Oral communication

USE OF "EARTH INTELLIGENCE®" FOR UPDATING GEOLOGICAL MODEL OF RADIOACTIVE WASTE DISPOSAL SITE

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Abstract

Safety is the major concern in the design and operation of a repository for radioactive waste in a deep geological formation. In-depth studies have been conducted to specify the characteristics of the geological environment and, in particular, of the clay formation for the safe disposal of radioactive waste. Provided that the authorization for Cigéo is granted, this knowledge will continue to progress during the initial construction of the facilities and the operation phase (drilling, excavation of the ramp, shafts and underground structures, etc.). The technical processes and workflows for the study and operation of an underground storage site are similar to those well-established for the exploration and production of hydrocarbon reservoirs.
Specific artificial intelligence techniques, known as Earth Intelligence (EI), have been successfully developed for oil and gas reservoirs to make the most of available and future seismic and drilling data, reduce modeling time, and gain confidence in operational decision making. They are also applicable to the automation and updating of clay layer modeling workflows. EI complement and extend geoscientific expertise to enable real-time construction and updating of geological models. The Industrial Centre for Geological Disposal is at the forefront of implementing automated EI workflows and is used to illustrate the case study.

Cigeo Case study: Automatic update of the Callovo Oxfordian (COX) structural model after reprocessing of the 3D seismic and before integration of new drilling data.
In 2018, Andra reprocessed the 2012 high-resolution ZIRA 3D seismic survey to better manage static corrections. The question arose to quantify the impact of the 2018 reprocessing on:

- the quality and interpretation of the seismic cube;
- the calibration at the 3 surrounding boreholes;
- the depth conversion and thickness of the COX layer.

A probabilistic EI workflow (Figure 1) was developed to automate the workflows that were defined in the 2012 modeling for the spatial qualification of the seismic data in the time domain and their conversion in the depth domain (Ref 2).
Running the EI workflow in real time allows us to assess the impact of reprocessing on seismic data quality (Figure 2) and update with confidence the structural modeling of the COX layer (Figure 1).

EI workflows allow existing structural scenarios to be updated with new seismic or borehole data in near-real time. In the next step, the EI workflows will incorporate data from the geological survey (digging of the facilities). These updated models will be used to confirm compliance with post-closure safety requirements during facility deployment.

References

(1) Luc Sandjivy (ERM.S) Use of Earth Intelligence for automating geophysical data integration SEG AIEE workshop 2021
(2) Luc Sandjivy (Seisquare) Beatrice Yven (Andra): Heading for a digital clay disposal Clay conference Davos 2017

Figure 1: The Earth Intelligence platform user interface (UDOMORE software by SEISQUARE): Automatic evaluation of the performance of 2012 and 2018 seismic processing.

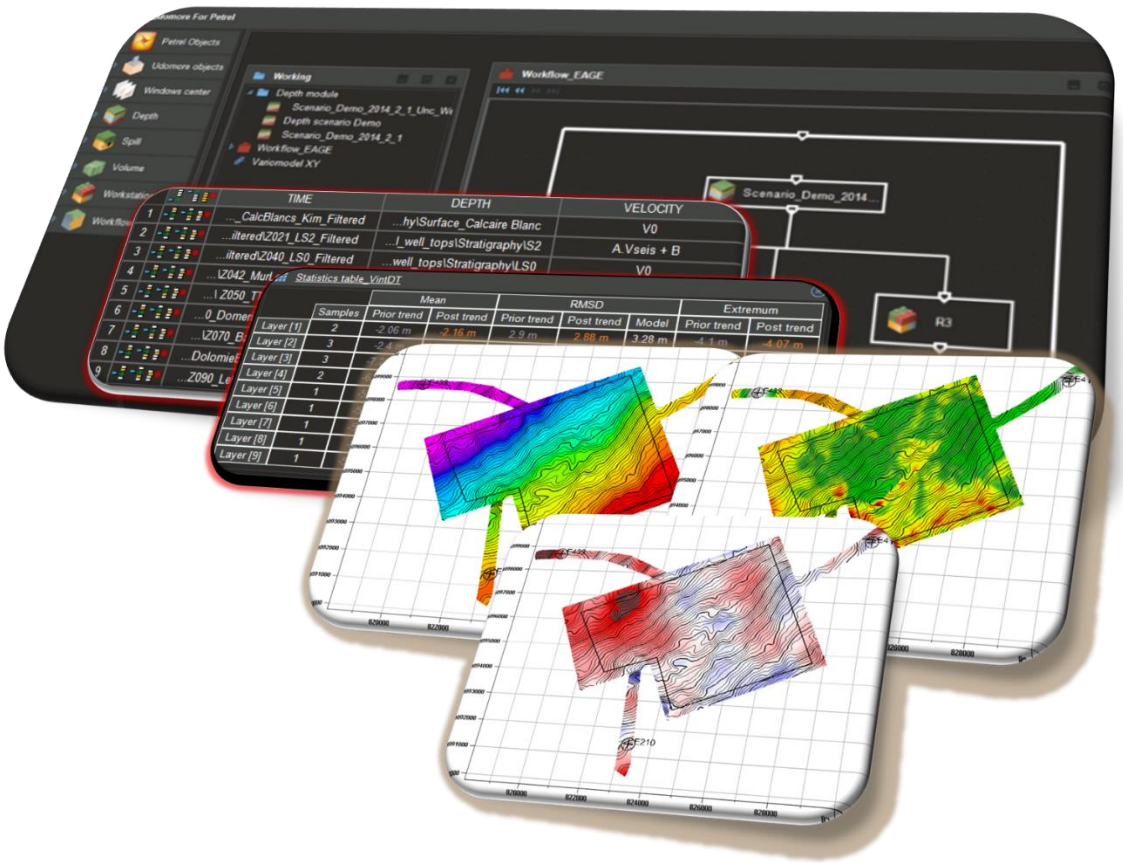

Figure 2 : Impact of reprocessing on the quality of the 3D seismic amplitude cube