Training Course

Example (12 hour training module)

Downhole Weight on Bit and Geomechanical Property Logs in Unconventional Reservoirs

Topic Outline

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Topic Outline - 1 (Downhole Weight on Bit)

1) 2D Torque and Drag Modeling – 2 Hours

- Overview of torque and drag analysis in drilling
- 2D torque and drag (T&D) modeling
- Johancsik drill string T&D model
- Stiffness effects on drill string

2) Torque and Drag Modeling – 2 Hours

- 3D T&D model (Aadnoy's model)
- 3D T&D simulation model (Combined model using drilling data)
- Calculation of friction coefficient
- Calculation of downhole weight on bit (DWOB)
- DWOB in sliding mode

3) Hands-on Technical Experience – 2 hours

- Introduction to Rocsol D-WOB software
- D-WOB Inputs – data collection and data QC
- Simulation analysis of friction coefficient and downhole weight on bit using sample drilling data

4) Quiz, group project and project presentation

Topic Outline - 2 (Geomechanical Property Log)

5) Geomechanical Properties and ROP (Rate of Penetration) Modeling for Drill Bits – 2 hours

- Geomechanical properties for reservoir characterization and stimulation design
- Conventional logging techniques in unconventional reservoirs
- ROP models for PDC and Tricone bits with different IADC (International Association of Drilling Contractors) codes

6) Geomechanical Property Log using Drilling Data – 2 hours

- Hydraulics and bit wear effects on ROP models
- Inverted ROP model to calculate rock strengths using drilling data
- Modeling and simulation of Young's modulus, porosity, permeability and Poisson's ratio using rock strength

7) Hands-on Technical Experience – 2 hours

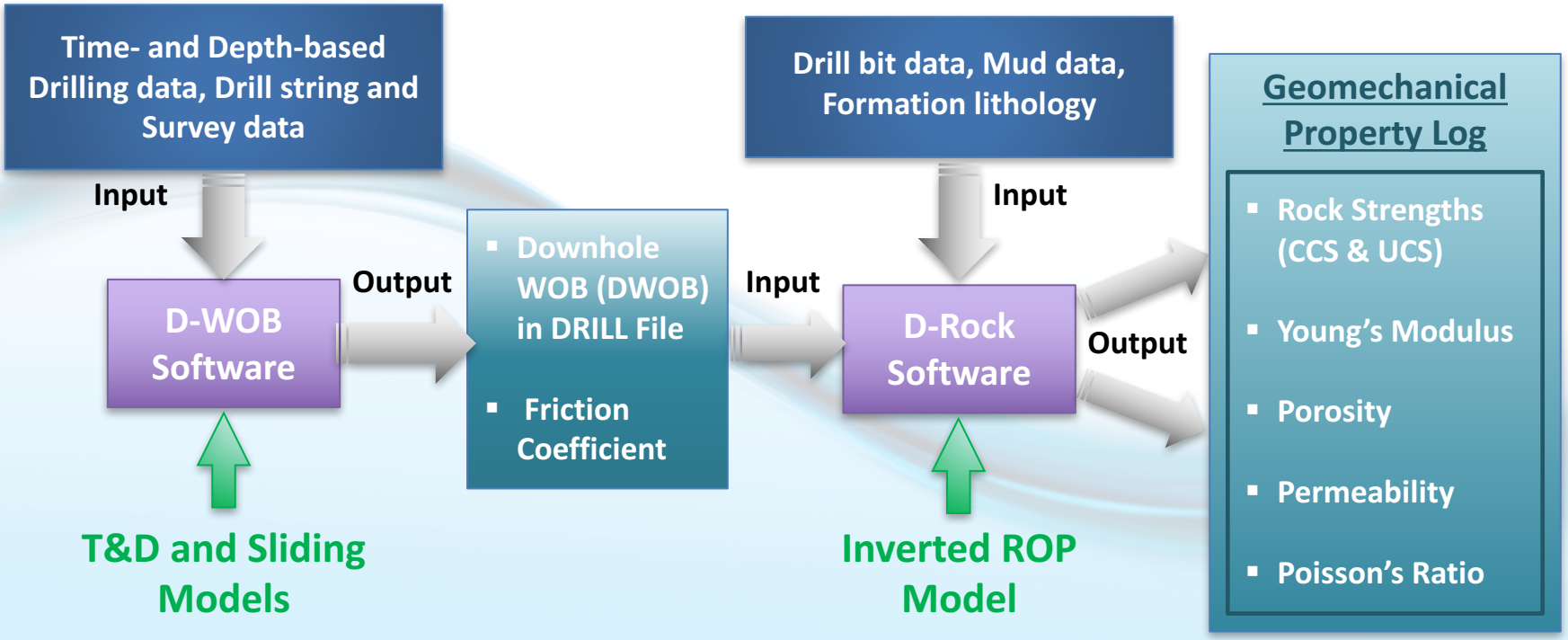
- Introduction to Rocsol D-Rock software
- D-Rock Inputs – data collection and prepare input files
- Calculate formation constants using D-Rock tools
- Calculate geomechanical properties using sample drilling data in unconventional reservoirs

8) Quiz, group project and project presentation

Overview of D-Series Technology

- **D-WOB :** Uses torque & drag (T&D) and sliding models to calculate friction coefficient (FC) and downhole weight on bit (DWOB) from drilling data, drill string information and wellbore survey measurement

- **D-Rock :** Uses inverted ROP model to calculate rock strengths (CCS and UCS), Young's modulus, porosity, permeability and Poisson's ratio using the output from D-WOB, drill bit information, mud data and formation lithology



Input Data for D-Series

❑ D-WOB

- ***Drilling data:*** date & time, measured/hole depth, bit depth, weight on bit (WOB), hook load, rate of penetration (ROP), rotary RPM, stand pipe pressure (SPP), flow rate, differential pressure and pore pressure
- ***Survey data:*** measured depth, true vertical depth (TVD), inclination and azimuth
- ***Drill string details:*** lengths, inner diameter, outer diameter and unit weights of drill string sections such as, bit and BHA components, drill pipes (DPs) and HWDPs
- ***Additional data:*** weight of travelling block, number of lines, single sheave efficiency and mud weight

❑ D-Rock

- ***Drill data:*** output data file from D-WOB including measured/hole depth, TVD, downhole weight on bit, ROP, RPM, SPP, flow rate, pore pressure and mud weight
- ***Drill bit details:*** type of drill bit (PDC or Rollercone), bit diameter, IADC code, bit wear in and wear out, number and diameter of bit nozzles
- ***Mud and formation data:*** drilling mud type (water or oil), mud motor constants and formation name
- ***Laboratory triaxial data:*** confining pressure, CCS, average UCS and Young's modulus