DEPTH ERROR TERM VALUES

Background

The depth error terms in the ISCWSA error model are based on the work of Roger Ekseth.

Roger Ekseth in his PhD thesis (Reference CUR 230) identified 14 physical sources of drill-pipe depth measurement error. By using expressions to predict their magnitude and by substituting typical parameter values he predicted the total error for a number of different well profiles. He then proposed a simplified model of just four terms, and chose the magnitudes of each to match the predictions of the full model as closely as possible.

The four error terms are: Random Reference, Systematic Reference, Scale and Stretch Type error terms.

The stretch type error dominates, which dominates the other terms in deep wells, models two physical effects, stretch and thermal expansion of the drill pipe. Both of these effects generally cause the drillstring to elongate, so it may be appropriate to apply this term as a bias. If this is done a mean value of 4.4 x10^{-7} m^{-1} should be used as Roger Ekseth effectively treated his estimates of these errors as 2-standard deviation values.

The results published in SPE 67616 for a fixed and a floating rig was as follows:

Table 1 Values (1 sigma) for Drill Pipe from MWD Paper SPE 67616:

Term	Prop. Mode	Code	DP Fixed	DP Floating
Random Ref	R	DRFR	0.35 m	2.20 m
Systematic Ref	S	DRFS	0.00 m	1.00 m
Scale	S	DSFS	2.4 x 10^{-4}	2.1 x 10^{-4}
Stretch*	G	DSTG	2.2 x 10^{-7} m^{-1}	1.5 x 10^{-7} m^{-1}

*Note: When modelled as a bias the Stretch term becomes DSTB with a value 4.4*10^{-7} m^{-1}

This Table shows that the Scale and Stretch terms are different for essentially the same drill pipe.

Reference is made to R. Ekseth's dr. thesis (1998), section 7.5.1 and 7.5.2. The tables are showing 2 sigma values for the depth error terms. They are calculated in an erroneous way.

The recalculation is done with the reference values fixed to the values given in Ekseth's initial discussion of the depth uncertainties. The scale and the bias stretch values are assumed to be identical at a fixed or floating installation.

Depth Error Terms Derived from Roger's PhD Thesis

Values produced by Torgeir

Table 2 Values (1 sigma) for Drill Pipe and Wireline depth from Torgeir Torkildsen:

Term	Code	DP Fixed	DP Floating	Wireline Fixed	Wireline Floating
Random Ref	DRFR	0.35 m	2.20 m	0.20 m	2.15 m
Systematic Ref	DRFS	0.00 m	1.00 m	0.00 m	1.00 m
Scale	DSFS	5.6×10^{-4}	5.6×10^{-4}	1.50×10^{-3}	1.50×10^{-3}
Stretch	DSTG	$2.5 \times 10^{-7}\ m^{-1}$	$2.5 \times 10^{-7}\ m^{-1}$	$2.5 \times 10^{-7}\ m^{-1}$	$2.5 \times 10^{-7}\ m^{-1}$

Note: Statoil is using 6.0×10^{-4} instead of 5.6×10^{-4} for the Drill Pipe scale term.

Proposed Depth Terms

Table 3 Values (1 sigma) for Drill Pipe Depth Proposed:

Term	Code	DP Fixed Rig	DP Floating Rig
Random Ref	DRFR	0.35m	2.20m
Systematic Ref	DRFS	0.00m	1.00m
Scale	DSFS	5.6×10^{-4}	5.6×10^{-4}
Stretch	DSTG	$2.5 \times 10^{-7}\ m^{-1}$	$2.5 \times 10^{-7}\ m^{-1}$

Table 4 Values (1 sigma) for Wireline Depth Proposed:

Term	Code	Wireline Fixed Rig	Wireline Floating Rig
Random Ref	DRFR	0.20m	2.15m
Systematic Ref	DRFS	0.00m	1.00m
Scale	DSFW	1.1×10^{-4}	1.1×10^{-4}
Stretch	DSTW	$1.1 \times 10^{-7}\ m^{-1}$	$1.1 \times 10^{-7}\ m^{-1}$