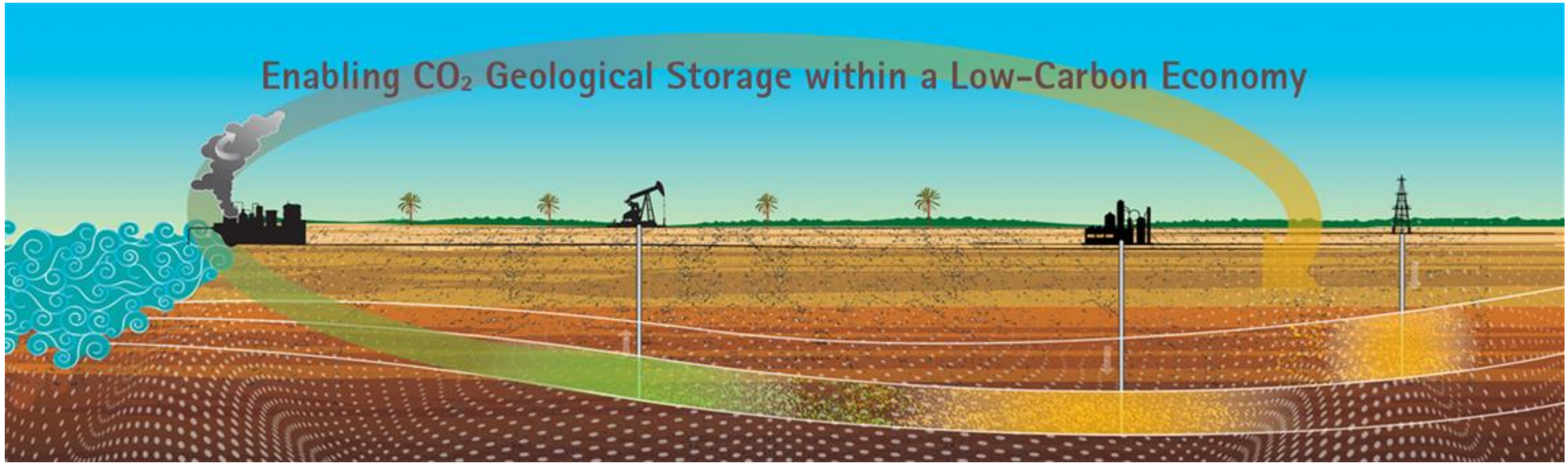

Type-Curves for Herschel-Bulkley Fluid Model Resembling Lost Circulation in a Fractured Formation

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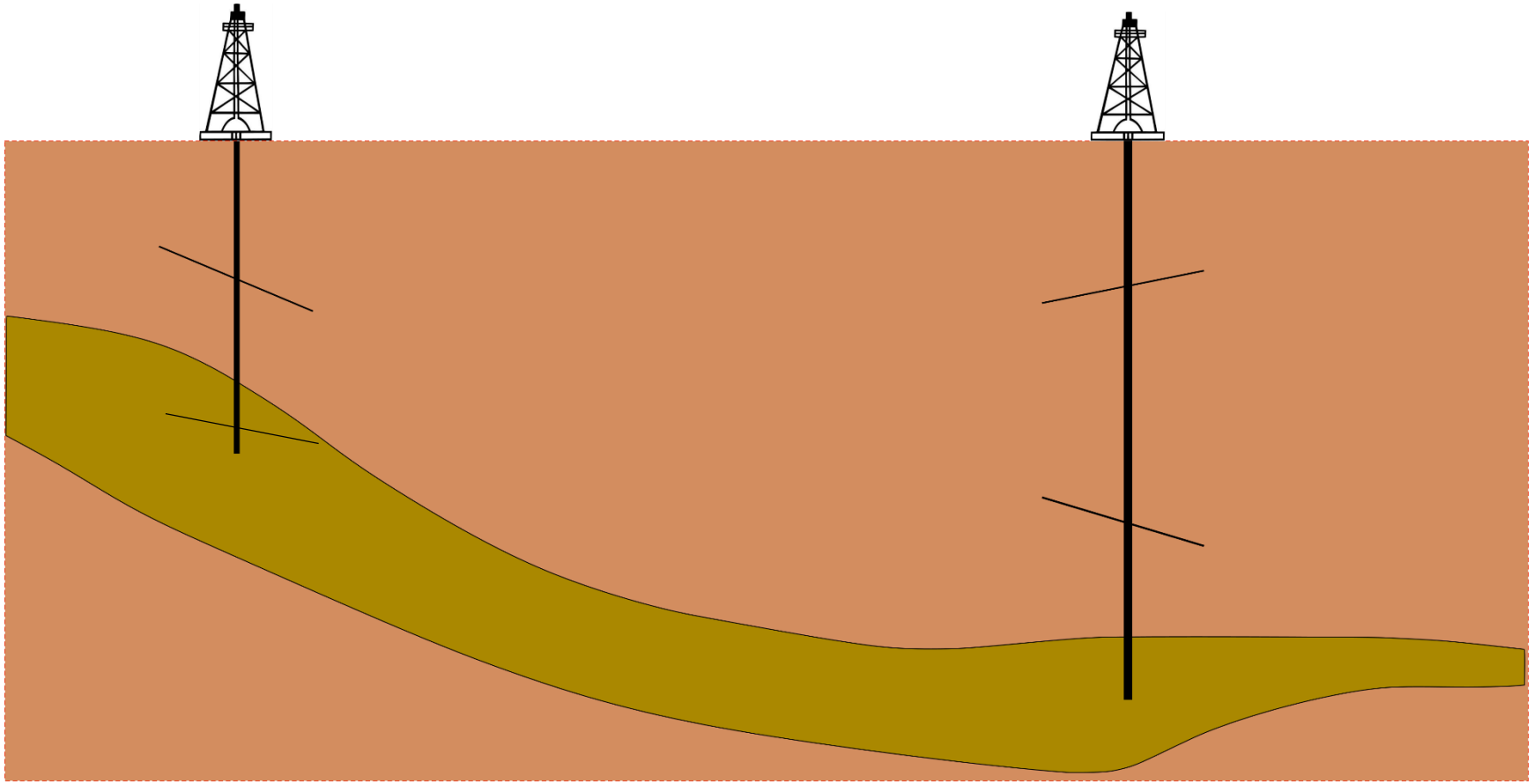
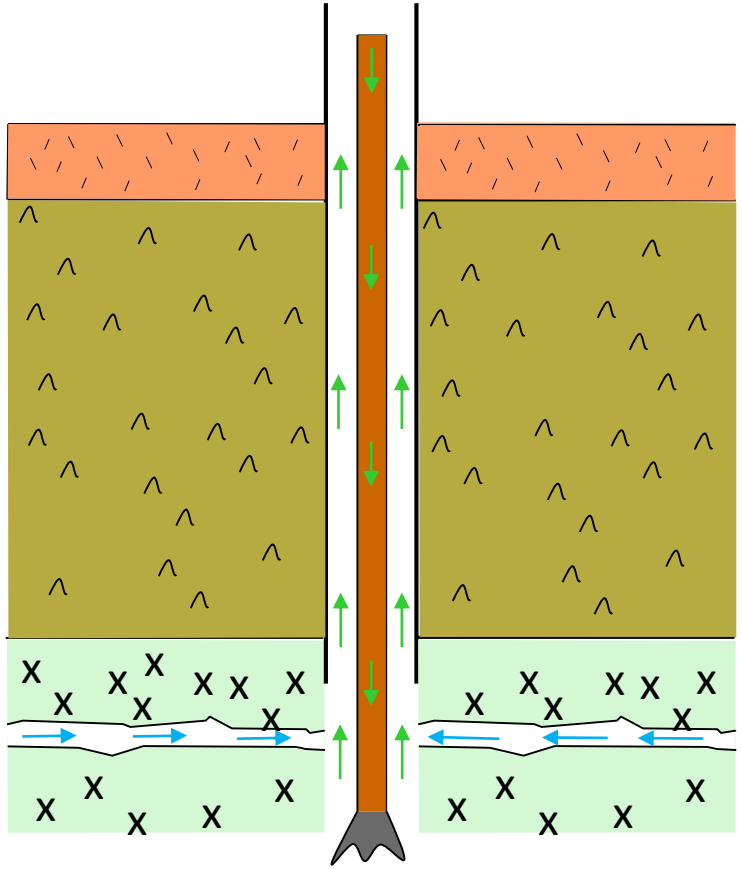
Site Construction: Drilling



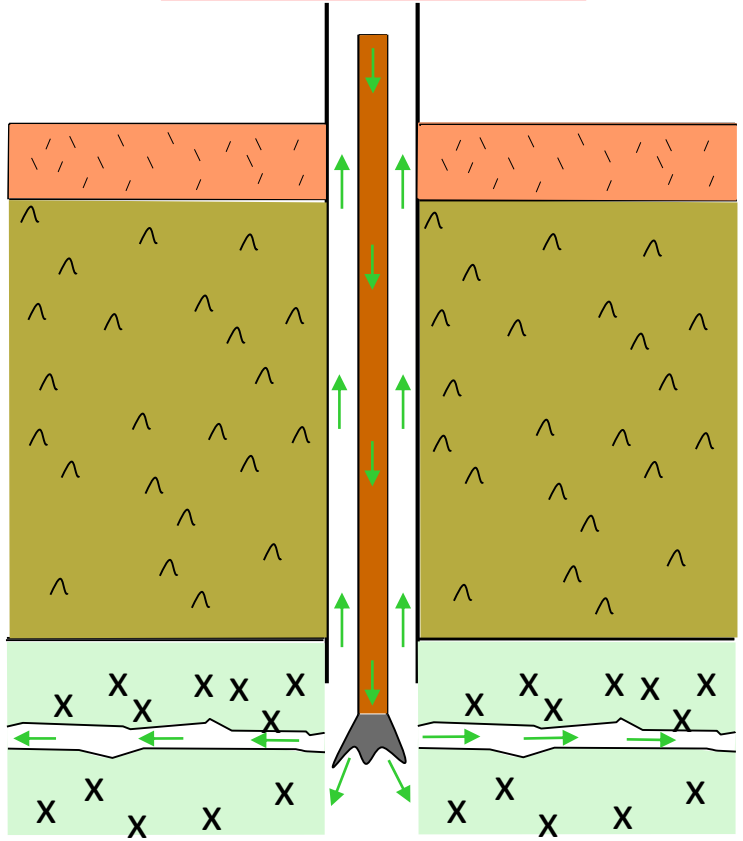
Drilling Incidents

King Abdullah University of Science and Technology

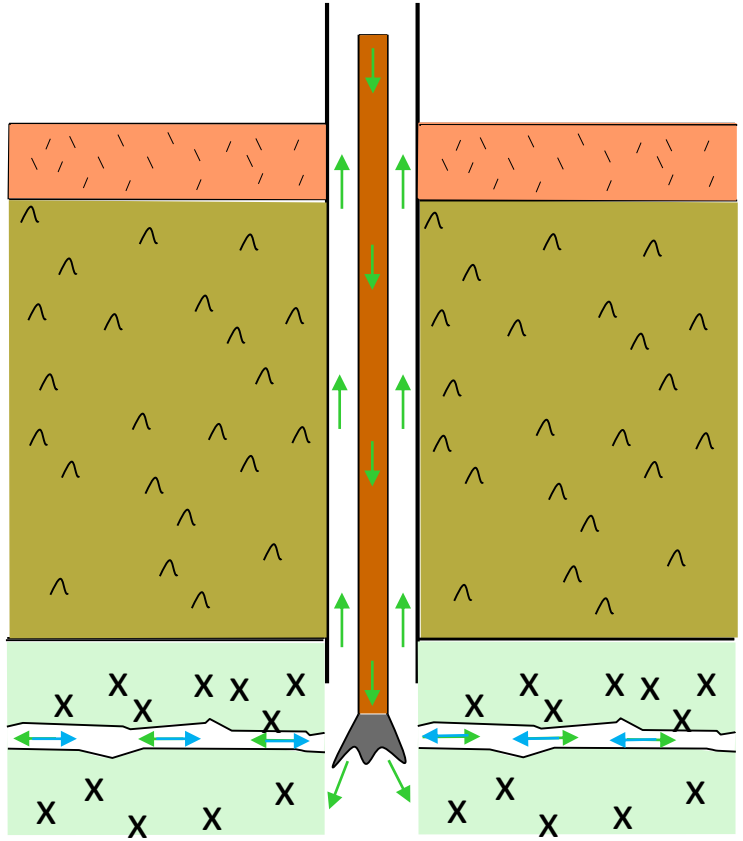
Kick



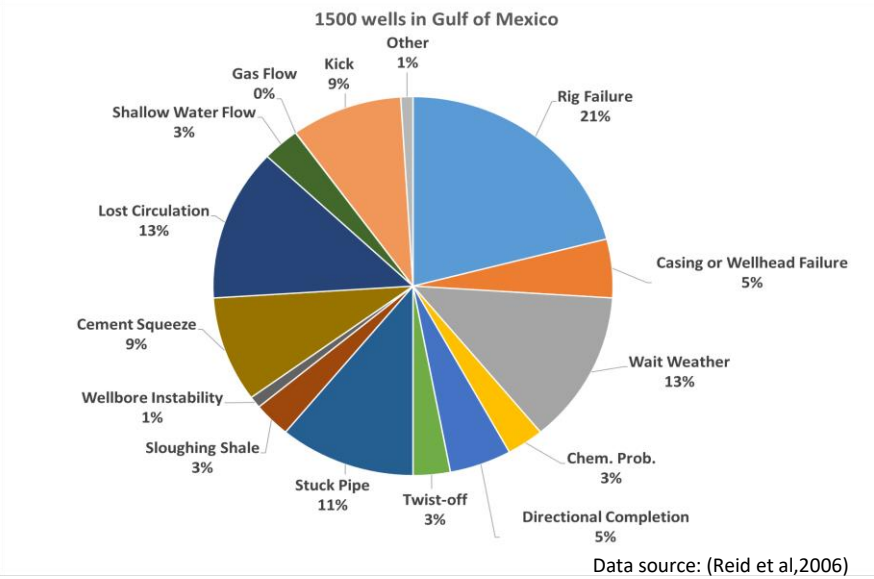
Lost Circulation



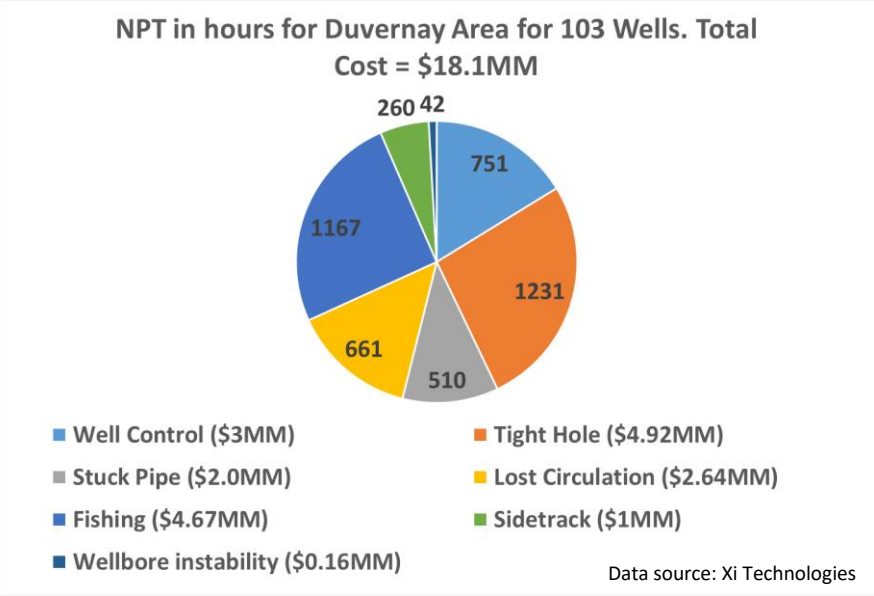
Mud loss/gain



Introduction

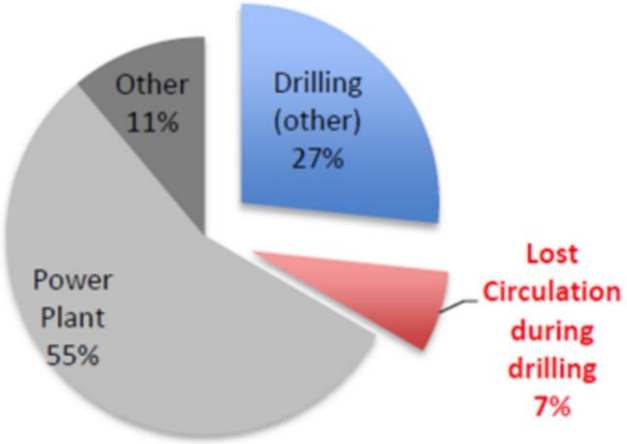


Data source: (Reid et al,2006)



Data source: Xi Technologies

Geothermal Drilling

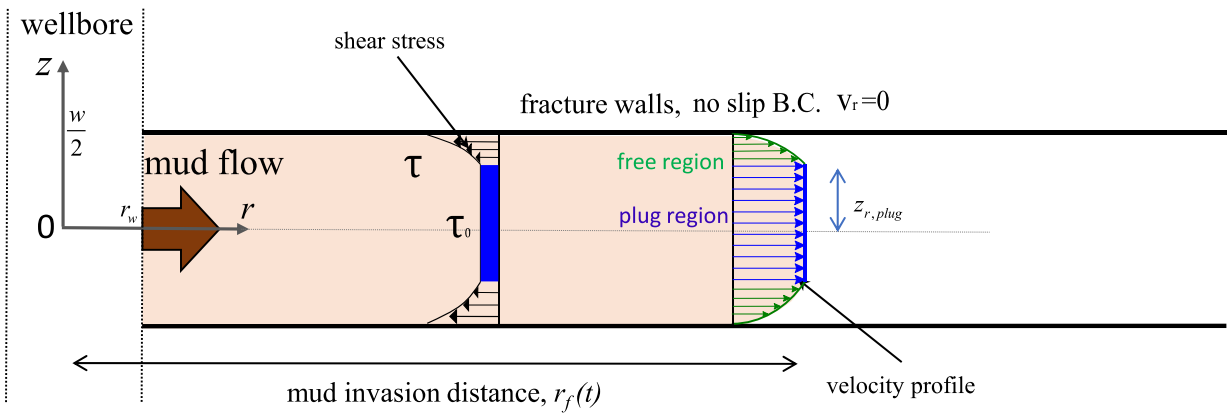


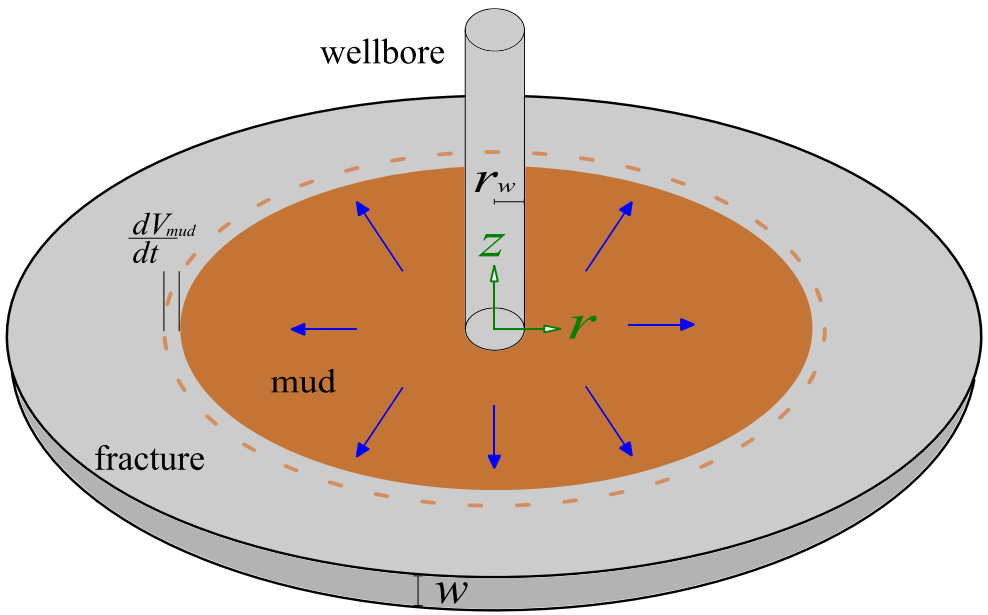
Single well drilling cost:	USD $1-7 Million
Lost circulation drilling cost component:	~ 20%
Lost circulation cost:	USD $200,000-$1.4M
Wells per field:	10-20
Total drilling cost per field:	USD $10M-140M
Lost circulation cost per field:	USD $2M-28M

Cole et al. (2017)

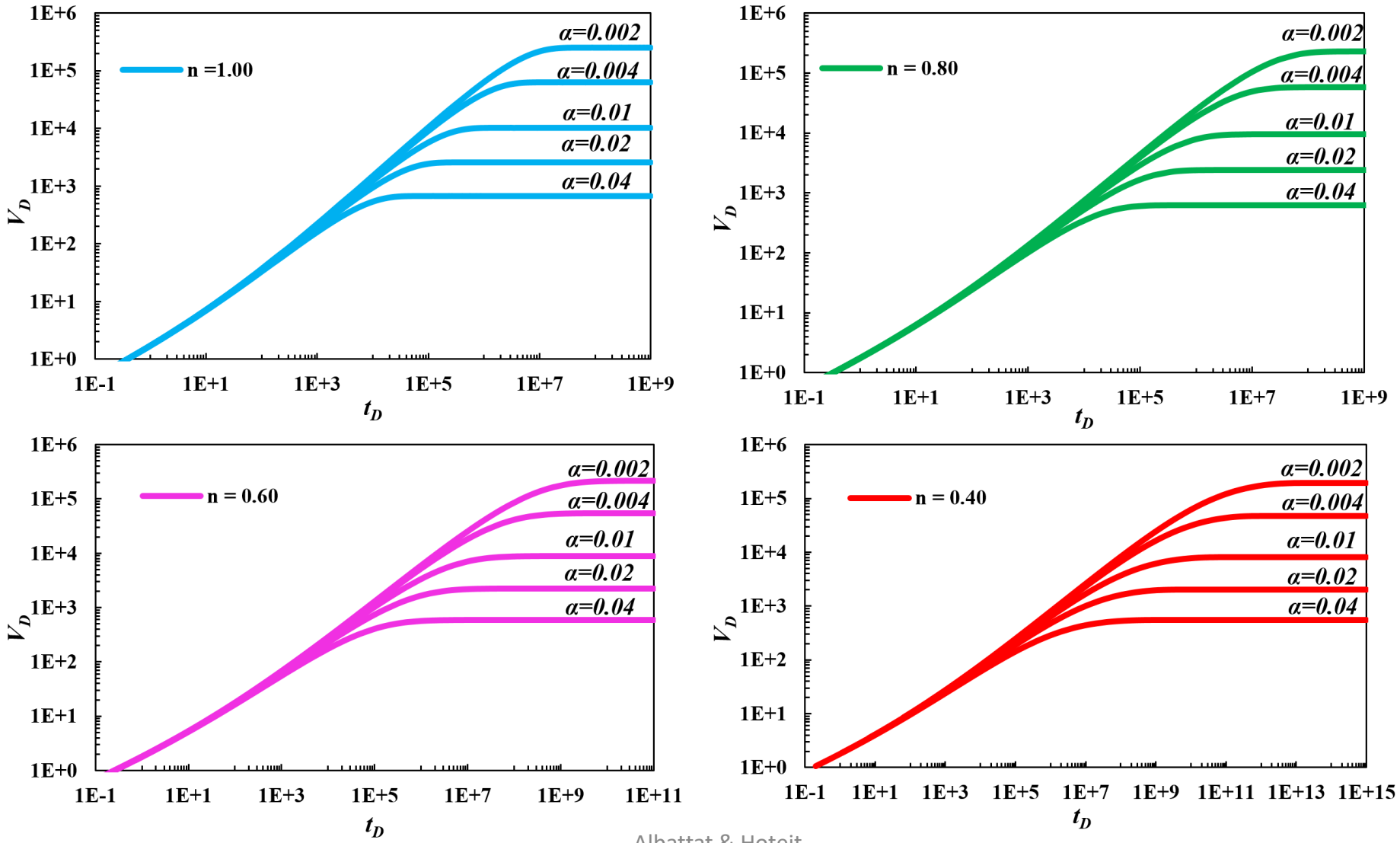
Solving non-linear ODE

$$\begin{cases} p_f - p_w = \dfrac{B\left(r_f(t) - r_w\right)}{2} + \dfrac{Q_{total}^n\left(r_f(t)^{1-n} - r_w^{1-n}\right)}{2(1-n)A} + \dfrac{1}{2}\displaystyle\int_{r_w}^{r_f(t)}\left(\sqrt{\left(B + \dfrac{Q_{total}^n}{r^n A}\right)^2 - 4D}\right)dr \\ Q_{total} = 2\pi w r_f(t)\dfrac{dr_f(t)}{dt} \end{cases}$$



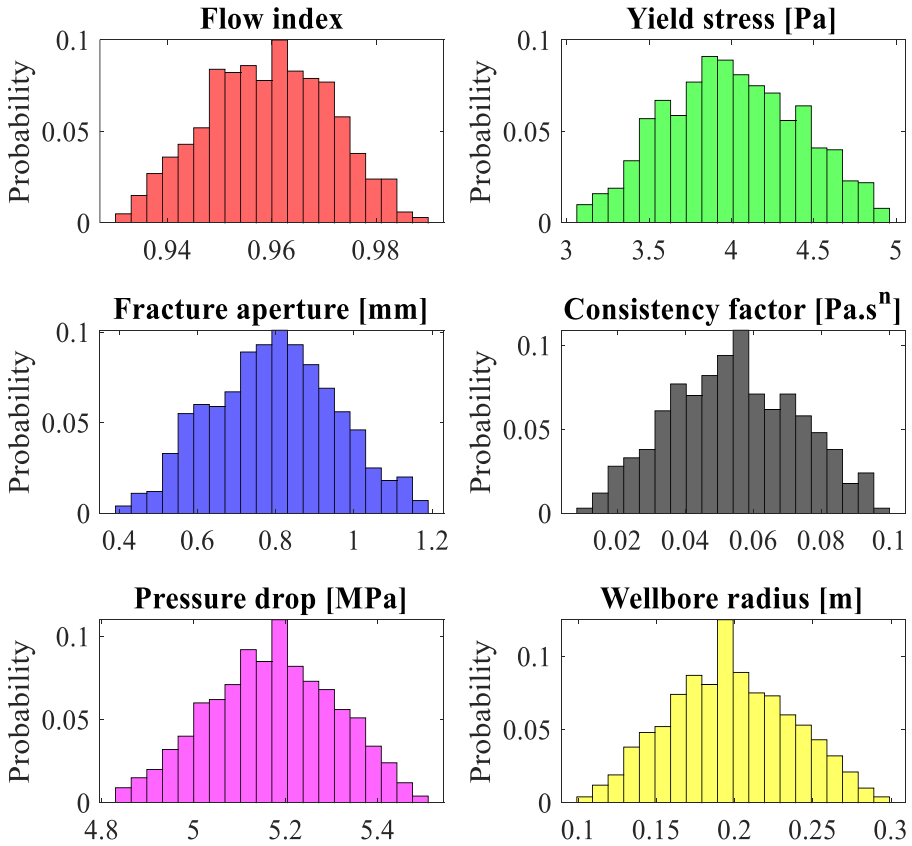


Type-curves Generation

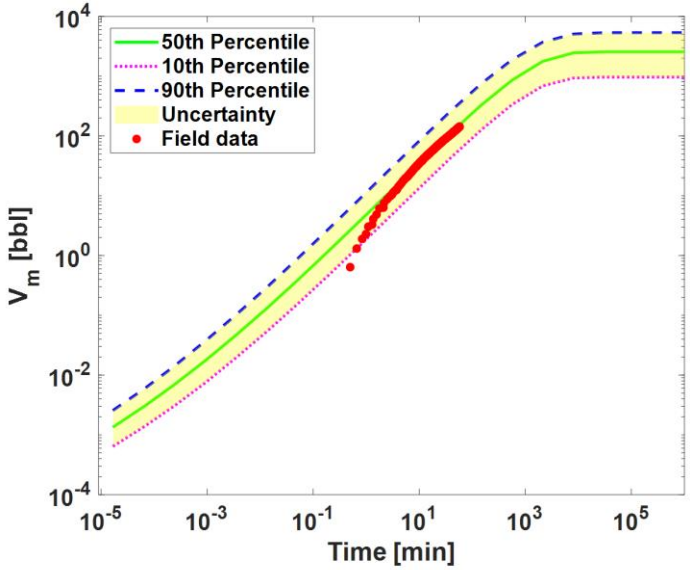


Results of Well 1

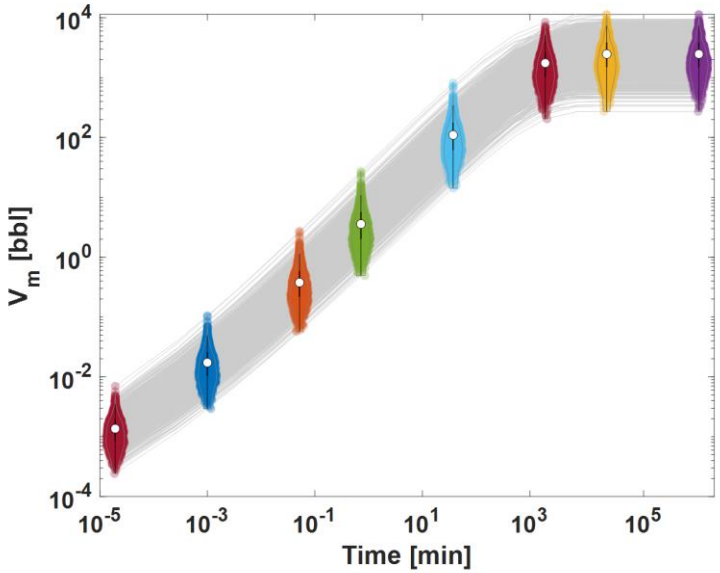
Input Parameters



Output Results



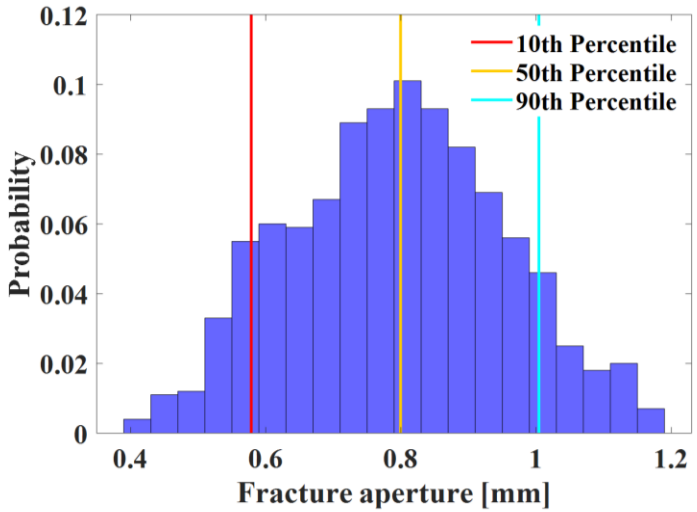
a) Model match with uncertainty range.



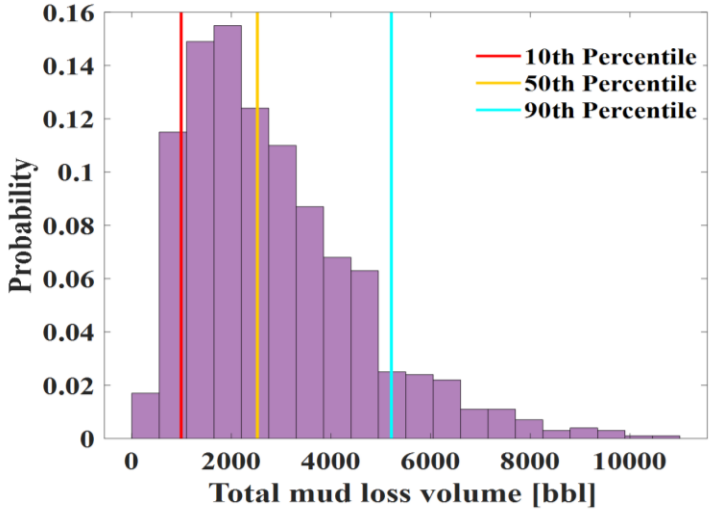
b) Distribution of probabilistic match.

Summary of Well 1 & 2

Well 1

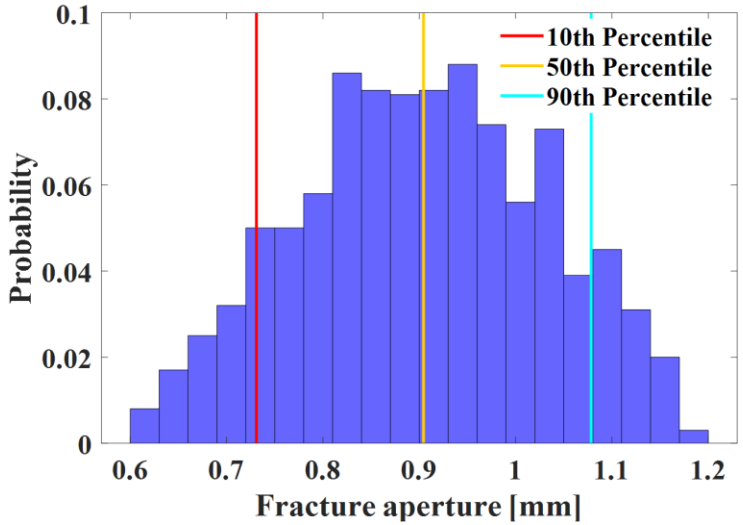


a) Distribution of fracture aperture uncertainty.

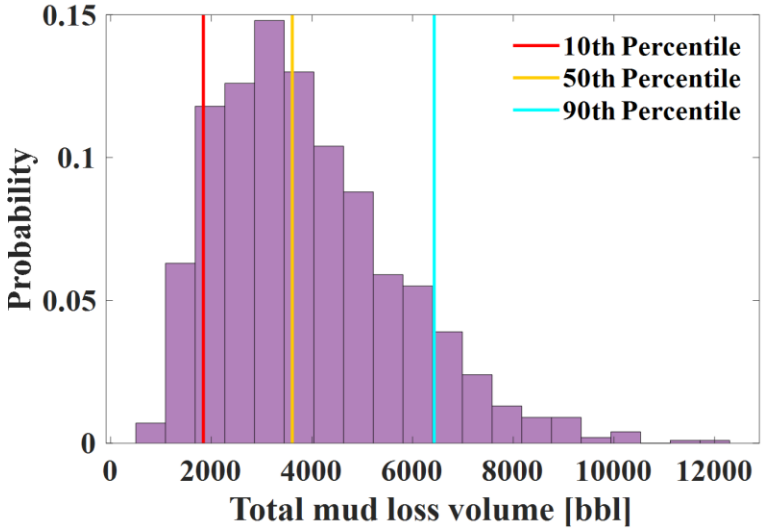


b) Distribution of total mud loss uncertainty.

Well 2



a) Distribution of fracture aperture uncertainty.



b) Distribution of total mud loss uncertainty.