INSTITUTE OF GEOPHYSICS
OF THE CZECH ACADEMY OF SCIENCES

CZECH GEO

Seismic data quality assurance and control

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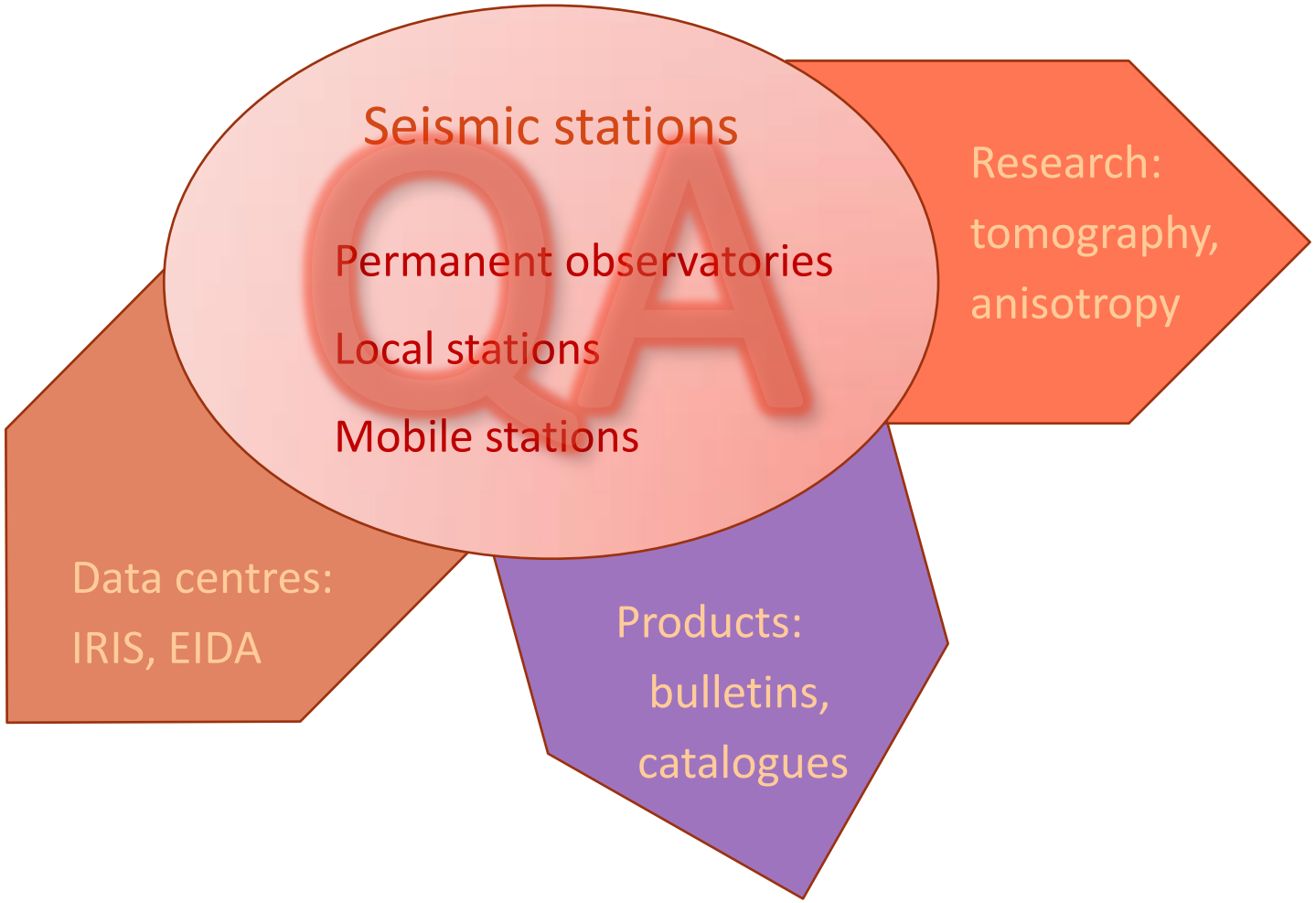
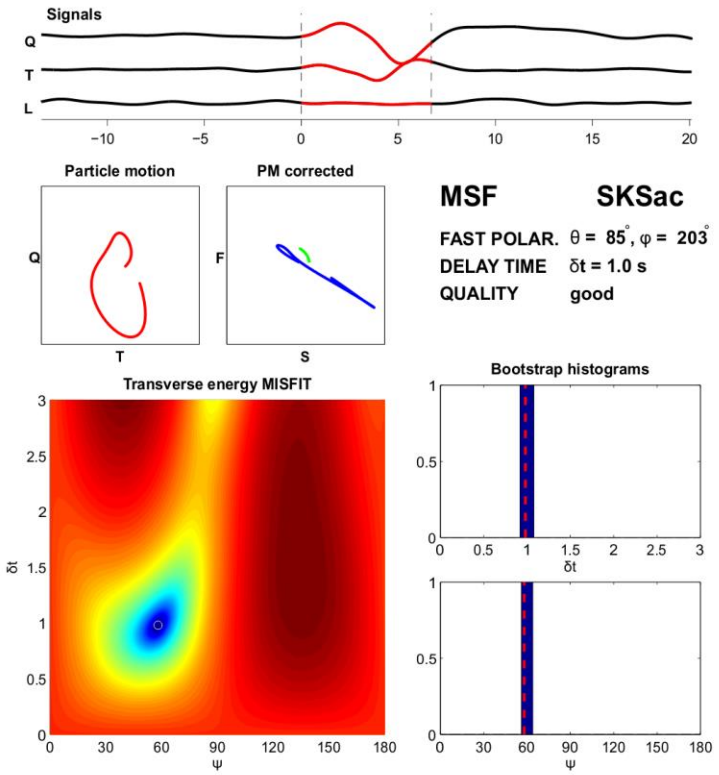
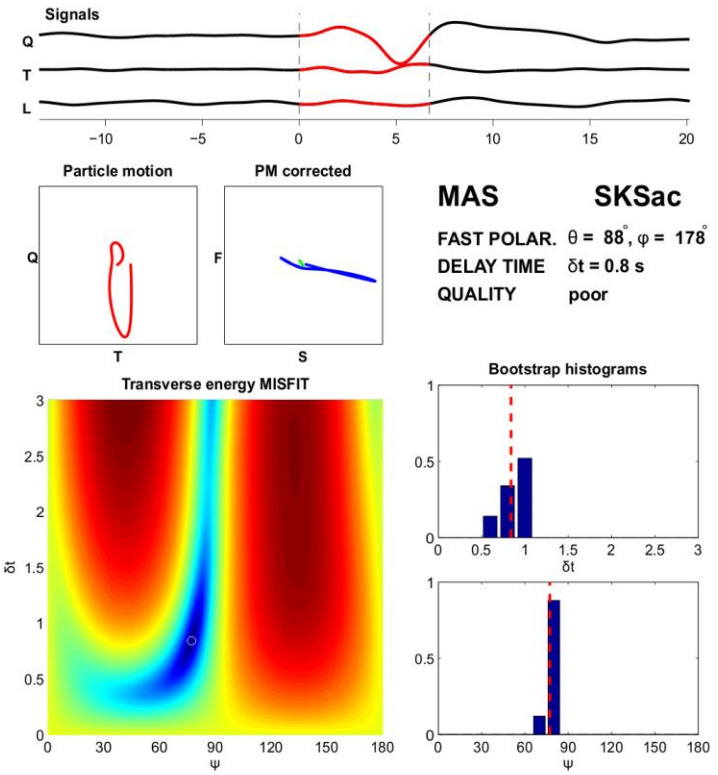
November 16, 2016

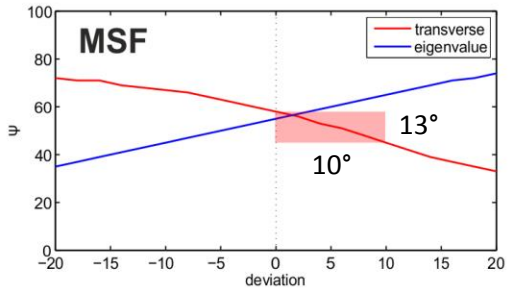
Data quality assurance



Sensitivity of splitting methods to sensor misorientation



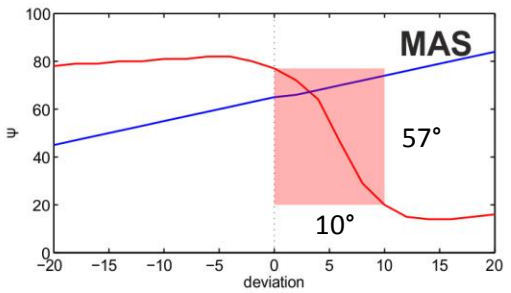




Stability of splitting methods:

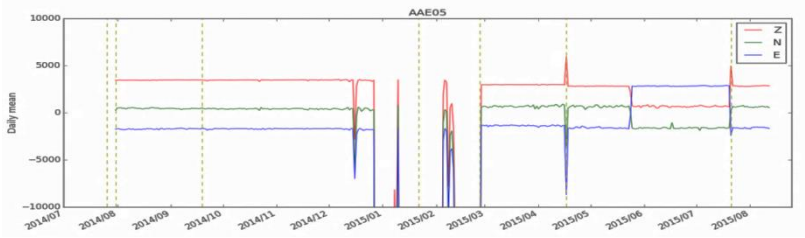
noisy signal:
transverse eigenvalue
misorientation:
transverse eigenvalue

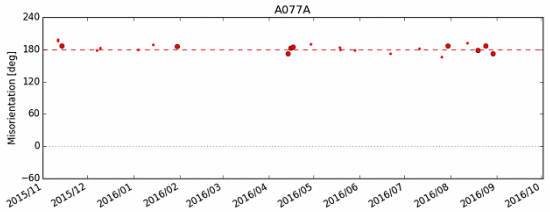
[Vecsey et al., 2008]

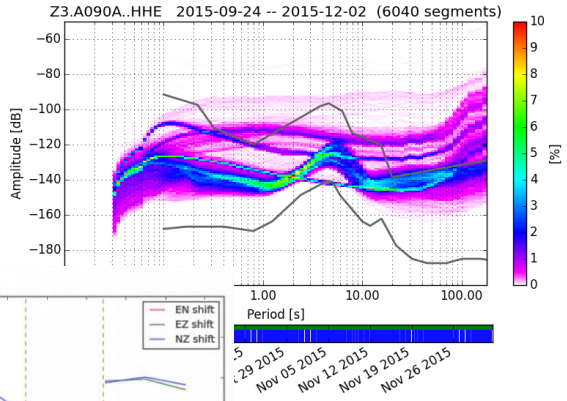


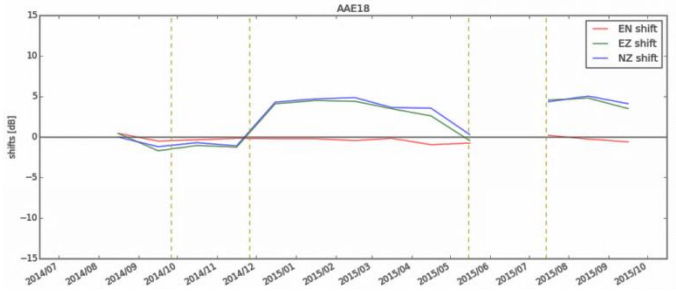
Data quality and assurance

- Time issues
- Sensor orientation
- Reversed or exchanged components
- Mass centring problems
- Anomalous channel amplitudes
- Glitches in signal
- Noise in signals



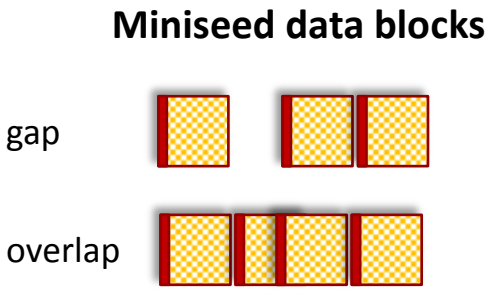






Vecsey et al., submitted to PEPI, 2017

Time issues



- Source of information:
  - log files
  - service sheets
  - **headers of mseed data**

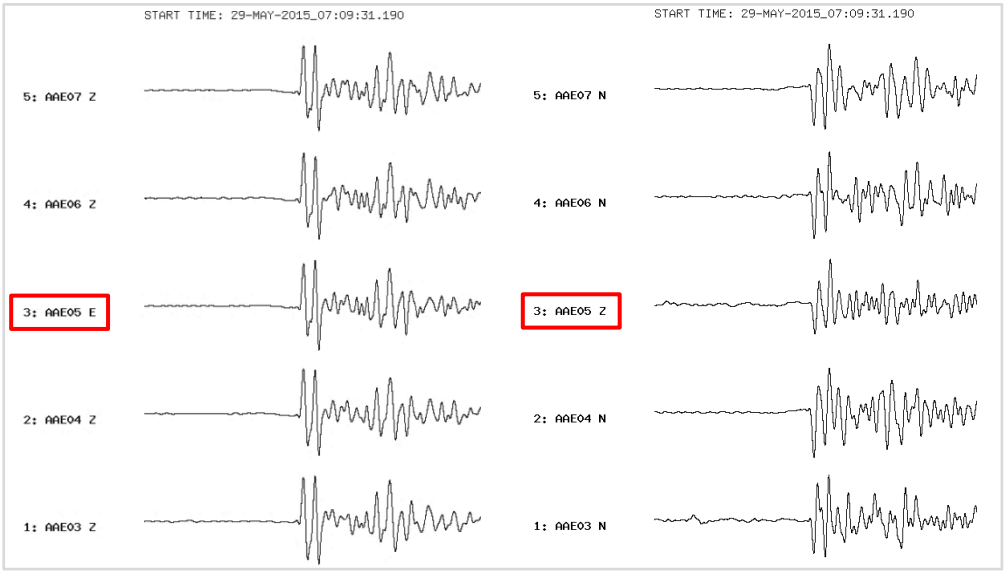
- Time issues
  - failure of oscillator tuning station time
  - leap second (station time corrected with 30-90 minute delay)
  - switch between UTC and GPS times (17 s forth and back, standing for hours)

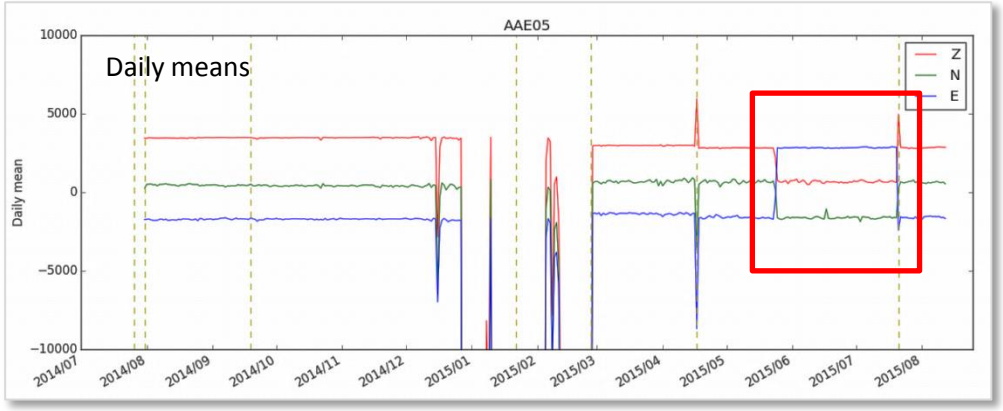
Vecsey et al., submitted to PEPI, 2017

Exchange of channels

Can be detected by different methods:

- wave similarities in array of stations
- wave polarization
- channel offsets (daily means)
- noise level in PPSD





Vecsey et al., submitted to PEPI, 2017

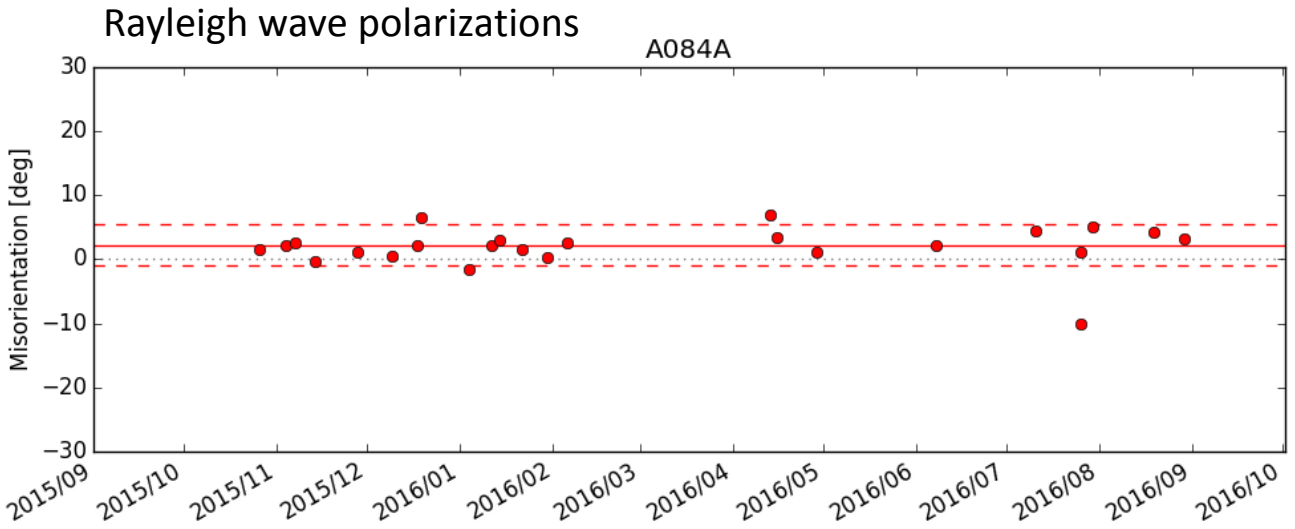
Sensor orientation

Orientation *in situ*:

- gyrocompass

Orientation *ex situ*:

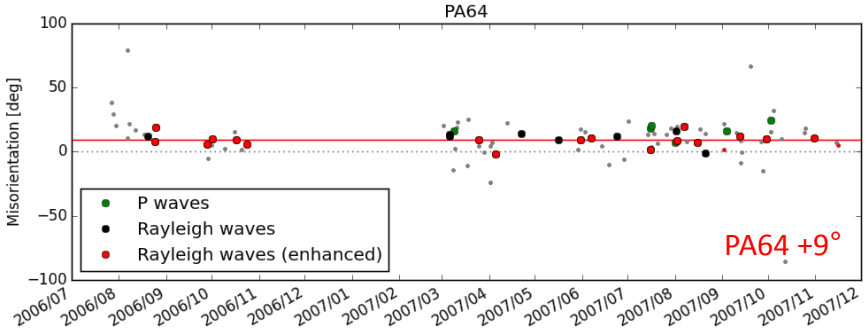
- wave polarization

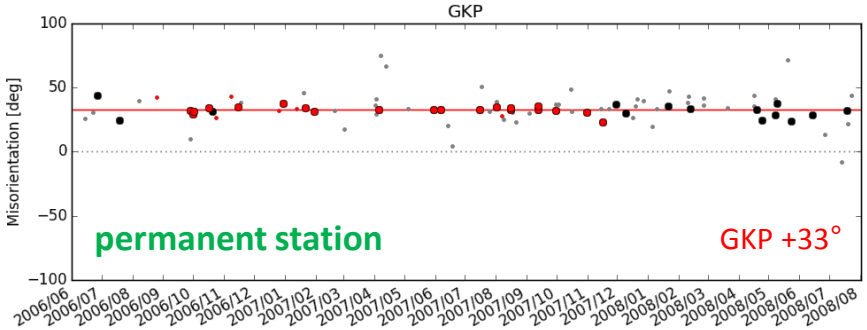


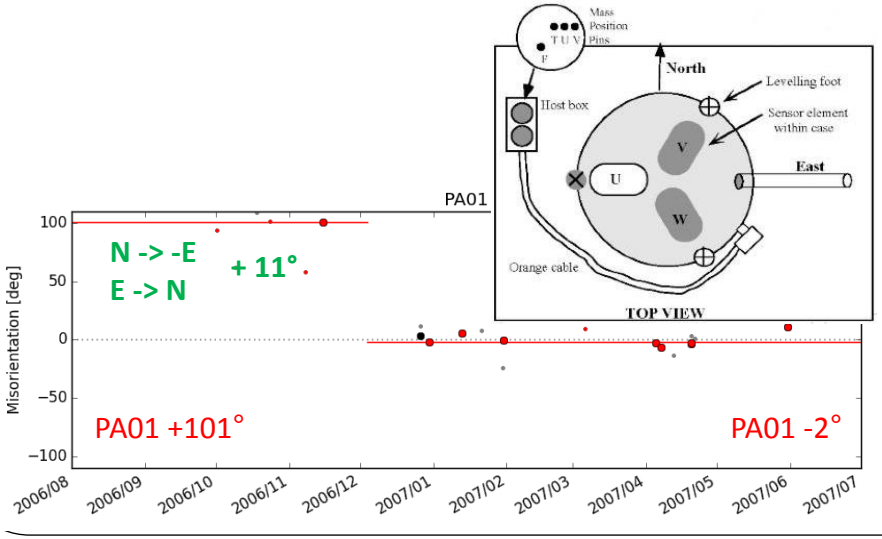
gyrocompass: 0° ± 1° | **RW polarization: 2° ± 3°**

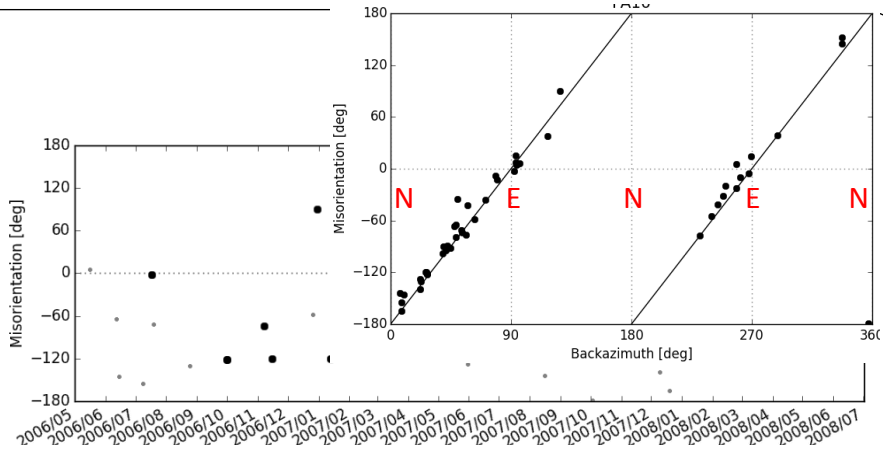
Vecsey et al., submitted to PEPI, 2017

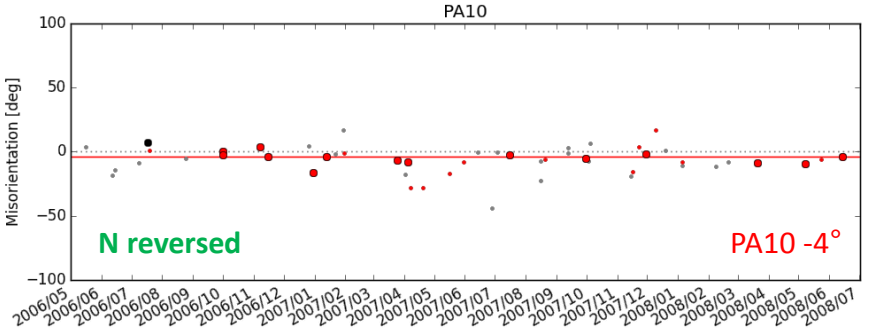
Sensor orientation

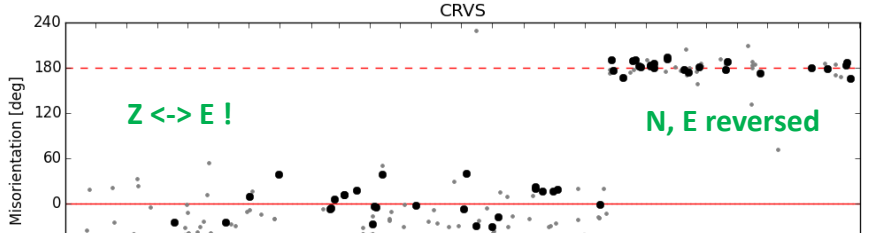


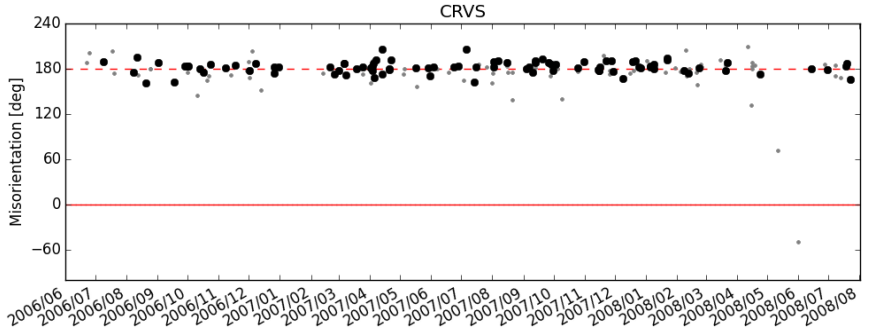






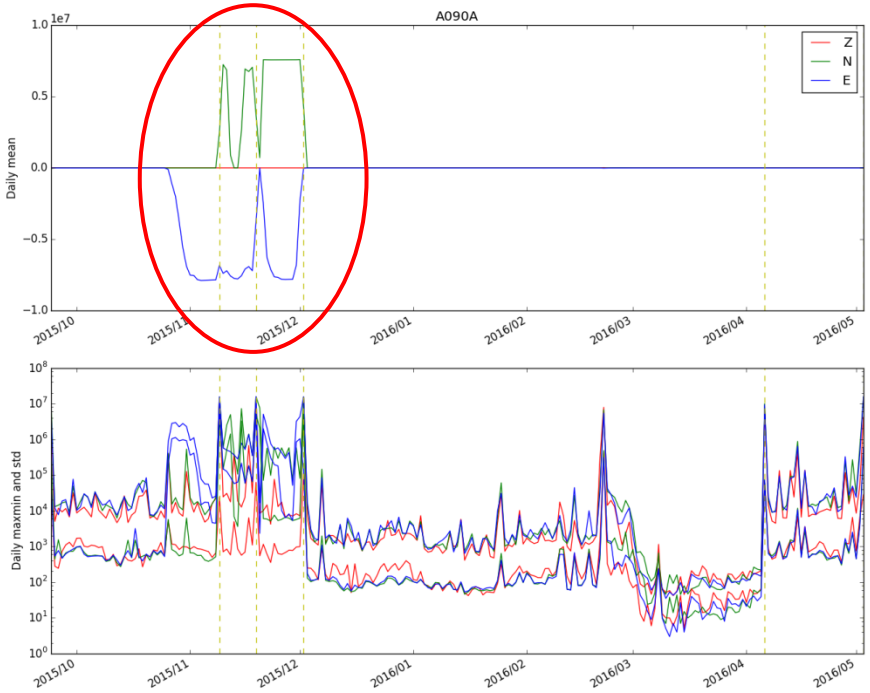




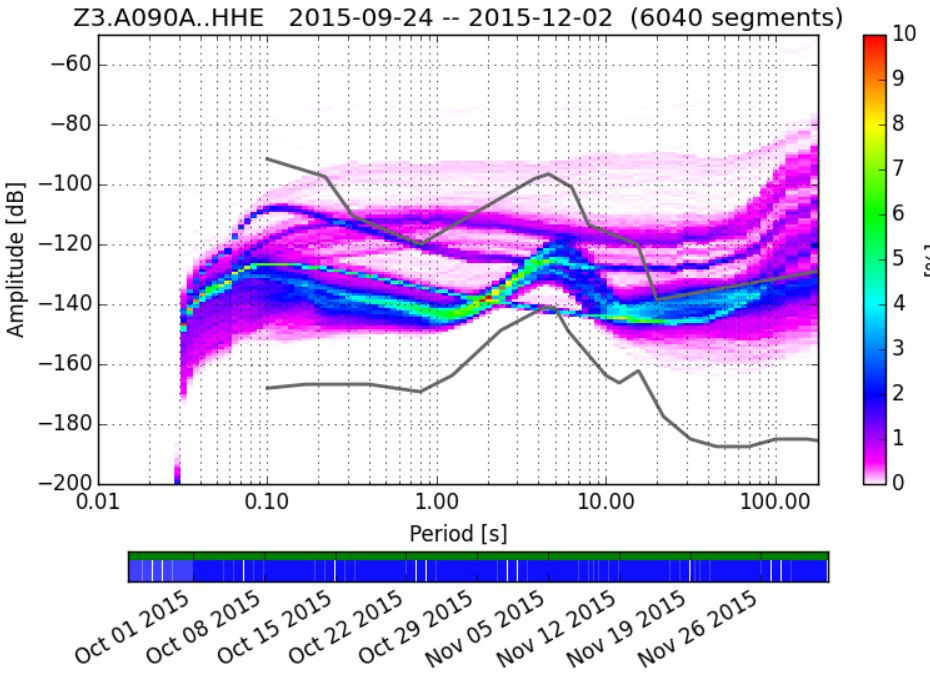


Mass centring problems

Daily means, maxima and std



Probabilistic power spectra density



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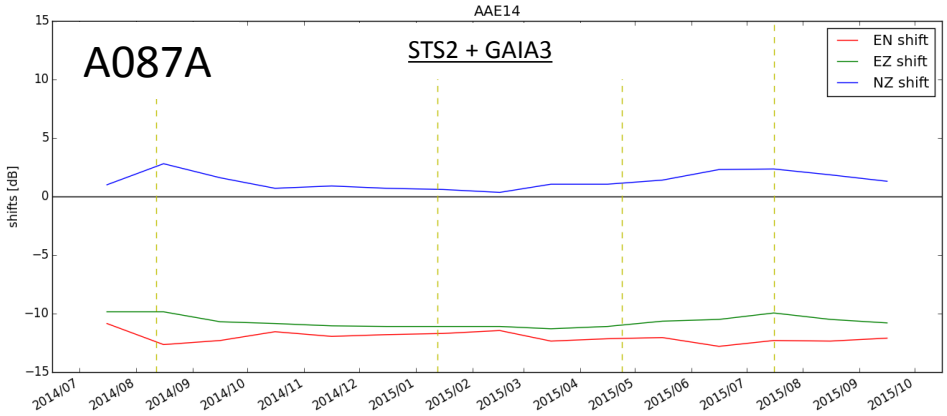
Anomalous channel amplitudes

Ratios of power spectra of three channels



Power spectrum of E component is lower by 11 dB, i.e., E component is 3.6x smaller.

Confirmed by the Gaia gain & calibration box, **datalogger** issue.

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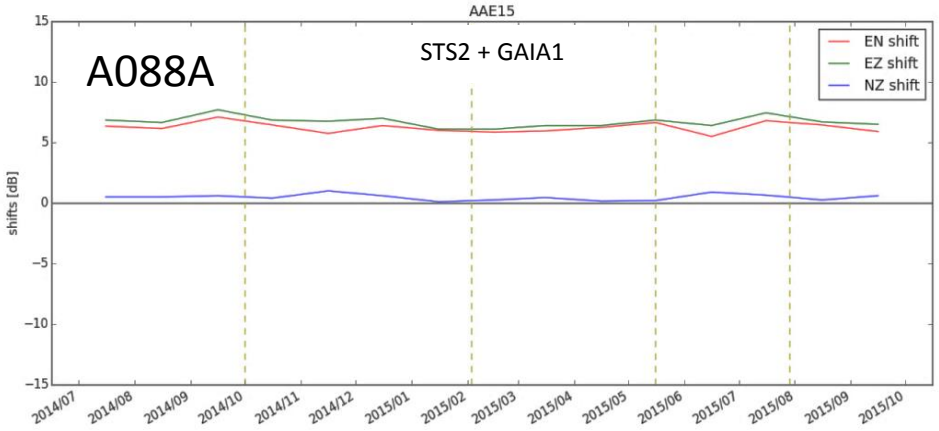
Anomalous channel amplitudes

Ratios of power spectra of three channels

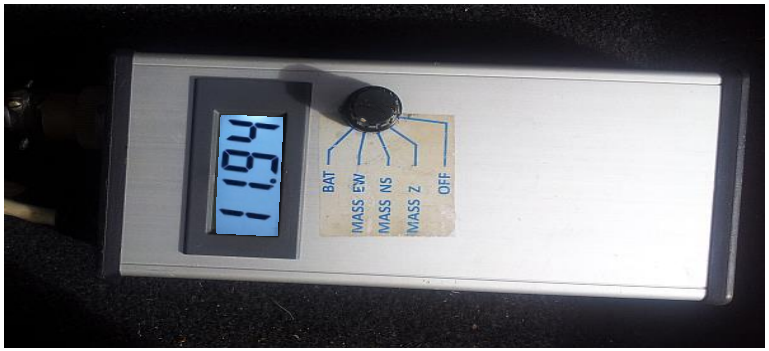


Power spectra of N,Z components are lower by 6 dB, i.e., N,Z component are 2x smaller.

Confirmed by the STS2 calibration box, **cable** issue.

STS2 calibration box

GURALP calibration box



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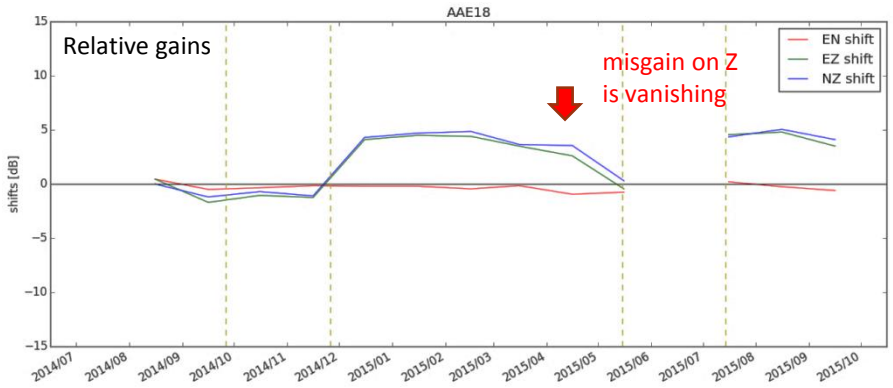
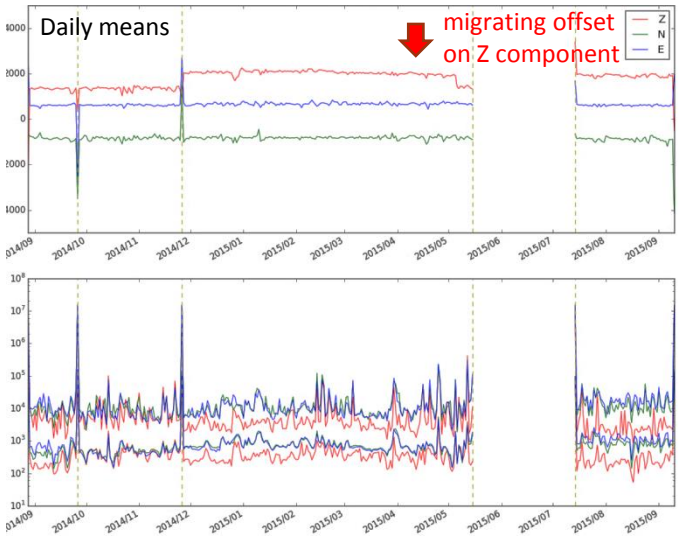
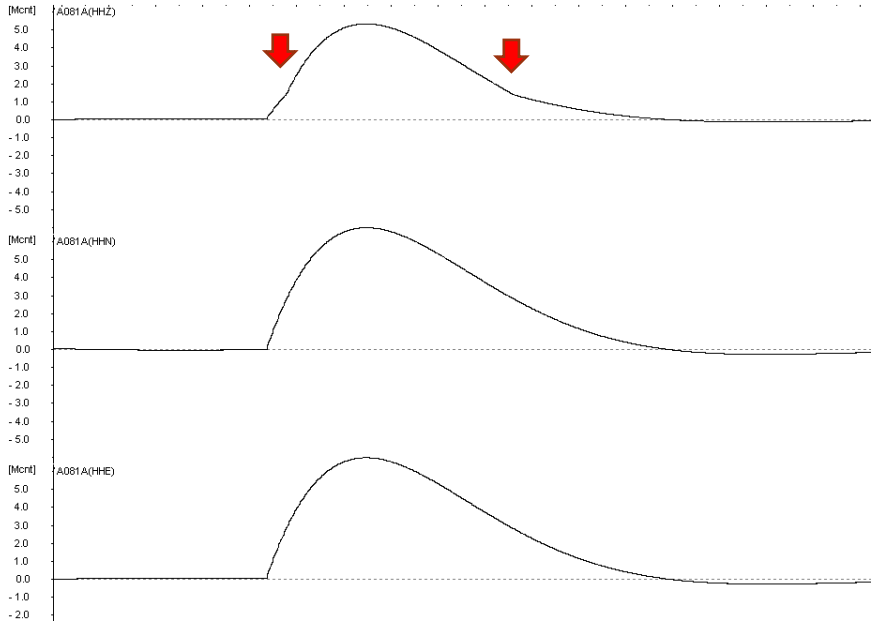
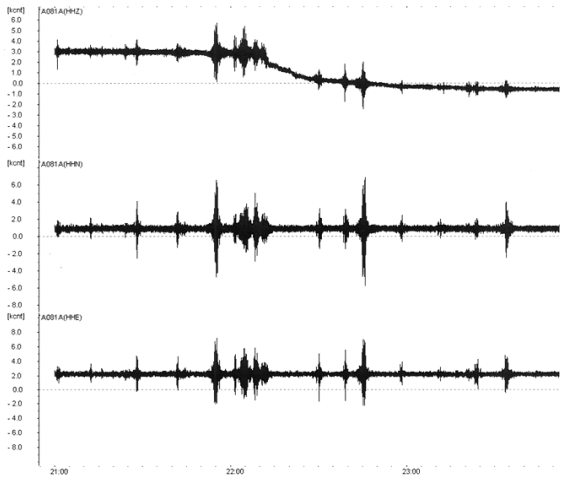
Amplitude gain issue (complex)









Conclusions

- Quality assurance procedures are crucial for integrated accessible data, high-quality products and precise analysis of seismological data
- We have implemented new methods to identify and correct potential difficulties occurred in seismic signals
- Direct technical measurements (by, e.g., a gyrocompass, calibration seismometer and datalogger boxes) are combined with backward software methods, thus resulting in double-checking data quality
- Most signal issues can be corrected by changes in seismic metadata; tracking the changes and sharing metadata updates are important for integration of large seismic datasets