

ISCWSA / SPE Wellbore Positioning Technical Section

Error Model Maintenance Work Group

Minutes of the Meeting at ISCWSA #57, Stavanger, 9th March 2023

Present

Andy McGregor	H&P	Erik Blake	Icefield Tools
Jon Bang	Gyrodata	Stephen Winchester	Baker Hughes
Adrian Ledroz	Gyrodata	Manoj Nair	NOAA
Darren Aklestad	SLB	Hans Dreisig	Total
Phil Scott	DGI	Jonathan Lightfoot	Occidental
Denis Reynard	Pathcontrol	Xiong Li	Excalibur
Chad Hanak	SuperiorQC	Spyridon Raizis	Baker Hughes
Jerry Codling	Landmark	Morten Gjertsen	Baker Hughes
Lu Jiang	SLB	Andreas Hueper	Baker Hughes
Petter Kvandal	Aker BP	Marianne Houbiers	Equinor
Suzanne Thompson	Baker Hughes		
Matthew Weber	Shell		
Nicholas Robertson	BP		
Kyle Rickey	DGI		
Patrick Knight	Halliburton		
Brett Van Steenwyk	Algo & Analytical		
Steve Grindrod	Copsegrove		

Rev5 Implementation

Implementation of Rev5 continues with the main software houses. SLB has the development work done but not released yet. Compass users are asking for the relative geo-mag correlation but the details of this are not clear. One operator would like to see a comparison of revisions as ellipse dimensions rather than as covariance diagnostics more suited for implementors.

The discussion also covered error model management issues related to version control and migration of existing data to new models. Much of the detail required for this is included in the meta data originally defined for the OWSG models and still provided for the ISCWSA generic models. However, this header information is not consistently used. Jonathan Lightfoot commented that his company used the model prefix as the start of the short name provided to users and had the revision number attached as a suffix to the name.

ACTION: Andy McGregor to call a meeting to go over details of relative correlation handling.

ACTION: Andy McGregor offered to create a spreadsheet comparing MWD revisions on the standard test wells.

Handling of Site and Slot Uncertainties

Jerry Codling gave an overview of site and slot uncertainty. The write up in the API RP-78 material is generally thought to be complete and detailed. There was a comment that vertical reference uncertainty also needs taken into account. Since RP-78 is due to go to balloting soon, it was decided that this group did not need to publish anything new. That decision to be reviewed if RP-78 is held up further.

Contributors to Error Model Development

Benny Poedjono's working group have finished their summary of those who made significant contributions to development of the error model. The main ISCWSA committee have agreed there should be a page on the website to recognise the contribution that these people made and detailing those who received achievement awards.

ACTION: Andy McGregor to talk to education committee and see if they would take on this task.

Location Based Magnitudes for Geo-magnetic Models

A tool-code name is needed for models which instead of using the fixed generic ISCWSA geo-magnetic uncertainty values, make use of magnitudes obtained from higher resolution location and date information. Such magnitudes are provided by most of the high-resolution geo-mag model (HRGM) providers. After a vote the group agreed on adding an _L suffix to the existing geo-mag model short name. e.g. MWD+HRGM_L

Weighting Functions for Continuous Rotating MWD Surveys

A SLB/SuperiorQC paper defining weighting functions for continuous rotating MWD surveys was circulated for comment before the meeting. Limit comments have been received.

Several technical details were raised:

- 1) Model uses toolface terms – it was reported that this a tool design parameter defining the magnetic toolface frame in which sensor data is averaged and not a conventional instantaneous highside toolface measurement.
- 2) Cross axial magnetic field, B_{xy} is used and has not been explicitly defined.
- 3) The phase shift (AMXY-PS) and Eddy share a weighting function.
- 4) The accelerometer scalefactor (ASXY-ROT) and attenuation (ASXY-ATTEN) terms have the same form, and are related to the existing ASXY_TI1 term. However, at first look the matching magnetometer terms (MSXY-ROT and MSXY-ATTEN) do not have the same form and do not resemble MSXY_TI1. What is the reason for this?
- 5) It was suggested that abbreviation DMS for Drilling Mode Surveys is used for these kind of error models, e.g., MWD+DMS.
- 6) Surveys will be taken with the drill pipe in compression, not off bottom and under tension as is usual for MWD. The depth terms may need to be modified.

Since Halliburton have developed such a tool and Baker Hughes may also be, it was agreed that some input from these would be particularly useful before proceeding.

These companies are designing new tools specifically for continuous, rotating survey use. The performance is expected to be better than might be obtained by processing continuous data obtained from conventional MWD tools.

The original intent was that the committee would only publish weighting functions for these tools. However, Total were keen to see if it would be possible to define a worst-case generic model, which could be used as a backstop and before a specific service provider was selected.

ACTION: Andy McGregor to get written clarification on the detailed points raised.

ACTION: Andy McGregor to request input from HAL + BHI.

ACTION: Hans Dreisig to head up a working group to try to obtain data from such tools and compare to reference data (static surveys or gyro).

Misalignments Terms

Jerry Codling presented his latest thoughts on modeling of misalignment errors. Rev5 changed how misalignments are modelled in top-hole but did not touch misalignment deeper in the well. He is now proposing three changes:

- 1) A changed to the XYM1 and XYM2 error sources to random propagation.
- 2) A changed to the W_10 weighting function term from $\sin(\text{inc})$ to 1
- 3) Modification of all the misalignment magnitudes.

With implementation of Rev5 progressing slowly, there is little appetite for the complication of releasing Rev6 now. It was agreed that when he came to a suitable conclusion in his analysis that Jerry should write up his findings and this work should be kept in readiness for when a revision 6 update is being considered.

Further Business

There was not time in the meeting to discuss the details of Relative Correlation calculations or a common way to handle Combiner Surveys (i.e., an optimal mix of survey data in the same hole-section).

ACTION: Andy McGregor to call two online meetings on these specific topics.

Jonathan Lightfoot requested that we discuss the modelling of synthetic surveys (e.g., use of slide sheets to determine implied points of inflection in the well and add points to reduce Stockhausen effect). This is carried forward to the agenda of the next meeting.

Actions Carried Forward - Sidetrack Recommended Practices

ACTION: Andy McGregor, DGI, SLB (and Landmark) to work on update collision-avoidance diagnostics with improved side-track test cases.

ACTION Jon Bang & Erik Nyrnes to write up the matrix summation method for the definition document.