



Re-scheming Plan NOAA's Electronic Navigational Chart Coverage



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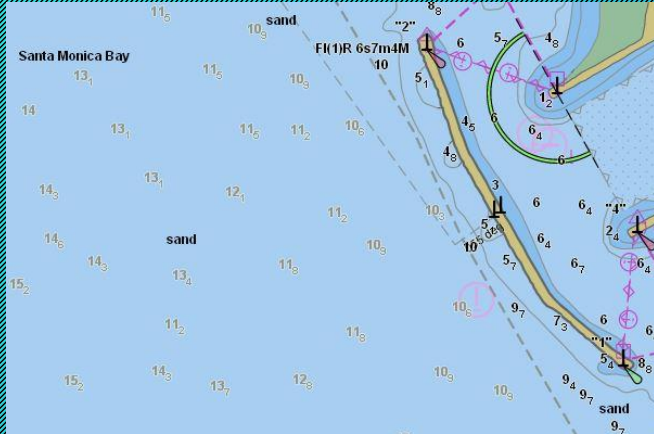
Office of Coast Survey
USCHC (3/2018)

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Key motivation – display in ECDIS

(ECDIS - Electronic Chart Display and Information System)



- Displays ENC's and integrates a variety of real-time information
- Meets IHO regulations and is an alternative to paper charts

- Vector database of chart features
- Built to IHO's S-57 standard



Legacy data issues



- Too many scales
- Scales don't conform to IHO (S-57 & S-101) recommended scales
- Duplication of coverage
- Lacking uniformity, consistency, and coherence
 - Not a smooth transition from scale to scale while navigating on ECDIS systems

Standards are common grounds for argument!



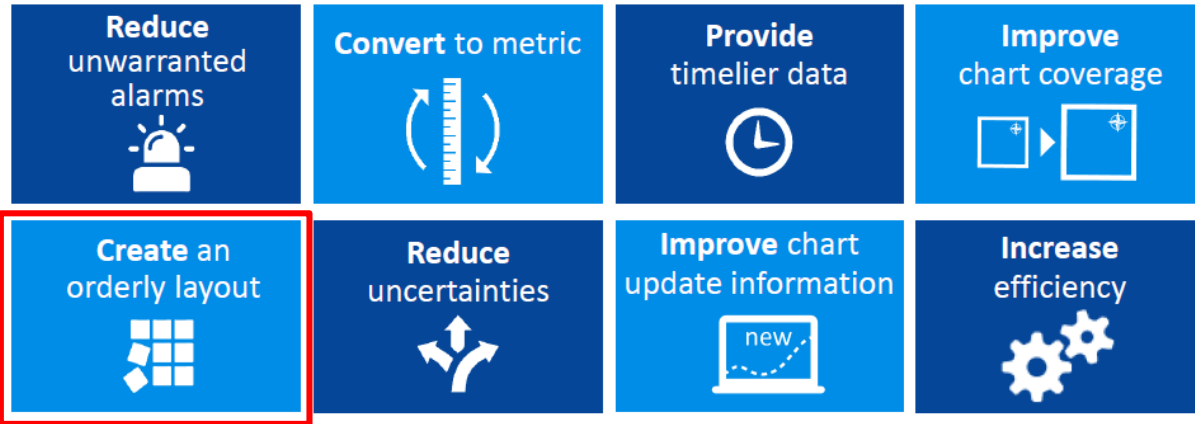
Navigational Purpose	Code	NOAA Scale Ranges	CHS Scale Ranges	IHO Recommended Scale Ranges
Berthing	6	< 1:5,000	< 1:2,000	<1:4,000
Harbor	5	1:5,001 – 1:50,000	1:2,001 -1:20,000	1:4,001 – 1:21,999
Approach	4	1:50,001 – 1:150,000	1:20,001-1:50,000	1:22,000 – 1:89,999
Coastal	3	1:150,001 – 1:600,000	1:50,001 – 1:150,000	1:90,000 – 1:349,999
General	2	1:600,001 – 1:1,500,000	1:150,001- 1:500,000	1:350,000 – 1:1,499,999
Overview	1	>1:1,500,001	> 1:500,001	>1:1,500,000



Vision for the future: Nautical Charting Plan

Purpose Improve NOAA nautical chart coverage, products, and distribution

Improvements

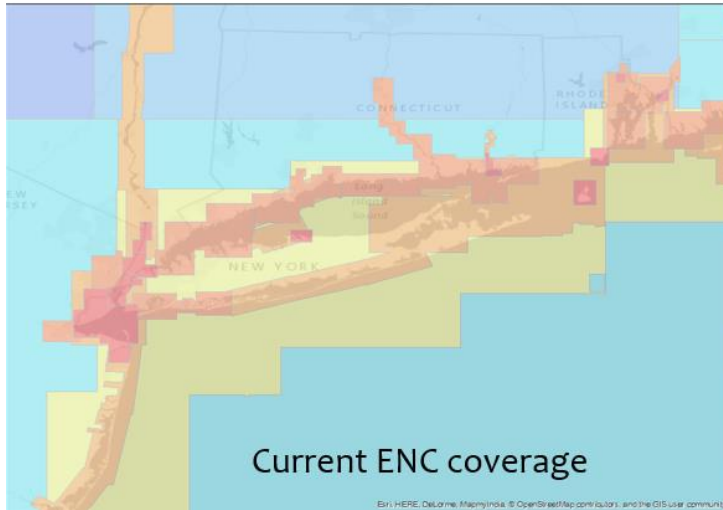


Outcome Ease of access to more precise, higher-resolution charts that deliver the most up-to-date navigation information possible

Rescheming

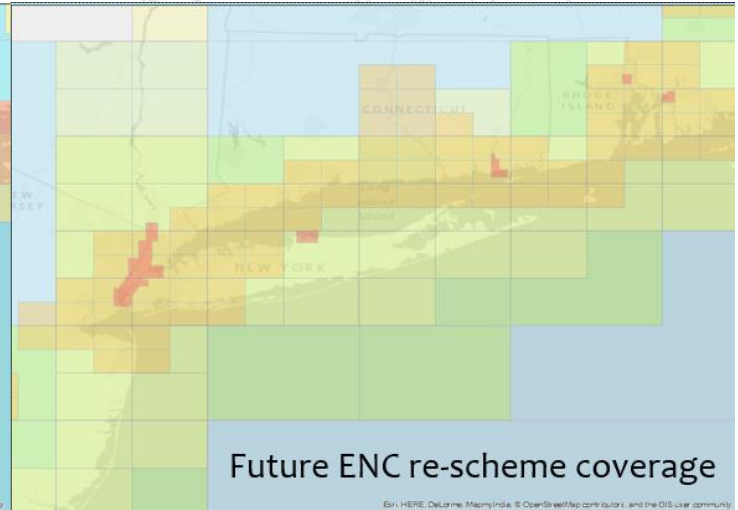


Create an orderly layout for ENC



Current ENC coverage

Esri | HERE, DeLorme, Mapbox, © OpenStreetMap contributors, and the GIS user community



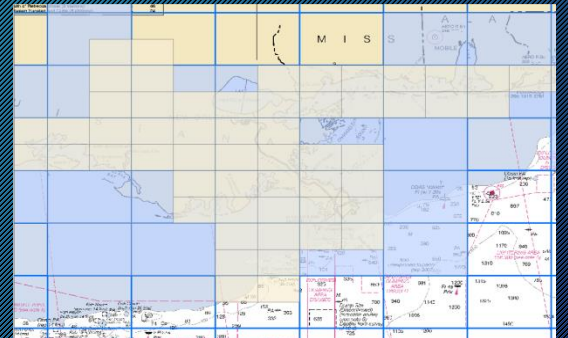
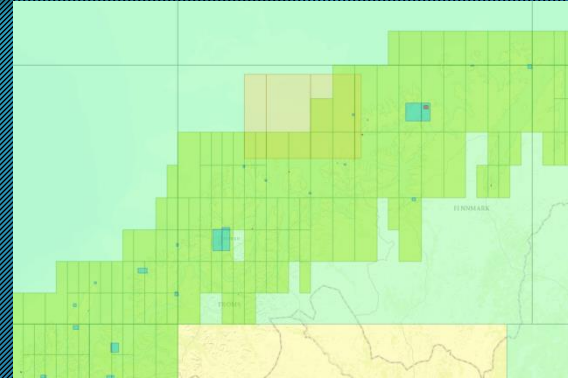
Future ENC re-scheme coverage

Esri | HERE, DeLorme, Mapbox, © OpenStreetMap contributors, and the GIS user community



Vision for the future: ENC re-scheming

- Standardized progressive scales (IHO specs)
 - Reduced number of scales
- Standardized size and scope
- Interlocking boundaries through the scales
- Boundaries/limits following lines of longitude & latitude





	Standard scale (rounded)
Band 1	1:3,000,000
	1:1,500,000
Band 2	1:700,000
	1:350,000
Band 3	1:180,000
	1:90,000
Band 4	1:45,000
	1:22,000
Band 5	1:12,000
	1:8,000

- Based on RADAR range
- Not compatible for web-services
- Requires “re-scaling” current features that are not with ~10% of the proposed scales.



Scales that are compatible to web services

Gmap	Gmap (rounded)	Binary_1	Binary_2	Binary_3
• 2256.994440	• 2,250	• 2,500	• 3,000	• 3,125
• 4513.988880	• 4,500	• 5,000	• 6,000	• 6,250
• 9027.977761	• 9,000	• 10,000	• 12,000	• 12,500
• 18055.955520	• 18,000	• 20,000	• 24,000	• 25,000
• 36111.911040	• 36,000	• 40,000	• 48,000	• 50,000
• 72223.822090	• 72,000	• 80,000	• 96,000	• 100,000
• 144447.644200	• 144,000	• 160,000	• 192,000	• 200,000
• 288895.288400	• 288,000	• 320,000	• 384,000	• 400,000
• 577790.576700	• 576,000	• 640,000	• 768,000	• 800,000
• 1155581.153000	• 1,152,000	• 1,280,000	• 1,536,000	• 1,600,000
• 2311162.307000	• 2,304,000	• 2,560,000	• 3,072,000	• 3,200,000
• 4622324.614000	• 4,608,000	• 5,760,000	• 6,144,000	• 6,400,000

IHO Recommended Scales

	Standard scale (rounded)
Band 1	1:3,000,000
	1:1,500,000
Band 2	1:700,000
	1:350,000
Band 3	1:180,000
	1:90,000
Band 4	1:45,000
	1:22,000
Band 5	1:12,000
	1:8,000

NOAA's Re-schemed Scales



Scale band	Standard Scale (rounded)
Band 1	1:5,120,000
	1:2,560,000
Band 2	1:1,280,000
	1:640,000
Band 3	1:320,000
	1:160,000
Band 4	1:80,000
	1:40,000
Band 5	1:20,000
	1:10,000

Calculating ENC cell width and height

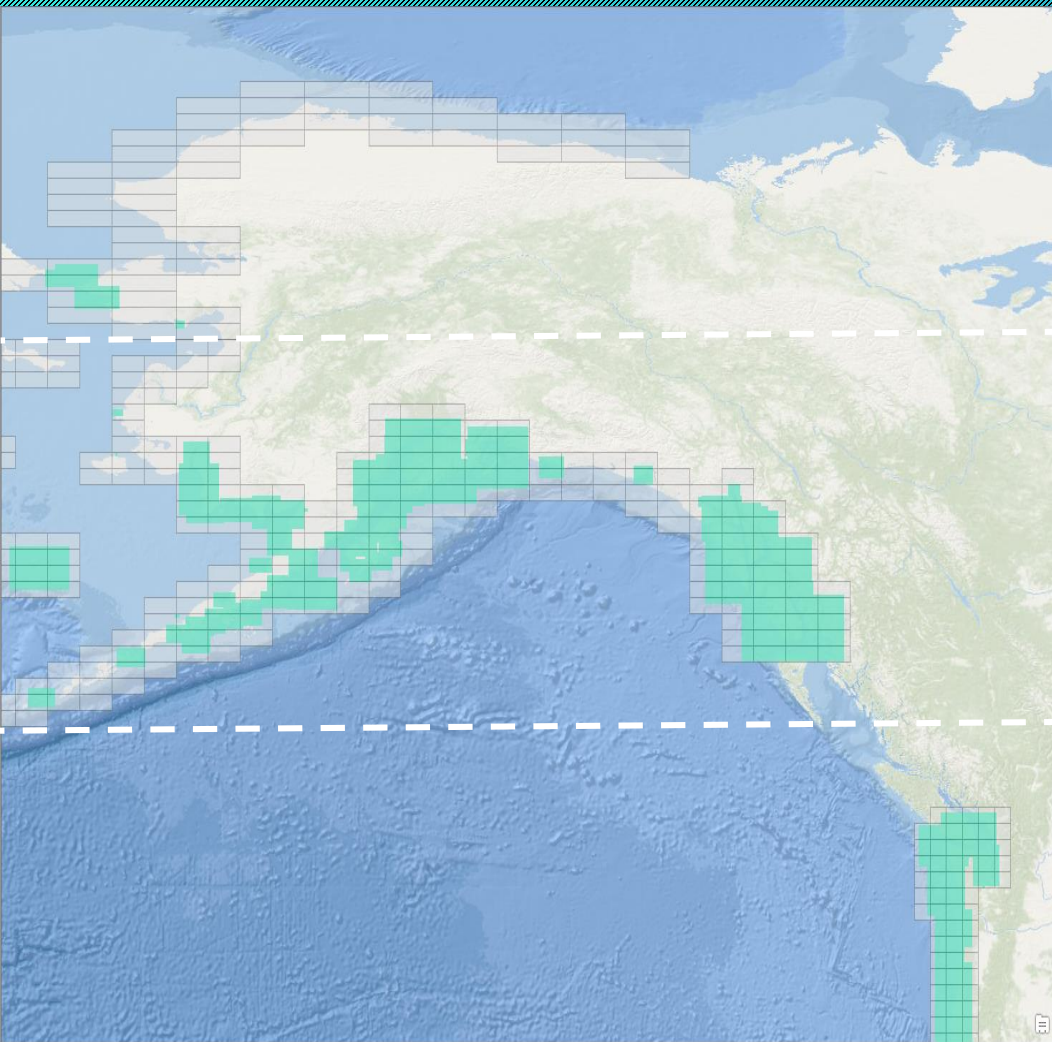


Scale band	Standard Scale (rounded)	Width	Height
Band 1	1:5,120,000	38.4°	38.4°
	1:2,560,000	19.2°	19.2°
Band 2	1:1,280,000	9.6°	9.6°
	1:640,000	4.8°	4.8°
Band 3	1:320,000	2.4°	2.4°
	1:160,000	1.2°	1.2°
Band 4	1:80,000	0.6°	0.6°
	1:40,000	0.3°	0.3°
Band 5	1:20,000	0.15°	0.15°
	1:10,000	0.075°	0.075°

Calculating ENC cell width and height



Scale band	Standard Scale (rounded)	Width	Height
Band 1	1:5,120,000	19.2°	19.2°
	1:2,560,000		
Band 2	1:1,280,000	4.8°	4.8°
	1:640,000		
Band 3	1:320,000	1.2°	1.2°
	1:160,000		
Band 4	1:80,000	0.3°	0.3°
	1:40,000		
Band 5	1:20,000	0.075°	0.075°
	1:10,000		



Re-scheming at high latitudes

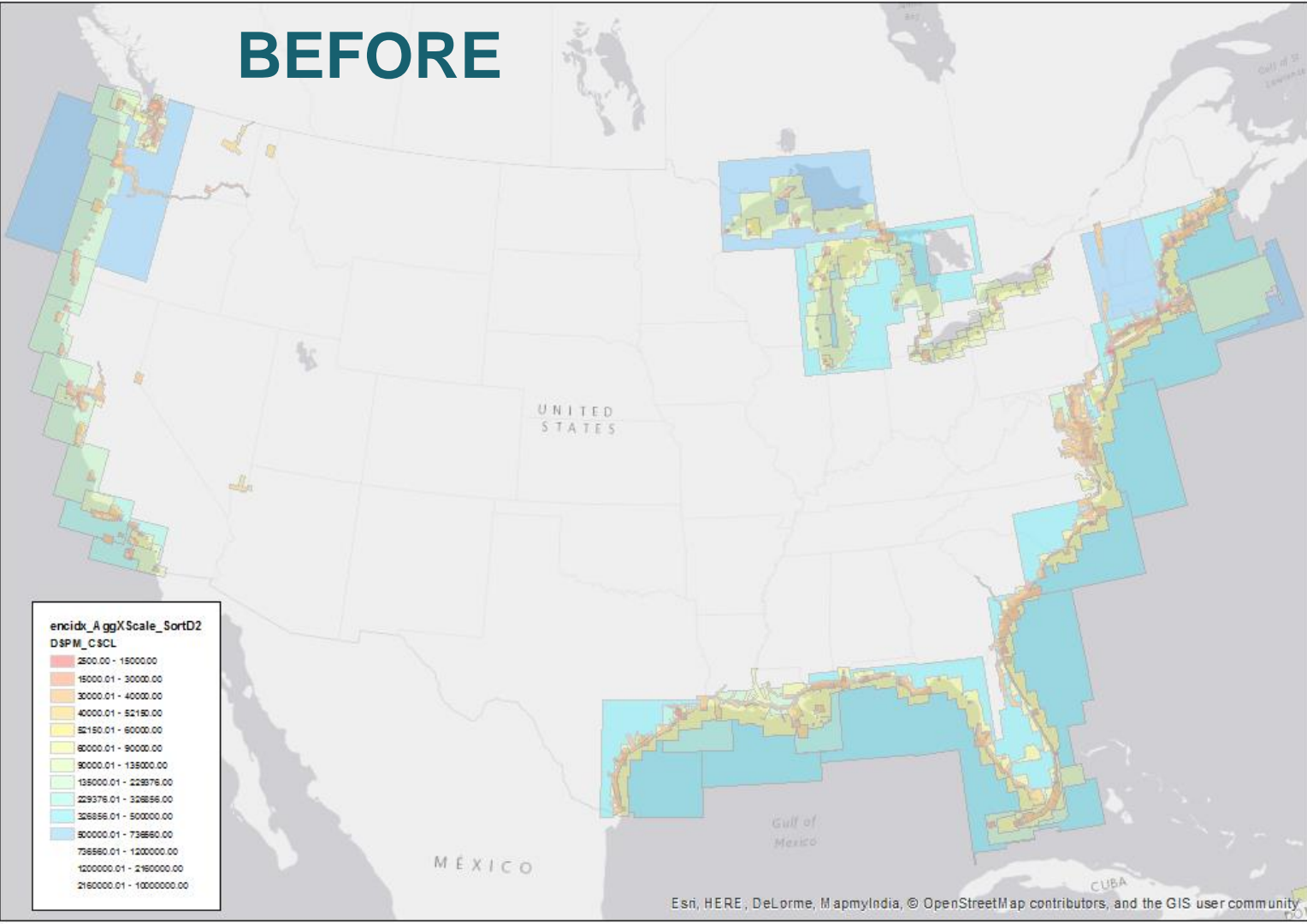


Table B.2 ENC Cell width dimension zones

Zone	Latitude	
III	64°N - 80°N	
II	48°N - 64°N	
I	0° - 48°N	
	Equator	
II	0° - 48°S	
	48°S - 64°S	
III	64°S - 80°S	

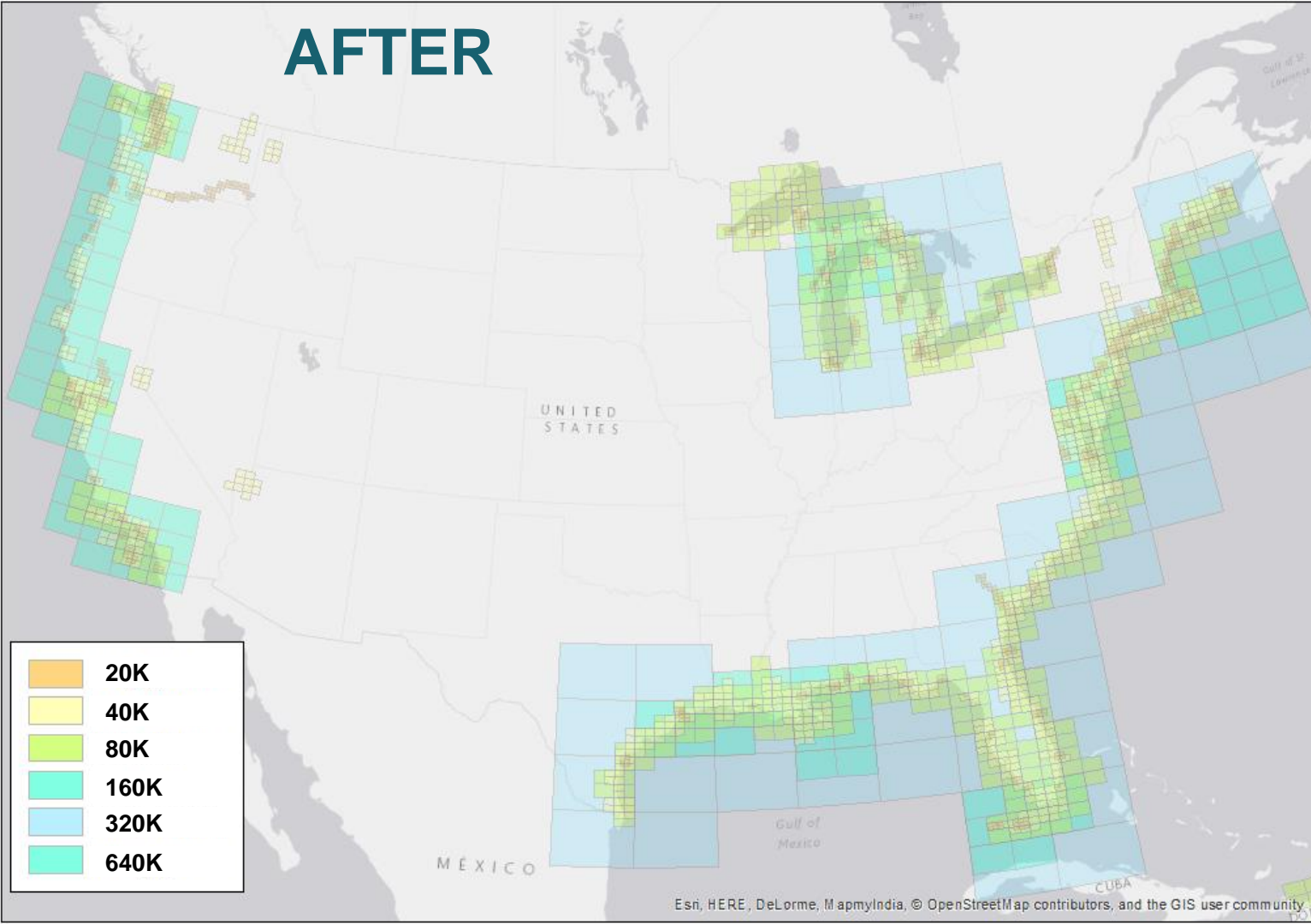
Band 4
80k

BEFORE



encidx_A ggXScale_SortD2 DSPM_C_SCL	
2500.00 - 15000.00	Red
15000.01 - 30000.00	Orange-Red
30000.01 - 40000.00	Orange
40000.01 - 52150.00	Yellow-Orange
52150.01 - 60000.00	Yellow
60000.01 - 90000.00	Light Yellow
90000.01 - 135000.00	Light Green
135000.01 - 229376.00	Green
229376.01 - 326856.00	Light Blue-Green
326856.01 - 500000.00	Light Blue
500000.01 - 736660.00	Blue
736660.01 - 1200000.00	Dark Blue
1200000.01 - 2160000.00	Very Dark Blue
2160000.01 - 10000000.00	Black

AFTER



A map of the state of Florida is shown with a grid overlay. The grid consists of red lines for latitude and blue lines for longitude. Several areas are highlighted with green boxes: a small area in the panhandle, a larger area in the central part of the state, a small area near the panhandle coast, a small area near the central coast, a small area near the southern coast, and a small area near the southern coast. The word "Thanks" is written in large black font across the center of the map.

Thanks

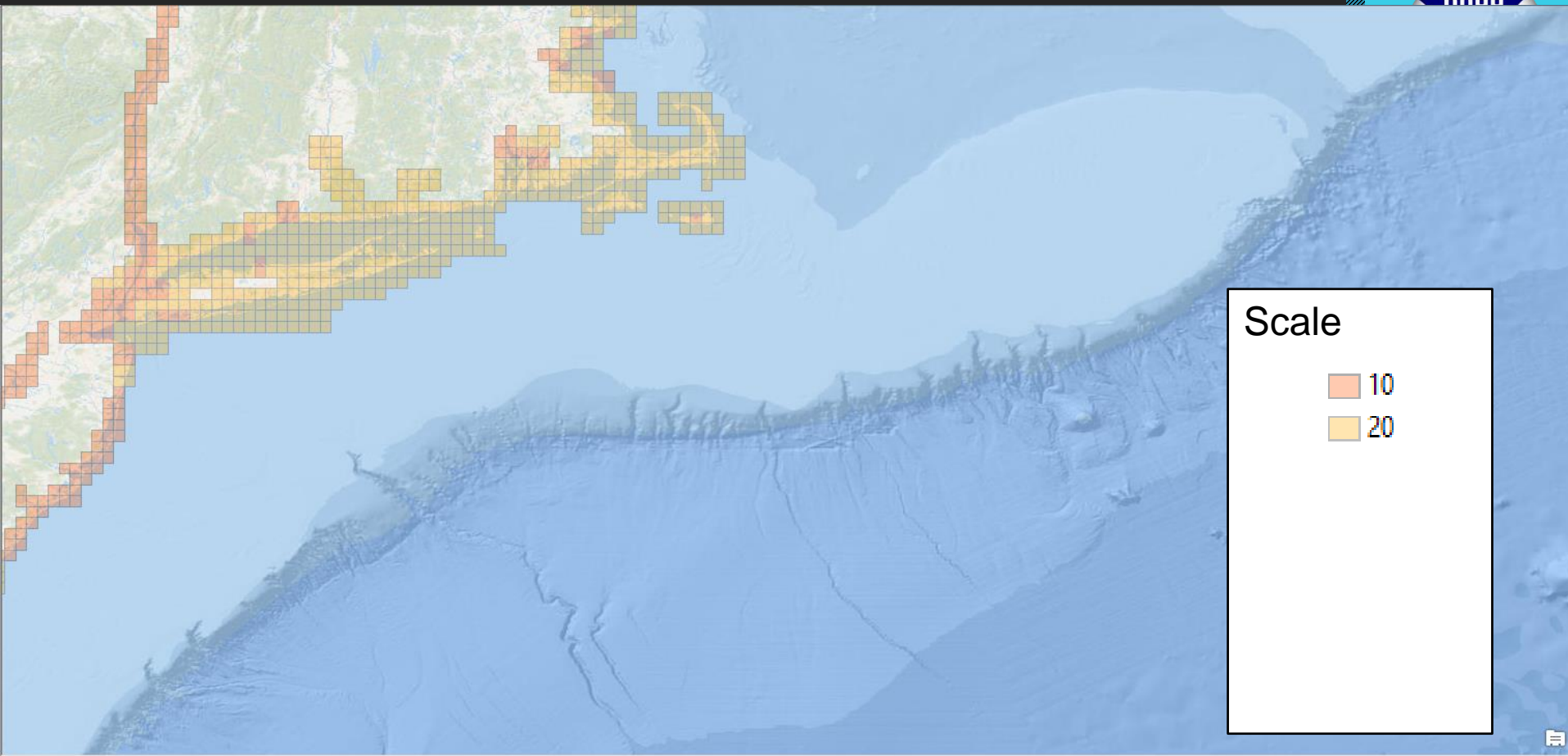
... more slide for going into the weeds

Calculating ENC cell width and height

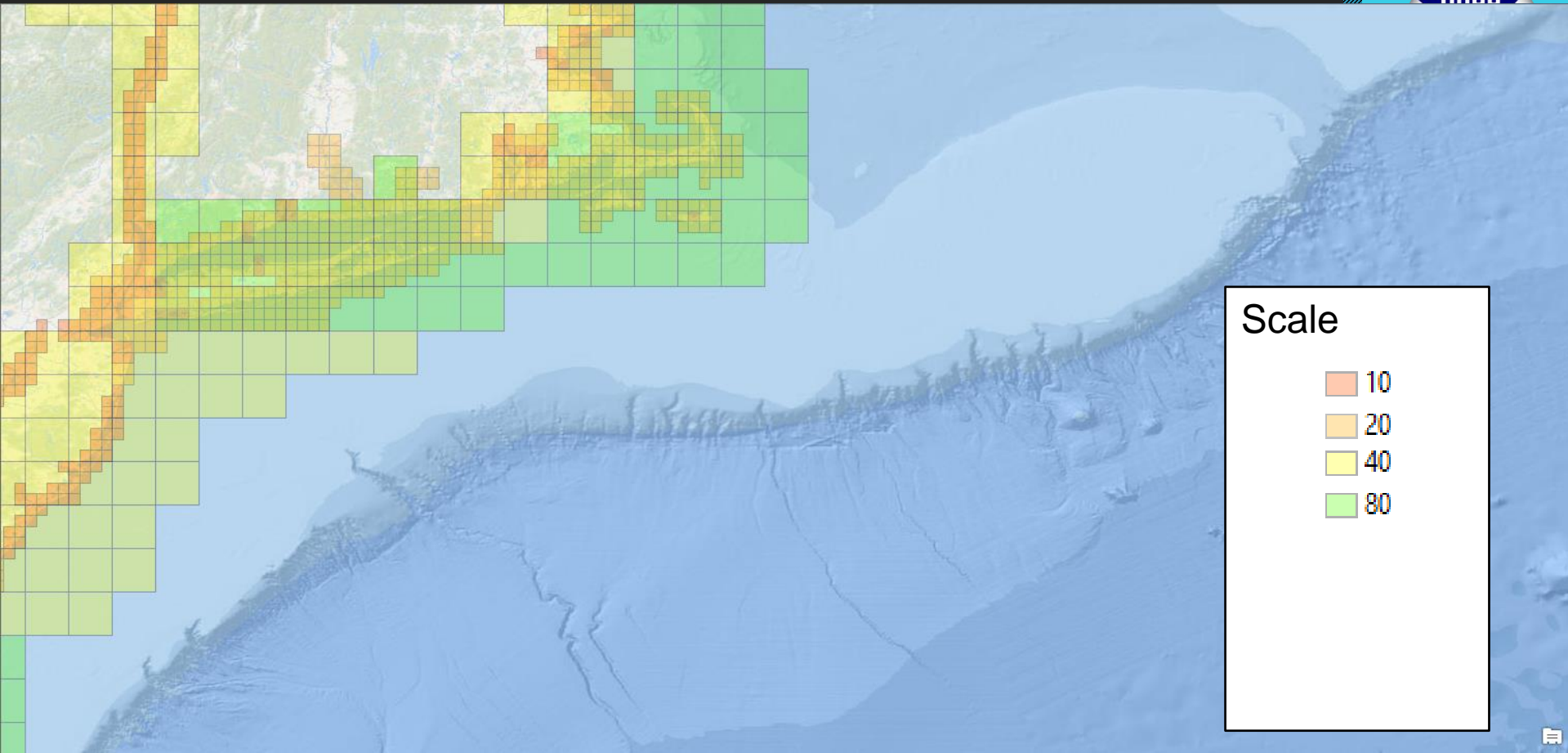


Scale band	Standard Scale (rounded)	Width	Height
Band 1	1:5,120,000	38.4	38.4
	1:2,560,000	19.2	19.2
Band 2	1:1,280,000	9.6	9.6
	1:640,000	4.8	4.8
Band 3	1:320,000	2.4	2.4
	1:160,000	1.2	1.2
Band 4	1:80,000	0.6	0.6
	1:40,000	0.3	0.3
Band 5	1:20,000	0.15	0.15
	1:10,000	0.075	0.075

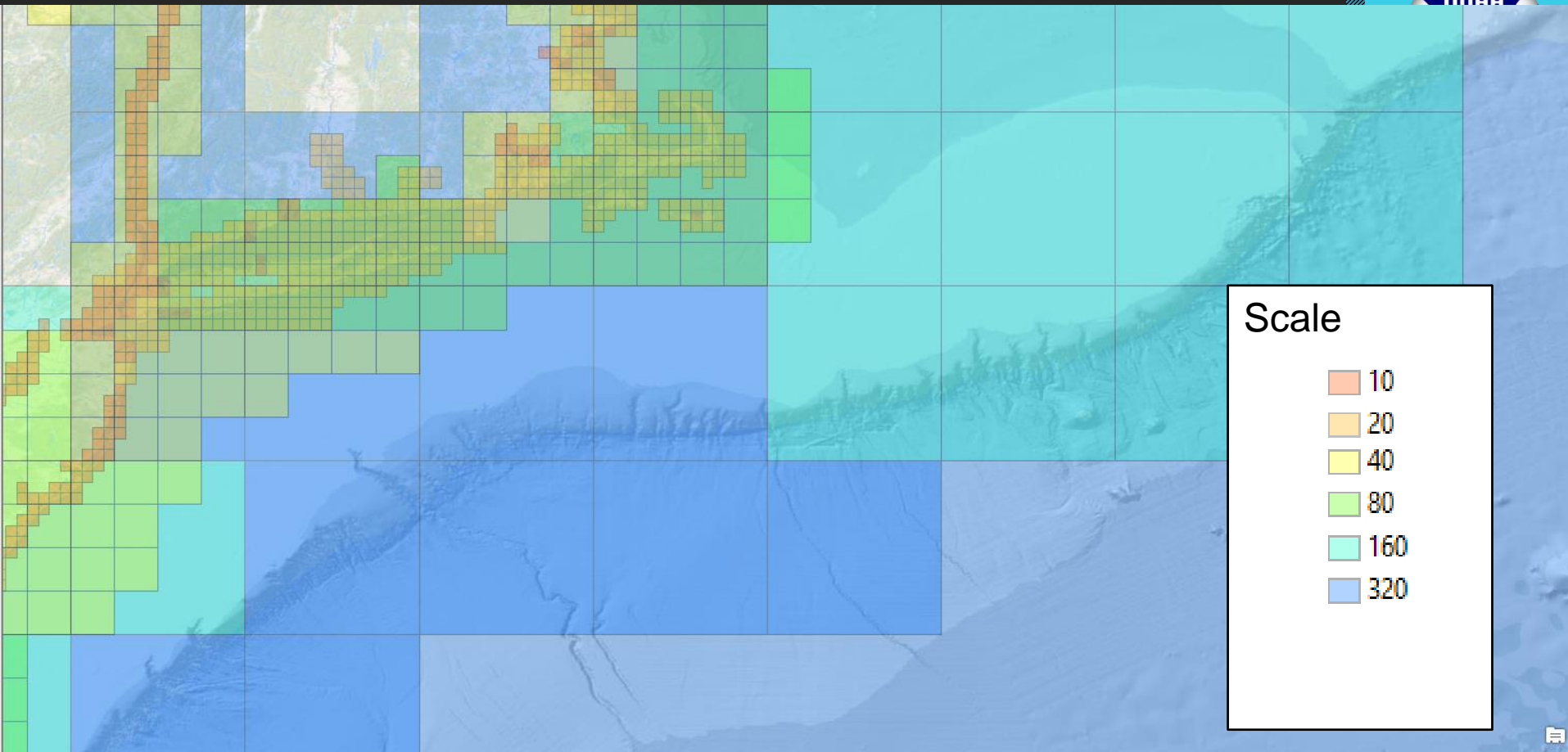
Coverage: Band 5



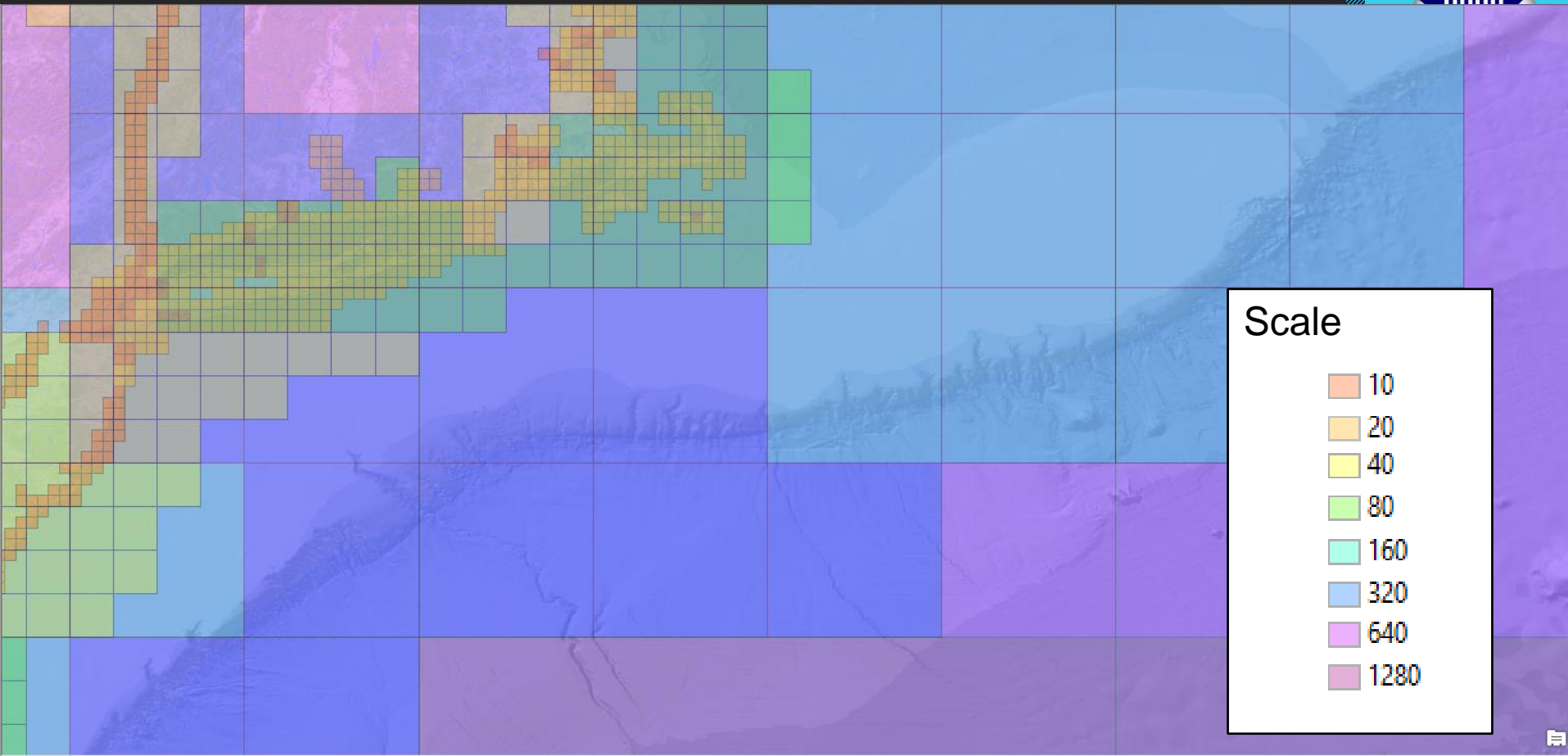
Coverage: Band 4



Coverage: Band 3



Coverage: Band 2





Recommended depth contours per scale band

Scale band	Standard Scale (rounded)	Width	Height	IHO S-4 (B-411)
Band 1	1:5,120,000	38.4	38.4	100, 200,...
	1:2,560,000	19.2	19.2	50,100,150,200,...
Band 2	1:1,280,000	9.6	9.6	50,100,150,200,...
	1:640,000	4.8	4.8	20, 50,100,150,200,...
Band 3	1:320,000	2.4	2.4	20,30,50,100,150,200,...
	1:160,000	1.2	1.2	10, 20,30,50,100,150,200,...
Band 4	1:80,000	0.6	0.6	5, 10, 20,30,50,100,150,200,...
	1:40,000	0.3	0.3	2, 5, 10, 20,30,50,100,150,200,...
Band 5	1:20,000	0.15	0.15	2, 5, 8,10,15,20,30,50,100,150,200,...
	1:10,000	0.075	0.075	2,3,4,5,6,7,8,10,15,20,30,50,100,150,200,...



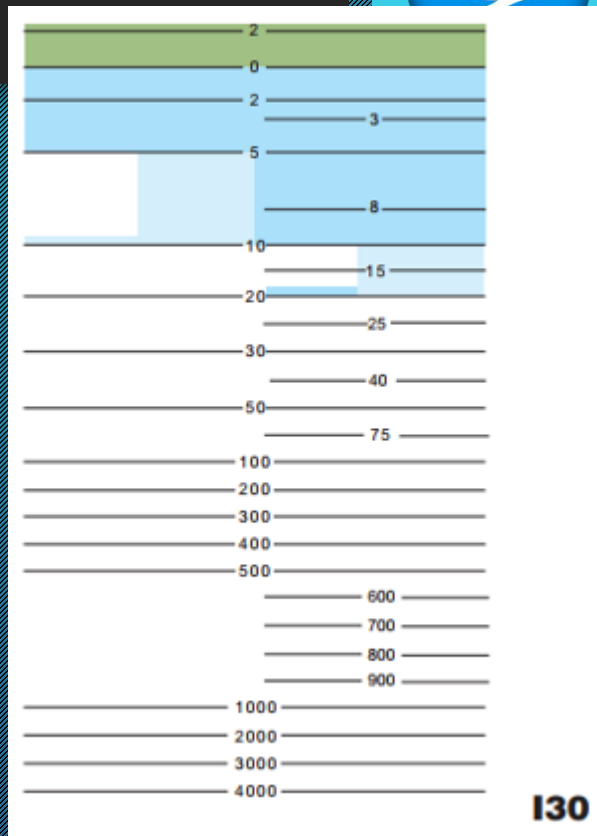
IHO S-4 (B-411) – Depth Contours

B-411 DEPTH CONTOURS AND SHALLOW WATER TINT

The standard series of depth contour lines to be charted is: 0 (where tides are appreciable), 2, 5, 10, 20, 30, 50, 100, 200, 300, 400, 500, 1000, 2000m, etc. The 2 and 5m contours may be omitted where they serve no useful purpose. It is not necessary for the complete sequence of contours to be shown, for example on steep slopes and around isolated pinnacles.

Supplementary contours, for example at: 3, 8, 15, 25, 40, 75m and multiples of 10 or 100m may be shown, if the available data permit, to delineate particular bathymetric features where soundings would otherwise be the only depth information over a large area, or for the benefit of particular categories of shipping. The 2500m contour may be required for measuring continental shelf limits (see UNCLOS Article 76)

Other contours. In waters where the 4 or 6 metres contours have been surveyed and charted these contours may be shown in place of the standard ones, provided they are labelled with their values (even where otherwise defined by a shallow water tint).



IHO S-4 (B-412) – Rounding rules



B-412 SOUNDINGS

Charted soundings must represent the depth measured from Chart Datum to the sea floor placed in such a way that the centre of gravity (geometric centre) of the set of numerals coincides with the position referred to.

Rounding of depths, including drying heights, must always be on the safe (shoaler) side (that is: soundings must be rounded down and drying heights rounded up, if necessary). The rounding should be:

For depths

- to the nearest decimetre between 0,1 and 21m:
0,001 to 0,099 rounds **down** to nearest decimetre for example: a recorded depth of 4,38m rounds down to 4,3m.
- to the nearest half metre from 21 to 31m:
0,001 to 0,499 rounds **down** to 0,0 for example: a recorded depth of 23,49 rounds down to 23m;
0,500 to 0,999 rounds **down** to 0,5 for example: a recorded depth of 23,51 rounds down to 23,5m.
- thereafter, to the nearest metre:
0,001 to 0,999 rounds **down** to 0,0 for example: a recorded depth of 31,85m rounds **down** to 31m.

For drying heights

- to the nearest decimetre:
0,001 to 0,099 rounds **up** to nearest decimetre for example: a recorded drying height of -2,32m rounds **up** to -2,4m

However, these soundings must be adjusted as a function of the degree of accuracy with which depths were actually measured, so that the precision with which soundings are recorded on charts can never be misleading as to the accuracy of such soundings.

Rasterization

Boston Inner Harbor (US5MA11M (1:10K))



ENC



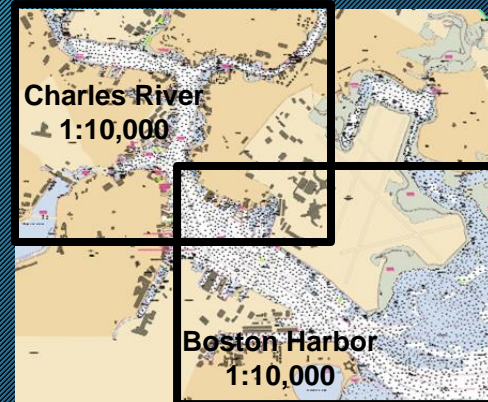
RNC-ish (tile)



No title, notes, ...



PoD / Paper



With all the
“cartographic furniture”