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An Introduction to Technical Aspects of Maritime Boundary Delimitation
held in Durham on 11-13 September 2023.

Questions concerning use of this presentation should be directed in the first instance to:

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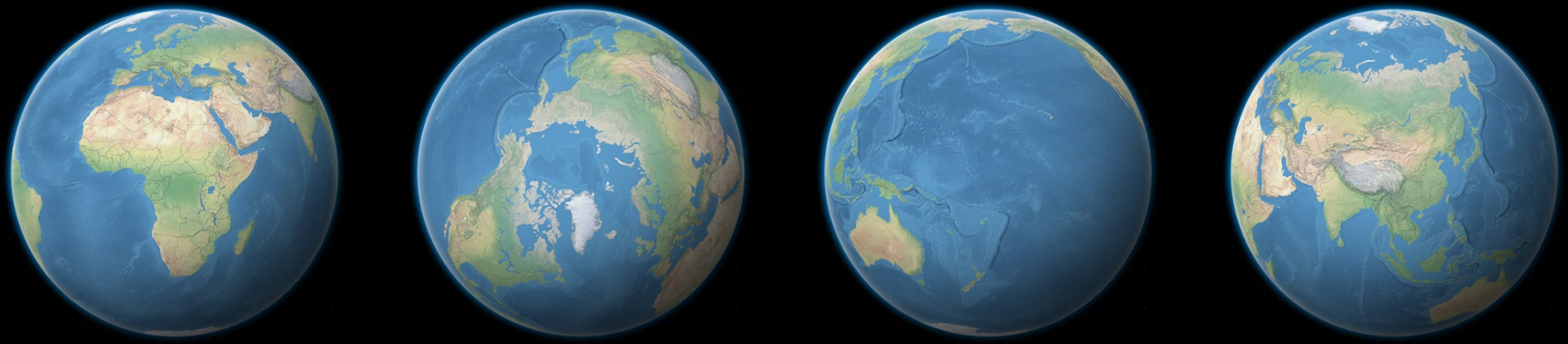
Thank you.

IBRU

Durham University

Do you know where you are?

A beginner's guide to geodesy and coordinate systems



Martin Pratt

bordermap consulting

Geographical intelligence for international boundary-making and dispute resolution

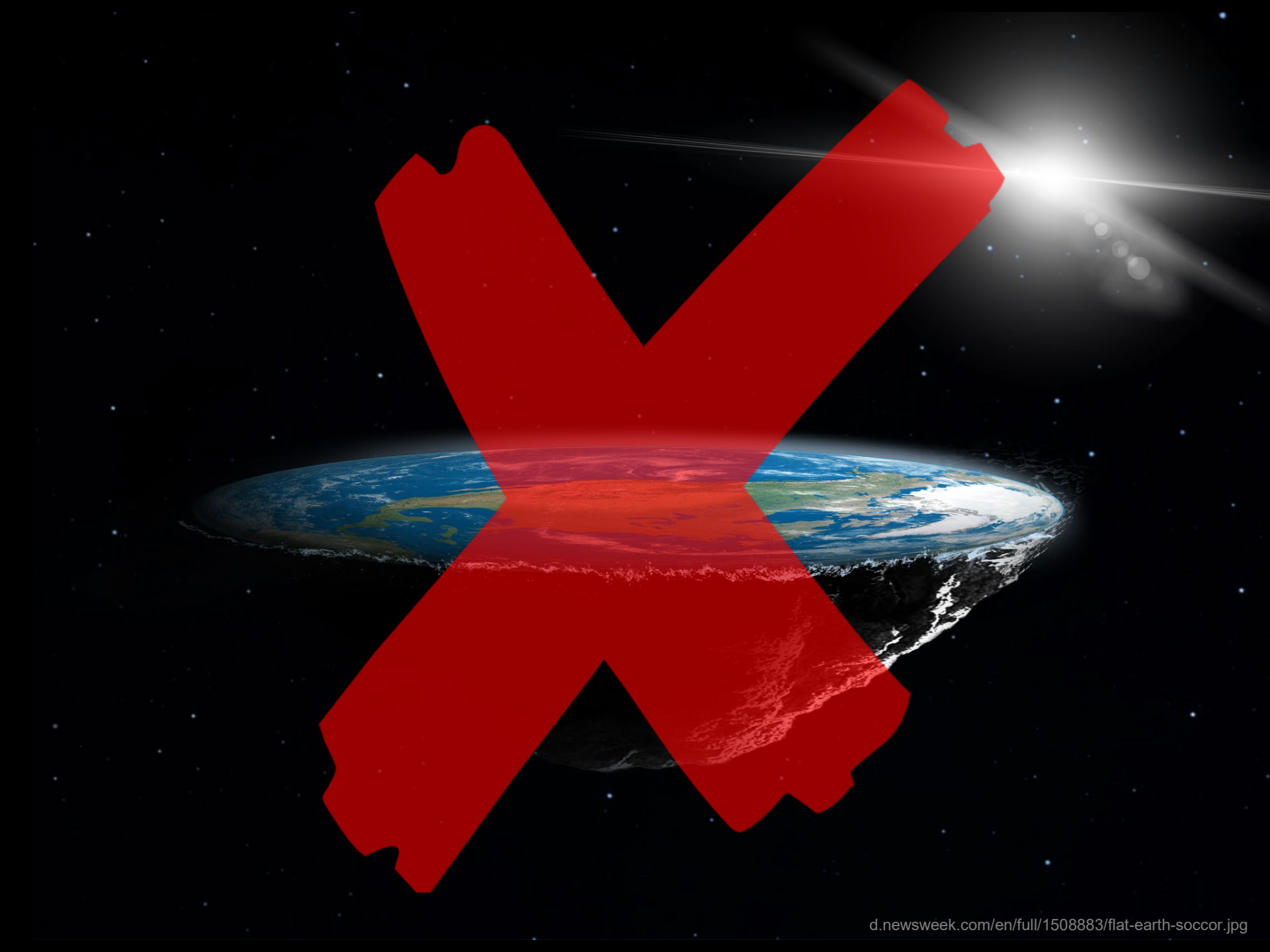
A technical perspective on maritime delimitation

Aim

- An equitable division of maritime space.
- The unambiguous definition of a line that can be located on the surface of the earth with sufficient accuracy for practical needs.

Requirements

- Coordinates of turning points referred to an appropriate geodetic reference system (or systems).
- Definition of the nature of the lines connecting turning points.

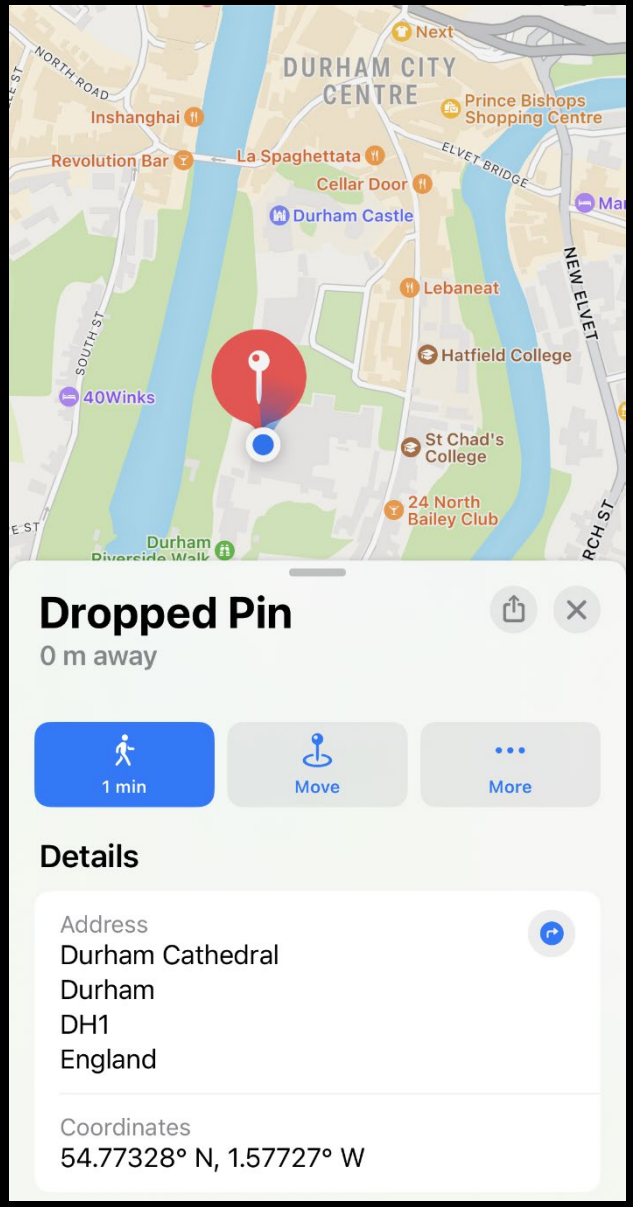


d.newsweek.com/en/full/1508883/flat-earth-soccor.jpg

en.wikipedia.org/wiki/File:Durham_MMB_02_Cathedral.jpg

Google Earth

Apple Maps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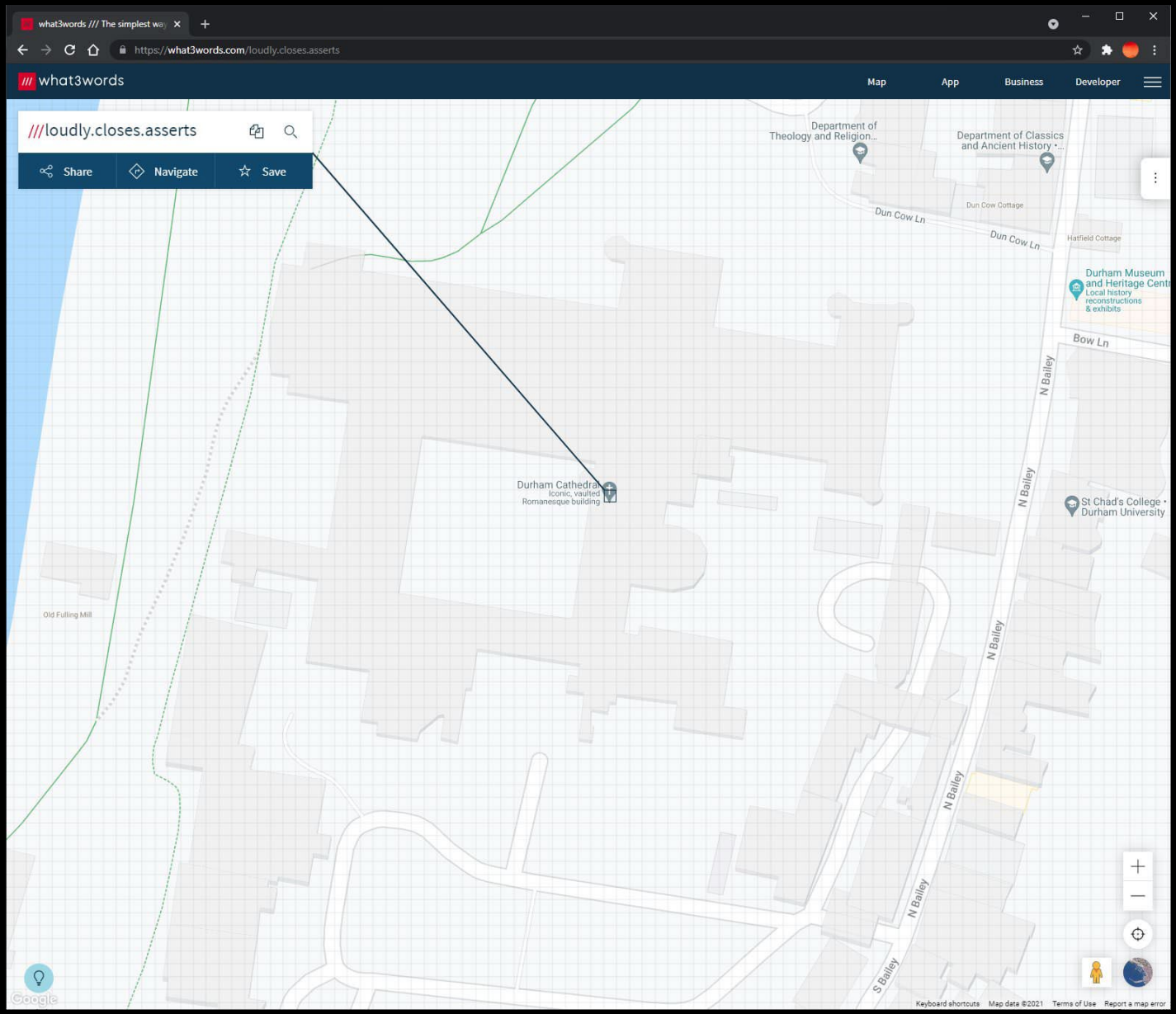
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Durham Museum and Heritage Centre
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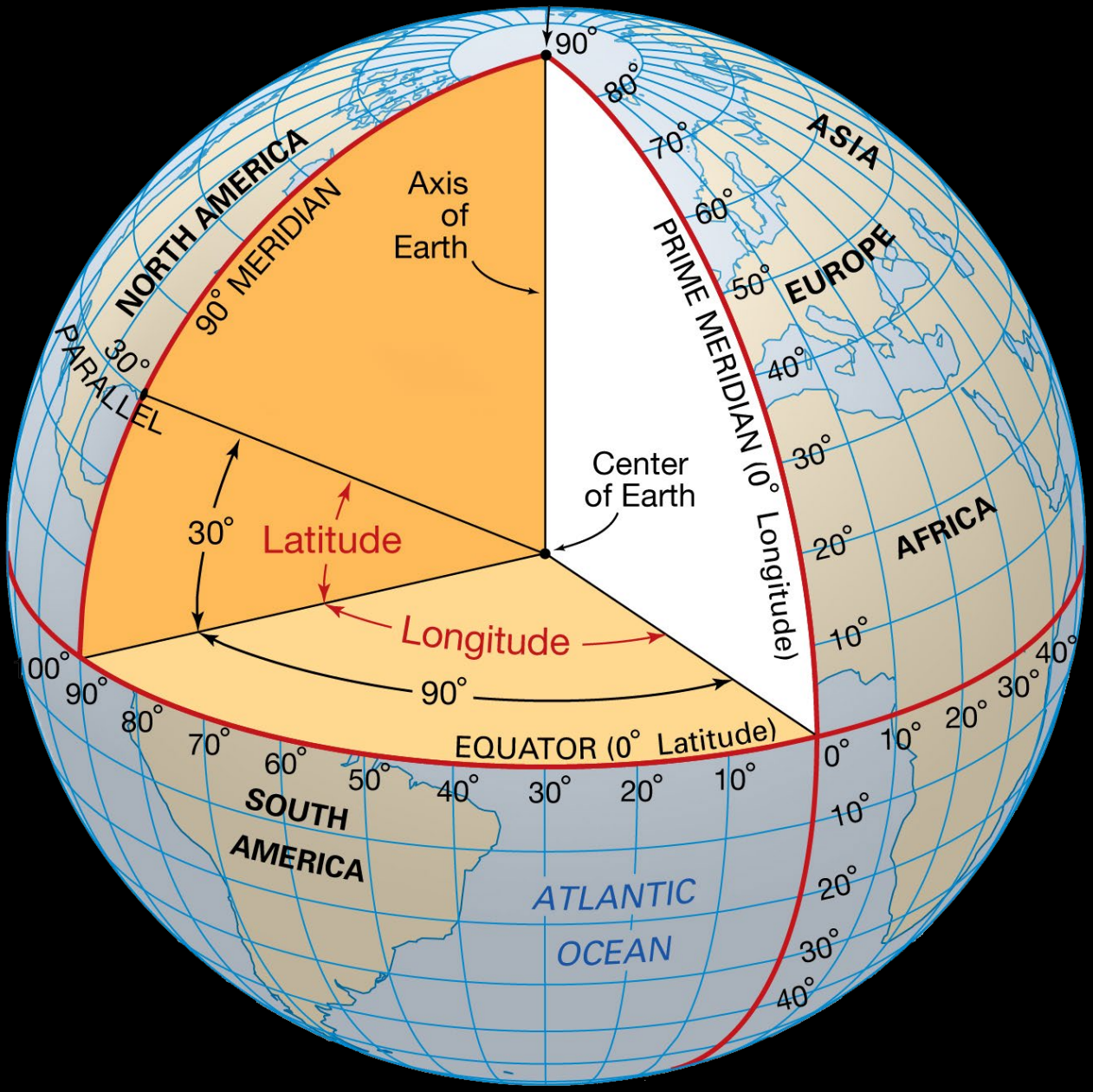
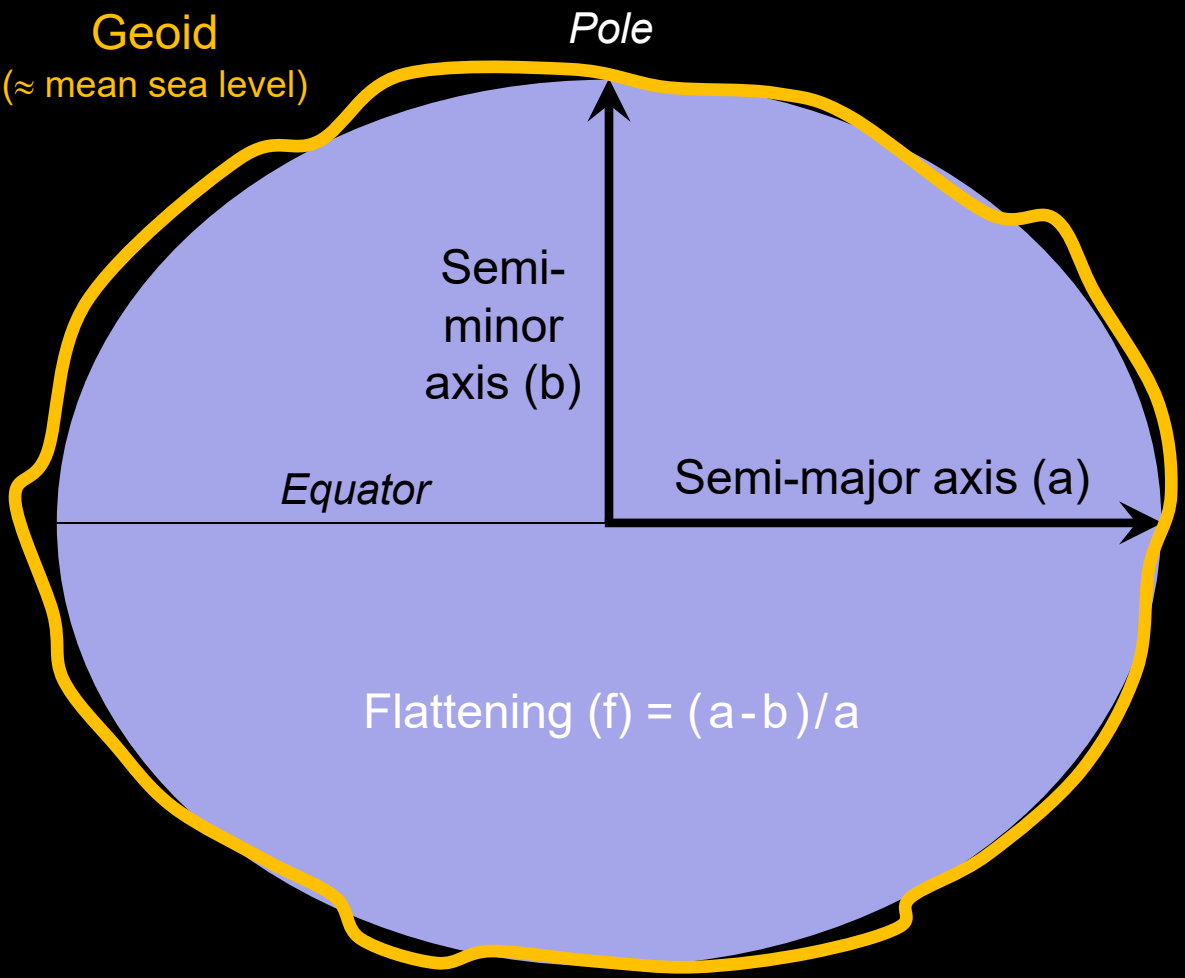


Modelling the earth: ellipsoids and datums



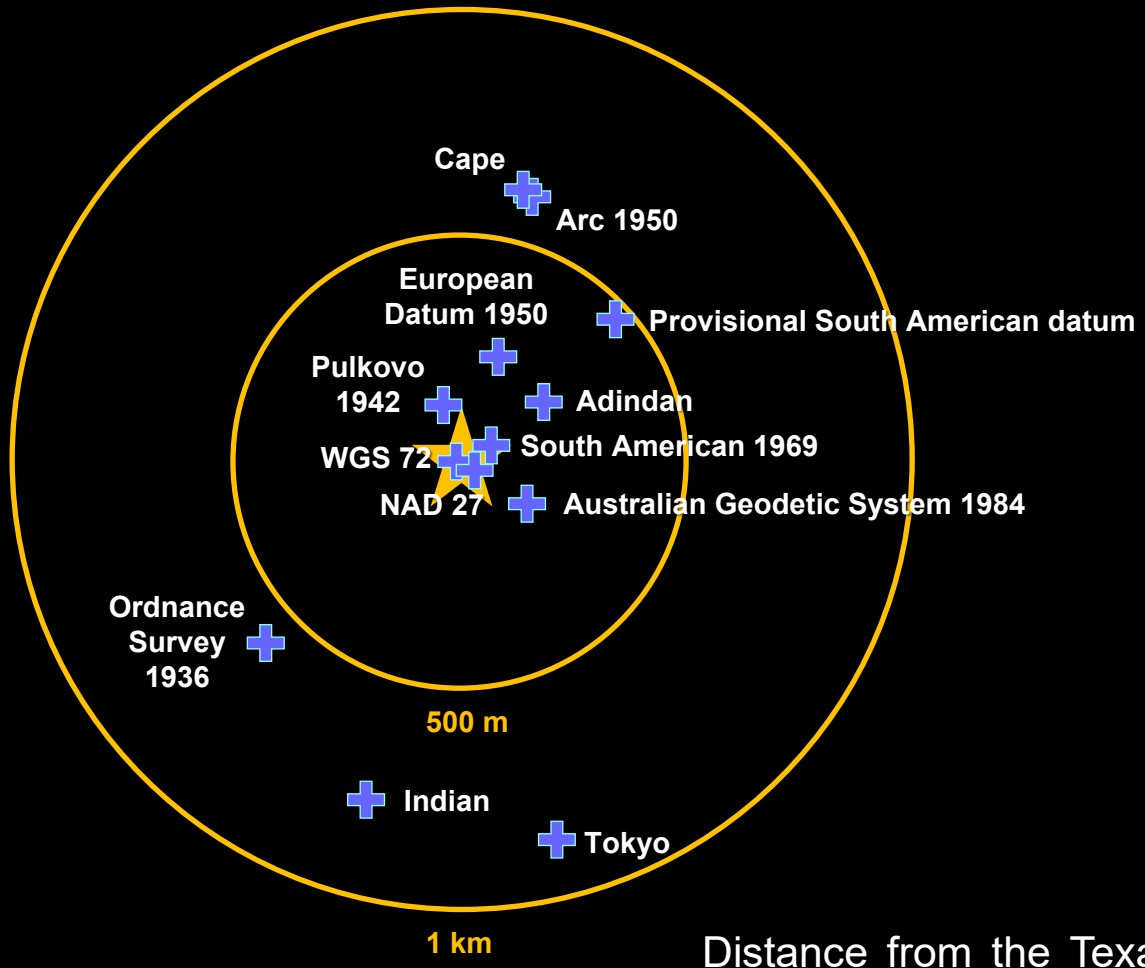
Local datums (origin at location on surface) e.g. NAD 27, Kertau, OSGB 36

Geocentric datums (origin at earth's centre of mass) e.g. WGS 84, NAD 83

Datums 101

- A geodetic datum is a mathematical model which defines how coordinates are measured on an ellipsoid.
- The latitude and longitude values of a point on the surface of the earth vary from datum to datum.
- Unless a datum is specified, you cannot be certain which point on the surface of the earth to which a set of coordinates is referring.
- Using the wrong datum can create an error of several hundred metres.
- Positions referring to one datum can usually be converted to another datum, but you must know the original datum.

The impact of the choice of datum



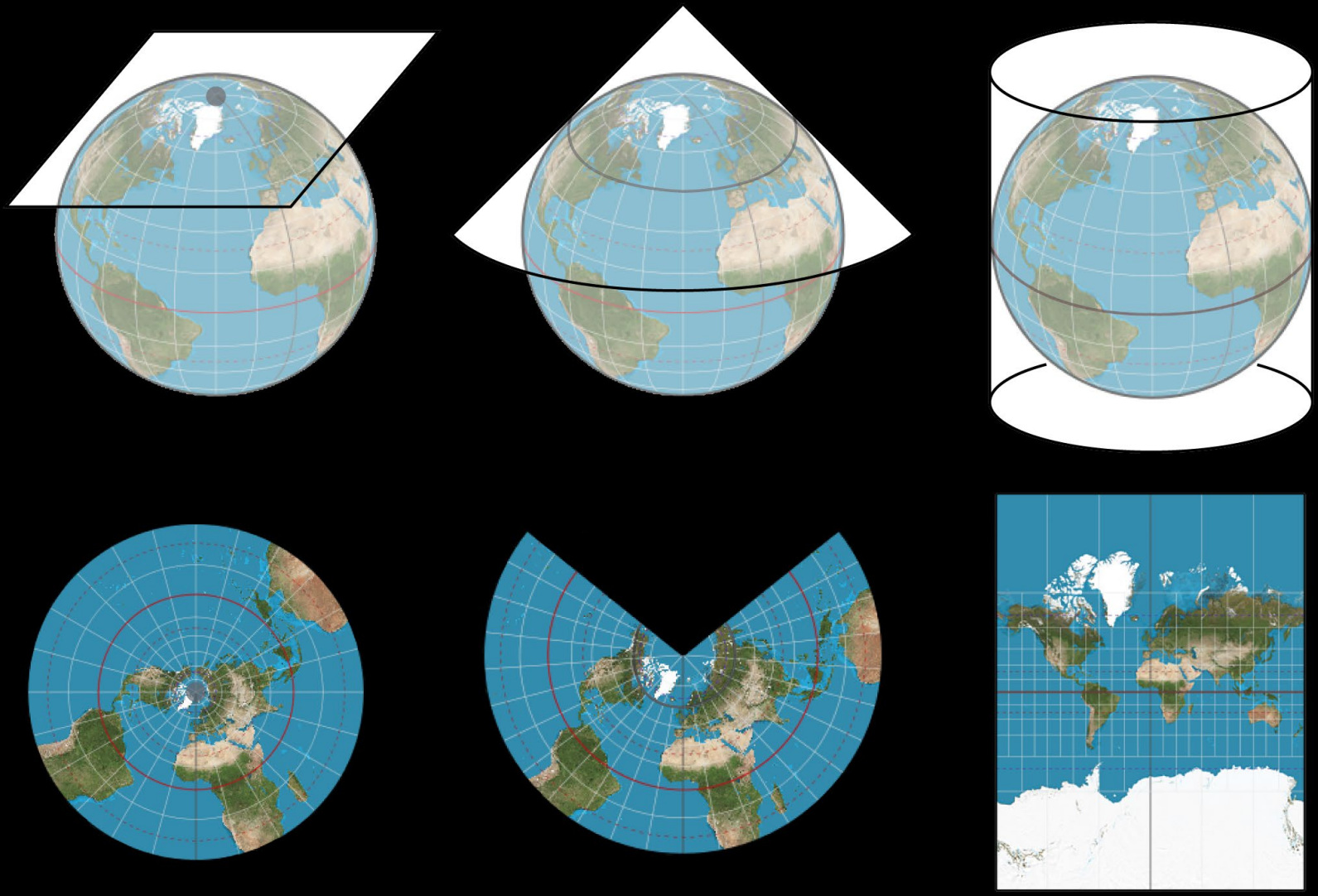
Distance from the Texas Capital Dome of the WGS 84 coordinates of the dome referred to different datums

Original graphic: Peter H. Dana

Map projections

123rf.com/photo_389274_glass-globe-in-orange-peel.html

Map projections



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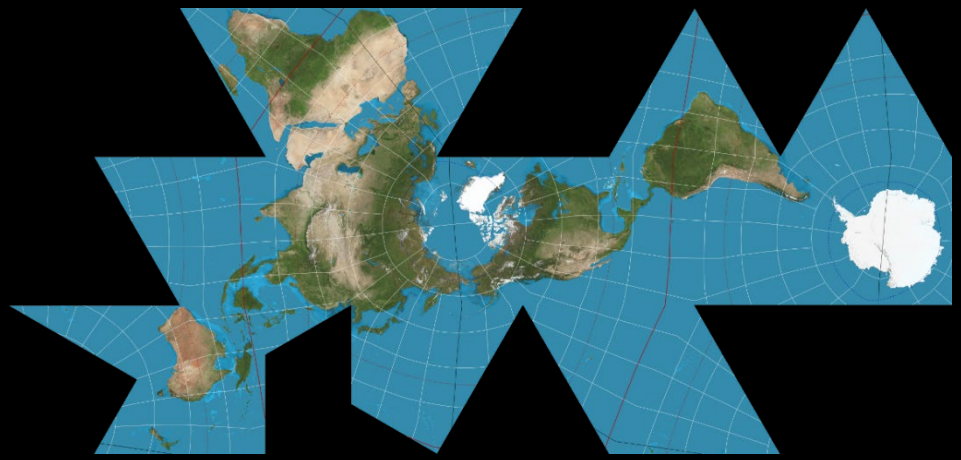
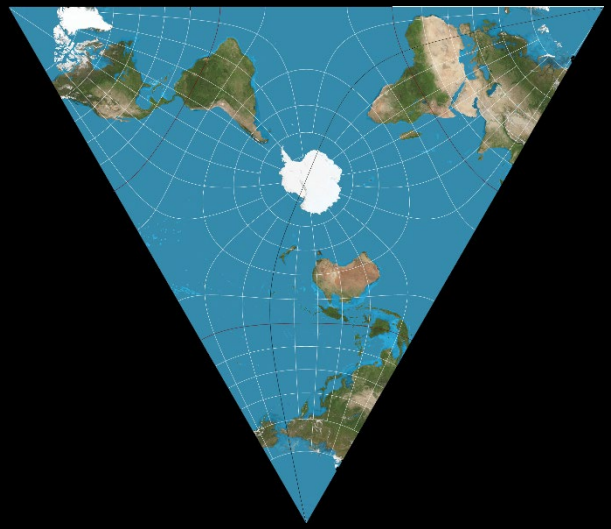
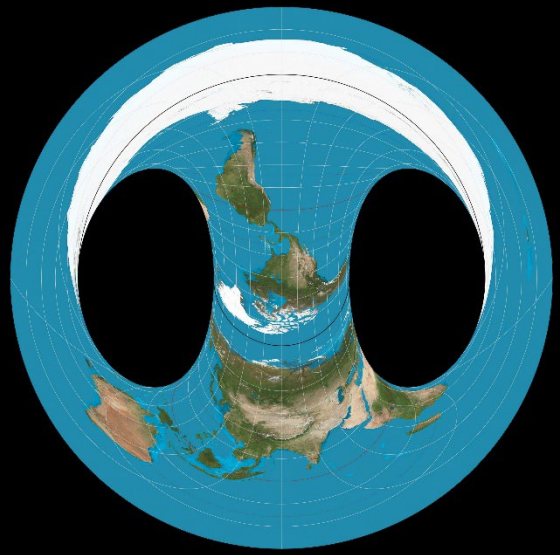
Map projections

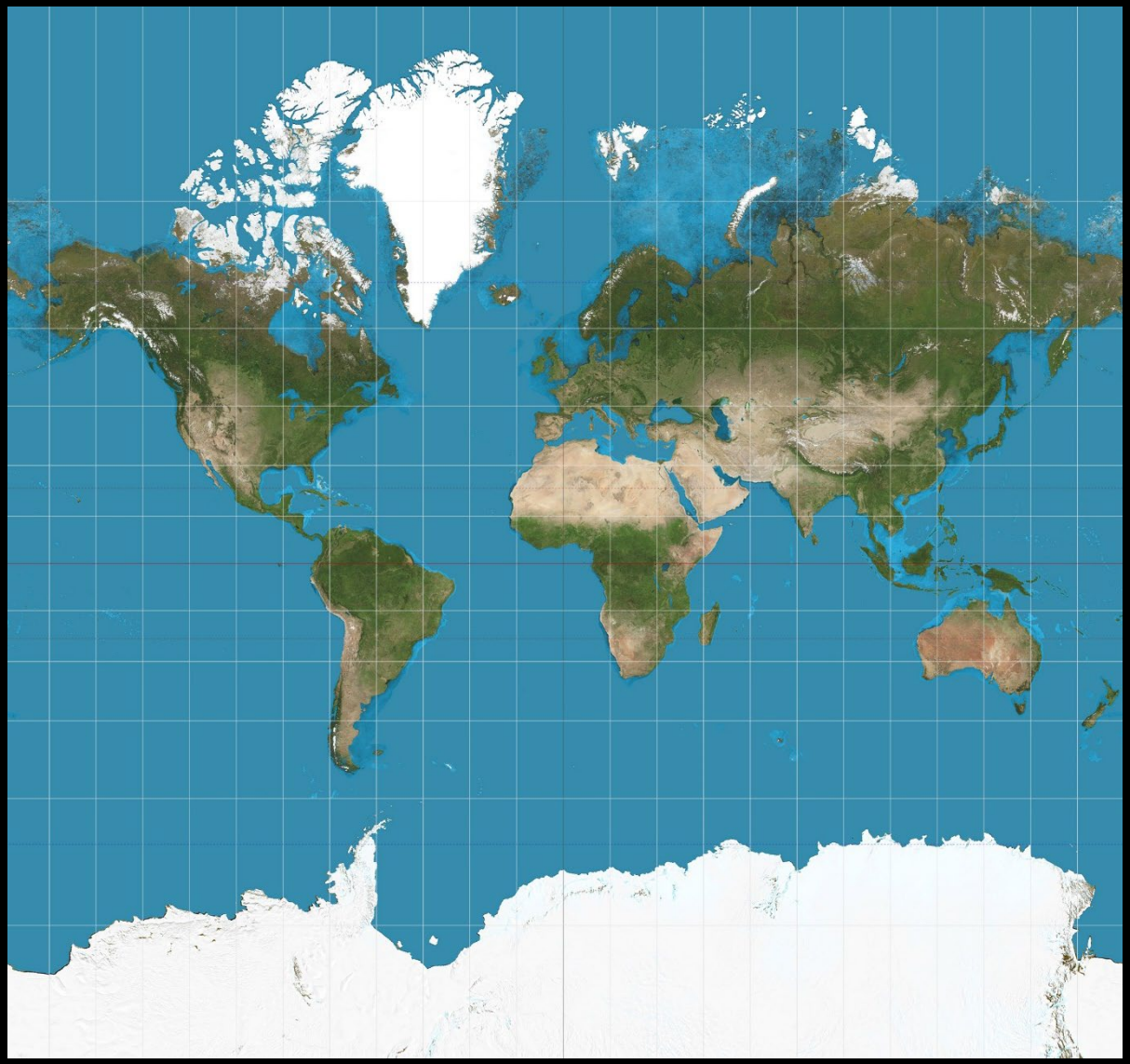






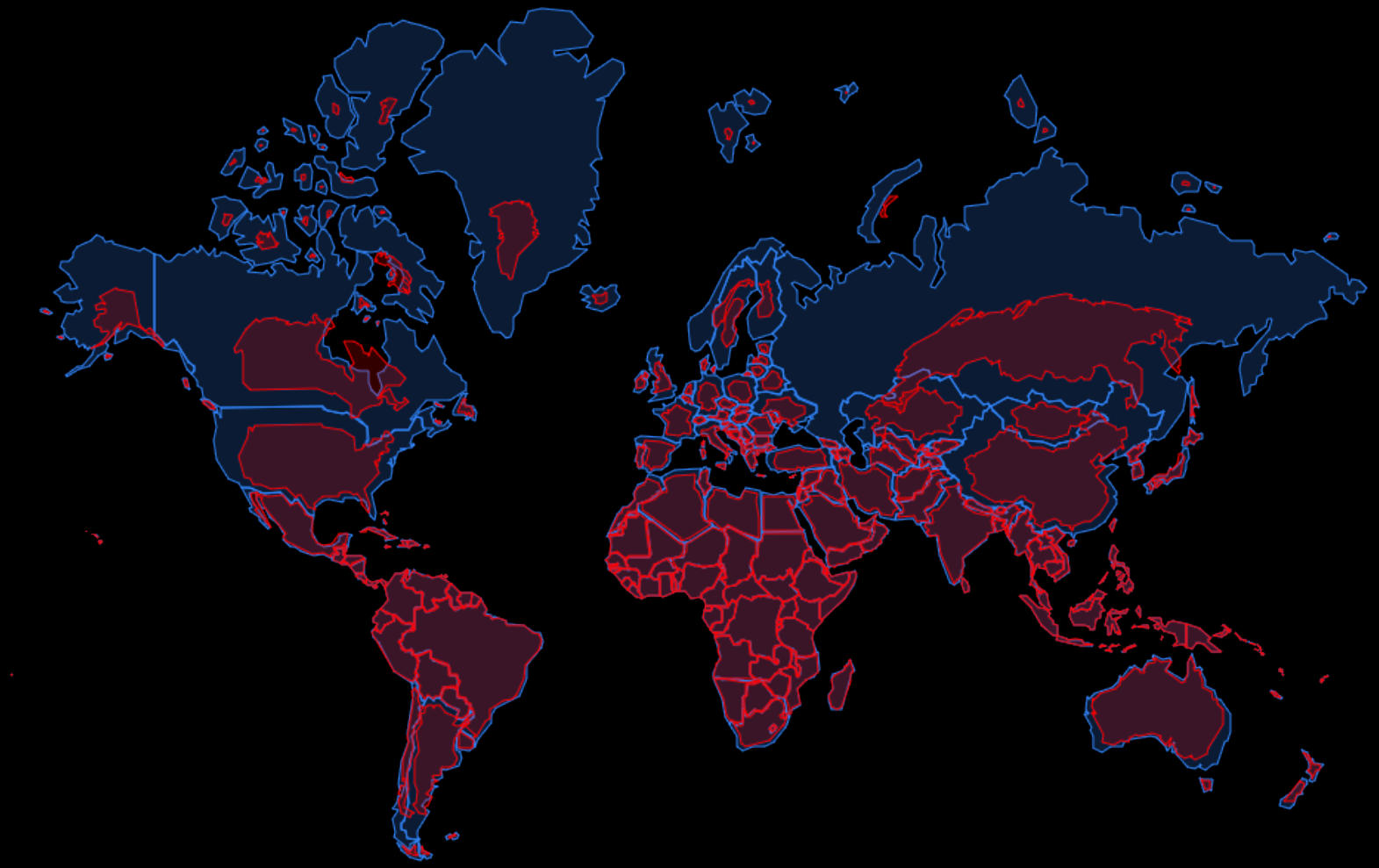
https://en.wikipedia.org/wiki/List_of_map_projections

Mercator projection

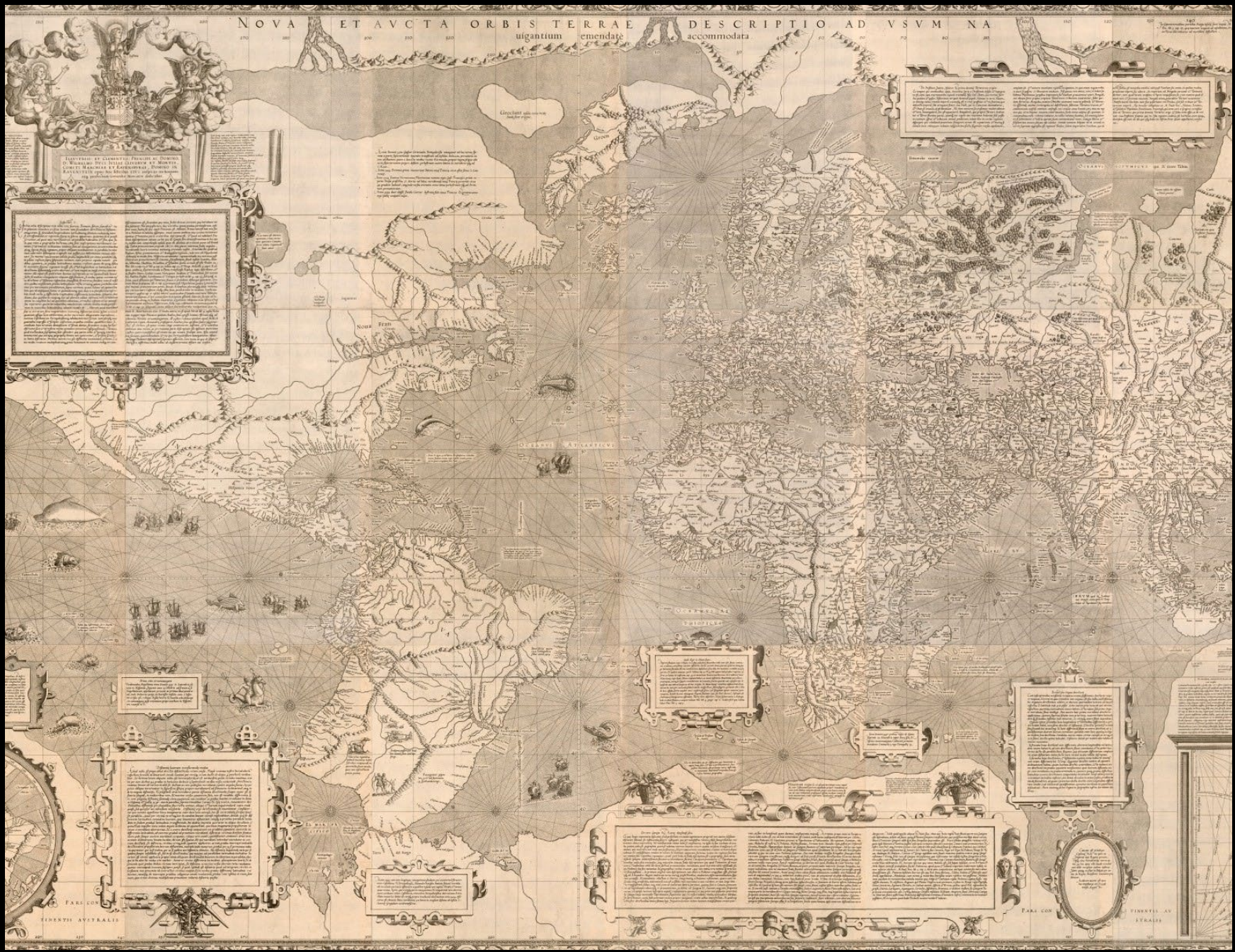


upload.wikimedia.org/wikipedia/commons/7/73/Mercator_projection_Square.jpg

Mercator projection and country size



engaging-data.com/country-sizes-mercator



‘Straight’ lines: loxodromes and geodesics

- A straight line on Mercator projection map or chart represents a line of constant compass bearing known as a loxodrome or rhumb line. This characteristic explains the use of the Mercator projection for most navigational charts.

- The line of shortest distance between two points on a spheroid is known a geodesic. A geodesic plots as a curve on a Mercator projection chart.

- The difference between a loxodrome and a geodesic increases with latitude.

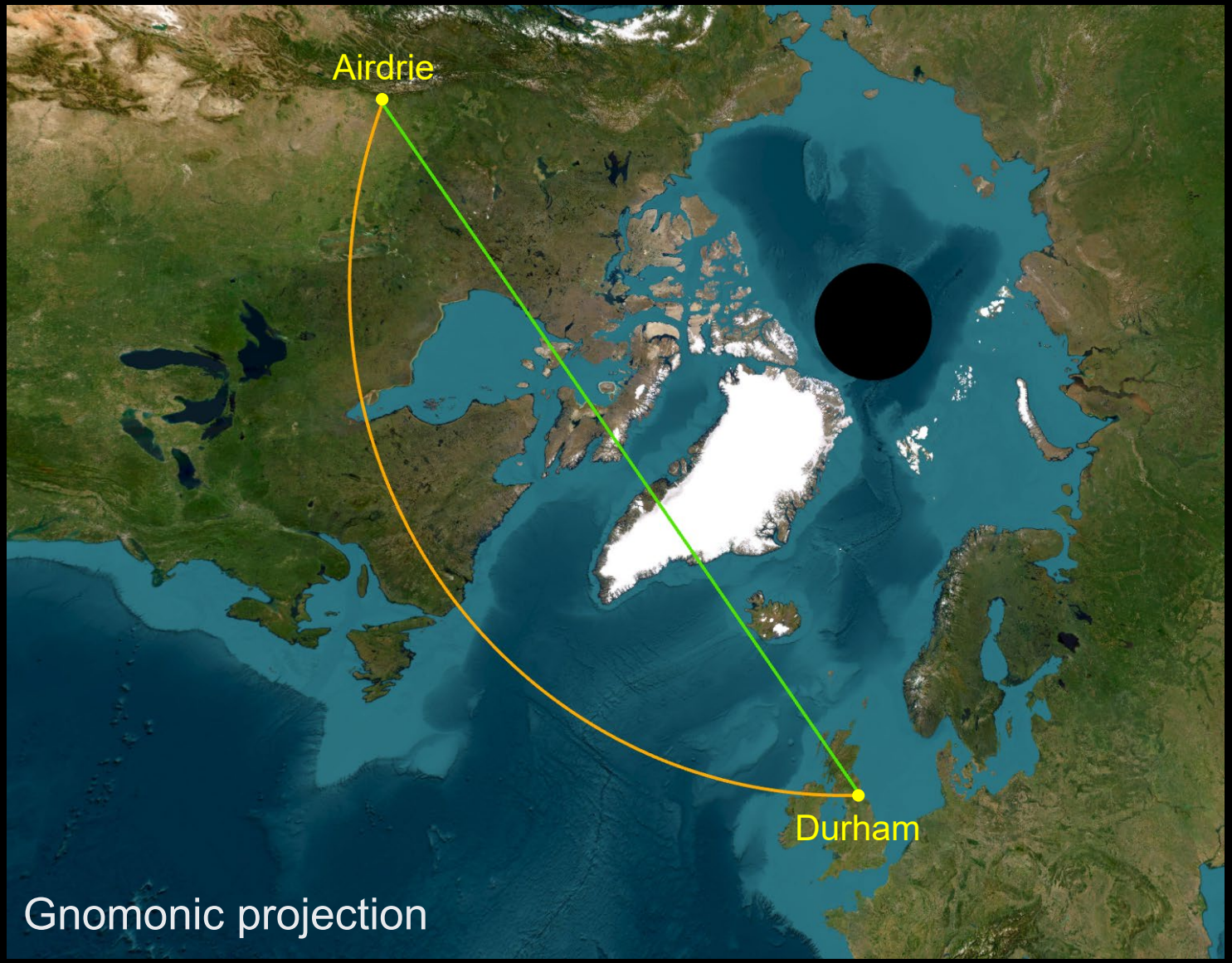
‘Straight’ lines: loxodromes and geodesics

Mercator projection

‘Straight’ lines: loxodromes and geodesics

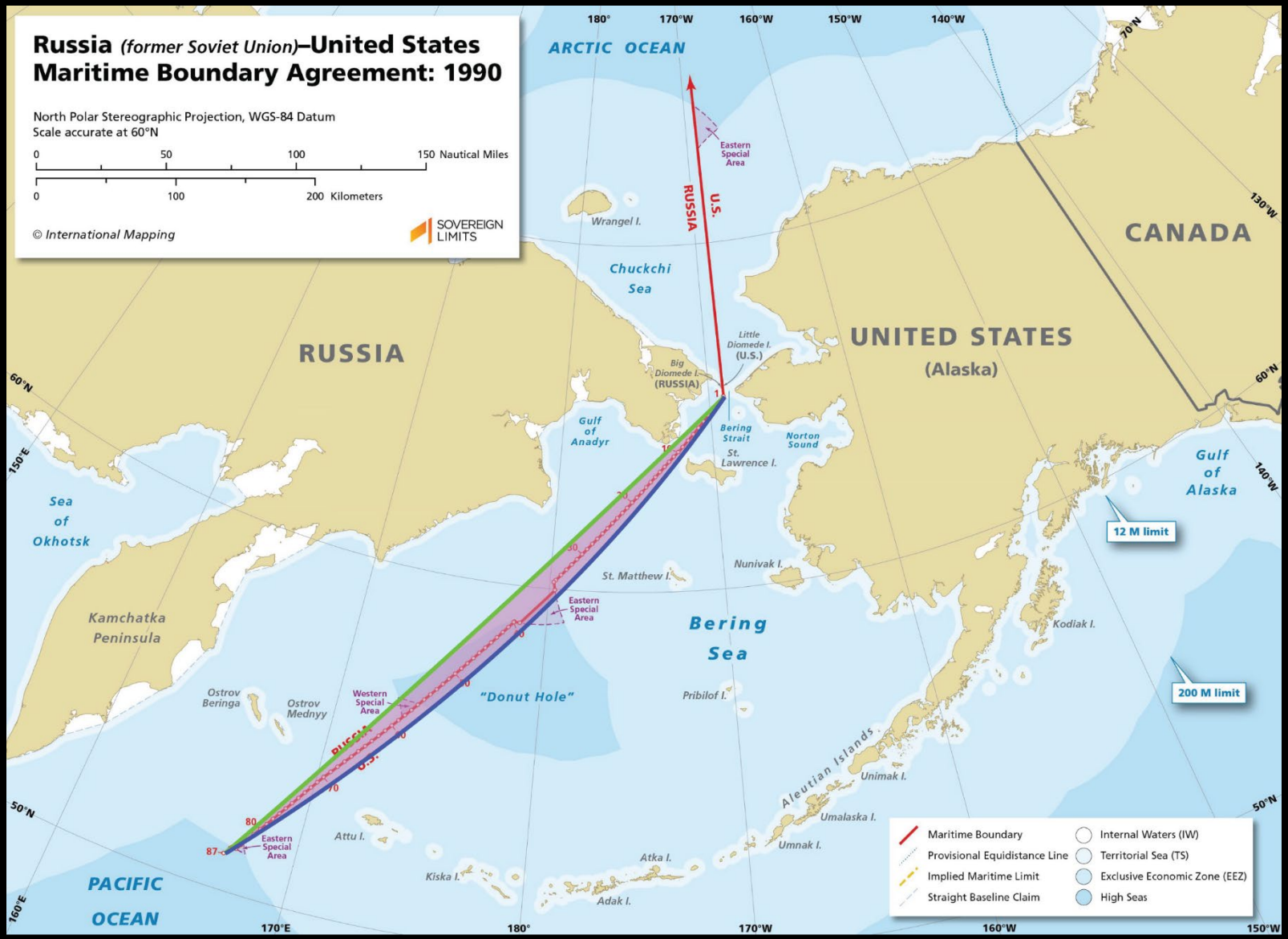
Orthographic projection

‘Straight’ lines: loxodromes and geodesics



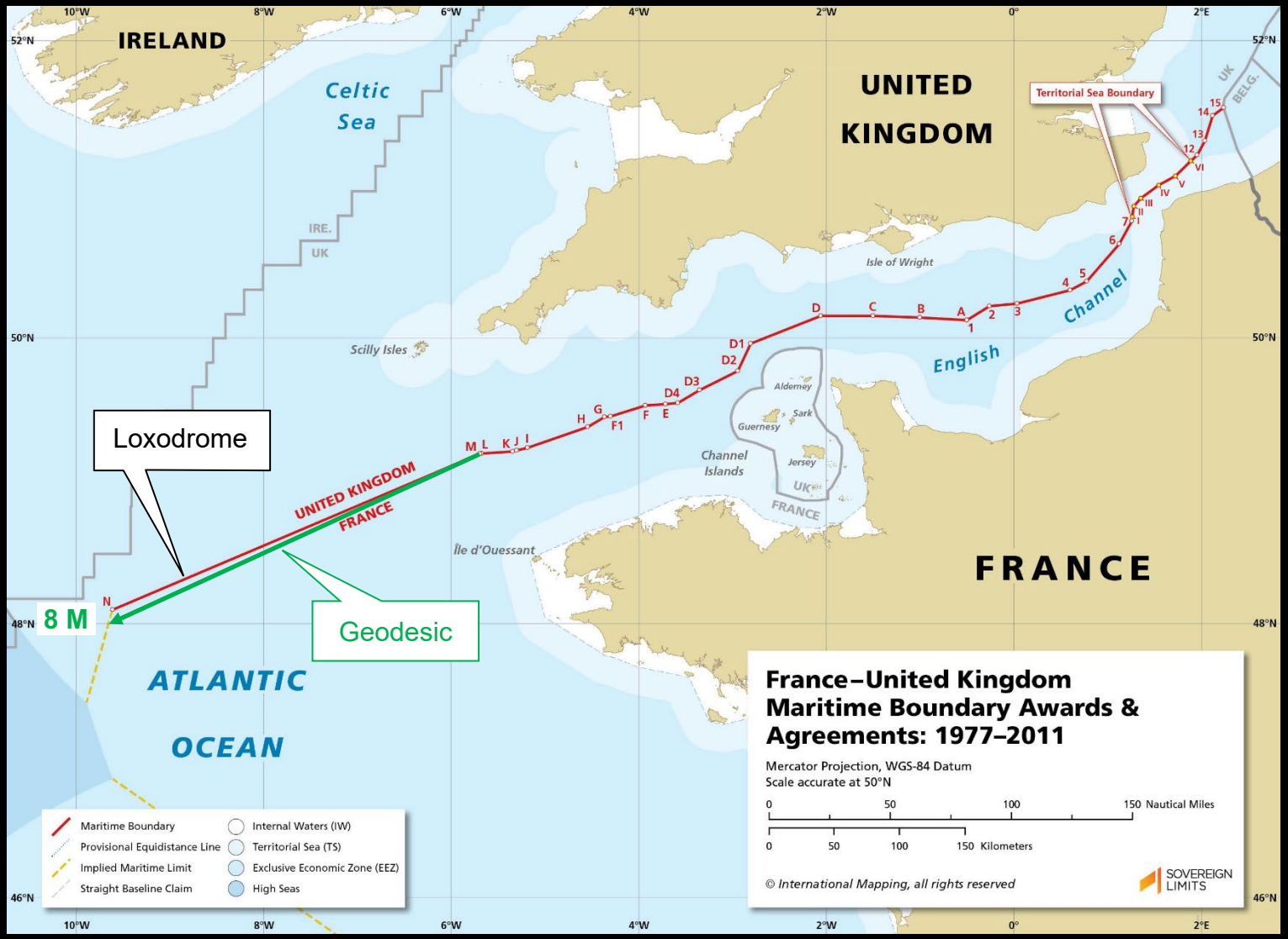
Choice of line

USA-USSR, 1990



Choice of line

France-UK maritime boundary arbitration, 1977



Latitude, longitude and distance

1 sea mile = 1 minute (’) of latitude = c.1,860 metres

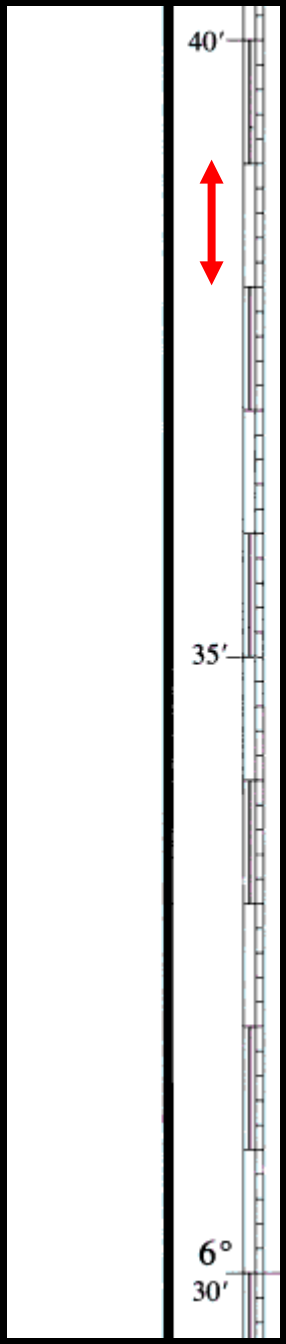
1 second (”) of latitude = 1/60 sea mile = c.31 metres
(30.7151 m at Equator; 31.0261 m at Poles)

1 international nautical mile (M) (nm) = 1,852 metres

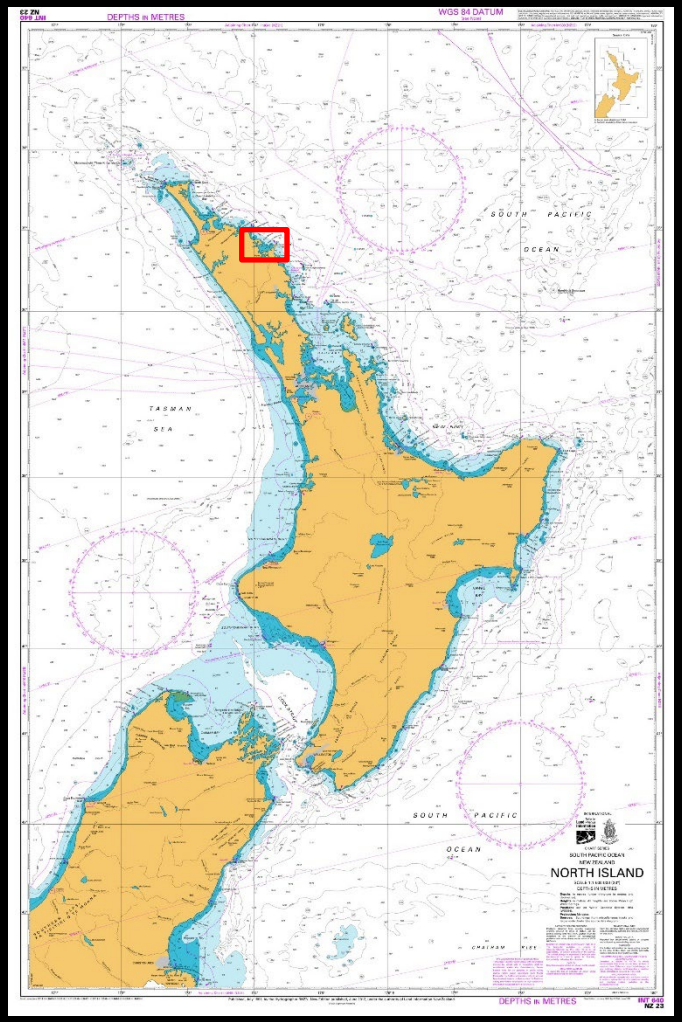
1º of longitude at Equator = 111 km

1º of longitude at Poles = 0 km

1º of longitude at Durham (54.5º N = 64 km)



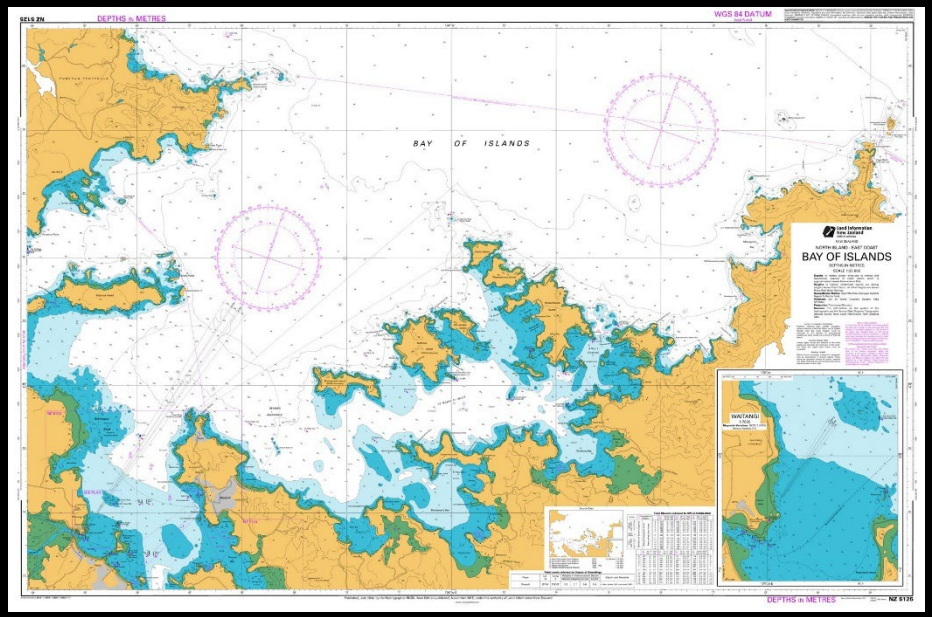
Large scale v. small scale



Small scale

1:1,500,000 (1 mm = 1.5 km)

"Small detail over a large area"



Large scale

1:25,000 (1 mm = 250 m)

"Large detail over a small area"

Positional accuracy

Which is more accurate?

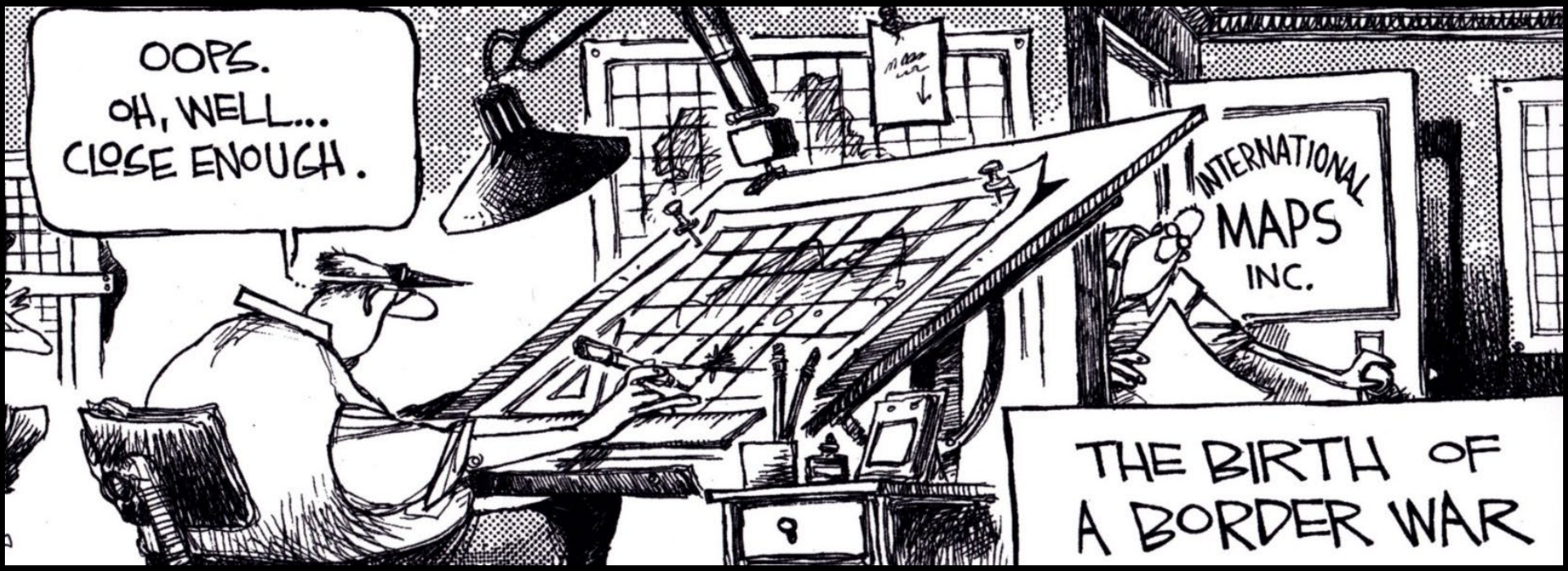
a) 4° 17’ 18.445” N, 8° 21’ 20.238” E

b) 4° 17’ 18” N, 8° 21’ 20” E

- Without a specified geodetic datum, coordinates are of limited use for jurisdictional purposes, no matter how ‘accurate’ they may appear.

Positional accuracy

- 1 mm on a 1:250,000 scale chart = 250 m on ground.
- ‘Plottable error’ = ±50 m at best.
- Pointless to quote coordinates with an accuracy of ±3 cm (0.01of a second) or even ±3 m (0.1 of a second) if derived from a chart at 1:250,000 or smaller.


OOPS.
OH, WELL...
CLOSE ENOUGH.
INTERNATIONAL
MAPS
INC.
THE BIRTH OF
A BORDER WAR

Thank you!

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