Full Waveform Inversion

Full Waveform Inversion (FWI) is the state-of-the-art tool for high-resolution model building.

Full Waveform Inversion is an iterative approach to find the best sub-surface velocity model for simulating seismic data that match the waveform of the acquired data in the sub-surface. The objective is to find the global minimum of a misfit function (objective function). The true wavefield propagation can be described by a set of non-linear partial differential equations.

The fundamental limitation of the linearized inversion is the so-called "cycle skipping problem". The correct model can only be resolved if the simulated waveform of the starting trial model is no more than half a wavelength away from the waveform of the field data. Vintage marine data sets often lack low frequencies (< 5Hz) which increases this problem. The second challenge is to take the varying signal properties of land data into account to achieve a stable inversion result.

TEEC has developed several solutions to overcome these issues. This makes FWI applicable to a broad variety of marine and land data sets. A fast and scalable FWI is available that delivers accurate interval velocity models.

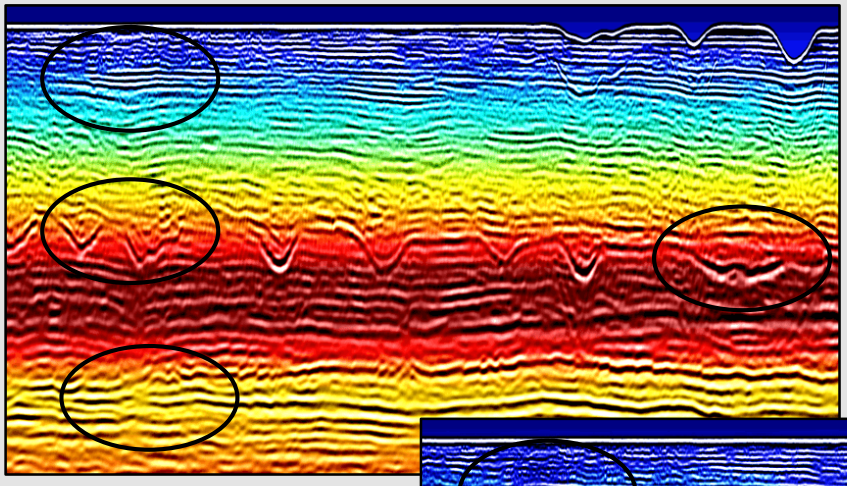

Fig.1: Tomography result

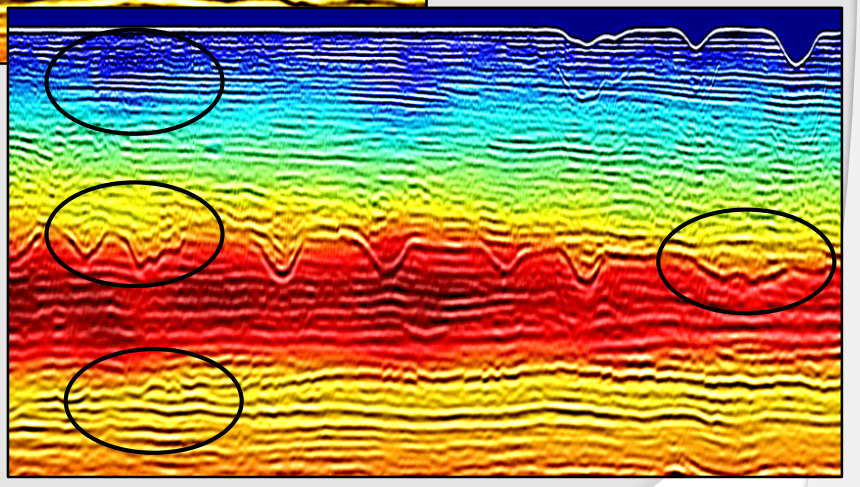

Fig.2: FWI result

The example shows a tomography (Fig.1) and a FWI result (Fig.2), respectively. The FWI model has a better resolution (low velocity zones in the upper part, channels in the lower part). The overlaid RTM image benefits from the improved velocity model.

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