A significant number of carbonate reservoirs worldwide have been modified by karst. Karst can impact reservoir performance in various ways, including changing reservoir connectivity and fluid flow patterns. To better understand the impact of karst on reservoir performance, a study was conducted in Waddell Field, west Texas.

The study integrated core, log, 3D seismic, and production data to identify the nature, distribution, and impact of karst in a Permian San Andres carbonate reservoir. The reservoir in the study area is highly compartmentalized and fluid flow is influenced by the presence of karst.

The reservoir in Waddell Field is comprised of a retrogradational to aggradational to progradational stratal architecture resulting in southeastward thinning. Special attention was given to the top of the Permian San Andres Formation, which is interpreted as karst. A southeast-trending plunging anticline is located on the east central flank of the Central Basin Platform.

The study used a variety of geological, petrophysical, and geophysical analyses, including BVW profile analysis, to assess the spatial continuity of the reservoir. Statisticalzonation of well logs was employed to identify the base of karst. Multi-mineral models were essential for estimating effective porosities that provided good matches with core data.

In particular, petrophysical and geophysical analyses were used to evaluate the gross producing interval in the “high volume area” of Waddell Field. The upper karst interval in these wells involved the porous karst zone. The lower karsted zone was associated with the base of the tight, dolomitic reservoir in Waddell Field.

Cumulative oil and gas (left), cumulative total fluid (oil + gas + water) (center), and cumulative gas (right) maps in the “high volume area” of Waddell Field were developed on the top of the Permian San Andres Formation. The petrophysical and geophysical characterization of karst is crucial for better understanding reservoir performance and optimizing production.

The analysis of the reservoir in Waddell Field highlights the importance of karst in modifying carbonate reservoirs. Further studies are needed to better characterize karst and its impact on reservoir performance in other similar settings.