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RESEARCH PROJECT: METHODOLOGIES TO INTEGRATE RESERVOIR SIMULATION AND 4D SEISMIC DATA
Alessandra Davolio

The research project focused on the integration between reservoir simulation and 4D seismic (4DS) had its first phase completed in the end of 2017. This project followed a general methodology that proposes a cyclical integration of the two data, aiming to mitigate uncertainties inherent to simulation models and also to 4D seismic interpretation.

According to Prof. Denis Schiozer, project coordinator: "In addition to leveraging 4DS to calibrate simulation models, we had the idea of using engineering analysis to calibrate seismic data. Since 4DS also involves many uncertainties, we have developed an interactive and probabilistic process where the uncertainties are reduced from the two sides from the comparison of reservoir behavior using the simulation and the 4DS. We have made the proposal of this idea and it has been immediately accepted by Shell." In 5 years the project generated 33 papers, 5 master's dissertations and 3 PhD theses. Also, we have received 7 awards:

- First place of CEPETRO Award 2014 – PhD degree, Alessandra Davolio Gomes.
- First place of CEPETRO Award 2014 – MS Degree, Forlan La Rosa Almeida.
- First place at the Student Paper Contest 2015-PhD Degree - Carla Janaína Ferreira
- Best of EAGE Vienna 2016 Brazilian Society of Geophysics – Juliana Santos.
- Scientific award Mário Quartin Graça, 2018 - Technology and Natural Sciences - Gil Fernando Gomes Correia.
- "Best of Petroleum Geoscience: Global Resource Developments", 2018- EAGE (European Association of Geoscientists and Engineers) - Masoud Maleki.
- ANP Award for Technological Innovation 2018.

The most important recognition was the "ANP Award for Technological Innovation 2018" (Figure 1), received on last November 23rd, from ANP (Agência Nacional de Petróleo, Gás e Biocombustívies). This research project was classified at first place in the category of projects developed exclusively by Brazilian universities and research centers, in collaboration with an oil company, in this case Shell.

Another approach proposed by this project concerns a methodology that estimates the chance of success of a 4D seismic project. As in all other methodologies proposed, the initial developments started with controlled cases (synthetic dataset) and then in the second half of the project we started using a real and complex data set. Although very challenging, this case was important to propose solutions to particularities of field data.

All these achievements were possible due to commitment of the project team which includes researchers, PhD and master students (some of them are in Figure 2), technology technicians and the essential support from ANP, Shell, CEPETRO and FEM.

In January/2018 we have started the phase 2 of the project also sponsored by Shell, now with new challenges and aiming to deepen the integration methodologies. This new phase includes a partnership with Prof. Anderson Rocha from the Computer Institute of UNICAMP, for the use of Machine Learning techniques in the recognition of data patterns and to propose fast approaches of 4DS data assimilation.

UNISIM appreciates all the support received from the oil companies and highlights the importance of such partnership which bears good fruit to academia and industry.

Figure 1: *ANP 2018 award ceremony held in Rio de Janeiro on November 23rd. From left do right: Décio Oddone (general-director of ANP), Alessandra Davolio (project's researcher leader), Denis Schiozer (project coordinator), Frances Abbots and Moises Silva (project coordinators from Shell).*

Figure 2: *Part of the staff of the project. From left to right: Forlan Almeida, Juliana Santos, Ana Teresa Gaspar, Denis Schiozer, Bruno Pazetti, Guilherme Tonin, Felipe Mesquita e Alessandra Davolio.*

About author:

Alessandra Davolio is a researcher of UNICAMP. She holds a PhD in Petroleum Science and Engineering from the same university and leads UNISIM's research activities related to the integration between reservoir simulation models and 4D seismic data.