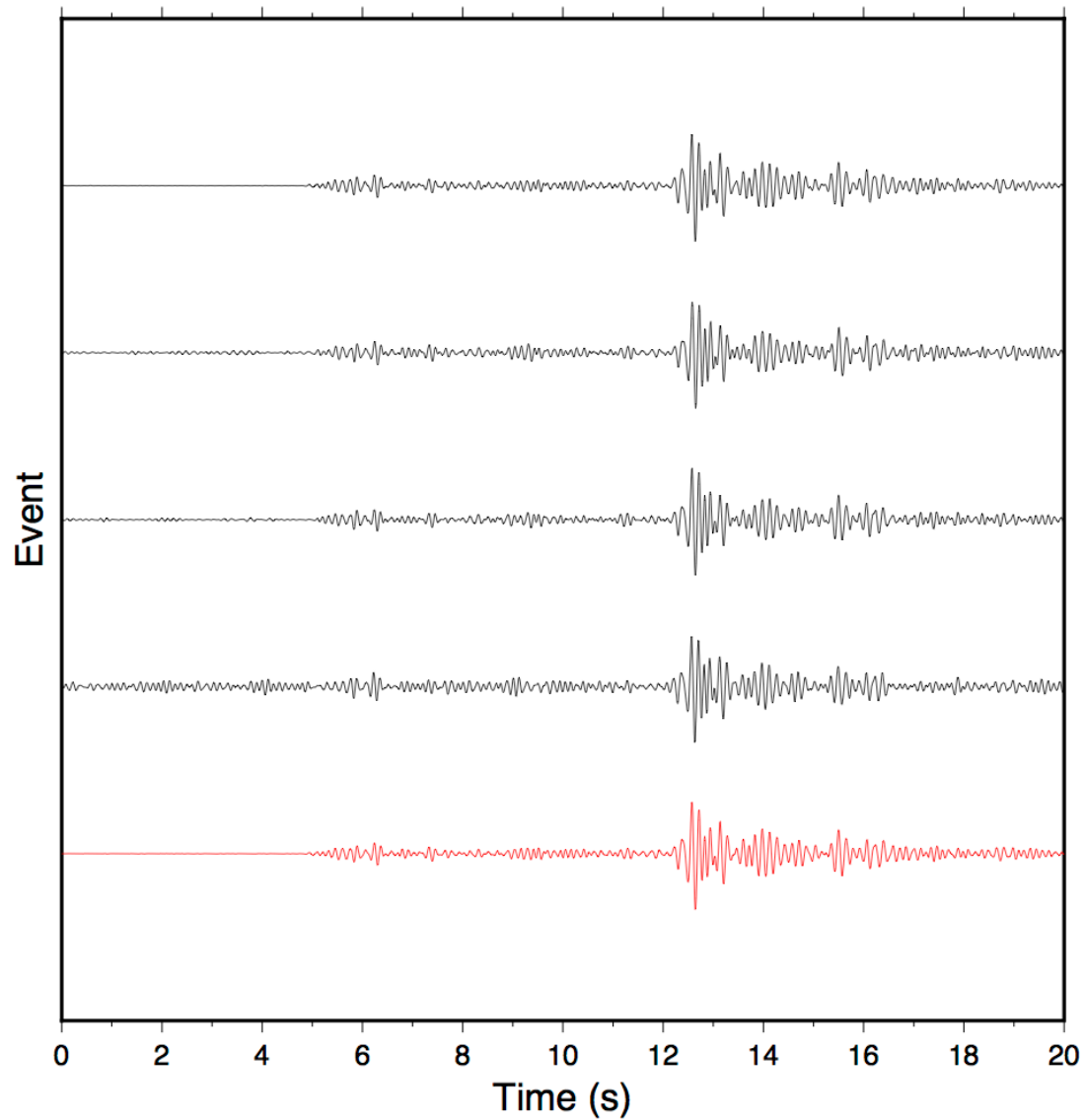
# Leitrim



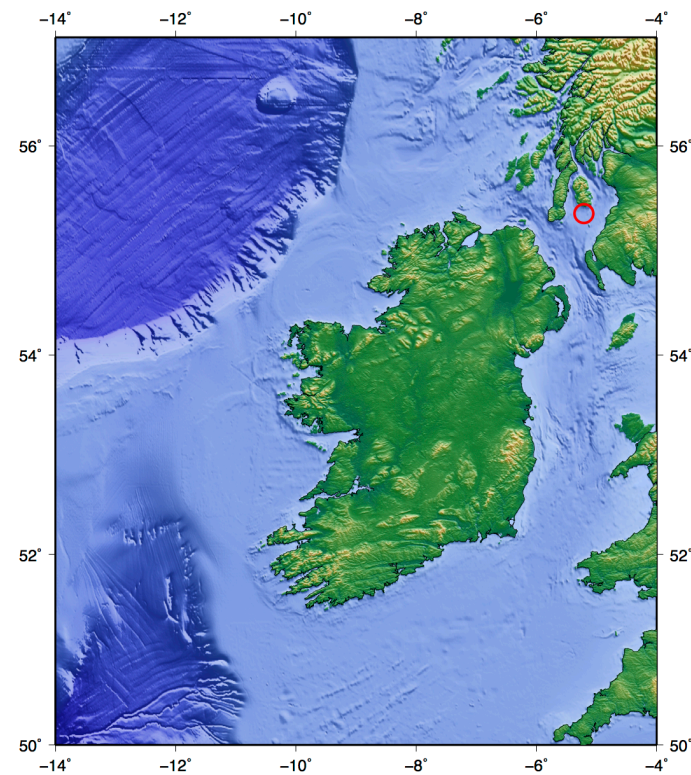


# Donegal



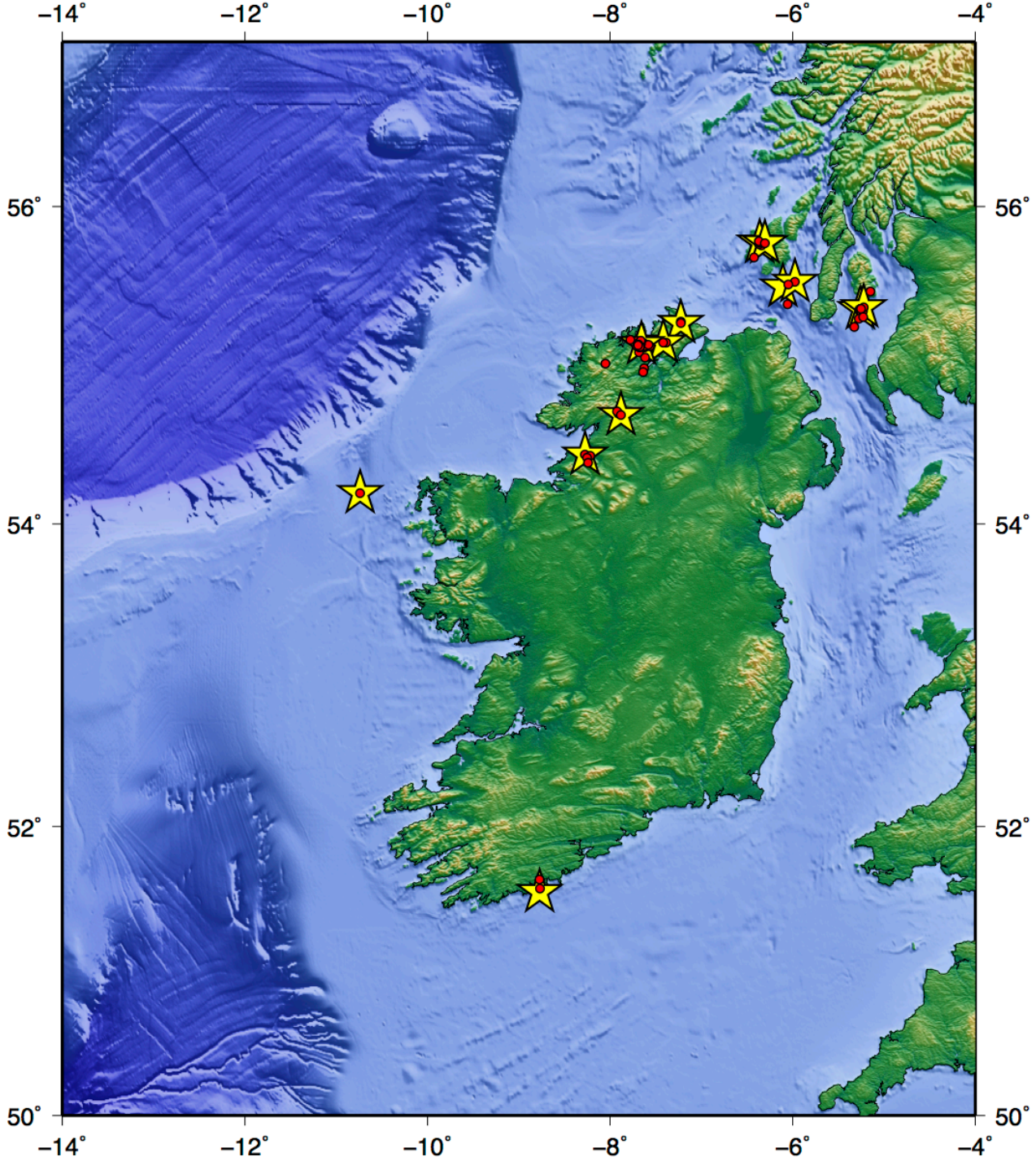


# Scotland





# SYNTHESIS



# SUMMARY

- New results obtained from waveform matching by cross-correlation
- 218 new events
- Locations are preliminary, relocation needed
- Method limited to repeating events
- Effective 'non-repeating' event detection still needed

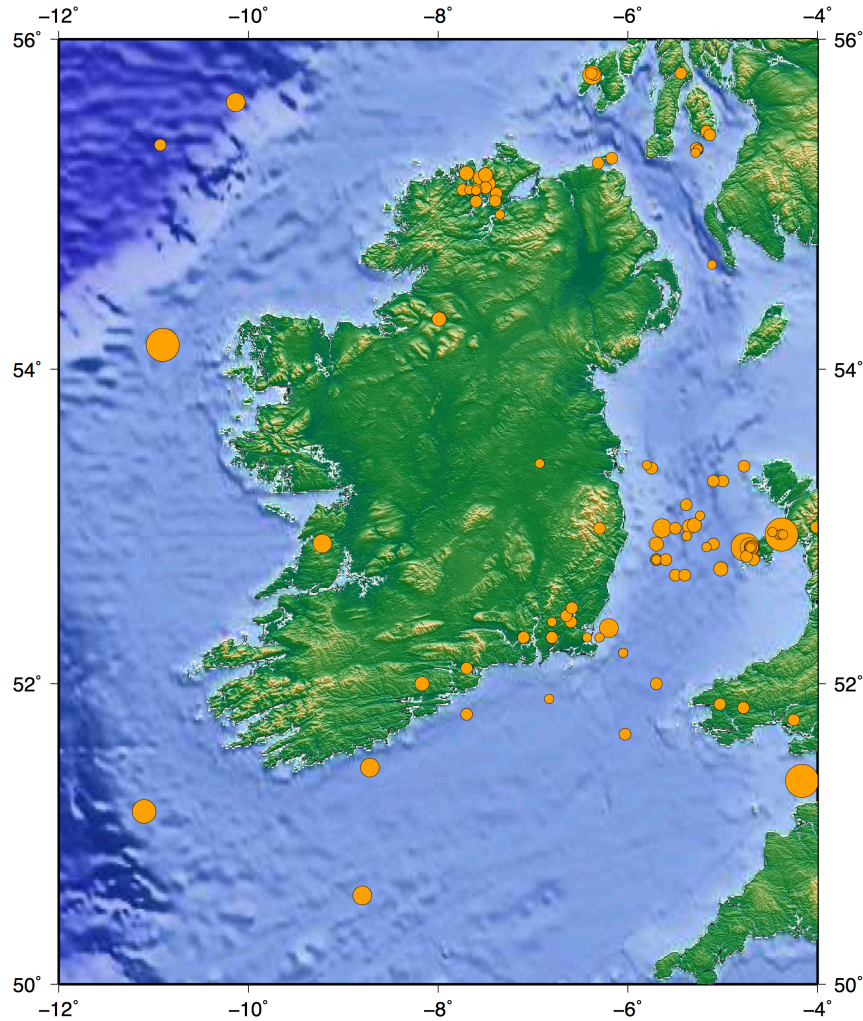




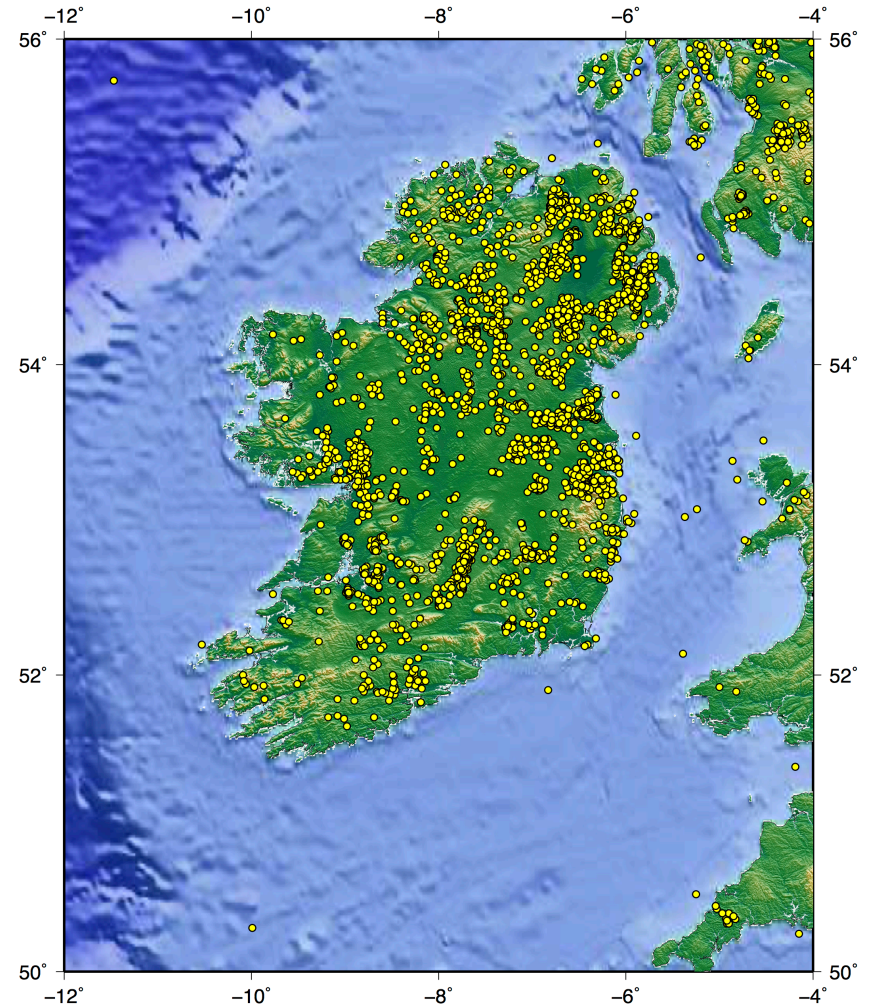
THANK YOU!



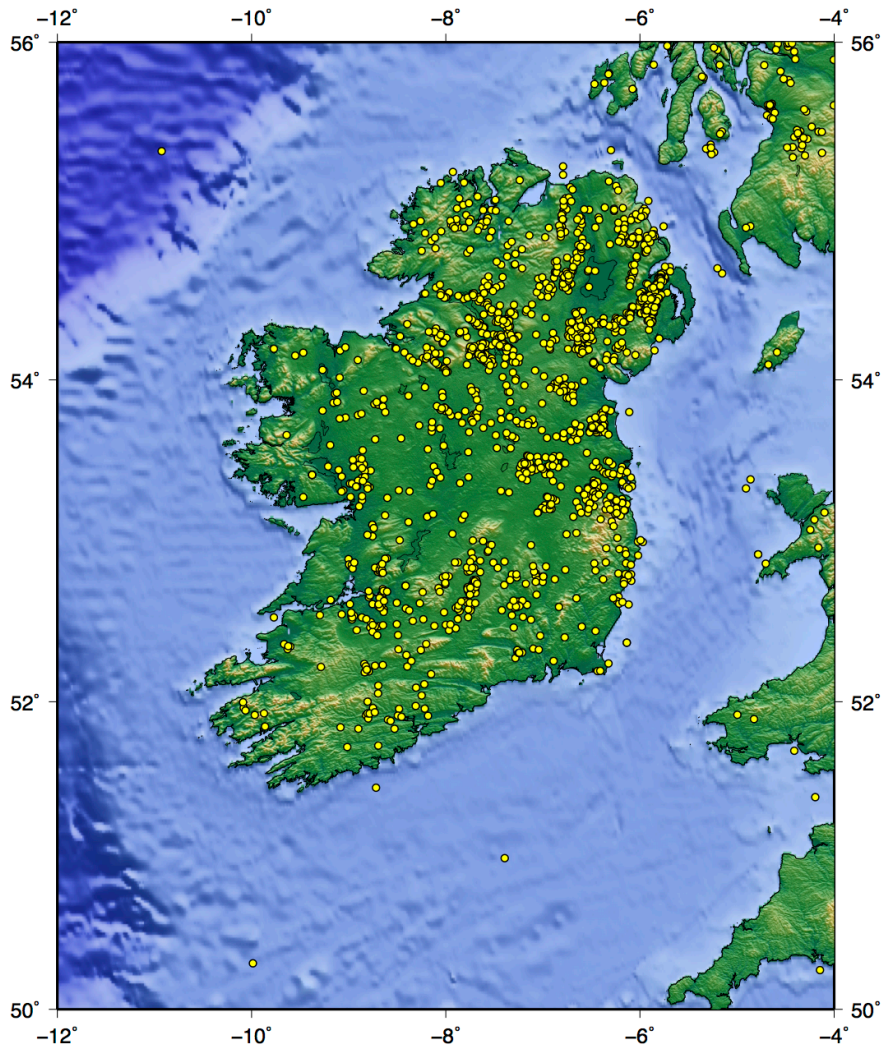
# NATURAL AND MAN-MADE SEISMICITY IN IRELAND



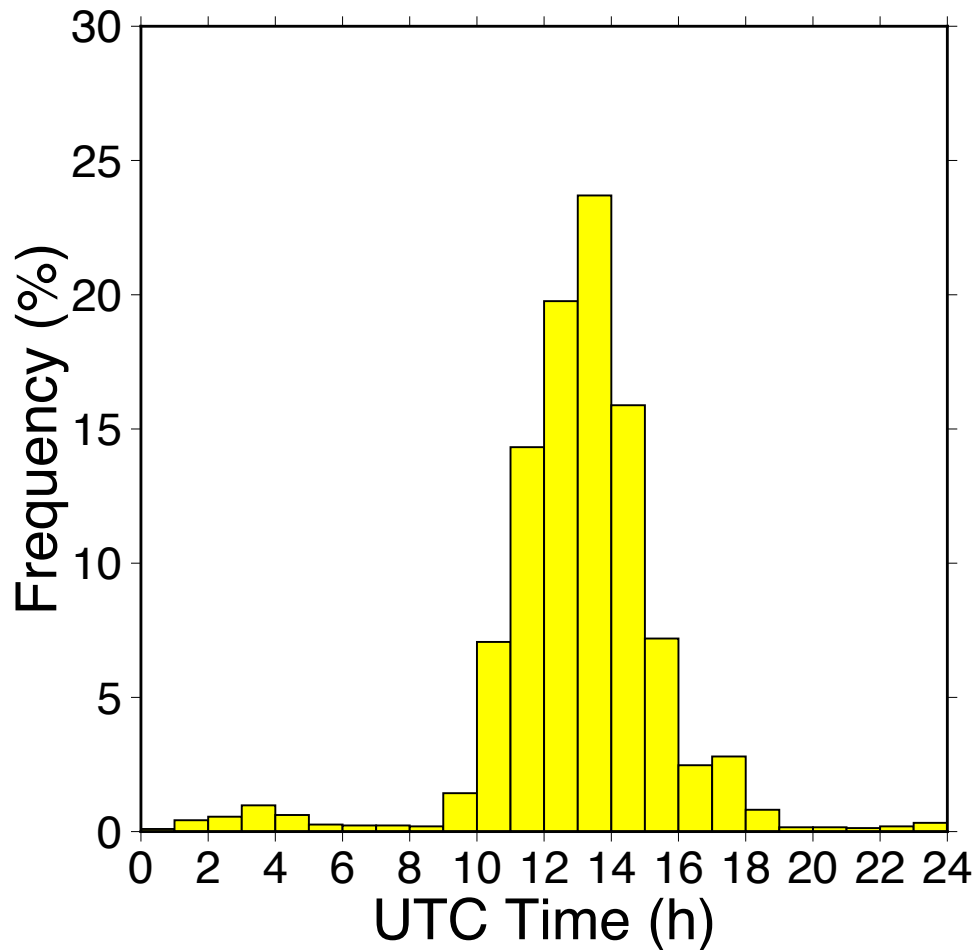
INSN earthquake catalog (1980-2016)



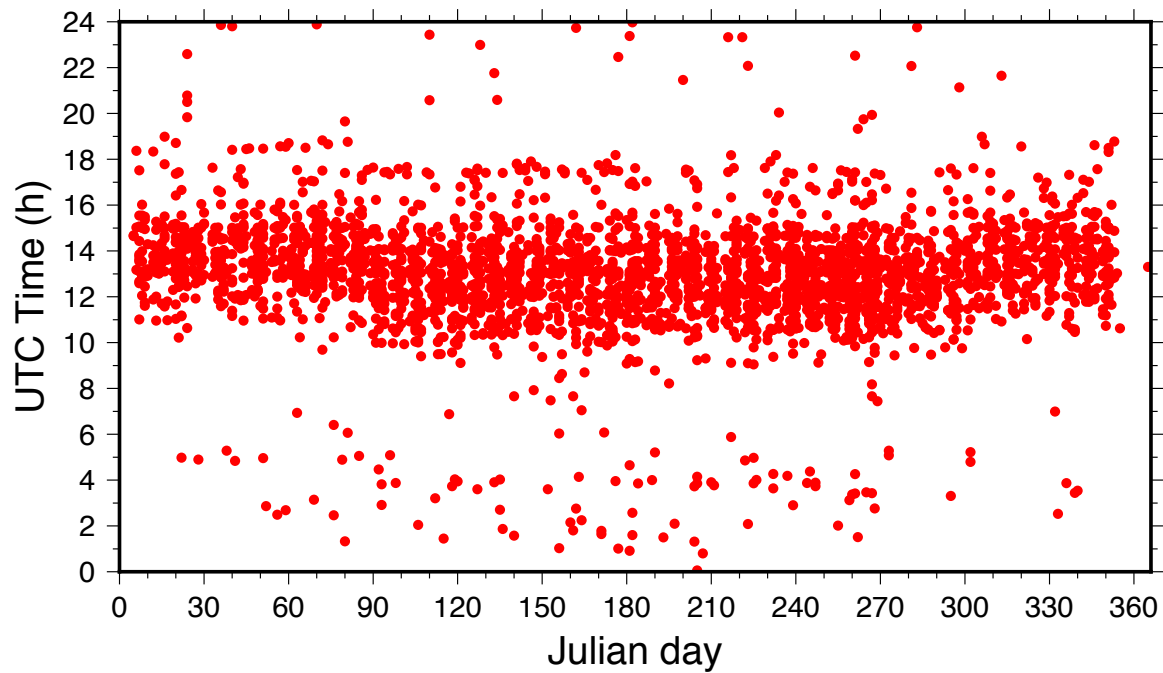
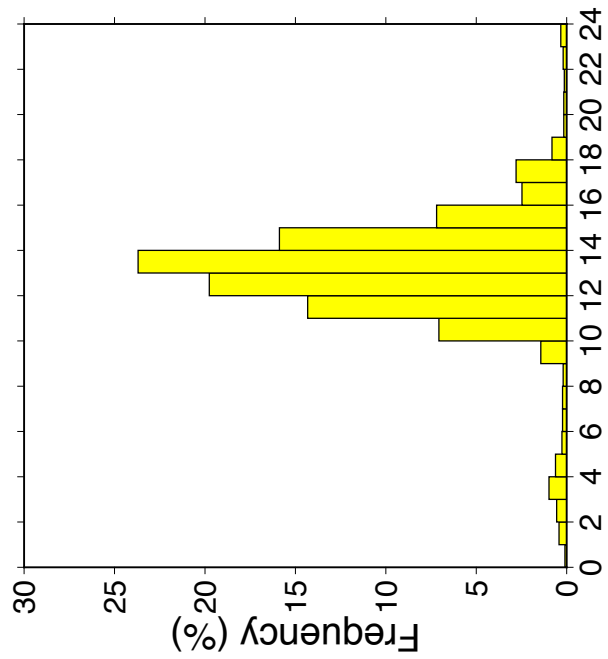
INSN - All detections (2013-2015)



INSN seismic event detections  
and preliminary locations (2013-2015)

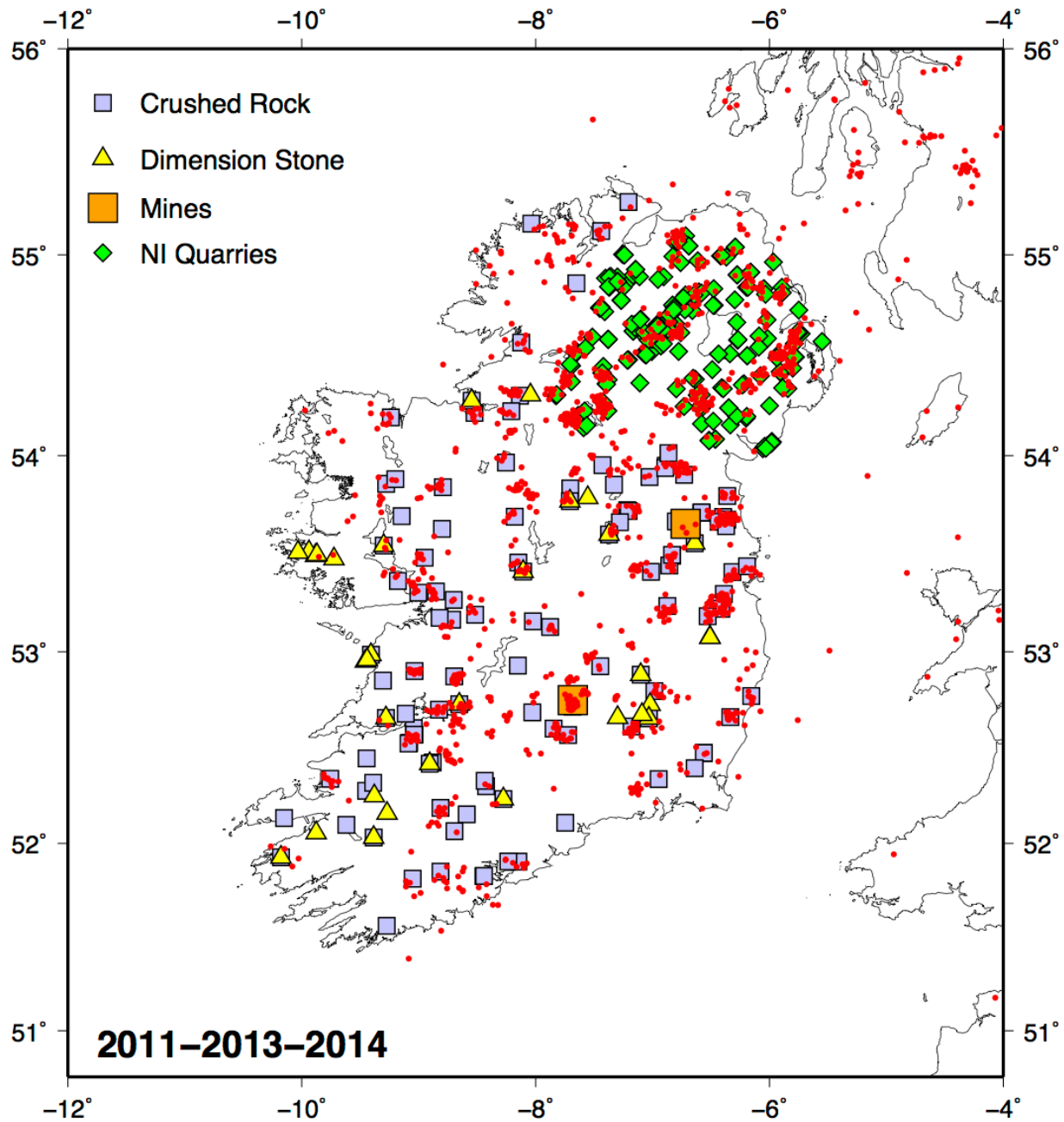


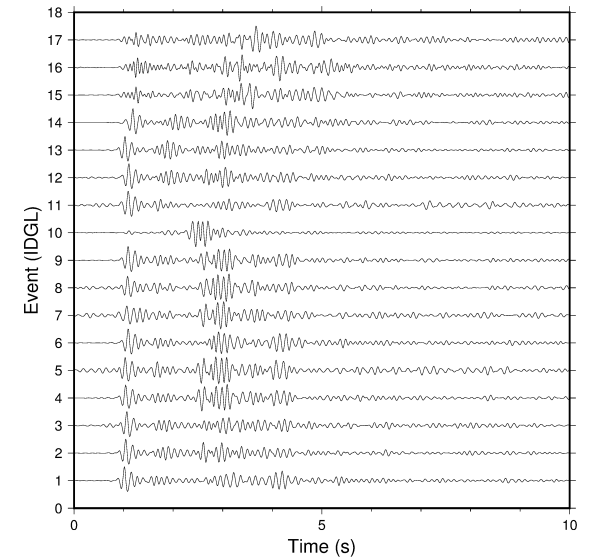
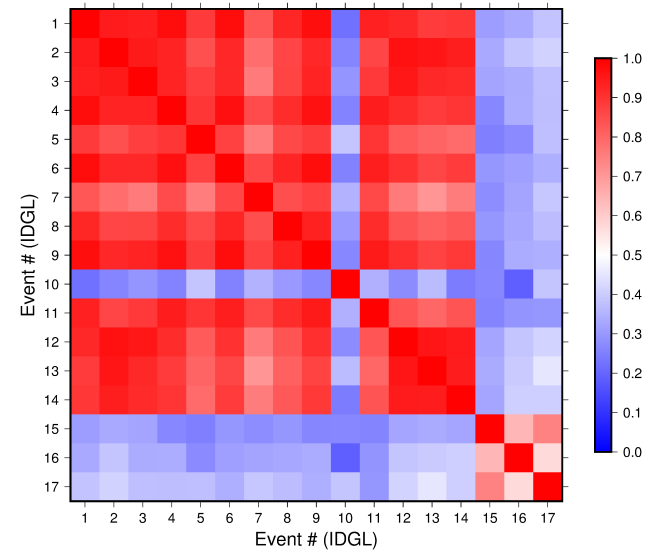
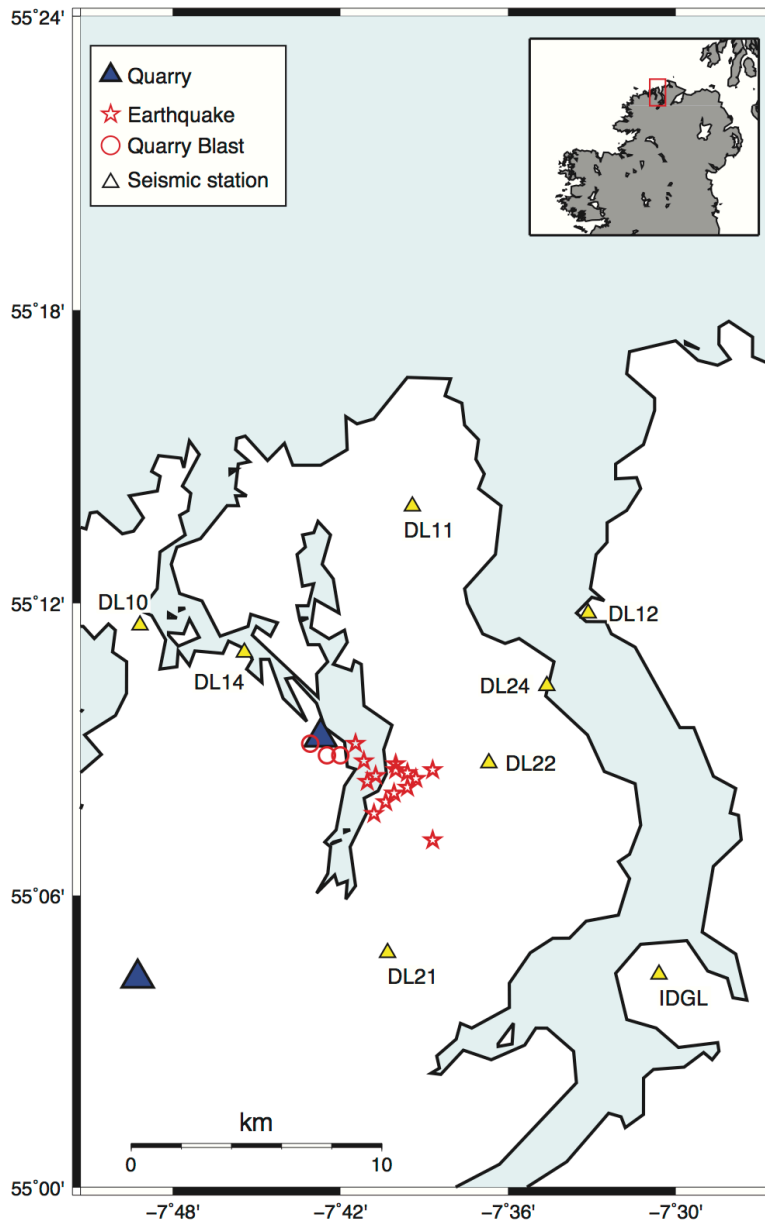
Time of occurrence



INSN detected seismic events (2013-2015) - Time of occurrence







Application to previously detected natural and man-made events in the region of Donegal