SnT 2023
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
HOFBURG PALACE - Vienna and Online
19 TO 23 JUNE

Forensic Seismology for On-Site Inspection and Basic Research: The Concept of Nanoseismic Monitoring

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seismic software & services

INTRODUCTION

Forensic Seismology

Is intended to find

- the unknown,
- the unexpected,
- the exceptional,
- the non-seismic,
- the very weak

beyond routine seismology for earthquakes.

METHODS/DATA

Nanoseismic Monitoring

Is based on

SonoView for visual screening (no STA/LTA)

HypoLine for graphical location (no LS average)

HypoLine*expert* for further in-depth analysis

START

RESULTS

The **PSM** toolkit of **CTBTO** Is based on software of **Nanoseismic Monitoring**.

It has proven success at **IFE08** and **IFE14**.

Basic research apps were landslides, mapping active faults, induced seismicity.

CONCLUSION

Nanoseismic Monitoring

is available with example data for testing at www.sonicona.com

It is also demonstrated during S&T2023 at the Sonicona Booth 16 In Prinz Eugen Saal.

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The Concept of **Nanoseismic Monitor**ing

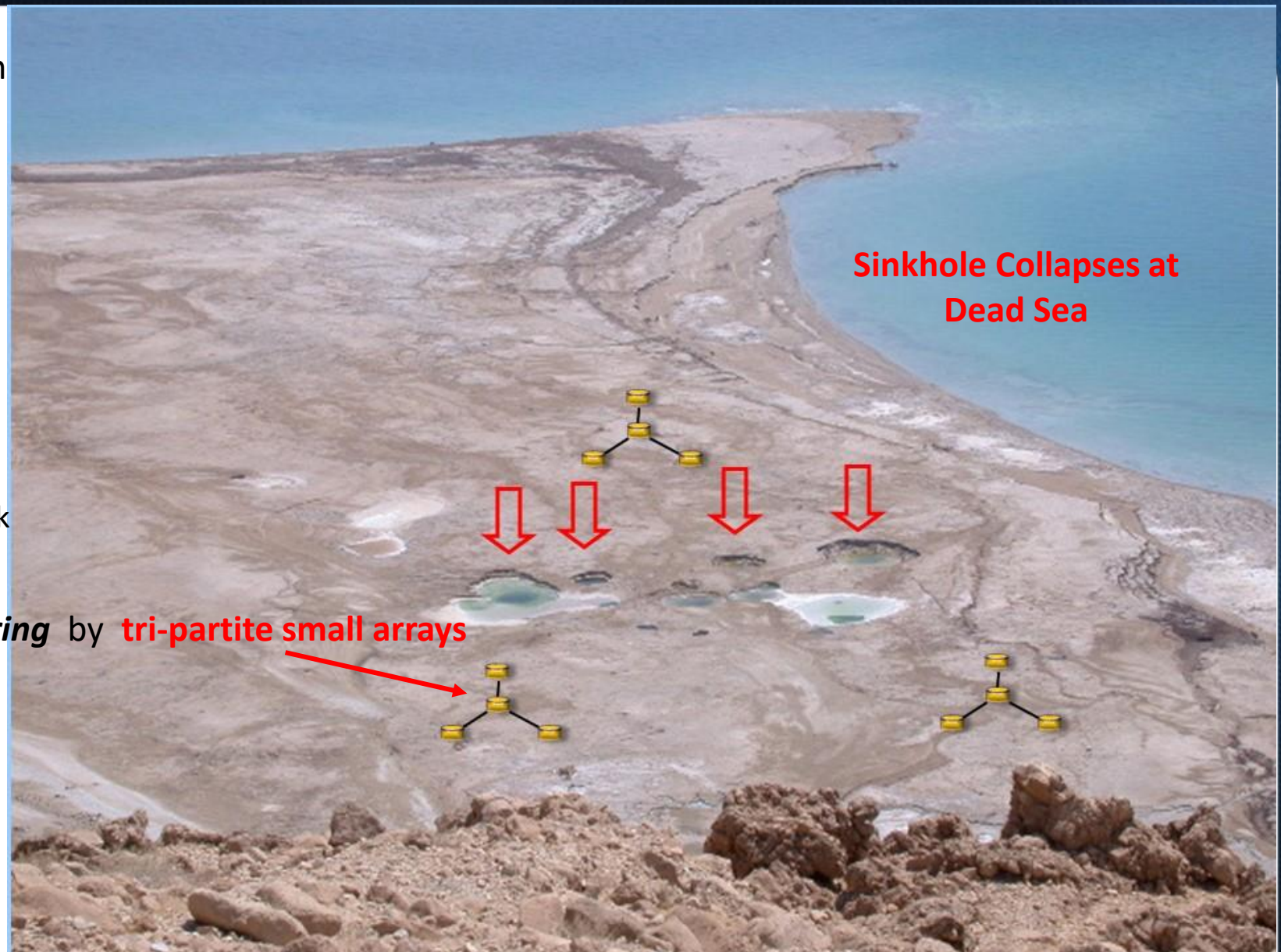
Nanoseismic Monitoring is both

Software suite for
Forensic Seismology of

- UNE Aftershocks
- Slidequakes of slow Landslides
- Rockfalls and Avalanches
- Sinkhole Collapses
- singular Deep Earthquake under shallow seismicity
- Impact/Explosion by accident/sabotage/hostile attack

Concept for ***high-resolution, ultra-portable Seismic Monitoring*** by **tri-partite small arrays**

- OSI Field Campaigns
- Mapping Active Faults and Induced Seismicity
- Rapid Aftershock Monitoring
- Studies for Network Design
- Urban Seismology



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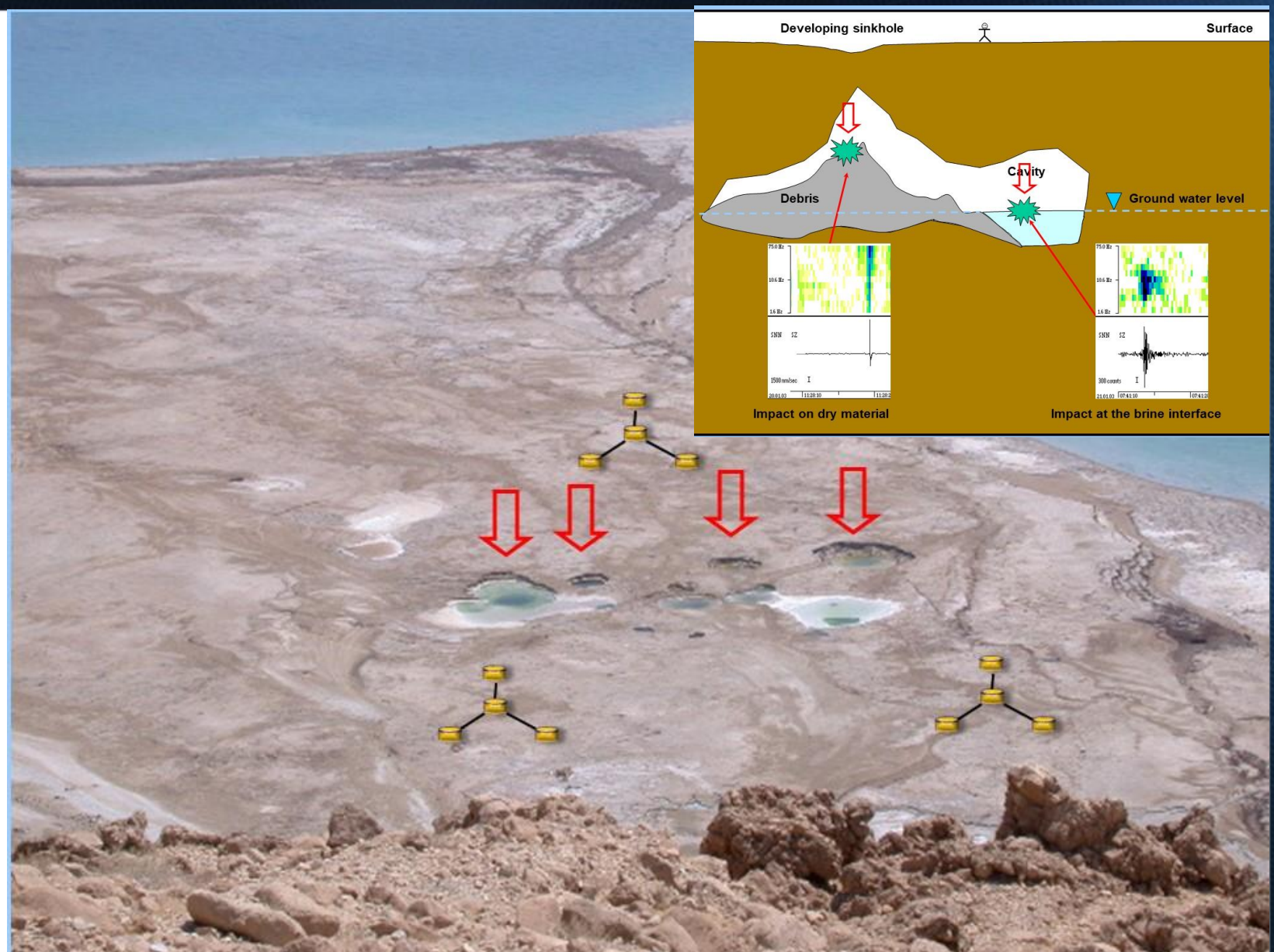
Challenges for **Nanoseismic Monitoring**

Challenges for
Nanoseismic Monitoring:

- Unknown event signature
- Low magnitudes to ML -3
- Short event duration
- Low Signal-to-Noise ratio
- Manifold of noise bursts
- Few stations, bad layout
- Short campaign duration
- Unknown velocity model
- Missing Ground Truth

→ Every piece of info counts
But is it reliable?
Does it fit?



INTRODUCTION
OBJECTIVES
METHODS/DATA
RESULTS
CONCLUSION

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SonoView: Event Detection by Visual Screening instead of automatic (blind) detection

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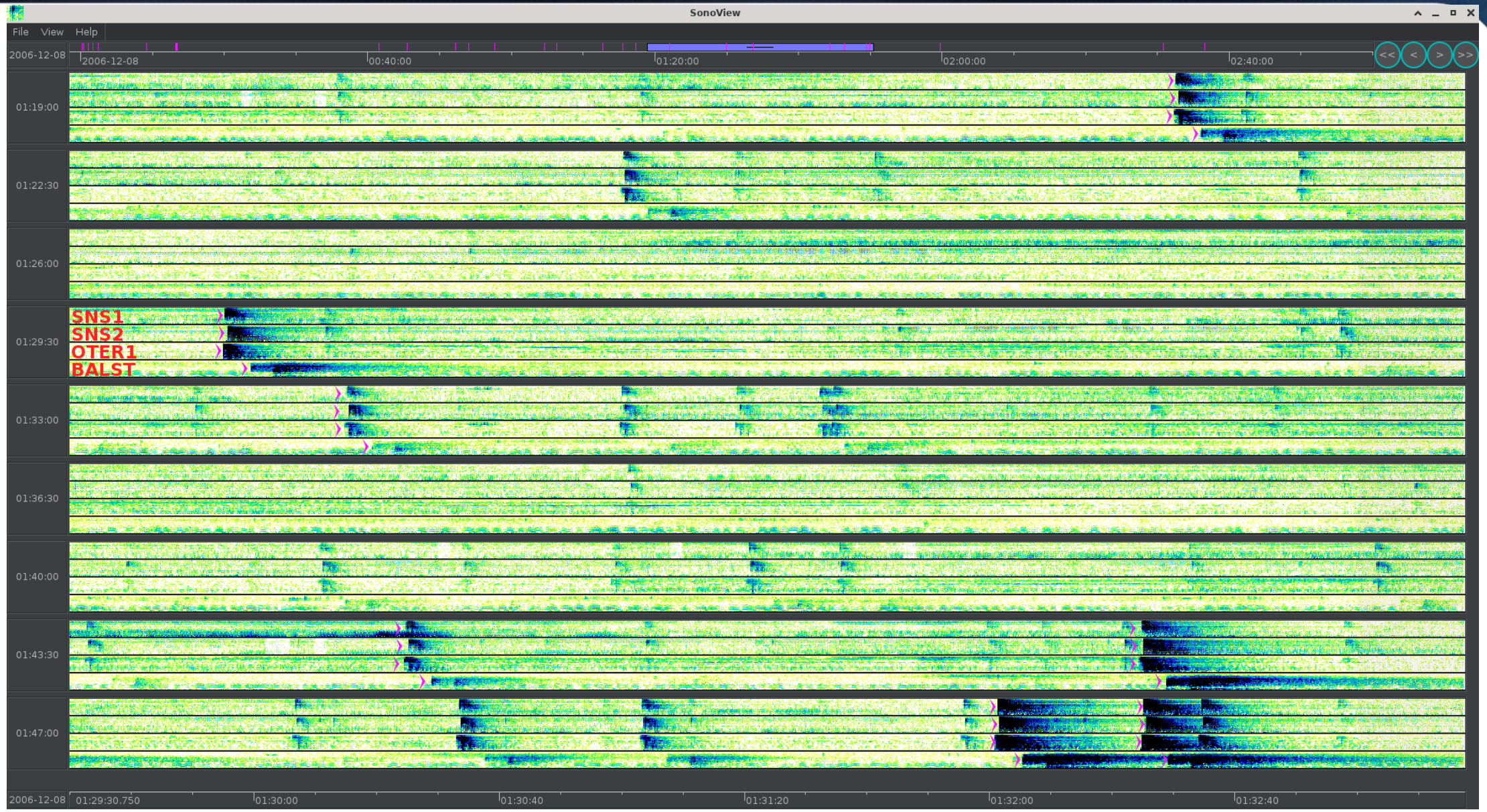

INTRODUCTION
OBJECTIVES
METHODS/DATA
RESULTS
CONCLUSION

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HypoLine: Event Location by Graphical Constrains instead of RMS of phase residuals

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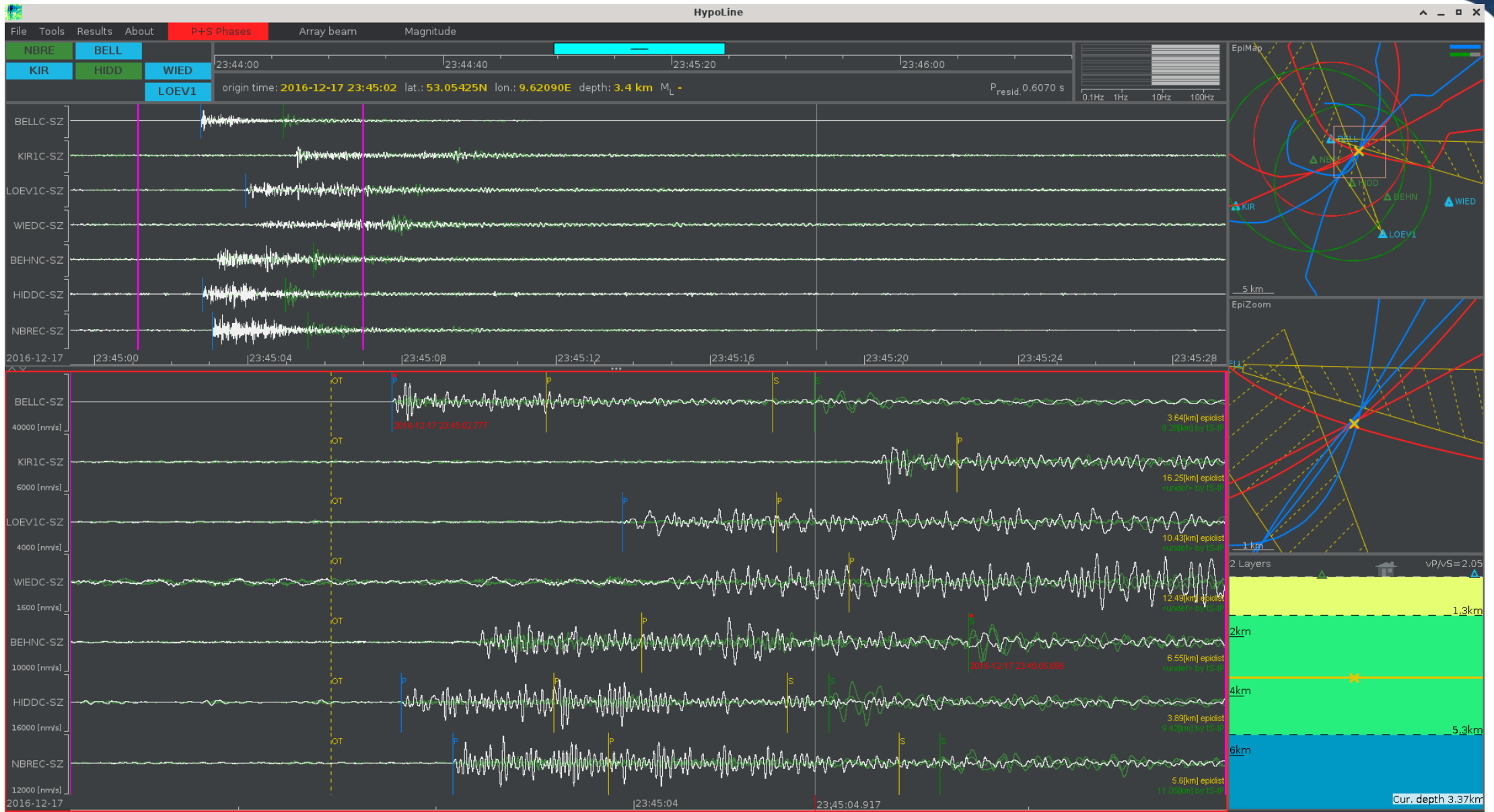

INTRODUCTION
OBJECTIVES
METHODS/DATA
RESULTS
CONCLUSION

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HypoLine*expert*: In-Depth Analysis for the Seismologist for visual control of single location parameters

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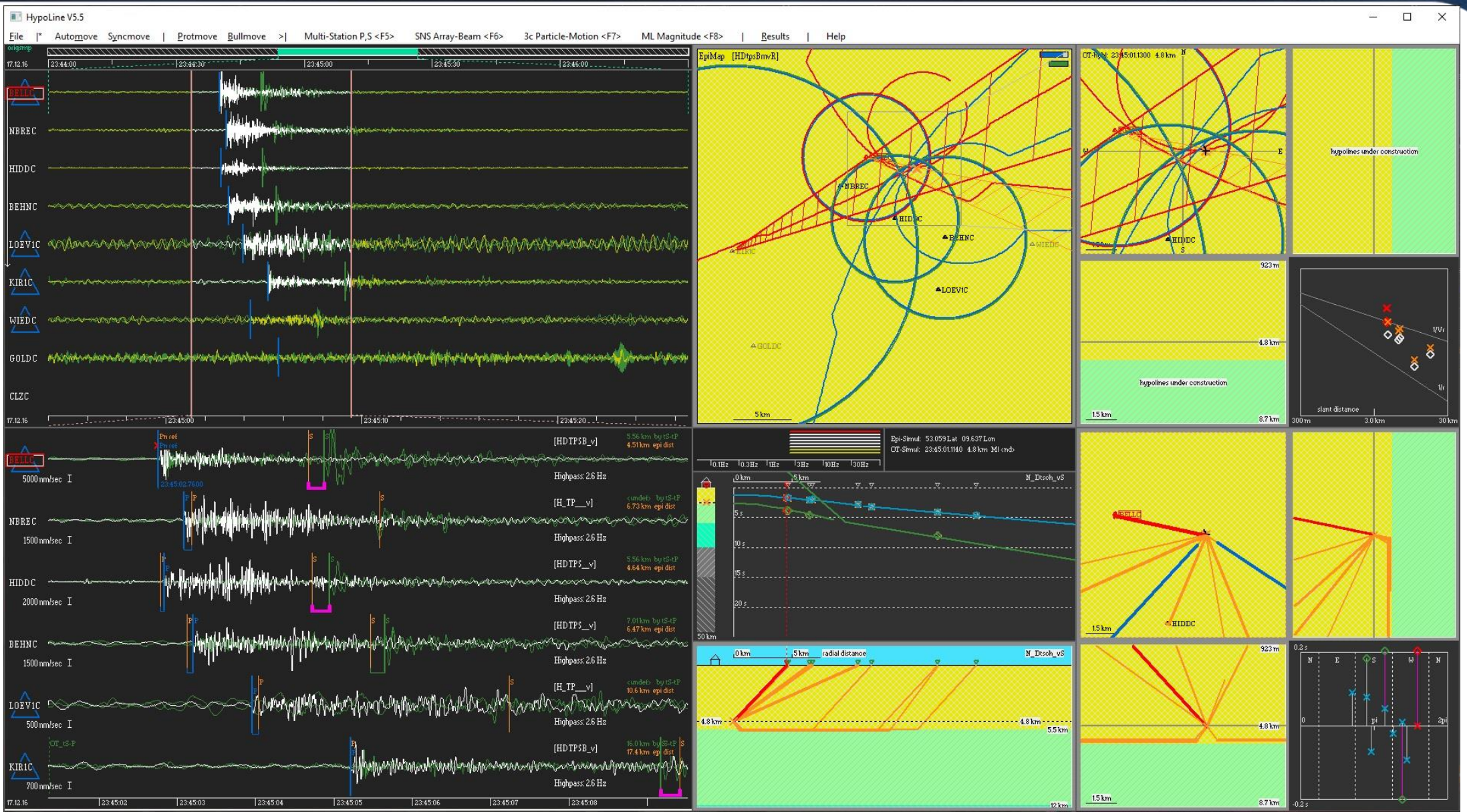

INTRODUCTION
OBJECTIVES
METHODS/DATA
RESULTS
CONCLUSION

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P3.3-466

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Example for **Nanoseismic Monitoring**
Super-Sauze slow-moving landslide (French Alps)

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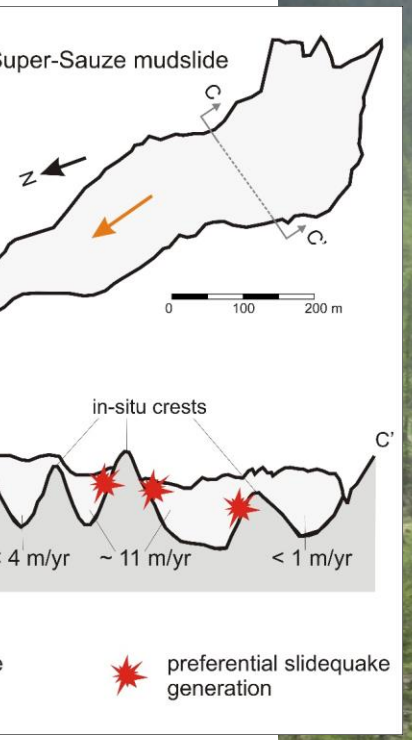

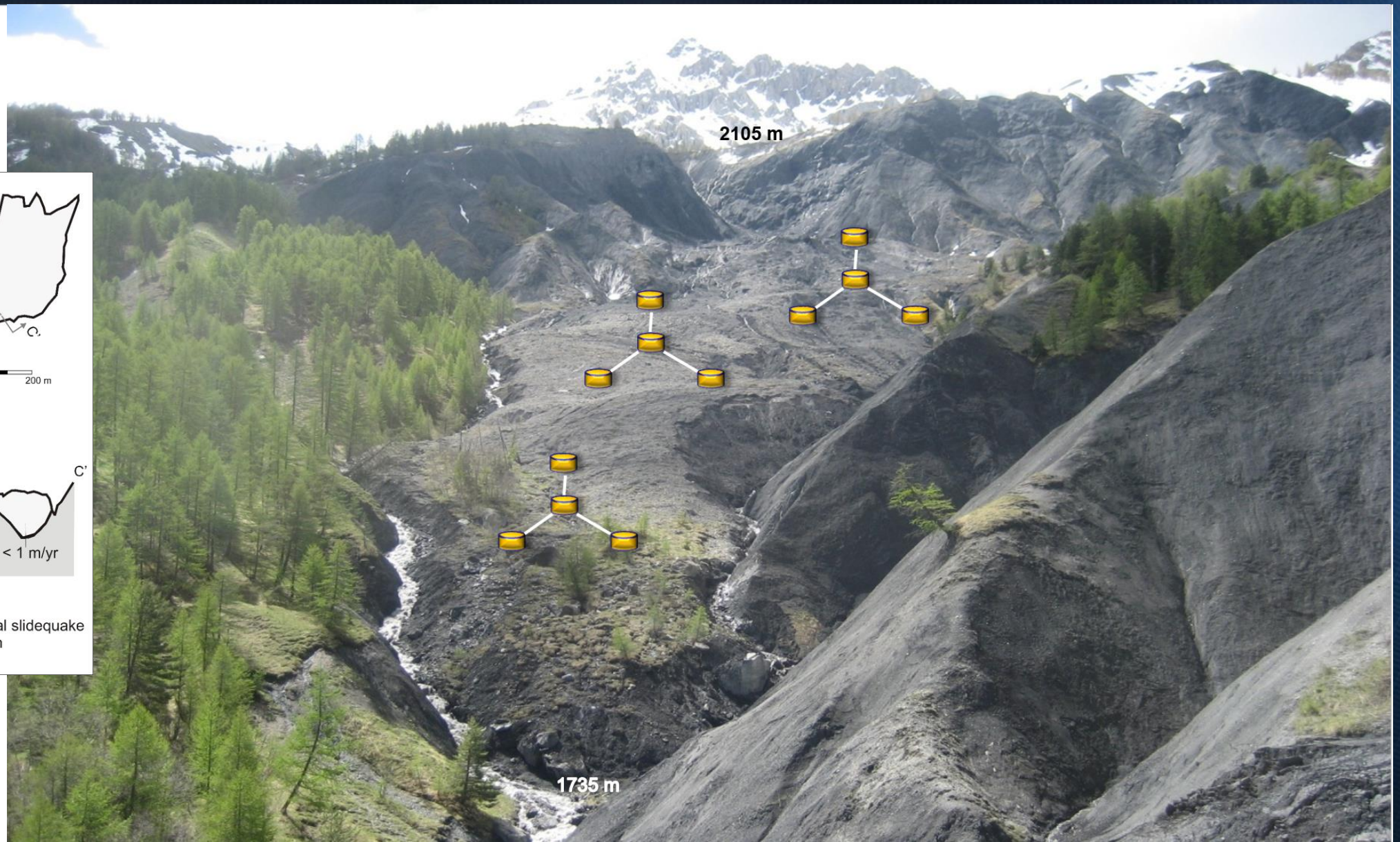

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Software Suite of **Nanoseismic Monitoring**

SonoView

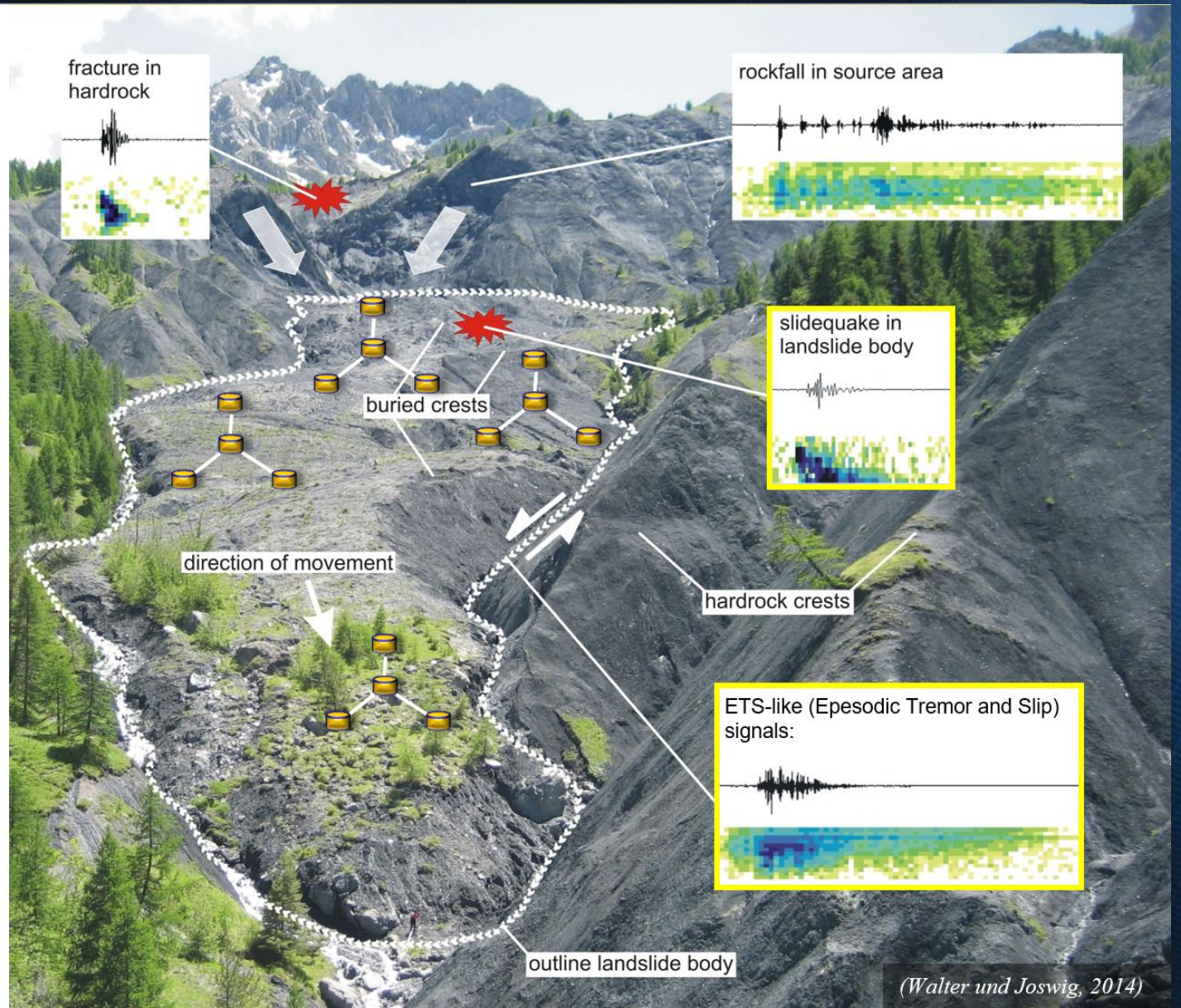
- scans continuous seismic data
- auto-adaptive SNR optimization
- Super-Sonograms for small arrays

HypoLine and HypoLine*expert*

- hyperbolae, circles, array beams …
- … are loction constrains by jack-knifing,
- … get real-time update in map graphics
- support processing of small arrays
- enable plausibility check for outliers
- implement instantaneous model switch

HypoLine*expert*

- shows ray paths in maps and depth cuts
- velocity model: LVZ, non-constant vP/vS
- underground stations, topography, statics
- supports 3c particle motion analysis
- adds phase residual mapping
- modify velocity models interactively



INTRODUCTION
OBJECTIVES
METHODS/DATA
RESULTS
CONCLUSION

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