

WORKSHOP  
REPORT

# Seabed seismic workshop features continuing research and innovation

The 85 geoscientists and engineers who attended the Second EAGE Seabed Seismic Today Workshop in Milan on 18-20 September were treated to the presentation of novel technologies and numerous successful case histories, some not previously presented. We report on some of the highlights.

Images obtained with the so-called reflectivity FWI are becoming increasingly accepted in the industry. Whether they are an accurate representation of the subsurface is unclear. In his keynote speech René-Édouard Plessix highlighted the importance of pre-processing to magnify FWI sensitivity to the events that we want to interpret. Preconditioning in the model space is important to speed-up convergence.

Carbon Capture and Sequestration (CCS) was featured in the New Energy session. Case histories from Malaysia, Norway and the UK showed some innovative methods such as the deployment of self-recovery nodes and using unmanned surface vehicles in very shallow water. Despite progress, further enhancement in resolution is needed.

The desire for removing the effects of the water layer in OBN processing in complex geological scenarios calls for more advanced methods such as multi-dimensional deconvolution. Davide Calgagni (ENI), during his opening address, and Ahmad Riza Ghazali (Petronas), in his keynote presentation in the joint session with the 7<sup>th</sup> EAGE Borehole Geophysics workshop, highlighted that shear and converted waves recorded during seabed acquisitions are not used to their full potential.

Dr Ghazali proposed a consortium with academic and industrial partners for improving PS processing. Several representatives of processing companies reported that their processing centres spend more time than planned in processing auxiliary data, near-field hydrophones (NFH) in particular. It was proposed that chief geophysicists of the major acquisition and processing companies should get together to agree on a standard. However, several acquisition contractors were hesitant, probably due to the perceived cost of upgrading long-in-the-tooth gun controllers.

## Seabed seismic acquisition

Carsten Udengaard and Nicolas Tellier presented and discussed field data from respectively an optimized airgun array and a large volume, low pressure pneumatic source, both commercially available for the seismic industry.

Tim Bunting proposed a method based on the measurement of the temperature for OCXO type of clocks to estimate and compensate for clock drift. This could lead to a commercial alternative to CSAC.



Seabed seismic committee and speakers group photo.

Chris Walker presented the logistic challenges and solutions of the world largest seismic to date in the Arabian Gulf in water depths from zero to 30 m. Simultaneous recording of onshore and shallow water data when either onshore vibrators or offshore airguns were activated was one of the several distinctive features of this project.

Hugo Ruiz presented a technology that, if incorporated in an OBN survey, enables the measurement of node depths with a relative accuracy of a few centimetres in deep waters.

## Processing and model building

Arash Jafar Gandomi presented a machine learning method for noise attenuation in the Z component based on the assumption that the P component is noise-free whilst the radial component contains the noise reference. Discussion raised issue of conditions that may invalidate the assumption

that the radial component is the reference for the shear-on-z noise.

Max Vassallo presented a method (Spectral gap-based survey design with time dithers) to optimally design simultaneous source surveys that facilitates deblending model building.

Denes Vigh presented elastic FWI applied to a sparse OBN dataset acquired in the Gulf of Mexico with two source vessels and triple source. The distance between receivers was 1200x1200 m.

Tom Rayment presented multi-parameter FWI asserting that the reflectivity obtained has resolution superior to that obtained using pre-processing and migration. The modelling kernel is visco-acoustic with fixed Qp.

Fang Wang presented the results of processing sparse nodes and streamers acquired over Nordkaap basin (Barents Sea) as well as in Fram (Norwegian Sea). The Barents Sea example used sparse sources above the streamers that enabled the acquisition of offsets close to 0 m. However, the first 100 m of offsets were discarded because of clipping. On both examples, elastic FWI handled well anisotropy, as shown from the ties to the wells.

## New energy and case studies

Koon Hong Ho showed a node survey design for CCS on a depleted reservoir 140 m depth over 100 km<sup>2</sup> in a survey area covered by a gas cloud. Eventually, a parallel shooting configuration was chosen.

Sandrine David presented a case history to assess the value of OBN acquisition for CCS in the Sleipner field. Target depth was 800-1000 m, water depth 80 m. The objective was to demonstrate that mini-streamers can provide better imaging in the overburden and plume level whilst the OBN (500 x 525 m) was used for velocity model building but not imaging.