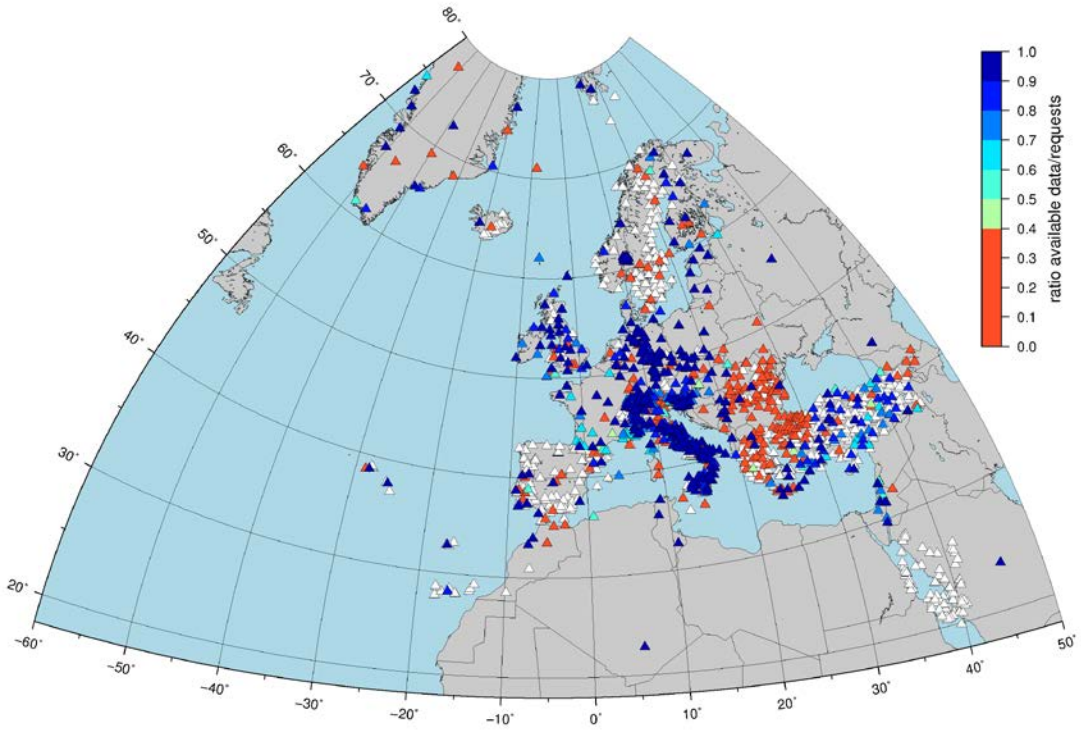
ADVANCES IN DATA QUALITY ASSESSMENT



Ciências ULisboa

INSTITUTO DOM LUIZ

Susana Custódio (IDL/Univ. Lisbon), Thomas Meier (Univ. Kiel)

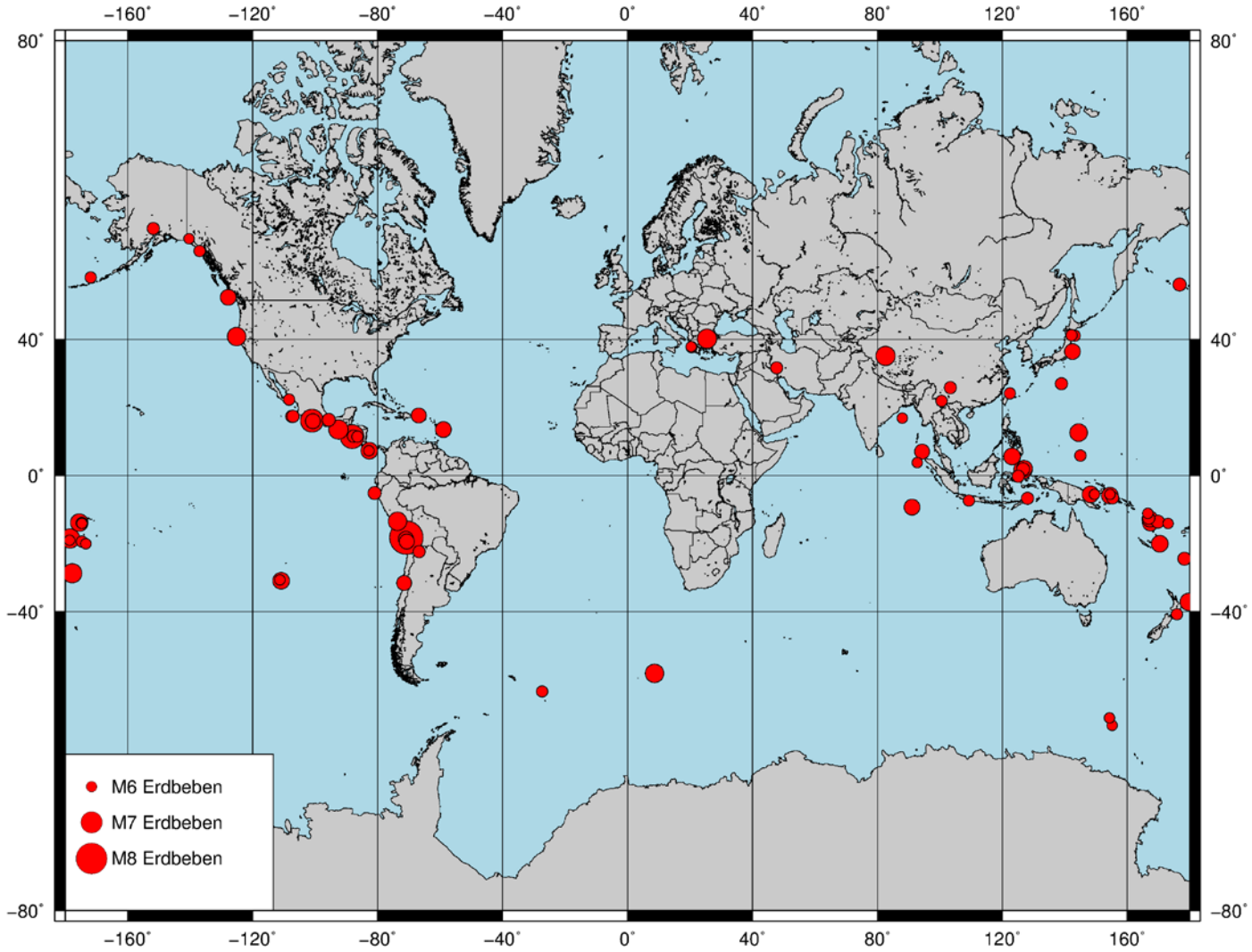
susana@fc.ul.pt

Orfeus, Sept/2015

Data Availability

Check of data availability:

- Permanent stations
- Availability of data for about 80 events in 2014 (teleseismic distances)
- Download of Z component, various channels from Orfeus-EIDA and IRIS

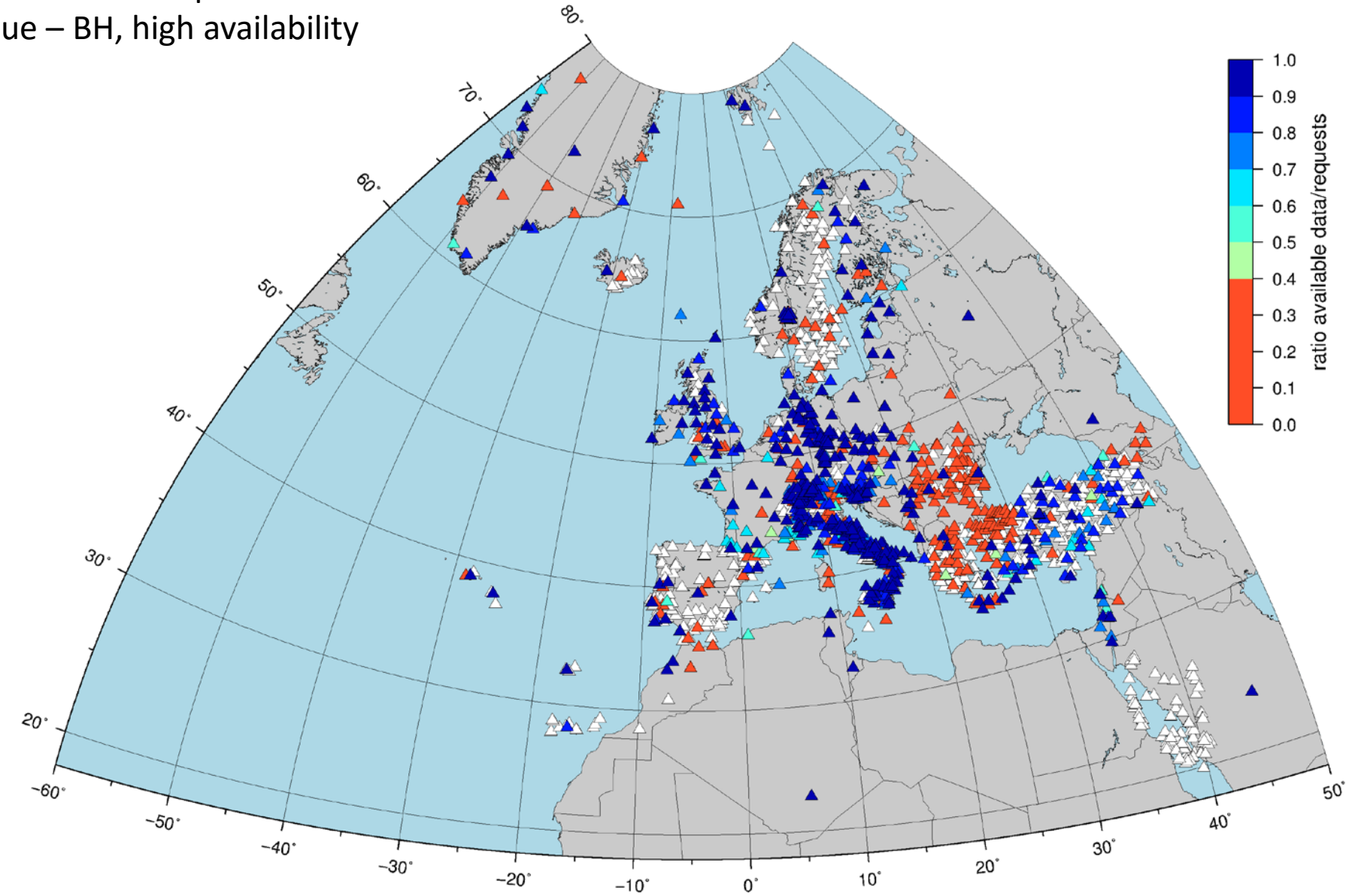


L. Cristiano, S. Mader

Data availability in 2014:

White – VBB reported to EPOS

Blue – BH, high availability

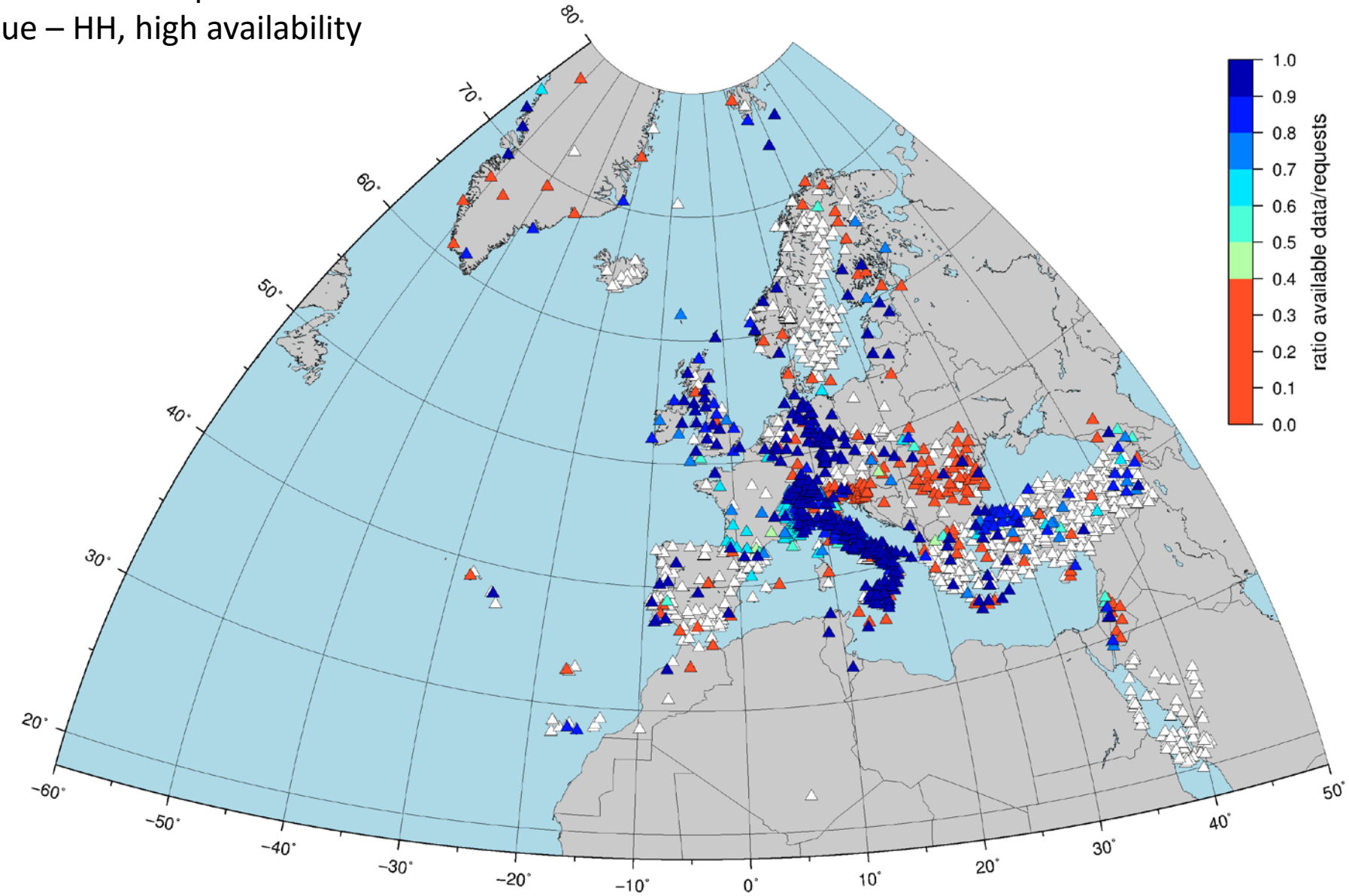


L. Cristiano, S. Mader

Data availability in 2014:

White – VBB reported to EPOS

Blue – HH, high availability

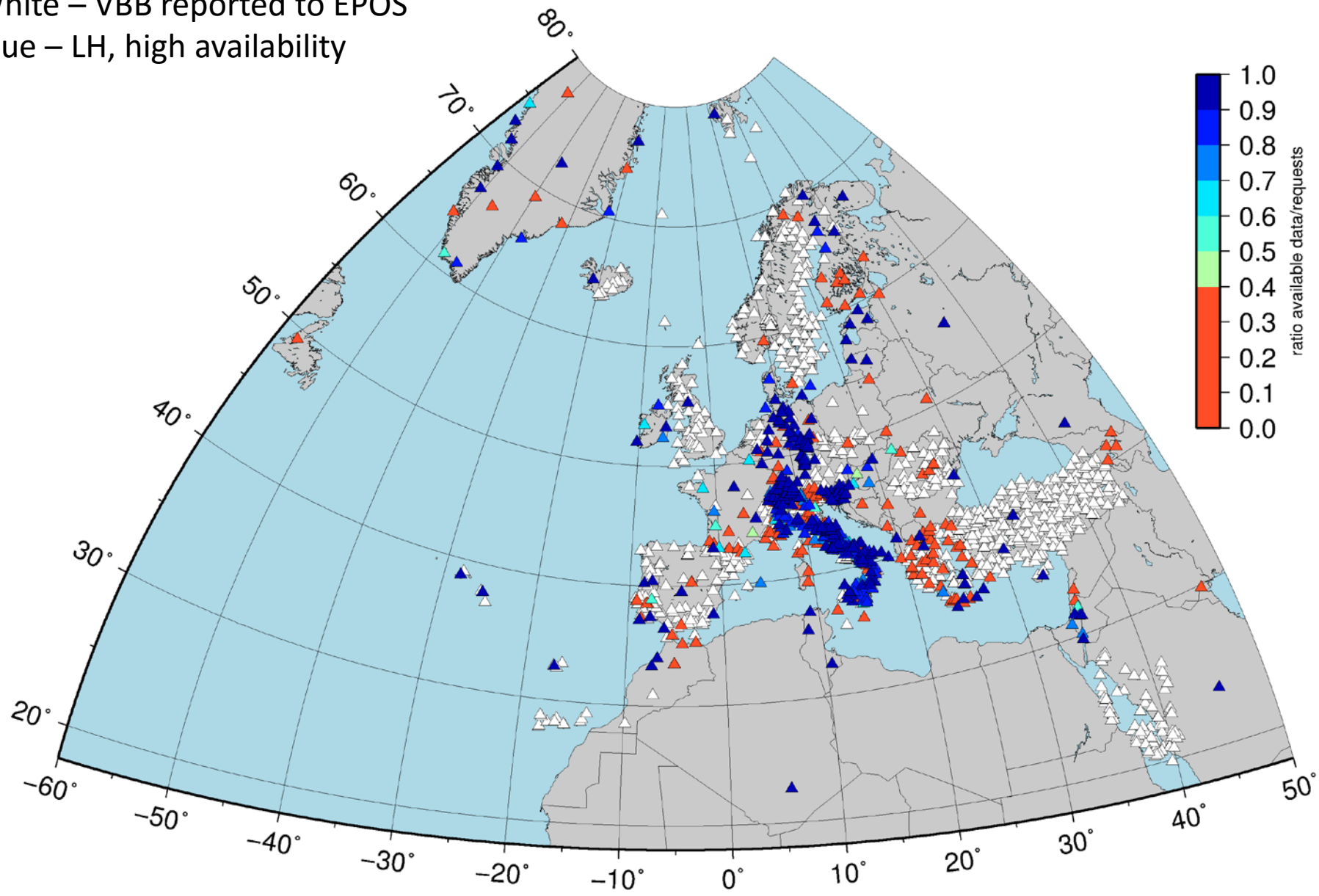


L. Cristiano, S. Mader

Data availability in 2014:

White – VBB reported to EPOS

Blue – LH, high availability

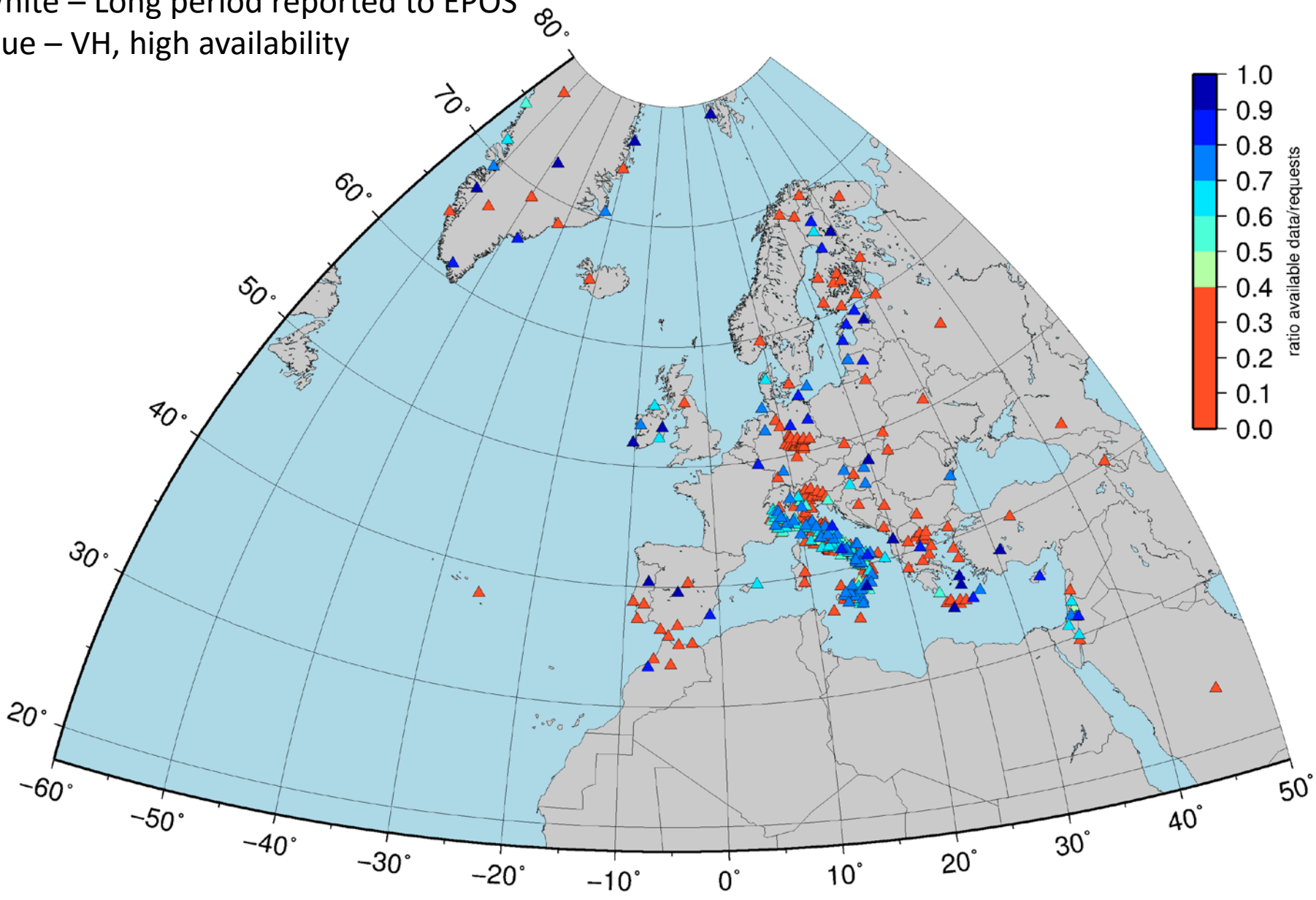


L. Cristiano, S. Mader

Data availability in 2014:

White – Long period reported to EPOS

Blue – VH, high availability

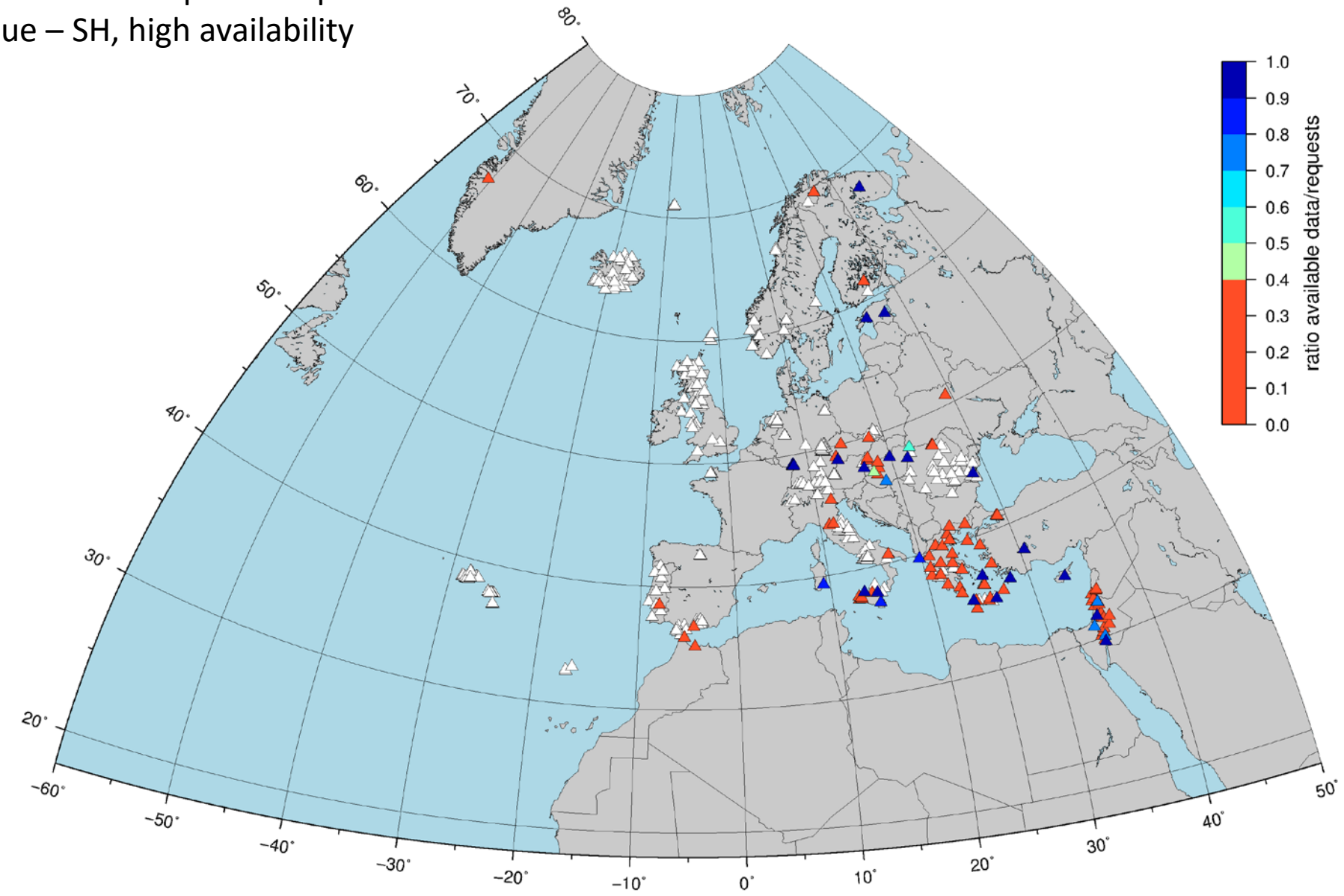


L. Cristiano, S. Mader

Data availability in 2014:

White – Short period reported to EPOS

Blue – SH, high availability

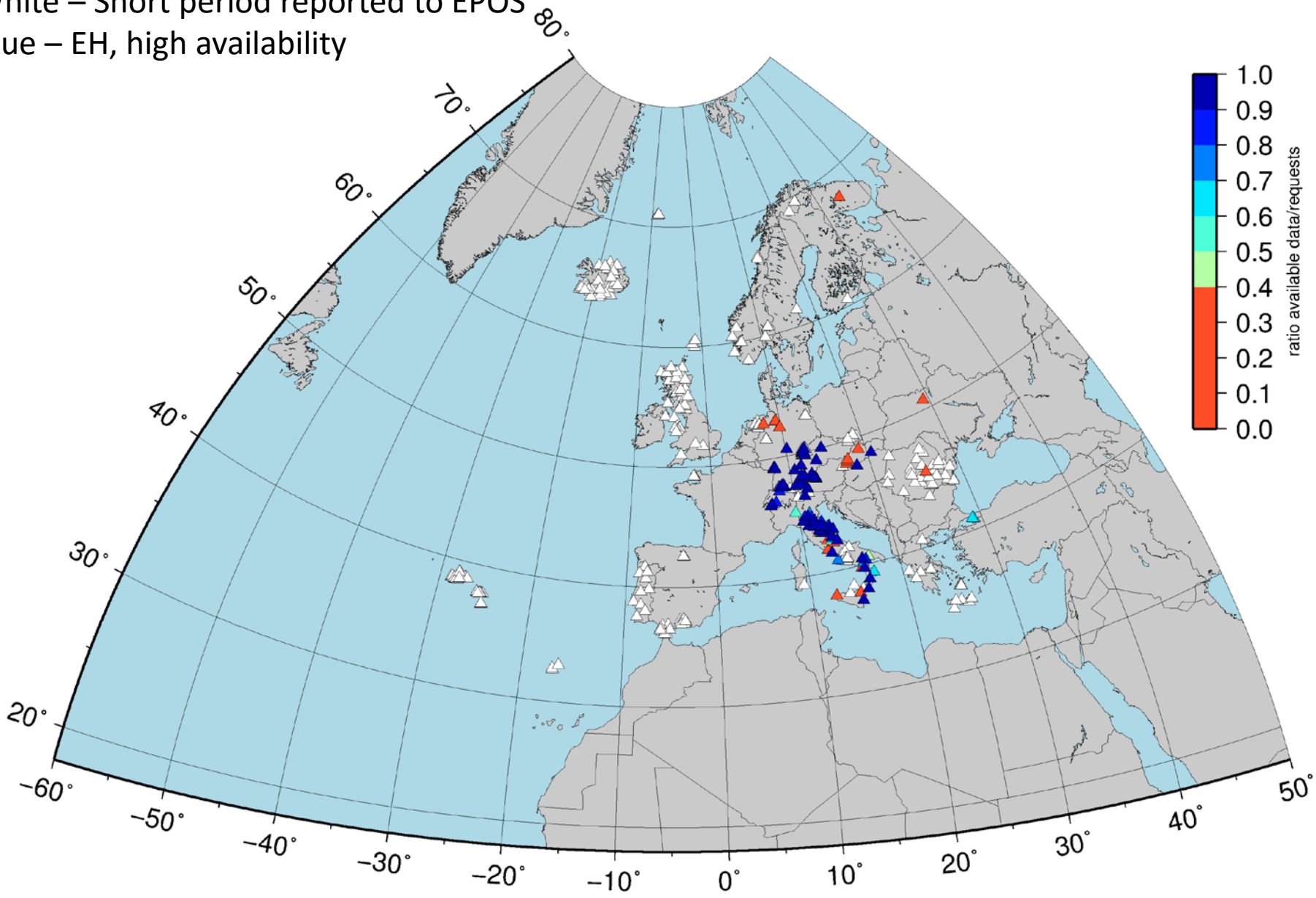


L. Cristiano, S. Mader

Data availability in 2014:

White – Short period reported to EPOS

Blue – EH, high availability

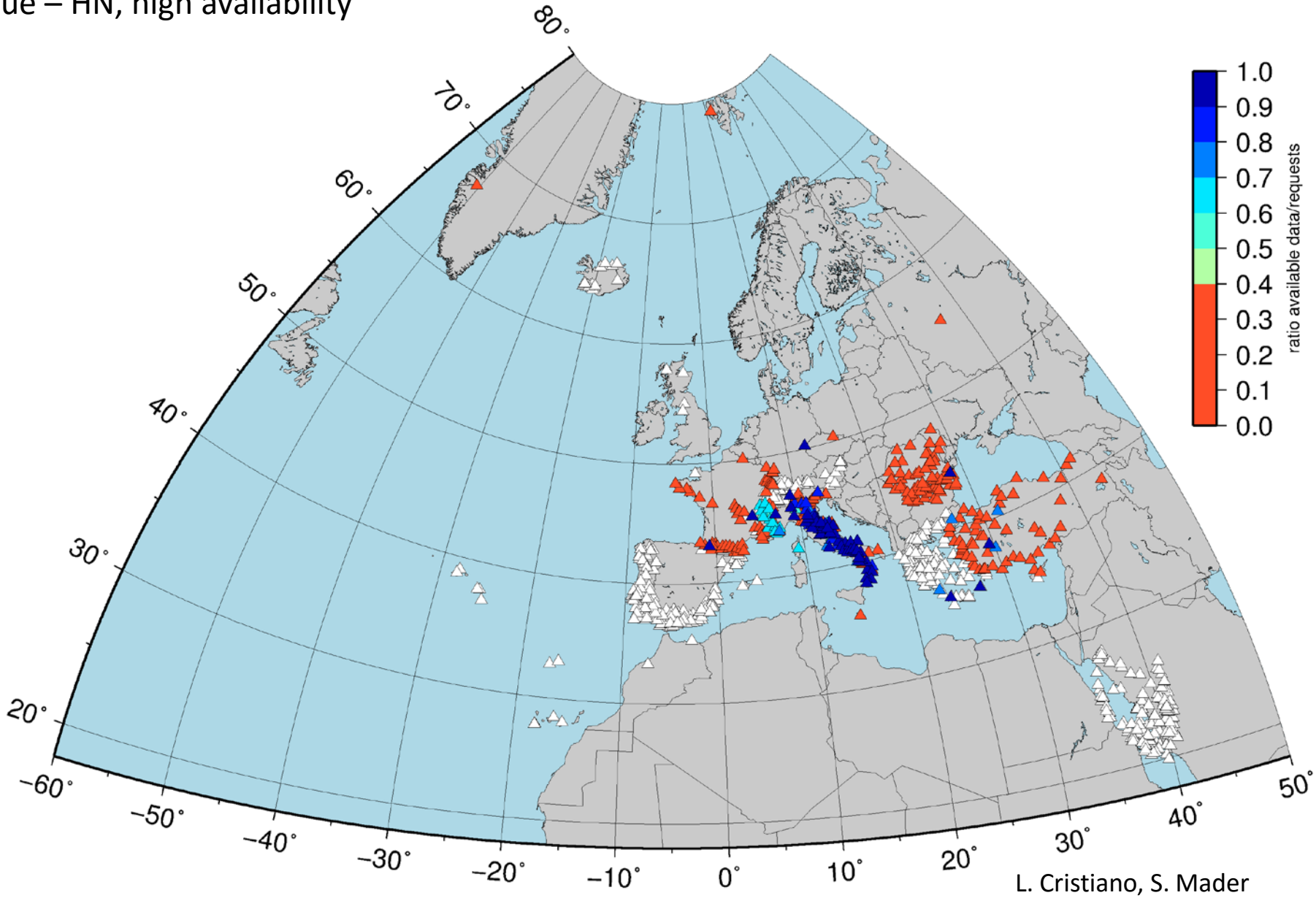


L. Cristiano, S. Mader

Data availability in 2014:

White – Strong motion reported to EPOS

Blue – HN, high availability

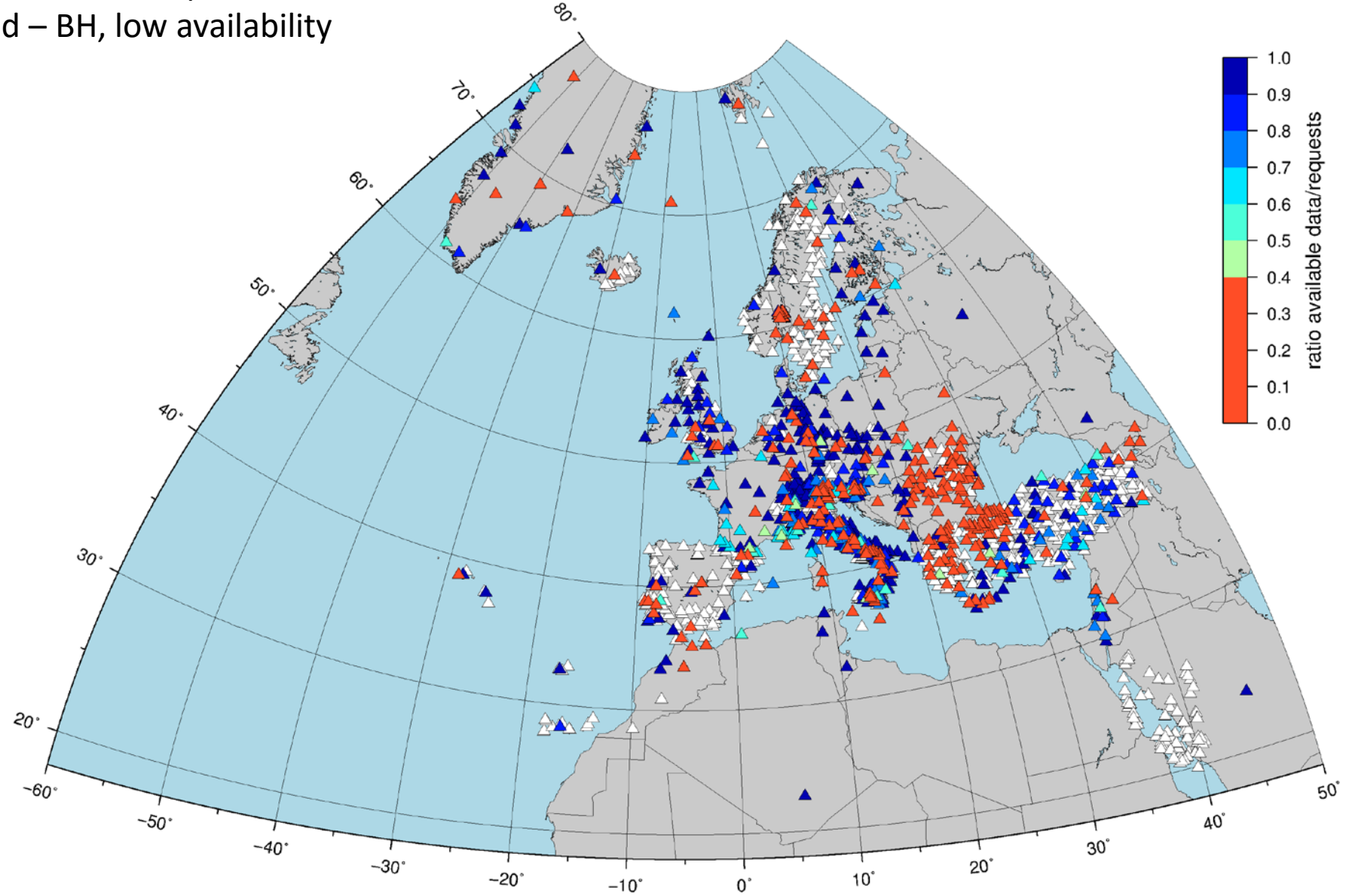


L. Cristiano, S. Mader

Data availability in 2014:

White – VBB reported to EPOS

Red – BH, low availability

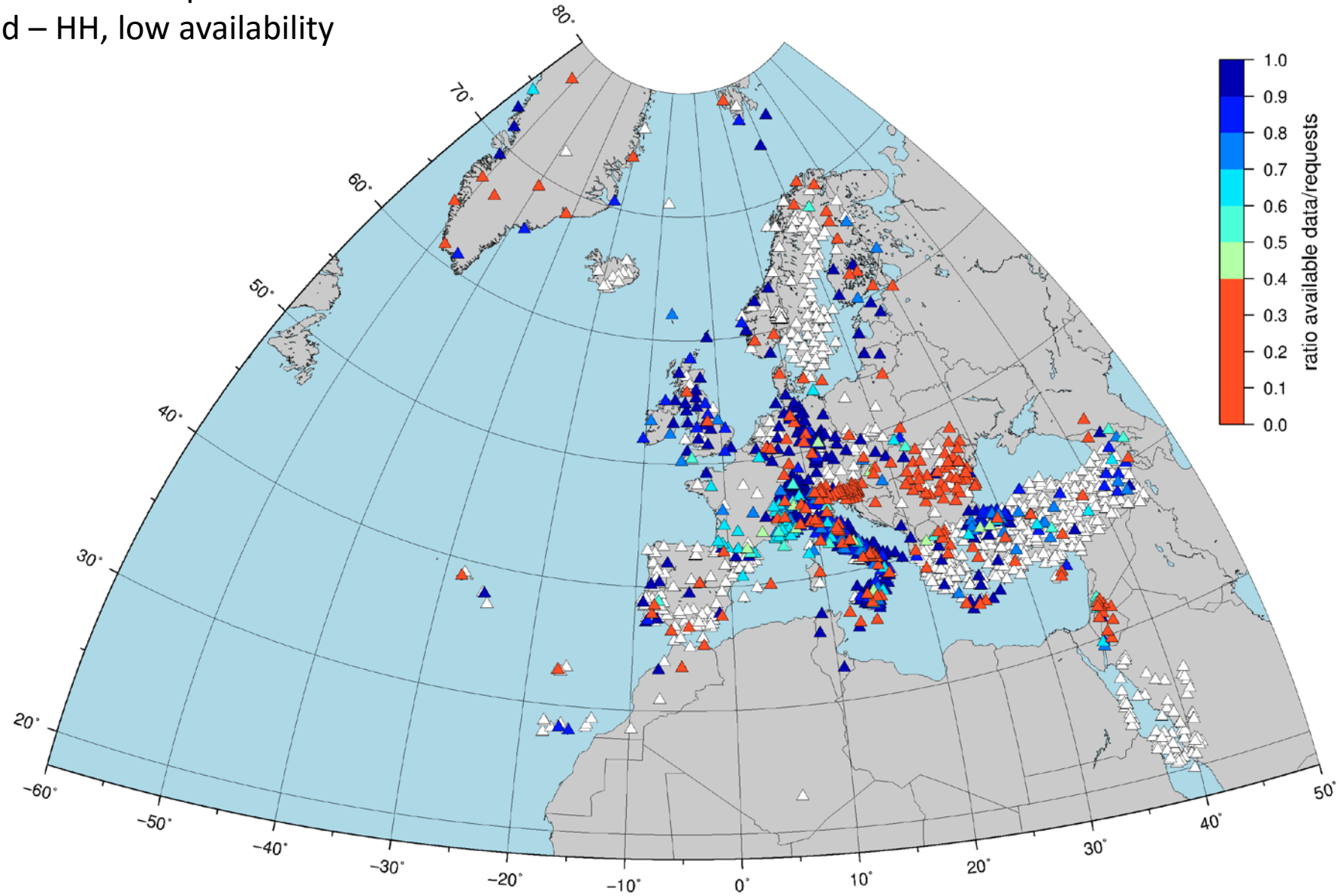


L. Cristiano, S. Mader

Data availability in 2014:

White – VBB reported to EPOS

Red – HH, low availability

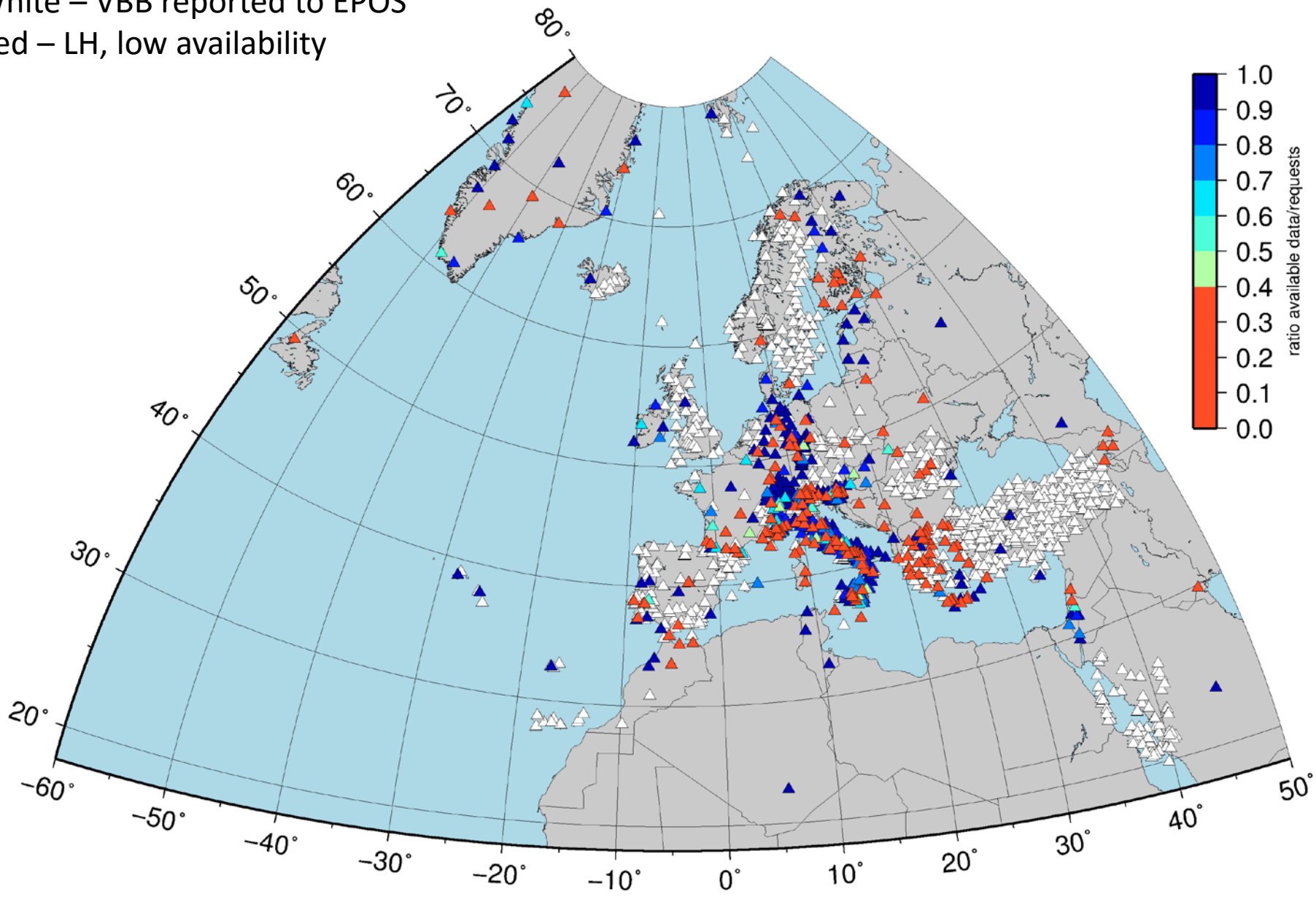


L. Cristiano, S. Mader

Data availability in 2014:

White – VBB reported to EPOS

Red – LH, low availability



L. Cristiano, S. Mader

Data availability in 2014:

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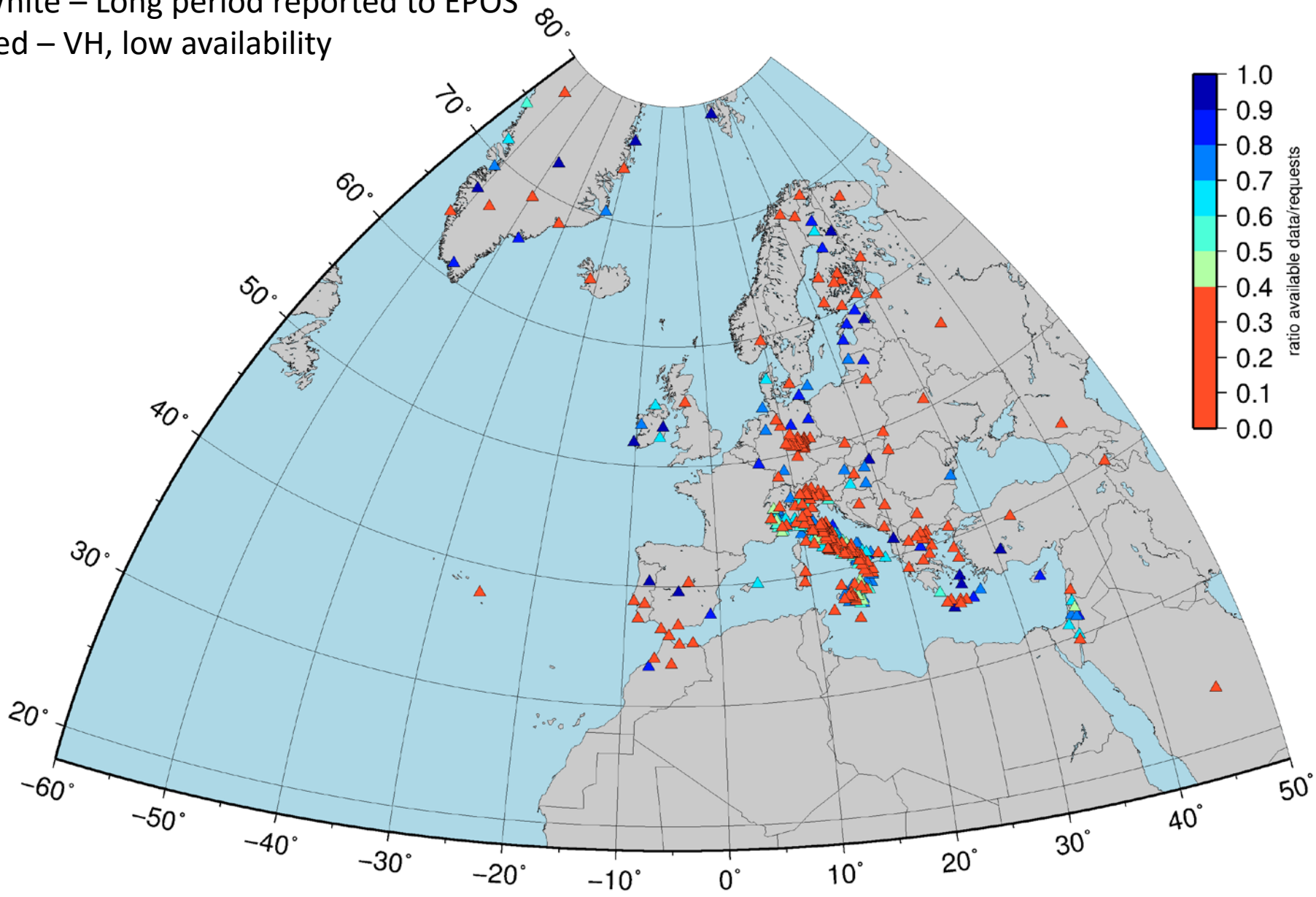
Red – VH, low availability

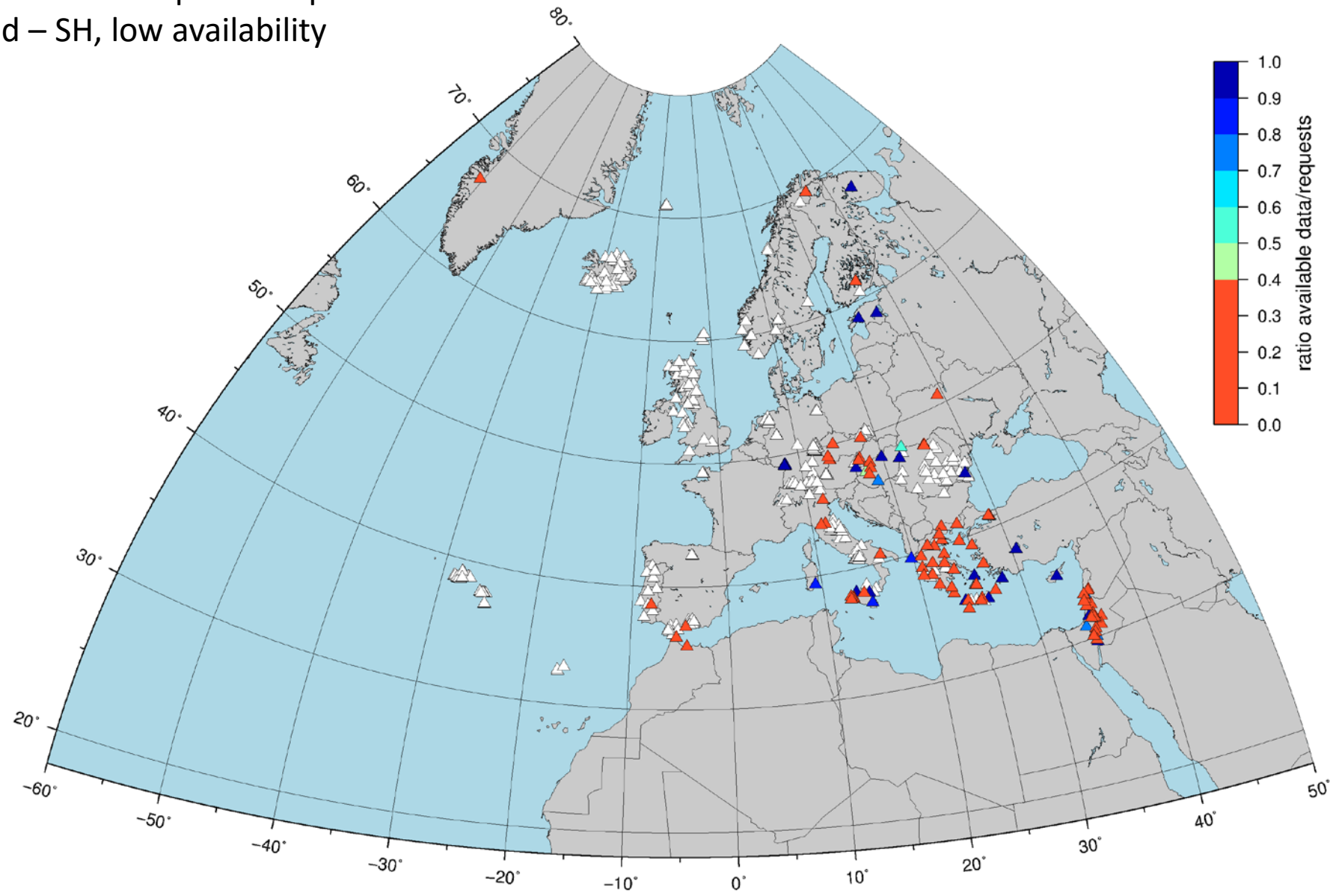


L. Cristiano, S. Mader

Data availability in 2014:

White – Short period reported to EPOS

Red – SH, low availability

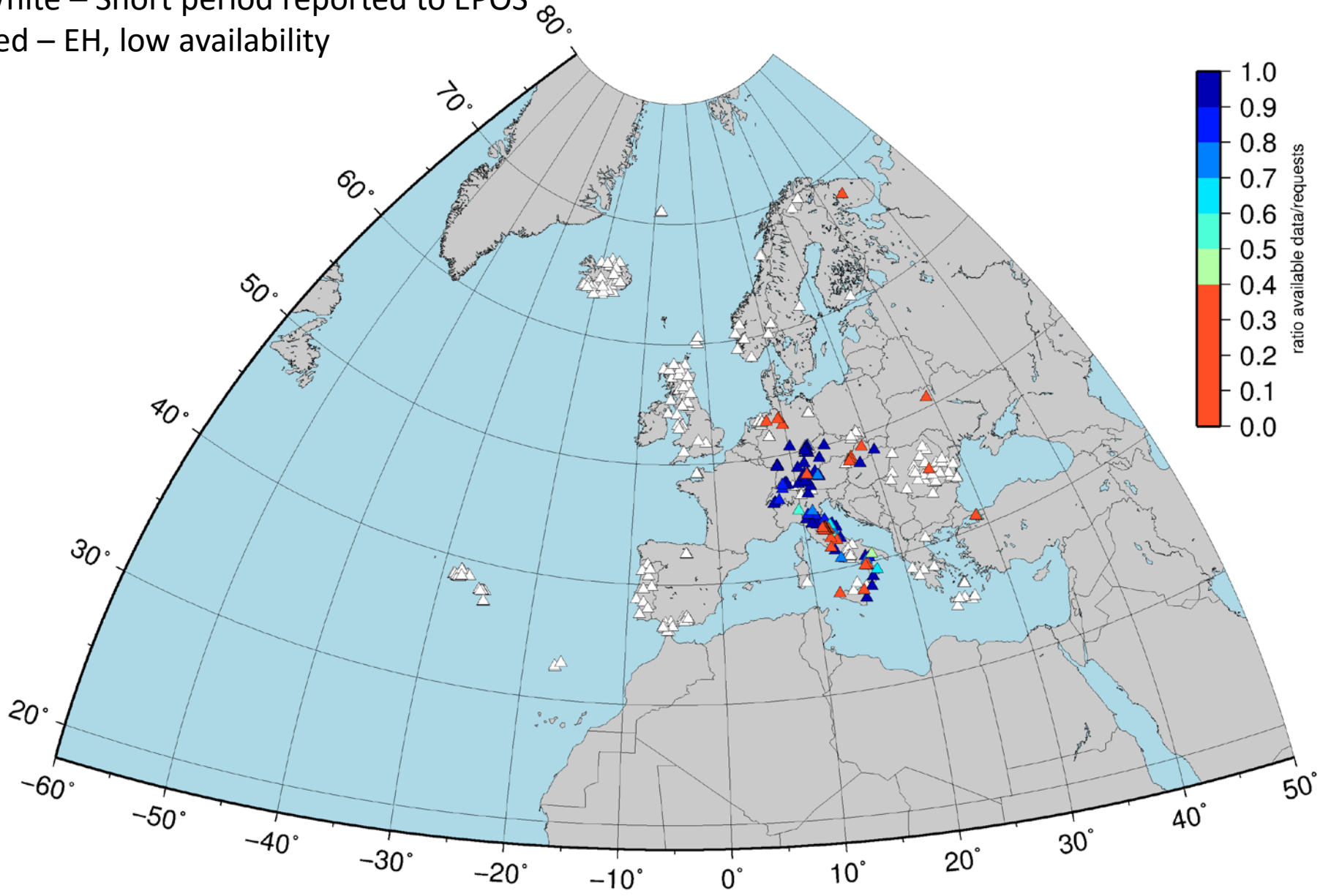


L. Cristiano, S. Mader

Data availability in 2014:

White – Short period reported to EPOS

Red – EH, low availability

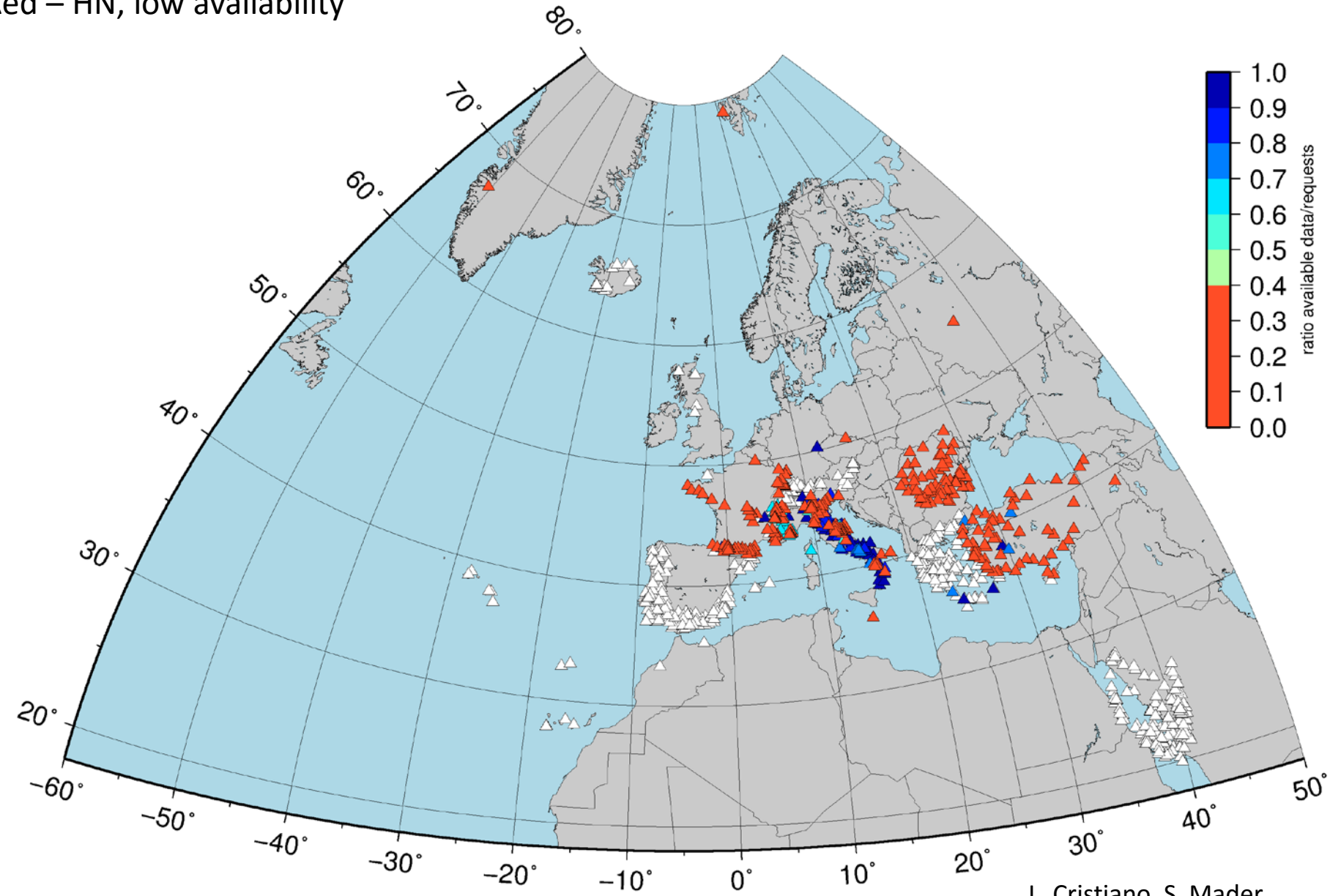


L. Cristiano, S. Mader

Data availability in 2014:

White – Strong motion reported to EPOS

Red – HN, low availability



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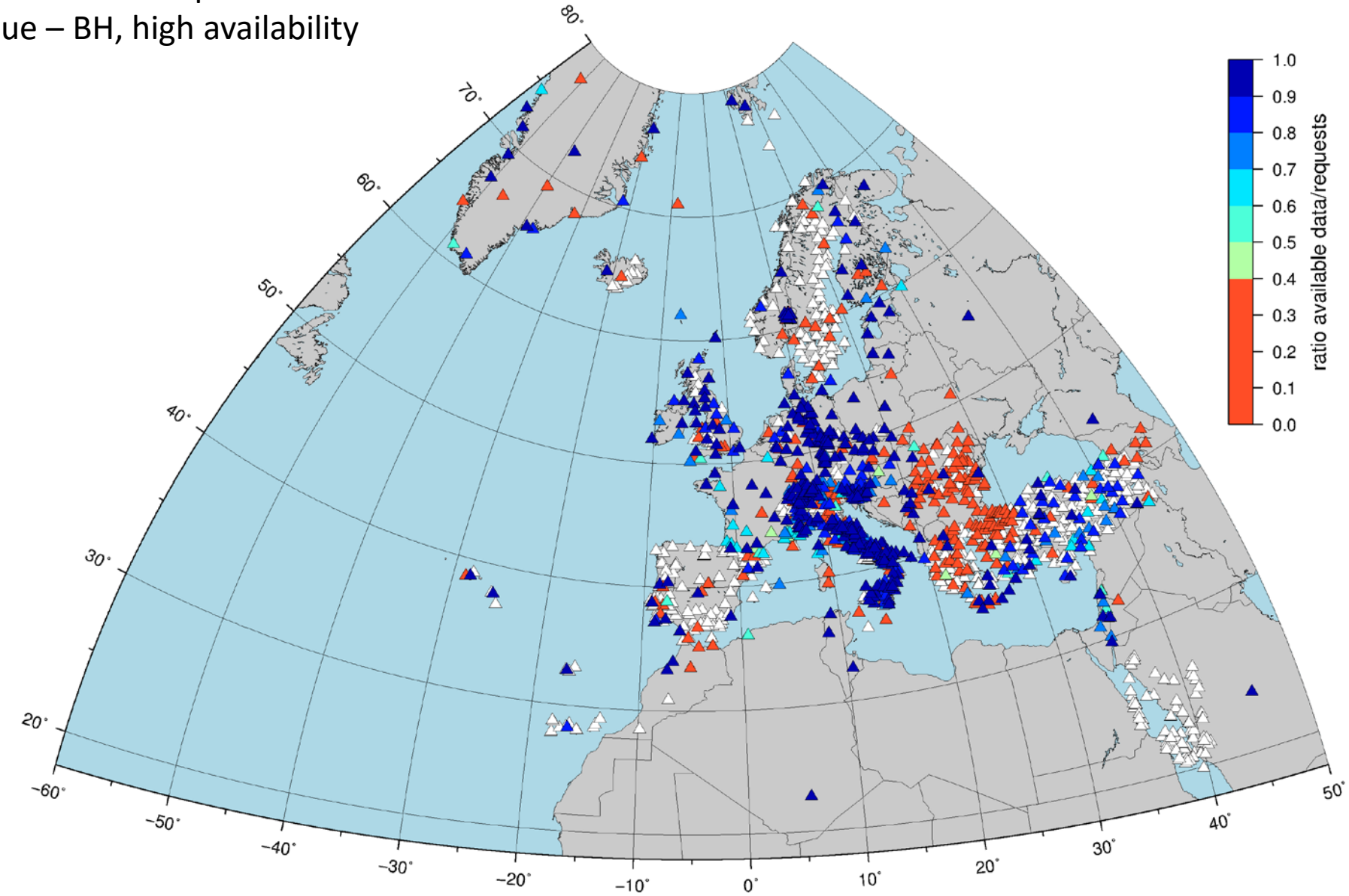
Data availability in 2014:

White – VBB reported to EPOS

Blue – BH, high availability



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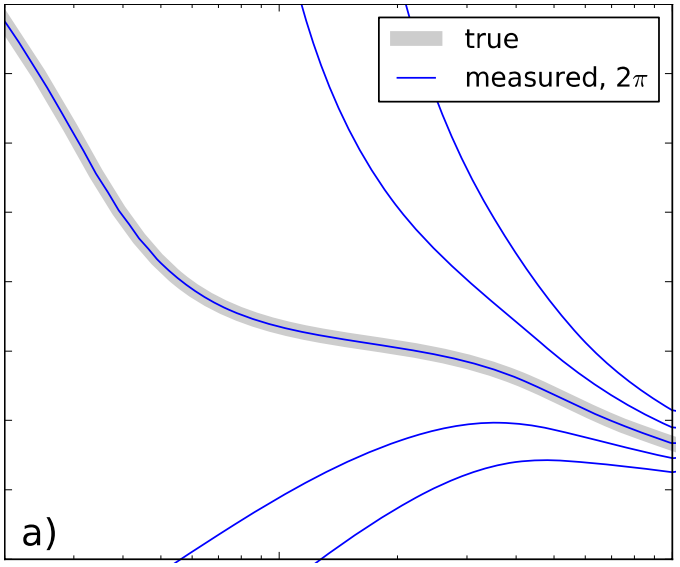
Response and timing issues

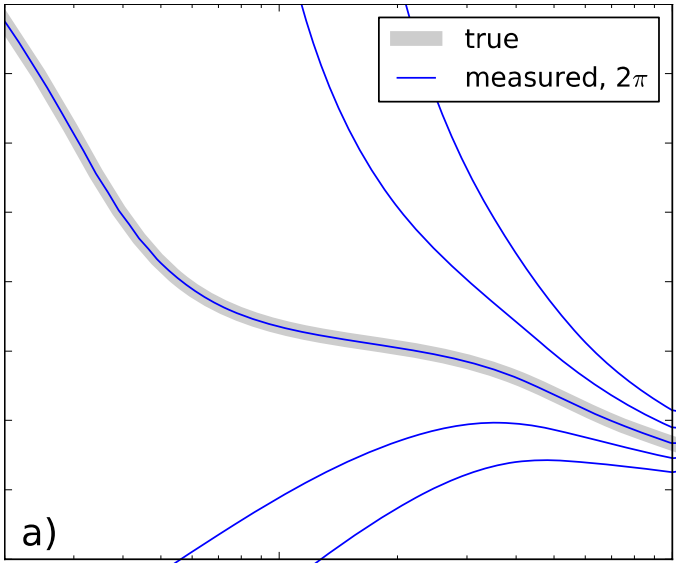
Synthetic example



Weidl et al (Adv Geosci 2013)

Synthetics computed from PREM (Dziewonski and Anderson, 1981) + CRUST2.0 (Bassin et al, 2000)

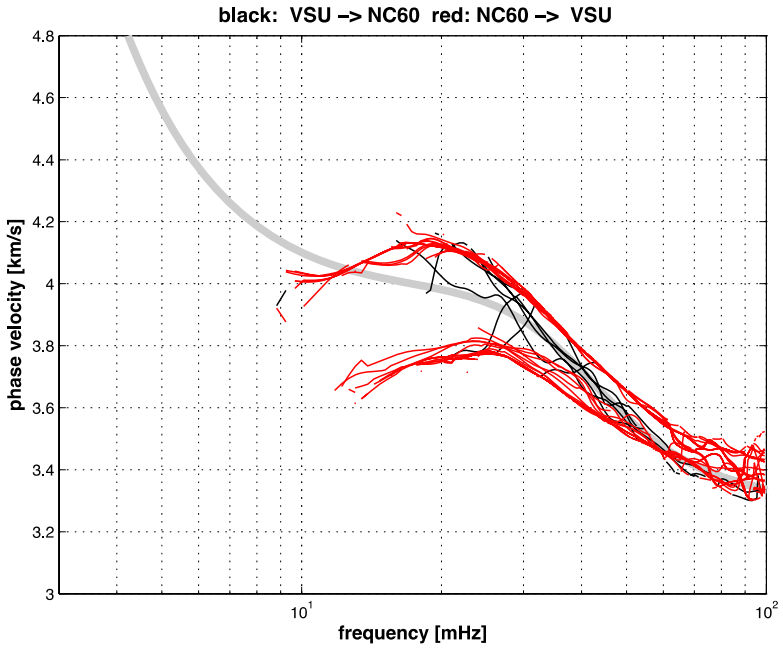
Synthetic example: Reversed polarity



Weidl et al (Adv Geosci 2013)

Synthetics computed from PREM (Dziewonski and Anderson, 1981) + CRUST2.0 (Bassin et al, 2000)

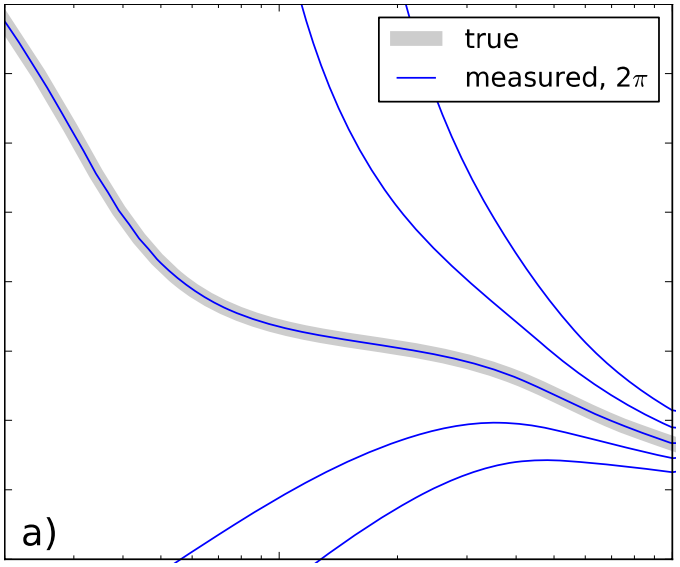
Real data: Reversed polarity



Weidl et al (Adv Geosci 2013)

Synthetics computed from PREM (Dziewonski and Anderson, 1981) + CRUST2.0 (Bassin et al, 2000)

Synthetic example: Timing problem



Weidl et al (Adv Geosci 2013)

Synthetics computed from PREM (Dziewonski and Anderson, 1981) + CRUST2.0 (Bassin et al, 2000)

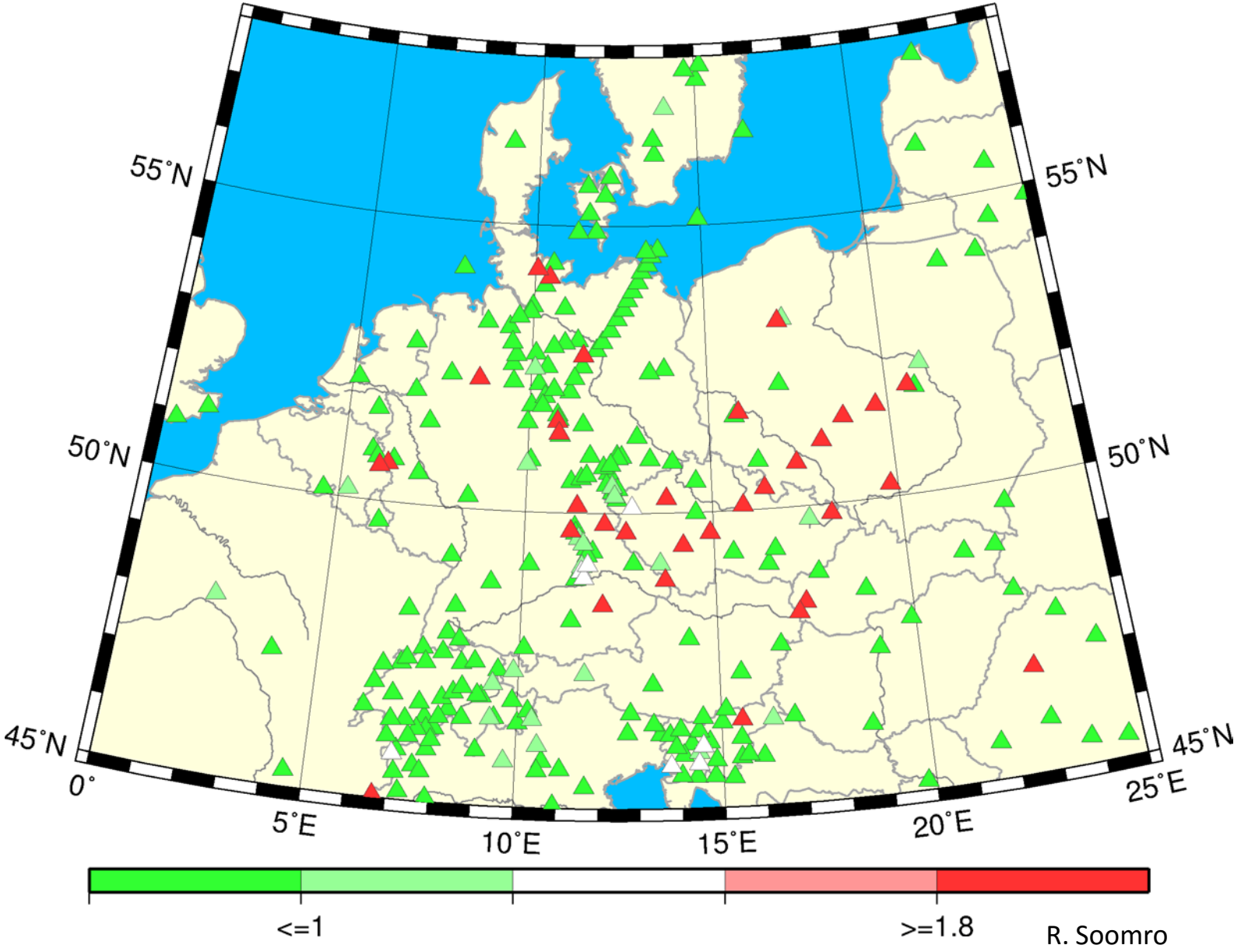
Real data: Timing problem

Weidl et al (Adv Geosci 2013)

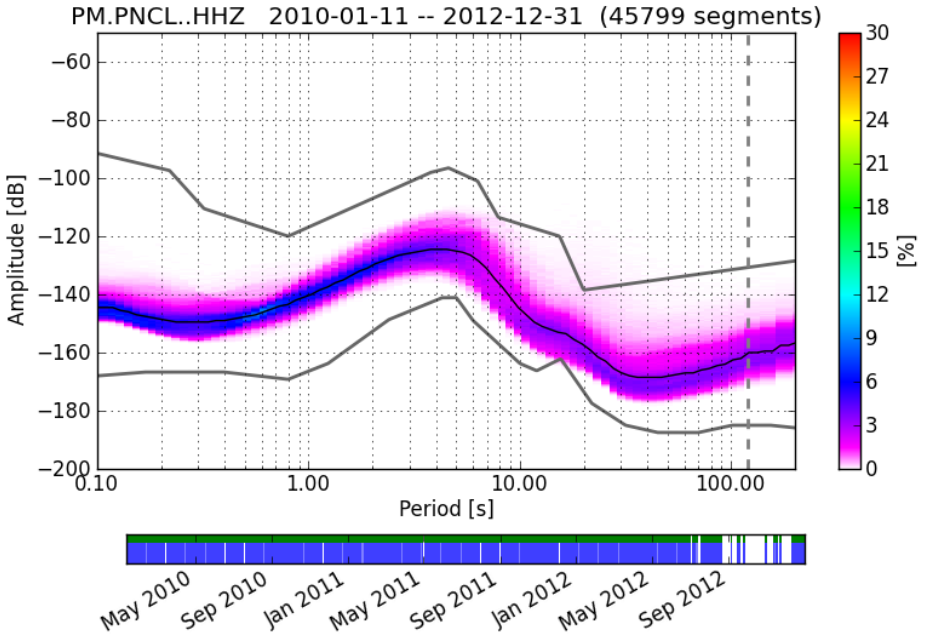
Synthetics computed from PREM (Dziewonski and Anderson, 1981) + CRUST2.0 (Bassin et al, 2000)

indicator for response or timing problems from cross correlation of waveforms (1990-2013)

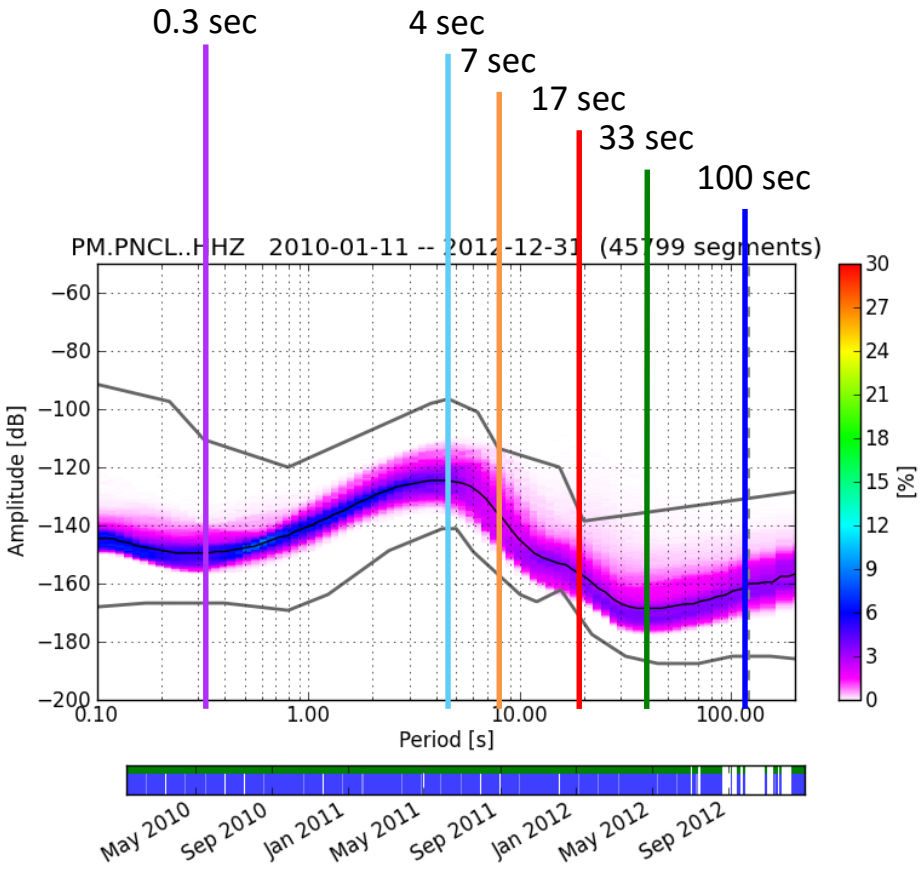
Permanent + temporary broad-band stations, central Europe (red potentially problematic)

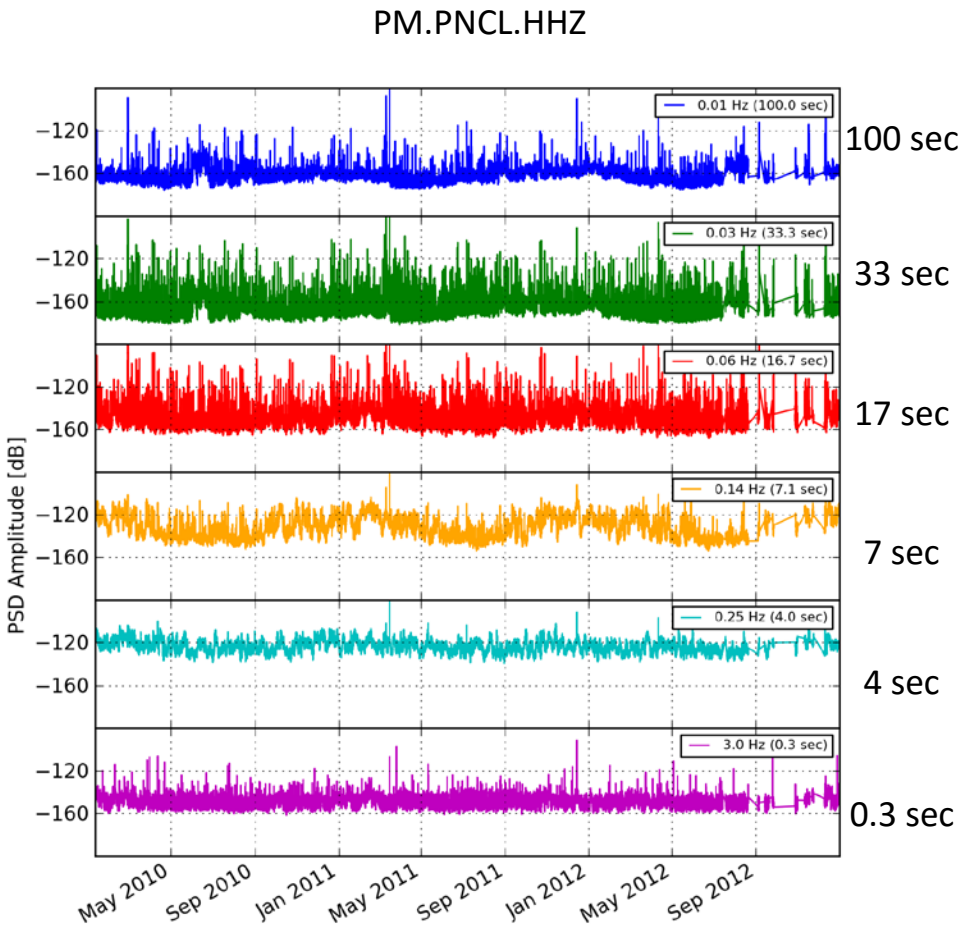


Example of sensor response problems

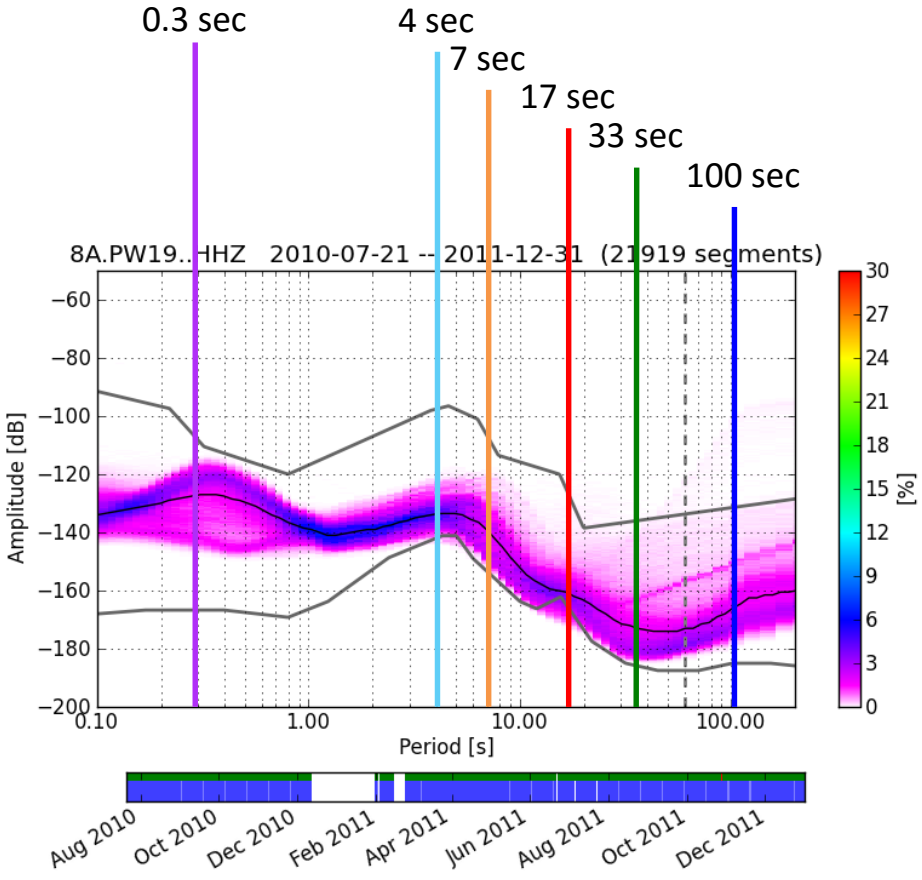


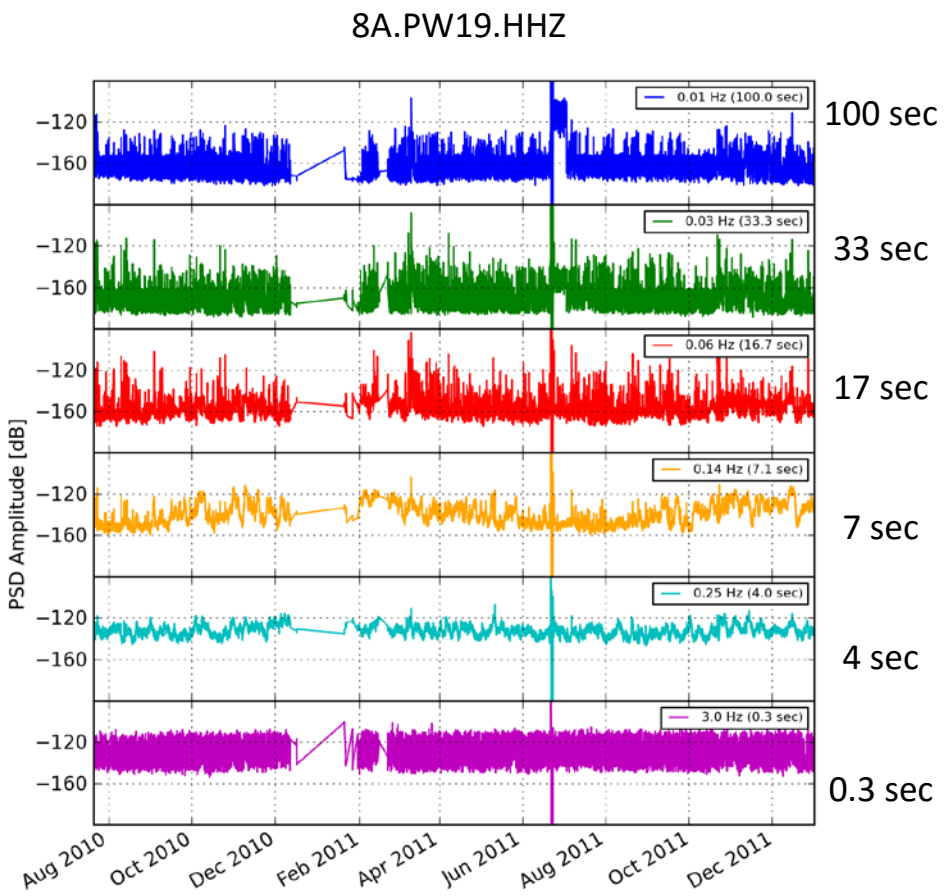
Example of sensor response problems





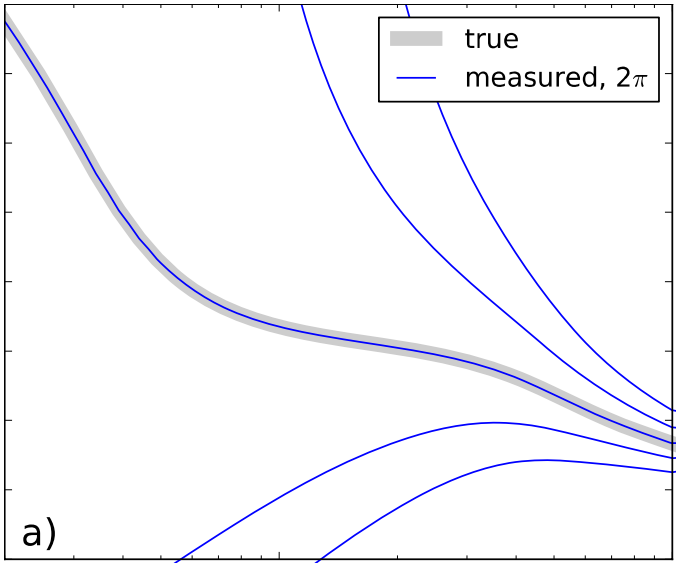
Example of sensor response problems





Custódio et al (BSSA 2014)

Synthetic example: Response problem



Weidl et al (Adv Geosci 2013)

Synthetics computed from PREM (Dziewonski and Anderson, 1981) + CRUST2.0 (Bassin et al, 2000)

Real data: Response problem

Weidl et al (Adv Geosci 2013)

Synthetics computed from PREM (Dziewonski and Anderson, 1981) + CRUST2.0 (Bassin et al, 2000)

Sensor Orientation

Methods to assess sensor “true” orientation

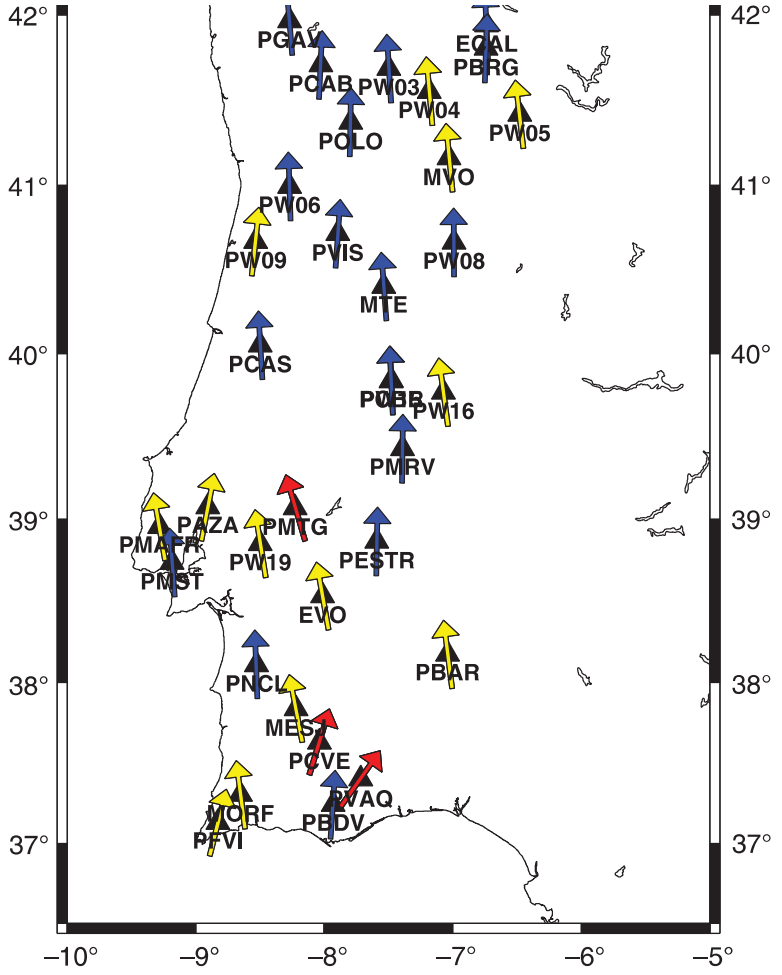
1. Direct measurements.

2. Cross-correlation techniques (e.g. Grigoli et al, GJI 2012).

1. Polarization analysis (e.g. Ekstrom and Busby, SRL 2008).

1. Techniques based on the comparison between data and synthetics/waveform modeling.

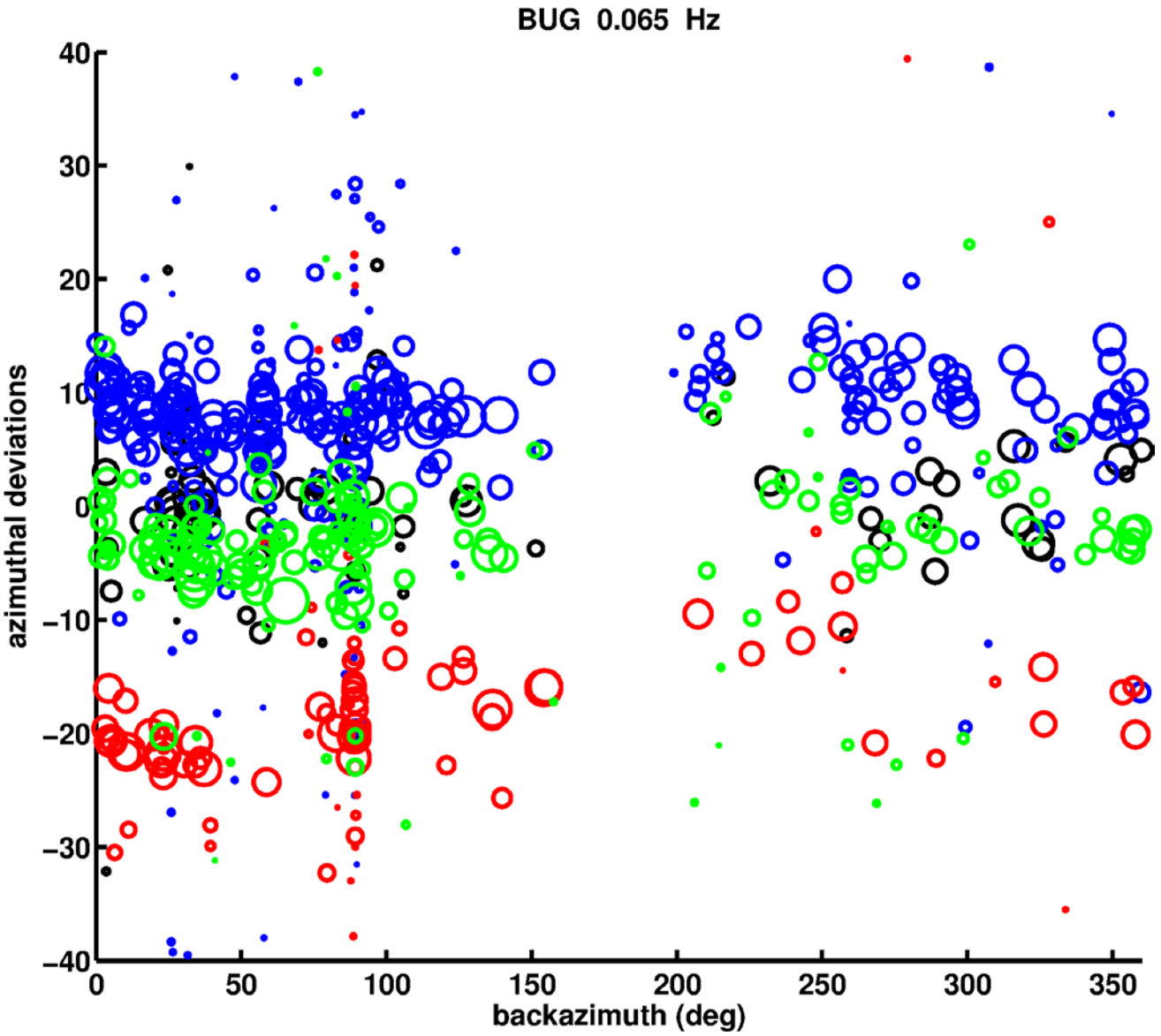
Joint correlation and polarization analysis



Custódio et al (BSSA 2014)

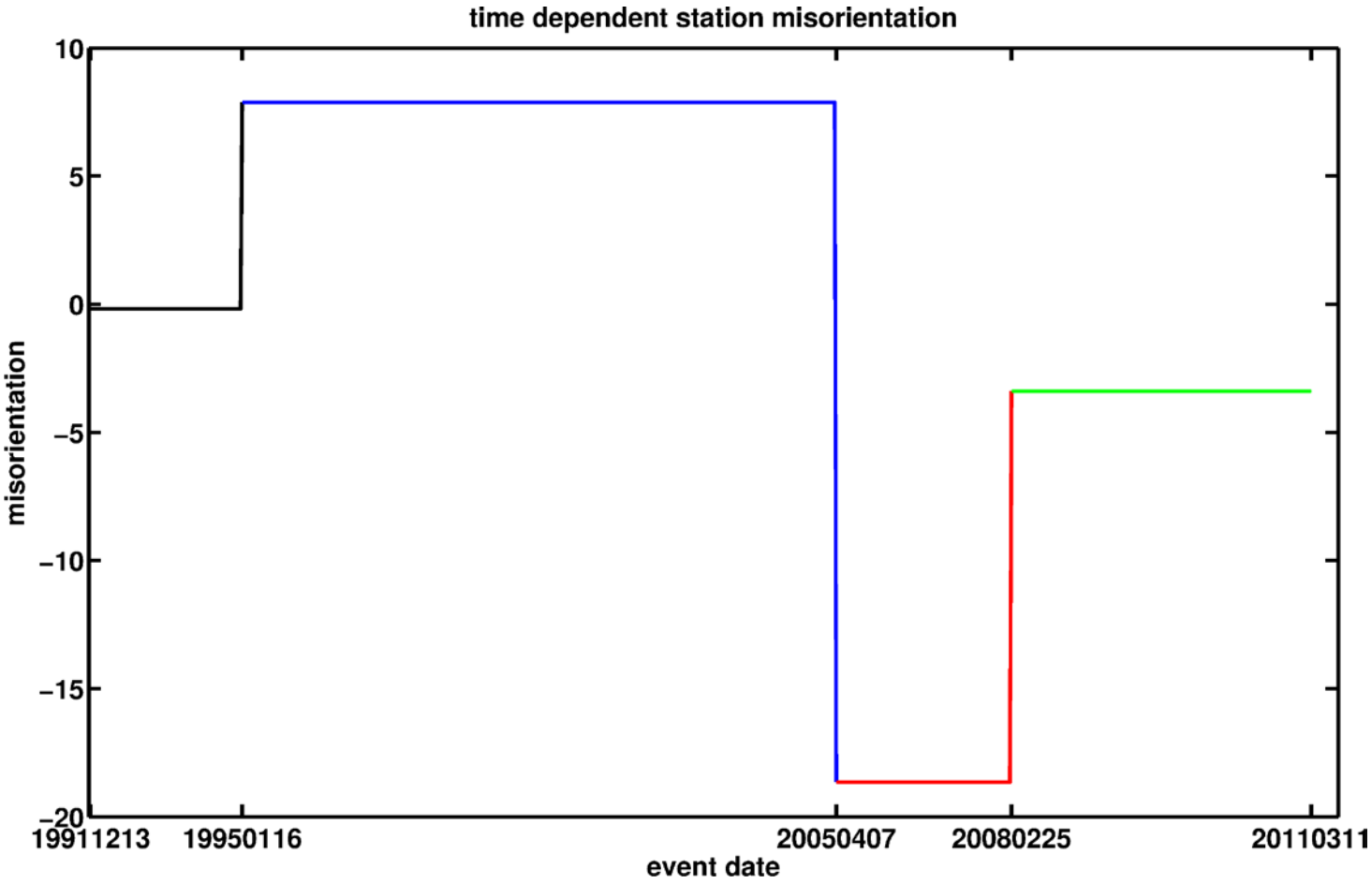
Detection of misorientation of horizontal components using P-wave polarization analysis

Measurements of azimuthal deviations: not corrected



L. Cristiano

Detection of misorientation of horizontal components using P-wave polarization analysis



L. Cristiano

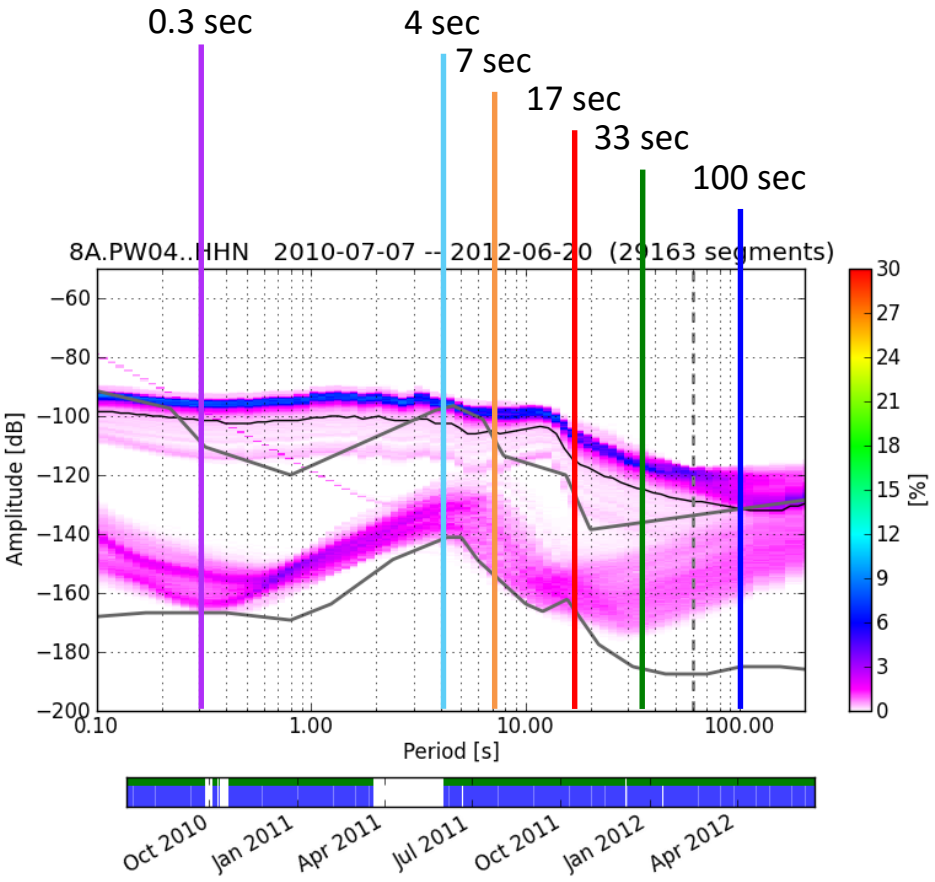
Summary

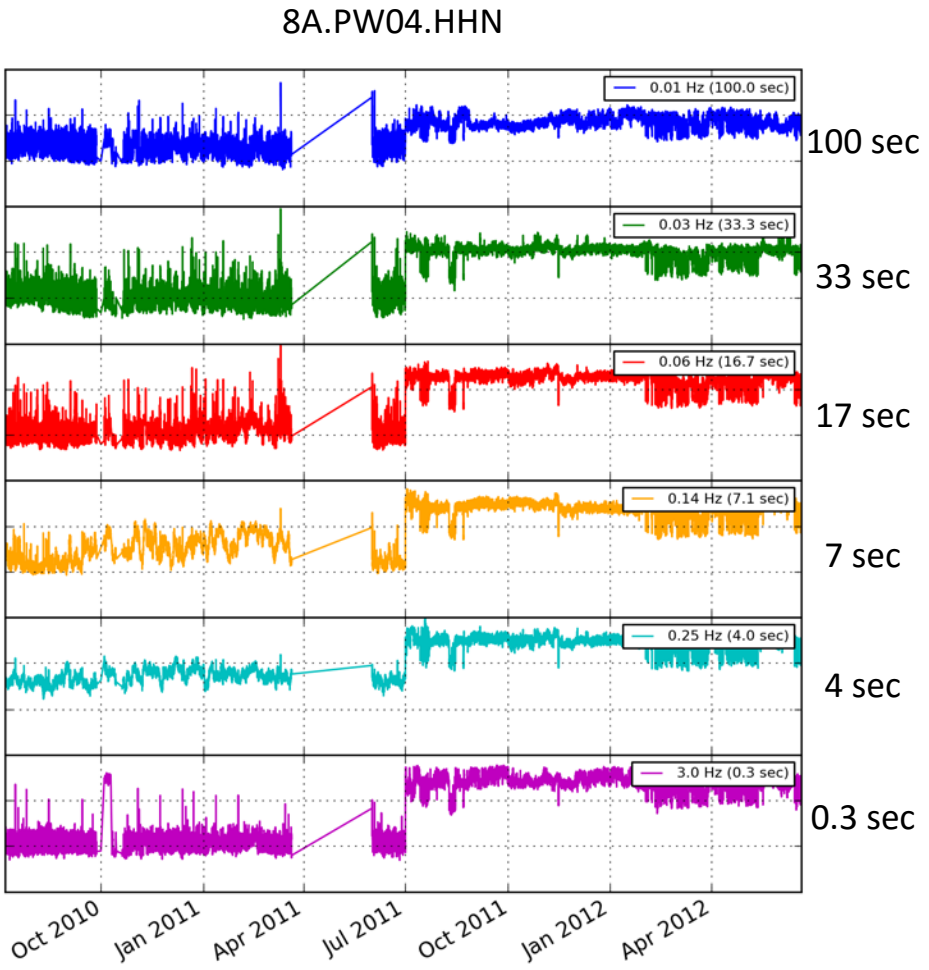
- For research purposes, it is important to characterize the stations concerning:
  - Data availability
  - Sensor response
  - Sensor timing
  - Orientation

- These parameters are usually variable in time, and therefore should be computed continuously (or near-continuously)

- Within the scope of a project, most of these methods can be streamlined / adapted for operational implementation.

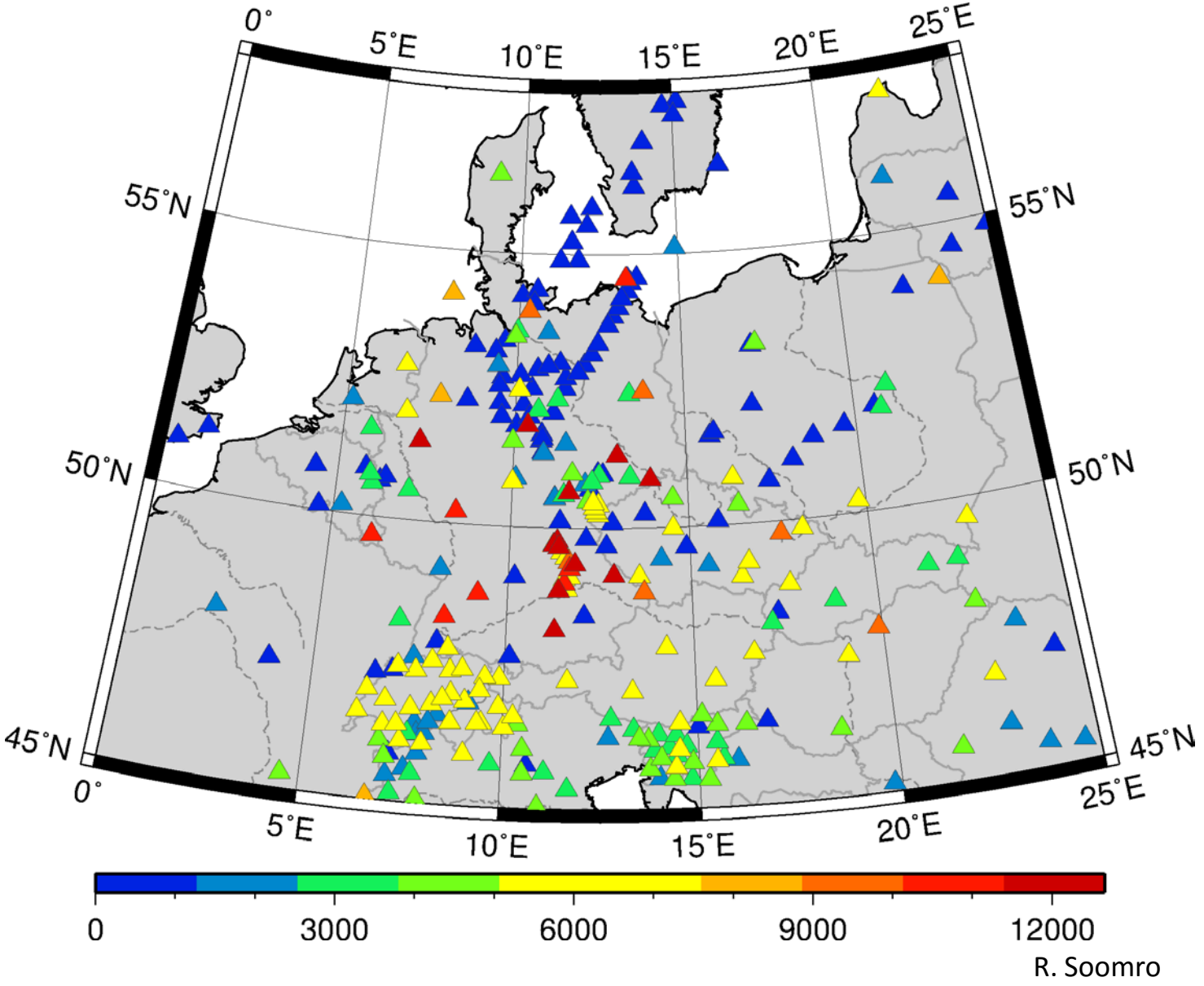
Example of sensor response problems





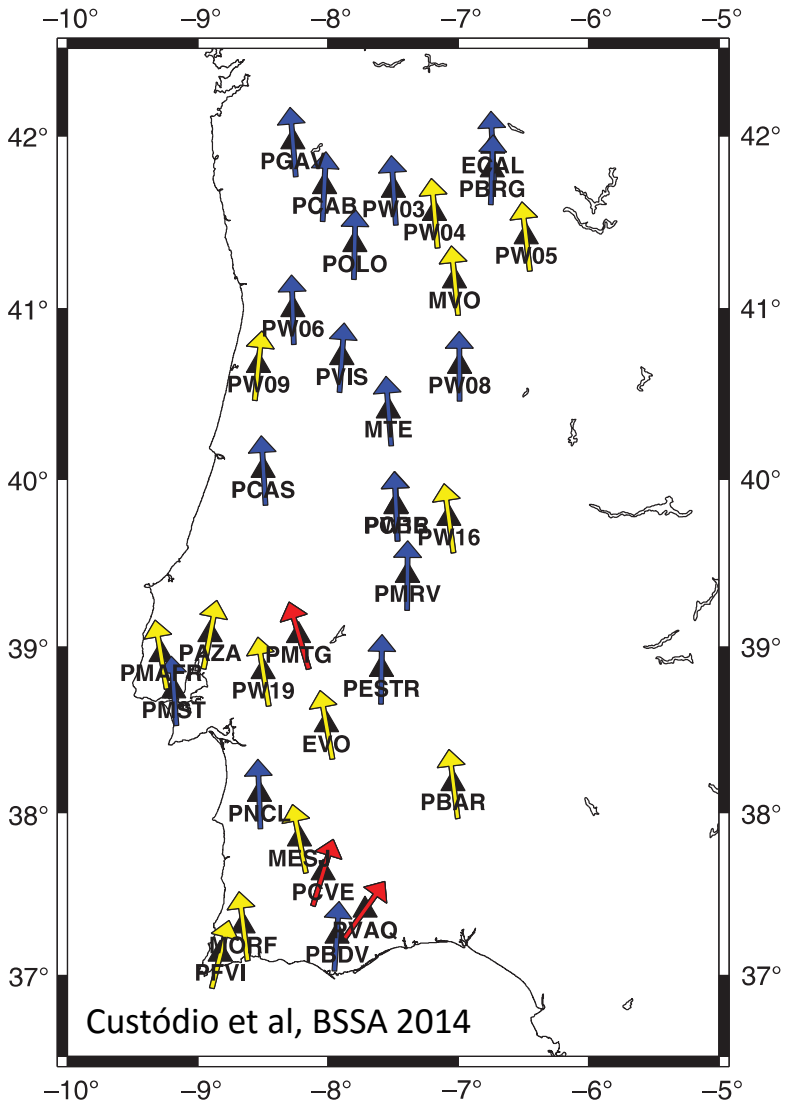
indicator for data availability (1990-2013) of broad-band stations: no. of processed events

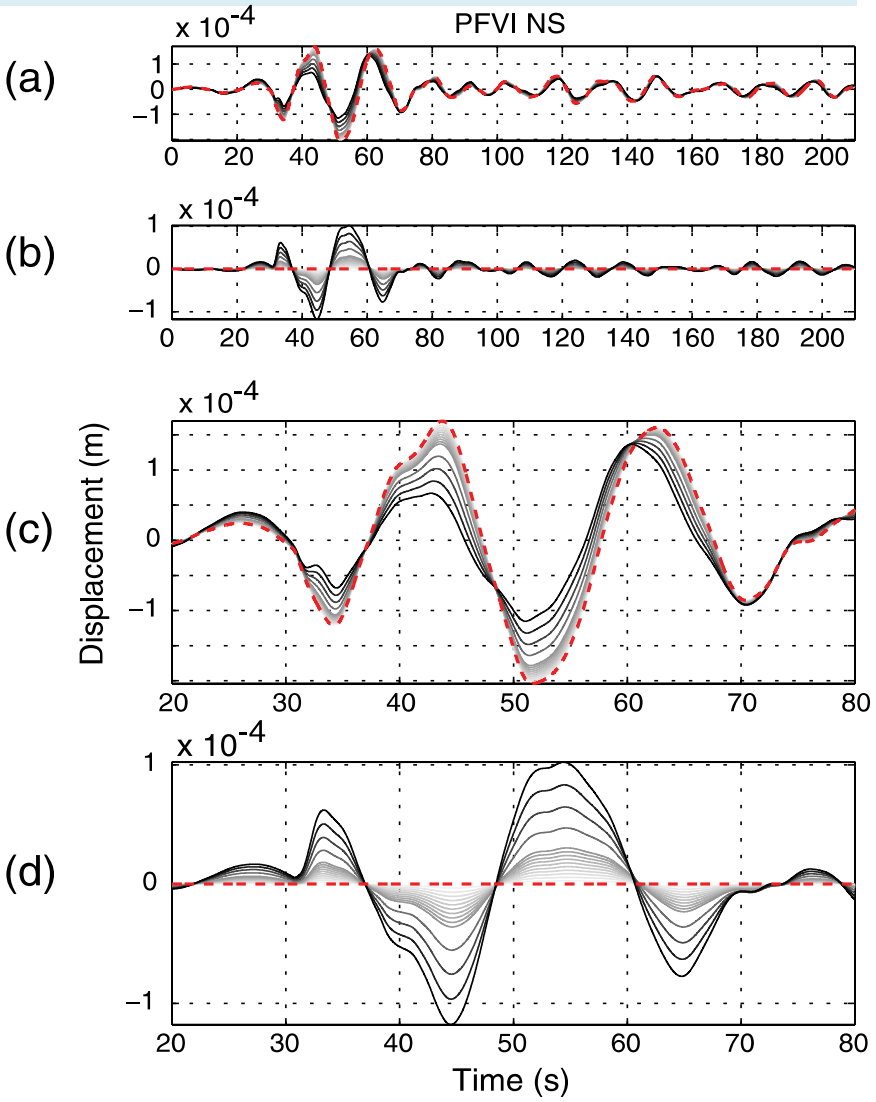
Permanent + temporary stations, central Europe



R. Soomro

QC: Check station orientations



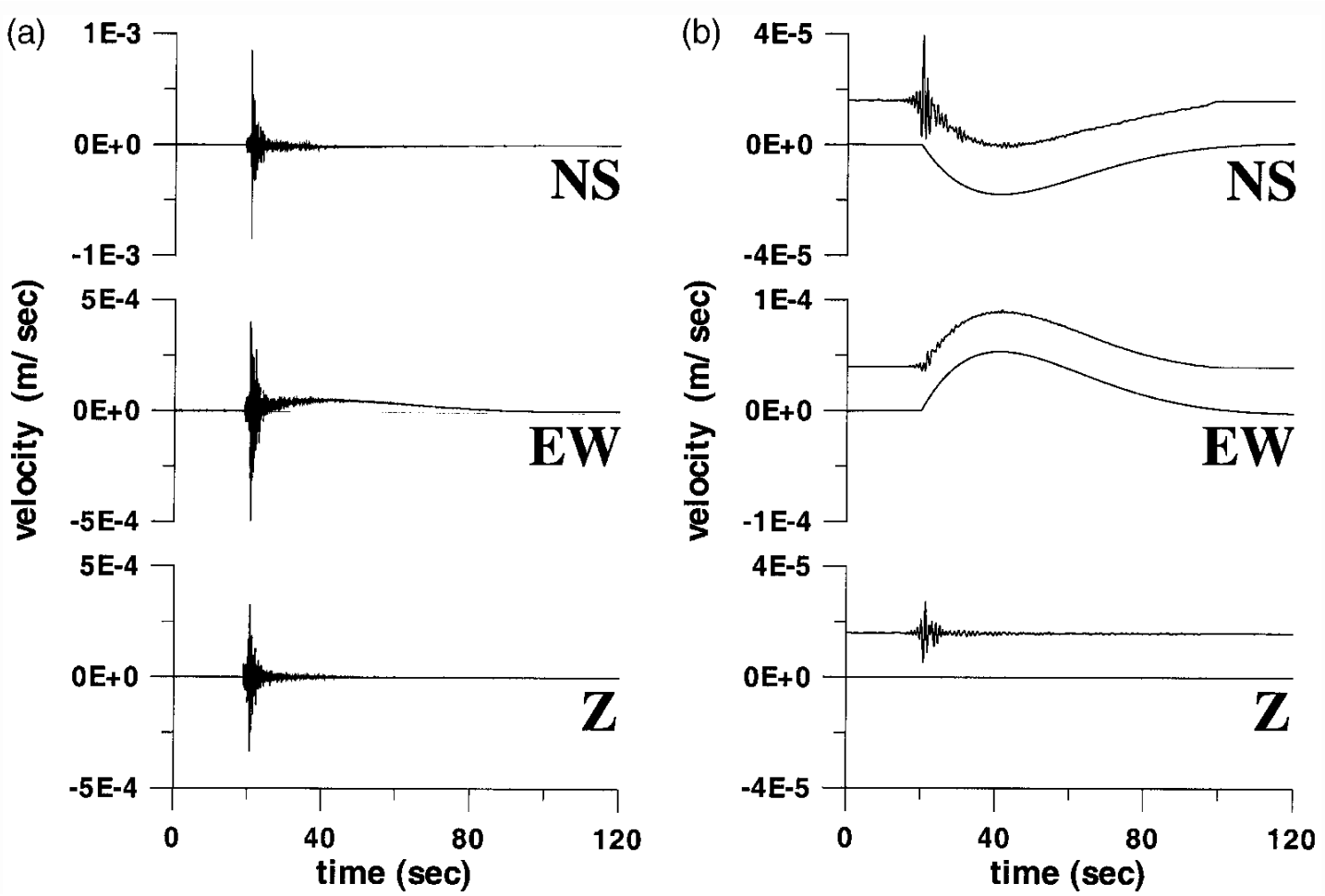


Zahradník and Custódio, BSSA 2012

QC: Check for artifacts (e.g.: ‘mice’)

Raw data

Frequency < 1 Hz

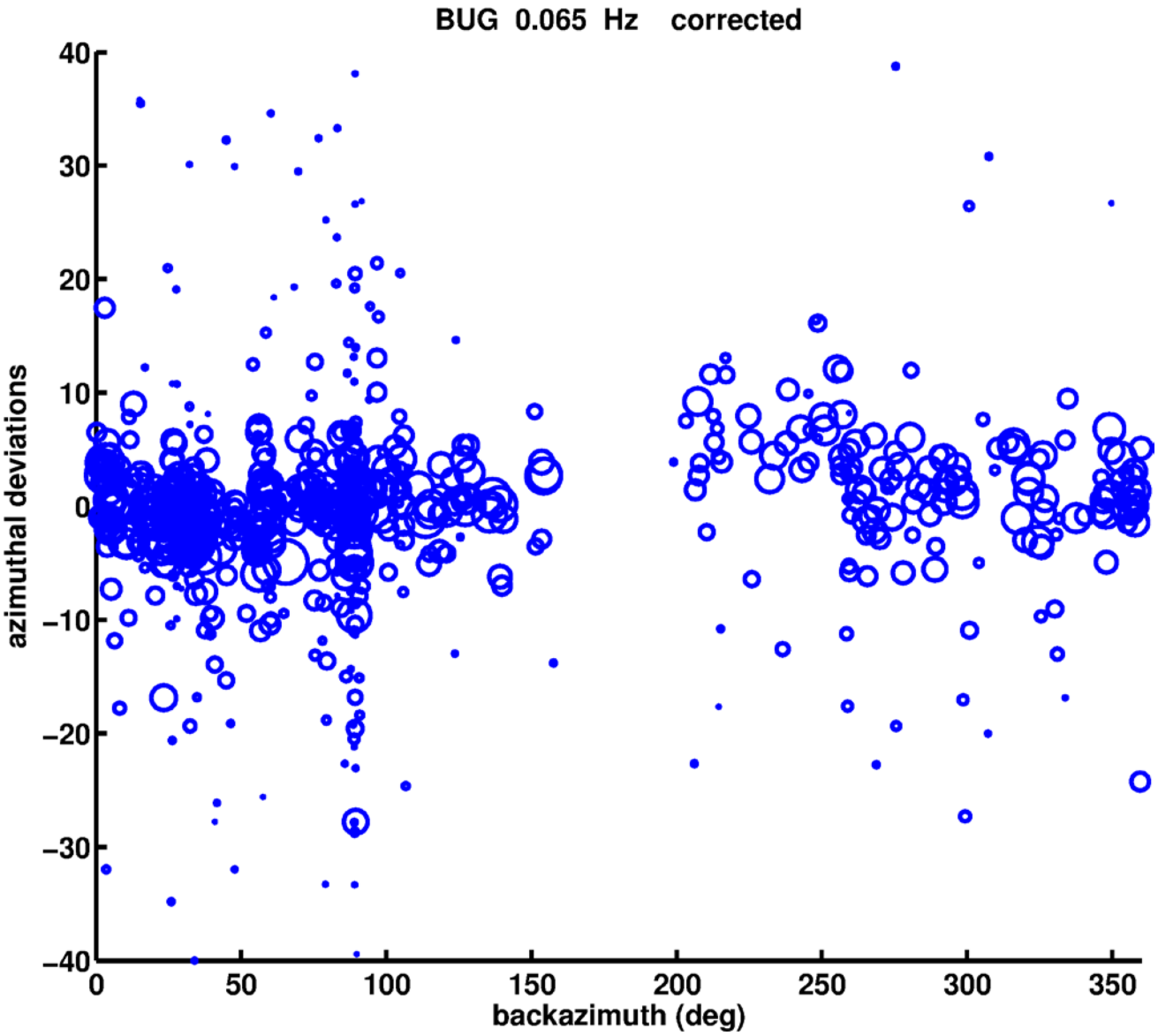


Zahradník and Plesinger, BSSA 2005

Fundamental mode dispersion curves

Detection of misorientation of horizontal components using P-wave polarization analysis

Measurements of azimuthal deviations: corrected



L. Cristiano