

Temporal seismic velocity variations prior and during the 7.8 and 7.5 MW earthquakes occurred in south-central Turkey implementing ambient noise interferometry

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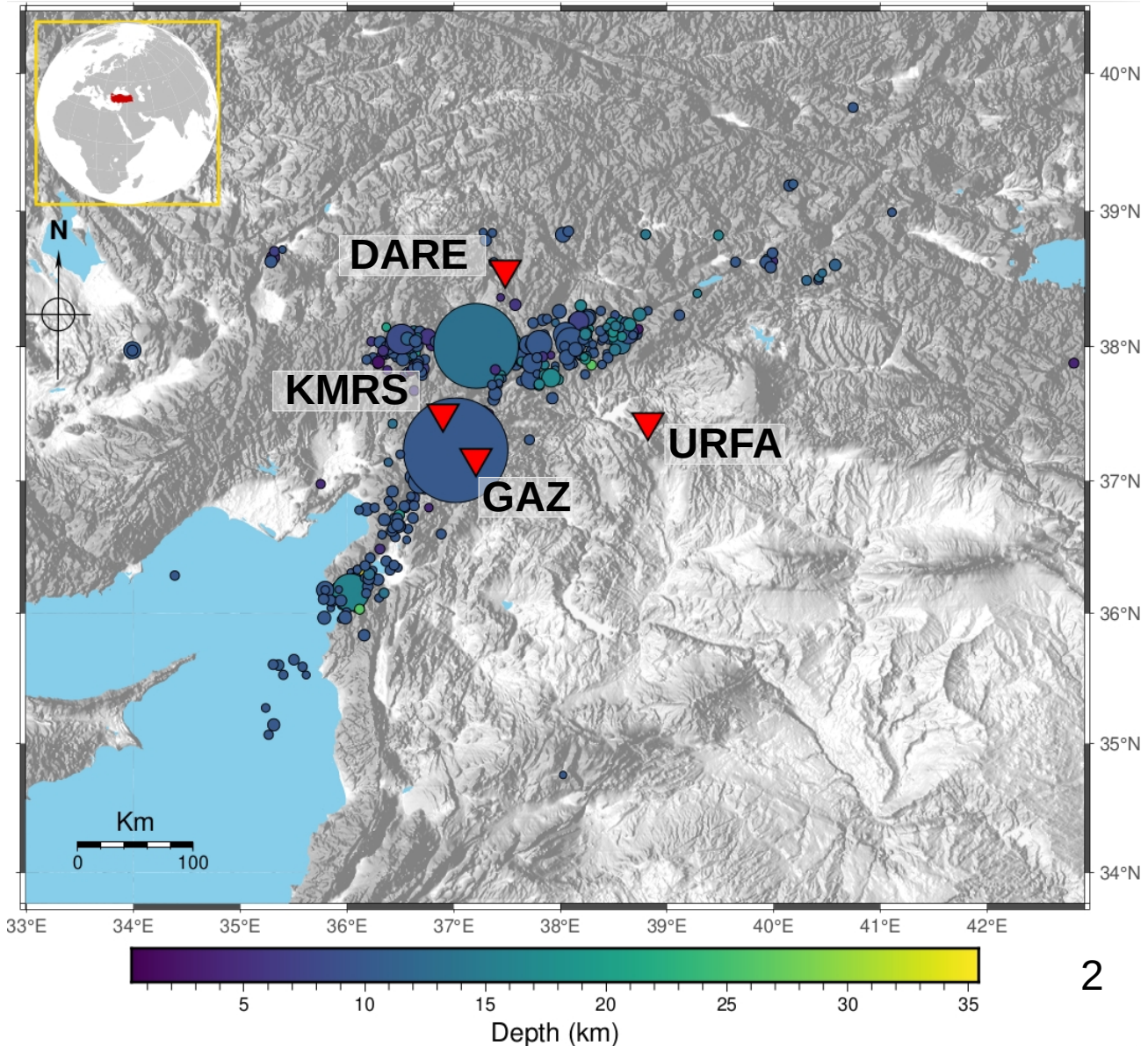


Available
broad-band
stations.

Data source:
Kandilli Observatory and
Earthquake Research
Institute of Turkey

Earthquakes > 4.0 Mw

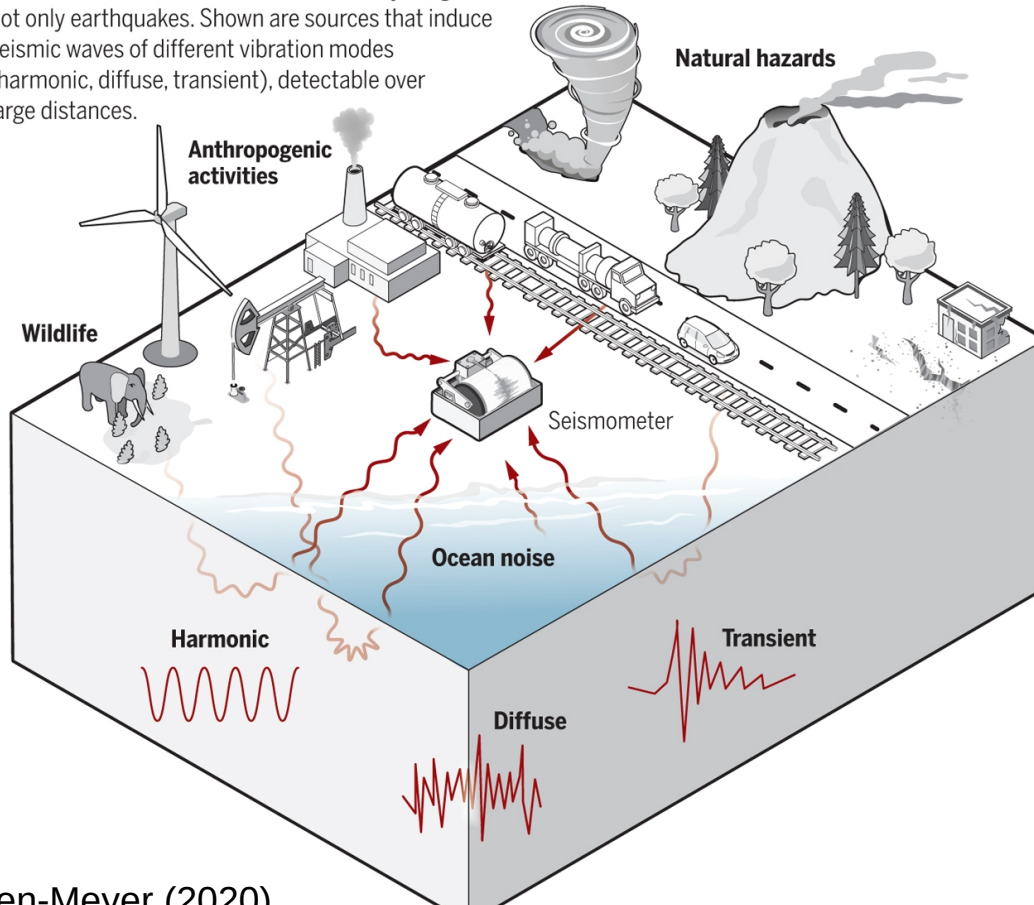
Events from 01-02-2023
to 31-03-2023



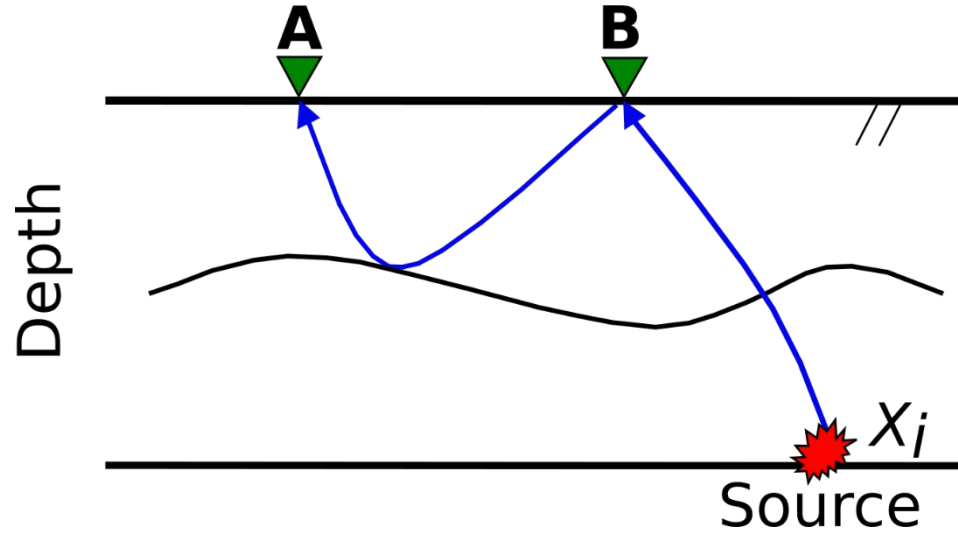
Noise ?

Humans and nature excite seismic waves

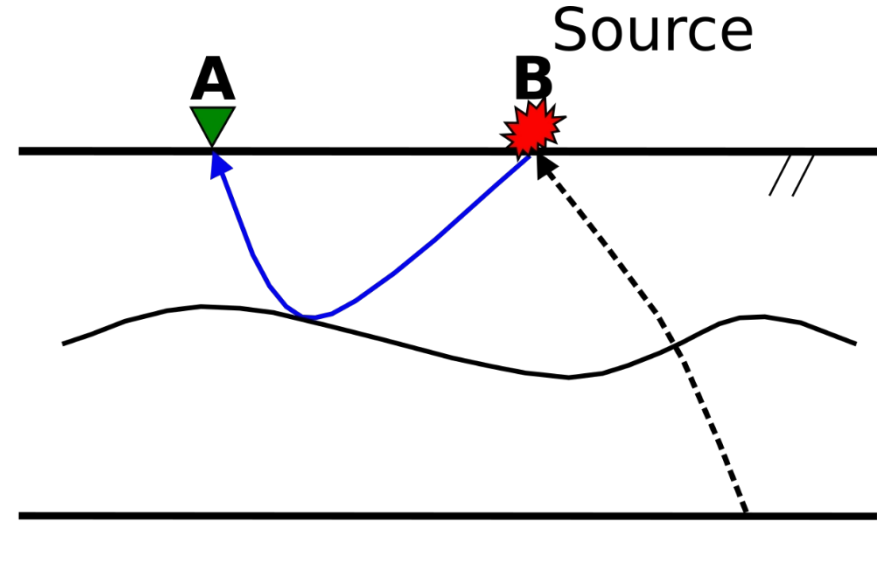
Seismometers record vibrations from everything, not only earthquakes. Shown are sources that induce seismic waves of different vibration modes (harmonic, diffuse, transient), detectable over large distances.



Seismic interferometry



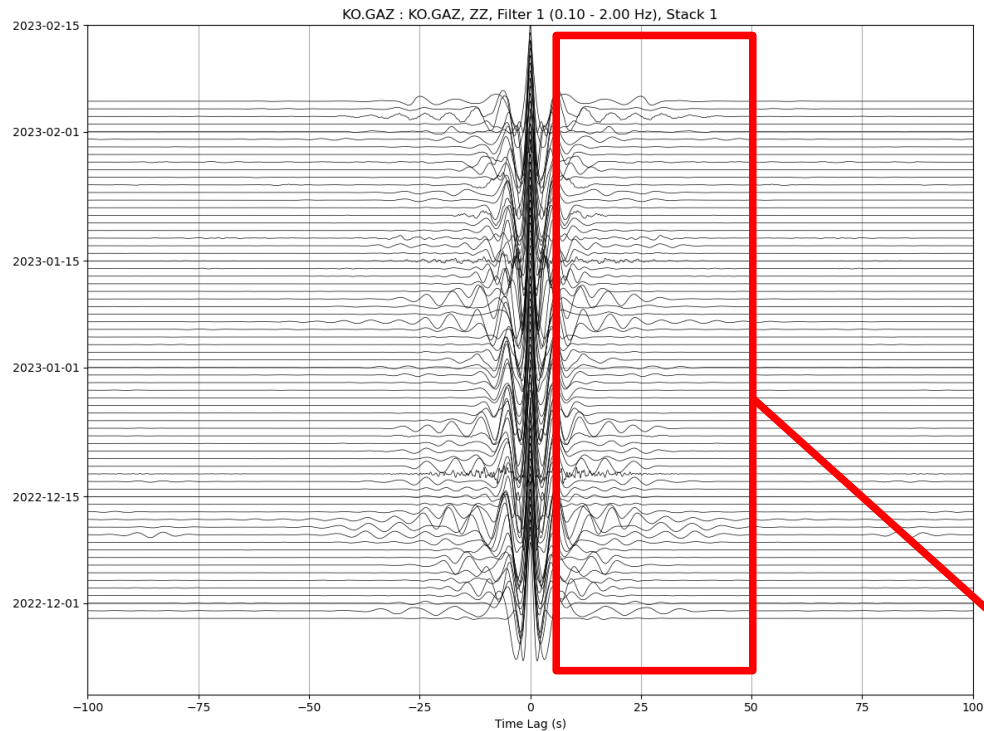
CC of seismic noise is analogue to the GF



Modified after Matzuoka et al. (2006)

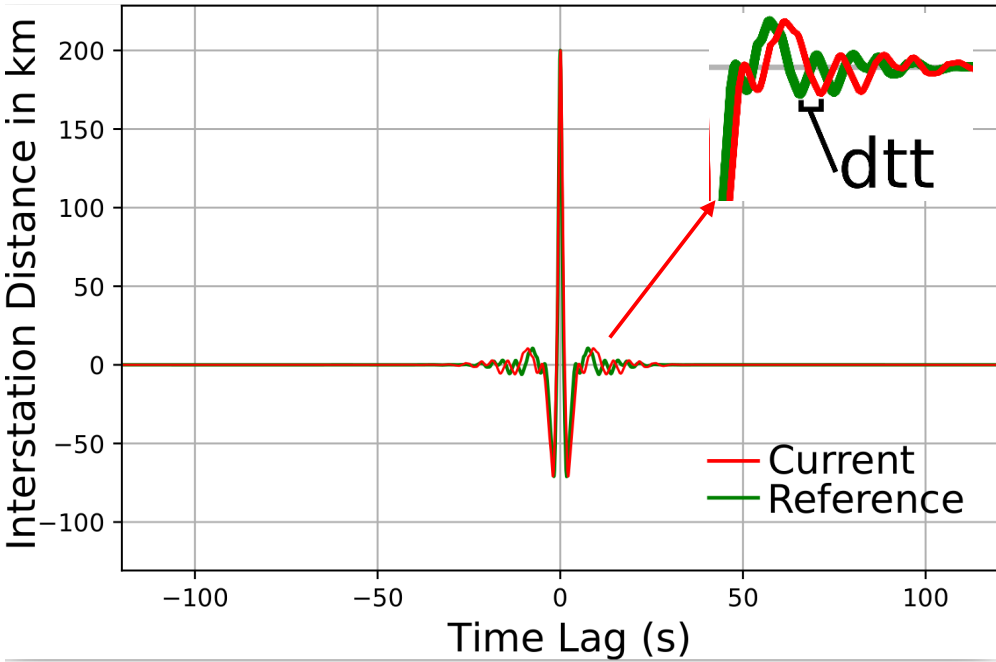
Why coda?

Sensitive to small changes of the velocity structure



Coda of the Green function

Workflow

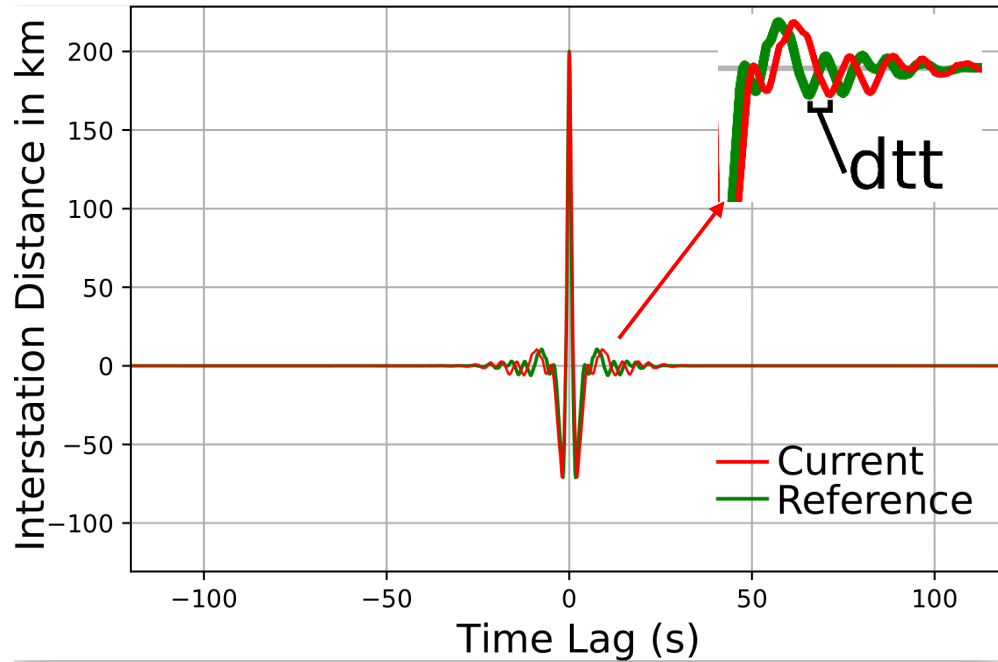


Coda of the Green function

dv/v Workflow

Implementing the code MsNoise. Lecocq et al. (2014)

Preprocessing

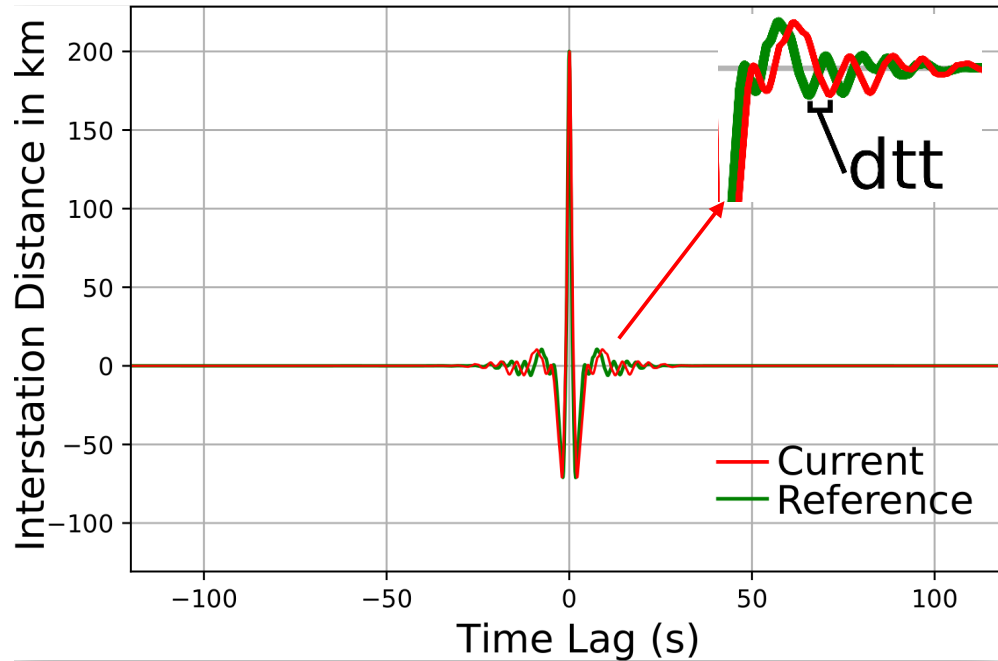


dv/v Workflow

Implementing the code MsNoise. Lecocq et al. (2014)

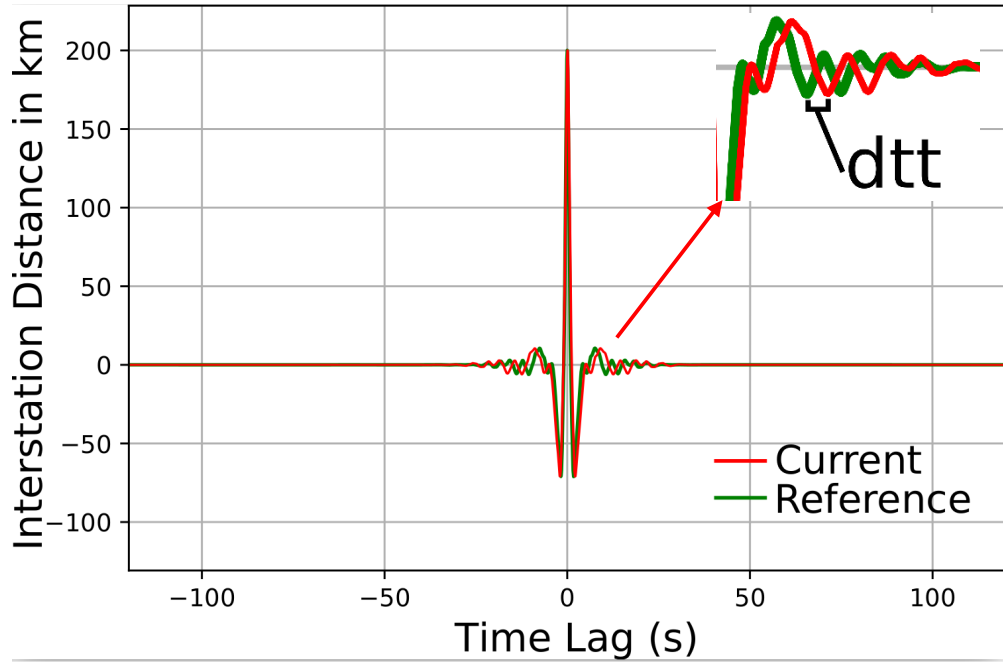
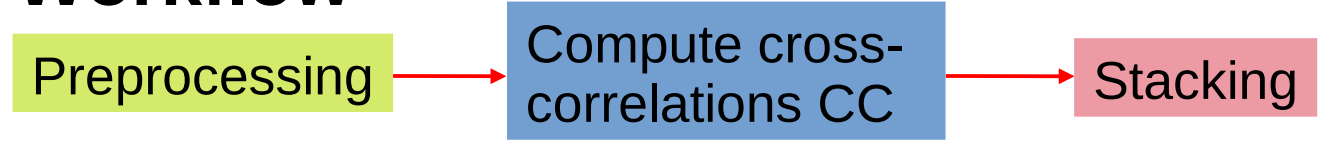
Preprocessing

Compute cross-correlations CC



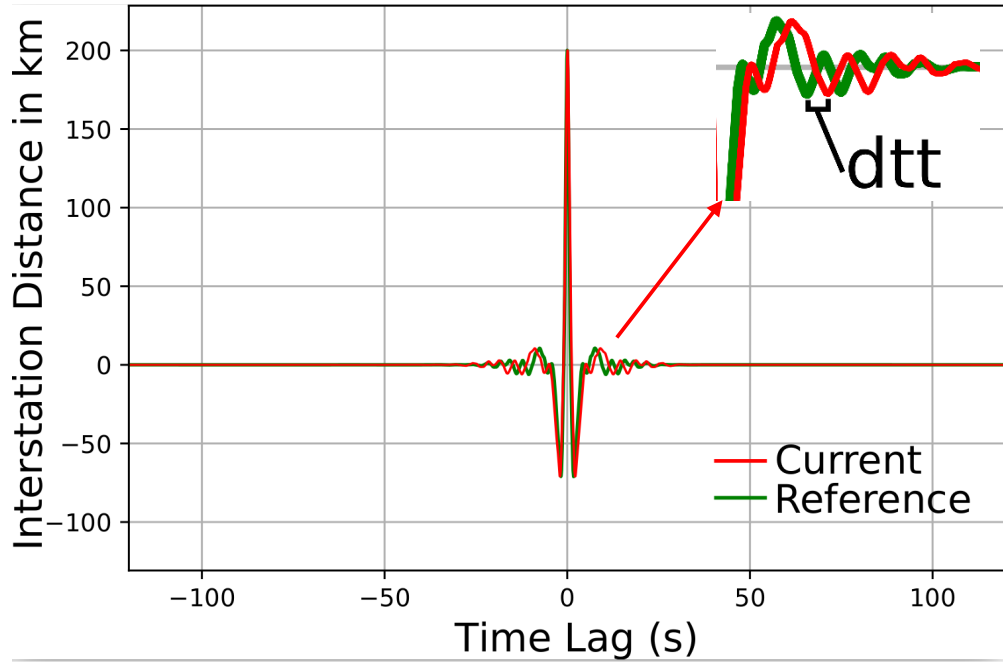
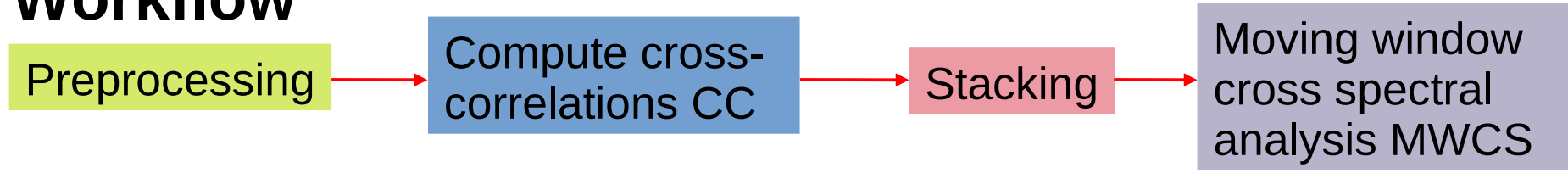
dv/v Workflow

Implementing the code MsNoise. Lecocq et al. (2014)



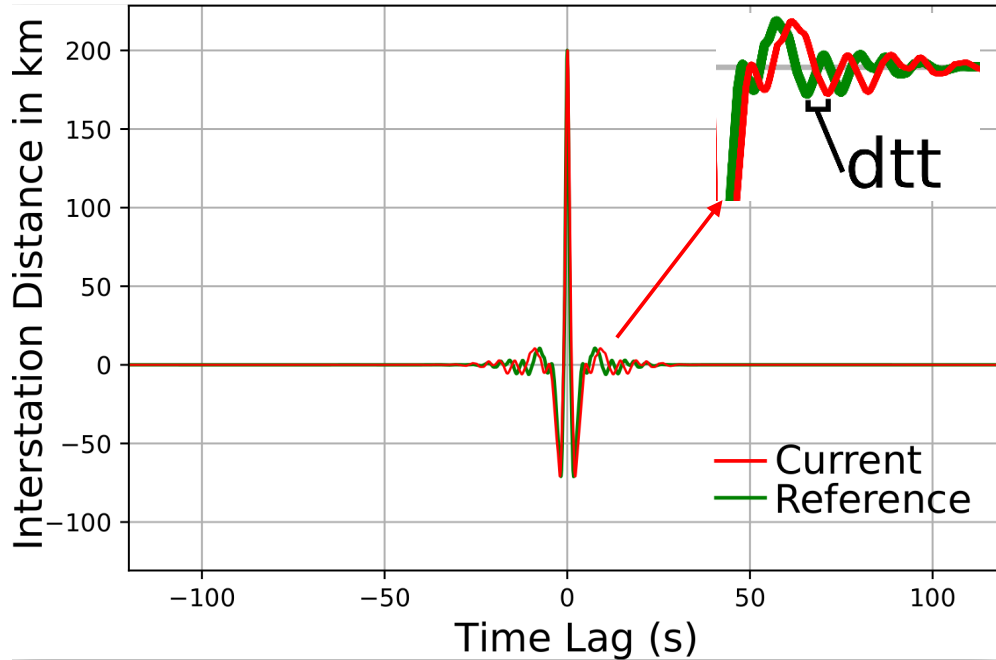
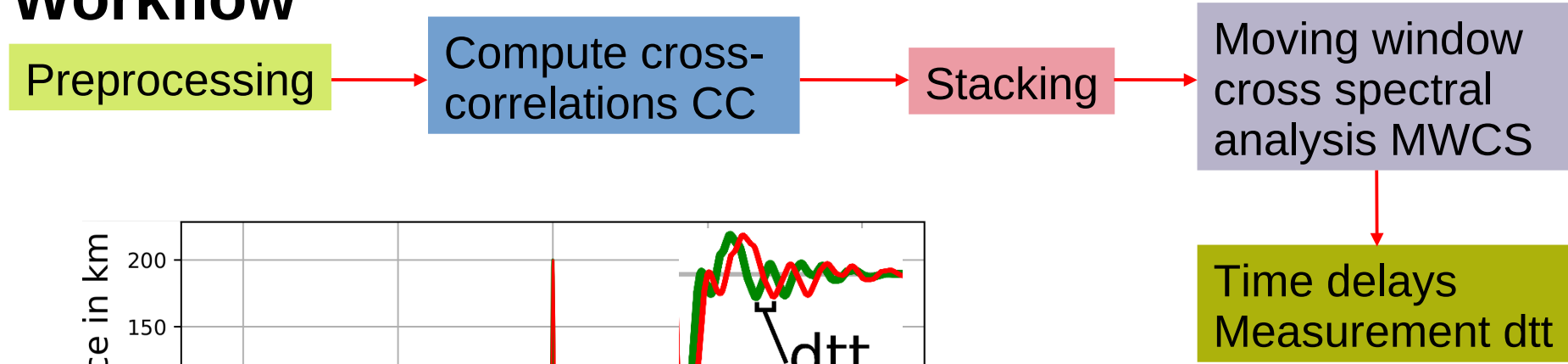
dv/v Workflow

Implementing the code MsNoise. Lecocq et al. (2014)



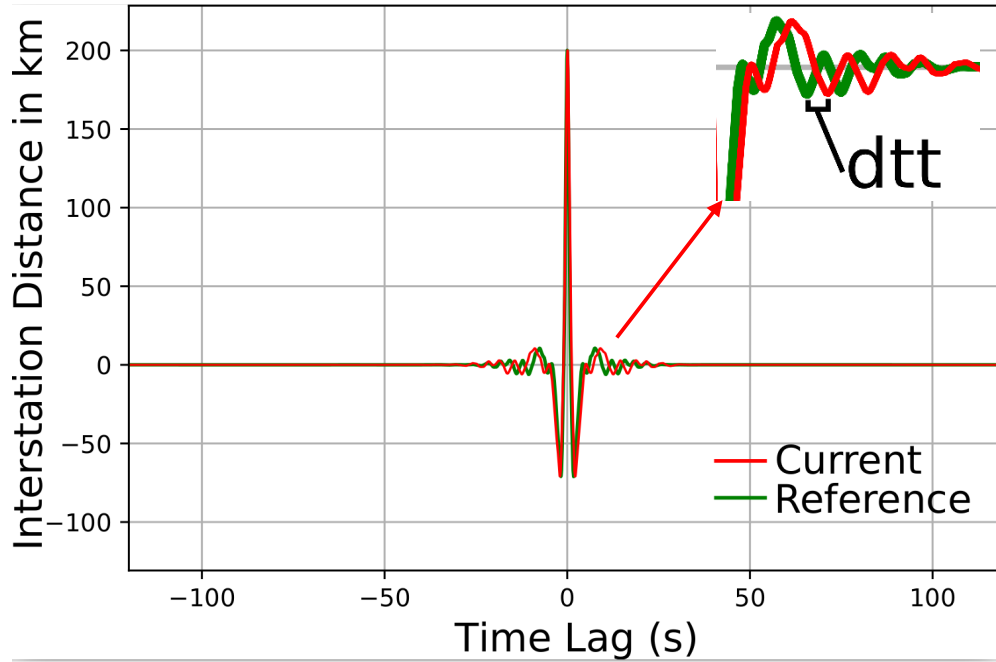
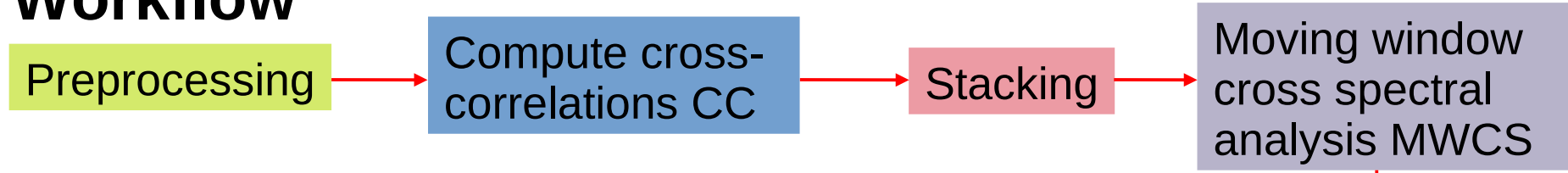
dv/v Workflow

Implementing the code MsNoise. Lecocq et al. (2014)



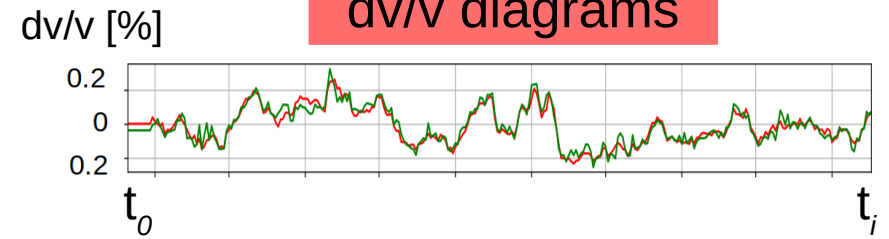
dv/v Workflow

Implementing the code MsNoise. Lecocq et al. (2014)



Time delays
Measurement d_{tt}

dv/v diagrams



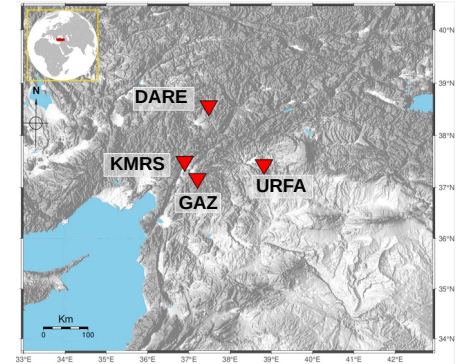
I) ALL DATA-SET
Cross-correlation
of vertical channels

II) Auto-correlations
3 components
EN, EZ, NZ, ZZ

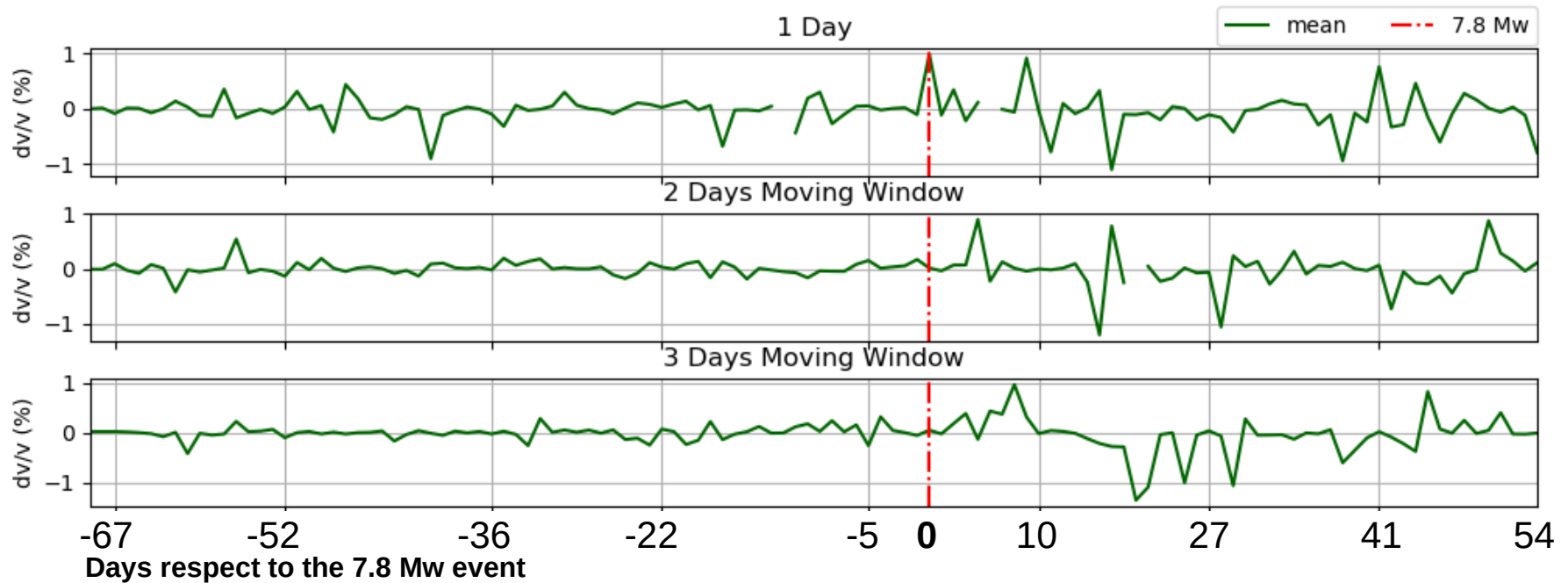
I) ALL DATA-SET

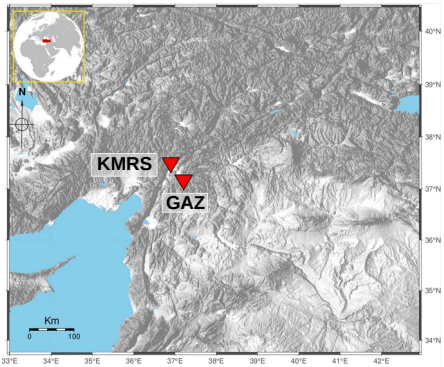
Cross-correlation of vertical channels

dv/v %
from 2022-11-29
to 2023-03-28

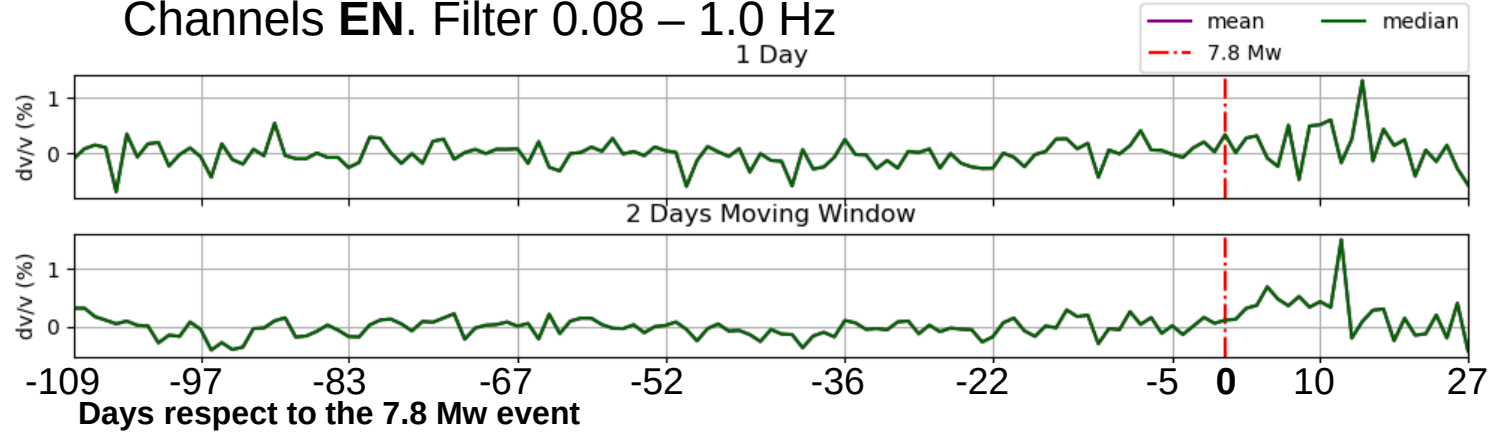


Channels ZZ. Filter 0.40 – 0.60 Hz



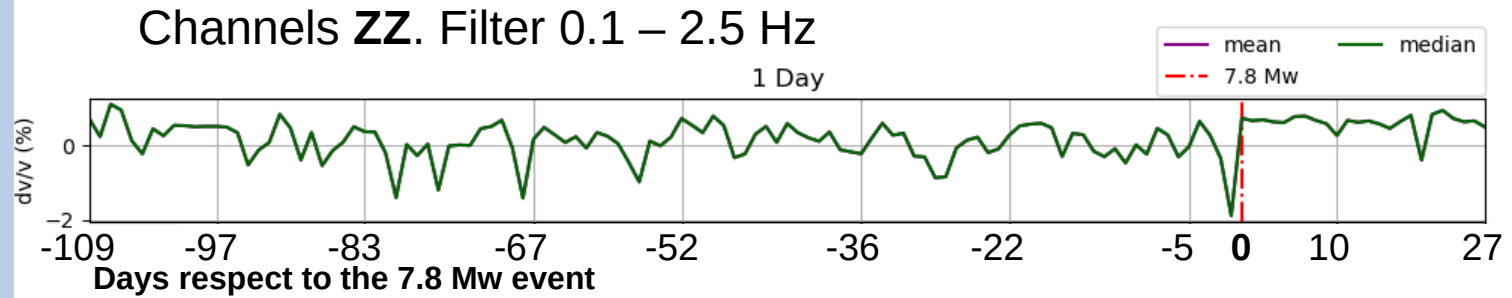
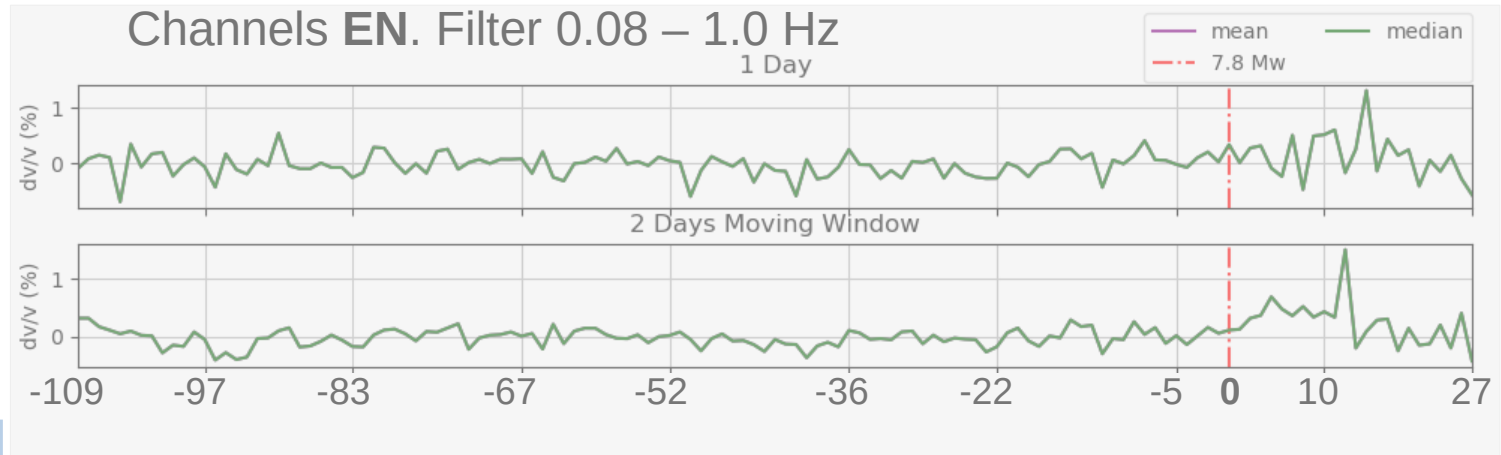
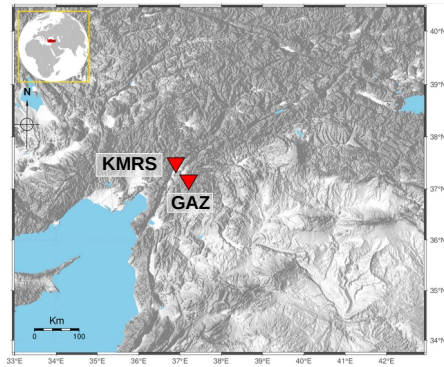


Channels EN. Filter 0.08 – 1.0 Hz 1 Day



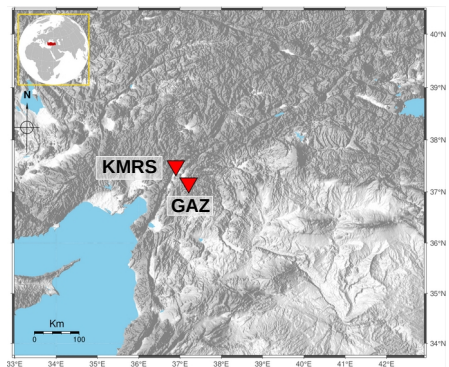
II) Auto-correlations Inter-channels of the stations GAZ and KMRS

dv/v
from 2022-10-20
to 2023-02-28



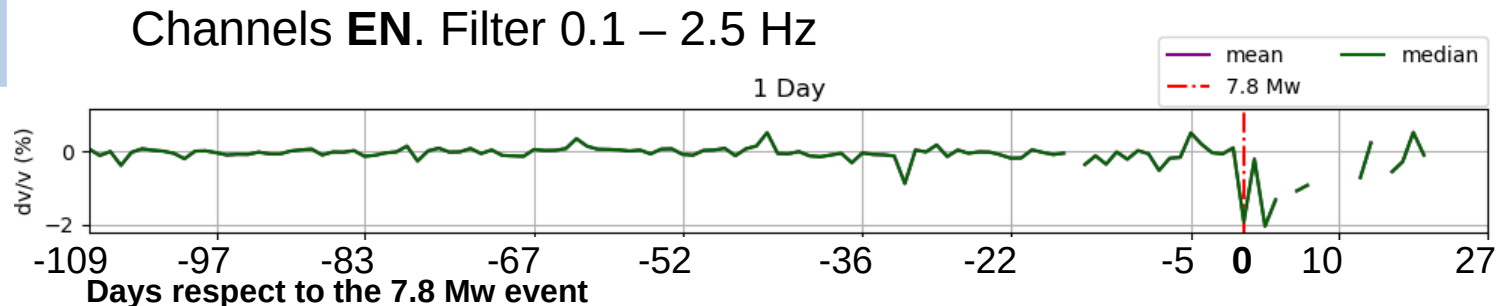
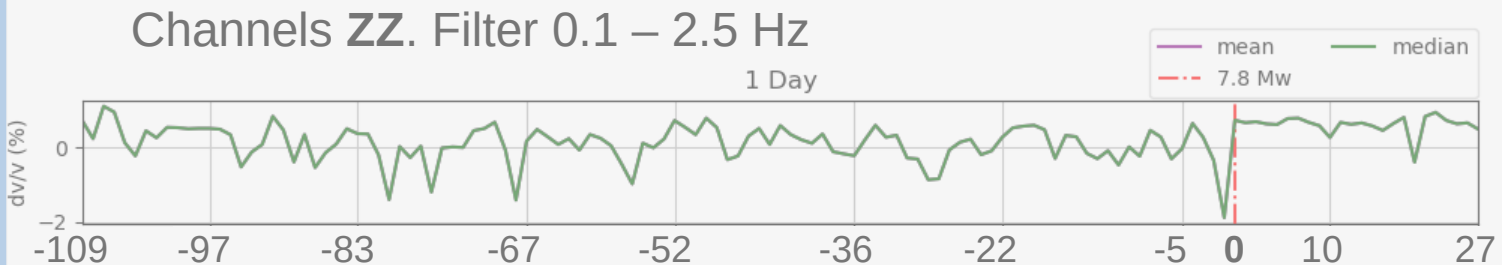
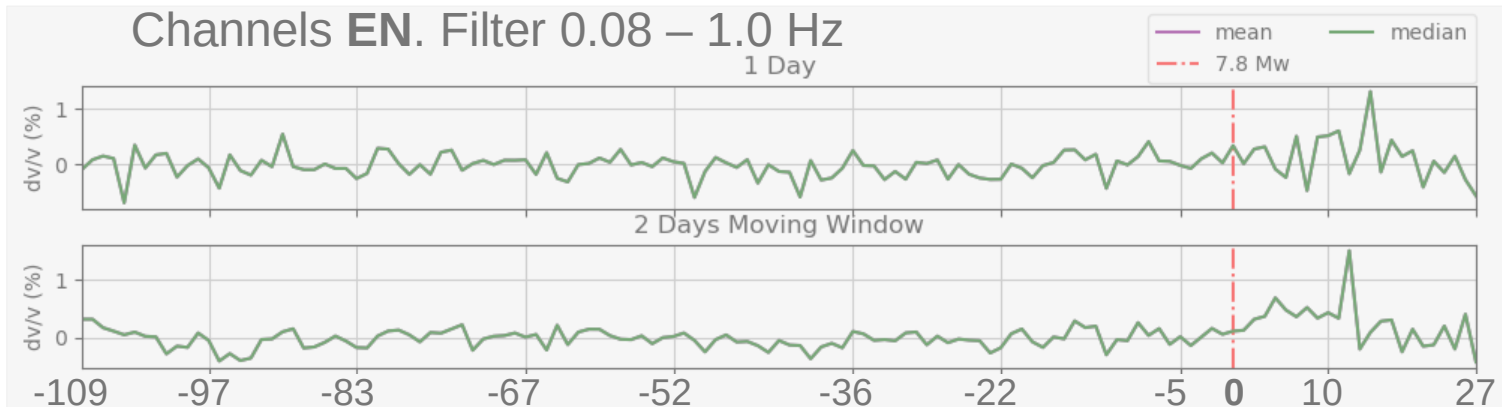
II) Auto-correlations Inter-channels of the stations GAZ and KMRS

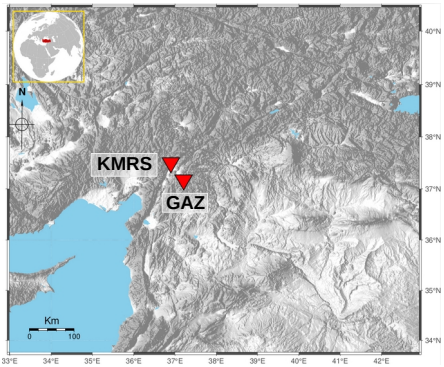
dv/v
from 2022-10-20
to 2023-02-28



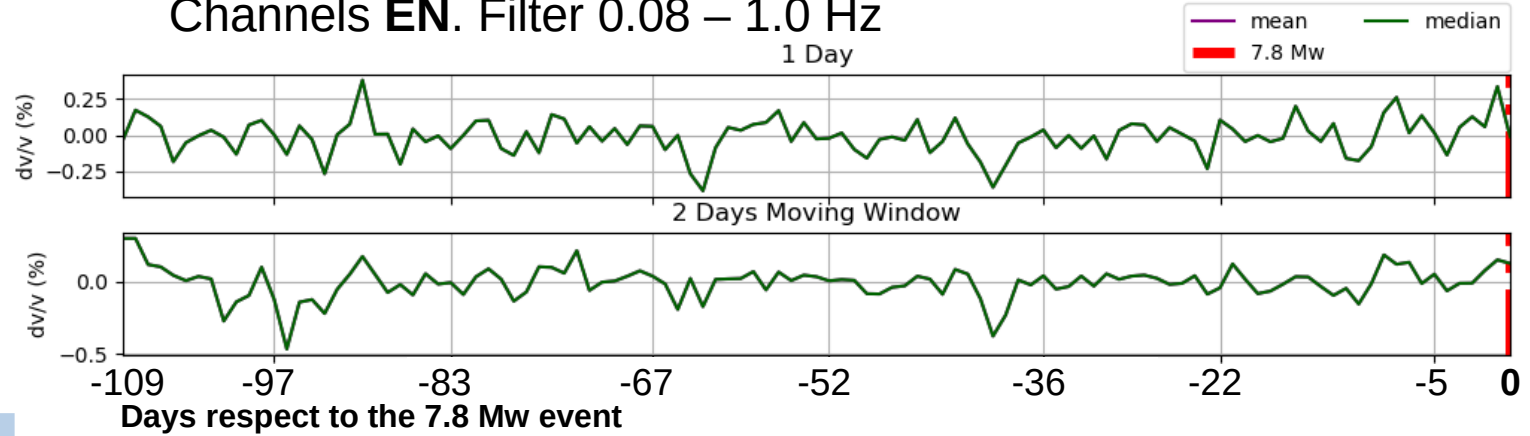
II) Auto-correlations Inter-channels of the stations GAZ and KMRS

dv/v
from 2022-10-20
to 2023-02-28





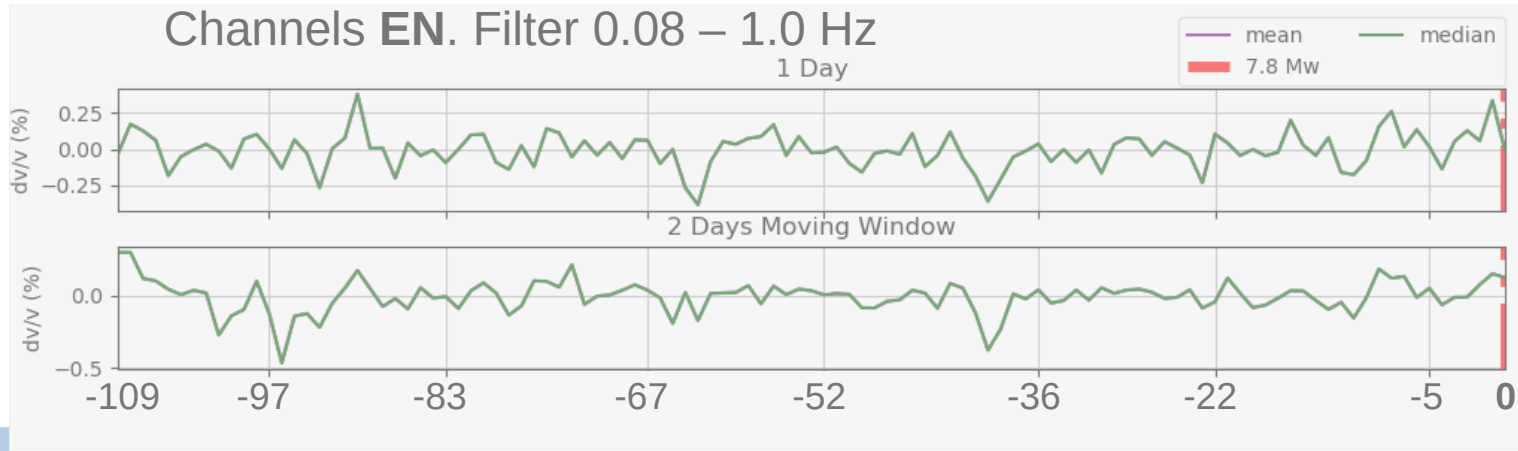
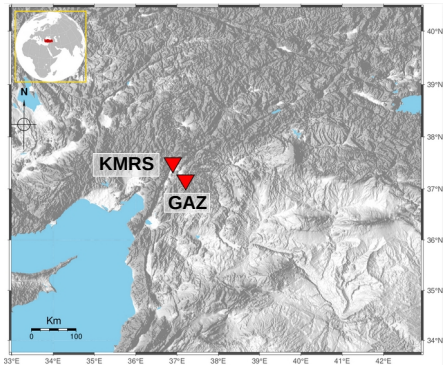
Channels EN. Filter 0.08 – 1.0 Hz



II) Auto-correlations Inter-channels of the stations GAZ and KMRs

dv/v
from 2022-10-20
To 2023-02-06

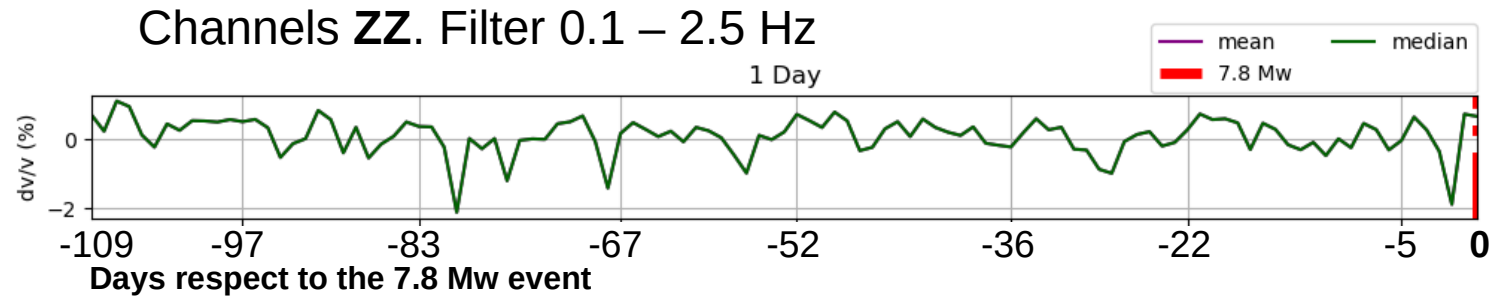
47 minutes before
the 7.8 Mw

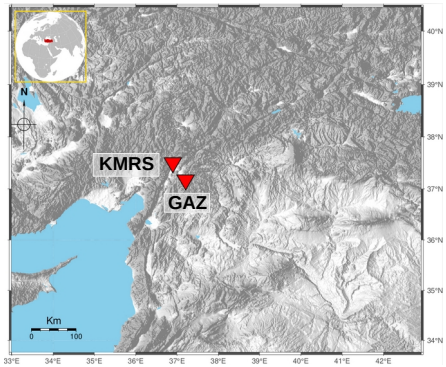


II) Auto-correlations Inter-channels of the stations GAZ and KMRS

dv/v
from 2022-10-20
To 2023-02-06

47 minutes before
the 7.8 Mw

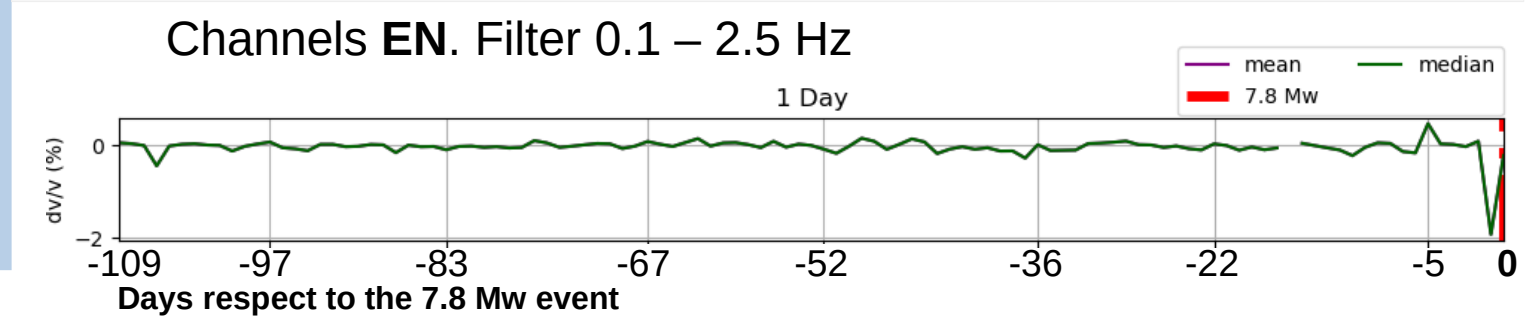
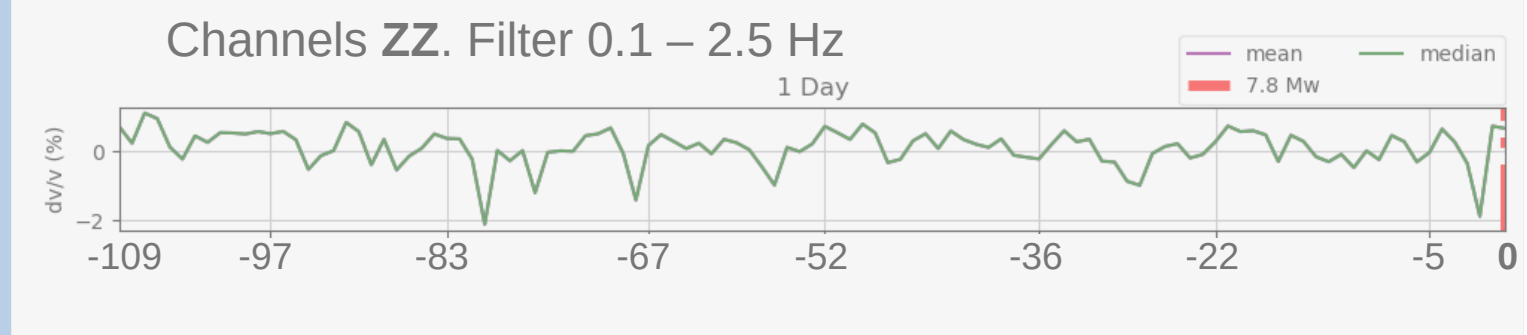
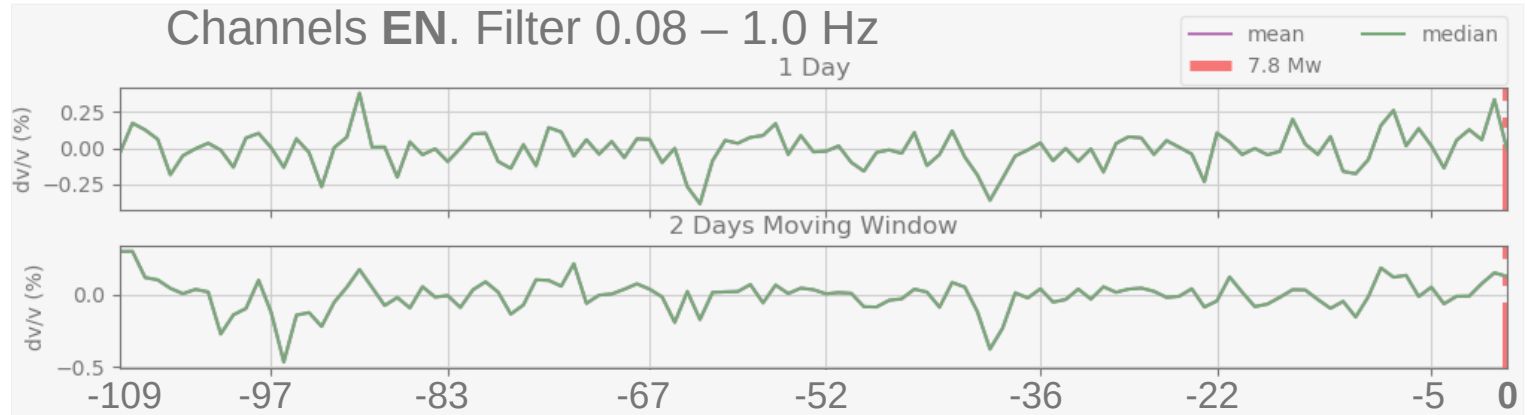




II) Auto-correlations Inter-channels of the stations GAZ and KMRS

dv/v
from 2022-10-20
To 2023-02-06

47 minutes before
the 7.8 Mw



Remarks

Pre-seismic signals are still ambiguous

Open questions

Do the **filters** give us information about the **depth** where the **earthquakes** are **nucleating**?

Why a **pre-earthquake drop** and subsequent quasi-constant **dv/v** is only visible on the **vertical components**?

Remarks

Seismic velocity variations may obey to a combination of phenomena happening in the upper crust.

Rock fracturing
Fluid flow
Fracture healing

Change of effective stress and rock properties

Conclusion

Analysing the changes in seismic velocity dv/v over time would possibly give hints about **co-seismic and post-seismic changes into the Earth's velocity structure**.

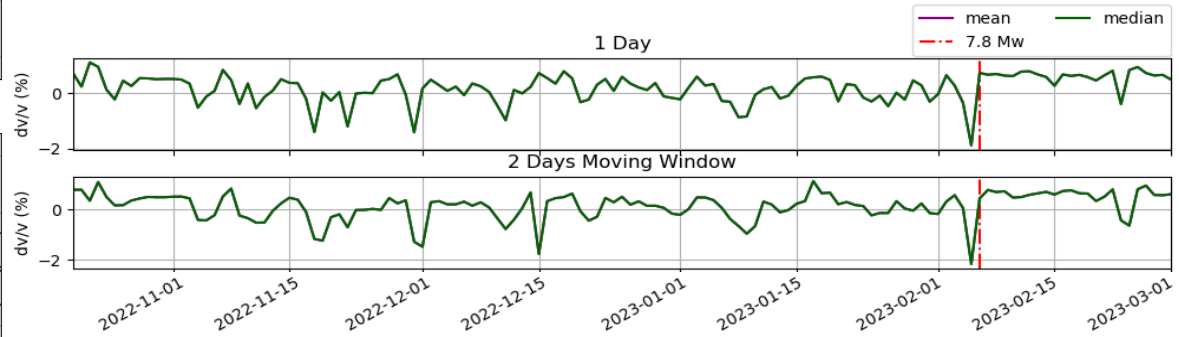
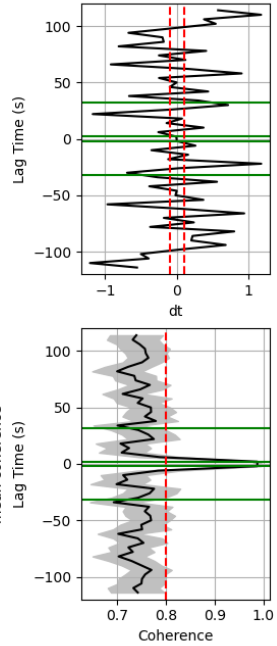
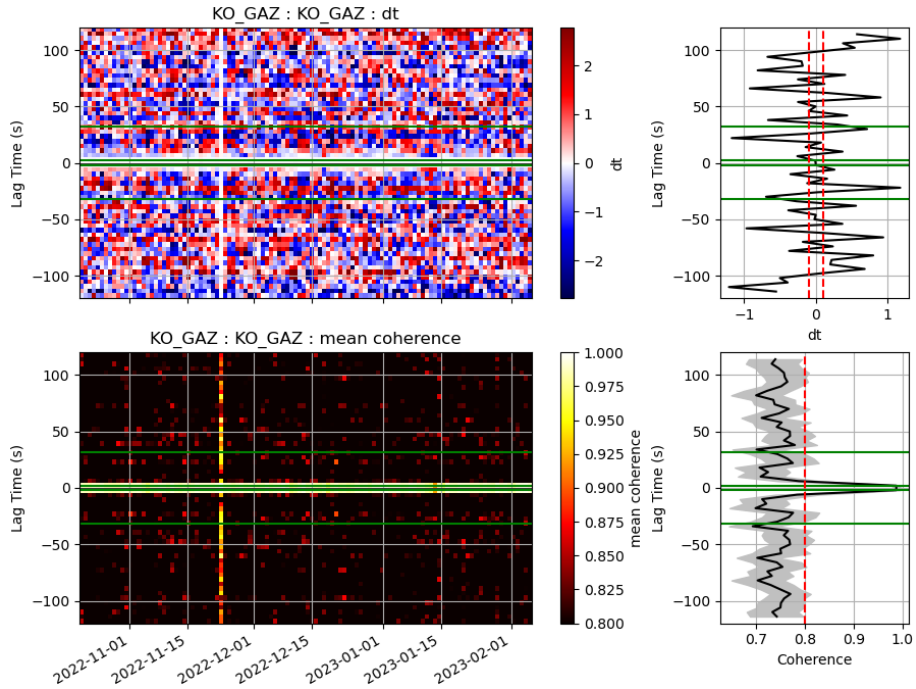
We propose to **implement ambient noise interferometry** as a complementary tool for ground motion **monitoring**.



Thank you!



Channels ZZ. Filter 0.1 – 2.5 Hz



Possible drop in dv/v % at the end of November 2022 due to a drop of network coherence

dv/v and PGV, PGA of the EAFZ EQ, and EQ > 7 Mw worldwide from 20-10-2022 to 01-03-2023

