Recent Advances of the CIVISA Seismic Monitoring Network in the Azores Islands

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(1) Centre for Volcanology and Geological Risks Assessment, University of Azores, Azores, Portugal
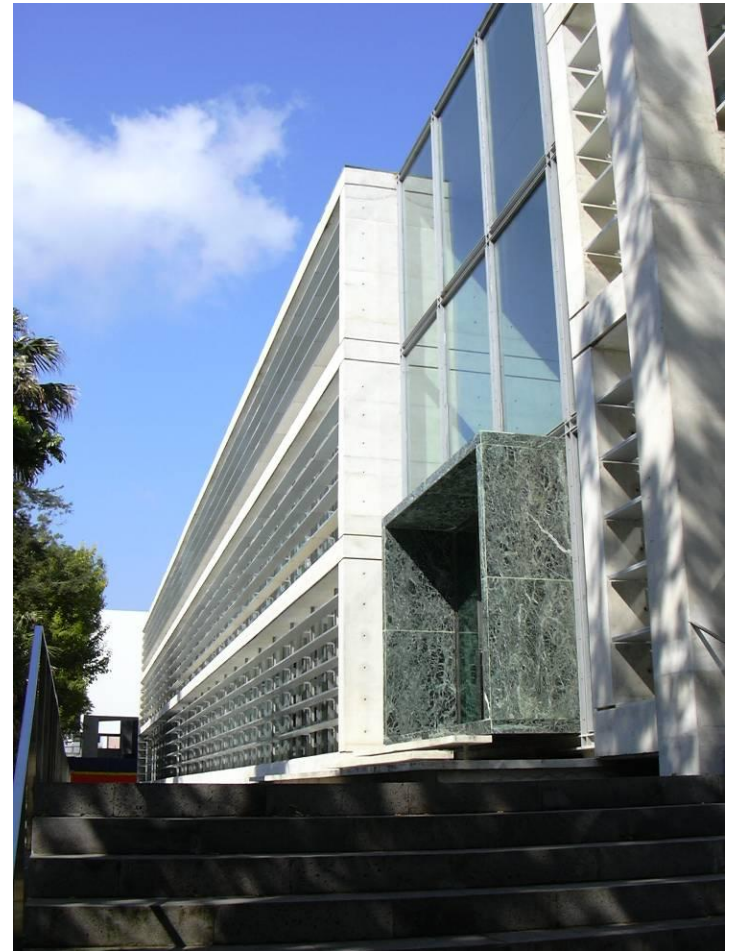(2) Centre for Seismovolcanic Information and Surveillance of the Azores, Azores, Portugal
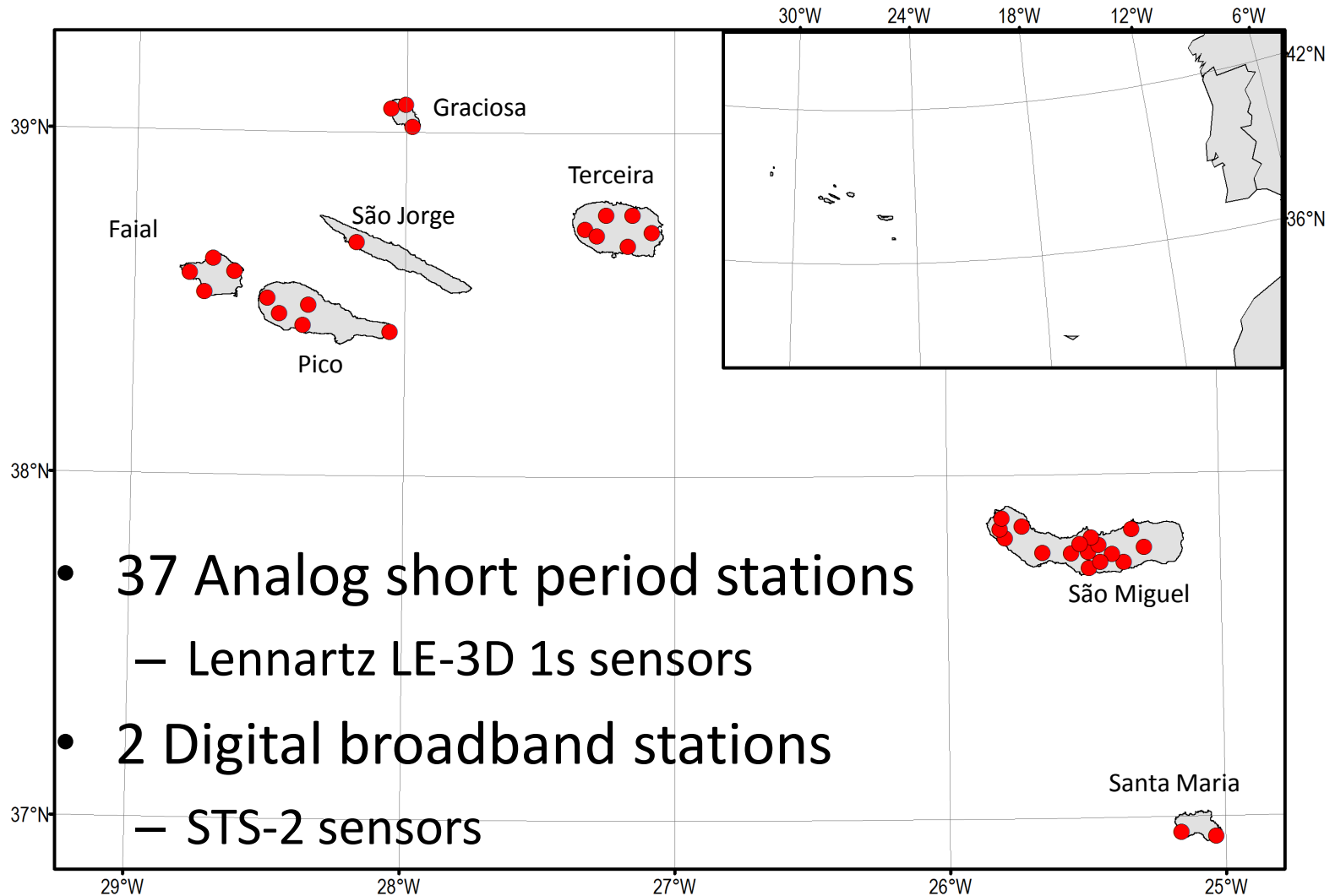(3) Department of Science, University of Bergen, Bergen, Norway
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DRCTC
DIRECÇÃO REGIONAL DA CIÊNCIA, TECNOLOGIA E COMUNICAÇÕES

CV
ARG

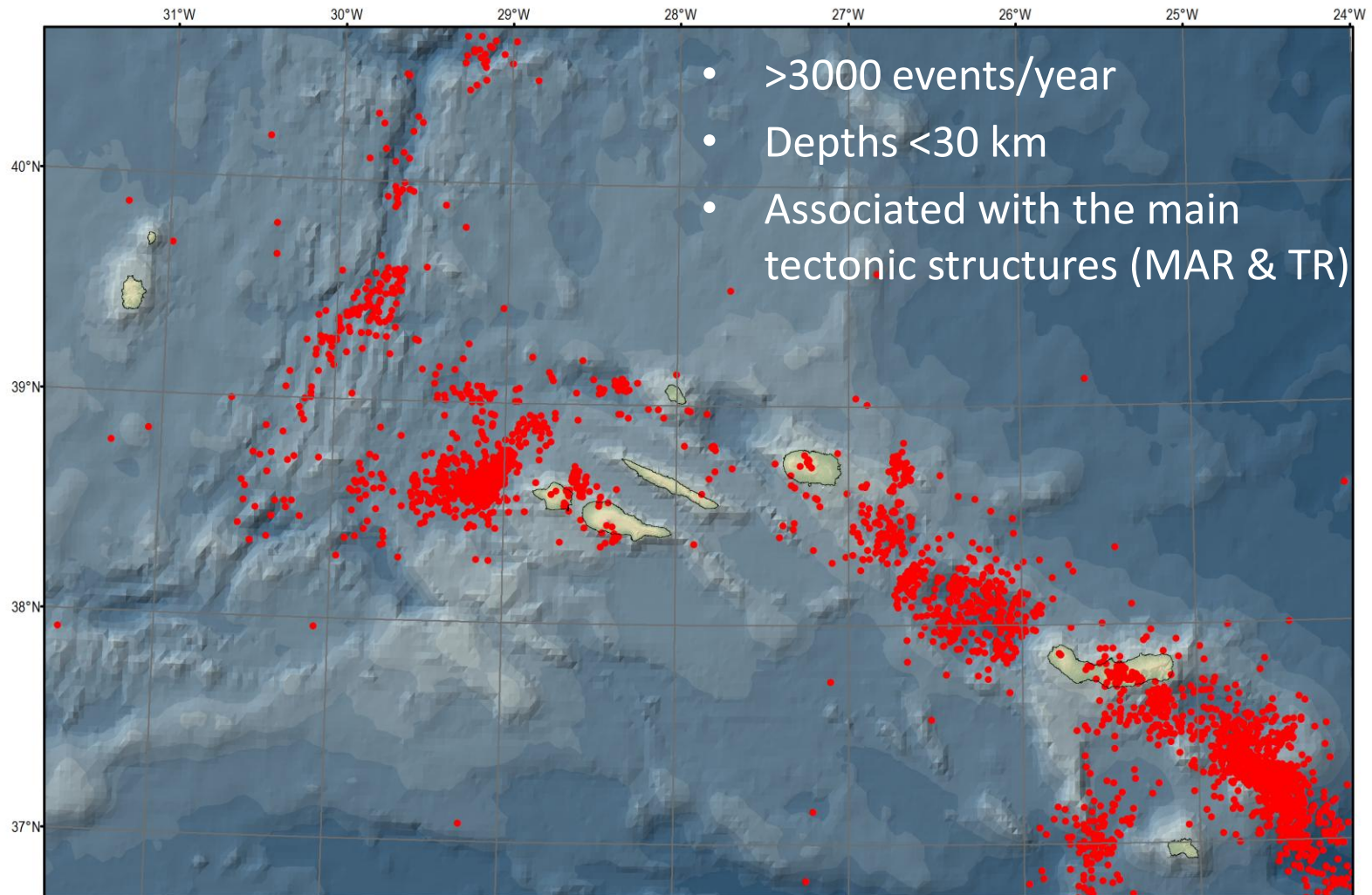# Centro de Informação e Vigilância Sismovulcânica dos Açores

- Non-profit association founded in 2008 by:
  - University of the Azores - Center of Volcanology and Geological Risk Assessment
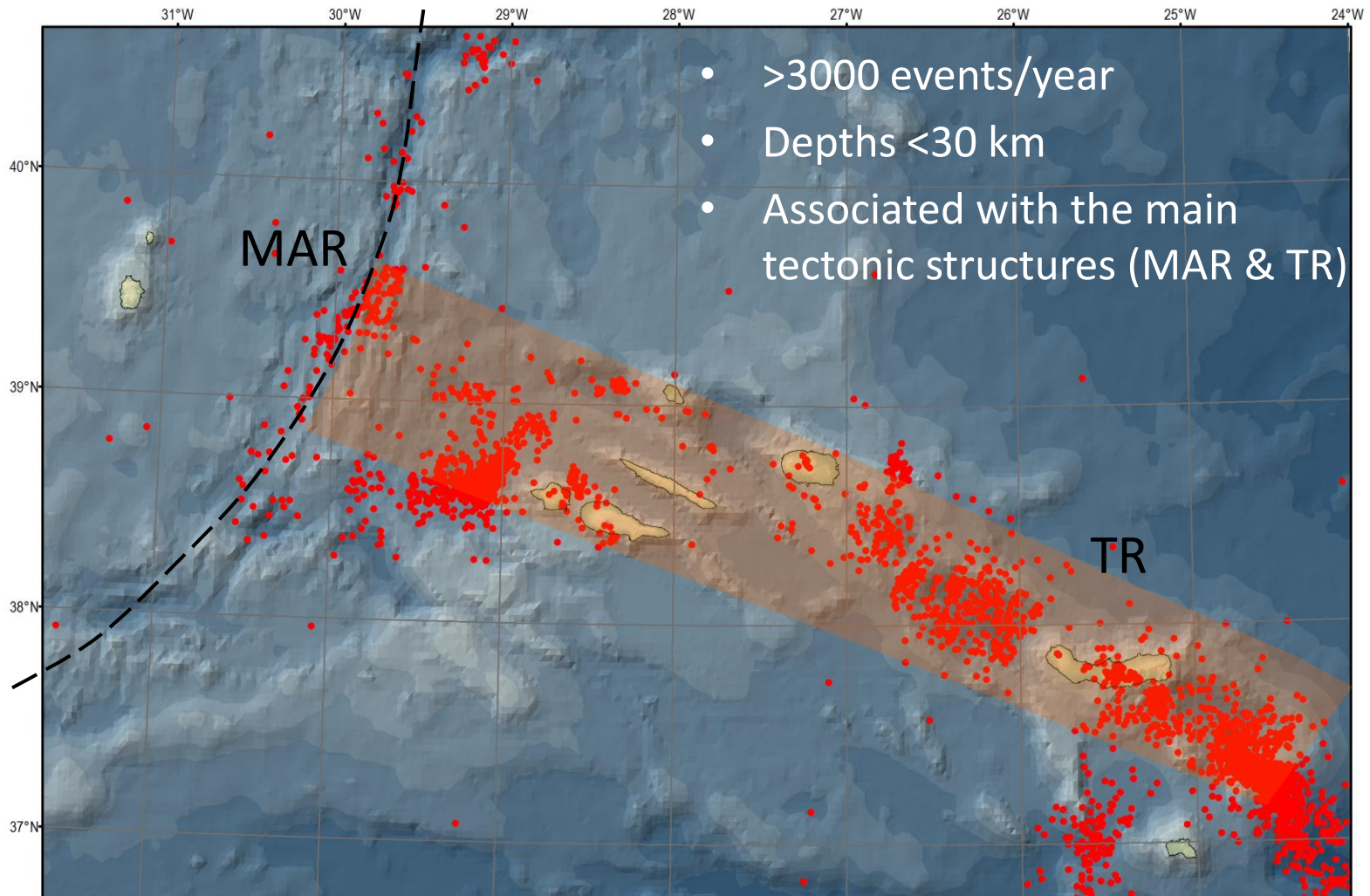 - Regional Government – Civil Protection Service
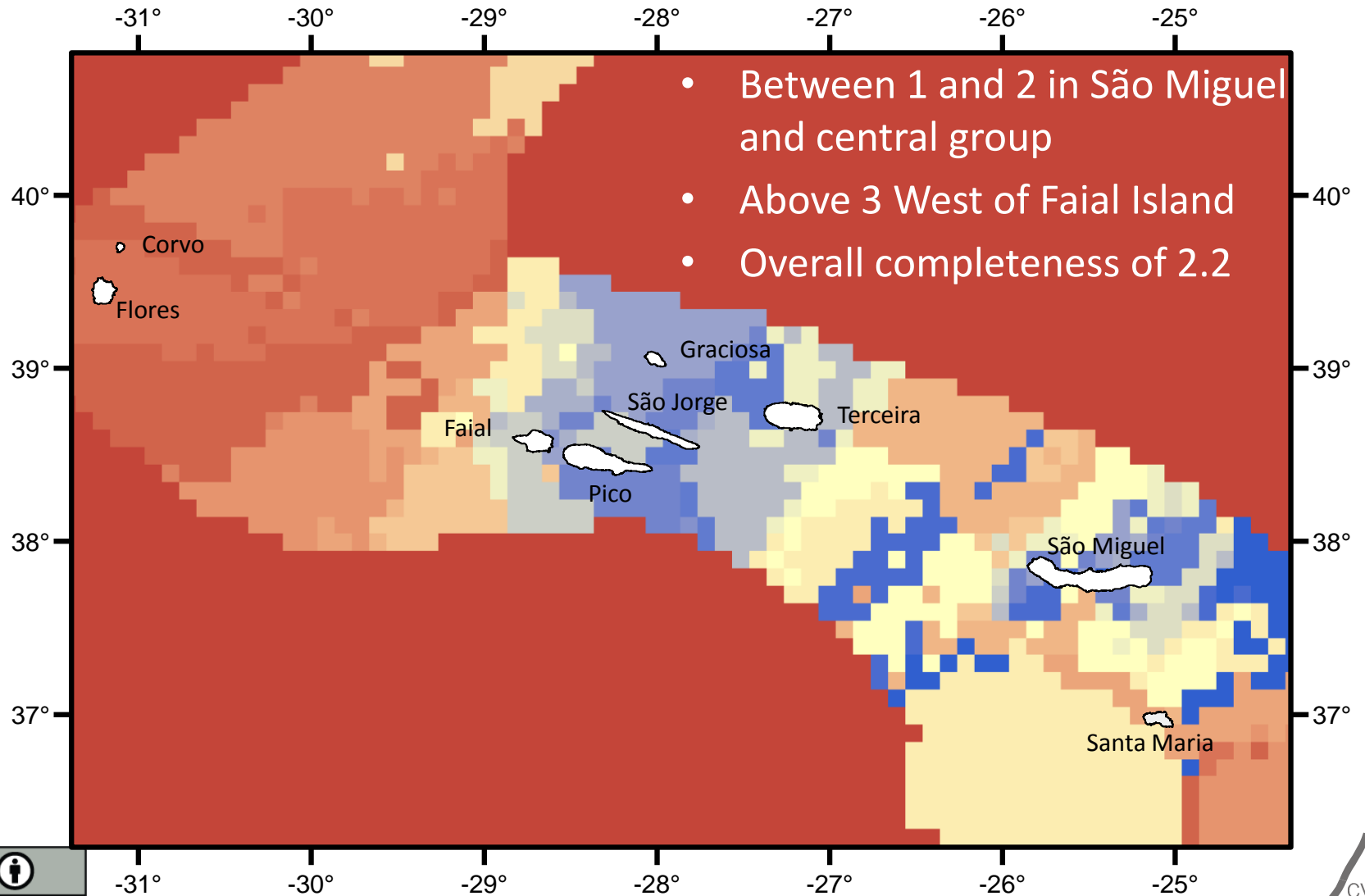
CV ARG

Seismic Monitoring Network

- 37 Analog short period stations
  - Lennartz LE-3D 1s sensors

- 2 Digital broadband stations
  - STS-2 sensors

Seismicity

- >3000 events/year
- Depths <30 km
- Associated with the main tectonic structures (MAR & TR)

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Completeness Magnitude

- Between 1 and 2 in São Miguel and central group
- Above 3 West of Faial Island
- Overall completeness of 2.2

Recent Advances

- Estimation of telemetry gains and sensor response files
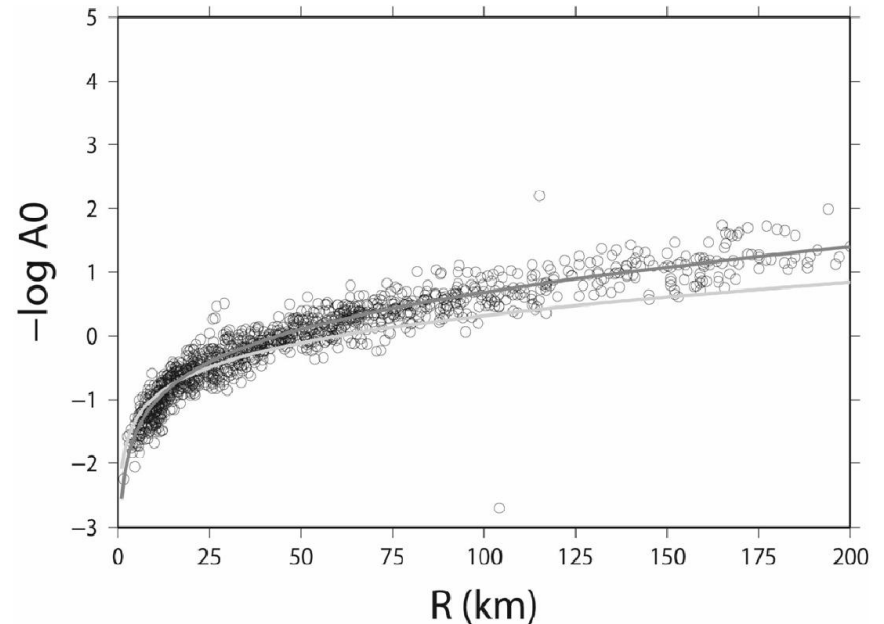
CV
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Recent Advances

- Estimation of telemetry gains and sensor response files
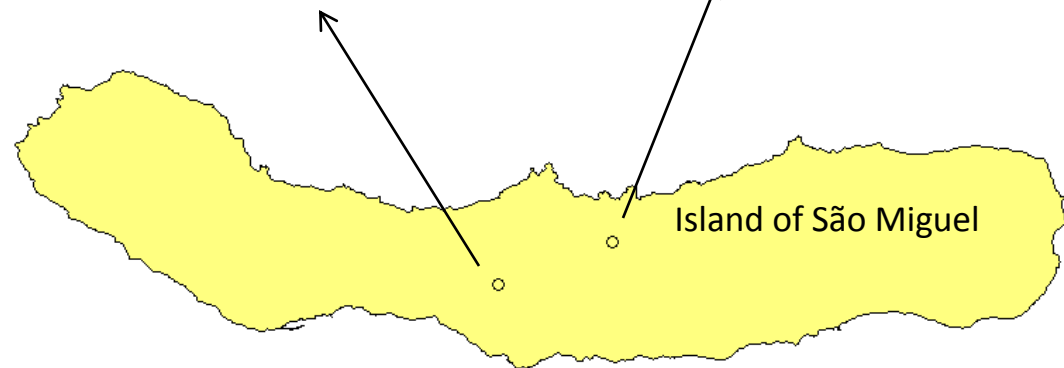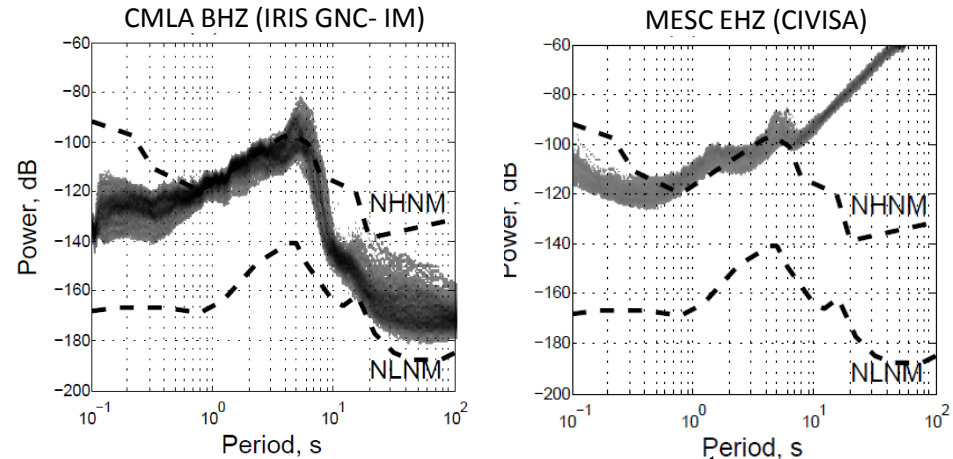- Review magnitude scales

$$MD = -0.87 + 2.00 \log T + 0.0035 \cdot R$$

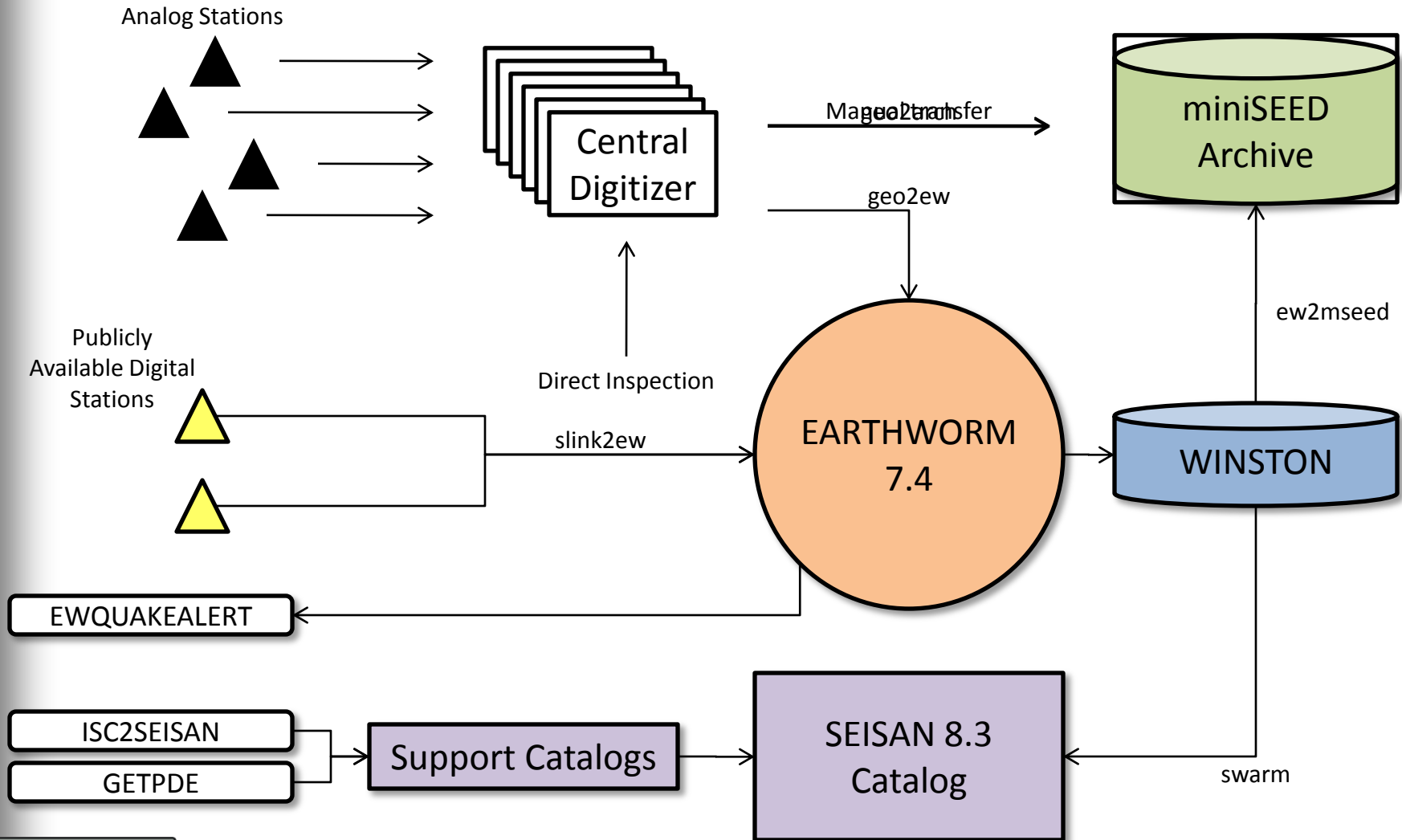$$ML = \log A + 1.489 \cdot \log R + 0.0027 \cdot R + S - 2.56$$

Recent Advances

- Estimation of telemetry gains and sensor response files
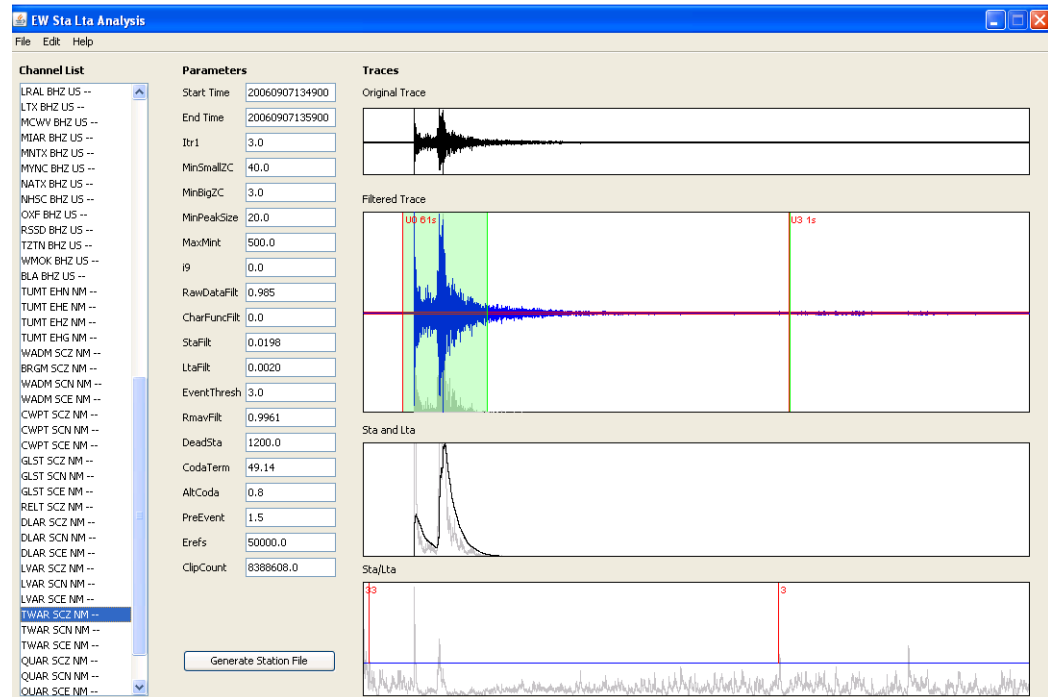- Review magnitude scales
- Noise analysis

CMLA BHZ (IRIS GNC- IM)

MESC EHZ (CIVISA)

Island of São Miguel

Information System

Analog Stations

Central Digitizer

Magc2transfer geo2transfer

miniSEED Archive

geo2ew

Direct Inspection

Publicly Available Digital Stations

slink2ew

EARTHWORM 7.4

ew2mseed

WINSTON

EWQUAKEALERT

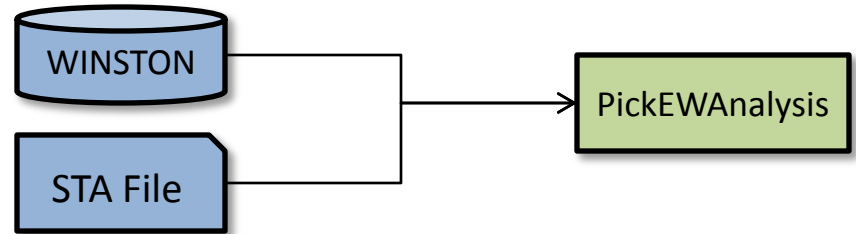ISC2SEISAN

GETPDE

Support Catalogs
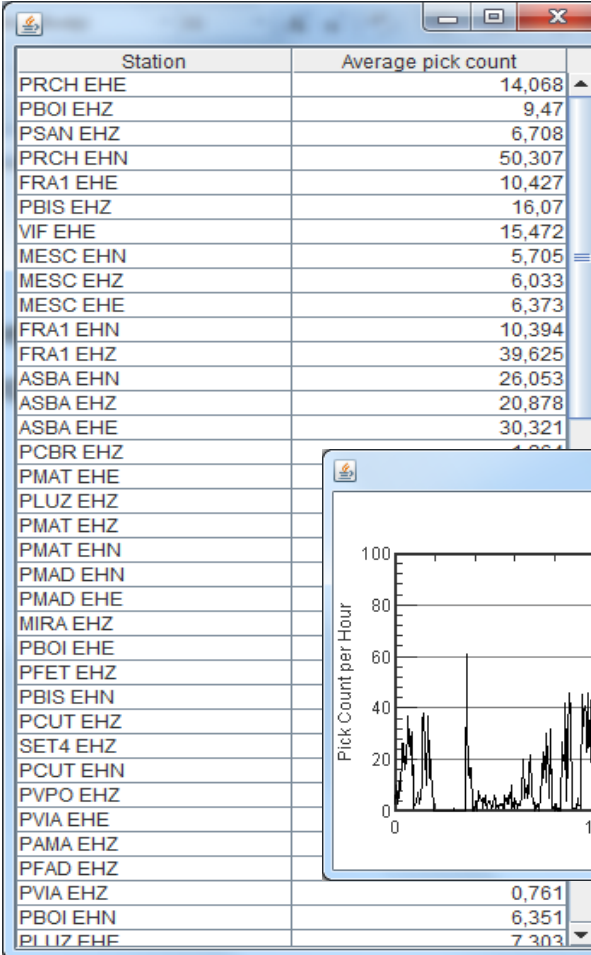
SEISAN 8.3 Catalog

swarm

CV
ARG

Contributions: PickEWAnalysis

- Read traces from WaveServerV or Winston server

- Read stations file from pick_ew

- Reproduce the behavior of pick_ew to assist the configuration of the phase picker
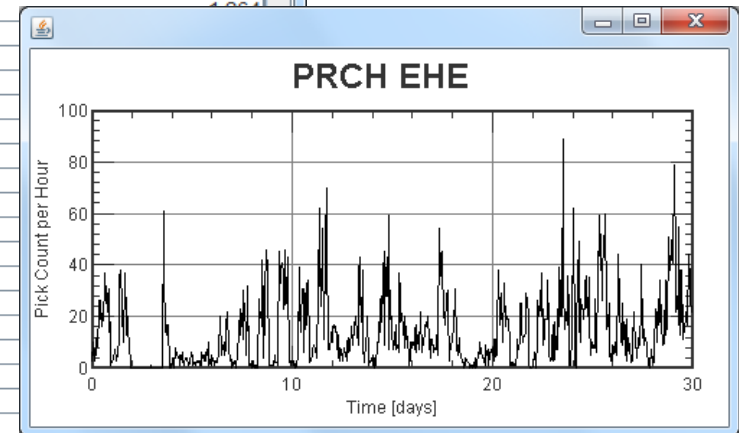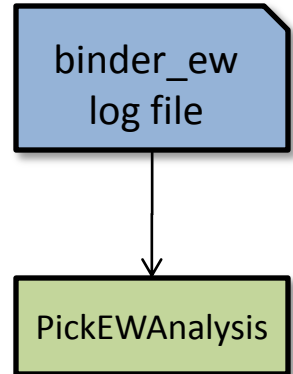
Contributions: PickStatistics

- Compute the average pick count per hour for each station

- Follow up on the pick_ew settings

- Evaluate "pick noise" for each channel
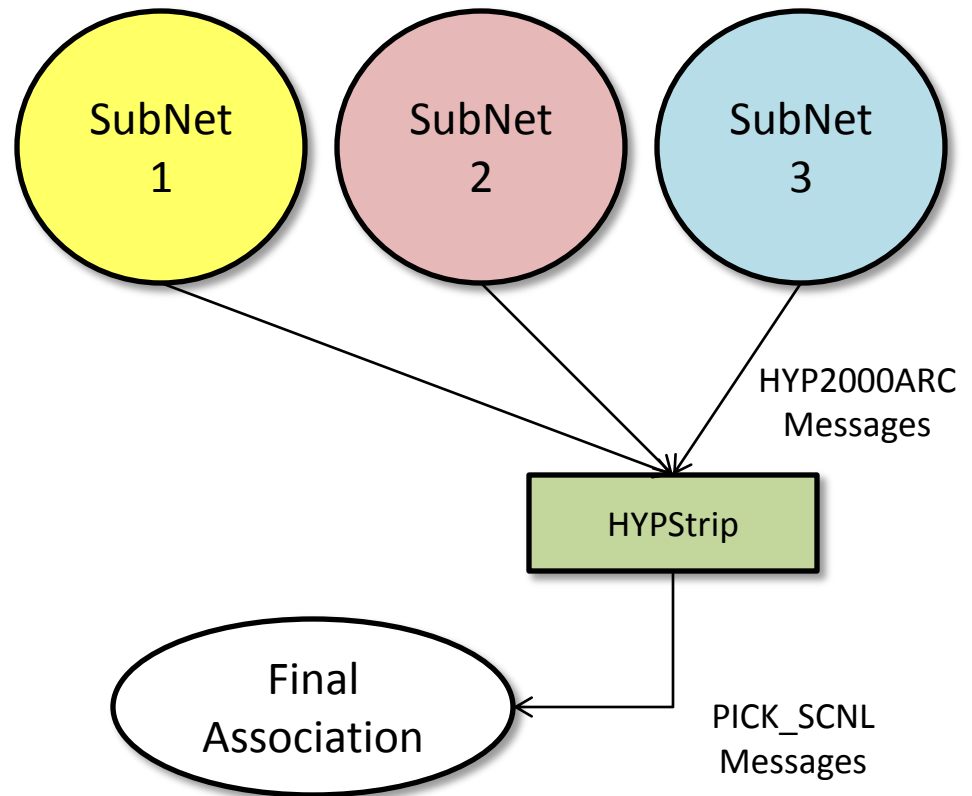
- Reads pick_recorder or binder_ew files

Station	Average pick count
PRCH EHE	14,068
PBOI EHZ	9,47
PSAN EHZ	6,708
PRCH EHN	50,307
FRA1 EHE	10,427
PBIS EHZ	16,07
VIF EHE	15,472
MESC EHN	5,705
MESC EHZ	6,033
MESC EHE	6,373
FRA1 EHN	10,394
FRA1 EHZ	39,625
ASBA EHN	26,053
ASBA EHZ	20,878
ASBA EHE	30,321
PCBR EHZ	
PMAT EHE	
PLUZ EHZ	
PMAT EHZ	
PMAT EHN	
PMAD EHN	
PMAD EHE	
MIRA EHZ	
PBOI EHE	
PFET EHZ	
PBIS EHN	
PCUT EHZ	
SET4 EHZ	
PCUT EHN	
PVPO EHZ	
PVIA EHE	
PAMA EHZ	
PFAD EHZ	
PVIA EHZ	0,761
PBOI EHN	6,351
PLUZ EHE	7,303

binder_ew log file

PickEWAnalysis

PRCH EHE
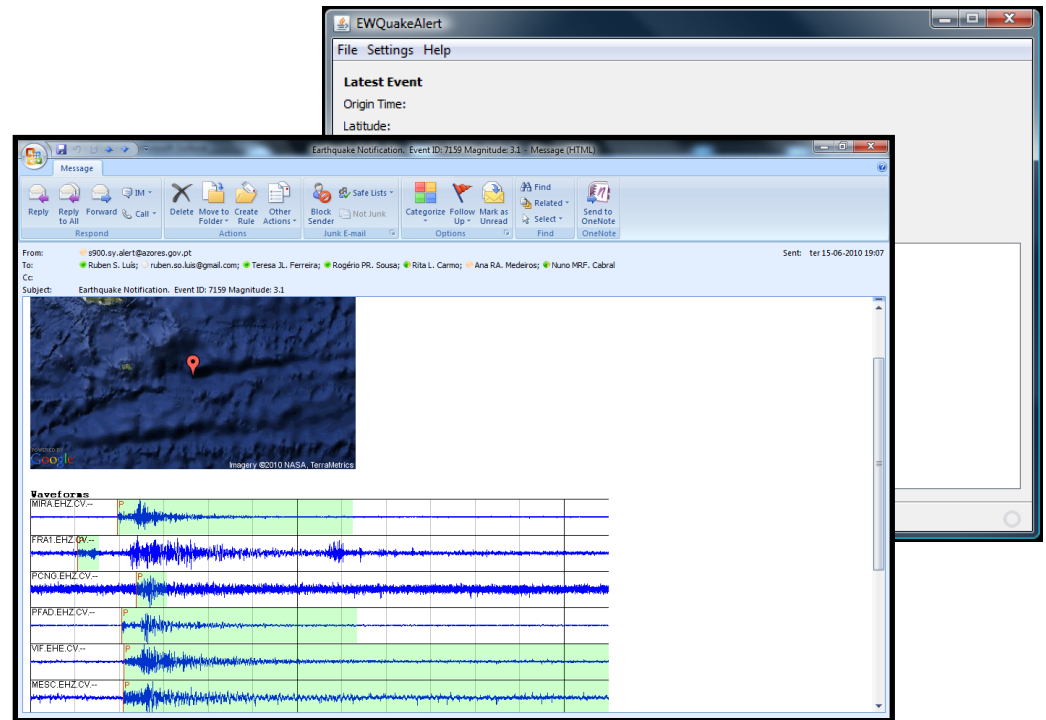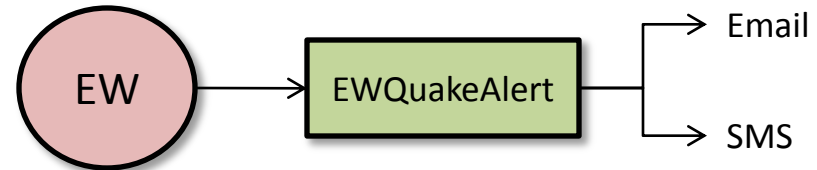
Pick Count per Hour / Time [days]

Contributions: HYPStrip

- Associates HYP2000ARC messages through time and location

- Re-creates pick_scnl messages from multiple hyp2000arc messages

- For usage with sub-network monitoring

- Based on HypAssoc from J.M. Saurel

SubNet 1

SubNet 2

SubNet 3

HYP2000ARC Messages

HYPStrip

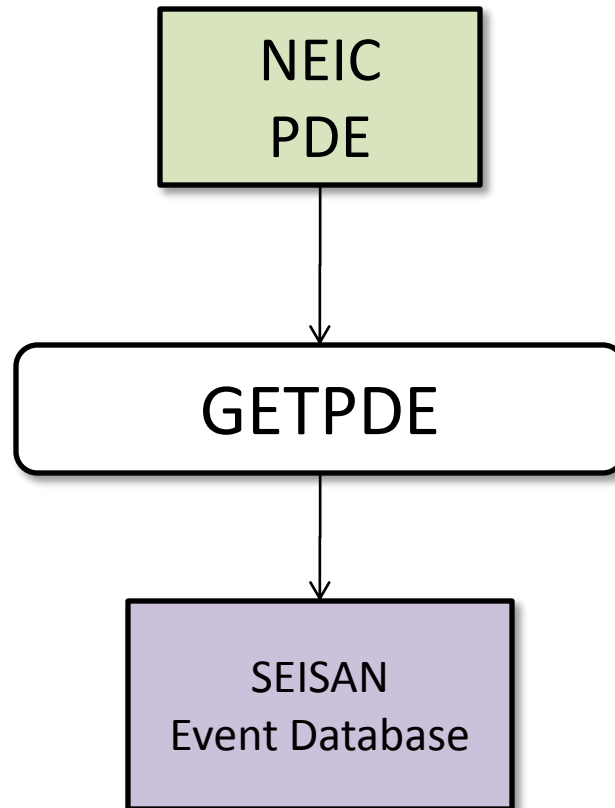Final Association

PICK_SCNL Messages

Contributions: EWQuakeAlert

- Sends email alerts

- Receives HYP2000ARC and TRIGLIST_SCNL messages from EARTHWORM via socket connection

- Connects to a WaveServerV to extract waveforms

- Performs evaluation of the event prior to sending alerts
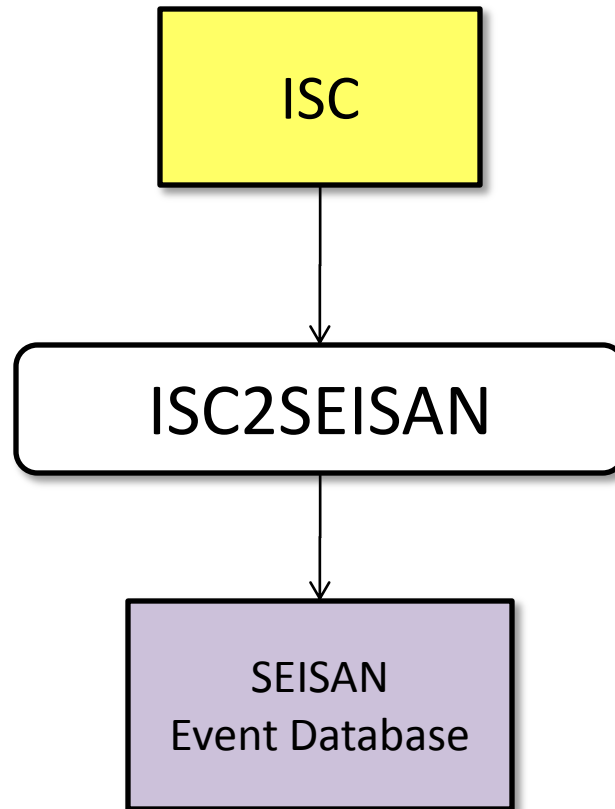
- Sends html email alerts

Contributions: GetPDE

- Periodically reads the events published in the NEIC global earthquake bulletin (PDE)

- Automatically updates a SEISAN database with the published events

NEIC PDE

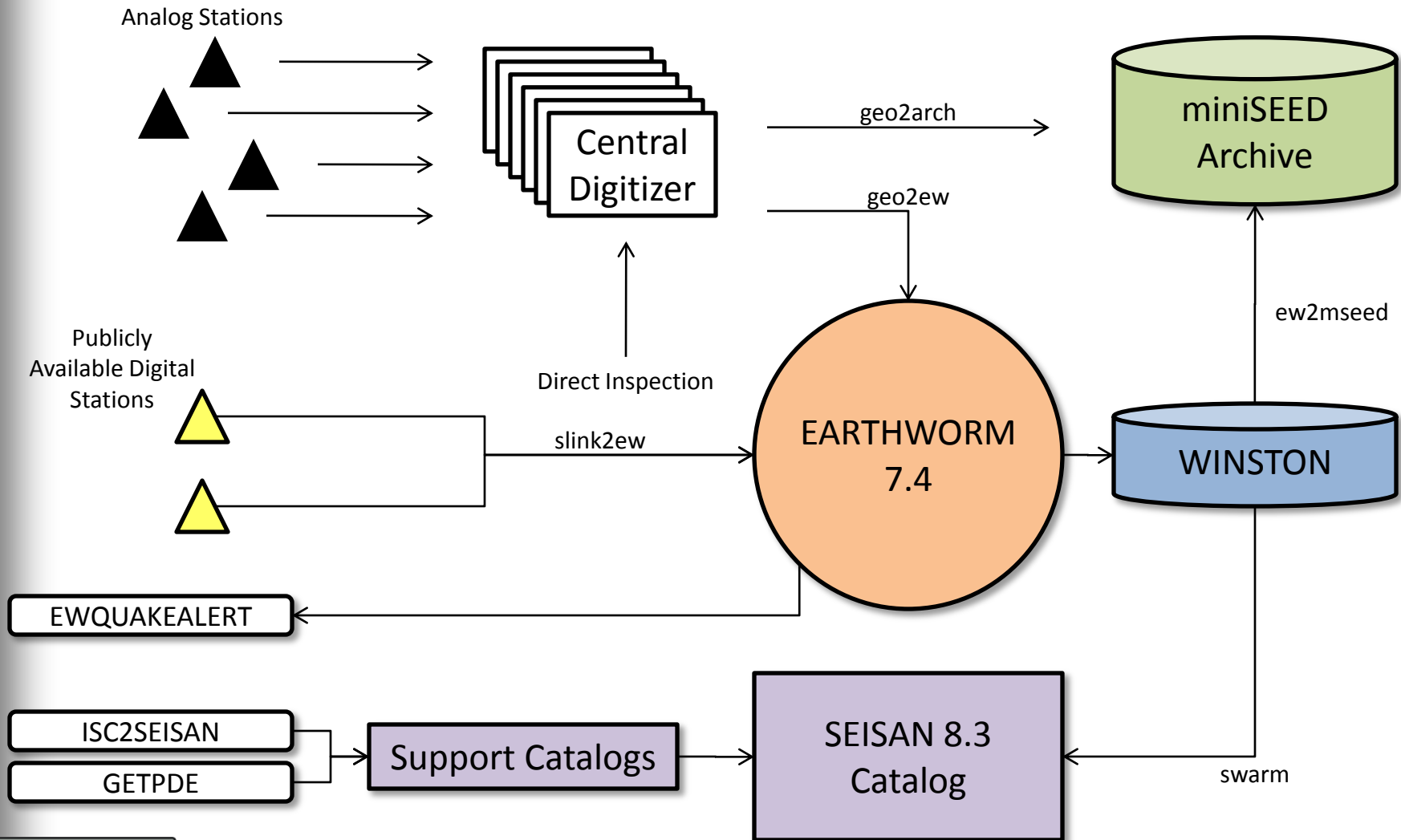GETPDE

SEISAN
Event Database
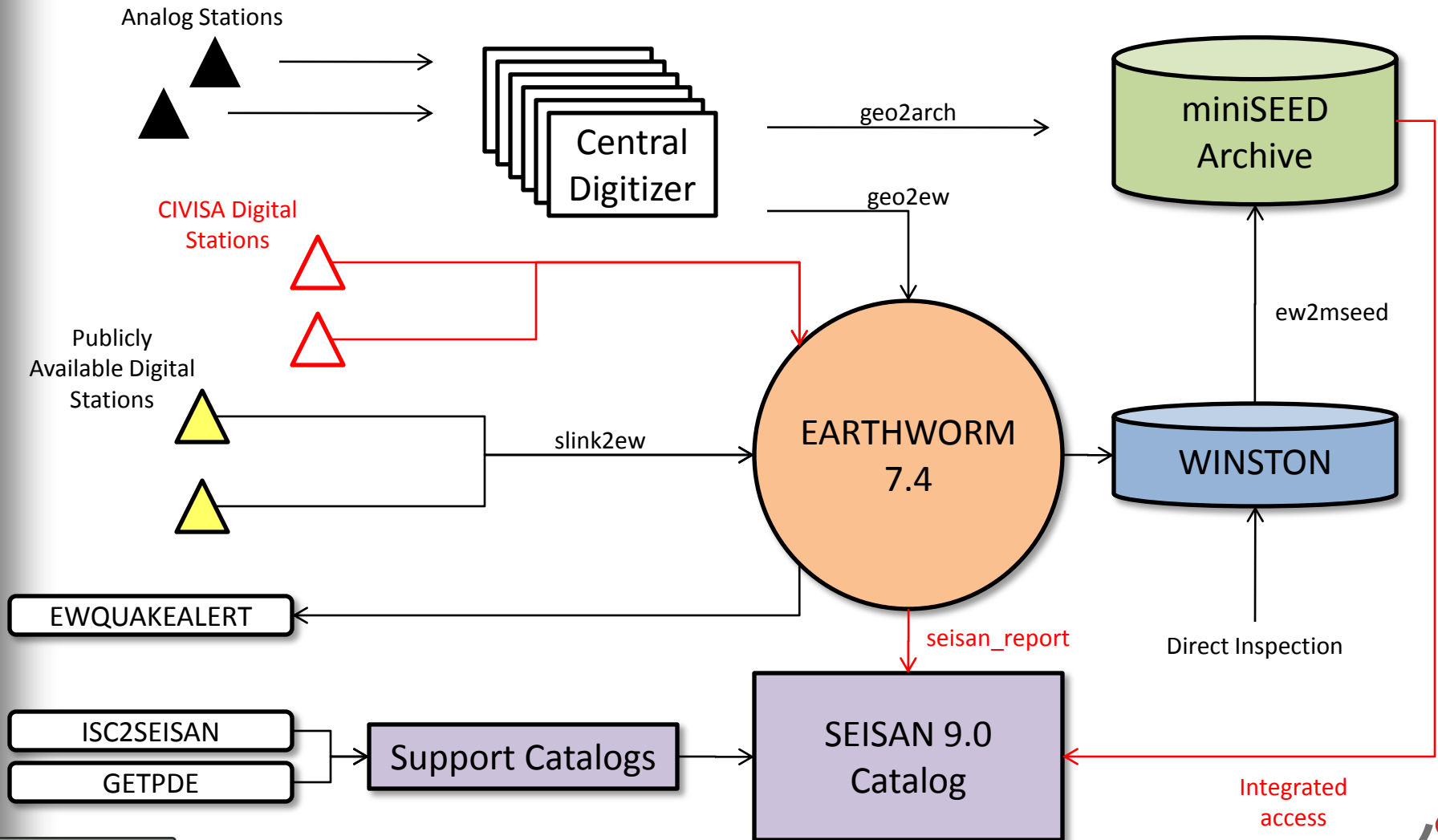
CV
ARG

Contributions: ISC2SEISAN

- Periodically reads the events published in the International Seismological Center (ISC)

- Automatically updates a SEISAN database with the published events

- Reviews previously collected events

ISC

ISC2SEISAN

SEISAN
Event Database

Information System: Next steps

Analog Stations

Central Digitizer

geo2arch

miniSEED Archive

geo2ew

Publicly Available Digital Stations

Direct Inspection

slink2ew

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ew2mseed

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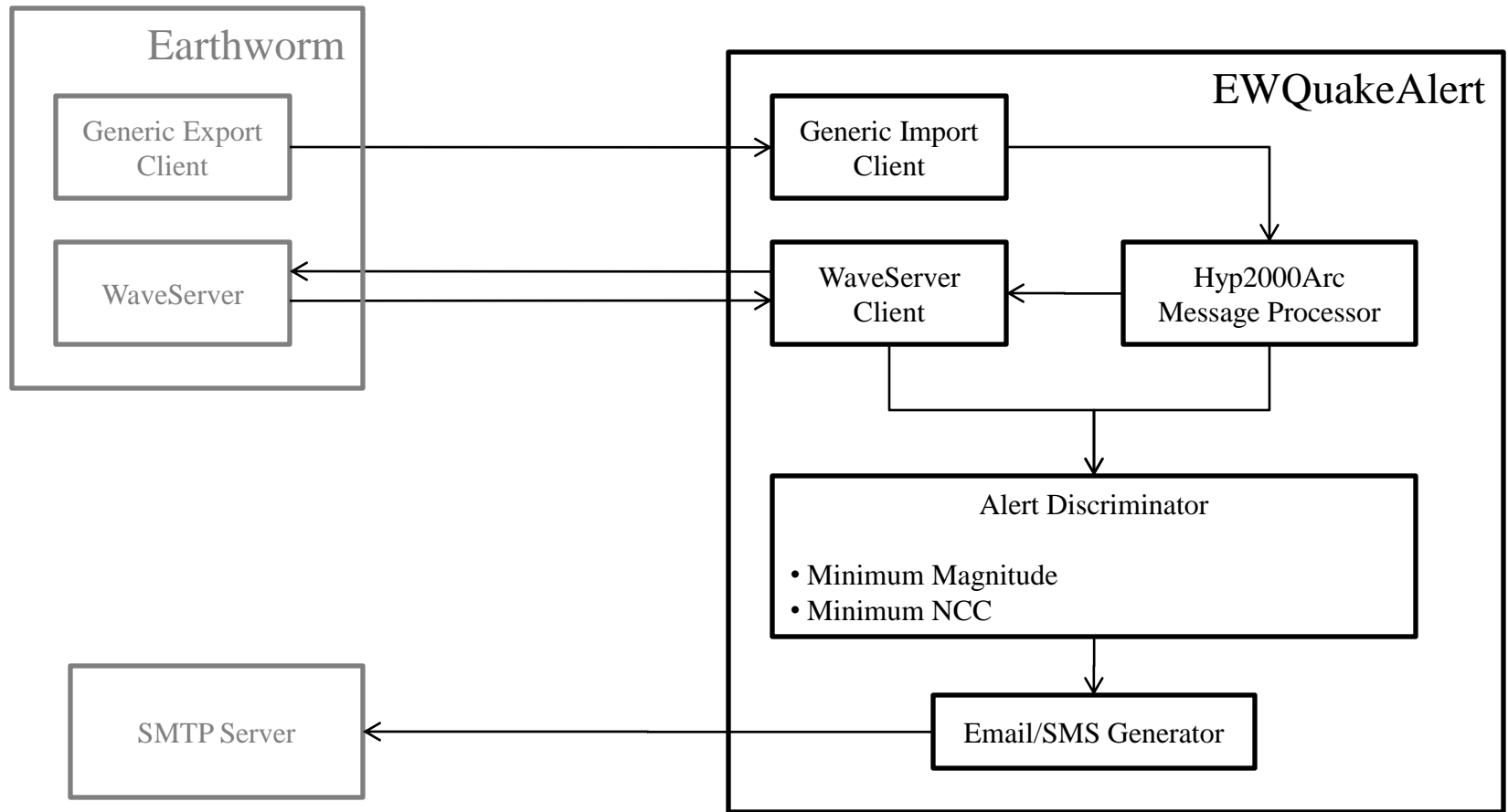
Information System : Next steps

Final Remarks

- Presented the recent developments of the CIVISA seismic monitoring network

- Recent calibration efforts allowed reviewing the quality of the data

- Strong effort has been taken to improve the information system

- Future developments will include improving the network hardware

Thank You

Backup: EWQuakeAlert I

Earthworm

Generic Export Client

WaveServer

EWQuakeAlert

Generic Import Client

WaveServer Client

Hyp2000Arc Message Processor

Alert Discriminator

• Minimum Magnitude
• Minimum NCC

Email/SMS Generator

SMTP Server

Backup: EWQuakeAlert II