

## **Integrating Geology and Waterflood Responses**

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Bubble and contour maps of the oil and water cumulative production can provide some indications about the waterflood effectiveness. Numerical approaches can assist in understanding complex effects of different drilling programs, field treatments, well completions, and new injectors. This paper shows how fluid communication through a reservoir can be assessed by the changes of the oil, gas, and water production relatively to the water injection changes. Specifically, a correlation between changes of injection and production rates are analyzed over a period of time for each injector-producer pair. Such analysis results in estimates of oil, gas, water responses, and their time lags. The results are presented with special diagrams and contour maps. Spine and spider special composite diagrams present up to six communication parameters, which can be overlaid with contour maps of facies, netpay, or other geological parameters. Furthermore, this paper shows how these response parameters and their combinations can be presented on the contour maps and assist in identifying flow units. Our special mapping improves geological understanding of field responses to the injection volumes and distribution. These diagrams and maps also help in selecting areas for the infill programs, new injectors, identifying unsupported wells and poor injectors. Finally, we show how the same approach can be applied in planning of new waterfloods.