From Geological Complexity to Operational Uncertainty
A Monte Carlo Modelling Approach
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ABSTRACT
As a reservoir matures, it becomes necessary to integrate an increasing amount of dynamic data into the development planning process. The subject field, the Cupiagüa gas-condensate field of the Casanare region, exhibits a high level of complexity in many aspects of the reservoir architecture:

- Rock properties (low permeability siliciclastics with natural fracturing)
- Tectono-structural style (compressive with multiple imbricate fault blocks)
- Fluid system (rich retrograde gas condensate with dry gas recycle)
- Multiple hydraulically isolated reservoirs (Mirador, Barco and Guadalupe)
- Complex well completions (multizone, laterals and multiple hydraulic fractures)

This complexity is reflected in the wide range of outcomes from development well drilling, namely a wide range of variation in initial well rates and decline styles between wells in the same reservoir.

The paper describes a method of analyzing uncertainty in development well performance to allow ranking of the different elements of reservoir complexity in terms of what matters: how they affect the ability to produce oil.

This approach allows the operator to optimize the target selection and well planning process, and provides more meaningful estimates of the range of uncertainty in development well drilling results.

INTRODUCTION
FIELD DESCRIPTION - CUPIAGÜA
The Cupiagüa gas-condensate field of Colombia’s Casanare Foothills province exemplifies reservoir complexity, in terms of structure, rock properties, fluid properties and the presence of natural fractures.

The field location, 195 kilometres northwest of Bogotá, is shown in Figure 1. Cupiagüa is the second largest hydrocarbon reservoir in the foothills. It was discovered in 1992 and commerciality was declared in 1994. Production started in 1996 and reached a maximum in 1998. It extends into two contract areas: Santiago de las Atalayas (SDL A) and Recetor.

Figure 1 - Operating Area location in Colombia

Figure 2 - Cupiagüa Structure and Well Paths showing line of section
The location, top structure and principal structural elements are shown in Figure 2 and Figure 3.