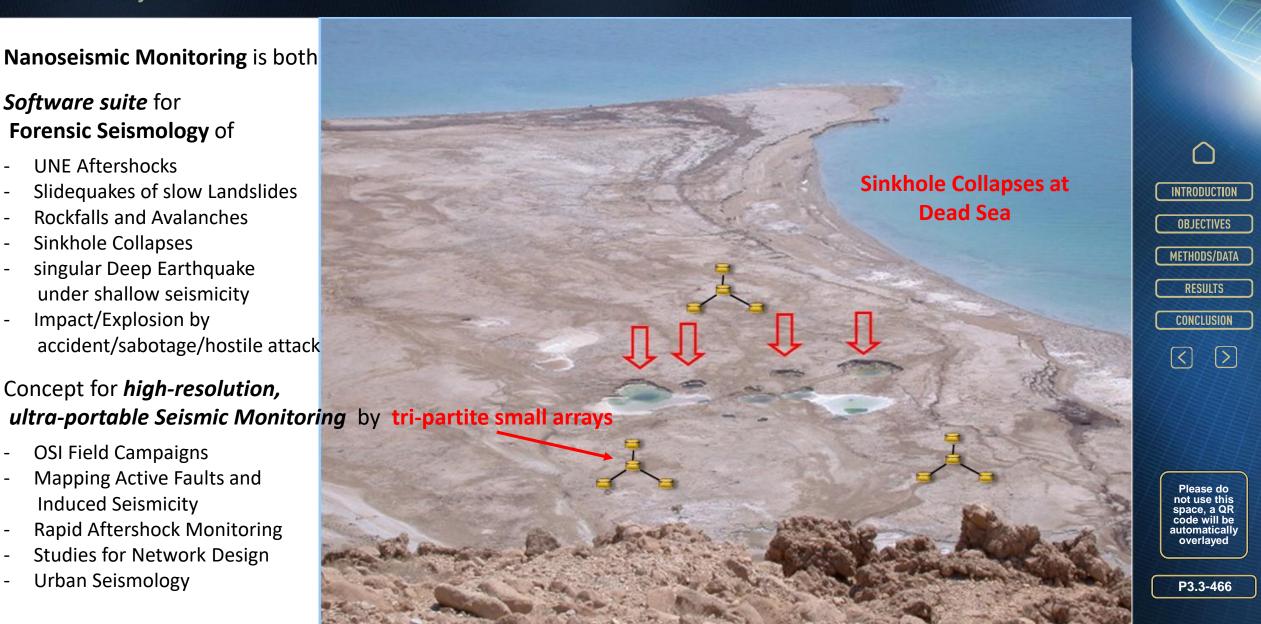


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# The Concept of Nanoseismic Monitoring





# Challenges for Nanoseismic Monitoring



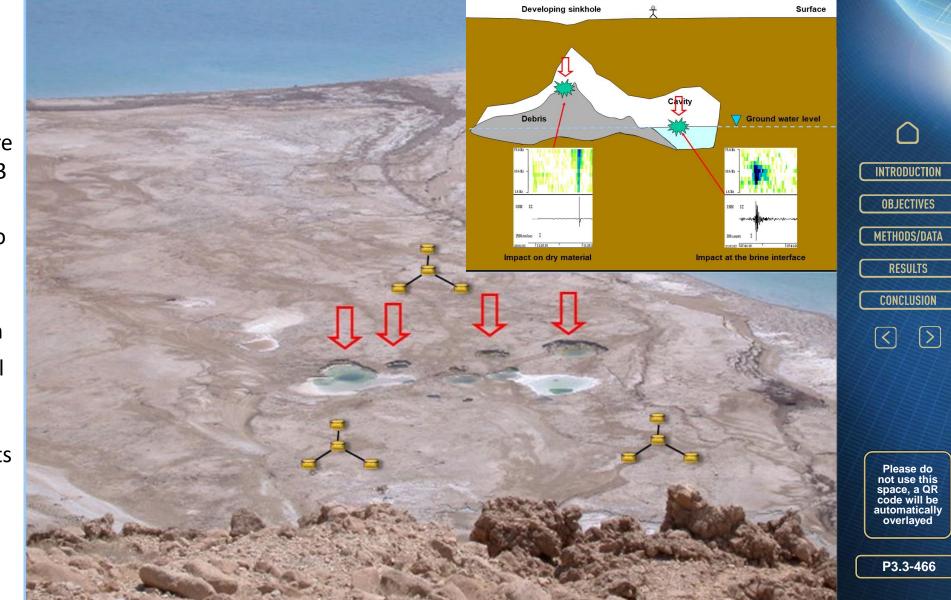
# Challenges for **Nanoseismic Monitoring**:

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- 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?



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



INTRODUCTION

OBJECTIVES

METHODS/DATA

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CONCLUSION

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



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HypoLineexpert: In-Depth Analysis for the Seismologist for visual control of single location parameters

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**Sonicona** 

seismic software & services

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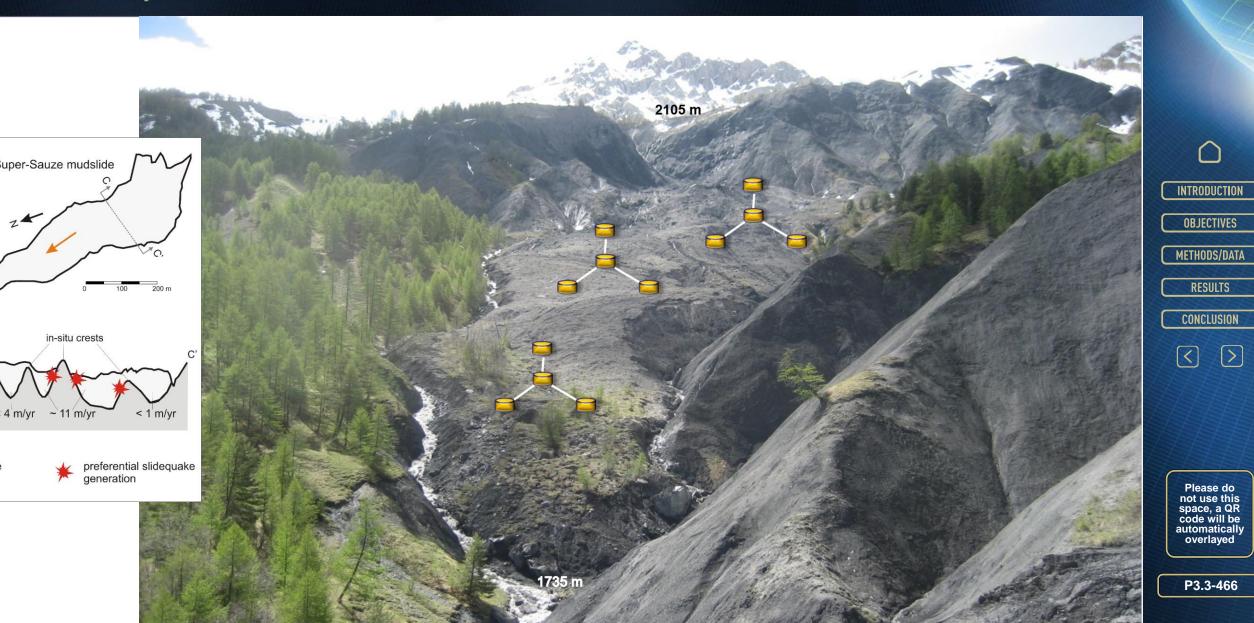
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HypoLine V5.5 X File I\* Automove Multi-Station P.S < F5> SNS Array-Beam < F6> 3c Particle-Motion <F7> ML Magnitude <F8> Results Help Syncmoye | Protmove Bullmove EpiMap [HDtpsBmvR] -- 23.44.30 23:45:00 12.16 23:44:00 23:45:30 23:46:00 hypolines under construction IIDDI REHNC a the market of the structure of the str ABEHNC LOEVIC NOVAMANANANANANANANA 923 m ALOEVIC ~~~~~~~~~~ WIEDC wasan many Aproxim washing and the second s 0 AGULDO von fining hypolines under construction slant distance  $15 \,\mathrm{km}$ 87km .12.16 23:45:00 23:45:10 5.56 km by tS-t 4.51 km epi dist Epi-Simul: 53.059Lat 09.637Lon [HDTPSB\_v] OT-Simul: 23:45:01.1140 4.8 km Ml <nd> Holy Mary Malana manager monimum 0.1Hz 0.3Hz 1Hz 200-Highpass: 2.6 Hz 5000 mm/sec I N Dtsch vS 6.73 km epi dis [H\_TP\_\_\_\_] NBREC HUMPHAN H WARD BURNESS AND STREET a marine and Highpass: 2.6 Hz 1500 mm/sec I [HDTPS\_v] 4.64 km epi di Highpass: 2.6 Hz 2000 mm/sec I 7.01 km by tS-t 6.47 km epi dis - HIDDO [HDTPS\_v] hall have the second BEHNC 923 n 5 km radial distance N\_Dtsch\_vS 0 km Highpass: 2.6 Hz 1500 mm/sec I <undeb by tS 10.6 km epi dis [H\_TP\_\_\_v] Mannan LOEVIC 🖻 500 mm/sec I Highpass: 2.6 Hz 4.8 km 5.5 km [HDTPSB v] anthenhave and a superior and a superior of the KIR1C Highpass: 2.6 Hz 700 mm/sec I 1.5 km

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





## Software Suite of Nanoseismic Monitoring



#### SonoView

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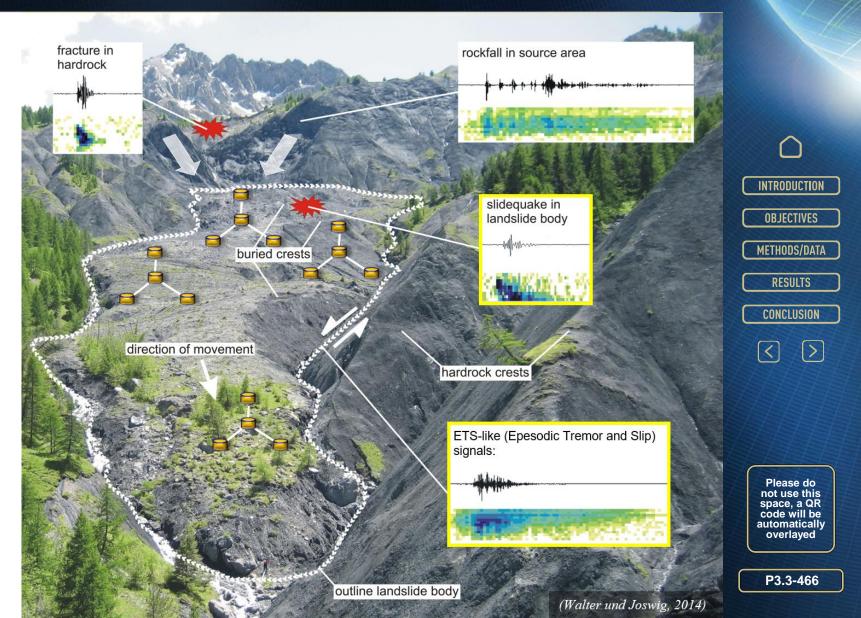
- scans continuous seismic data
- auto-adaptive SNR optimization
- Super-Sonograms for small arrays

#### HypoLine and HypoLineexpert

- 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





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