


Royal Netherlands Navy

AP 23/01 Define new proposal for the norm connected to S-44

NSHC TWG24 (VTC) – 27 Sept 2022

Ronald Kuilman

Hydrographic Service
Geodesy and Tides



Content

1. Old 1% norm
2. Proposal of the new TVU norm
3. Summary
4. The way forward

2

Royal Netherlands Navy
Seamless LAT on the North Sea



2. Old 1% norm

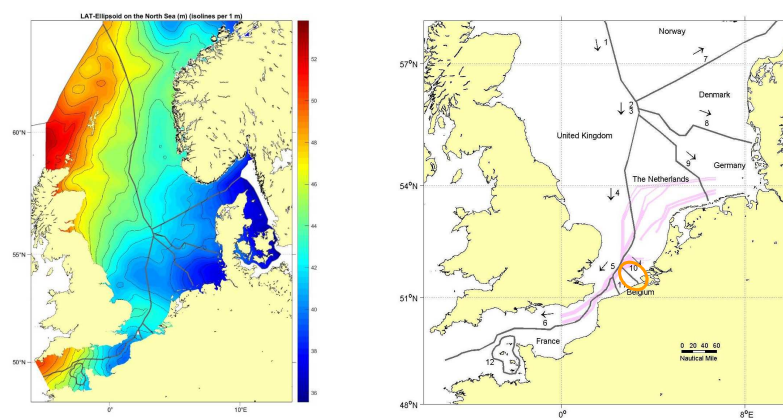
LAT difference divided by depth = < 1%

3

Royal Netherlands Navy
Seamless LAT on the North Sea



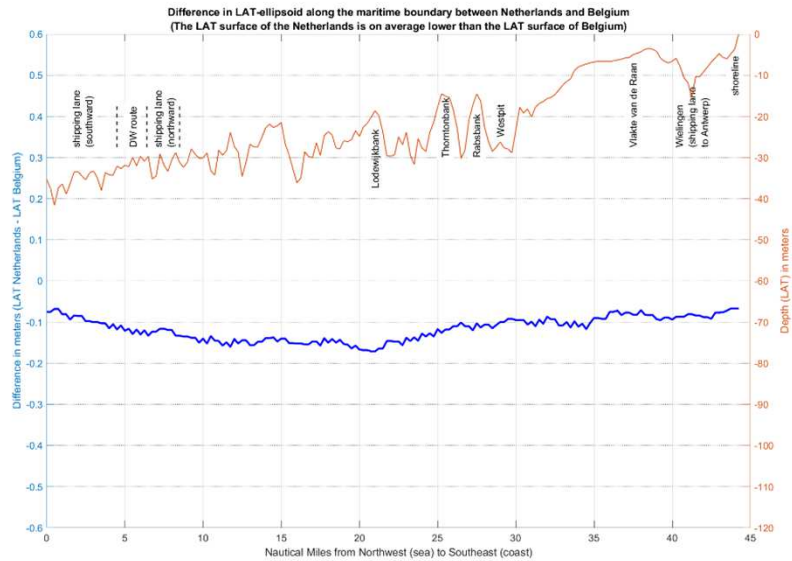
LAT difference divided by depth = < 1%



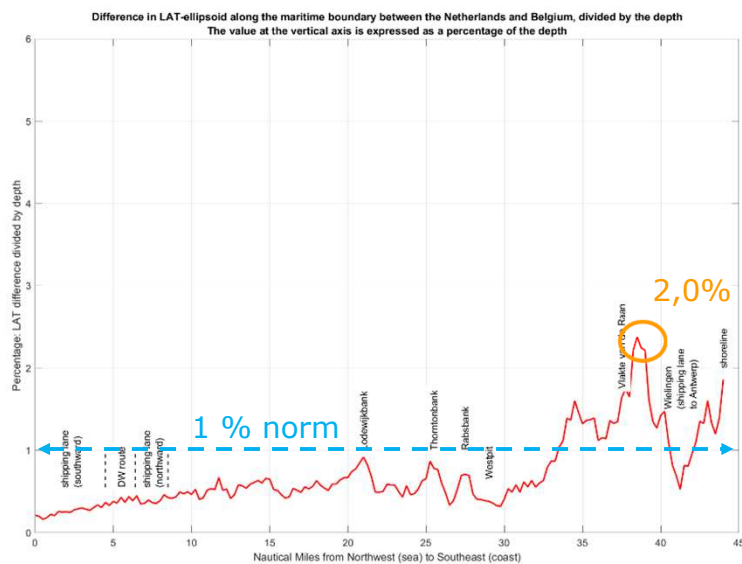
4

Royal Netherlands Navy
Seamless LAT on the North Sea

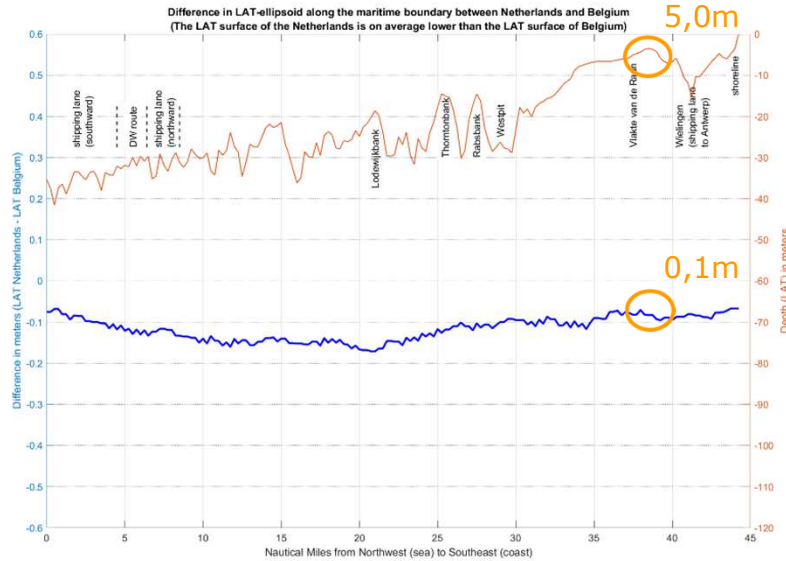
10. Netherlands-Belgium



10. Netherlands-Belgium



10. Netherlands-Belgium



1 procent

present				6		7		8		9		10		11		12	
Depth (m)				UK FR		NO DK		DK GE		GE NL		NL BE		BE FR		UK FR CI	
				max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)
1																	
2																	
3																	
4																	
5												0.1	2.0		0.14	5	
6				0.3	5.5												
7																	
8										0.1	0.4	0.1	1.3				
9																	
10				0.6	6.5												
11																	
12																	
13																0.3	3.8
14								0.4	2.0							0.4	2.2
15																	
25																	
30																	
35																	
50						0.1	0.1										

The rate of 1 percent or less (LAT difference divided by depth) was arbitrarily chosen.

AP 23/01: Define new proposal for the norm connected to S-44.



3. Proposal new TVU norm

Vertical uncertainty is to be understood as the uncertainty of the reduced depths. In determining the vertical uncertainty the sources of individual uncertainties need to be quantified. All uncertainties should be combined statistically to obtain a total vertical uncertainty (TVU).

*IHO STANDARDS FOR HYDROGRAPHIC SURVEYS (S-44)
5th Edition February 2008 – Paragraph 3.2 Vertical Uncertainty.*

9

Royal Netherlands Navy
Seamless LAT on the North Sea



3. Proposal new TVU norm

$$\pm \sqrt{a^2 + (b * d)^2}$$

- a** represents that portion of the uncertainty that does not vary with depth
- b** is a coefficient which represent that portion of the uncertainty that varies with depth
- d** is the depth
- b * d** represents that portion of the uncertainty that varies with depth.

	a	b
Special Order Surveys	0,25	0,0075
Order 1a & 1b Surveys	0,5	0,0013

10

Royal Netherlands Navy
Seamless LAT on the North Sea



Total vertical uncertainty (TVU)

Depth	TVU95% Special order (m)	TVU95% Special order (%)	TVU95% order 1a, 1b (m)	TVU95% order 1a, 1b (%)
5	0,25	5,0	0,50	10,1
15	0,27	1,7	0,54	3,6
25	0,31	1,0	0,60	2,4

11

Royal Netherlands Navy
Seamless LAT on the North Sea



TVU 95% special order				6		7		8		9		10		11		12	
Depth (m)	TVU SPECIAL ORDER			UK FR		NO DK		DK GE		GE NL		NL BE		BE FR		UK FR CI	
	(m)	(%)		max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)
1	0,25	25,0															
2	0,25	12,5															
3	0,25	8,3															
4	0,25	6,3															
5	0,25	5,0															
6	0,25	4,2		0,3	5,5							0,1	2,0	0,14	5		
7	0,26	3,6															
8	0,26	3,1								0,1	0,4	0,1	1,3				
9	0,26	2,8															
10	0,26	2,5		0,6	6,5												
11	0,26	2,3															
12	0,27	2,1														0,3	3,6
13	0,27	1,9															
14	0,27	1,8						0,4	2,0							0,4	2,2
15	0,27	1,7															
25	0,31	1,0															
35	0,36	0,7															
42	0,42	0,6															
50	0,45	0,5				0,1	0,1										

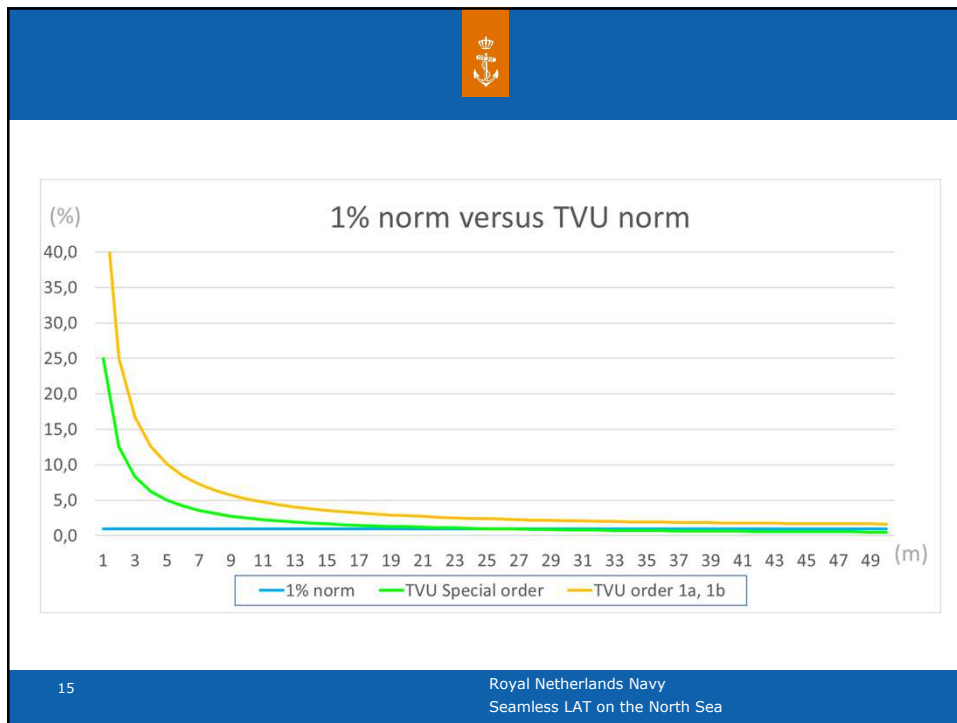
12

Royal Netherlands Navy
Seamless LAT on the North Sea

1 procent			6		7		8		9		10		11		12	
Depth (m)			UK FR		NO DK		DK GE		GE NL		NL BE		BE FR		UK FR CI	
			max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)
1																
2																
3																
4																
5											0,1	2,0	0,14	5		
6																
7			0,3	5,5												
8									0,1	0,4	0,1	1,3				
9																
10			0,6	6,5												
11																
12															0,3	3,8
13																
14							0,4	2,0							0,4	2,2
15																
25																
35																
45																
50						0,1	0,1									

TVU 95% special order			6		7		8		9		10		11		12	
Depth (m)	TVU SPECIAL ORDER		UK FR		NO DK		DK GE		GE NL		NL BE		BE FR		UK FR CI	
	(m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)
1	0,25	25,0														
2	0,25	12,5														
3	0,25	8,3														
4	0,25	6,3														
5	0,25	5,0									0,1	2,0	0,14	5		
6	0,25	3,8	0,3	5,5												
7	0,25	3,6														
8	0,25	3,1							0,1	0,4	0,1	1,3				
9	0,25	2,8														
10	0,25	2,5	0,6	6,5												
11	0,25	2,3														
12	0,27	2,1													0,3	3,8
13	0,27	1,9														
14	0,27	1,8					0,4	2,0							0,4	2,2
15	0,27	1,7														
25	0,31	1,0														
35	0,36	0,7														
45	0,42	0,6														
50	0,45	0,5				0,1	0,1									

TVU 95% order 1a, 1b			6		7		8		9		10		11		12	
Depth (m)	TVU ORDER 1a, 1b		UK FR		NO DK		DK GE		GE NL		NL BE		BE FR		UK FR CI	
	(m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)	max ΔLAT (m)	(%)
1	0,50	50,0														
2	0,50	25,0														
3	0,50	16,7														
4	0,50	12,6											0,14	5		
5	0,50	10,1									0,1	2,0				
6	0,51	8,4	0,3	5,5												
7	0,51	7,3														
8	0,51	6,4							0,1	0,4	0,1	1,3				
9	0,51	5,7														
10	0,52	5,2	0,6	6,5												
11	0,52	4,7														
12	0,52	4,4													0,3	3,8
13	0,53	4,1														
14	0,53	3,8					0,4	2,0							0,4	2,2
15	0,54	3,6														
25	0,60	2,4														
35	0,68	1,9														
45	0,77	1,7														
50	0,82	1,6				0,1	0,1									



3. Summary

Old 1% norm

LAT difference divided by depth $\leq 1\%$

→ Norm arbitrarily chosen.

Proposal new TVU norm

LAT difference divided by depth \leq Total Vertical Uncertainty (TVU)

→ Norm connected to S-44

→ LAT differences more accepted at shallow waters

16

Royal Netherlands Navy
Seamless LAT on the North Sea



4. The way forward

1. Does the TWG want to define a new norm, or do we want to continue reducing the differences. Or do we want both?
2. If yes, do we want to replace the 1% norm for the TVU norm (special order / order 1a + 1b)?

17

Royal Netherlands Navy
Seamless LAT on the North Sea



Questions?

18

Royal Netherlands Navy
Seamless LAT on the North Sea