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# The LSBB underground research laboratory : a unique facility for fundamental and applied low background inter-disciplinary ground and underground science and technology

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# THE LSBB UNDERGROUND RESEARCH LABORATORY: A UNIQUE FACILITY FOR FUNDAMENTAL & APPLIED LOW BACKGROUND INTER-DISCIPLINARY GROUND AND UNDERGROUND SCIENCE & TECHNOLOGY

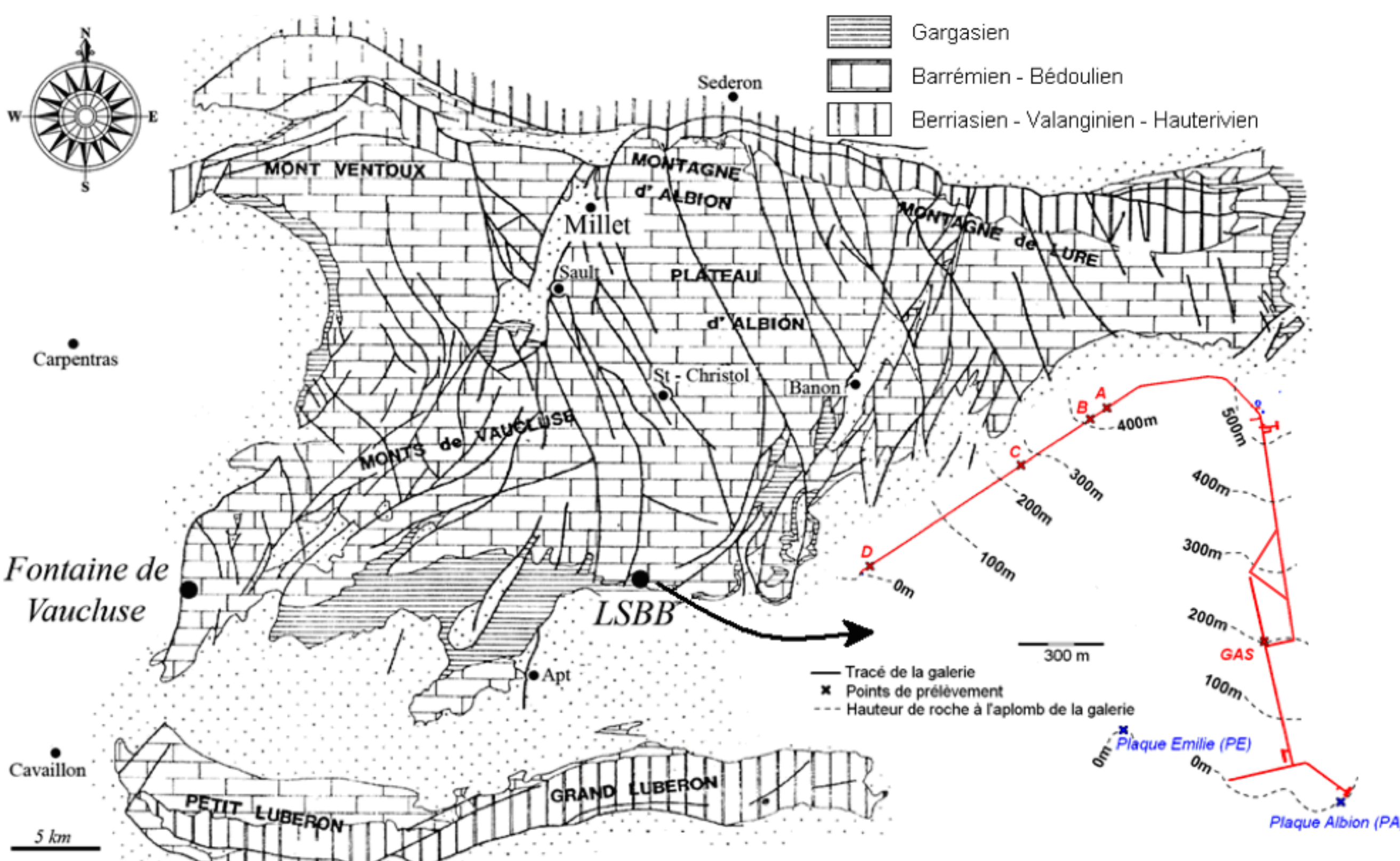
www.lsbb.eu

direction@lsbb.eu



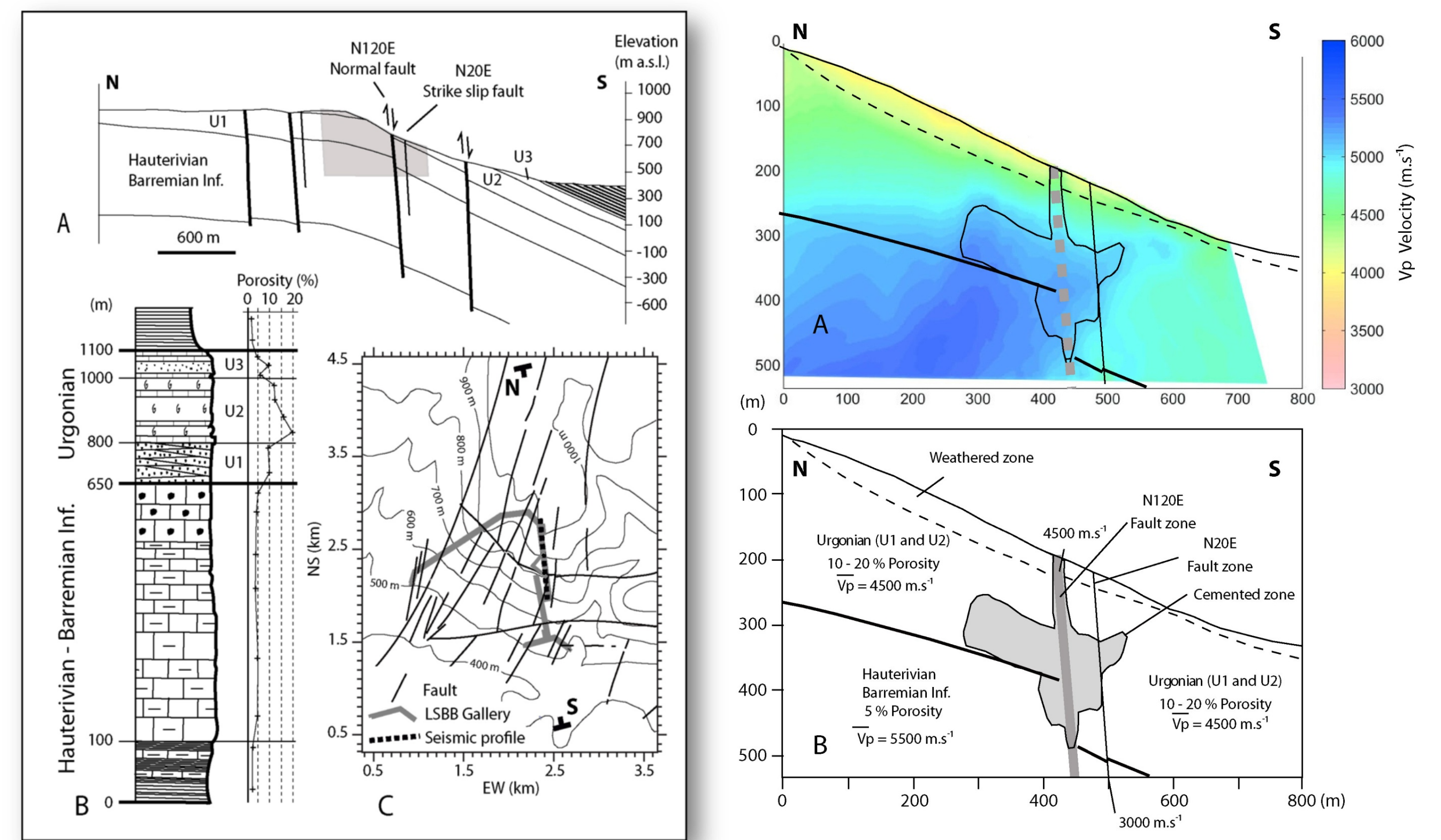
The low background noise interdisciplinary ground and underground based research laboratory (LSBB, CNRS Mixed Service Unit) contributes to the development of knowledge and know-how at national, European and international levels. As an interdisciplinary research facility, the LSBB is able to (i) accommodate large instruments, (ii) host scientific platforms, (iii) provide real-time measurements to national observatories, (iv) develop and to welcome ultra-sensitive multiphysics instrumentations of both academic and industrial collaborations in a low-anthropic-noise environment with particular interest in geological, electromagnetic and hydrogeological fields.

## Easy access to the shallow and deep unsaturated zones of the Fontaine-de-Vaucluse aquifer



Garry et al., 2008; Blondel et al., 2010; Carrière et al., 2013; Gaillardet et al., 2018; Jourde et al., 2018; Ollivier et al., 2019; Barbel-Périneau et al., 2019

## Access to Urgonian facies analog to oil fields of the Middle East



Maufroy et al., 2012; Bereš et al., 2013; Barruol et al., 2017; Matonti et al., 2017; Frau et al., 2018; Godeau et al., 2018; Tendil et al., 2018

### Addressing societal challenges

- Increasing stress on water resources due to climate change and anthropogenic impact
- Seismic hazard
- Optimization of oil bearing in carbonate reservoirs

### Interest of LSBB's location

- Access to underground water
- Karstic environment
- Within a main seismogenic zone
- Access to carbonated platform

### Research infrastructure

- Accommodation of large experiments in controlled environments
- Underground operation

### The LSBB offers

- Potential for multi-scales & multi-depths projects
- Permanent staff to ensure the experiment survey
- Fine monitoring of environmental parameters
- Boreholes at different depths and locations
- Easy access for materials and water, electricity and network availability
- Surface and underground facilities in a low-background noise environment
- Underground vaults, clean room, electromagnetically shielded spaces

### Platform for instrumentation characterization

- Development and characterization of high sensitivity technology
- Interdisciplinary test site for benchmarks
- Synergy between academics and industry

### LSBB know-how

- Development, implementation & characterization of sensors
- Interactions between research teams
- Data quality and reliability management
- Coupling between instrumentation and environment

Environment and resources characterization

Instrumentation and metrology development

Unique facility and potential for experimentation

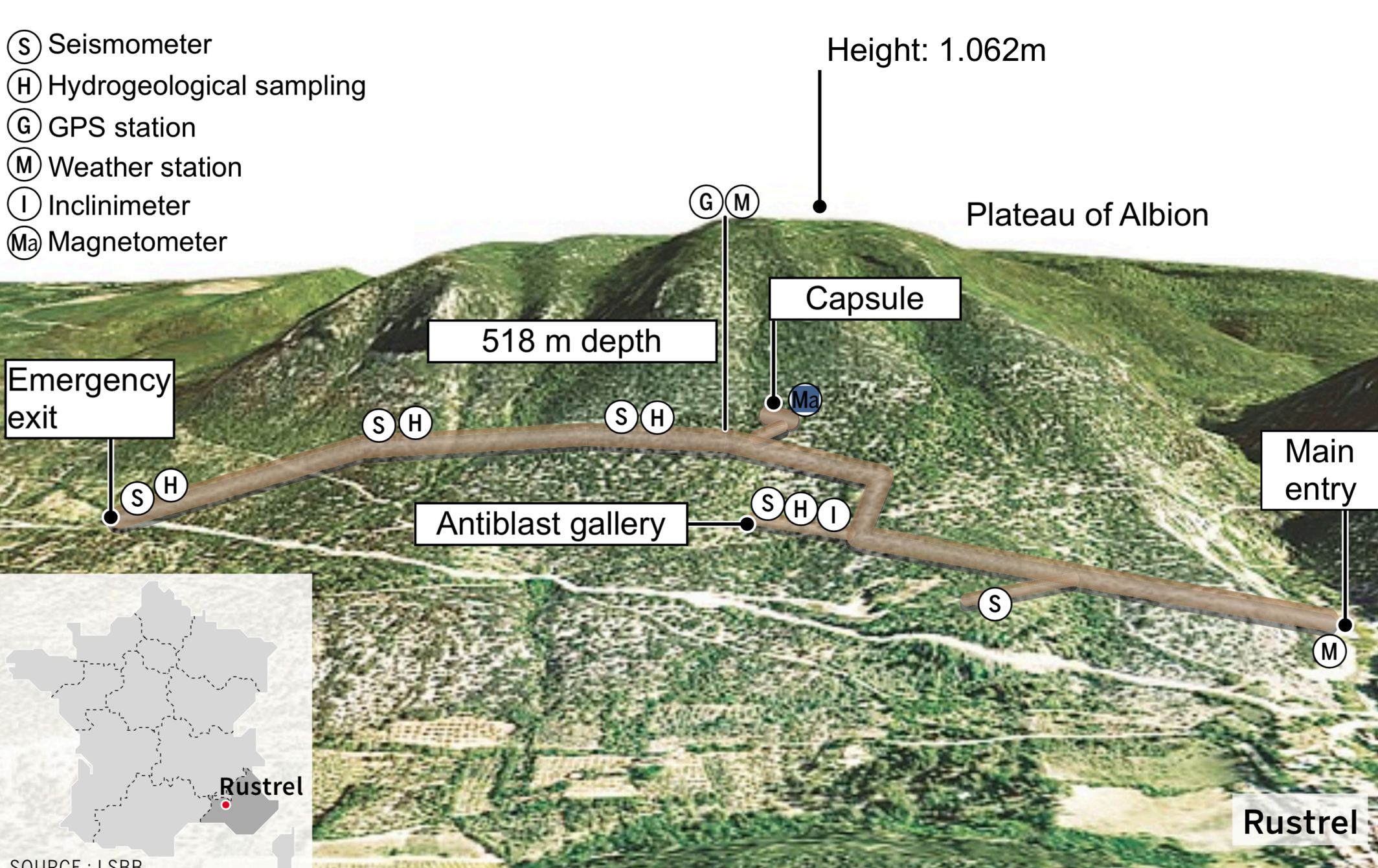
Measurements of waves and radiation

### Long term observation

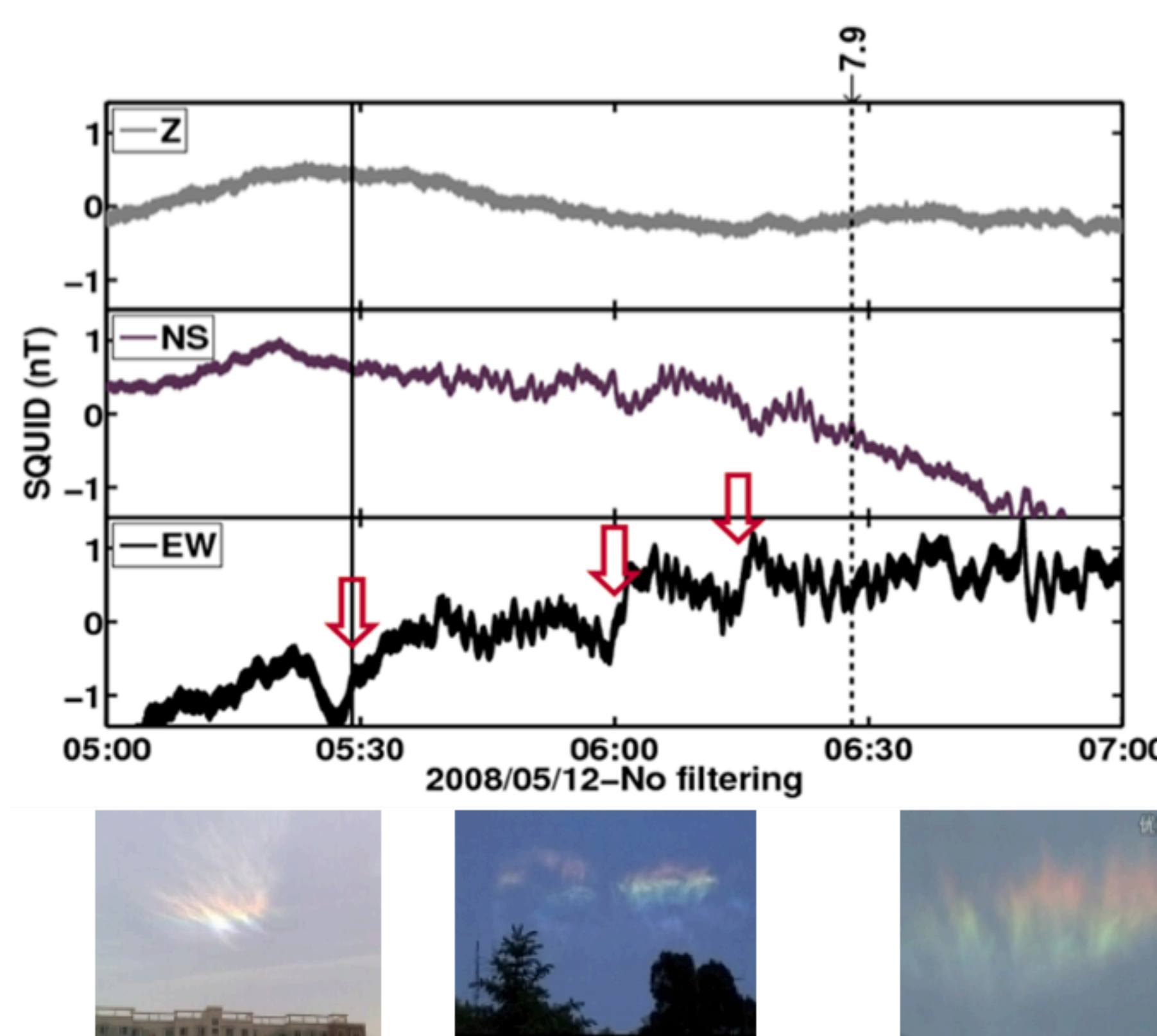
- Assure long term data acquisition provided to SNO

### LSBB multi-physics instrumentation

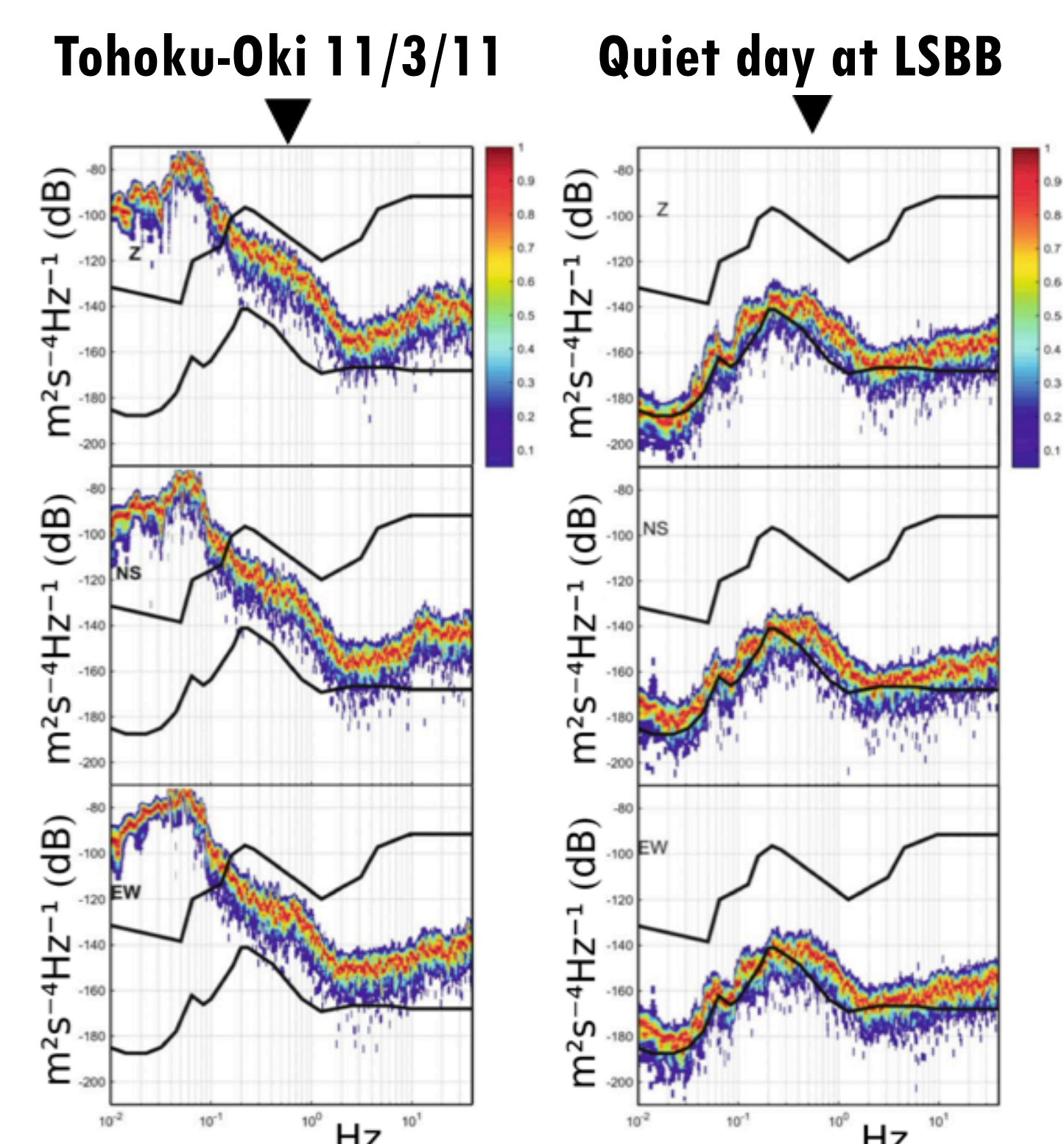
- Magnetometry
- Densitometry
- Gravimetry
- Hydrogeological survey
- Gravitational waves
- Neutron spectrum
- Clinometry
- Seismometry
- Optic fiber
- Muography
- Rotation
- Atm. EM & rad. Phenomena ... and others!



The LSBB counts with 54ha of surface and 4 km of underground galleries with depths ranging from 0 to 518 m



Jumps of magnetic field in time coincidence with "rainbow clouds" observed at different locations before Sichuan earthquake



PSD (top to bottom: Z, NS, EW) vs Peterson's high and low noise models