

## Seminario: Filtro Rápido de Coincidencias

### “Fast Matched Filter”

Posibles aplicaciones a microsismicidad

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Gracias a mis colegas:

P. Poli, L. Cabrera, D. Essing, A. Socquet, H. Tavera, E. Beaucé

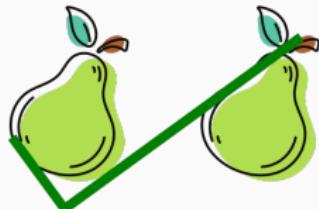
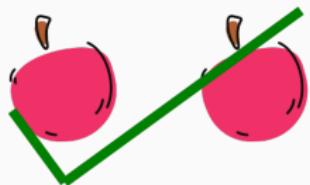
*Seminario en el IGP, LabEx OSUG Project EFASAP*

November 4, 2022

# Introducción

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Manzanas con manzanas  
y peras con peras



## Instalación

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# Creación de ambiente de trabajo "fmf\_tuto"

Activities Terminal ▾ nov. 4 11:59 •

```
sanchezh@ist-156-52: ~/Desktop/fmf
sanchezh@ist-156-52:~/Desktop/fmf$ conda create --name fmf_tuto --file FMF_tuto_Python_
packages.txt

Downloading and Extracting Packages
_libgcc_mutex-0.1      #####
ca-certificates-2019    #####
libgfortran-ng-7.3.0     #####
libstdcxx-ng-9.1.0       #####
pandoc-2.7.3            #####
libgcc-ng-9.1.0          #####
bzip2-1.0.8              #####
expat-2.2.5              #####
icu-64.2                 #####
jpeg-9c                  #####
libffi-3.2.1              #####
libiconv-1.15             #####
libopenblas-0.3.7         #####
libsodium-1.0.17          #####
libuuid-2.32.1            #####
ncurses-6.1                #####
openssl-1.1.1c            ##### 100%
sanchezh@ist-oar: /data/cycle/sanchezh
```

# Instalación de “ObsPy”

```
Activities Terminal ▾ nov. 4 12:01 · sanchezh@ist-156-52: ~/Desktop/fmf
sanchezh@ist-156-52: ~/Desktop/fmf$ conda activate fmf_tuto
(fmf_tuto) sanchezh@ist-156-52:~/Desktop/fmf$ pip install obspy
Collecting obspy
  Downloading https://files.pythonhosted.org/packages/4f/f8/cebf0acdfb8cd3a3c05937af73
212cf6f133b23357faced2951972cda83/obspy-1.3.1.tar.gz (16.9MB)
    |██████████| 16.9MB 5.0MB/s
Installing build dependencies ... done
Getting requirements to build wheel ... done
Installing backend dependencies ... done
Preparing wheel metadata ... done
Requirement already satisfied: requests in /home/sanchezh/anaconda3/envs/fmf_tuto/lib/p
ython3.7/site-packages (from obspy) (2.22.0)
Requirement already satisfied: sqlalchemy in /home/sanchezh/anaconda3/envs/fmf_tuto/lib/
/python3.7/site-packages (from obspy) (1.3.8)
Requirement already satisfied: lxml in /home/sanchezh/anaconda3/envs/fmf_tuto/lib/pytho
n3.7/site-packages (from obspy) (4.4.1)
Collecting matplotlib>=3.2.0 (from obspy)
  Downloading https://files.pythonhosted.org/packages/ad/62/7b662284352867a86acfb636761
ba351723fc3a235efd8397578d903413d/matplotlib-3.5.3-cp37-cp37m-manylinux_2_5_x86_64.many|
linux1 x86_64.whl (11.2MB)
    |██████████| 11.2MB 45.1MB/s
```

# Instalación de “ObsPy”

```
Activities Terminal ▾ nov. 4 12:01 • sanchezh@ist-156-52: ~/Desktop/fmf
sanchezh@ist-156-52: ~/Desktop/fmf          sanchezh@ist-oar: /data/cycle/sanchezh
Building wheels for collected packages: obspy
  Building wheel for obspy (PEP 517) ... done
    Created wheel for obspy: filename=obspy-1.3.1-cp37-cp37m-linux_x86_64.whl size=143776
72 sha256=92505f1e114853948b376b61c116181abb3b4552f2105b4eaf41e06e7dae4a99
    Stored in directory: /home/sanchezh/.cache/pip/wheels/ff/8f/e6/3e3aae47f0ea9ad1b70ecbae8a0fbfb6489e57c1bc1f467f9ff
Successfully built obspy
Building wheels for collected packages: pillow
  Building wheel for pillow (setup.py) ... done
    Created wheel for pillow: filename=Pillow-9.3.0-cp37-cp37m-linux_x86_64.whl size=1504
116 sha256=c53addc3e022195d936f9c71fc8267b036f89aff78794bc5feb7b6f68d25a9b9a
    Stored in directory: /home/sanchezh/.cache/pip/wheels/55/5a/ad/9f708fd6d1500e9ff680e1
7b1c2f436e8439477a5a226611c6
Successfully built pillow
Installing collected packages: pillow, fonttools, packaging, matplotlib, obspy
  Found existing installation: matplotlib 3.1.1
    Uninstalling matplotlib-3.1.1:
      Successfully uninstalled matplotlib-3.1.1
Successfully installed fonttools-4.38.0 matplotlib-3.5.3 obspy-1.3.1 packaging-21.3 pil
low-9.3.0
(fmf_tuto) sanchezh@ist-156-52:~/Desktop/fmf$
```

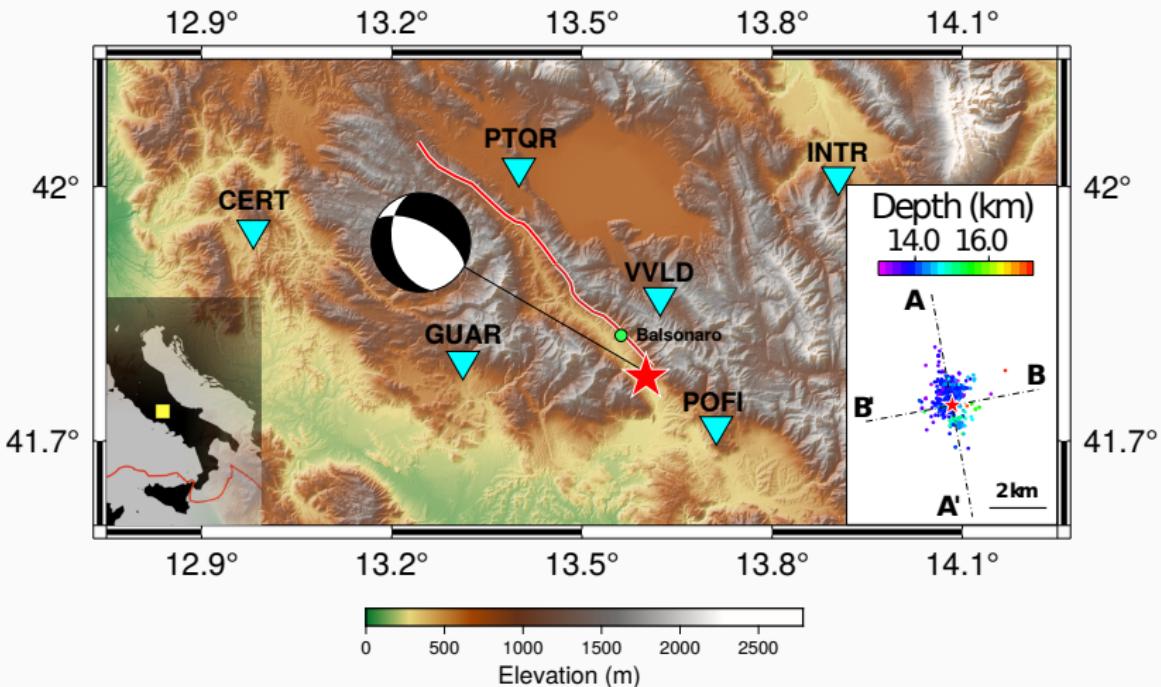
# Abrir "jupyter notebook"

```
Activities Terminal ▾ nov. 4 12:02 •
sanchezh@ist-156-52: ~/Desktop/fmf/tutorial
sanchezh@ist-156-52: ~/Desktop/fmf/tutorial  sanchezh@ist-oar: /data/cycle/sanchezh
Building wheel for obspy (PEP 517) ... done
Created wheel for obspy: filename=obspy-1.3.1-cp37-cp37m-linux_x86_64.whl size=143776
72 sha256=92505f1e114853948b376b61c116181abb3b4552f2105b4eaf41e06e7dae4a99
Stored in directory: /home/sanchezh/.cache/pip/wheels/ff/8f/e6/3e3aae47f0ea9ad1b70ecb
ae8a0fbfb6489e57c1bc1f467f9ff
Successfully built obspy
Building wheels for collected packages: pillow
Building wheel for pillow (setup.py) ... done
Created wheel for pillow: filename=Pillow-9.3.0-cp37-cp37m-linux_x86_64.whl size=1504
116 sha256=c53addc3e022195d936f9c71fc8267b036f89af78794bc5feb7b6f68d25a9b9a
Stored in directory: /home/sanchezh/.cache/pip/wheels/55/5a/ad/9f708fd6d1500e9ff680e1
7b1c2f436e8439477a5a226611c6
Successfully built pillow
Installing collected packages: pillow, fonttools, packaging, matplotlib, obspy
  Found existing installation: matplotlib 3.1.1
  Uninstalling matplotlib-3.1.1:
    Successfully uninstalled matplotlib-3.1.1
Successfully installed fonttools-4.38.0 matplotlib-3.5.3 obspy-1.3.1 packaging-21.3 pillow-9.3.0
(fmf_tuto) sanchezh@ist-156-52:~/Desktop/fmf$ cd tutorial/
(fmf_tuto) sanchezh@ist-156-52:~/Desktop/fmf/tutorial$ jupyter notebook
```

## Ejemplo

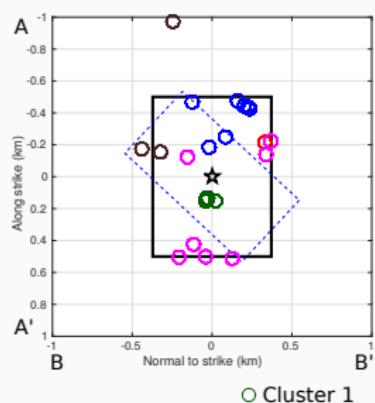
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Secuencia sísmica del sismo 2019 Mw4 Balsorano, Italia

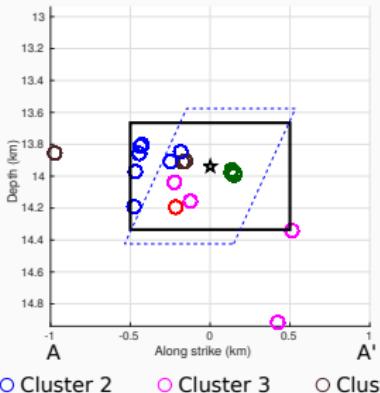


# Secuencia sísmica del sismo 2019 Mw4 Balsorano, Italia

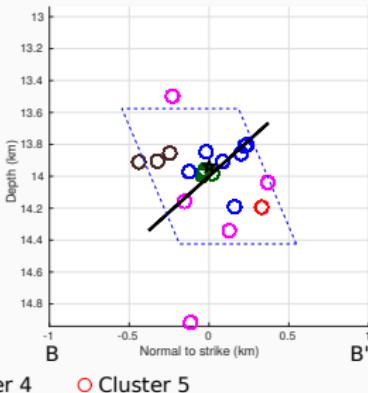
**Map view**



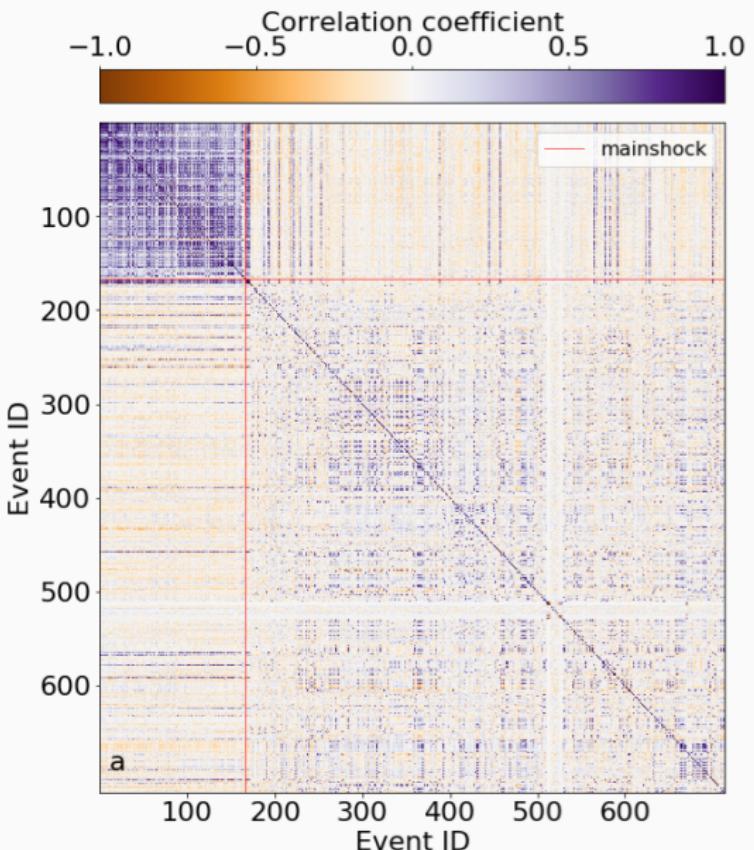
**Along strike vs depth cross section**



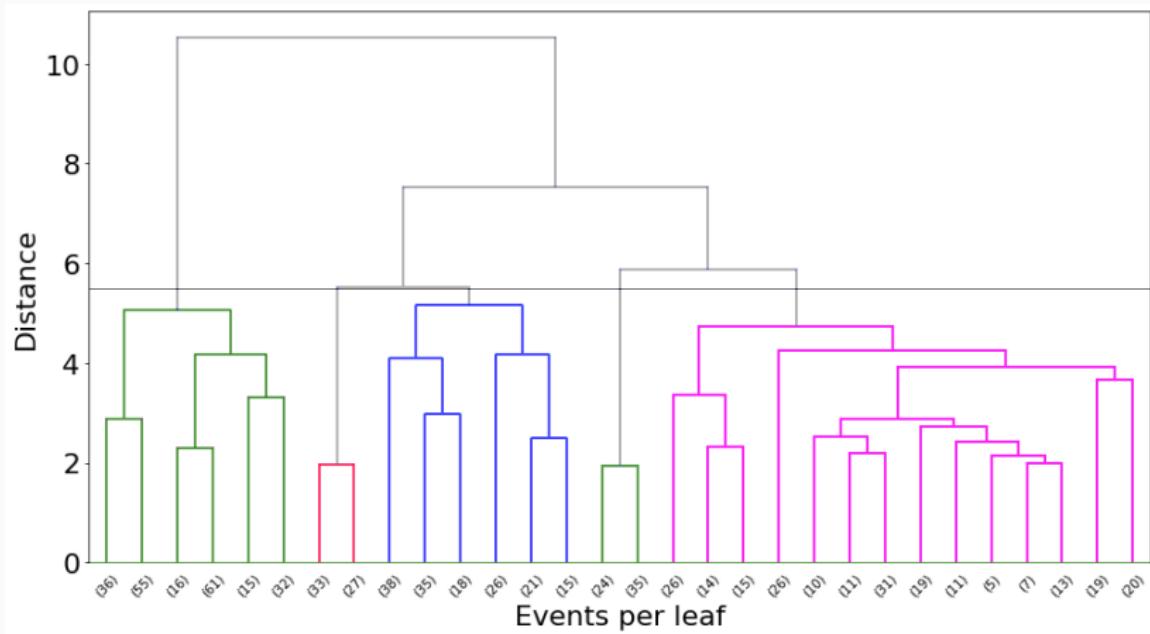
**Normal to strike vs depth cross section**



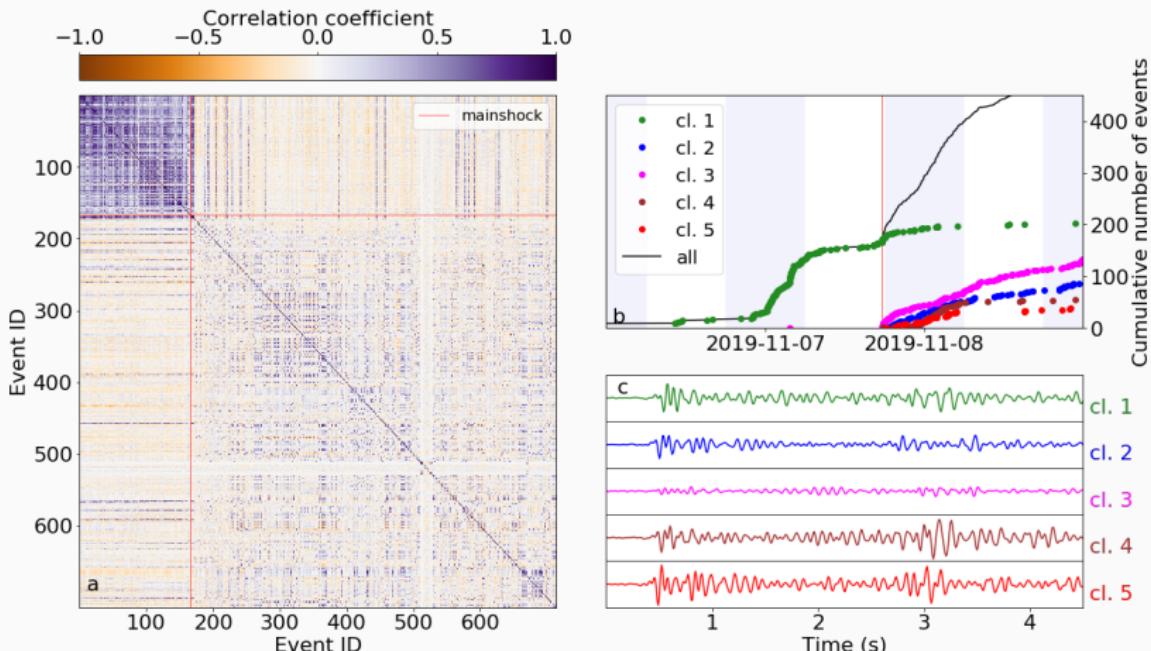
# Secuencia sísmica del sismo 2019 Mw4 Balsorano, Italia



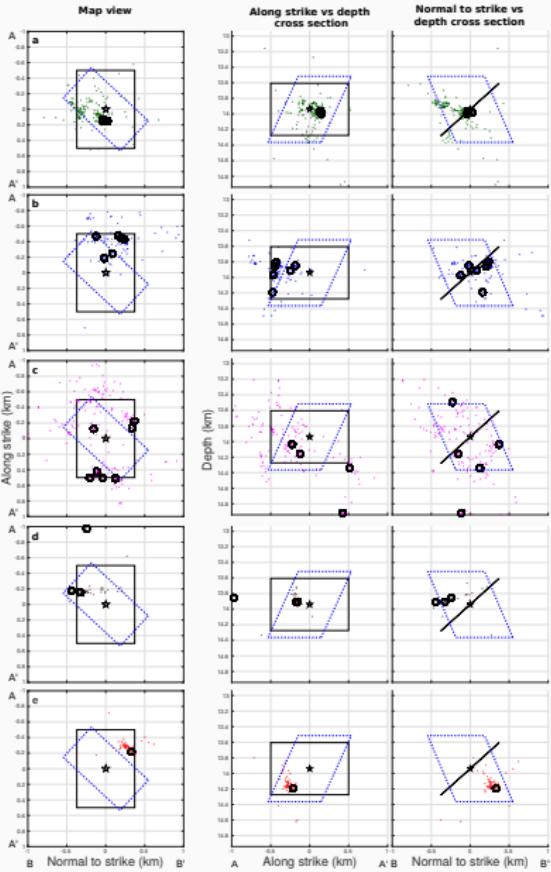
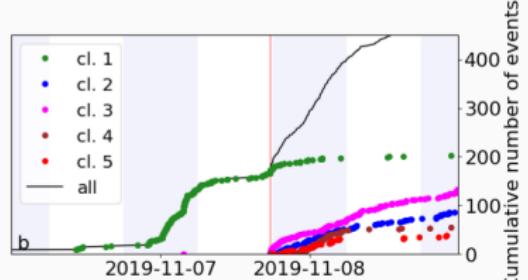
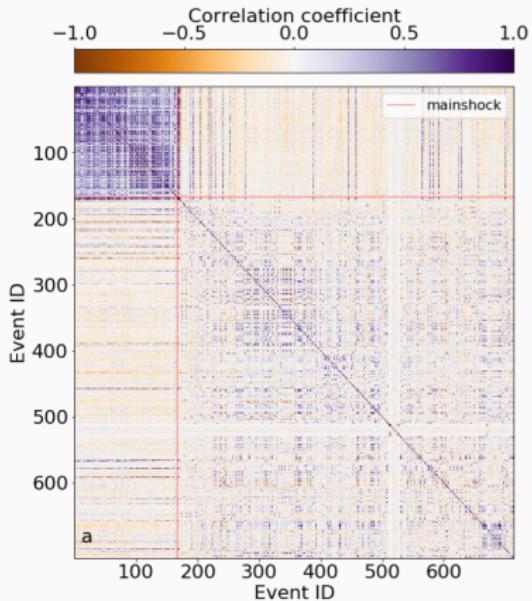
Secuencia sísmica del sismo 2019 Mw4 Balsorano, Italia



# Secuencia sísmica del sismo 2019 Mw4 Balsorano, Italia



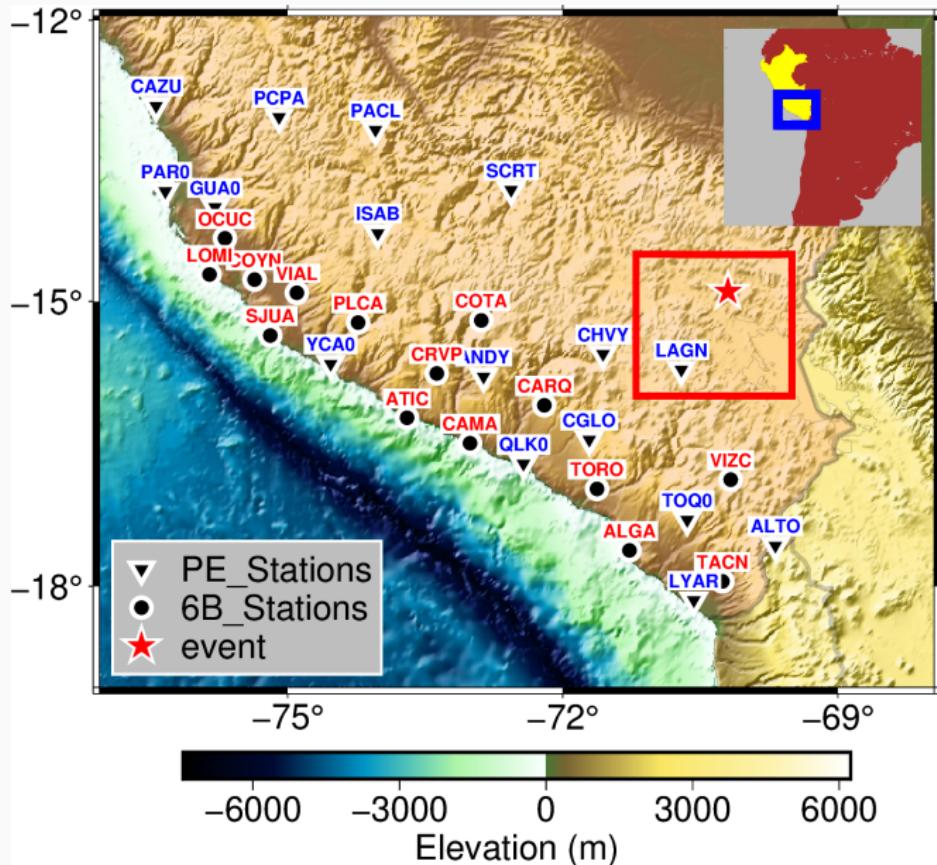
# Secuencia sísmica del sismo 2019 Mw4 Balsorano, Italia



## Ejercicio

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# Evento sísmico del 26 de Mayo del 2022, Mw7.2



2022-05-26T12:02:23.000000Z CHVY

