VERCE:
Virtual Earthquake and Seismology Research Community in Europe

A seismology architecture for data-intensive applications: data analysis, mining and modelling

VERCE vision and strategy

Aid society in the management of natural hazards, environmental changes and national security concerns through a significant advancement of our understanding of the Earth's structure and processes…

….the provision of a data-intensive e-Science environment to enable the earthquake and seismology research community to easily and more fully exploit the under-utilised wealth of available seismological data.

VERCE objectives

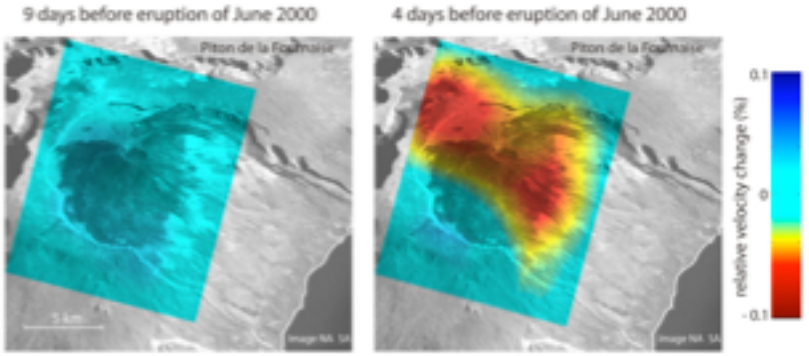
- Service-oriented architecture integrating specialised tools, data-flow and work-flow engines to support data-intensive applications
- Integration of the community data infrastructure with Grid, Cloud and HPC infrastructures
- Scientific gateway providing unified access and management of services and tools
- Intellectual ramps to encourage use of gateway and more sophisticated data use
- Collaborative environment between seismology research community, data scientists, HPC and Grid specialists → 'research technologists'

Context and challenges

- Data is globally distributed, continuously increasing, stored in different formats, file systems and schemas
- Different uses of data demand different computing architectures
- Existing code needs reviewing
- Engagement of the earthquake and seismology community
- Communication and collaboration with relevant EU projects and communities

Use cases: data-intensive analysis

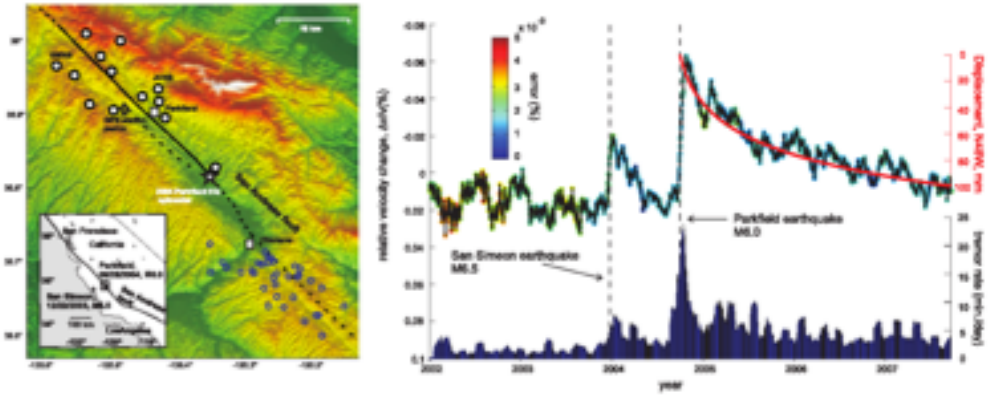
Seismic noise correlations:
observing precursors to volcanic eruptions



Brenguier *et al.* (2008)

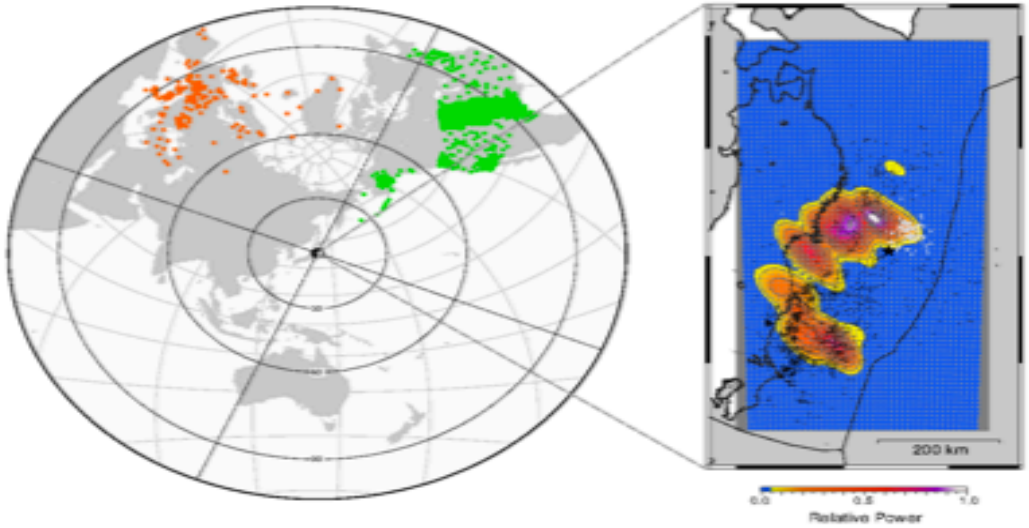
Seismic noise correlations:
Monitoring Physical property changes due to earthquakes

Seismic velocity and tremor activity changes in the Parkfield region (> 7 years)

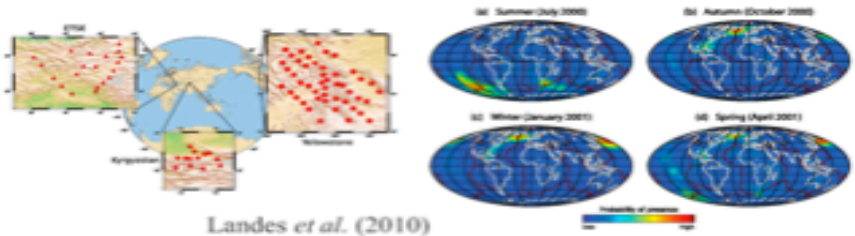


Brenguier *et al.* (2008)

Teleseismic interferometry:
Imaging earthquake rupture (Tohoku, Japan)



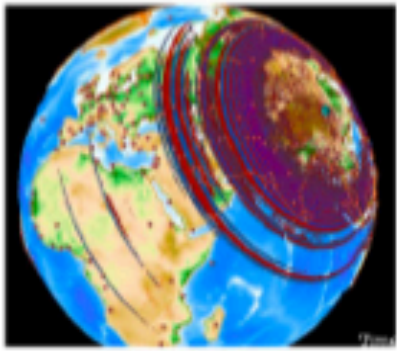
Seismic noise correlations:
Origin and time variation of deep oceanic wave sources



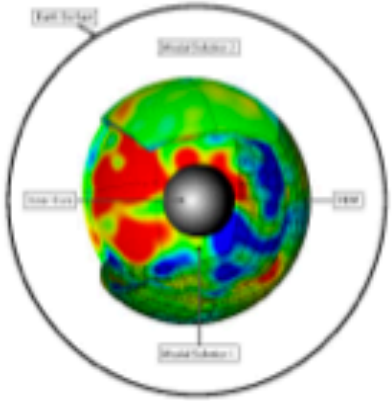
Landes *et al.* (2010)

Use cases: data-intensive simulation and inversion

Seismic wave propagation and tomography



Komatisch *et al.* (2009)



Capdeville *et al.* (2003)

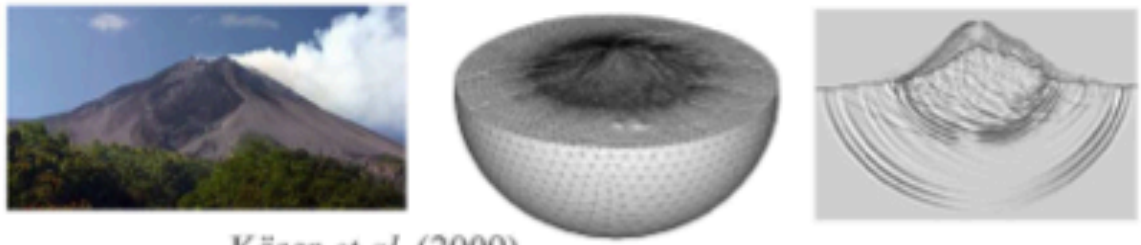
Global scale:

- **Waveform prediction for large earthquakes**
- **Full waveform inversion tomography: new inside in the deep Earth**

Regional scale:

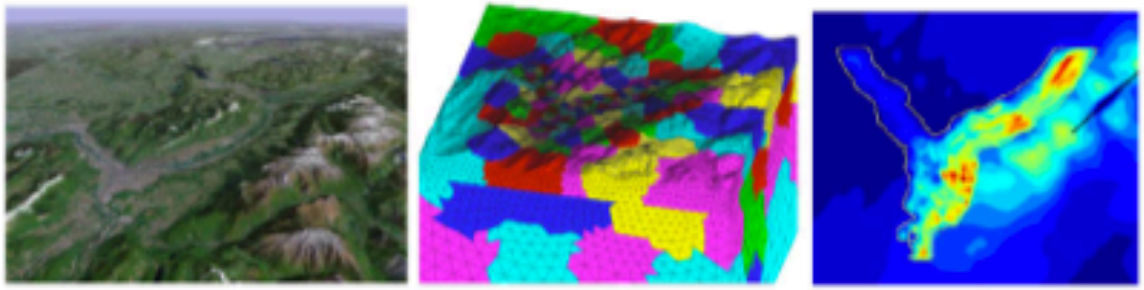
- **Wave propagation in complex geological media**
- Full waveform inversion
- **Extended earthquake sources imaging**

Aero-acoustic wave simulation in a volcano



Käser *et al.* (2009)

Strong motion simulation: Grenoble Valley



Chaljub *et al.* (2009); Delavaud *et al.* (2009)

Strong motion prediction:

- **Physically-based hazard assessment**
- **Earthquake source dynamics**
- **Stochastic wave simulation**