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EAGE/SBGf Workshop on Seismic Processing

23-25 SEPTEMBER 2026 • RIO DE JANEIRO, BRAZIL

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Processing challenges on modern land nodal systems

Amine Ourabah

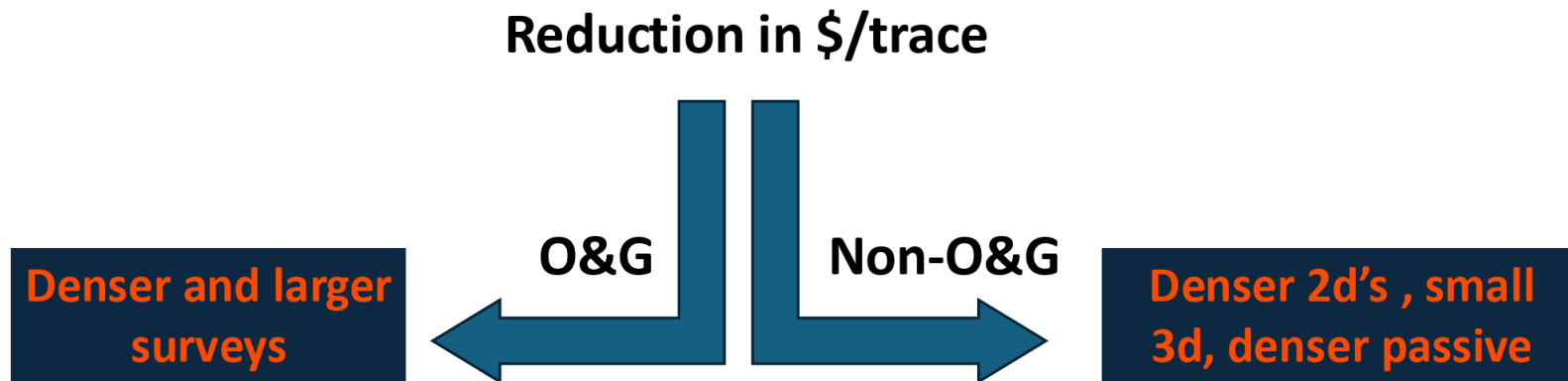
Jose Olaya*

STRYDE

Outline

- Introduction-Motivation
- Definition of arrays and single-sensor data
- Digital Group Forming (DGF) the way forward? Filtering B4 and/or After DGF?
- Challenges presented by modern high trace density data.
- Conclusion

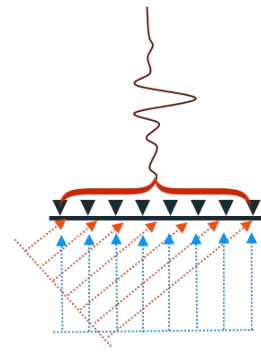
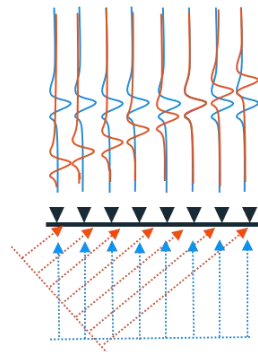
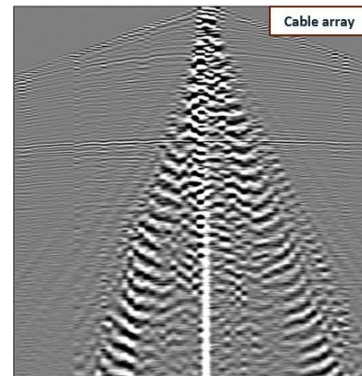
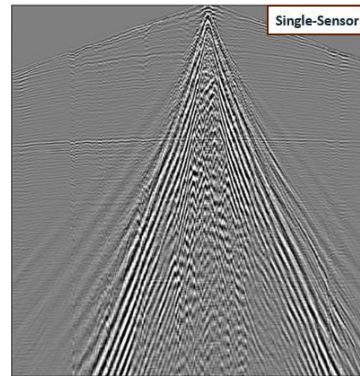
Impact of cost saving on the usage of seismic nodal systems



Definition Arrays & single-sensor data

Pros & Cros

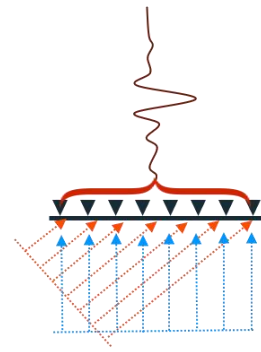
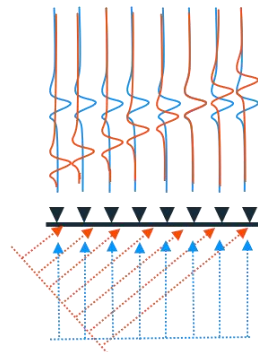
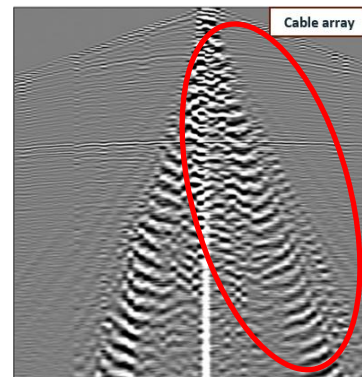
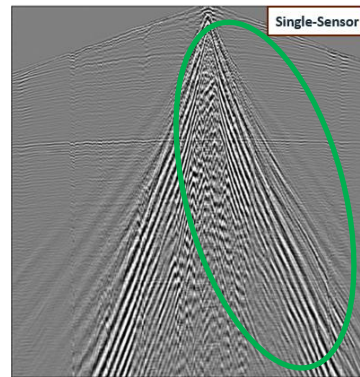
- Single sensor acquisition, every sensor delivers one output trace.
- Array acquisition, all sensors forming the array are connected to deliver one (irreversible) stacked output.



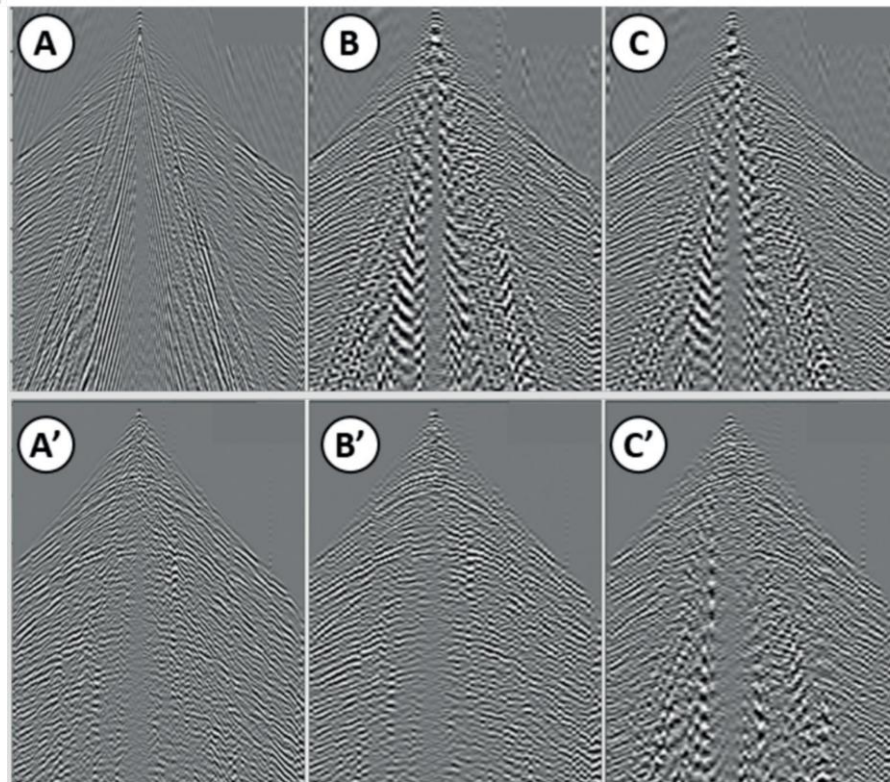
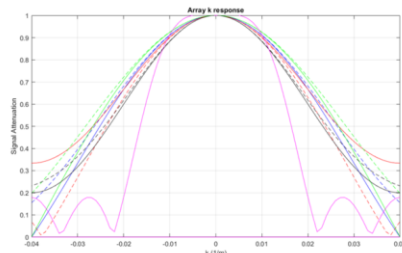
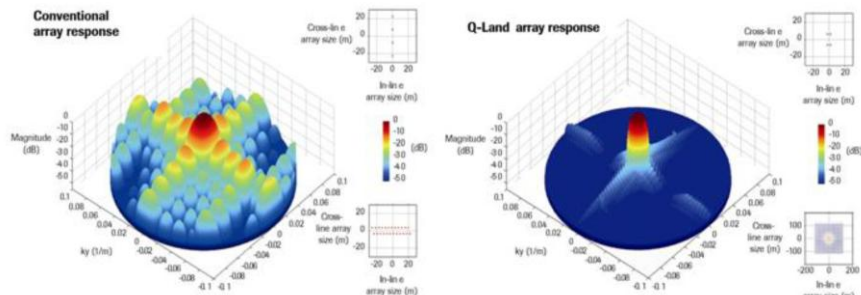
Definition Arrays & single-sensor data

Pros & Cros

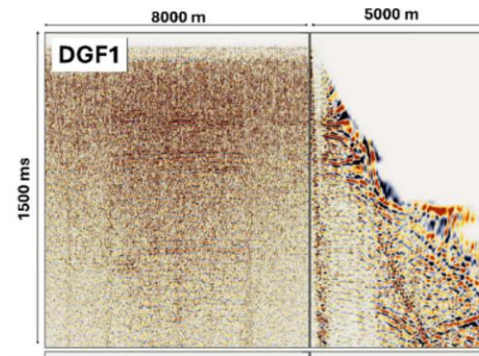
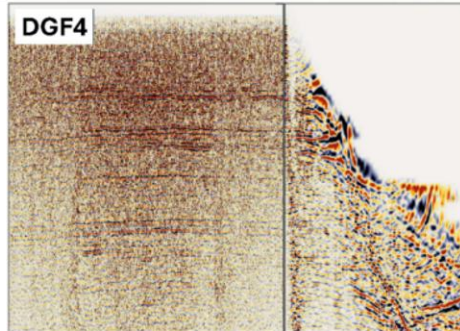
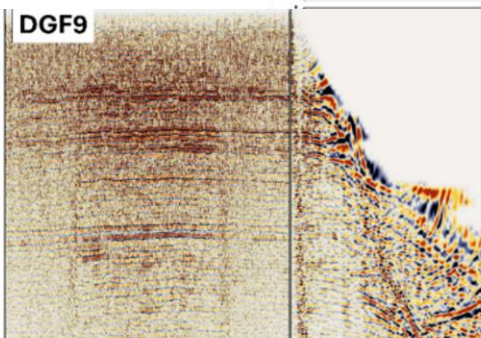
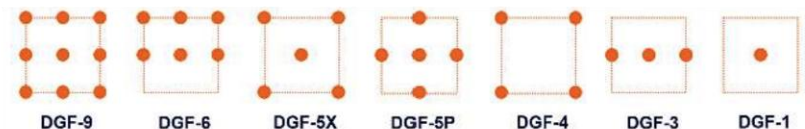
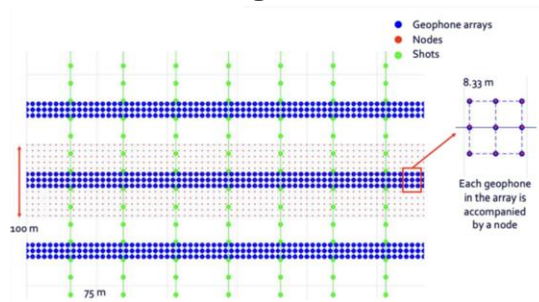
- Single sensor acquisition, every sensor delivers one output trace. **Coherent signal/noise is preserved.**
- Array acquisition, all sensors forming the array are connected to deliver one (irreversible) stacked output. **Alias signal is recorded.**



Strategic for DGF & De-noising data



Flexibility of DGF on-the-edge



“Optimal digital arrays for land seismic exploration in desert environments”

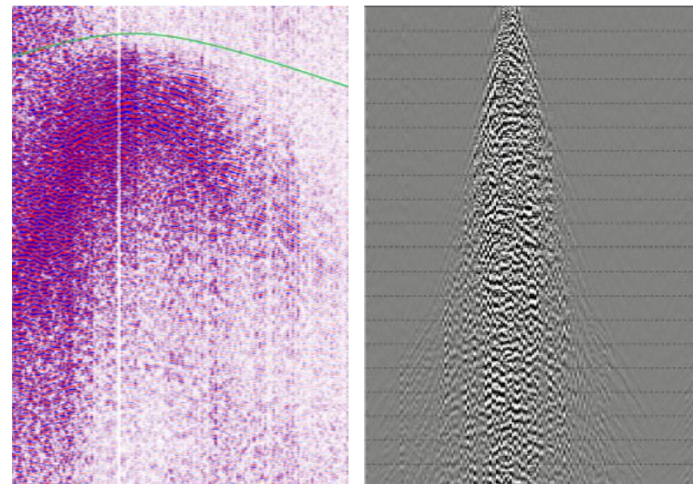
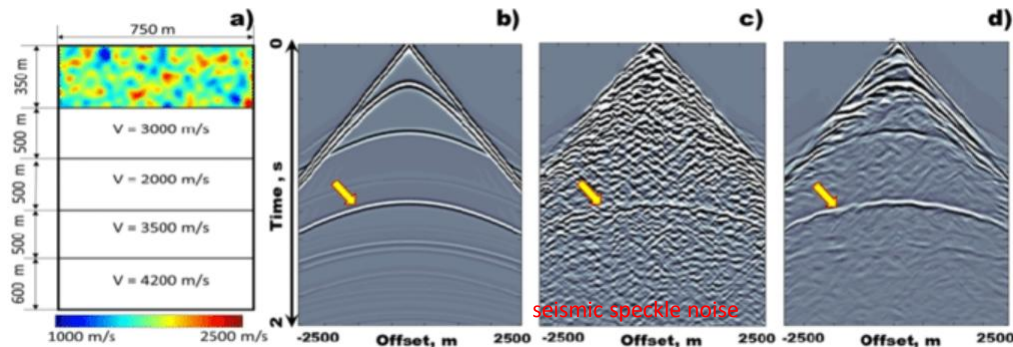
P.Golikov, G.Barnes, E.Murray, E.Alfataierge

SEG/IMAGE 2025 Poster Session

Flexibility of DGF on-the-edge

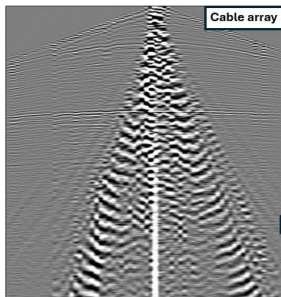
Would single sensor design work everywhere?

- In theory yes, but in practice, some complex near surface conditions might require unreasonable tight sampling not feasible for the whole survey !

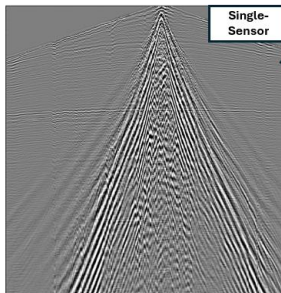


Challenges presented by modern high trace density data

Single sensor in quiet environment

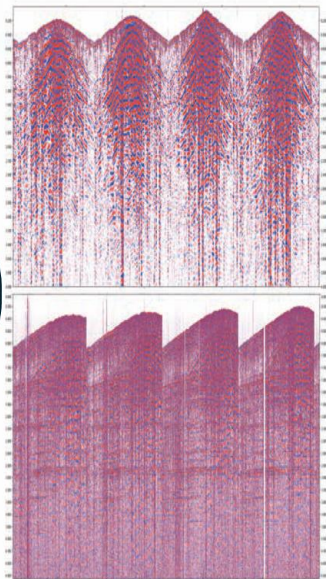


Cable array



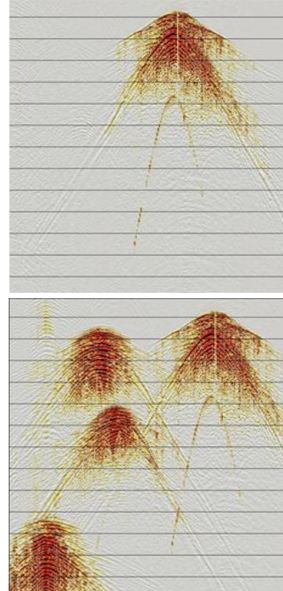
Single-Sensor

Single sensor in noisy environment

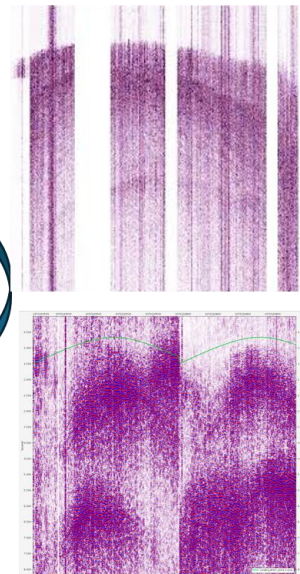


first break volume 32, January 2014

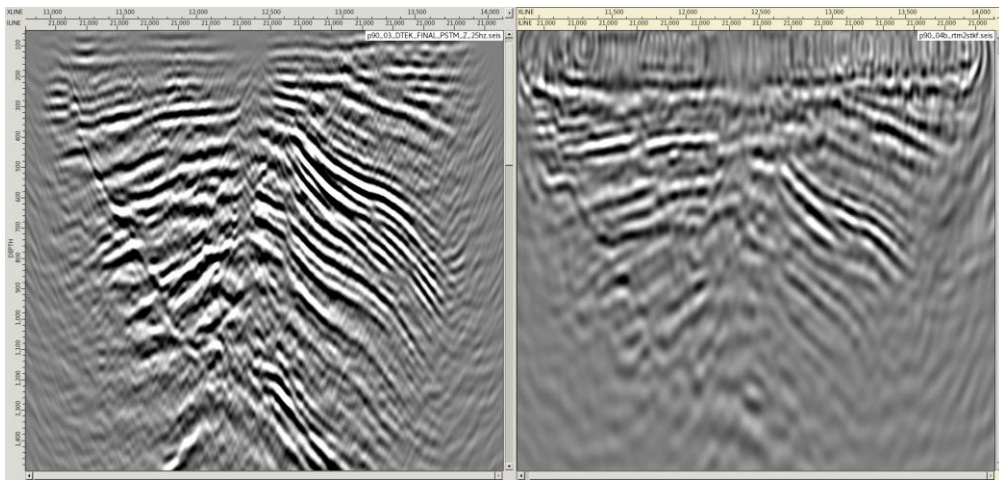
Simultaneous shooting in quiet environment



Simultaneous shooting
Noisy environment



Challenges presented by modern high trace density data

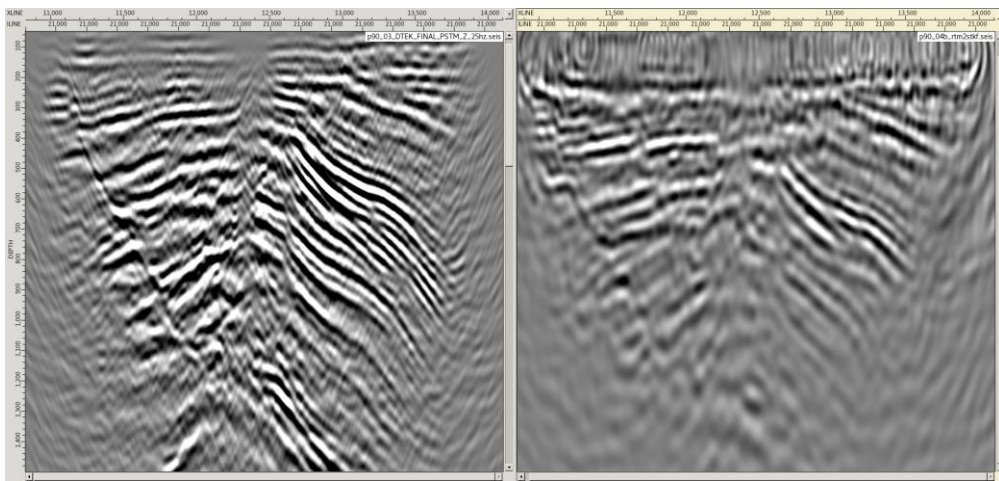


Kirchhoff PSTM

“Dirty RTM” 40Hz

- 10,000 traces, 2min/shot on CPU
- GPU's should offer 10 to 100 times increased throughput at large scale

Challenges presented by modern high trace density data



Kirchhoff PSTM

“Dirty RTM” 40Hz

- Single Sensor: 0.5 – 200 Hz
- Ultra Far Offsets are needed
- LFC for Inversion and energy penetration

FWI ???

Conclusions

- Impact on field QC, data conditioning & seismic signal preservation by nodal seismic systems.
- Digital Group Forming (DGF) aims to combine the operational efficiency of geophone arrays with the increased flexibility and signal fidelity offered by high-density single-sensor acquisition.
- Advances in land imaging like FWI and RTM combined with data reduction techniques such as DGF, are already paving the way for a future real-time imaging solution.



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