



Imaging in reflection seismology

Identification of distributed parameters
in the (anisotropic visco)
elastodynamic equations



P and S velocities, density,...

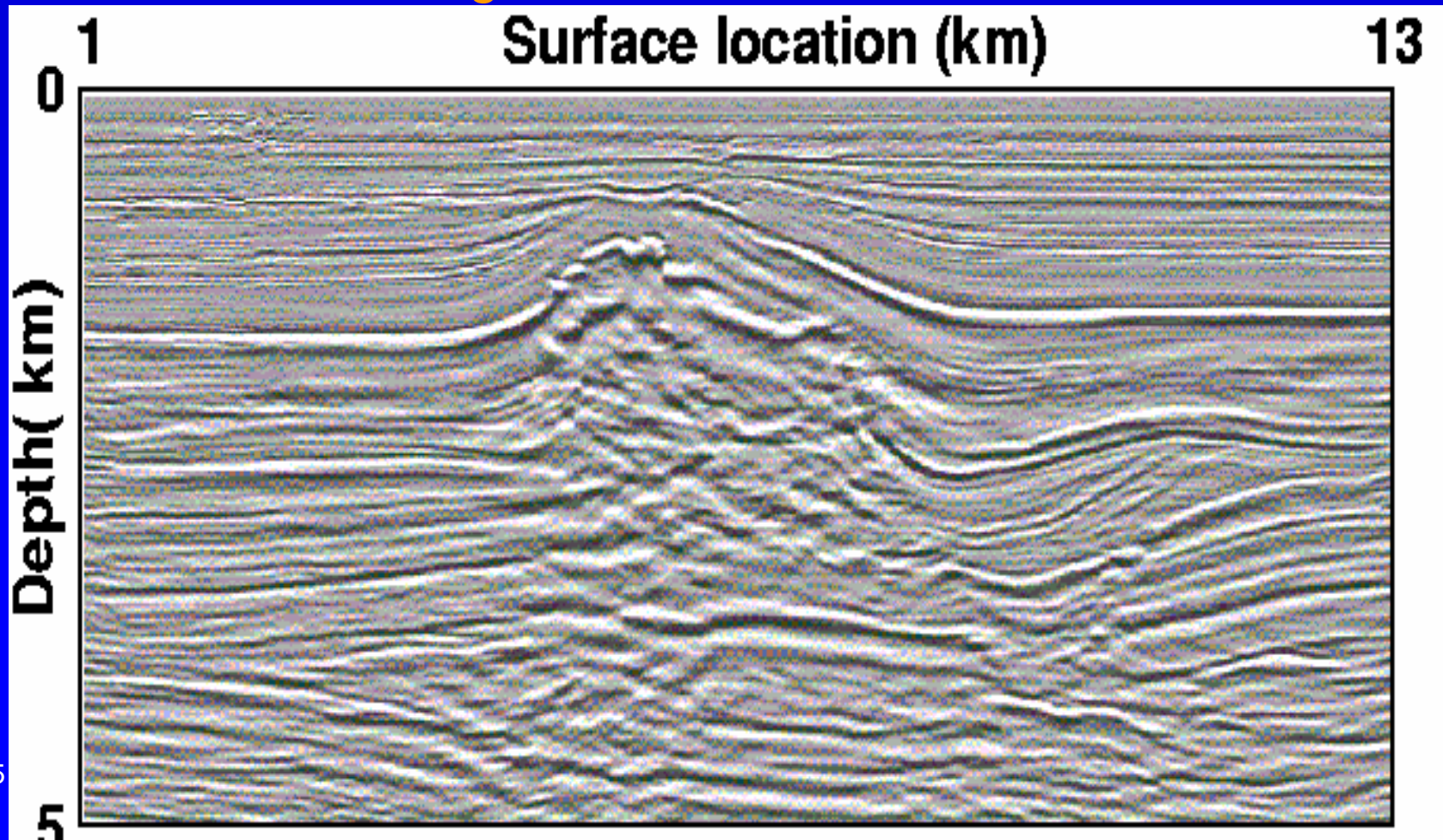
- Undergo large range variations (1/3)
- At very different scales





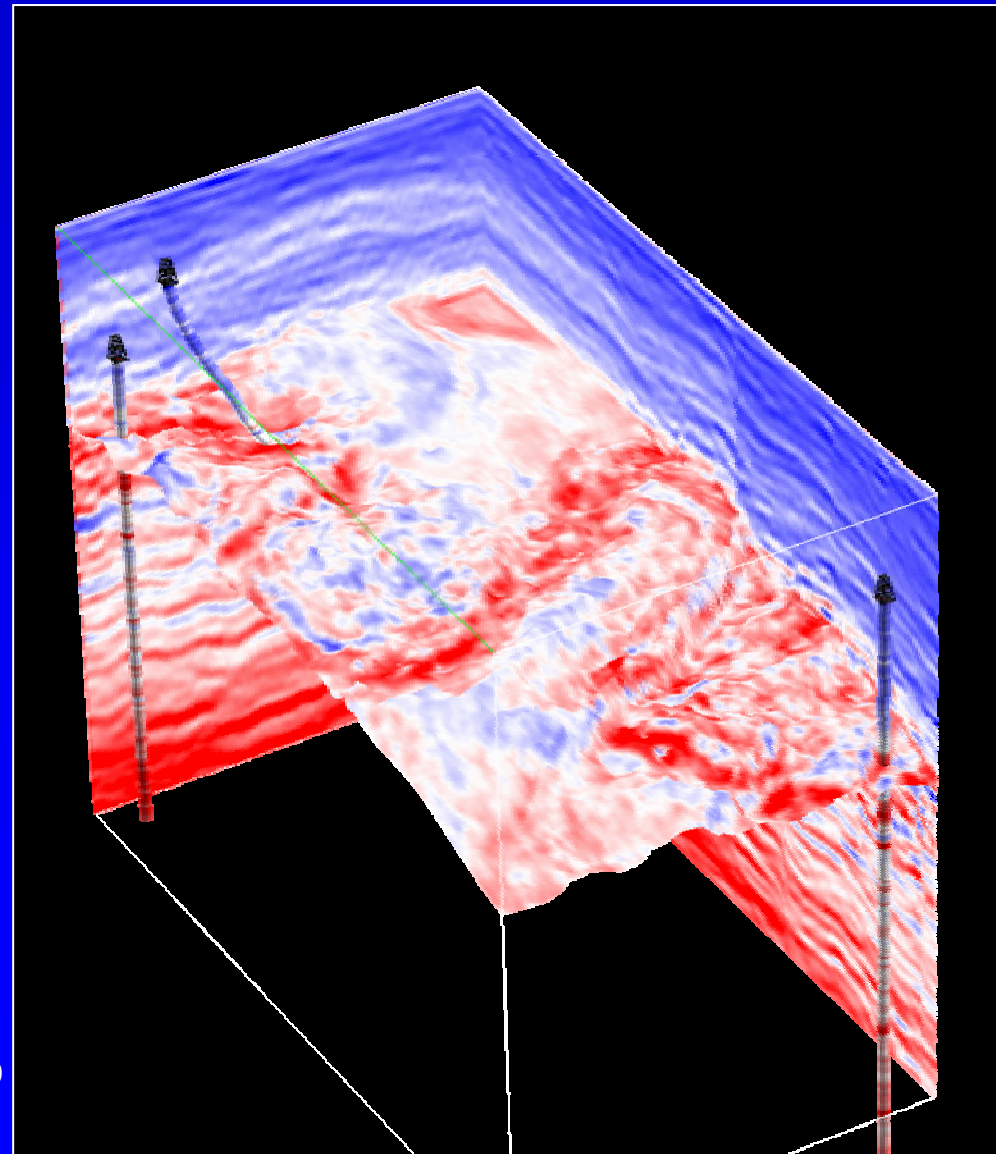
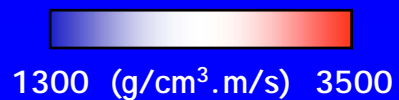
Standard imaging

- is based on quite a simple physical model ("Ray + Born")
- has met tremendous success
- makes use of a huge amount of data



- is based on quite a simple physical model ("Ray + Born")
- has met tremendous but also unreasonable success

S impedance distribution





Standard imaging

- is based on quite a simple physical model ("Ray + Born")
- has met tremendous **but also unreasonable** success
- meets important difficulties
 - quantitative imaging and ***estimation of realistic uncertainties***
 - imaging of **complex structures** (especially with onshore acquisition)



Beyond standard imaging

- need for the use of a **more realistic physical model**
 - beyond "Ray + Born" : NL wavefield inversion
 - very few attempts at facing the heart of the difficulty
 - some contributions : Tarantola, Symes, Chavent, Berkhout and Wapenaar, Herman, Pratt,...
- solving a **nonlinear problem in infinite dimension** may be not trivial...
- and may require **truly new ideas**



What cross-field interactions might be especially productive?





Some more constructive guidelines

- **Determination of the velocity distribution** still remains a major challenge for seismic imaging
- Accept the idea of working with a **simplified physical model** but try to estimate
 - a **robust image** of the subsurface
 - the **actual resolution** you can reach
- Forget about the **"theoretical" resolution** of seismic data and try to identify **large scale tendencies** (macrostructures)
 - areas with high hydrostatic pressure
 - fracturation
 - ...
- **"Relative" seismic imaging** (time lapse reflection seismology)



What cross-field interactions might be especially productive?

- Seismic imaging and random processes
- Exchanges between the different imaging communities who are in quest of macrostructures (**anisotropic responses,...**)
- A major difficulty for interactions: the contexts are quite different...