



Royal Netherlands Navy

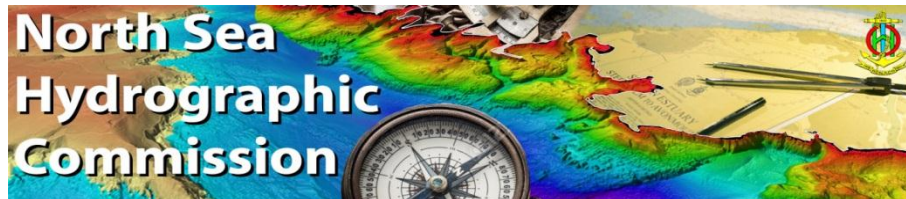


TWCWG2

Agenda item 6.6:

Seamless LAT on the  
North Sea

NLHO for NSHC TWG



Hydrographic Service  
Geodesy and Tides



## Background

October 2008: NSHC tasks Tidal Working Group (TWG) to study a seamless LAT for the North Sea.



## Agreed action items

A16/01/01 Each Hydrographic Office to describe methods and procedures for LAT, CD and database reference (re)calculations.

A16/01/02 Each Hydrographic Office to describe rationale for their choices for the respective subjects.

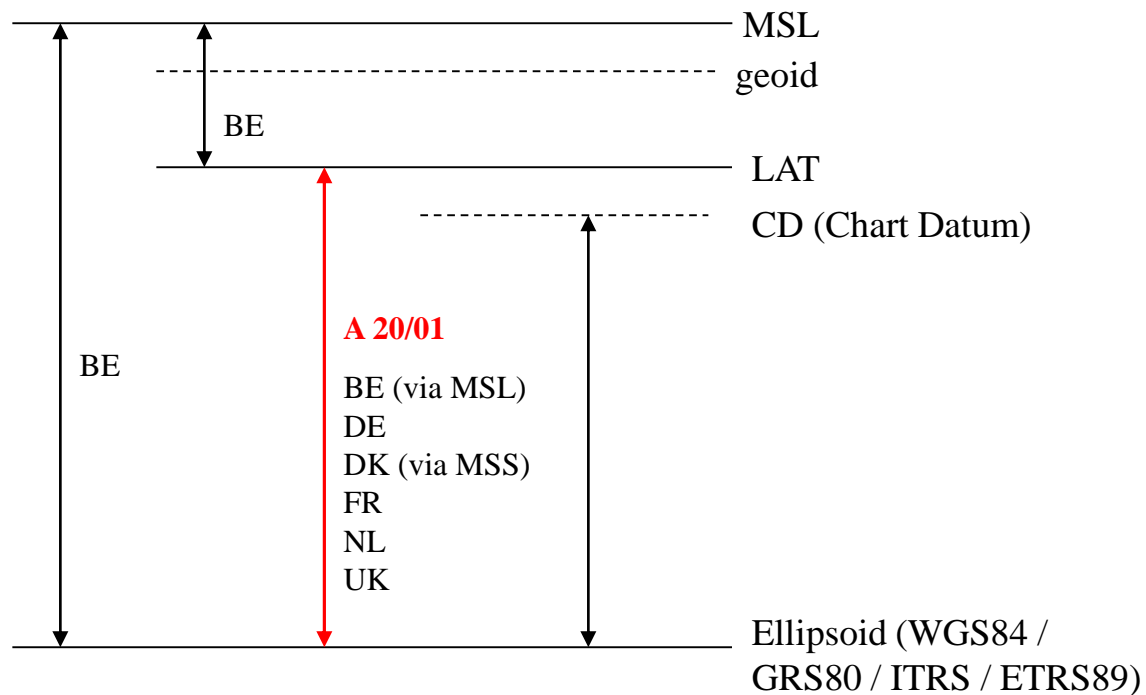
A16/01/03 Deliver present LAT surfaces to NLHO for further processing.

A20/01 Improve North Sea wide realisation of reference surfaces.

A20/02 Show insight in the status of all bilateral boundaries.

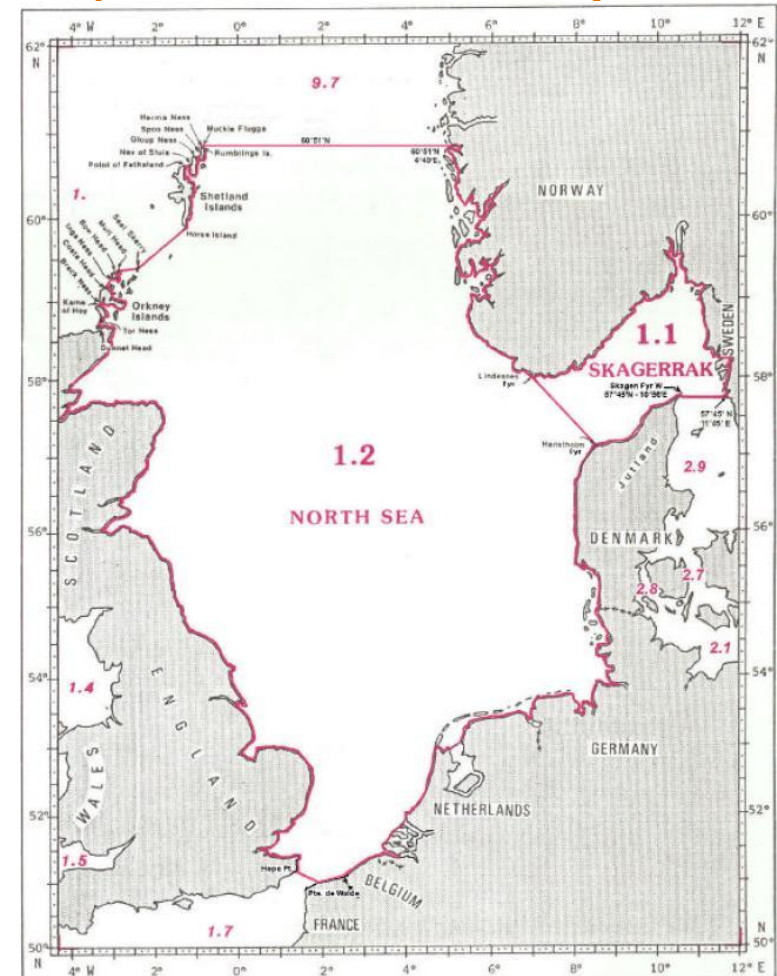
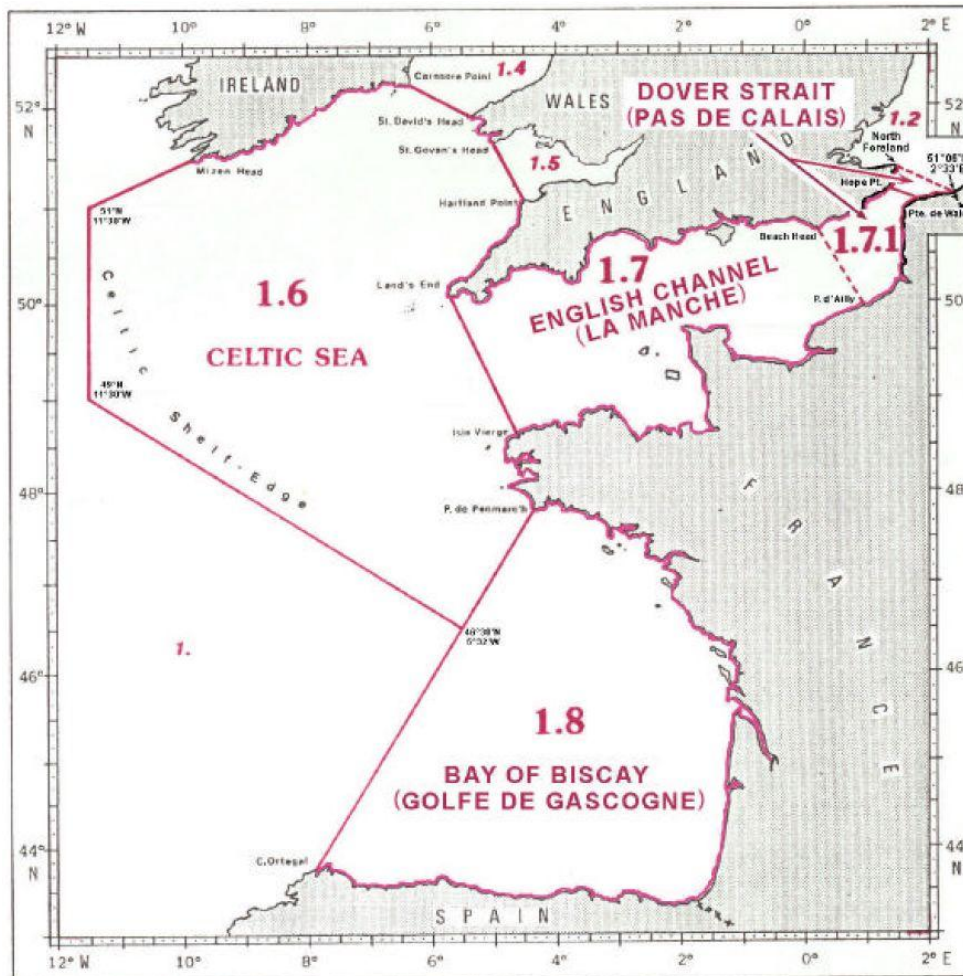


## Data delivered by nations





# Definition of the North Sea (IHO publication S23)



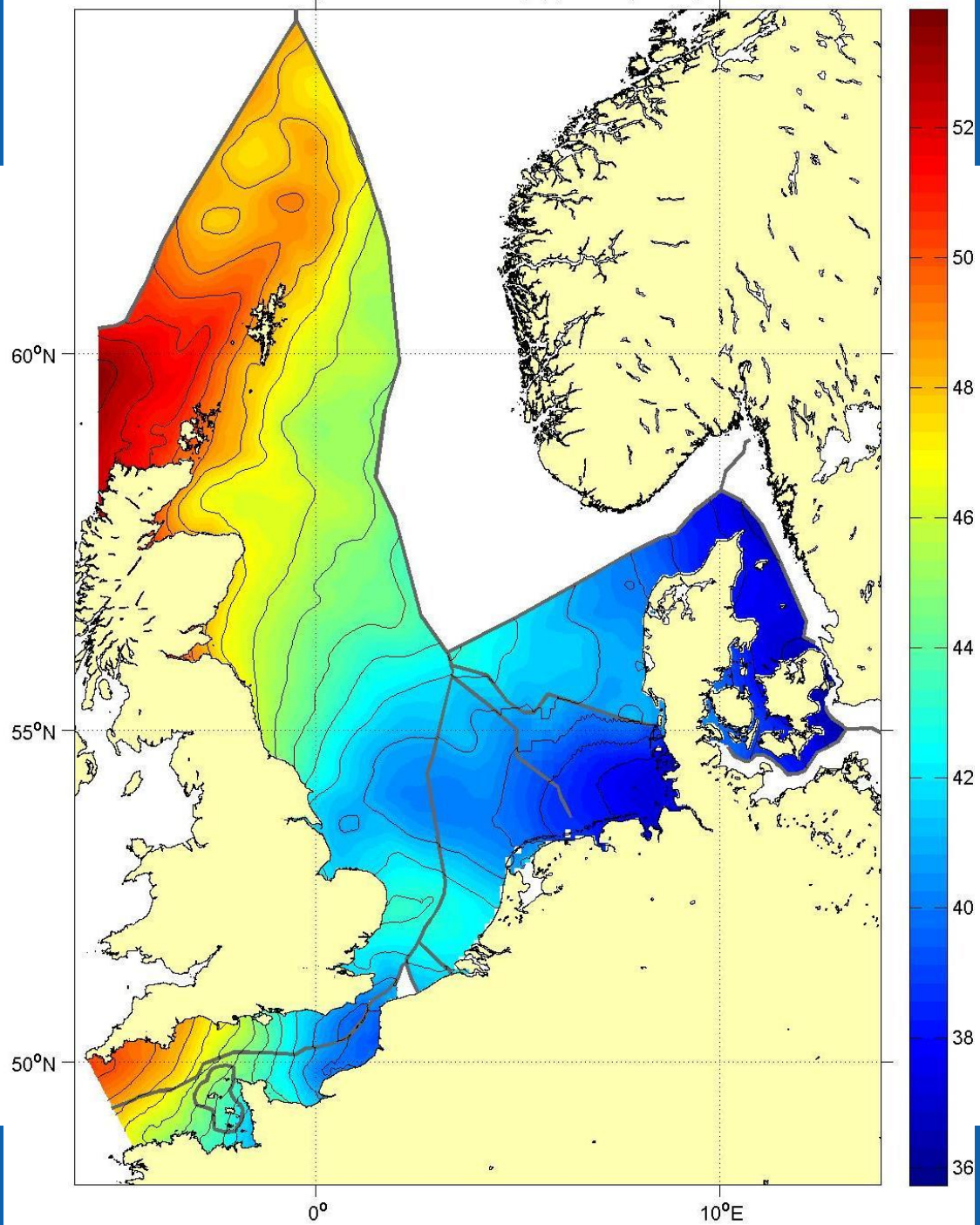


## Geographical domain

The comparisons in this presentation covers the Skagerrak (1.1), North Sea (1.2), the English Channel (1.7), parts of the Norwegian Sea (9.7) and parts of the North Atlantic Ocean (1, west of the Shetland Islands) as described in the 2002 draft of the IHO S23



LAT-Ellipsoid on the North Sea (m) (isolines per 1 m)

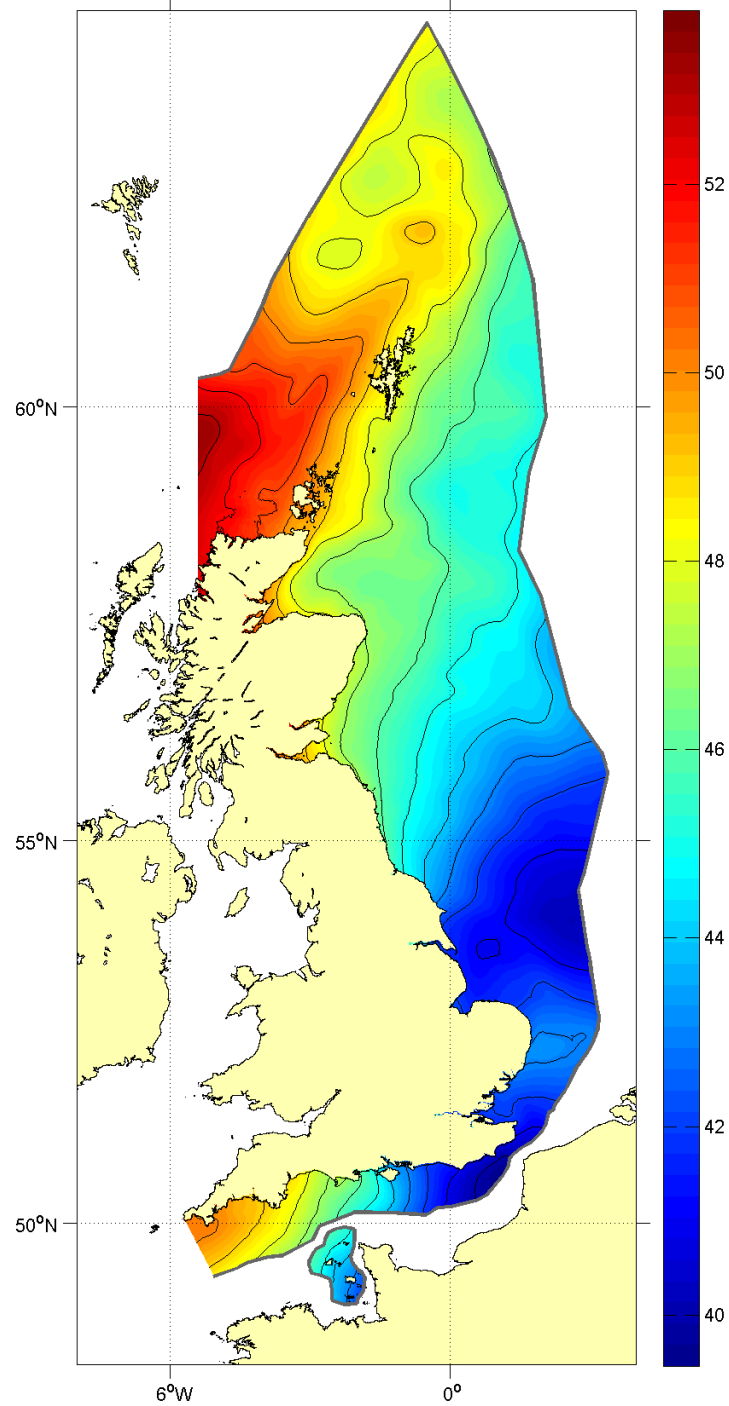




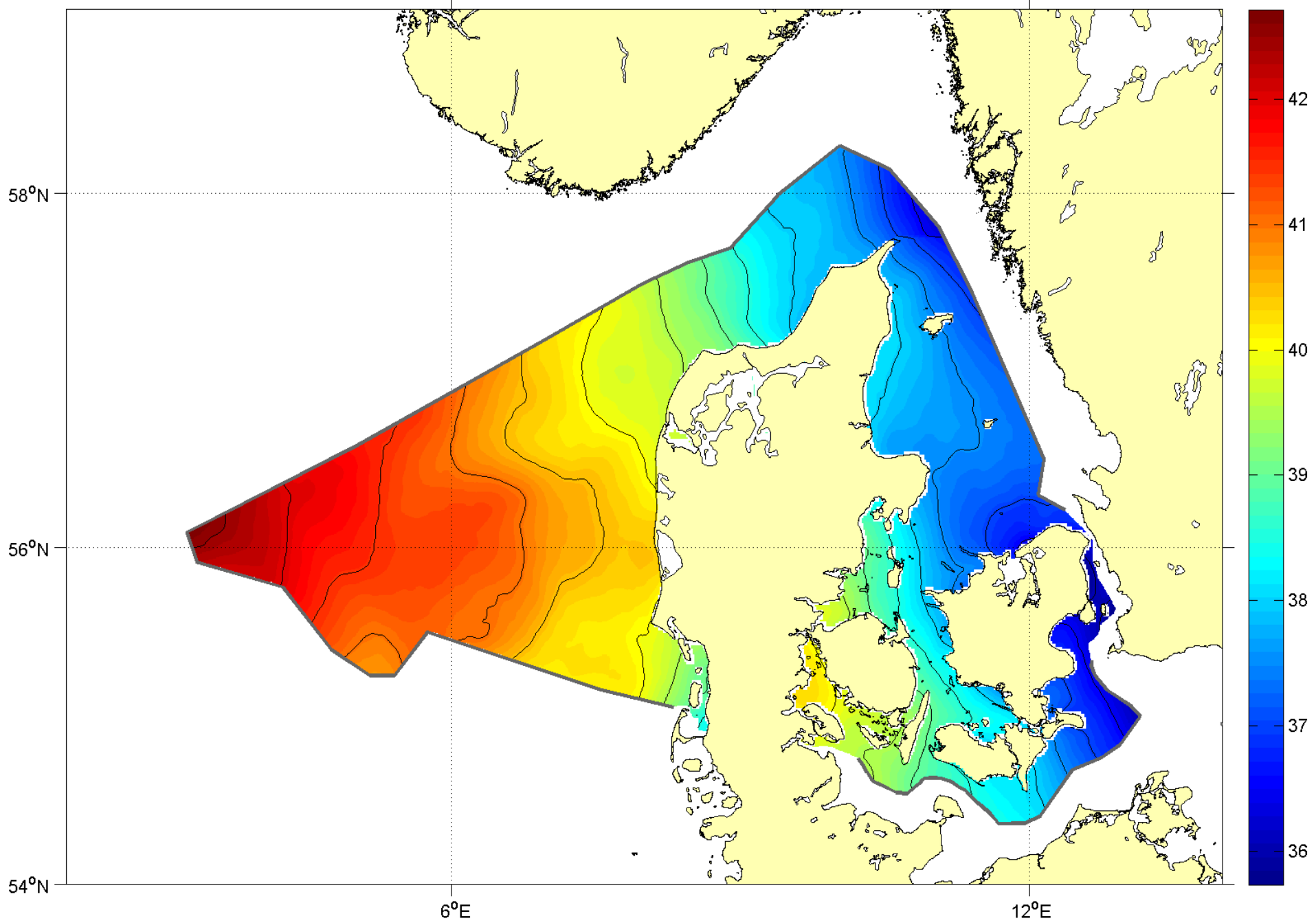
## Data delivered by nations

	Spatial resolution (deg)	Spatial resolution (m) North-South	Spatial resolution (m) West-East
UK	0.008	900	400-600
Denmark	0.0167	1850	975-1050
Germany, <~6 M from coast	~0.005	600	350
Germany, >~6 M from coast, east of 6°E	~0.02-0.06	2000-7000	1250-4000
Germany at sea, west of 6°E	0.15	16700	9000
Netherlands	0.00576	640	360-400
Belgium	0.00167-0.003	200	200
France	0.005-0.03	500-3000	350-2000
Analysis by NLHO (Mar 2016)	0.02	2200	980-1450
Analysis by NLHO (Aug 2016)	0.00576	640	360-400

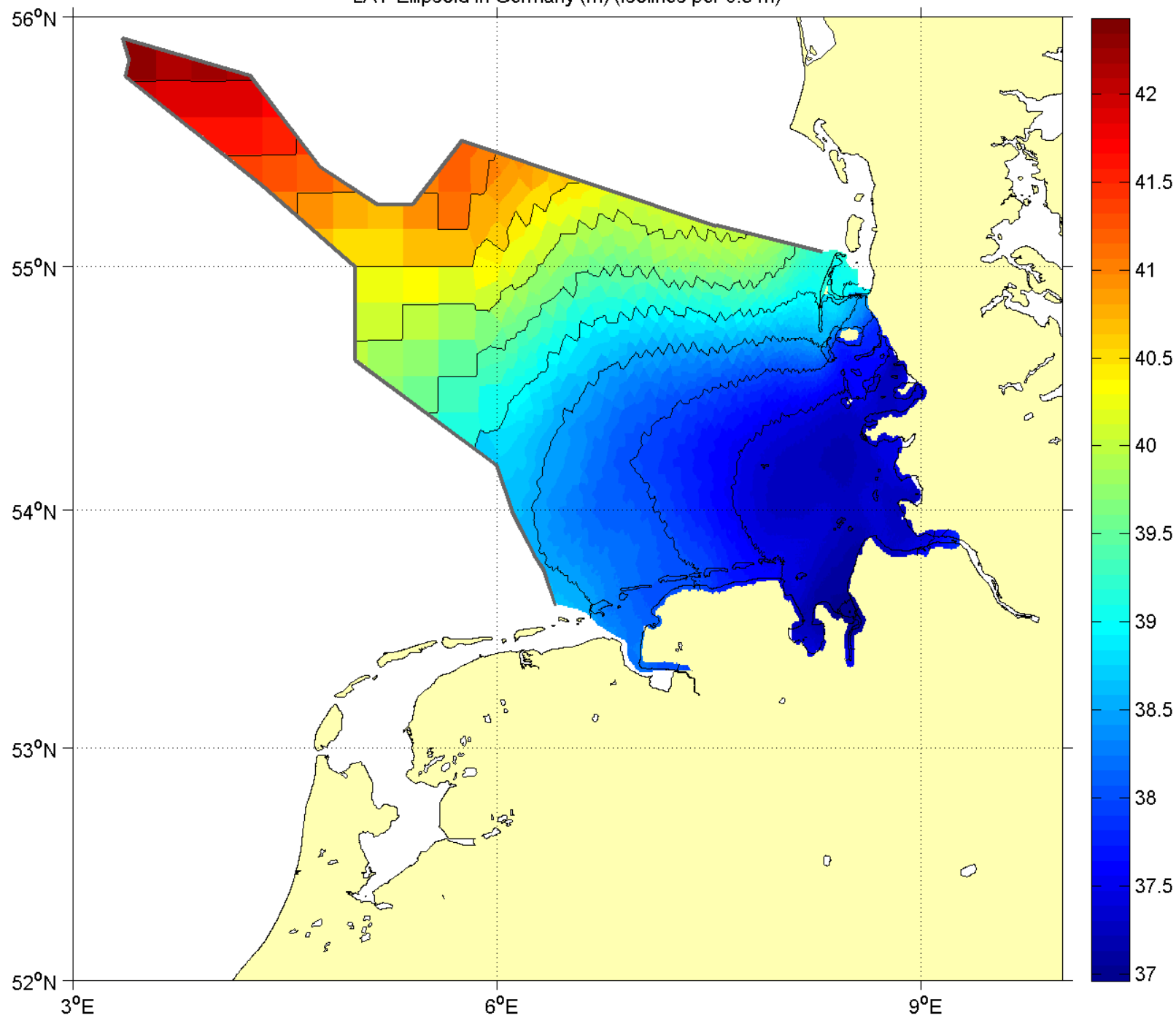




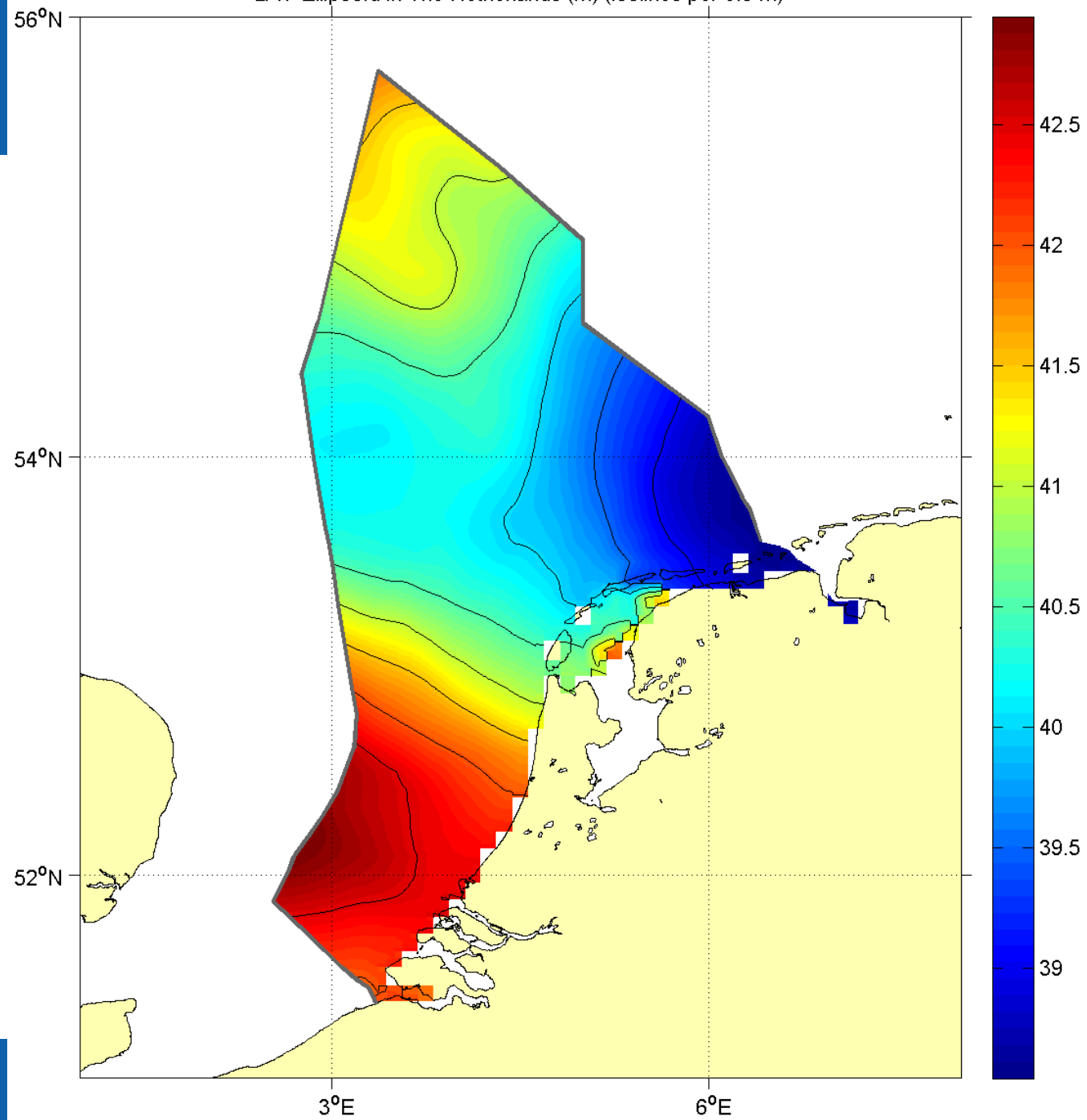
LAT-Ellipsoid in Denmark (m) (isolines per 0.5 m)



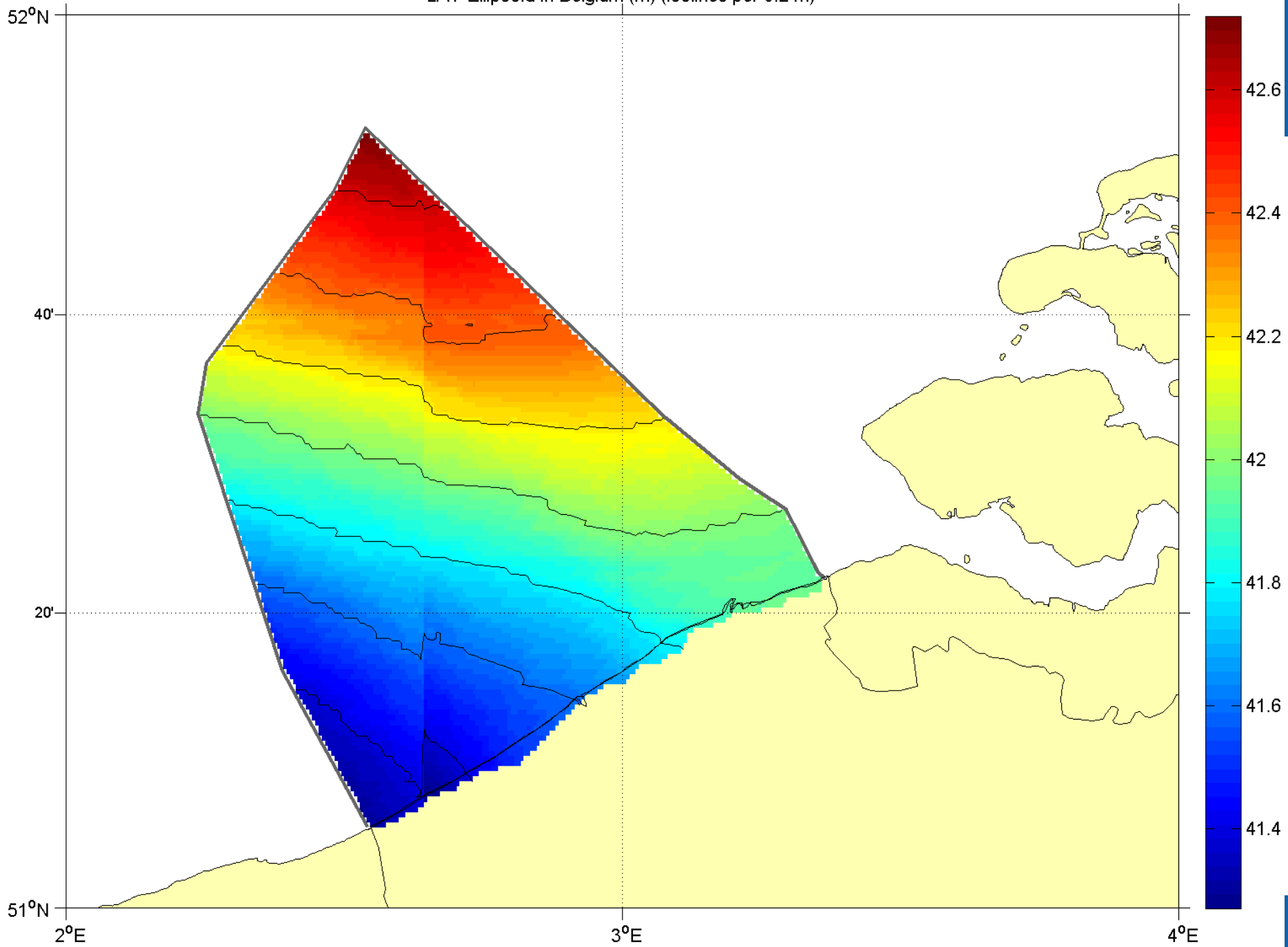
LAT-Ellipsoid in Germany (m) (isolines per 0.5 m)



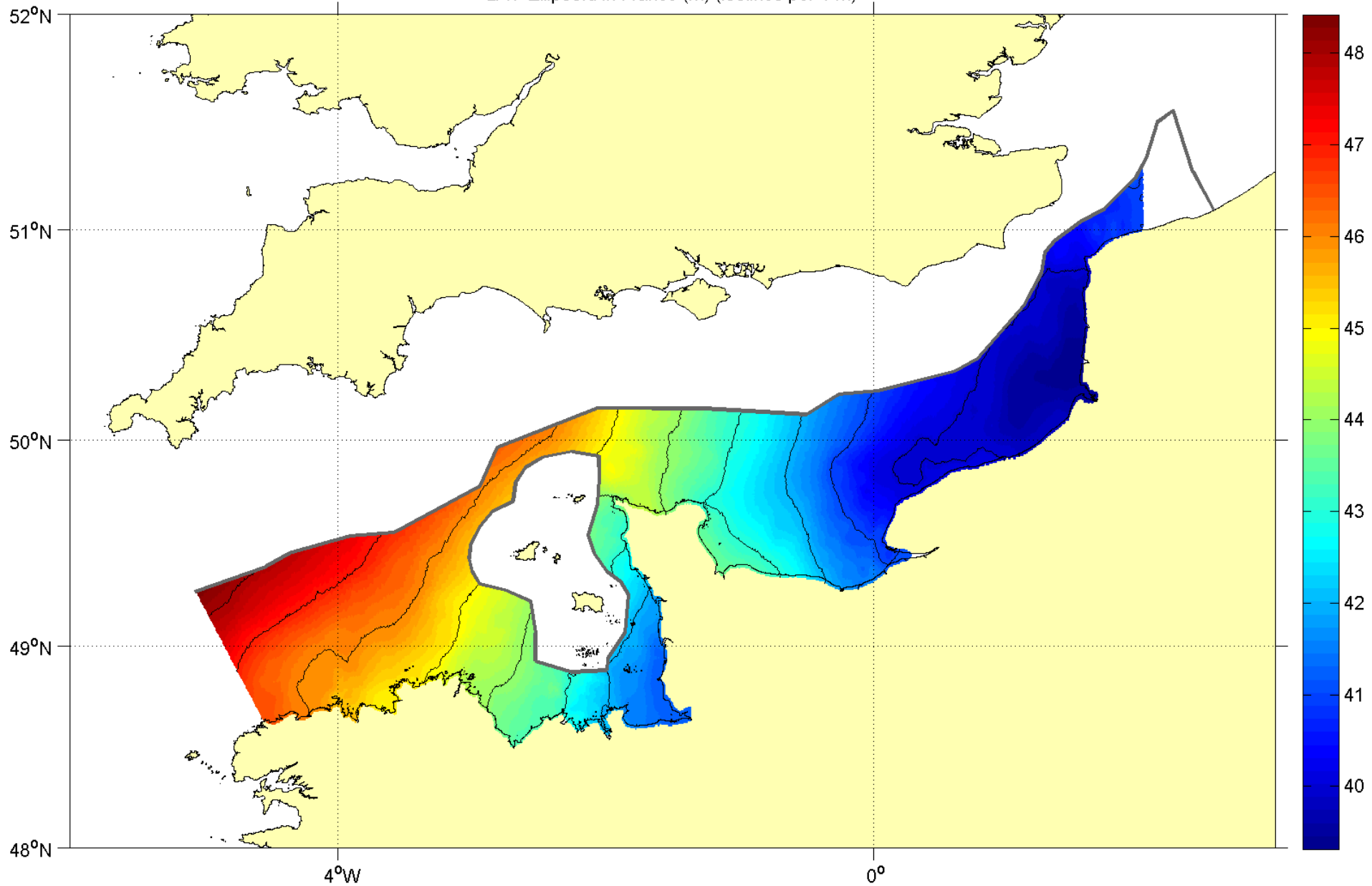
LAT-Ellipsoid in The Netherlands (m) (isolines per 0.5 m)



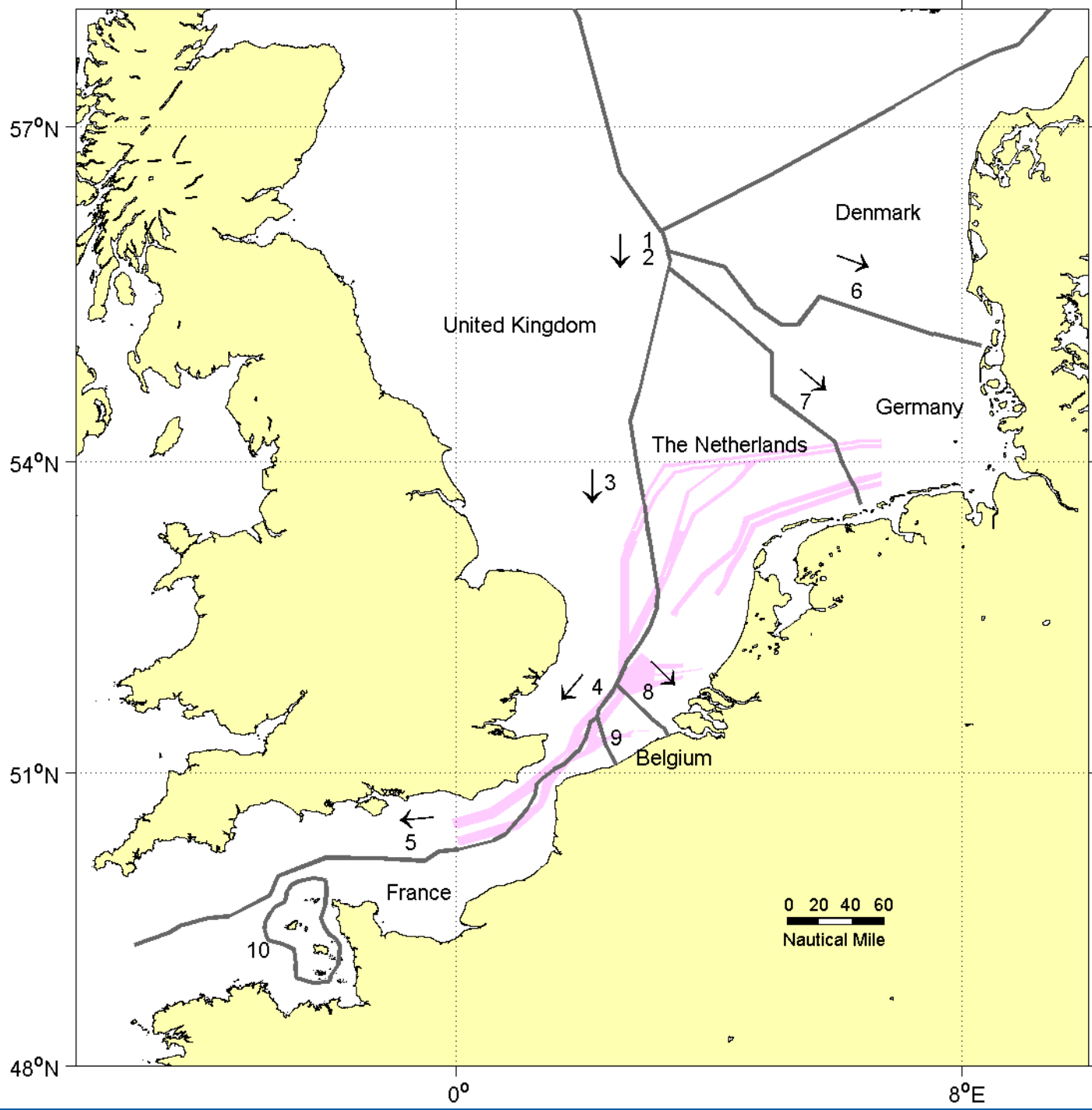
LAT-Ellipsoid in Belgium (m) (isolines per 0.2 m)



LAT-Ellipsoid in France (m) (isolines per 1 m)

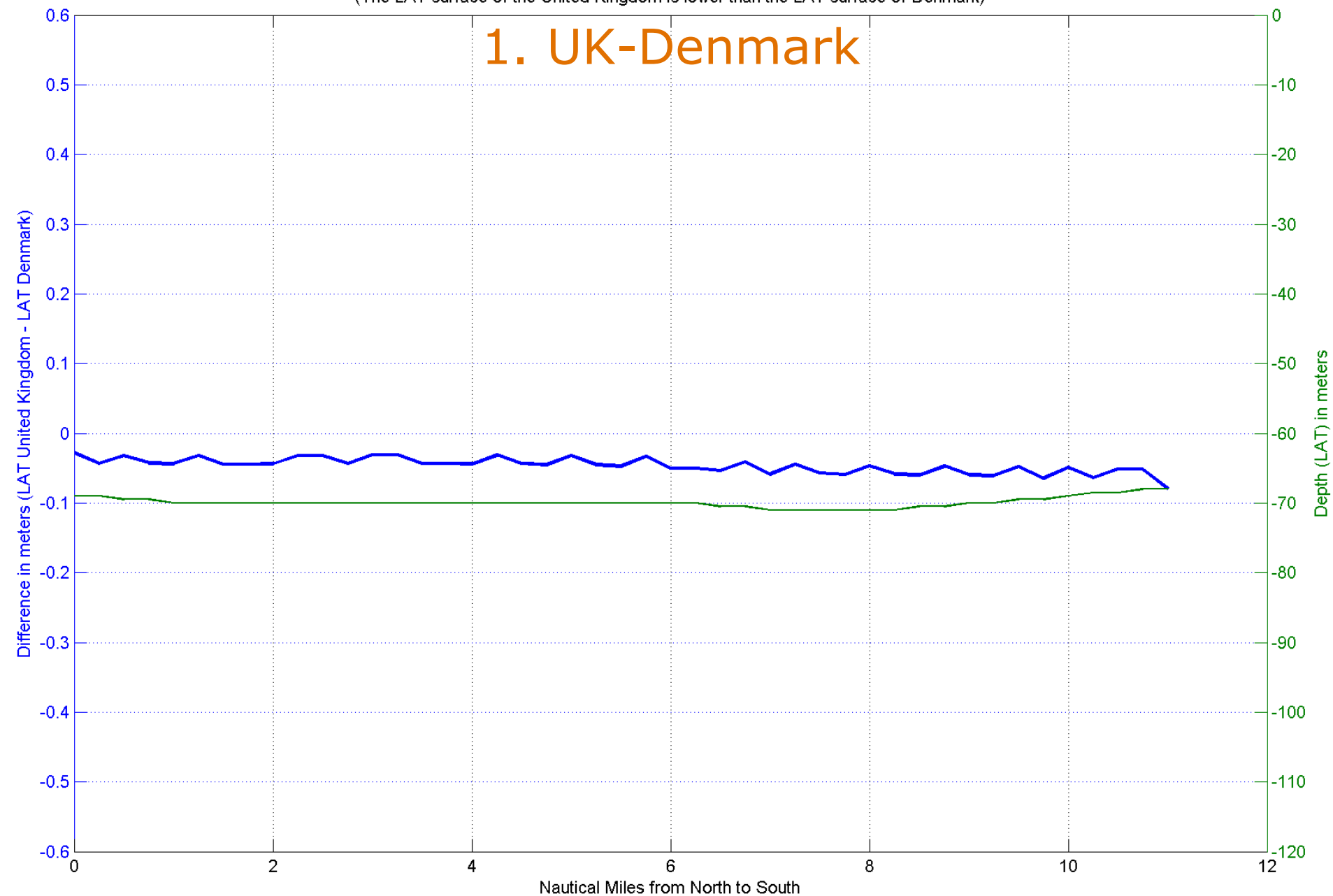




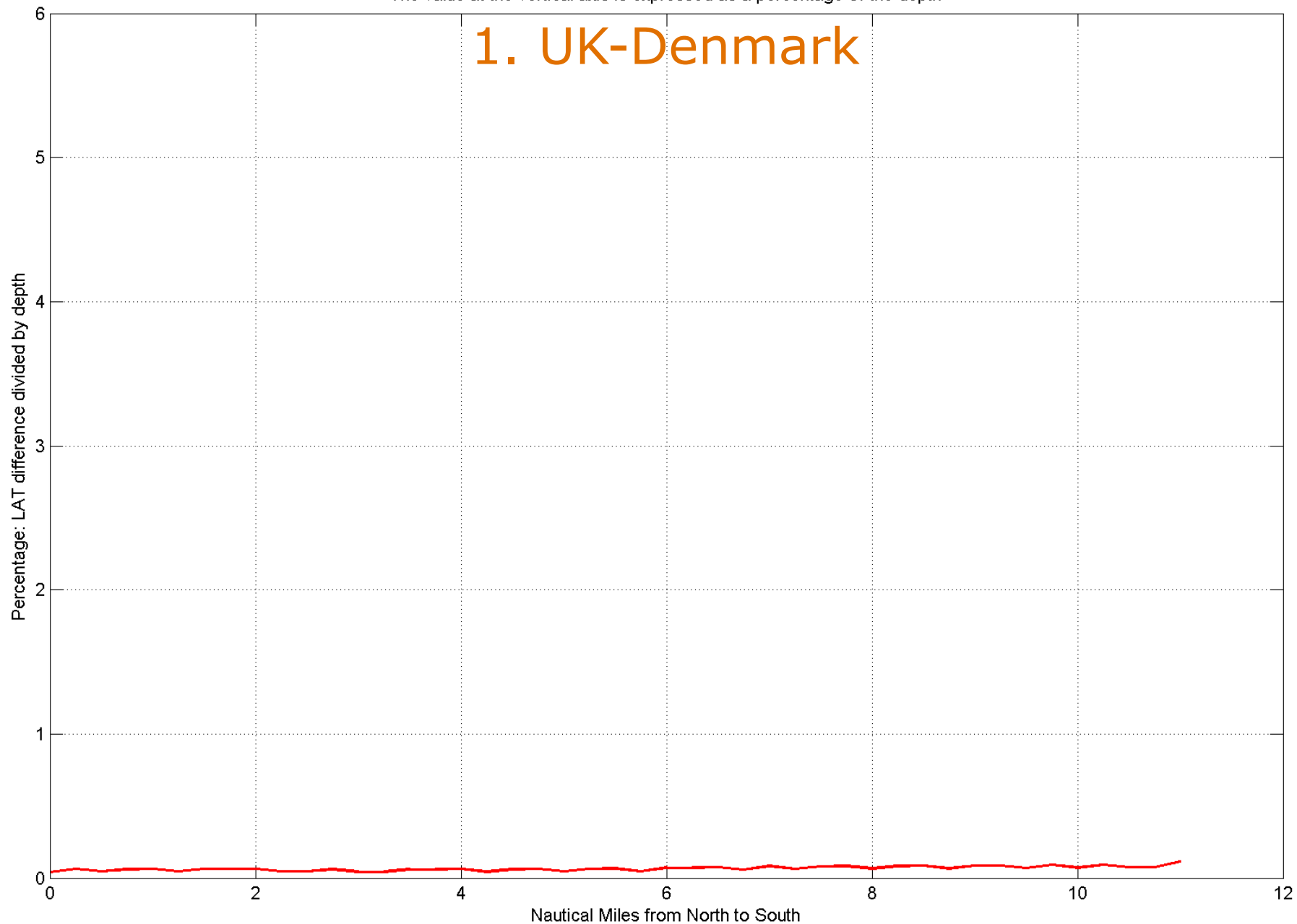


Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and Denmark  
(The LAT surface of the United Kingdom is lower than the LAT surface of Denmark)

# 1. UK-Denmark

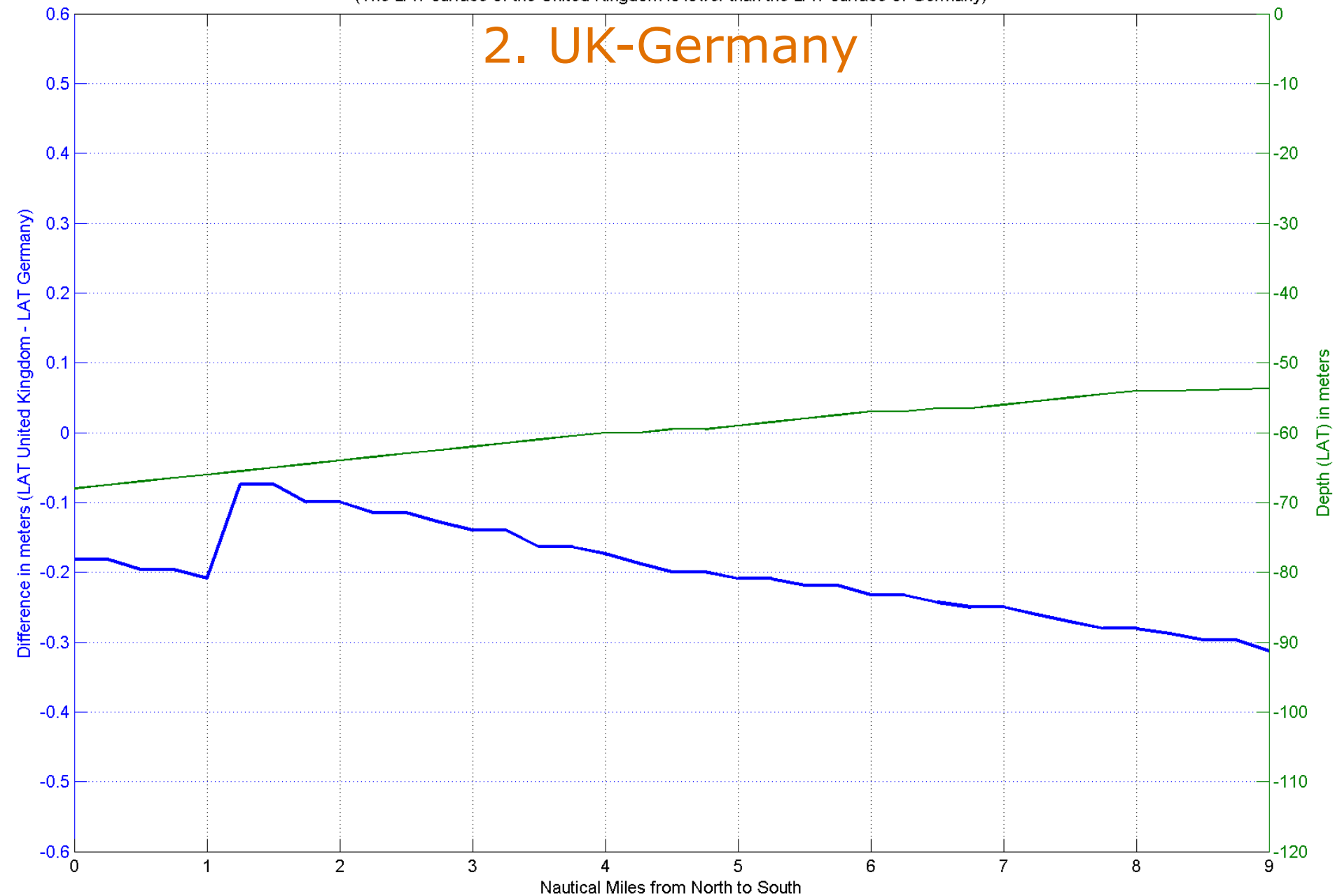


Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and Denmark, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth



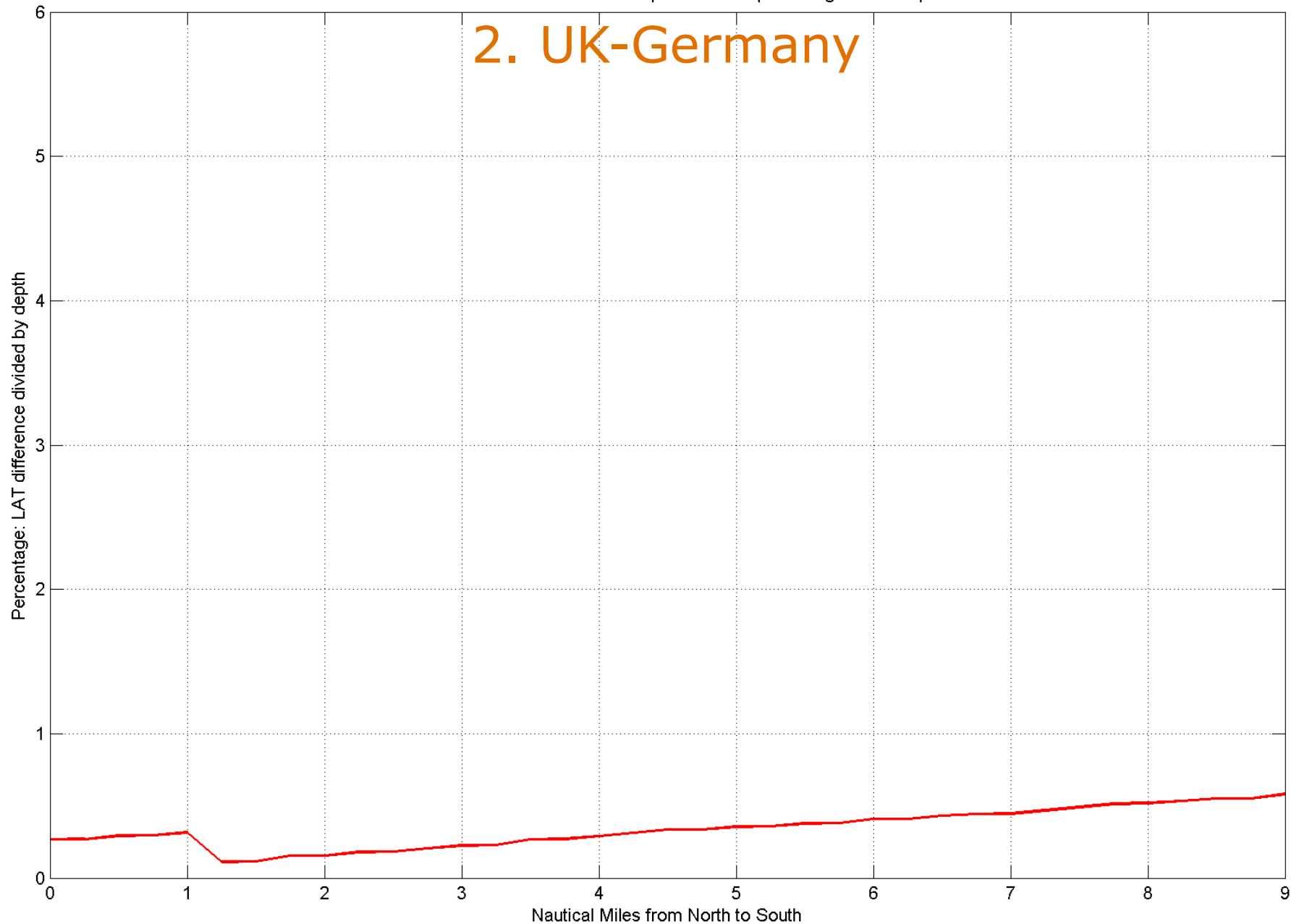
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and Germany  
(The LAT surface of the United Kingdom is lower than the LAT surface of Germany)

## 2. UK-Germany



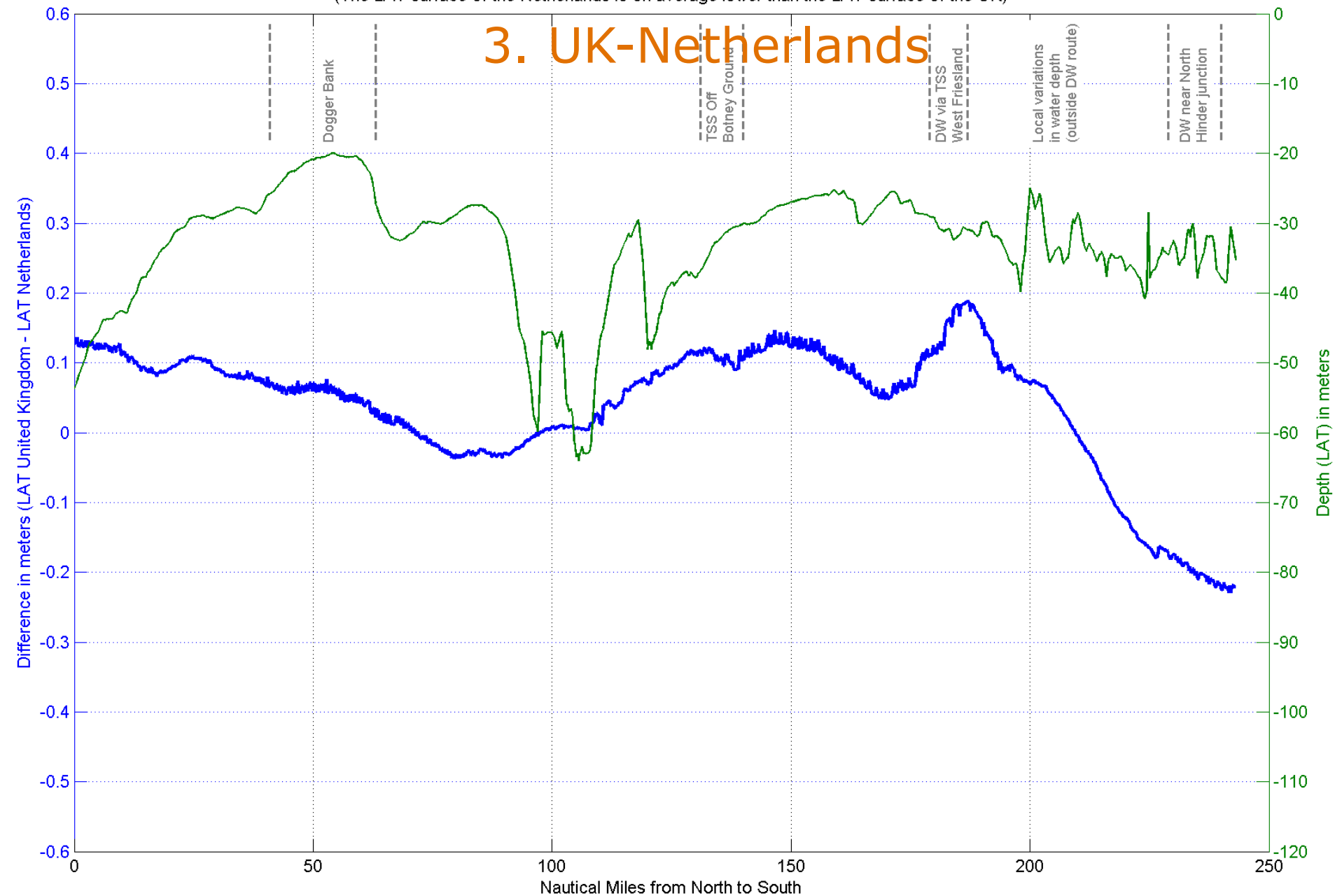
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and Germany, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

## 2. UK-Germany



Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and the Netherlands  
(The LAT surface of the Netherlands is on average lower than the LAT surface of the UK)

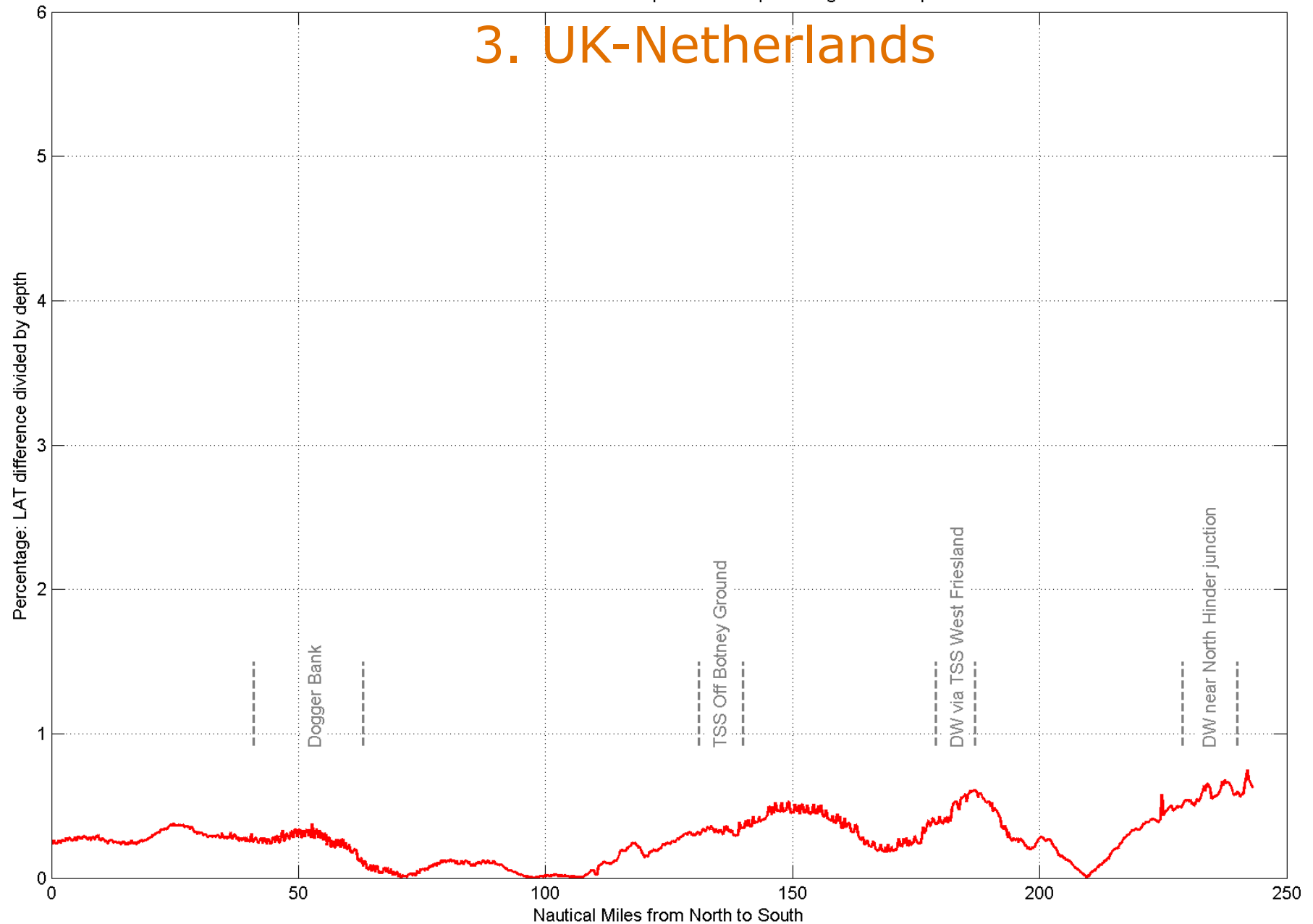
### 3. UK-Netherlands





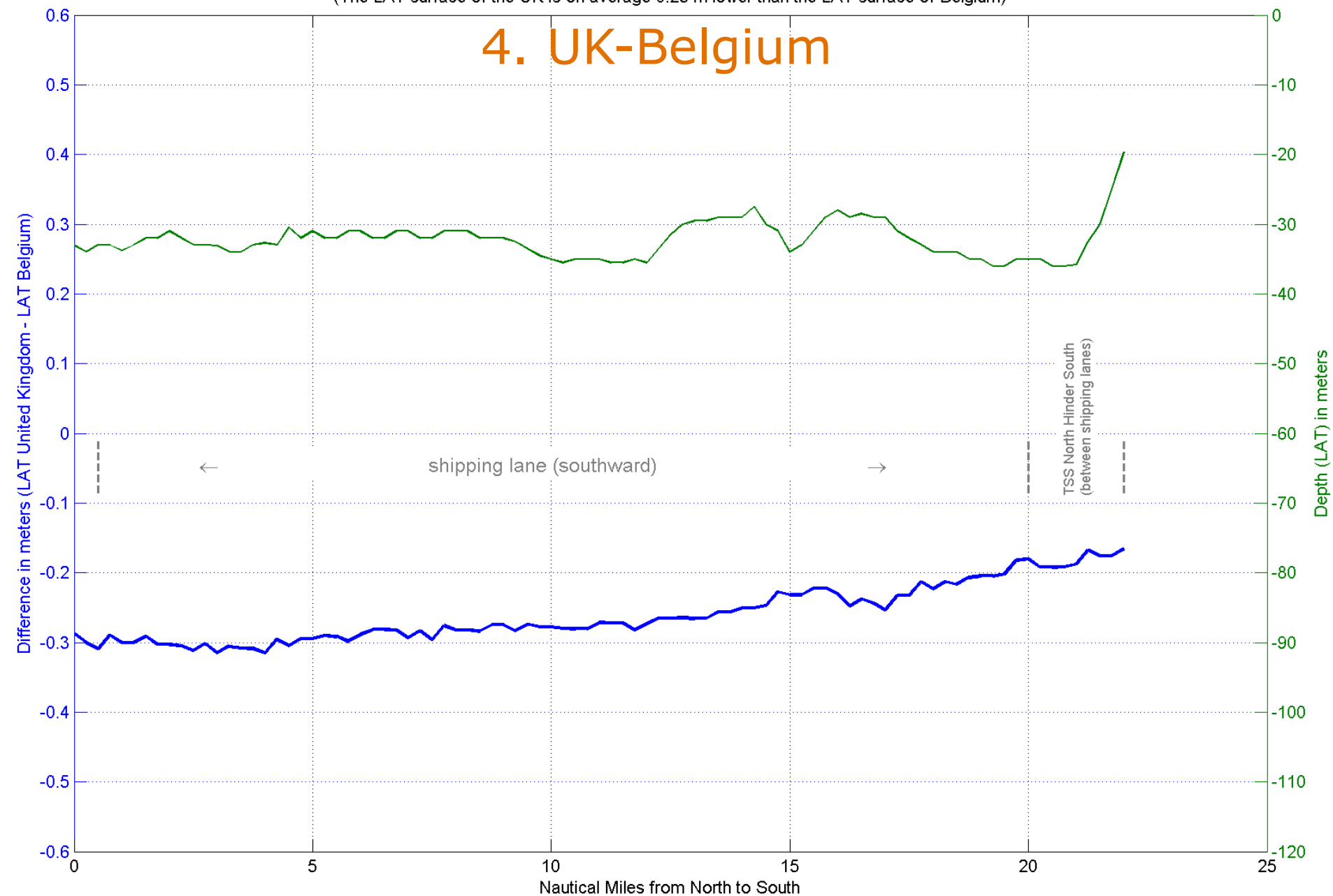
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and the Netherlands, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

### 3. UK-Netherlands



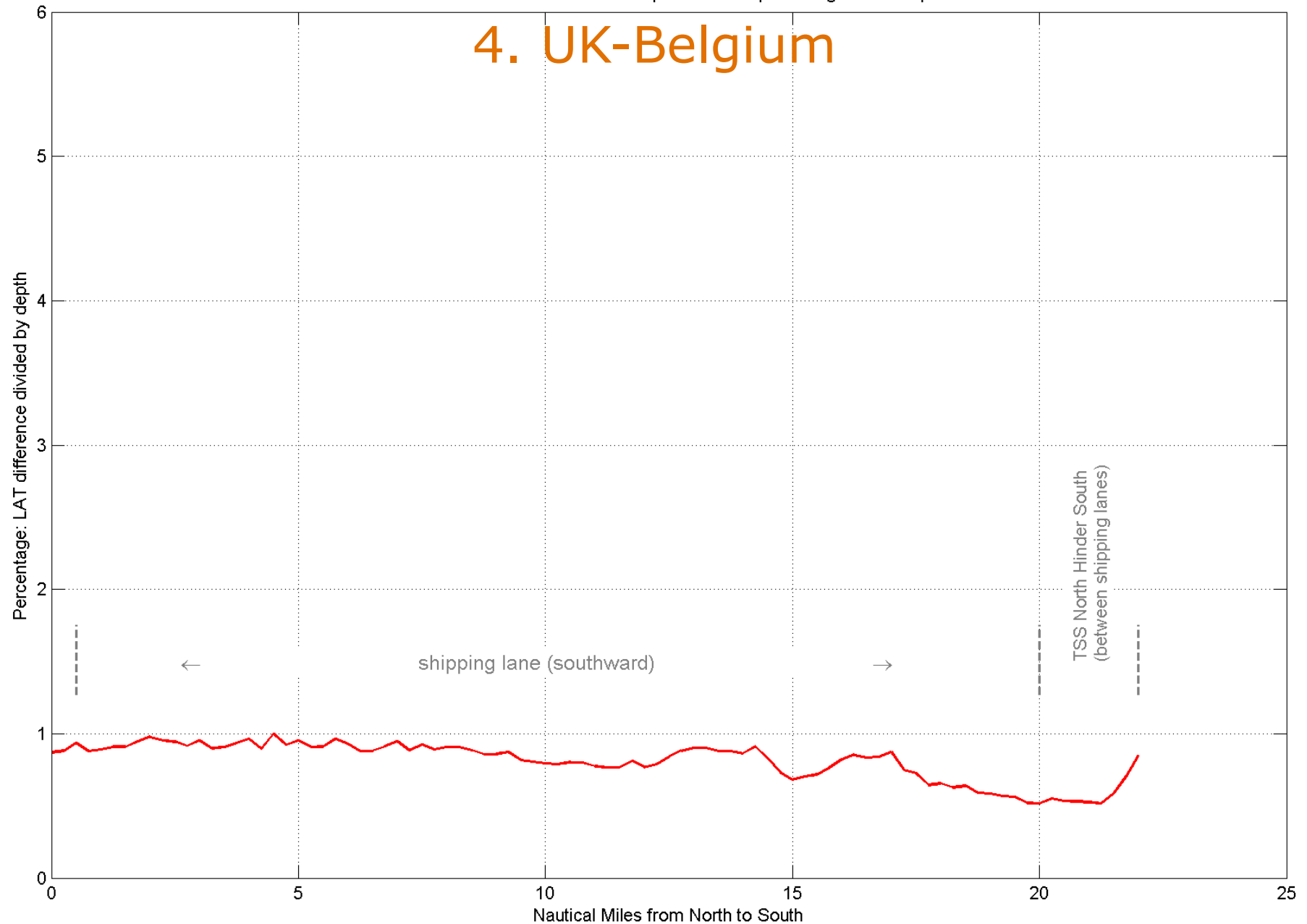
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and Belgium  
(The LAT surface of the UK is on average 0.25 m lower than the LAT surface of Belgium)

## 4. UK-Belgium



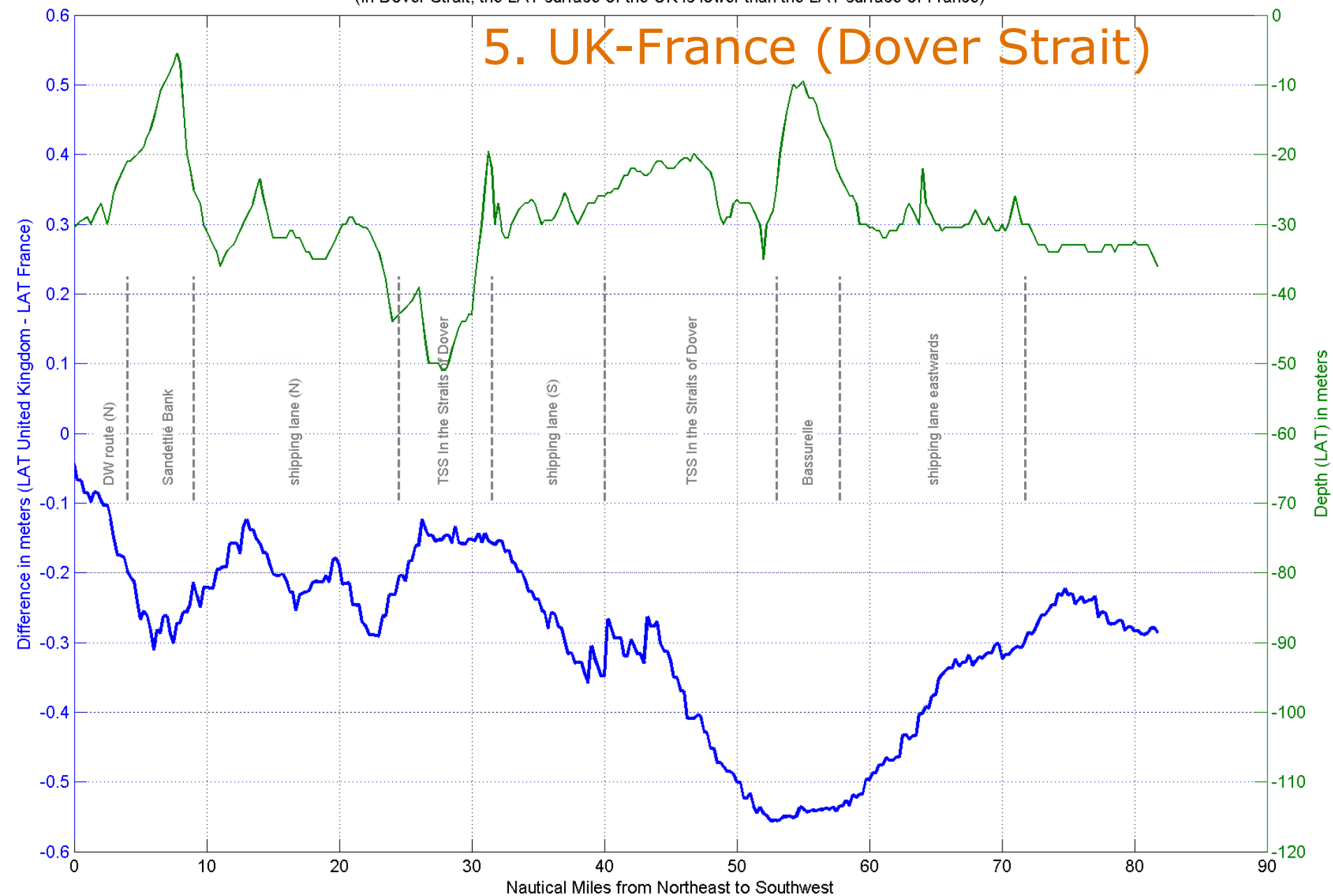
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and Belgium, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

## 4. UK-Belgium



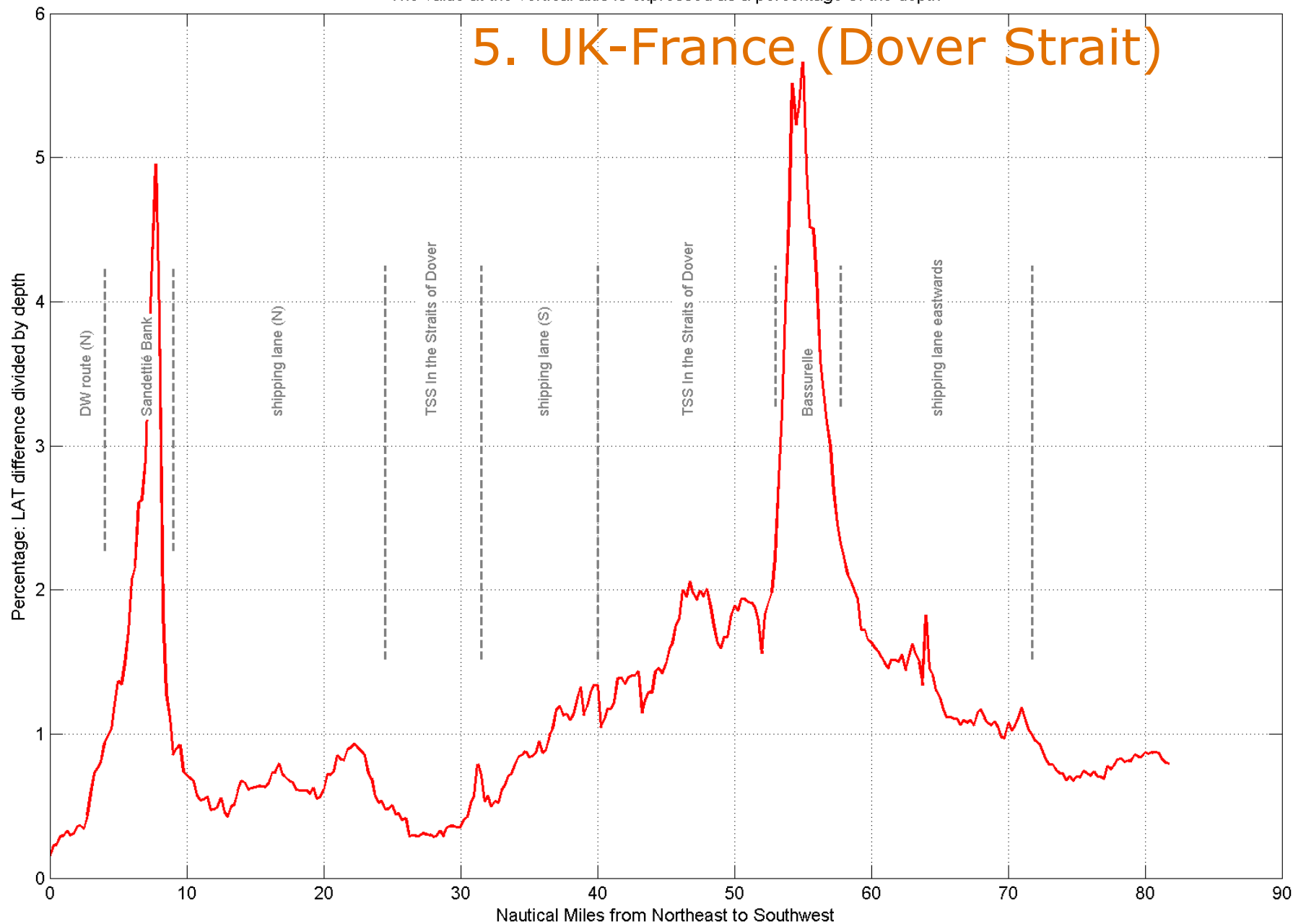
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and France in Dover Strait  
(In Dover Strait, the LAT surface of the UK is lower than the LAT surface of France)

## 5. UK-France (Dover Strait)



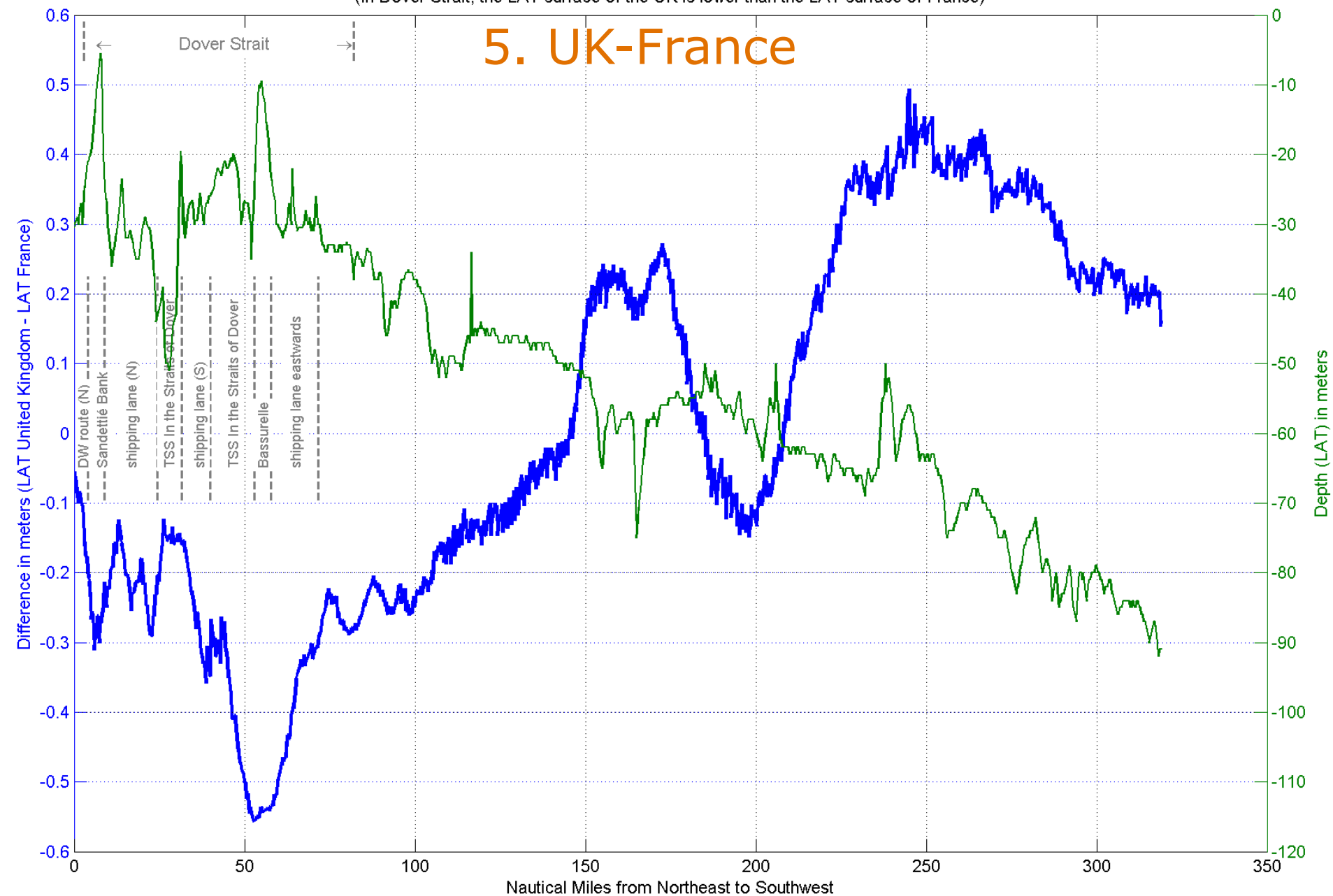
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and France in Dover Strait, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

## 5. UK-France (Dover Strait)



Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and France  
(In Dover Strait, the LAT surface of the UK is lower than the LAT surface of France)

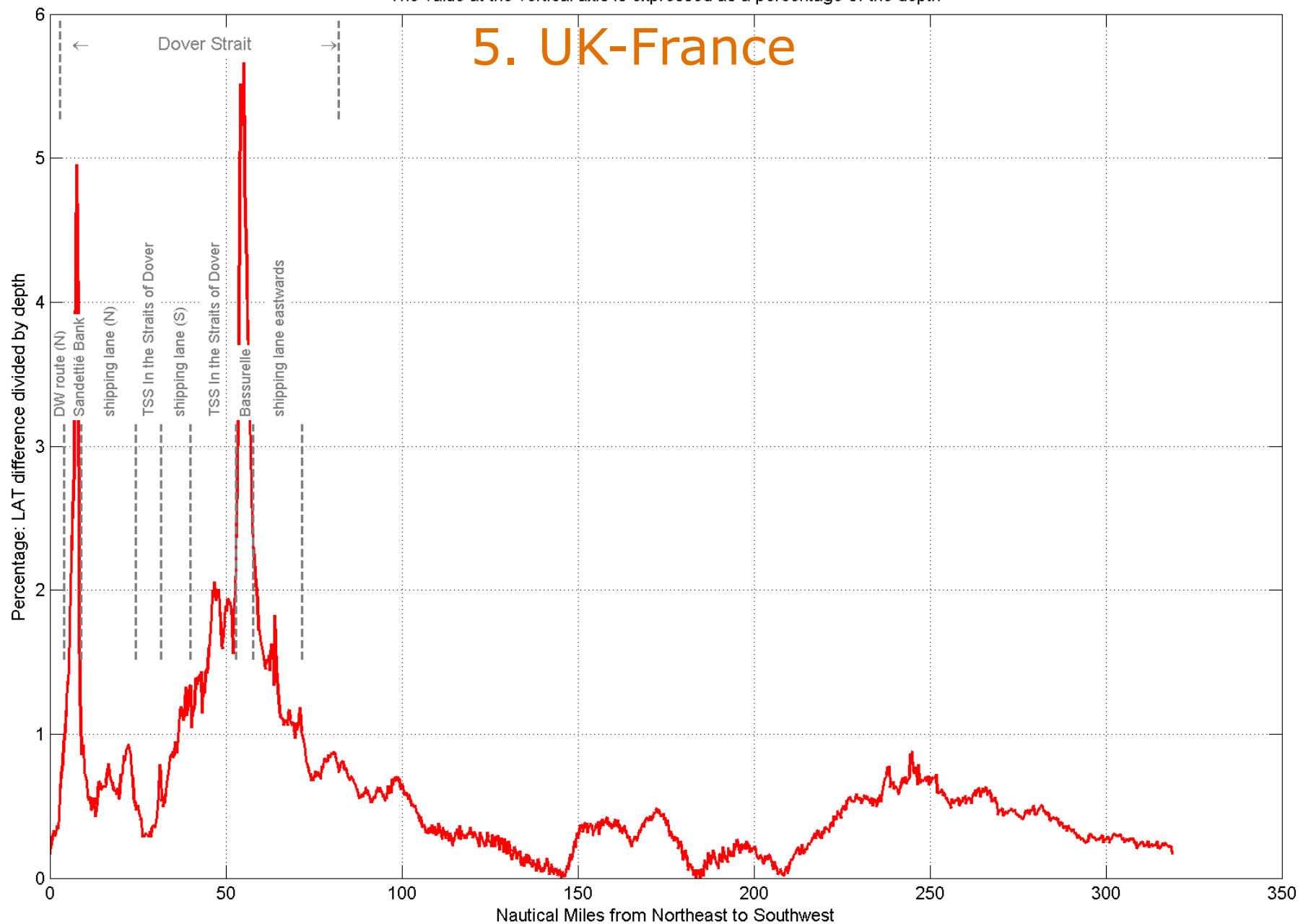
## 5. UK-France





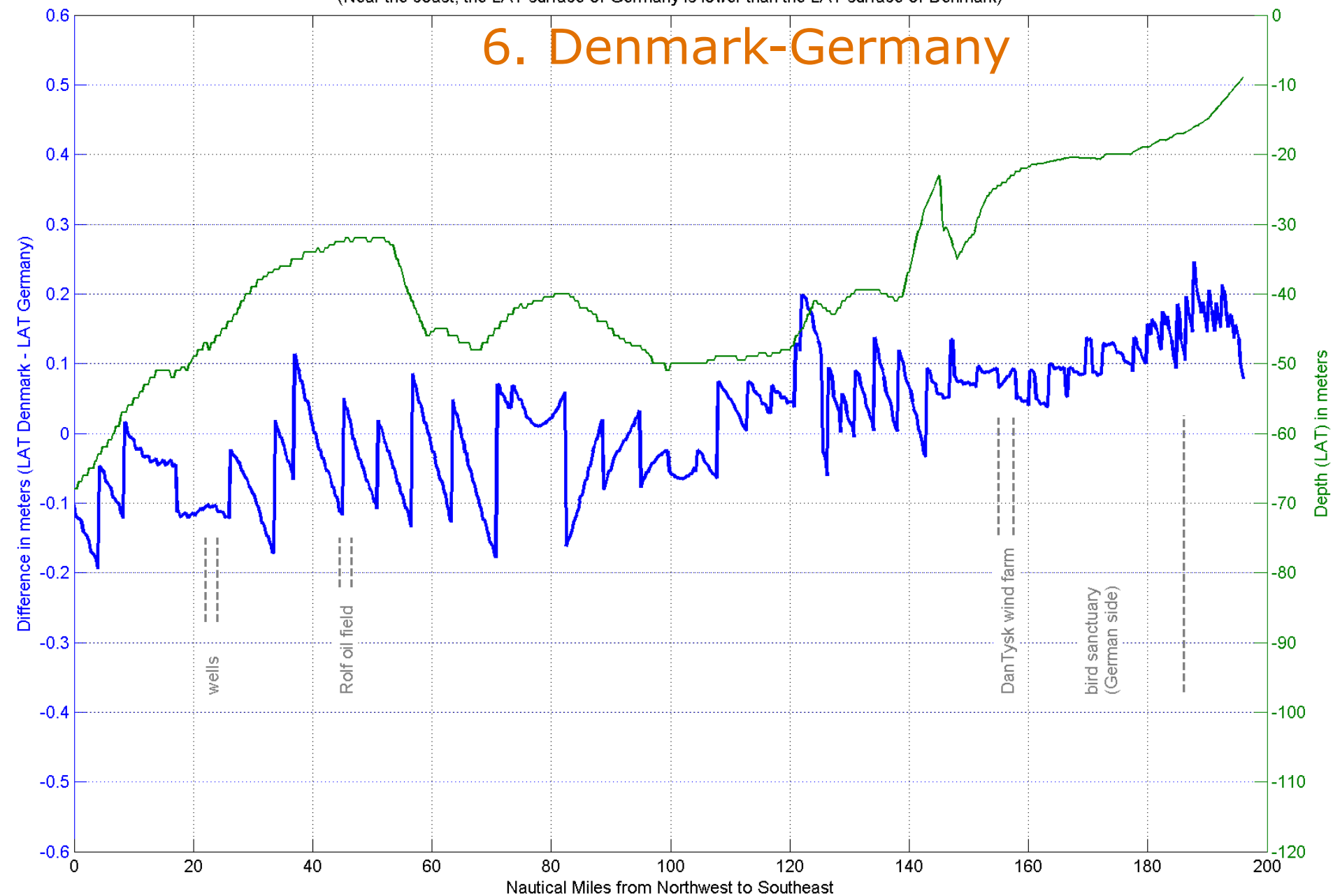
Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom and France, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

## 5. UK-France



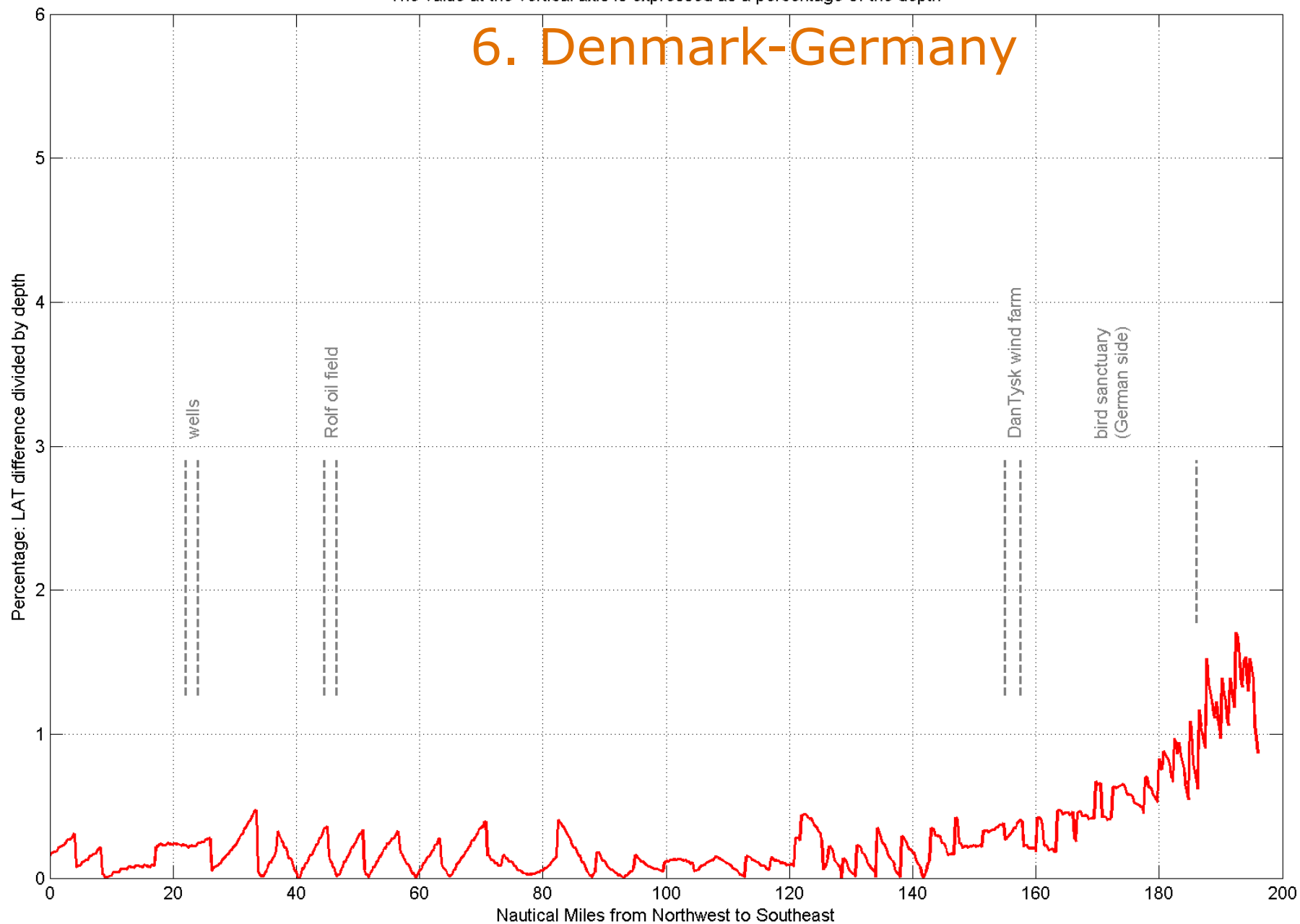
Difference in LAT-ellipsoid along the maritime boundary between Denmark and Germany  
(Near the coast, the LAT surface of Germany is lower than the LAT surface of Denmark)

## 6. Denmark-Germany



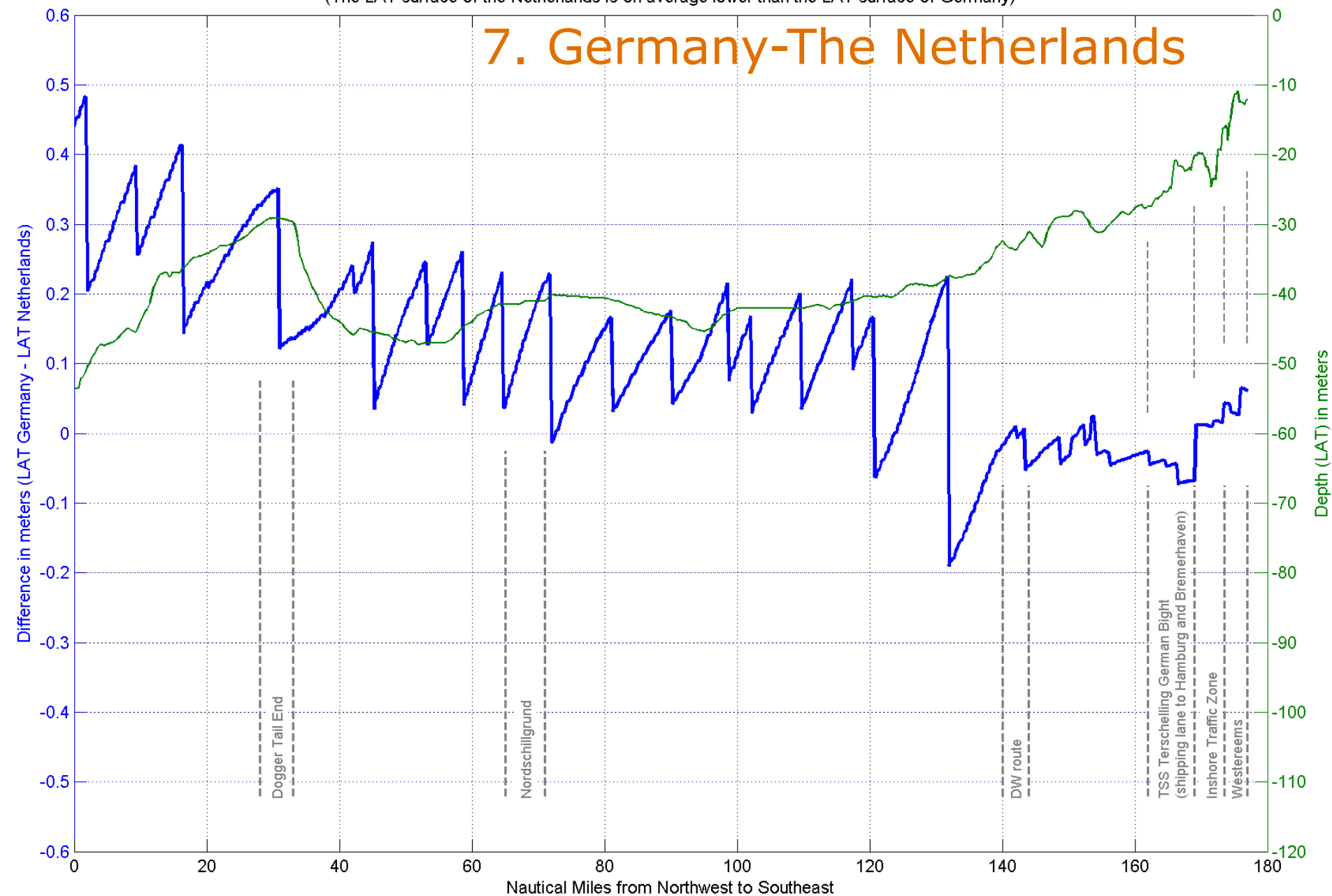
Difference in LAT-ellipsoid along the maritime boundary between Denmark and Germany, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

## 6. Denmark-Germany



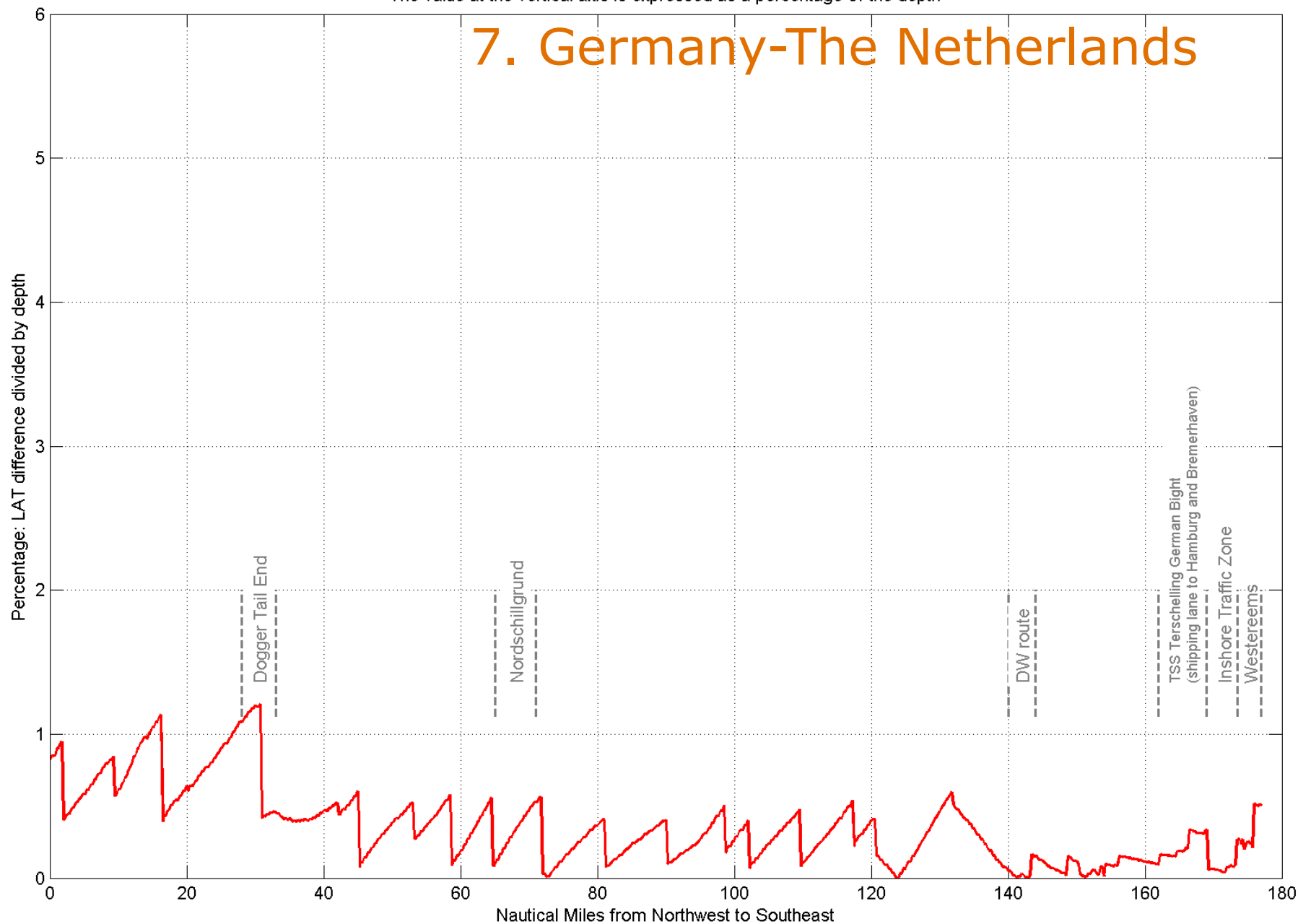
Difference in LAT-ellipsoid along the maritime boundary between Germany and the Netherlands  
(The LAT surface of the Netherlands is on average lower than the LAT surface of Germany)

## 7. Germany-The Netherlands



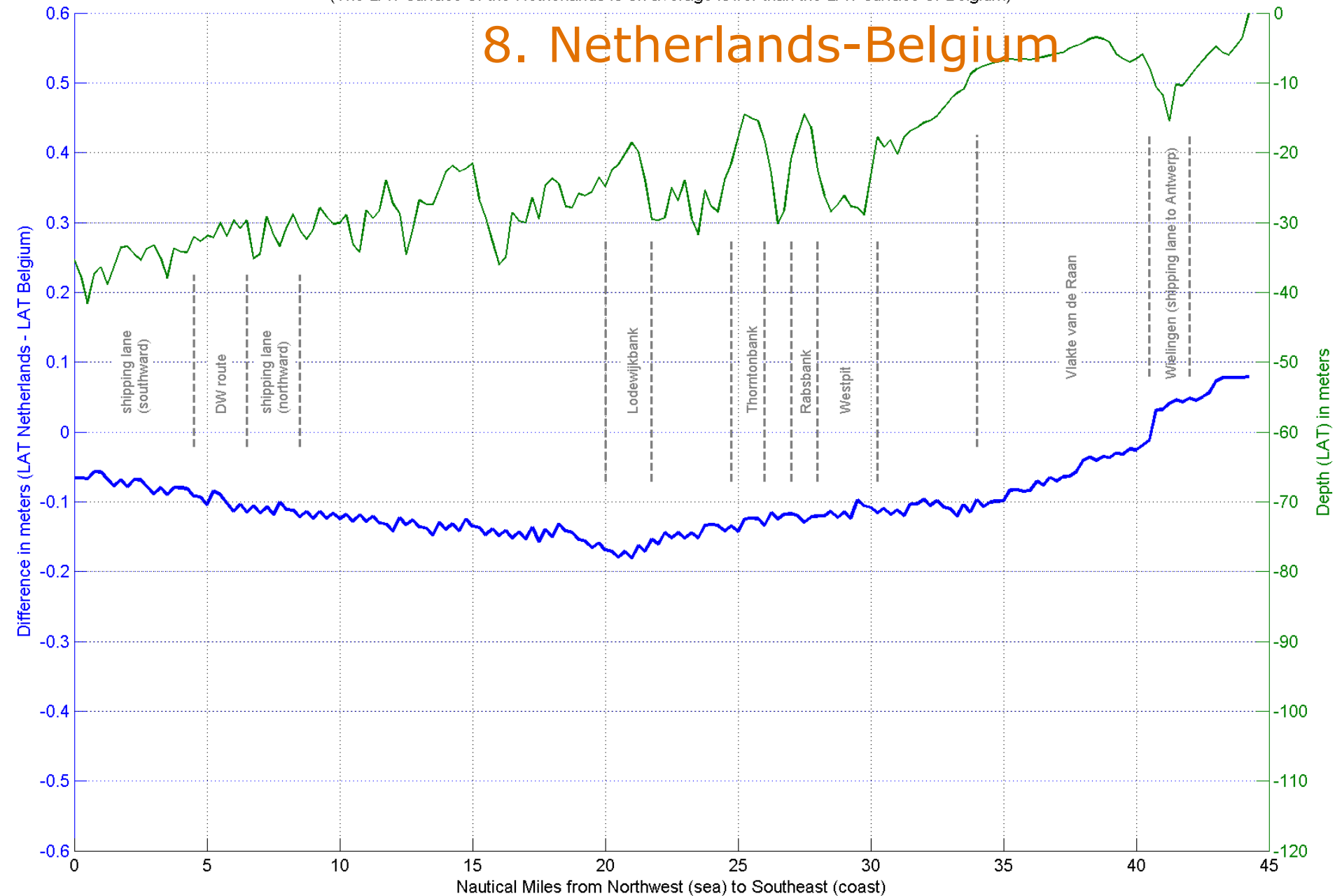
Difference in LAT-ellipsoid along the maritime boundary between Germany and the Netherlands, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

## 7. Germany-The Netherlands



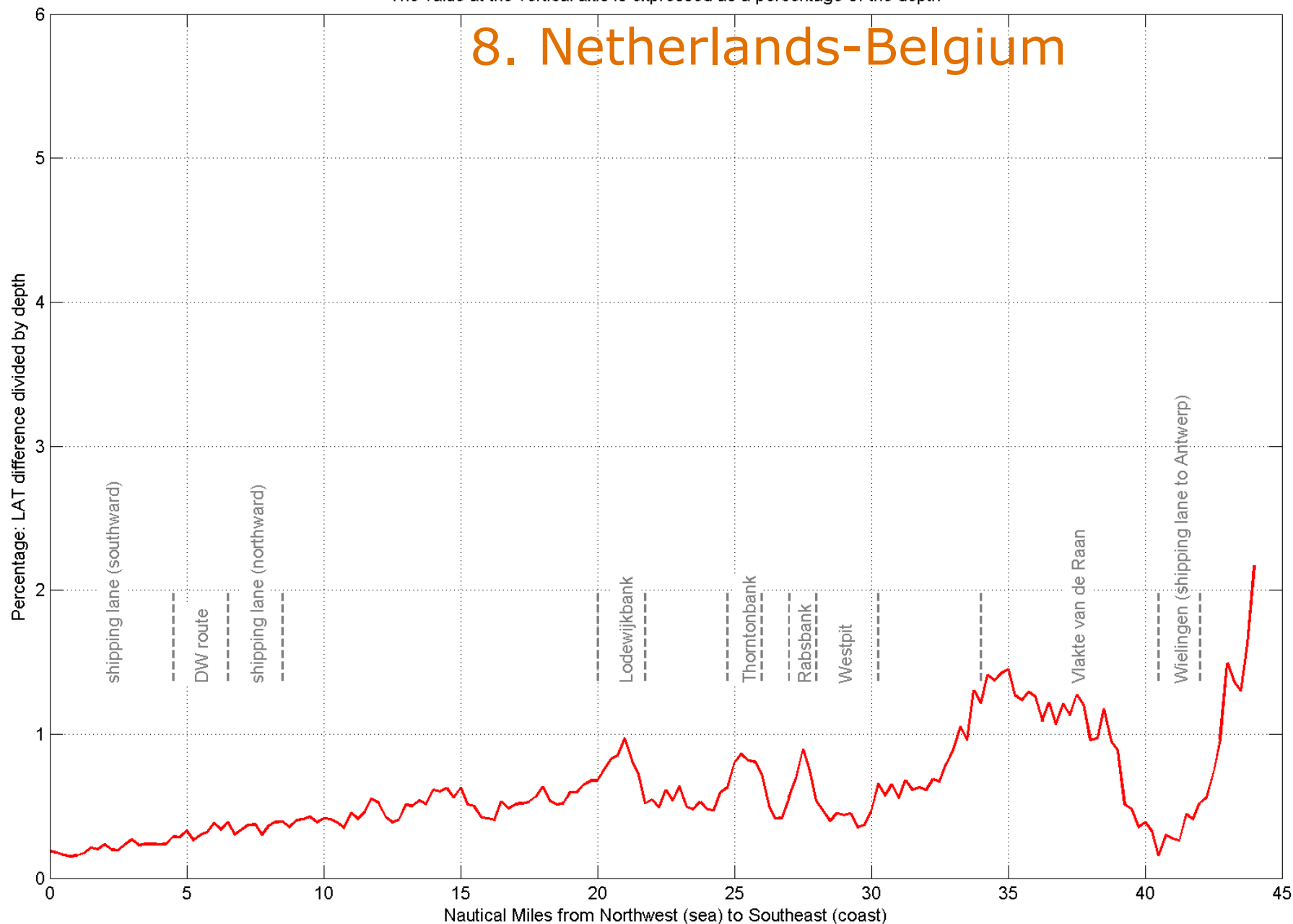
Difference in LAT-ellipsoid along the maritime boundary between Netherlands and Belgium  
(The LAT surface of the Netherlands is on average lower than the LAT surface of Belgium)

## 8. Netherlands-Belgium



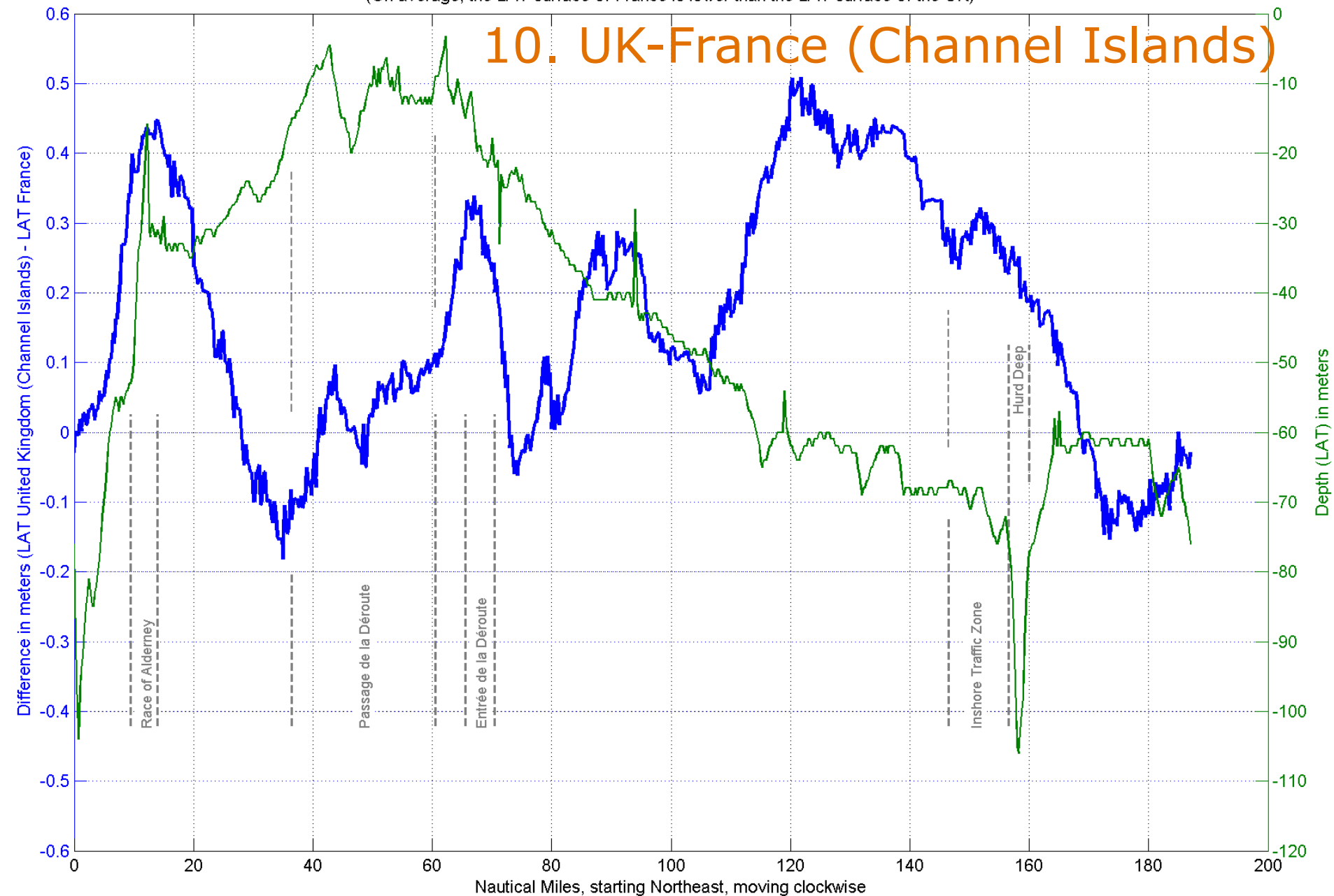
Difference in LAT-ellipsoid along the maritime boundary between the Netherlands and Belgium, divided by the depth  
The value at the vertical axis is expressed as a percentage of the depth

## 8. Netherlands-Belgium



Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom (Channel Islands) and France  
(On average, the LAT surface of France is lower than the LAT surface of the UK)

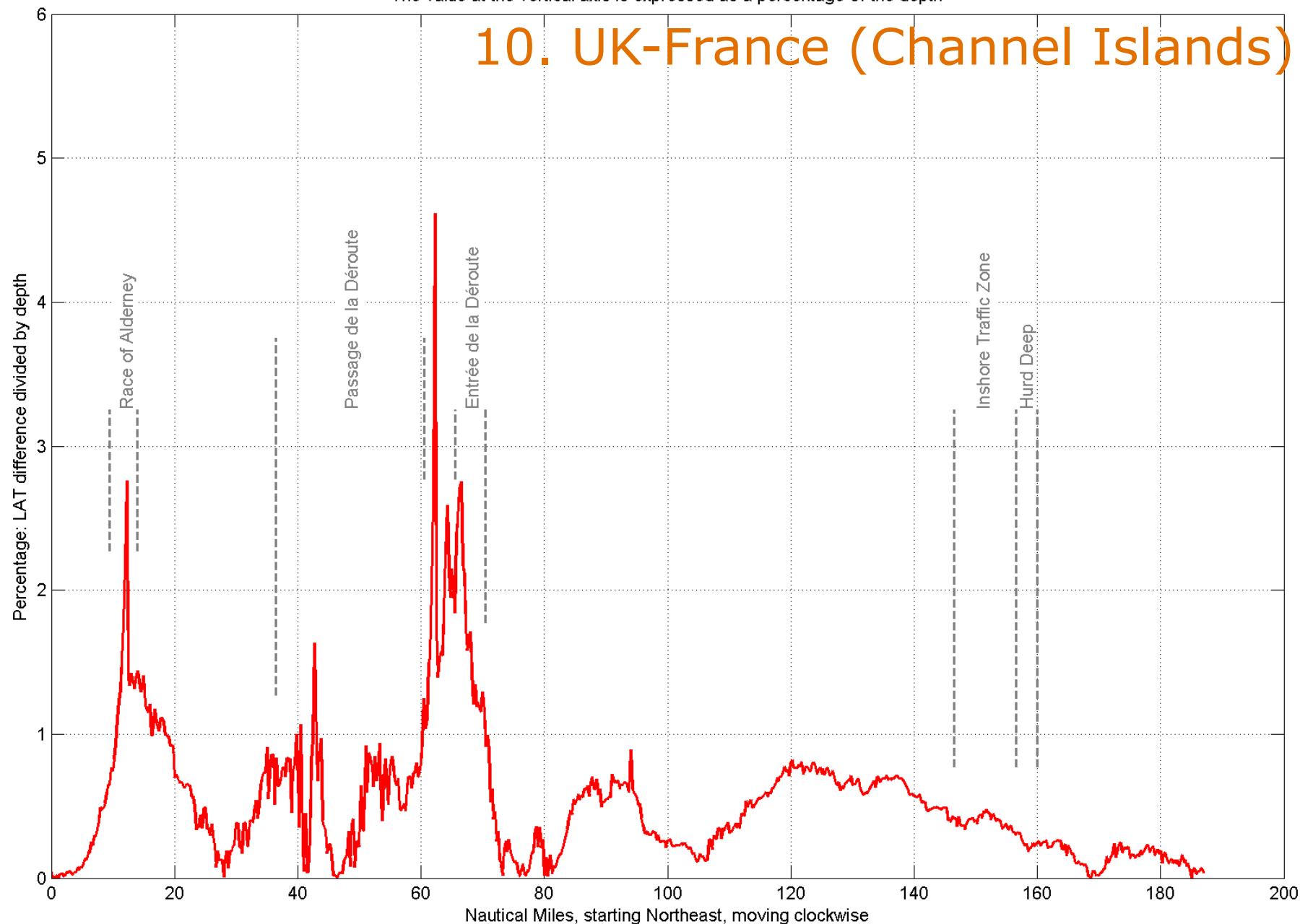
## 10. UK-France (Channel Islands)





Difference in LAT-ellipsoid along the maritime boundary between the United Kingdom (Channel Islands) and France  
The value at the vertical axis is expressed as a percentage of the depth

## 10. UK-France (Channel Islands)





## Status differences at all boundaries wrt LAT - as decided at NSHC TWG in March 2016

	BE	DK	FR	GE	NL	NO	UK	SW	IC
BE									
DK	1								
FR	2	1							
GE	1	4	1						
NL	4	1	1	4					
NO	1	2*	1	1	1				
UK	3	3	4	3	3	2*			
SW	1	2*	1	1	1	2*	1		
IC	1	1	1	1	1	1	1	1	

At WP 20/02 the following options are identified:

- |   |   |
|---|---|
| 1. no common LAT boundary                           | 2*. differences on a common boundary, not checked, different CD   |
| 2. differences on a common boundary but not checked | 3. differences on a common boundary checked to be not significant |
|   | 4. differences on a common boundary checked to need to be reduced |



## Conclusion LAT-ellipsoid

- Differences LAT-ellipsoid between nations are present.
- The largest differences are measured (up to 0.55 m) in the English Channel and particularly in Dover Strait.