



Seismic Imaging *Imaging the Earth's interior and beyond*

Topics:

(1) Seismic imaging: why?

(2) Seismic imaging: how?

(3) Beyond imaging the Earth's interior

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Seismic imaging: why?

Chasing for energy resources as hydrocarbon or geothermal reservoirs, or searching for safe underground CO₂ store sites: these are tasks that challenge our ingenuity, calling for the development of the ability to visually represent the Earth's interior. To address such requirement, industry started developing seismic imaging technologies almost one hundred years ago. Great strides have been made since then, and nowadays 3D seismic imaging technologies are routinely applied, but there is still room for improvements.

Seismic imaging: how?

We know how to probe the subsurface: first inject energy packets from the surface in the form of elastic waves, and then listen for their echoes reflected back from the subsurface. However, the acquired data are not the image: the information must be decoded from these data and mapped into the image. This is the essence seismic imaging; its substance is that of a fascinating problem involving our knowledge about physics, computational methods, and inverse problems. And solving it at an industrial scale involves also our skills in the fields of computers, high performance computing, and software engineering.

Beyond imaging the Earth's interior

There are other fields of application where cross-fertilization from seismic imaging techniques may be beneficial. One of them is medical imaging. What if elastic waves could replace x-rays to safely scan the interior of our bodies, without compromising imaging accuracy and resolution? Likewise, how can seismic imaging benefit from new data analysis paradigms such as machine learning?

Biography

Nicola Bienati received a Ph.D. in Telecommunications Engineering from Politecnico di Milano in 2000. He joined Eni geophysical services in 2002, and since then he has been mainly working on R&D in the field of seismic imaging technologies and on the development of the Eni high performance computing infrastructure. He has co-authored several peer-reviewed articles on these subjects.