Data-driven Workflows for Improved Productivity

Advances in AVO analysis and dynamic software with increased feedback lead to interactive visualization.

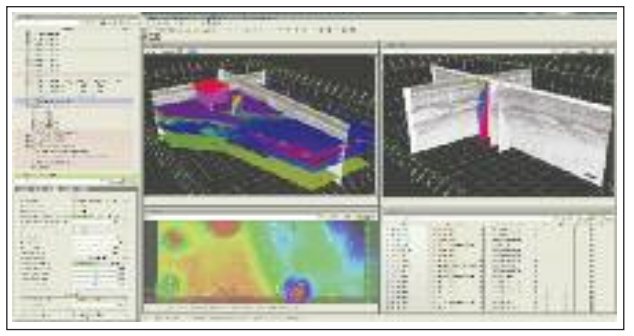
Contributed by Headwave

The oil and gas industry is constantly chasing productivity gains. Learnings from other industries, however, show that step changes in productivity are unlikely to be achieved from relatively minor user interface (UI) modifications such as ribbon interfaces and driving down mouse clicks. Let the data speak, and the geoscientists will draw their own conclusions.

For years, Headwave and its sister company, Hue, have been associated with truly interactive visualization. For several integrated and independent oil or seismic companies, the name "Headwave" is synonymous with incredibly fast multiterabyte prestack visualization and reservoir characterization. Hue, a Norwegian/U.S. company that develops and promotes its HueSpace technology for E&P application development, enabled Schlumberger's geobody workflows in Petrel 2007. The Petrel product included multiple innovations such as the sugarcube rendering (a Hue innovation in 2005) and the "what you see is what you track" approach, which lets users extract bodies based on visual characterization. Although it might not have been obvious, this was an early example of innovation in data-driven workflows.

In 2012, Headwave's geoscience adviser, Dr. Ron Masters, invented and introduced a new amplitude vs. offset (AVO) approach. As is practiced throughout the industry, interpreters can sometimes directly identify reservoirs and hydrocarbons by observing AVO anomalies in seismic data. The underlying science of AVO analysis is quite mature. Many forms of attribute analysis have been used routinely for a long time, including AVO cross-plotting.

Typically, AVO analysis has been applied by multidisciplinary experts to confirm prospects already identified by conventional interpretation. Their work always depended on prior knowledge of which prospective horizon to investigate and what combination of AVO attributes would provide the appropriate recognition criteria in each case, until Headwave's innovation. Headwave introduced a method that can identify AVO anomalies even if they have not previously been recognized as prospects and even if they have not been mapped. It does not require any prior knowledge about local conditions in the subsurface or which AVO class is locally likely to indicate reservoirs and hydrocarbons. This is yet another example of data-driven workflows that represent step changes in productivity.



Interactive time-to-depth model building with full feedback in Headwave 3 is demonstrated. (Image courtesy of Headwave)

Software vendors often are criticized for the awkwardness of their software tools. For users to be productive, they have to be experts in the use of a particular tool, which slows adoption of innovations and new methods. Having less mouse clicks is great and desirable and not to be underestimated, but small UI changes are unable to solve the underlying issue.

The industry has repeatedly attempted to increase productivity through automation; however, automation through strict scripts strongly interferes with the need geoscientists and engineers have to drive the software. Instead, the software drives the users, which leads to a decline in quality.

The first point on the agenda is to attack the lack of feedback. The best quality is obtained by users seeing a direct response to their parameterizations and choices. This holds true whether users are seeking velocity model building for depth conversion or imaging or interpretation of complex geology.

Aiming to change the current regime of "click, wait for results, change parameters, repeat," which is quite inefficient, Headwave's products rely on HueSpace and NVIDIA technologies for instant gratification. "Finally, users can work with not only the end result in mind; they can always see the end result as they work. This is a world first, and as we introduce new workflows, the benefits of this paradigm shift will become obvious to all geoscientists," Masters said.

The second point to be made is doing away with software that gets in the way. Experts in geoscience should be assisted by software. This requires the software to fully keep track of what users are doing and keep data live at all times so that as users improve their understanding of the model or reservoir, any changes they make upstream are immediately reflected downstream.

Combined with subtle workflow management, users no longer have to rely strictly on scripted processes. Instead, workflows are entirely dynamic and honor the acyclic nature of geoscience, making the geoscientists of tomorrow far more productive. Very few software packages in the industry manage this well, but new products designed bottom-up for this paradigm shift will lead the way. Older legacy products will likely not be able to follow, and the company expects to see a trend as both young and experienced geoscientists move to new software packages that allow them to work the way they want to.

During the SEG Annual Meeting, Headwave will lift the curtains of its next-generation platform and provide live demonstrations of the product. Headwave will demonstrate excerpts of workflows related to wide-azimuth data, including analysis of azimuthal variations of velocities and velocity model building with real-time feedback and depth conversion. Also, in collaboration with Lumina Geophysical, Headwave will give a demonstration of CLSSA—extreme high-resolution spectral decomposition—with fully interactive parameterization and visualization.

The company also will provide some insight into the architecture and how R&D groups can benefit from the incorporated HueSpace technologies for end-to-end GPU accelerated workflows. ■