55th Meeting of the ISCWSA
Day 2

Introduction from Adrian Ledroz

Introduction by Hans Dreisig

Three Considerations in Building an Accurate Crustal Magnetic Field Model
Xiong Li

Longer and closer horizontal wells require more accurate positioning:

- By drastically increasing the horizontal length of wells, producers have increased production despite using fewer rigs and drilling fewer wells

Examples of current Reference Field Model and IFR

Derivation and use of an IFR Model:

- Aeromag surveys
- Solar crustal TMI anomaly on surface
- Vector magnetic fields at depth
- 3D Interpolation

OWSG Error Model Global Values (1-Sigma)

Downward Continuation

- The magnetic field decays with the cubic of the distance
- The magnetic field gets stronger when we drill deeper or closer to crustal magnetic sources

Downward Continuation by the Fourier Transform Method

Examination of Downward Continuation

- The magnetic anomaly grid will be downward continued 4k to 6k ft
- We check the continuation results along the profile

Downward continuation by the equivalent source method

- Results at all continuation depths are produced by the same equivalent sources
- These results are stable and make geological sense
- Observed anomalies can be interpreted by the fictitious sources

Sediments over Basement: The Permian Basin

- Sediments contain no significant magnetization

- Basement has significant magnetization variations and produces dominant crustal magnetic anomalies

Basement depths in the Bakken
- Equivalent sources can be placed on the top of the basement of the Williston Basin

Scalar to Vector Conversion Example

East, North, and Vertical component differences: at 5000m below MSL

The 1-km NAmag
- Was released in 2005
- Canada, US, and Mexico complied their country-wide magnetic anomaly grids and then merged
- USmag and NAmag are the same within the USA
- The grid spacing is 1km but the actual spatial resolution varies and depends on individual surveys

Conclusions:
All three are important when building an accurate IFR model
- A stable downward continuation using geological constraint
- A conversion from the scalar TMI anomaly into the vector magnetic field considering variable declinations and variable inclinations
- High-resolution magnetic data

Questions:

Manoj Nair –
How do you place equivalent sources when there is no basement depth information?

Xiong Li –

When you drill a well the petroleum company doesn't load the basement depths.
The understanding of the basement depth and the basement structure is the very first step for any petroleum extraction project. The drilling people may not know but the g and g team should know.

Carlos Contreras –

Does the survey require multiple passes at different altitudes to help estimate the strength of the anomalies?

Xiong Li –

In your physical expression we do fly a so-called airborne magnetic gradiometer you can understand that to be like flying a conventional magnet at different levels, but we just mean graft gradient directly because you even if you want a mere magnetic field at multiple attitude, you still need to download continue to depths that you will draw to.

Harald Bolt –

Why use reference to mean sea level as opposed to ground level? Specifically, if the target formations are shallow?

Xiong Li –

You can edit the difference between the ground elevation to whatever value, but to me we've always preferred to use the sea level as the reference level for altitude and depth.

Mike Attrell –

Can you please describe the QA/QC process applied to the magnetic survey data used to generate an IFR model?

Xiong Li –

Using ground shots, I'm assuming he's talking in continuation of the airborne survey, but it could also be adding ground shots. Yes, some people have validated different IFR models using ground shots and basically, we just need to download continuum from the airborne survey altitude to ground level.

Hans Dreisig –

I'll add on a private note, as a young engineer I was responsible for an IFR project, aeromagnetic survey in 1999, and there the QA/QC that we got lambasted most with was actually the positional accuracy of the aircraft. So, it was more the x, y, and z than it was on the magnetometers that was where the issue was.

Xiong Li -

The accuracy of urban magnetic survey is very high, and we are even when you talk to those your physical service contractors, they will tell you the accuracy is much better.

Jonathan Lightfoot –

When wells are drilled extremely deep below the sedimentary basement, what can be used for declination, field strength, and magnetic dip angle?

Xiong Li –

I'm not sure if you can still use geomagnetic, probably you have to move to gyro.

Manoj Nair –

What is the error equivalent source model output?

Xiong Li –

We do check the error or uncertainty of our requirement resource result. For example, we can add some error distribution to your imported data then cut the difference. Another check is we can even change the equivalent source steps and then you get two different results and can estimate the magnitude of error you're mentioning.

Neil Bergstrom –

Is the assumption of no magnetization from sediments sufficient?

Xiong Li –

Yes. If that's not good enough then you should not use your magnetic case for directional training.

Michael Calkins –

Have you've seen an improvement to older aeromagnetic datasets for the purpose of IFR by collecting a new aeromagnetic survey?

Xiong Li –

For expression applications we do that very often, because some other service we need to we fly a new flyer survey primarily if we want to improve the spatial resolution.

OWSG Subcommittee Report –
Jonathan Lightfoot
Will Tank

Agenda:
- OWSG Report
- RP-78 Update
- Q&A

OWSG Mission:
- To promote practices that provide confidence that reported wellbore positions are within their stated uncertainty

Proposed Revision – Anti-Trust Statement

Meetings:
- Microsoft Teams
- Fourth Tuesday of every other month
- Core Membership – Exploration & Production Operators
- Meetings are open to all operators
- No membership fees or dues required
- 3-4 planned collaboration discussions each meeting
- Discussions geared towards operator issues and practices

Recent topics:
- Geomagnetic Reference Naming Convention
- ISCWSA 5-1 IPM Naming Recommendation
- Utility Error Models for Vertical Cone of Errors
- Introduction to Sustained Inclination Calculations
- Measure of Lateral Straightness
- WITS-Level 7 Survey Object Reference Table

Focus Areas:
- Operational Practices
- Adoption of RP-78
- Realtime Drilling Automation
- Management of Change & Safe Separation
- Human Factors
- Industry Collaboration
- Feedback to ISCWSA Sub-Committees
- Consistent Approach
- Outreach to Geothermal, Trenchless, and Mining
- Academic Support

RP-78 Wellbore Positioning:

- Current Status
- Draft of the document placed into the API Style
- Bid Request for a technical writer have gone out to provide doc cleanup

Action Items:

- Secure a technical advisor to review the document for cohesive voicing
- Gather a work group to review the document prior to balloting

Questions:

Hans Dreisig –

Is the OWSG open to service companies?

Jonathan Lightfoot –

Yes, however are not looking for presentations or marketing pitches. If there is a technical study with an operator, we prefer the operator to present. We are trying to gear it towards operators sharing ideas, but it is not closed off to anyone.

Harald Bolt –

What happened to the background information that formed the basis of API RP-78 document?

Will Tank –

It's probably specific to the QA/QC section which was very thorough and had lots of good information. It's still there it's not in the document but it has been captured and I believe that document is ready and they're going to publish it.

Mohamed Elshabrawy –

Can you please elaborate more on the contents of the API RP-78? It is an update to an existing document?

Will Tank –

Yes, you can reach out to one of us and we can get you the document.

Directional Survey Data Object
Linda Bragg

Abstract:
- What if we could design a method for defining clear baselines that allow data to be properly managed and audited, independent of technology in which it has been deployed, and data professionals had appropriate competency and capability?

Description of the Professional Petroleum Data Management Association

The PPDM Strategy:
- Member collaboration is at the heart of PPDM

The Challenge for all data types:
- Data struggles to achieve full usefulness because we all have a good idea of what “good” is

The Opportunity:
- Can we create a baseline for what “Good” data looks likes
- Data expectations plus professional competence equals useful data

Graph of Data Object Framework:
- Data managers consider these framework elements
- Each directional survey must have attributes

Behaviors can be described:
- What do data professionals need to know?
- What will drive interoperability?
- What will enhance data’s usefulness?

Data Rules can be captured:
- Concepts
- Principles
- Data rules
- Data expressions

Unstructured Data and Examples:
- What is this?
- What do these numbers mean?
- How do I know if the numbers are right?
- What should I look for?
- What should I do if it’s wrong or missing something?

We need links to useful articles, illustrations, prepared by experts

What data centric training is available?

Data Inspection / Auditability:

- Once a baseline is developed we can set up measurable expectations for data stores that are technology neutral
- Does verification that a data set has been inspected / audited add business value
- Who would see the most value?

Questions:

Michael Calkins –

Any thoughts on how to handle legacy survey data that may lack typical documentation needed to validate an entry? Do you have a definition for what constitutes a validated survey set?

Linda Bragg –

That's one thing we're trying to define and part of the learning we're trying to expand on. We're trying to make sure everyone has a check sheet, if you have a good survey set you check and balances. That's what we're trying to put in our courses that you won't have a valid set if you don't do certain checks and balances.

Carlos Contreras –

Are regulators taking part in this initiative? TRRC for example?

Linda Bragg –

We do not at this point. PPDM has just launched what we call DANR and it's directed a lot toward regulators. We are starting to engage them in conversation and would welcome more regulator input. Different information is required by different regulatory bodies, and we would like to have all their input.

Carol Mann –

Is PPDM involved with OSDU?

Linda Bragg –

Yes, we have a collaboration team. Right now we are focused on the reference values, any values OSDU has that they'd like PPDM to review, we are doing that. We are also publishing PPDM reference list. If the are mapped to an object, we are providing that link.

Alistair Charlton –

If you could help push the inclusion of tool codes with two surveys that have been used.

Linda Bragg –

That's the feedback we're looking for. What are we missing, what should we include?

Survey QA/QC Subcommittee Report
Phil Harbidge

MWD Gyro DSR & Depth QA/QC eBook Project update

SPE Affiliated "DDQUD":
- Standardize the industry
- Drilling data uncertainty
- Drilling data quality

SPE DDQUD Full Presentation:
- User Stories
- Pain Points

Methodology:
- The approach taken by DDQUD was to:
- Create a list of user stories along with associated key drilling data
- Rank the criticality
- For the most critical user stories, break down the user stories into case studies
- Develop a method to describe uncertainty and quality of the use cases
- This uses data modeling, data and knowledge representation, semantic networks, and multi layered graphs

Paper for SPE/IADC Drilling Conference 2022
- SPE 2087540-MS

COFFEE BREAK

Well Intercept Subcommittee Update
Jamie Dorey

WISC Milestone:
- Publishing of ISCWSA: Well Intercept Subcommittee eBook most downloaded eBook

WISC eBook Revision 4
- Version 3 feedbacks
- Surface location
- Active acoustic ranging
- Passive magnetic ranging

Distinguished Lecturer
- Benny Poedjono

Collision Avoidance Subcommittee Update
Gary Skinner

Agenda Topics:
- Pete Clark: inferred Wellbore Position
- Gary Skinner: Project ahead Uncertainty

Inferred wellbore position – Challenge:
- Many downhole positions defined by surface location or TD MD, no directional survey location

Leads to:
- Assign “Blind” uncertainty model

Inferred Wellbore Position – Proposal
- From existing models and measurements
- Calculate TVD for formation grid using surface location and regional formation top surfaces
- Compare recorded top MD to projected TVD
- Calculate Sustained Inclination

Proposal:
- Form a CA sub-committee work group
- Review this proposal
- Consider alternate approaches

- Optimize method
- Identify issues
- Produce guidance

Project Ahead Uncertainty – Sigma PA
- Projection to bit distance definition
- Look ahead distance definition

Effect on MASD example:
- Parallel wells

Actions:
- Publish draft document on CA subcommittee page for feedback
- Proposed values
- Rp78 will recommend the SPE ACR rule
- For RP78 what is the best option for Sigma-PA?

Collision-Tolerant Rock Bit with Special Heel Technology for Crowded Offshore Platform Drilling Environment
Bobby Grimes

Crowded Offshore Platform Drilling Environment example and definition

Risks associated with Conventional Bit Designs

Collision-Tolerant Bit Design Concept

Additional Features of Collision-Tolerant Bit Design

Other sizes of Collision-Tolerant Bits are possible

Case study results of Lab tests in Bedford Limestone

Laboratory Side Load Test Results – Casing Inclination 9° and 18°

Performance summary of CT Bit Field Trials

New vs. Dull CT Bit Condition Post-Run

Conclusions:
- The CT Bit will impart 70 to 80% less damage to casing than a conventional IADC 115 bit
- The CT Bit delivers excellent ROP and directional control

- All four wells in the subject field were drilled safely and economically with no indications of downhole collision.
- The CT bit is worthy of consideration as port of a holistic approach to minimize risk when planning in a densely populated area.

Questions:

Robert Estes –

Would the Collision-Tolerant bit offer any relief in the event of a perpendicular approach to existing casing?

Bobby Grimes –

I would not drive perpendicular into pipe, it is still a steel tooth bit in the middle and it would probably impart just as much damage as a conventional bit.

Michael Calkins –

Any plans on downsizing this bit design to 13.5-8.5” sizes?

Bobby Grimes –

There’s really nothing from keeping us from applying this to any size bit. We think of large diameter due to offshore applications, but it can be applied to any size bit.

Neil Bergstrom –

The CT bit could be combined with audio monitoring of the offset casing to stop drilling in case of contact.

Bobby Grimes –

That’s a good suggestion, or even an accelerometer might be able to clamp on and look for.

Treasurer Report
Robert Wylie

Online Course Financials

Highlights from last meeting:

- Final cohort #1 fees received
- Cohort #1 server, tutorial, assessment, and admin fees paid
- First cohort #2 fees received
- Drillbotics sponsorship of $5000 paid
- Ongoing web costs of around $1400 paid

Bank Account remains healthy ~$75k

Random comments and conversation from audience

Adrian Ledroz closes meeting