



Royal Netherlands Navy

AP 24/03 Refinement TVU norm

NSHC TWG25 (VTC) – 07 Feb 2023

Ronald Kuilman

Thijs Ligteringen

Hydrographic Service

Geodesy and Tides



Content

1. Timeline
2. Old 1% norm
3. Refinement TVU norm
4. Graphs - LAT differences at maritime boundaries with TVU norm
5. Summary



1. Timeline

TWG21 (2016) → defined the 1% norm
LAT difference divided by depth $\leq 1\%$

TWG23 (2020) → the arbitrary 1% norm should be redefined to be linked to something practical.

TWG24 (2022) → proposed the TVU norm
LAT difference \leq Total Vertical Uncertainty (TVU)

→ Norm connected to S-44

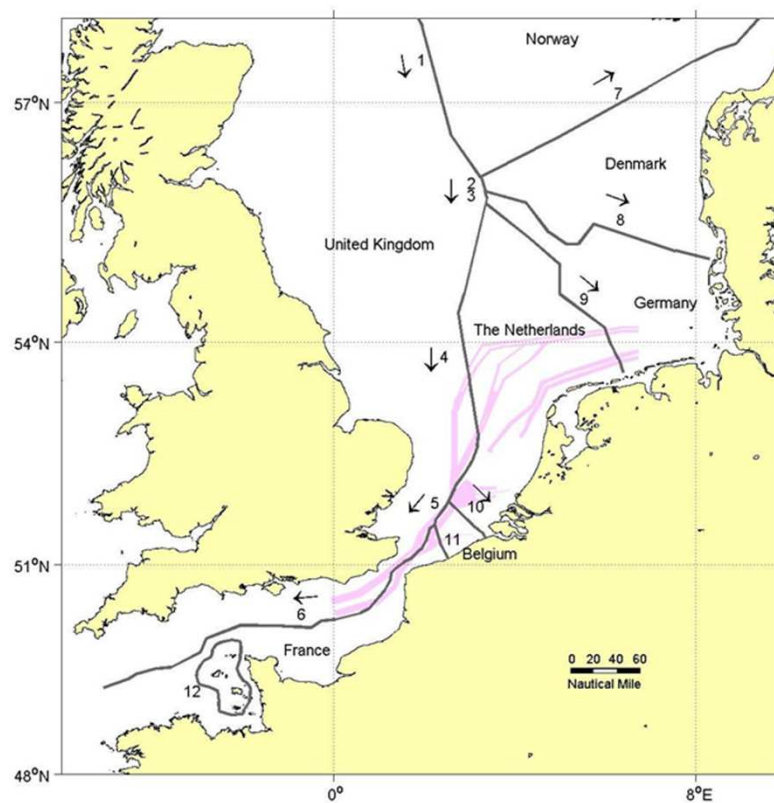
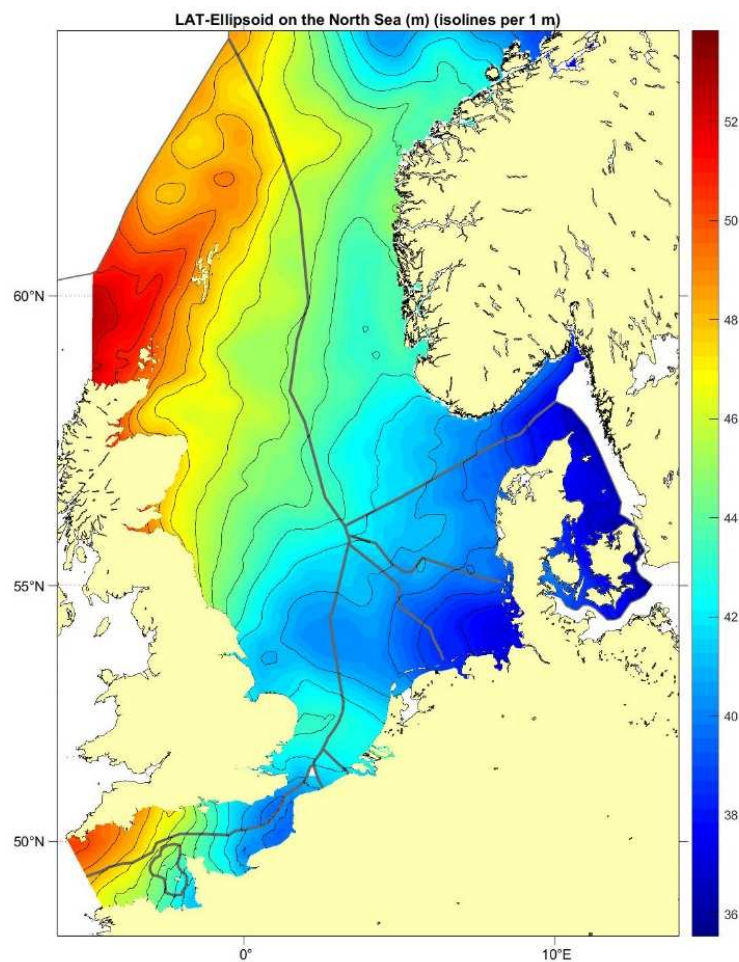
→ LAT differences more accepted at shallow waters

AP24/03 → Propose suitable refinement (and explanation of the reasons) to the newly proposed norm connected to S-44 by the next meeting.
“Which percentage of the TVU can be allocated by the LAT models.”

2. Old 1% norm

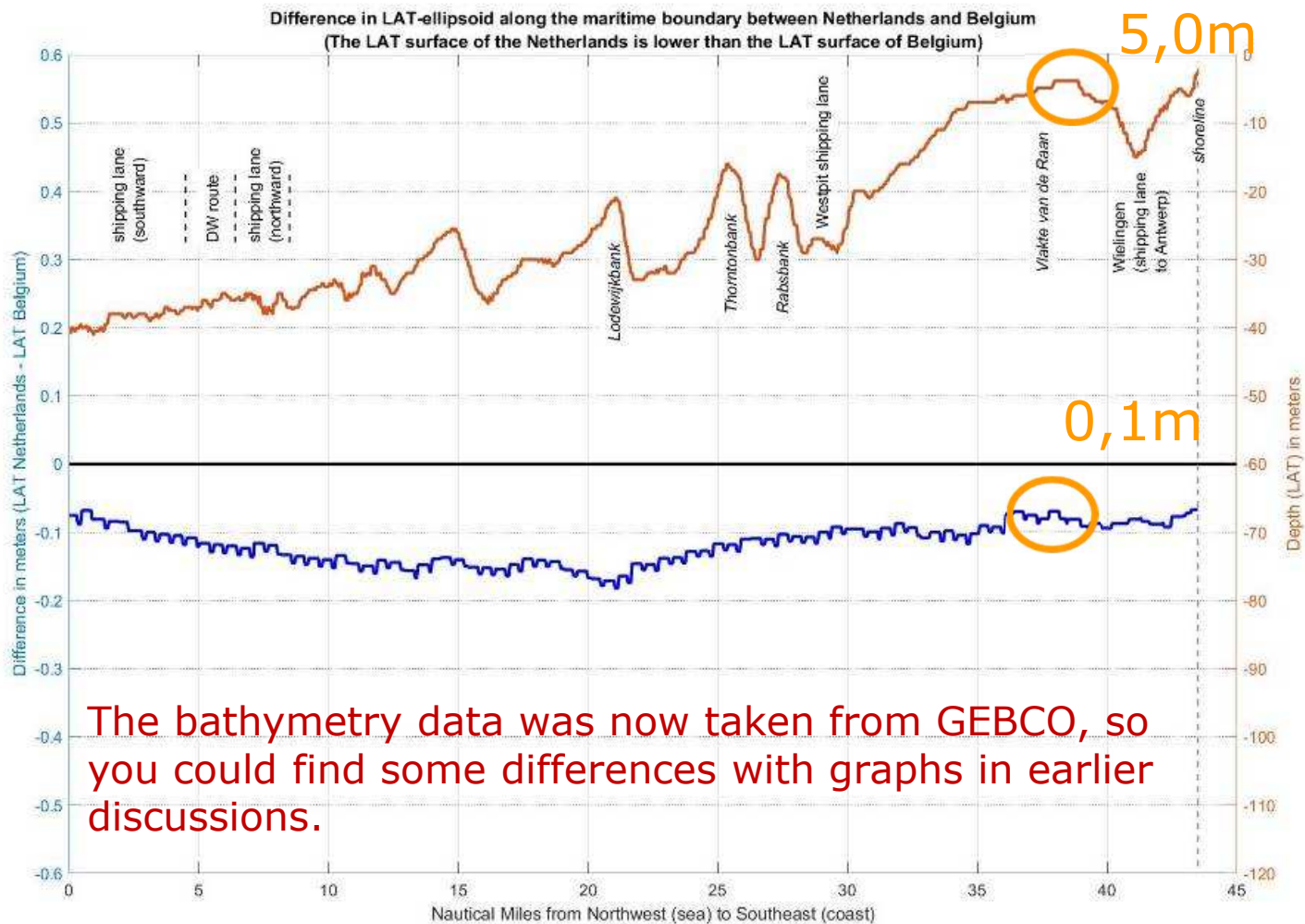


LAT difference divided by depth = < 1%



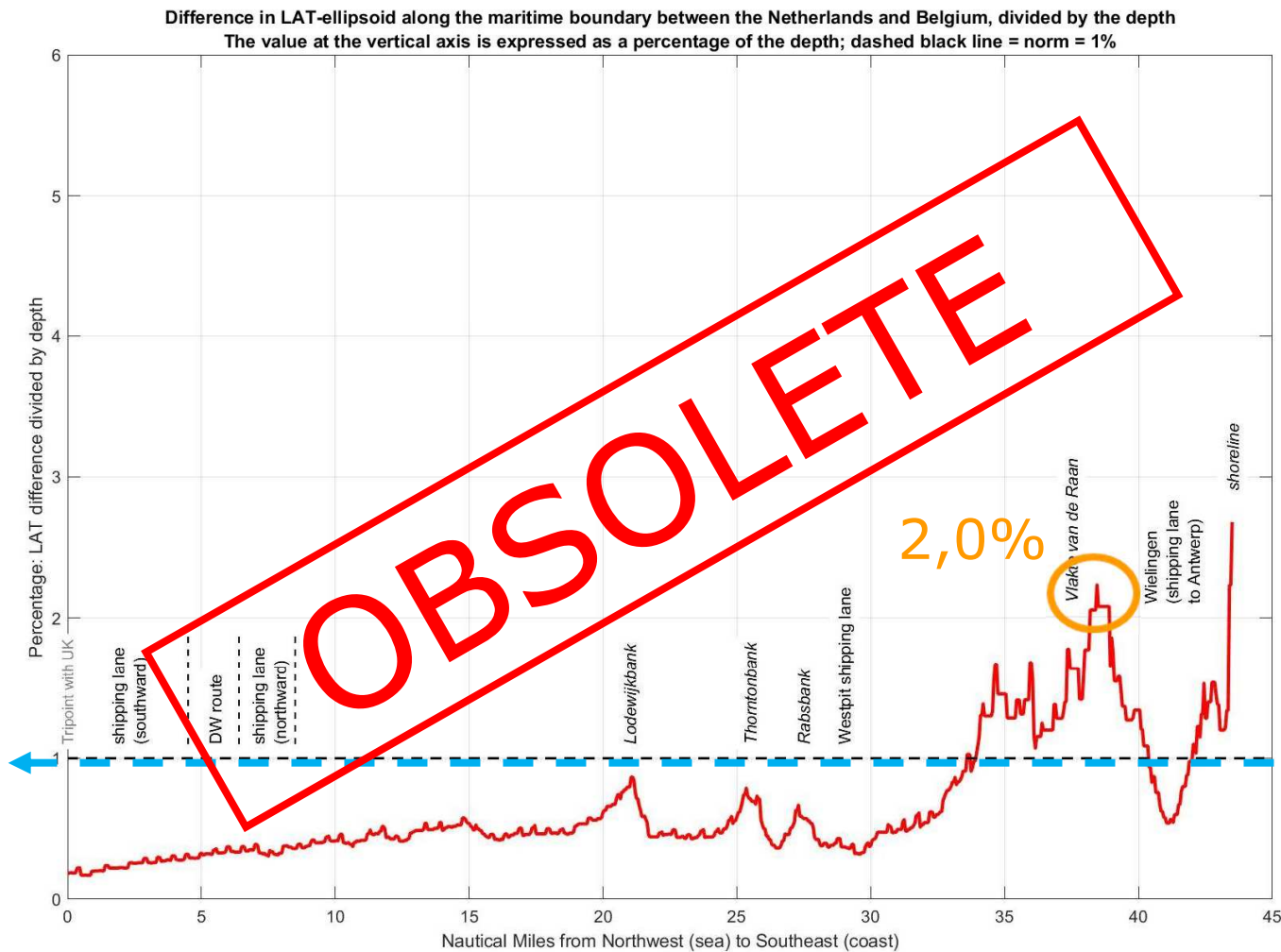
NLHO recently sent the text files with the coordinates of all our mutual boundaries in WGS84/ETRS89 (with reference to the treaties).

10. Netherlands-Belgium



The bathymetry data was now taken from GEBCO, so you could find some differences with graphs in earlier discussions.

10. Netherlands-Belgium

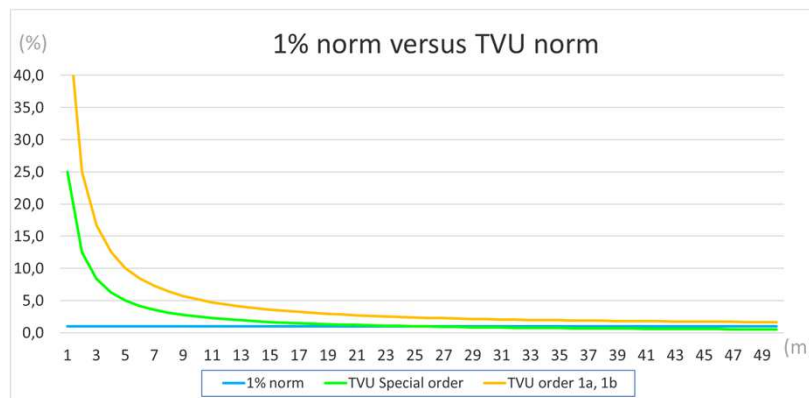




3. Refinement TVU norm

Proposal 1: TVU (S-44 order 1a) against the LAT difference along the maritime boundary.

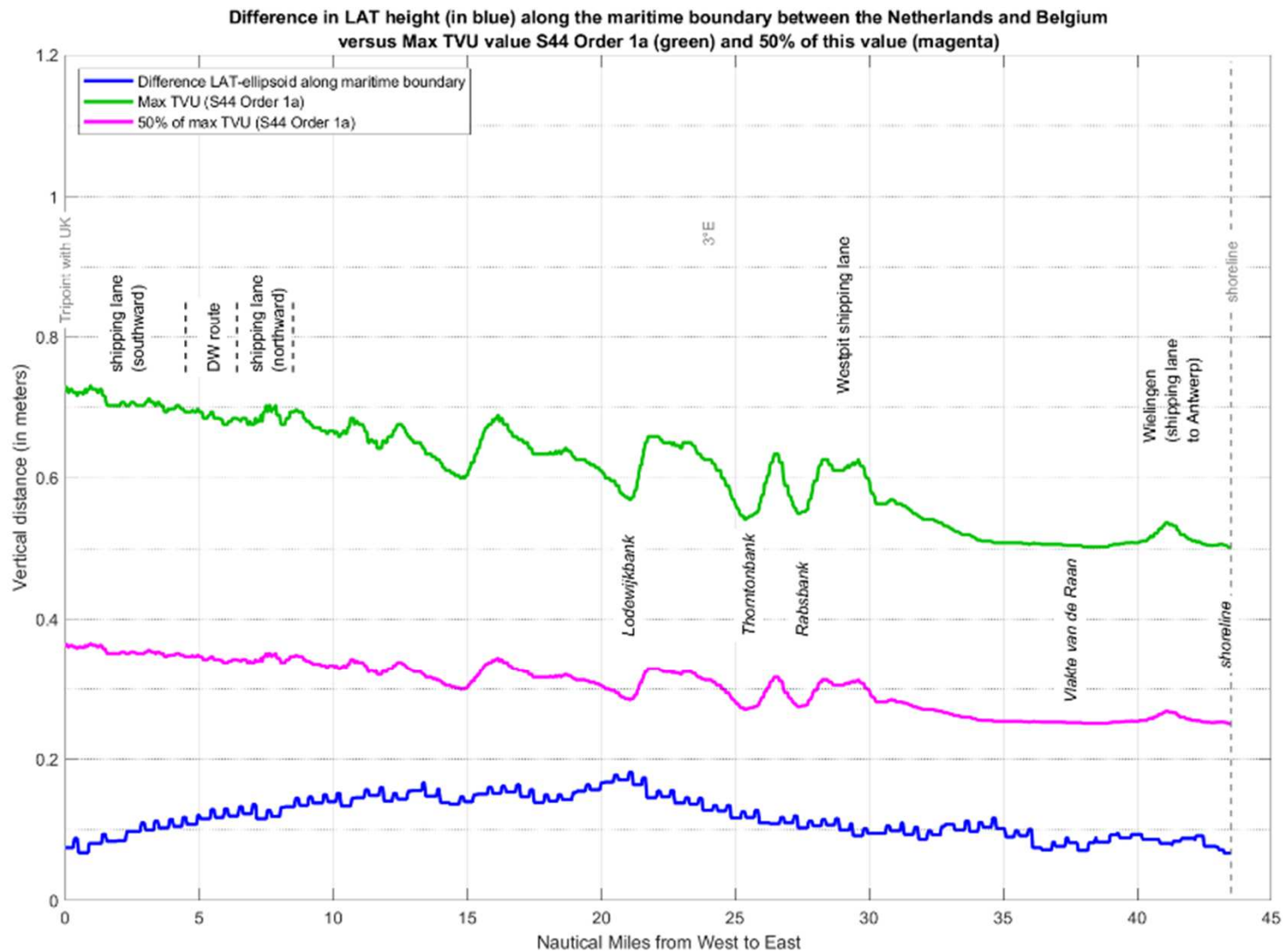
Proposal 2: ½ TVU (S-44 order 1a) against the LAT difference along the maritime boundary.



TVU norm: LAT differences more accepted at shallow waters

Depth (m)	1% norm	TVU order 1a, 1b (m)	TVU order 1a,1b (%)	1/2 TVU order 1a, 1b (m)	1/2 TVU order 1a,1b (%)
5	1,0	0,50	10,1	0,25	5,0
10	1,0	0,52	5,2	0,26	2,6
15	1,0	0,54	3,6	0,27	1,8
20	1,0	0,56	2,8	0,28	1,4
25	1,0	0,60	2,4	0,30	1,2

10. Netherlands-Belgium



TVU

1/2 TVU

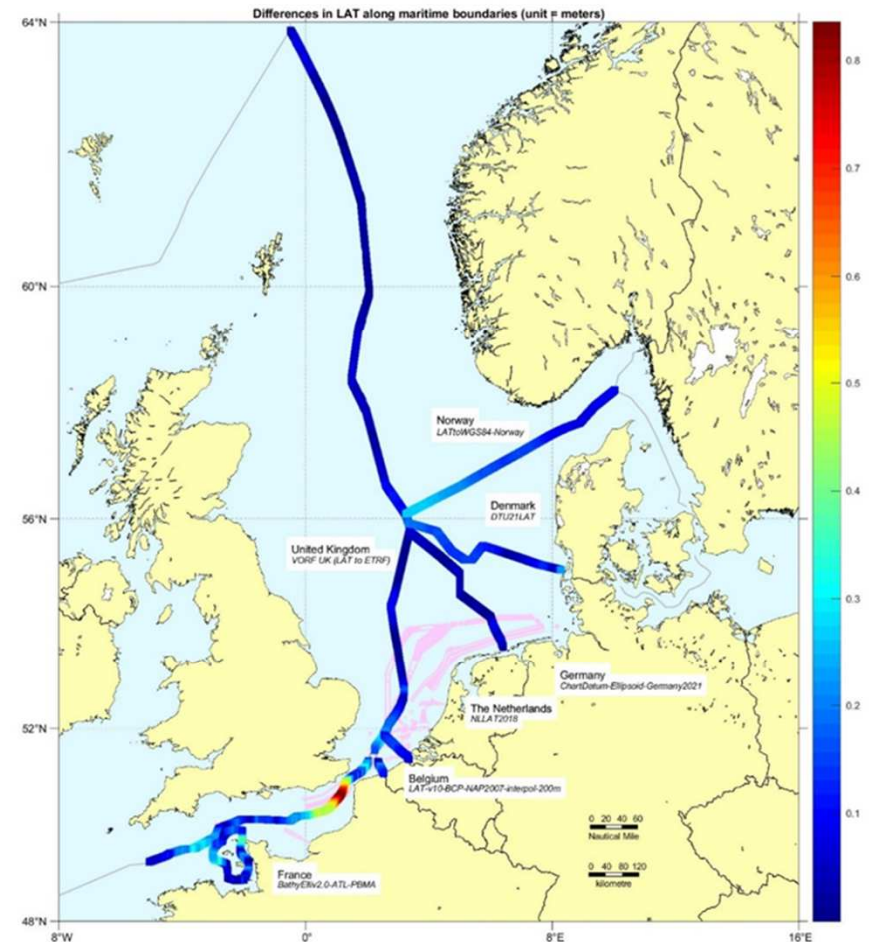
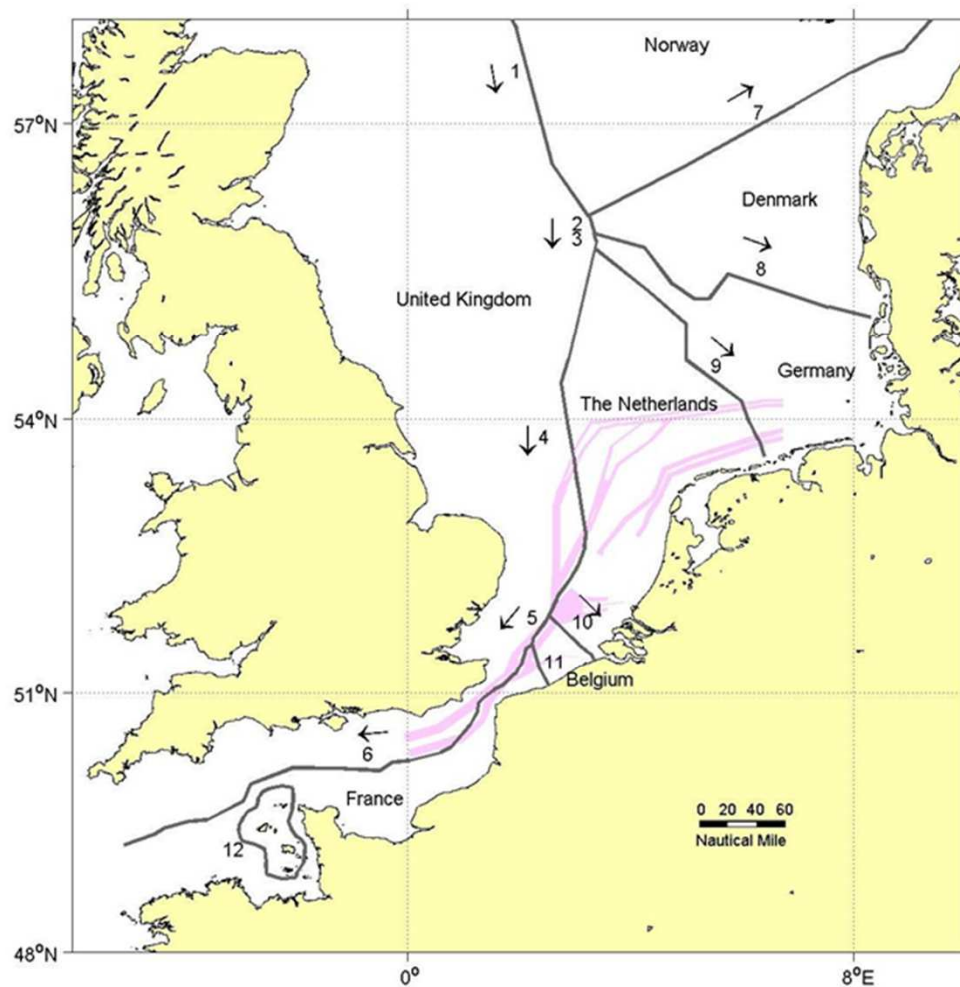
Δ LAT



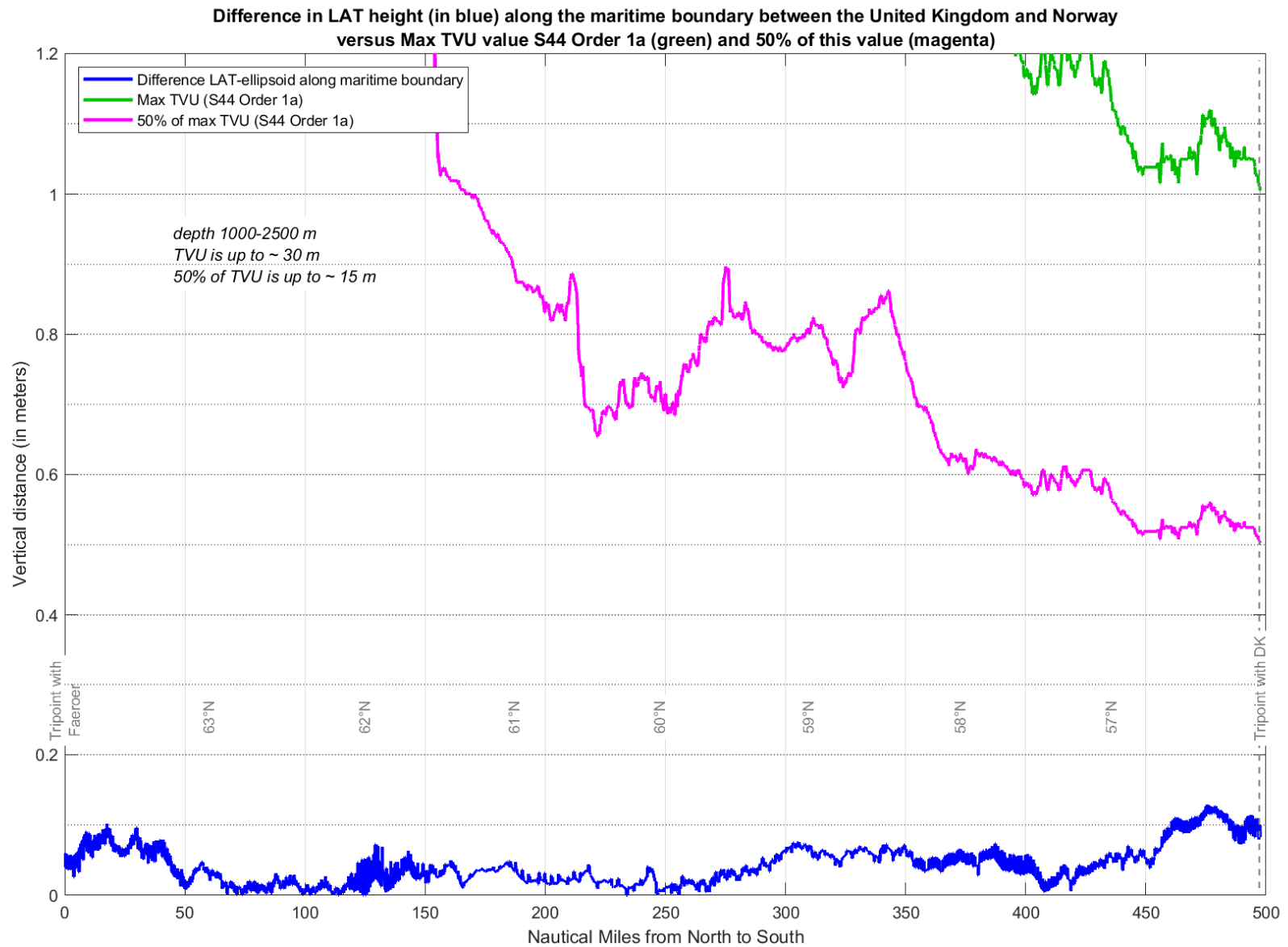
Comments Giuseppe Masetti

- If the blue line is entirely under the magenta line, we are in a safe status.
- When some parts of the blue line go between the magenta line and the green line, there should be concerns.
- Any parts of the blue line over the green line is definitely an issue.

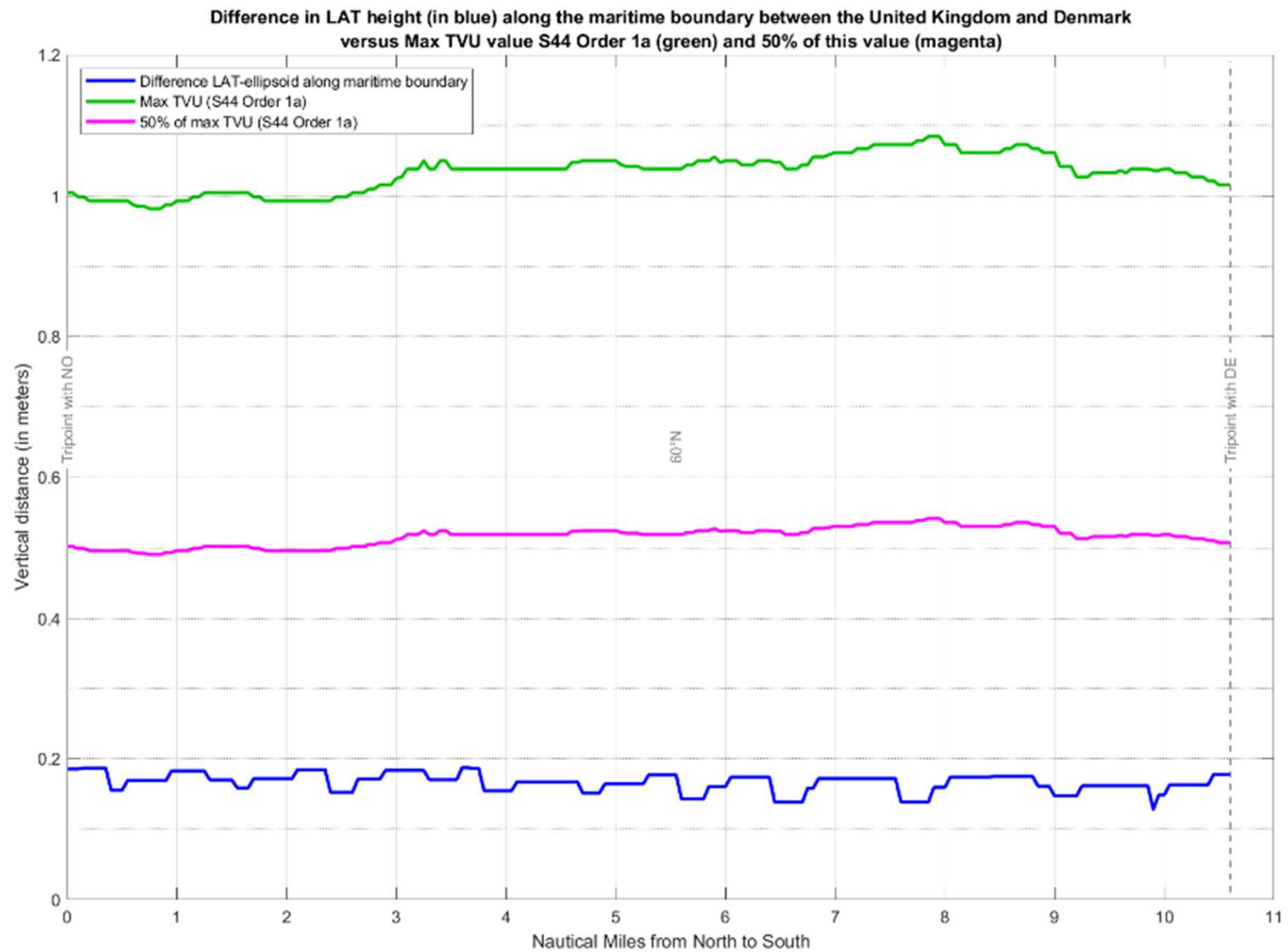
4. Graphs - LAT differences at maritime boundaries with TVU norm



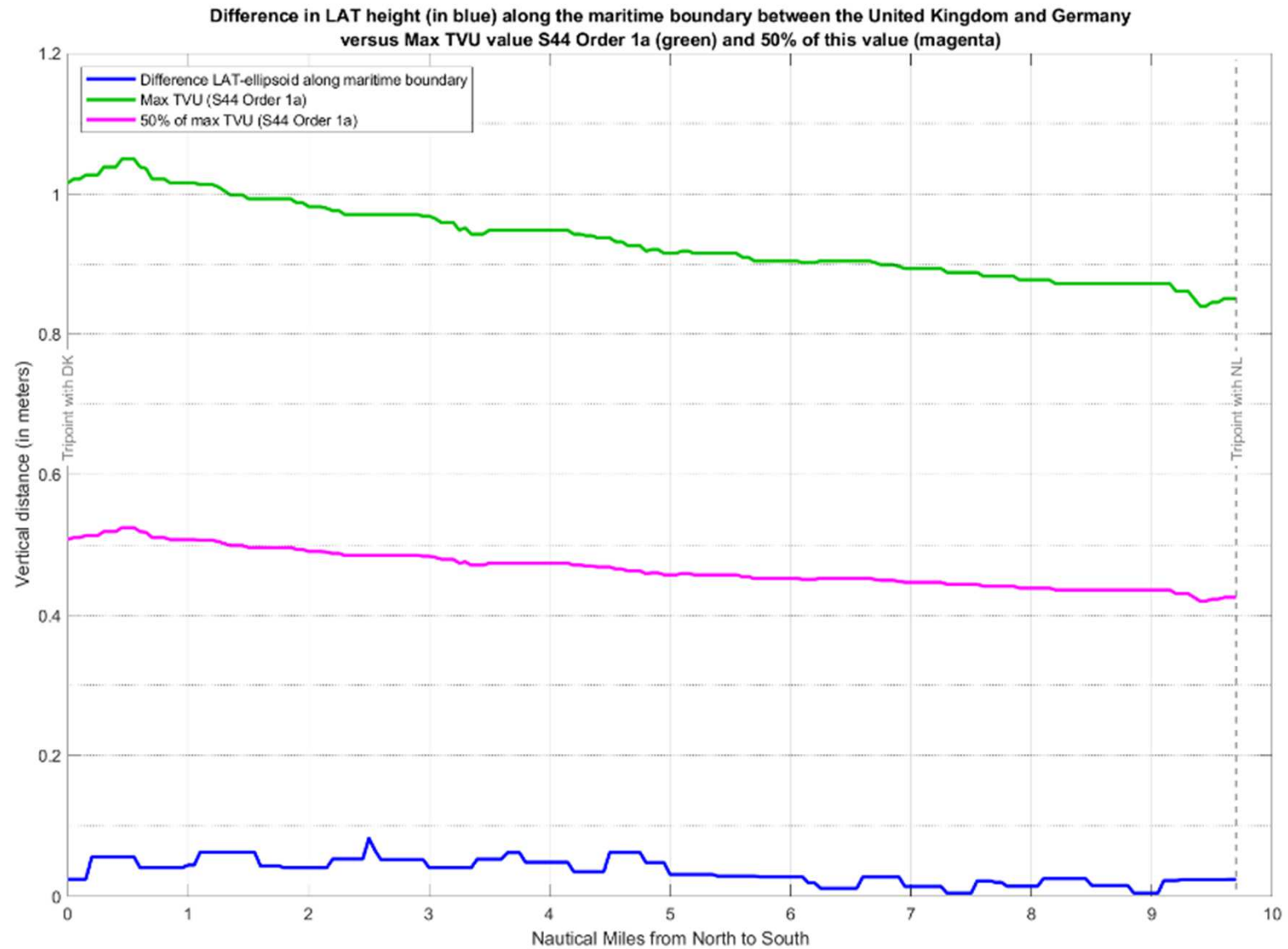
1.UK-Norway



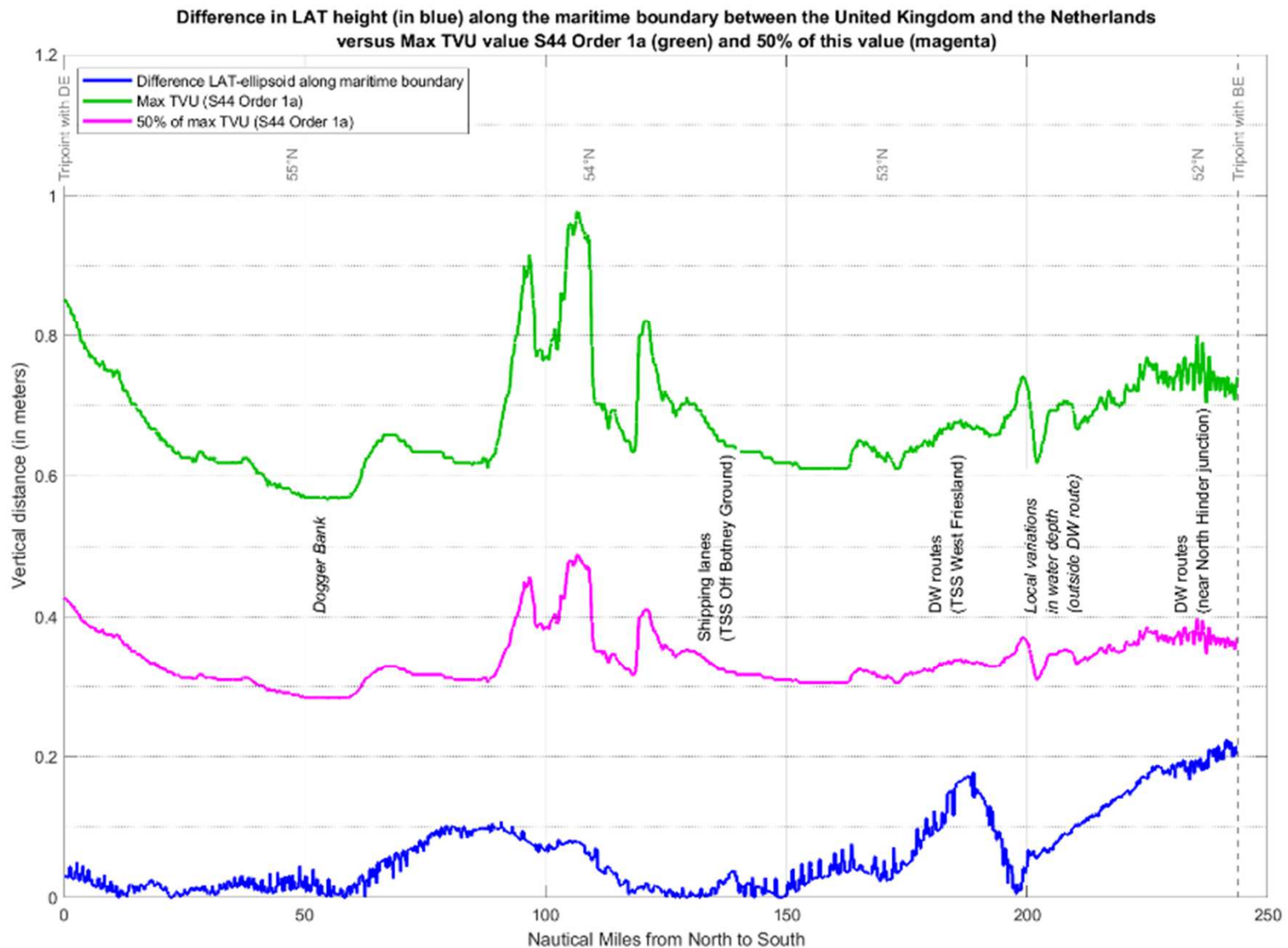
2.UK-Denmark



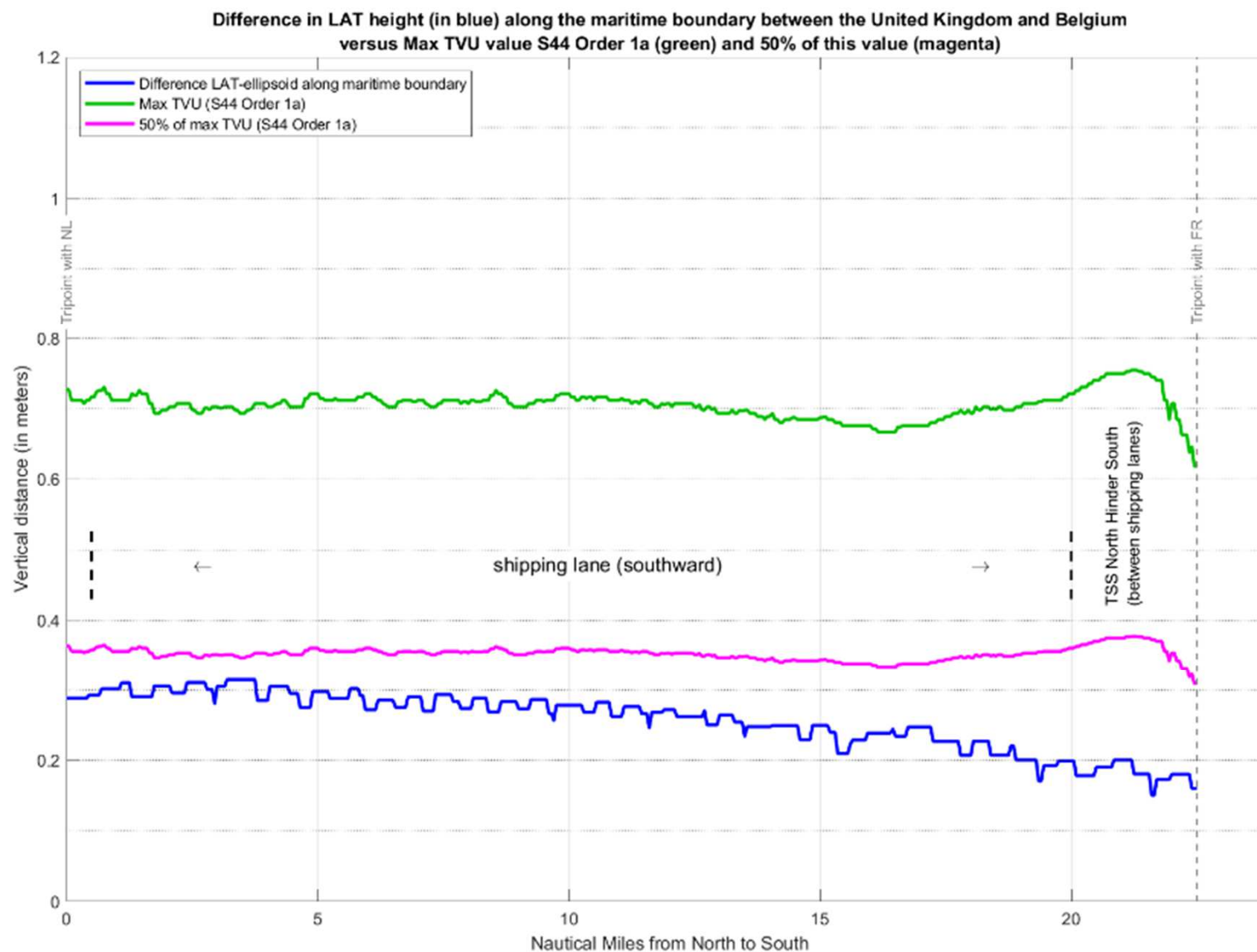
3.UK-Germany



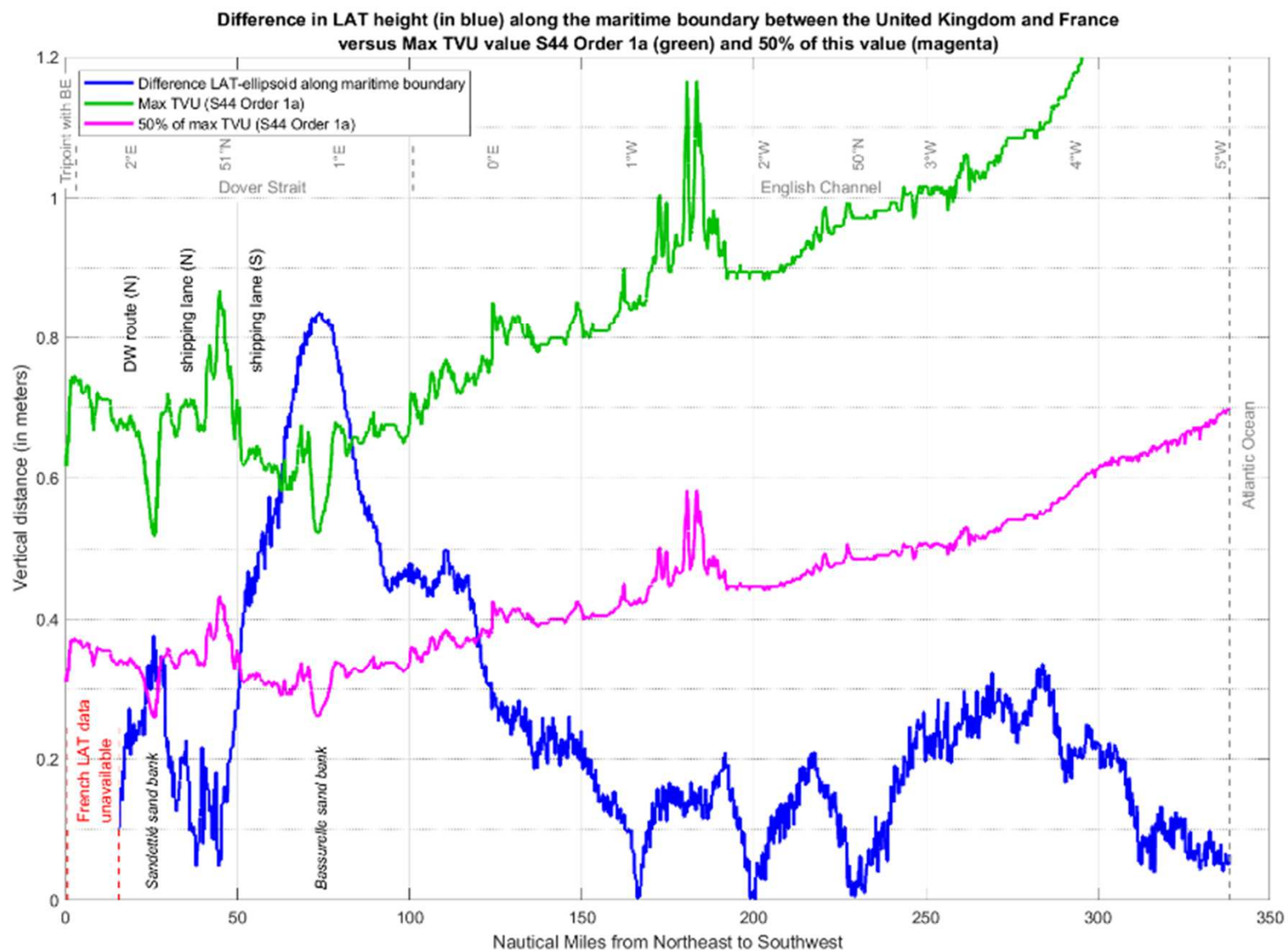
4.UK-Netherlands



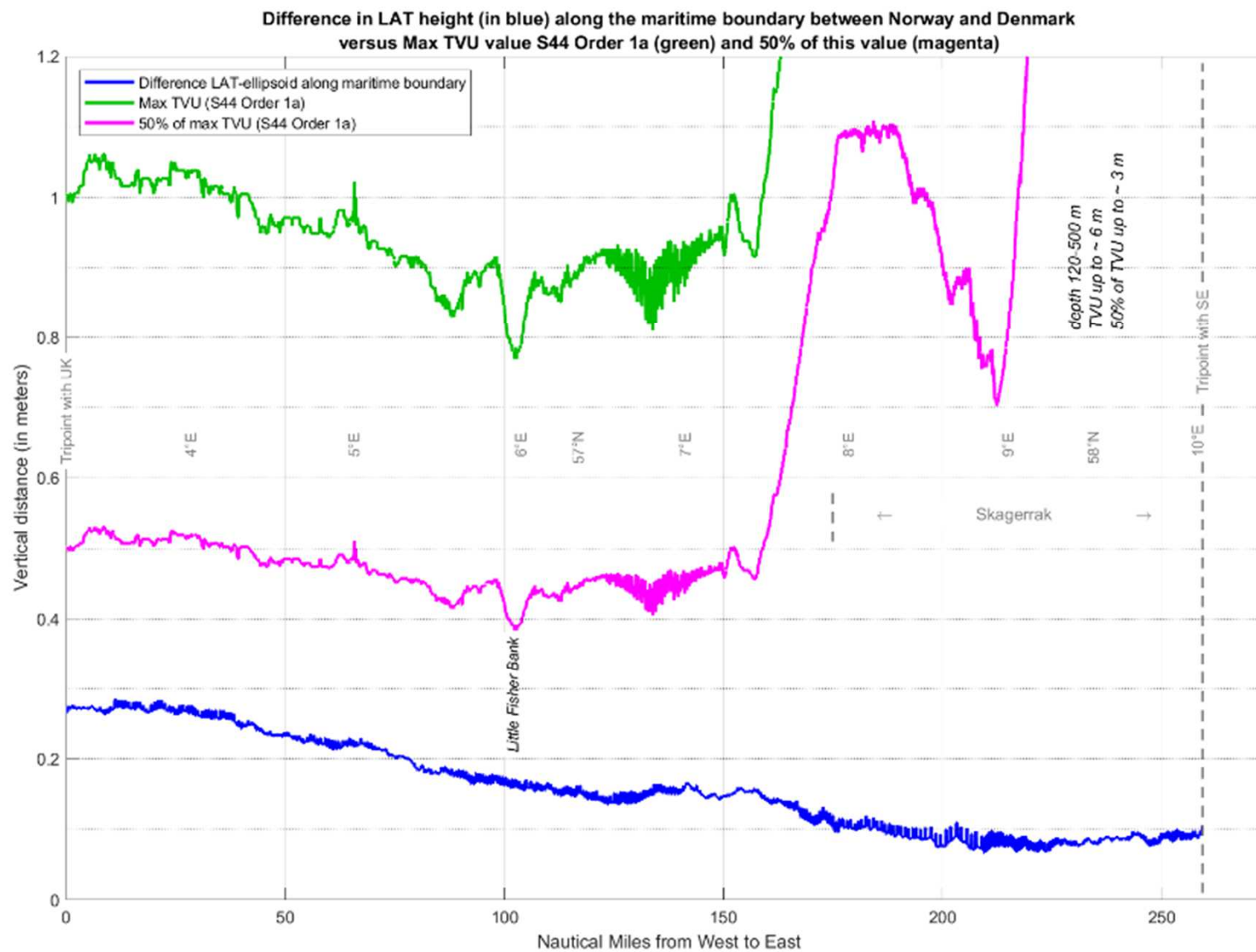
5.UK-Belgium



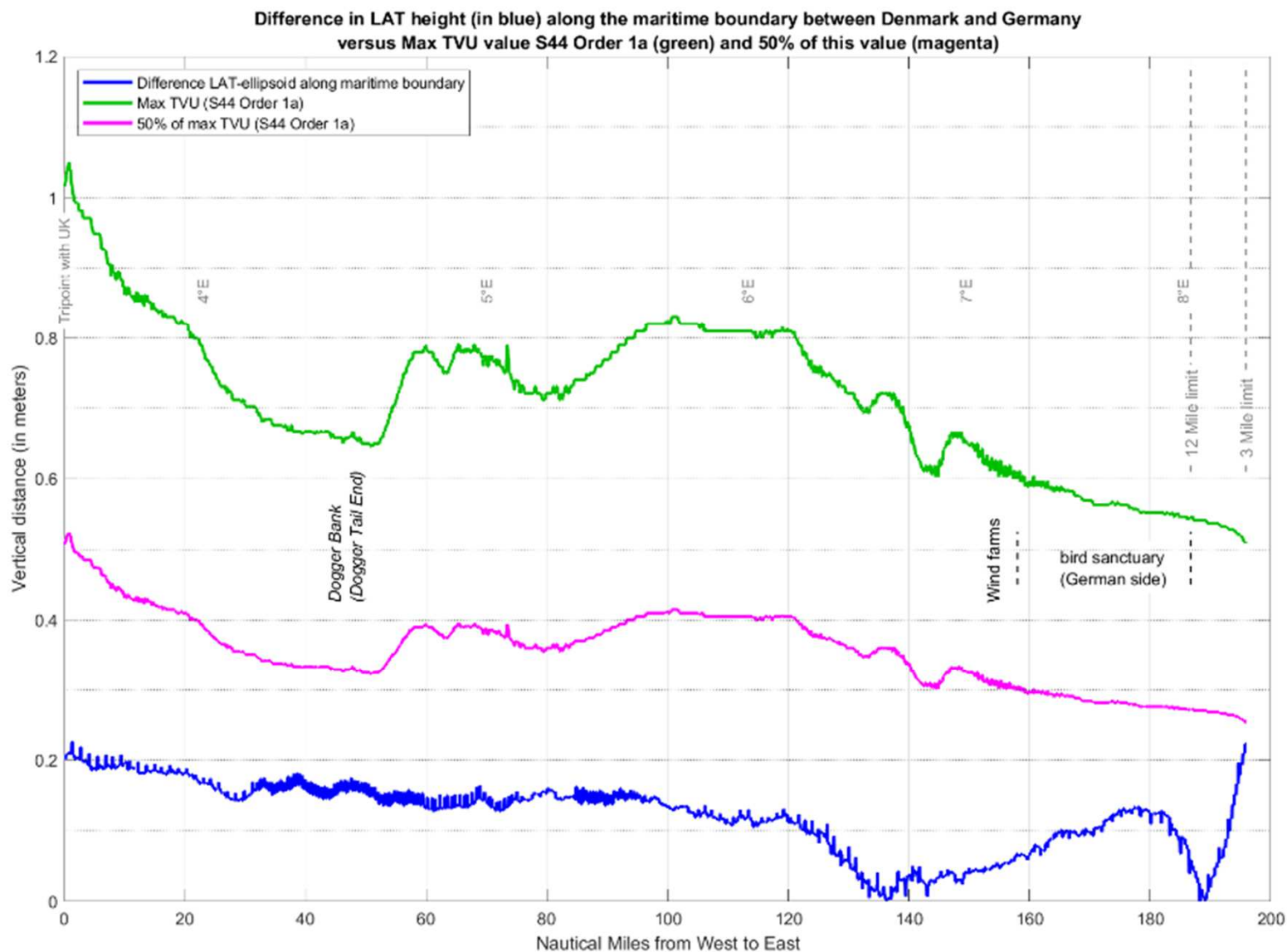
6.UK-France



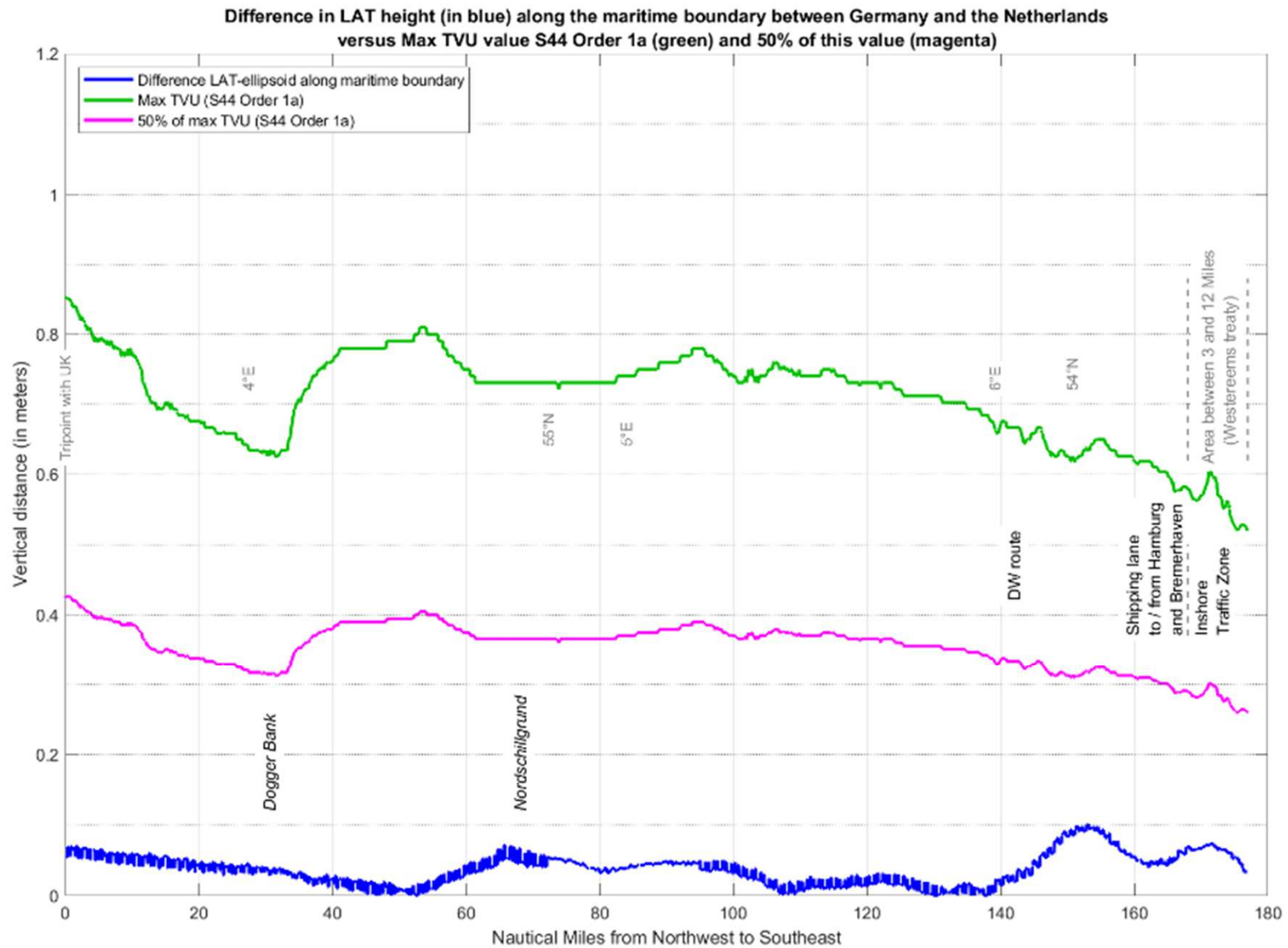
7. Norway-Denmark



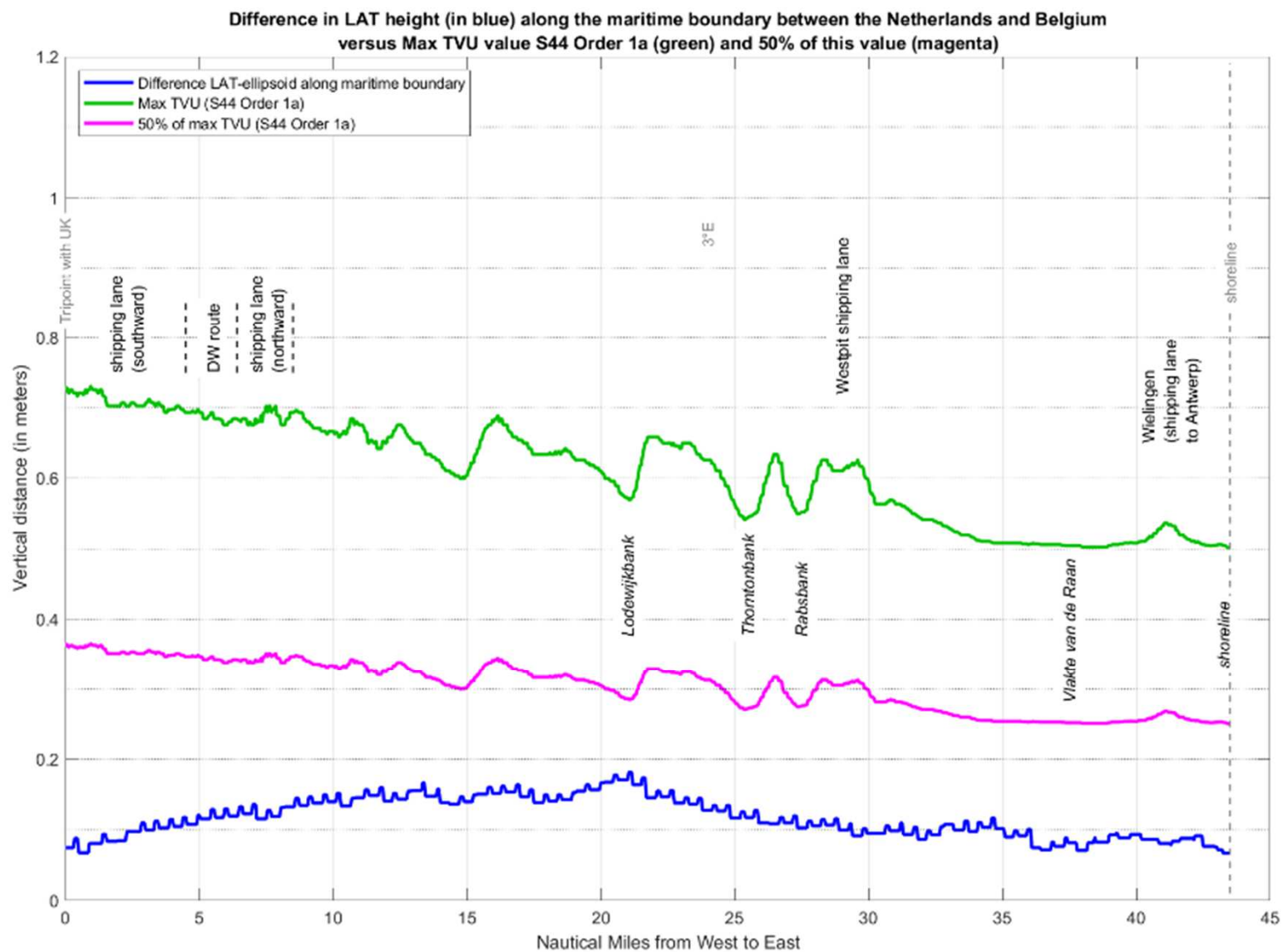
8. Denmark-Germany



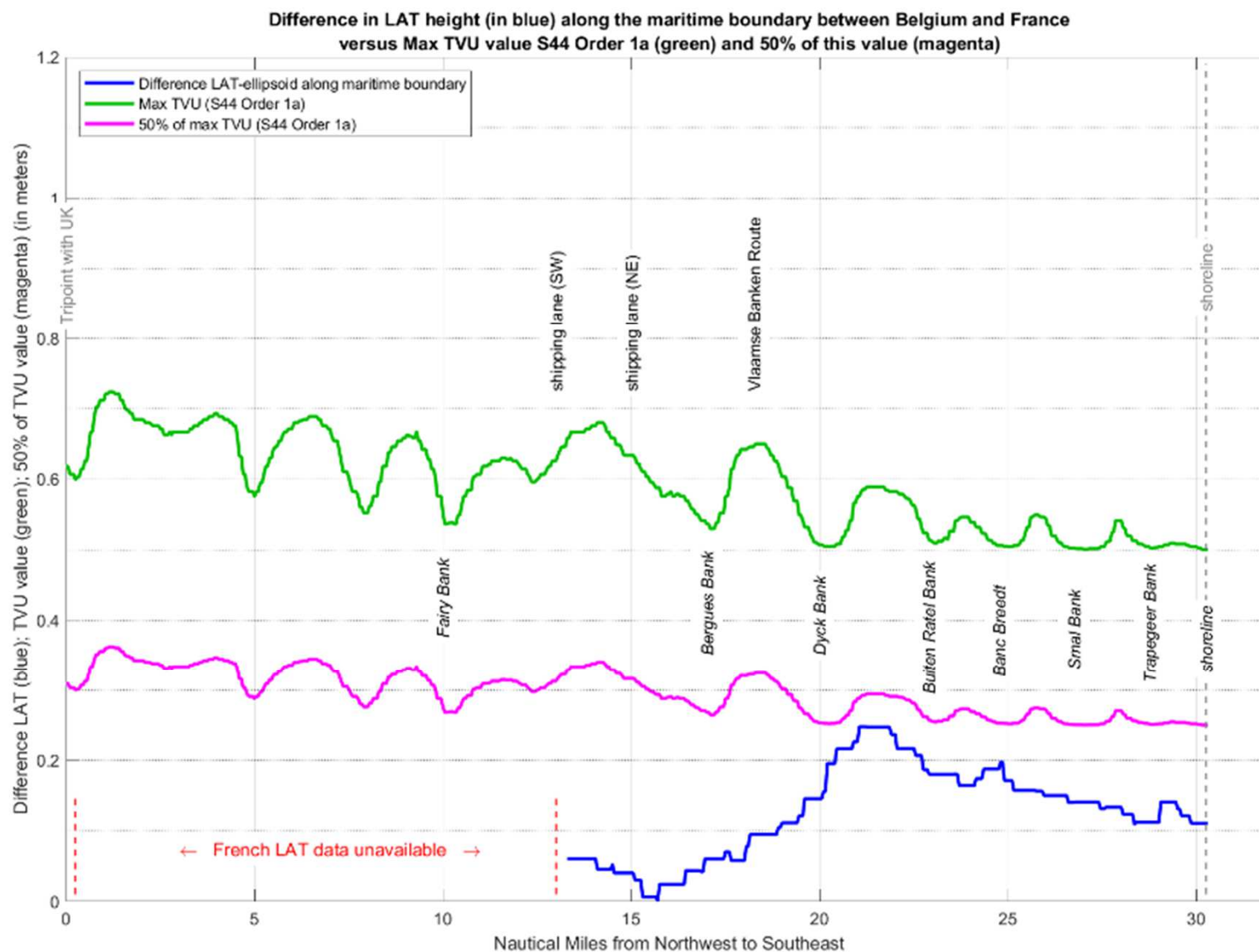
9. Germany-Netherlands



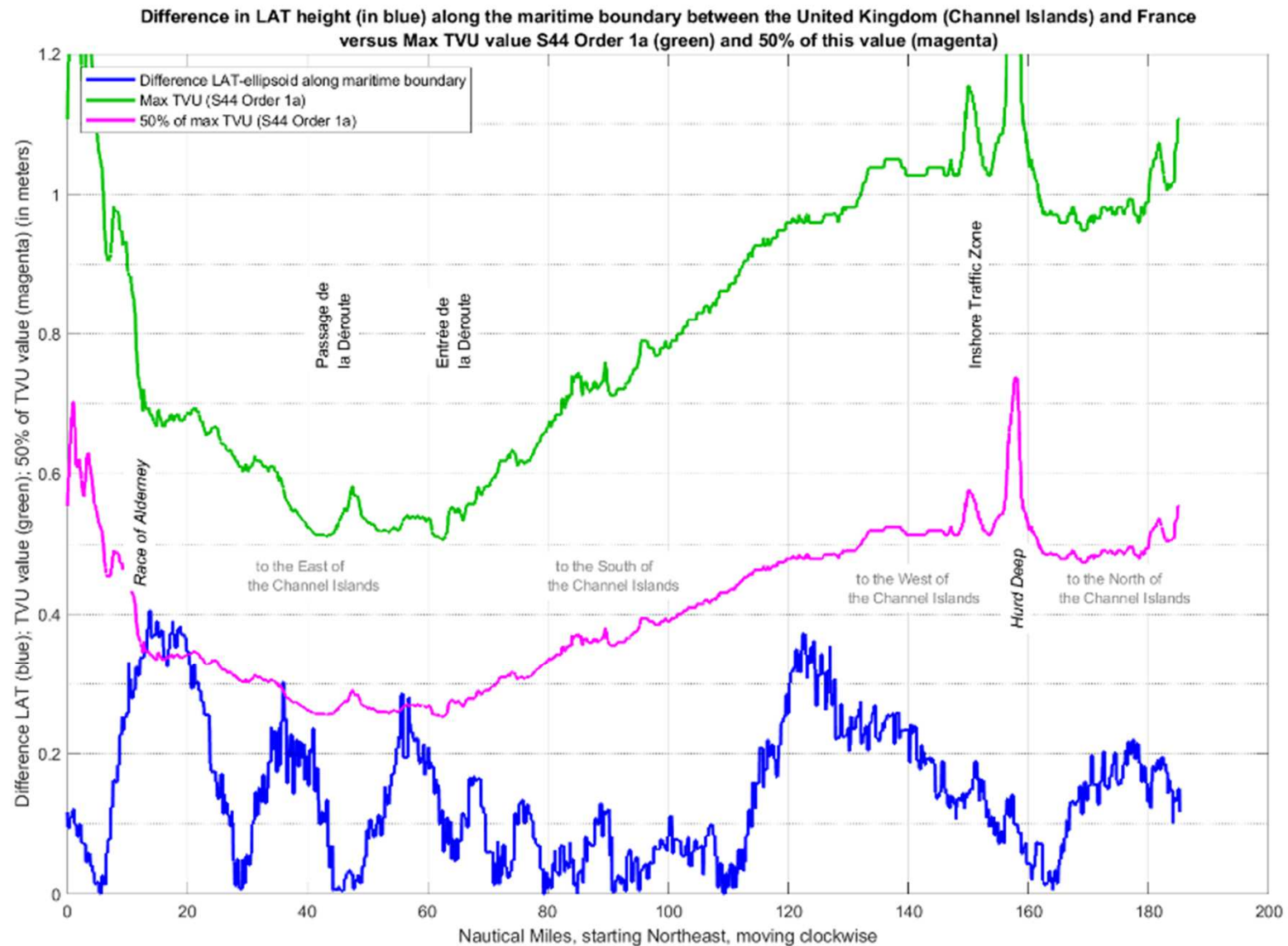
10.Netherlands-Belgium



11. Belgium-France



12.UK-France (Channel Islands)





LAT: status differences at boundaries

	BE		DK		FR		GE		NL		NO		UK		SW	IC
BE																
DK	0															
FR	1.2*	2.1*	0													
GE	0		1.2	2.1	0											
NL	1.2	2.1	0		0		1.1	2.1								
NO	0		1.1	2.1	0		0		0							
UK	1.1	2.1	1.1	2.1	1.2**	2.3**	1.1	2.1	1.1	2.1	1.1	2.1				
SW	0		?	?	0		0		0		?	?	0			
IC	0		0		0		0		0		0		0		0	

0 no common boundary

1.1 Difference in LAT height divided by depth is always smaller than 1%

1.2 Difference in LAT height divided by depth is (partly) larger than 1%

2.1 Difference in LAT height is always smaller than 50% of Max TVU value S44 Order 1a

2.2 Difference in LAT height is (partly) larger than 50% of Max TVU value S44 Order 1a, but always smaller than 100% of Max TVU value S44 Order 1a

2.3 Difference in LAT height is (partly) larger than 100% of Max TVU value S44 Order 1a

* Data partly not available

** Includes Channel Islands



Comments Andreas Boesch

"It is very difficult to state a percentage of the TVU for the LAT surfaces, because the accuracy of the other variables involved can be very variable.

As a rule, however, the inaccuracy of the reduction process is always the biggest factor. I asked around among the members of the NSHC-RWG and got a rough estimate of 30-50%.

Since the sensors used and the accuracy of the measuring setup can be assumed to be good in Europe and the absolute positioning is usually carried out with corrected GNSS coordinates, it is plausible to assume an approximate limit of 50% of the respective TVU allow value."



Summary

- 1) Proposed norm:
LAT difference \leq Total Vertical Uncertainty (TVU)
 $\leq \frac{1}{2}$ Total Vertical Uncertainty

Does the ($\frac{1}{2}$) TVU norm meets the expectations of the TWG?

- 2) 10 of 12 boundaries \rightarrow Difference in LAT height is always smaller than 50% of Max TVU value S44 Order 1a.
- 3) The ($\frac{1}{2}$) TVU norm accepted more LAT differences at shallow waters



Questions?