Today

Resolution
 Data acquisition
 CO₂ sequestration example
 Where to get data

Migration

٠



- BUT, could lie anywhere on a semi-circle centered on source-detector position
- Arcs of circles (wavefront segments) through all the mapped reflection points enables the actual reflector geometry to be mapped

0 ter alle the training the state of the state

Sampling rate and Nyquist frequency



Vertical Resolution



Tuning thickness





Survey key components





Typical Marine Seismic Sources



Sercel airgun array: ~5 – 50Hz

Sparker (GEOSOURCE 200)



Older techniques no longer used:

- Dynamite (!)
- Compressed air sleeve exploder



Sub-bottom acoustic profiler 2 – 20 kHz

Marine airgun



- Pressure: ~2000+ psi
- Volume 4,000-10,000 in³
- Shots every 10-20 seconds

Airgun noise and fin whale calls



Nieukirk et al., 2012

Source tuning

- Multiple airguns used to produce source
- Want to avoid bubble ringing, and noise
- Generator-injector (GI) guns control bubble collapse





Source ghost







(1) Linearly proportional to the number of guns in the array. All else being equal, a 40-gun array generates twice the amplitude of a 20-gun array.

(2) Close to linearly proportional to the firing pressure of the array. A 3000-psi array has 1.5 times the amplitude of a 2000-psi array.

(3) Roughly proportional to the cube root of its volume.





Modern 3D Acquisition Vessels



Ramform Atlas, courtesy PGS AS



Seismic sources



Acoustic source

- Size / volume
- Energy
- Directivity
- Repeatability
- Shape / frequency content

Recording

- Cable or streamer, 2d or 3d
- Can be several km long, hundreds of channels (hydrophones)
- Digital/optical fiver with buoyant casing
- Depth ~10-15 m
- Towed slowly, carefully...expensive!



Streamer and 'birds'







On land...





Vibroseis sweep: 10–60 Hz, 5–40 s



sweep function v(t)

Earth response function G(t)

u(t) =convolution v(t) * G(t)

 $u'(t) = cross-correlation v(t) \star u(t)$

Typical Land Seismic Receivers



Many geophones are usually deployed.



CO₂ sequestration: Sleipner Field, Norway



CO₂ sequestration time–lapse seismic





White et al., 2018

CO₂ sequestration time–lapse seismic



White et al., 2018

CO₂ buoyant infill





White et al., 2018

Academic Seismic Portal



About Tools Data Collections Resources

Academic Seismic Portal

Collections / Academic Seismic Portal

Summary	
Data Sets	
References	
Contributors	
Expeditions	
Compilations	
News	

cause. The Academic Seismic Portal is maintained as a primary data resource for field and processed data from active source marine seismic experiments (multi-channel, single-channel, chirp subbottom, sonobuoy) supported by the National Science Foundation. The field data collection includes shot data from all modern long streamer and 3D MCS marine expeditions funded by the NSF as well as data from portable seismic systems and other sources. Other legacy datasets dating back to the 1980s are served as well as geo-referenced images of single channel airgun sections acquired during the global-ocean ranging expeditions of the Vema. Eltanin and Conrad in the 1970's and 80s. The processed data collection, formerly curated

Data from the Academic Seismic Portal at UTIG has been migrated to LDEO. As we continue to verify the accuracy and completeness of this data, there may be temporary issues with some seismic metadata and web services. We apologize for any inconvenience this may

by parters at UTIG, includes data from multi- and single-channel studies, CHIRP, OBS, OOS, Sonobuoy and 3.5 kHz programs. Legacy data include shot and processed data acquired by UTIG (1974-early 1990's) on various ships, including UTIG's R/V Fred Moore and R/V Ida Green.



https://www.marine-geo.org/collections/#!/collection/Seismic#summary

EBAM / Cruise MGL1408 (2014)









- Magma bodies in 3-dimensions at the East Pacific Rise
- 2008 experiment, only 2 to date



Marjanović et al., 2023



Marjanović et al., 2023

Software: SeismicUnix



https://wiki.seismicunix.org/doku.php

Software: OpendTect



https://www.dgbes.com/ir dex.php/software#free