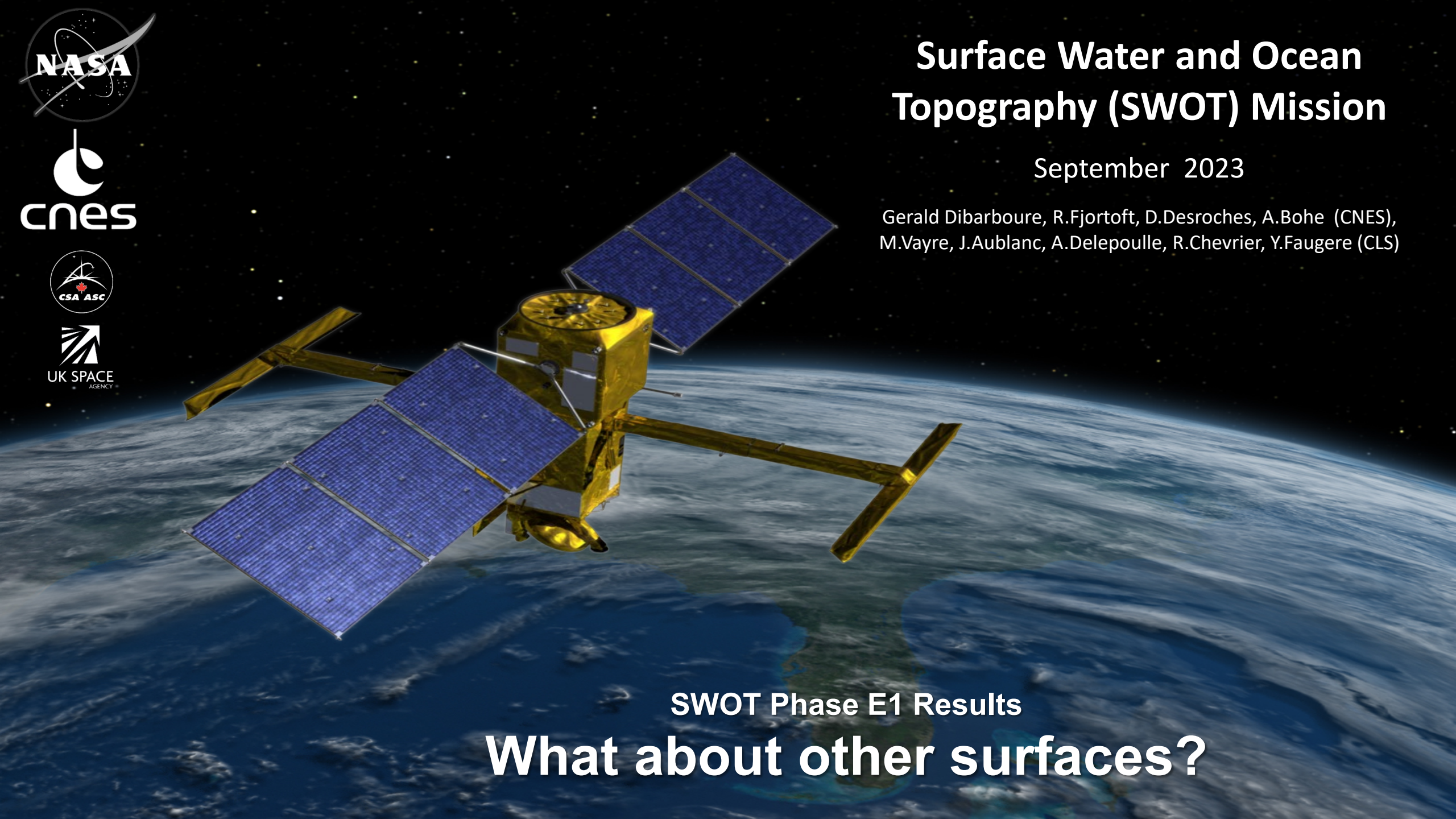


Surface Water and Ocean Topography (SWOT) Mission

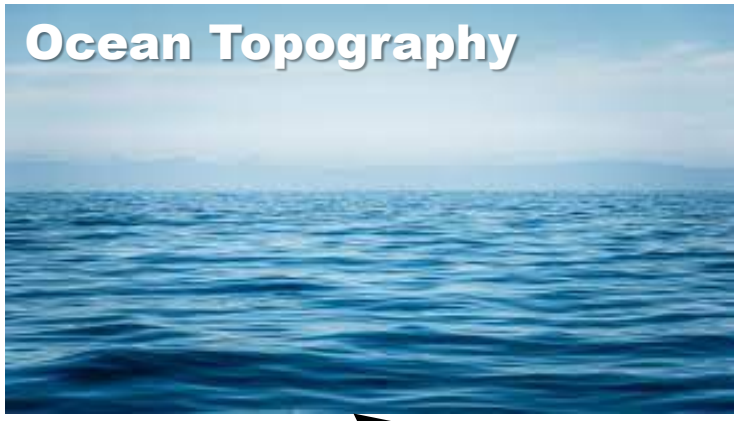
September 2023

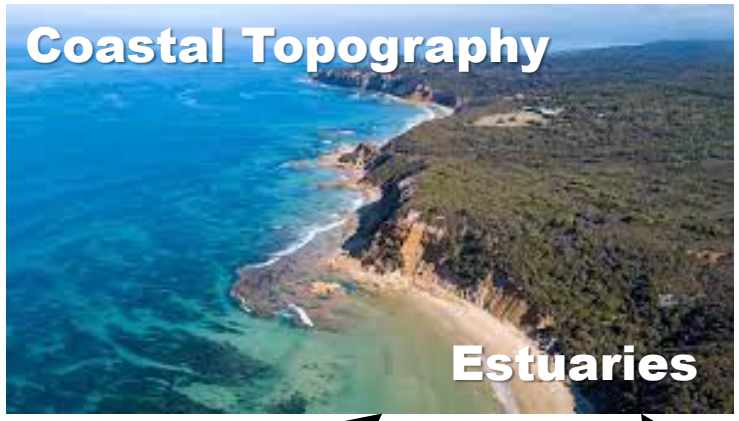
Gerald Dibarboure, R.Fjortoft, D.Desroches, A.Bohe (CNES),
M.Vayre, J.Aublanc, A.Delepoulle, R.Chevrier, Y.Faugere (CLS)

SWOT Phase E1 Results

What about other surfaces?

SWOT Products VS Usage





LR mode
2-km or 250-m

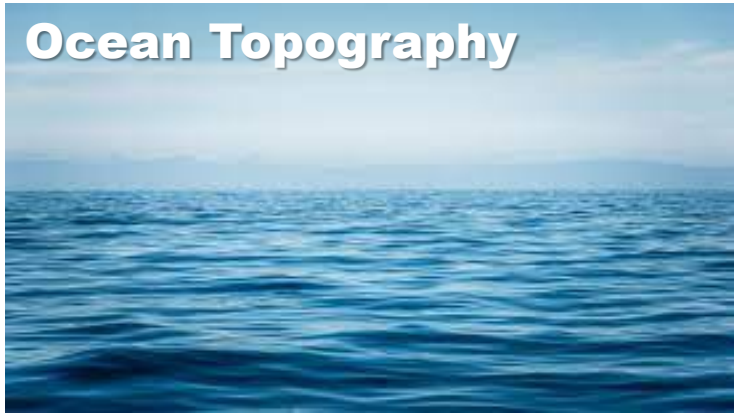
large target if
HR mask is off

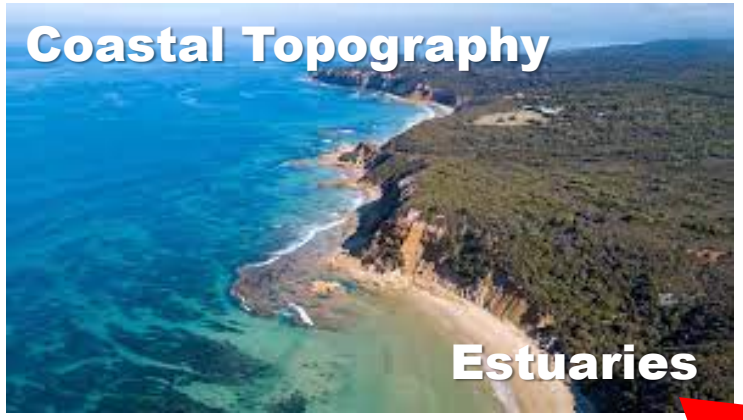
HR mode
Vector or PixC or Raster or L1B

Example #1

Geneva Lake with LR mode

SWOT Products VS Usage





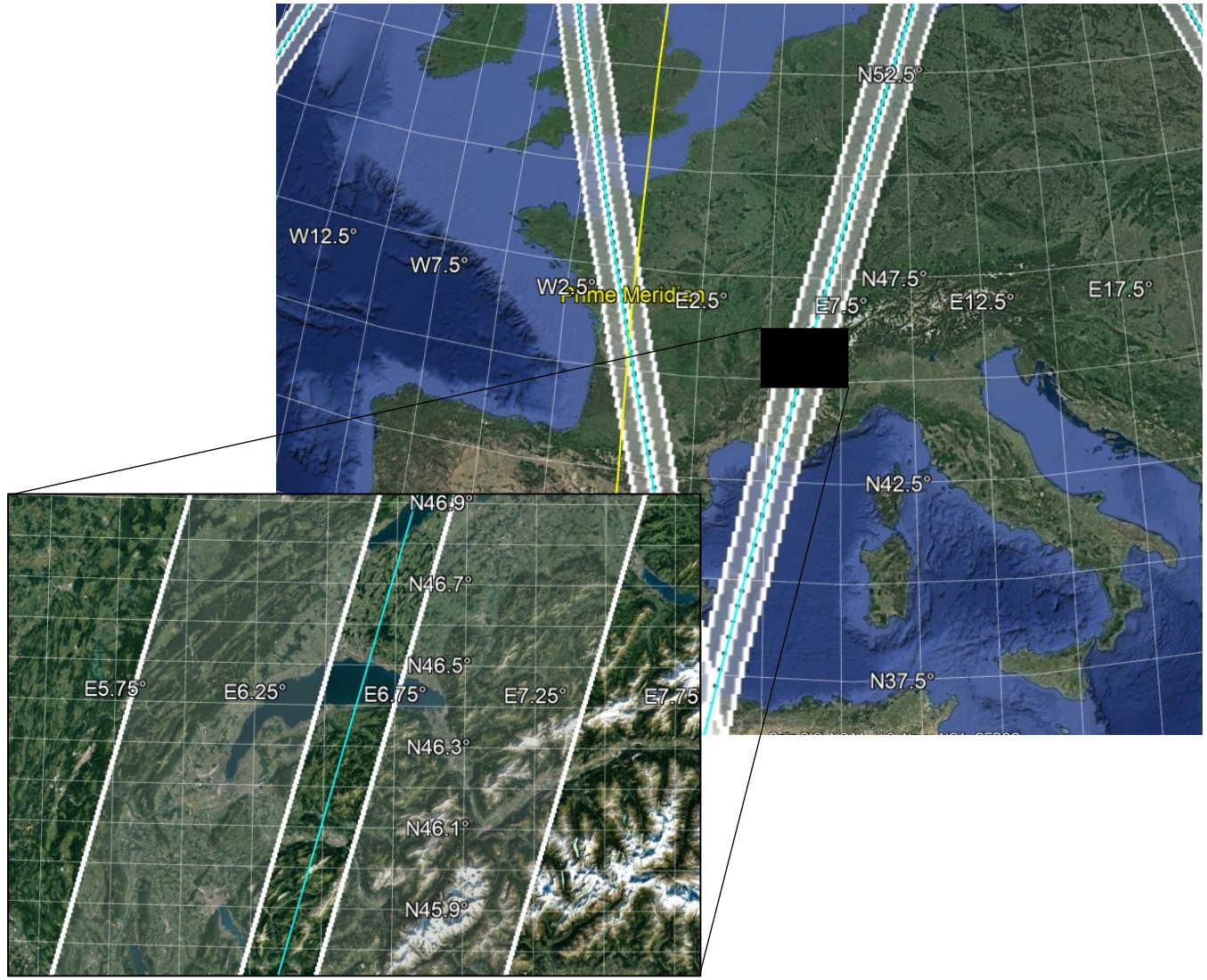
LR mode
2-km or 250-m

large target if
HR mask is off

HR mode
Vector or PixC or Raster or L1B

Context: LR Geneva lake

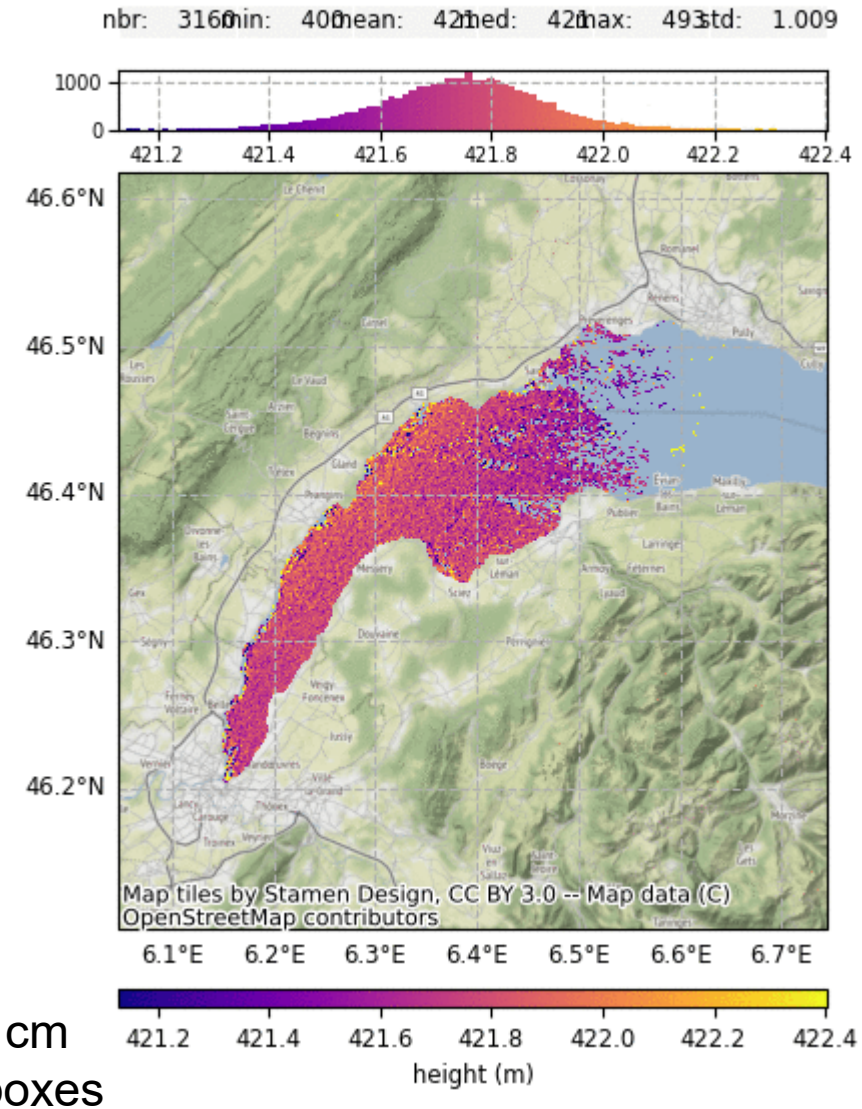
- Geneva lake seen by SWOT during the CalVal phase
- Well instrumented ➔ In-situ available from BAFU data (Office fédéral de l'environnement - Page d'accueil (admin.ch))



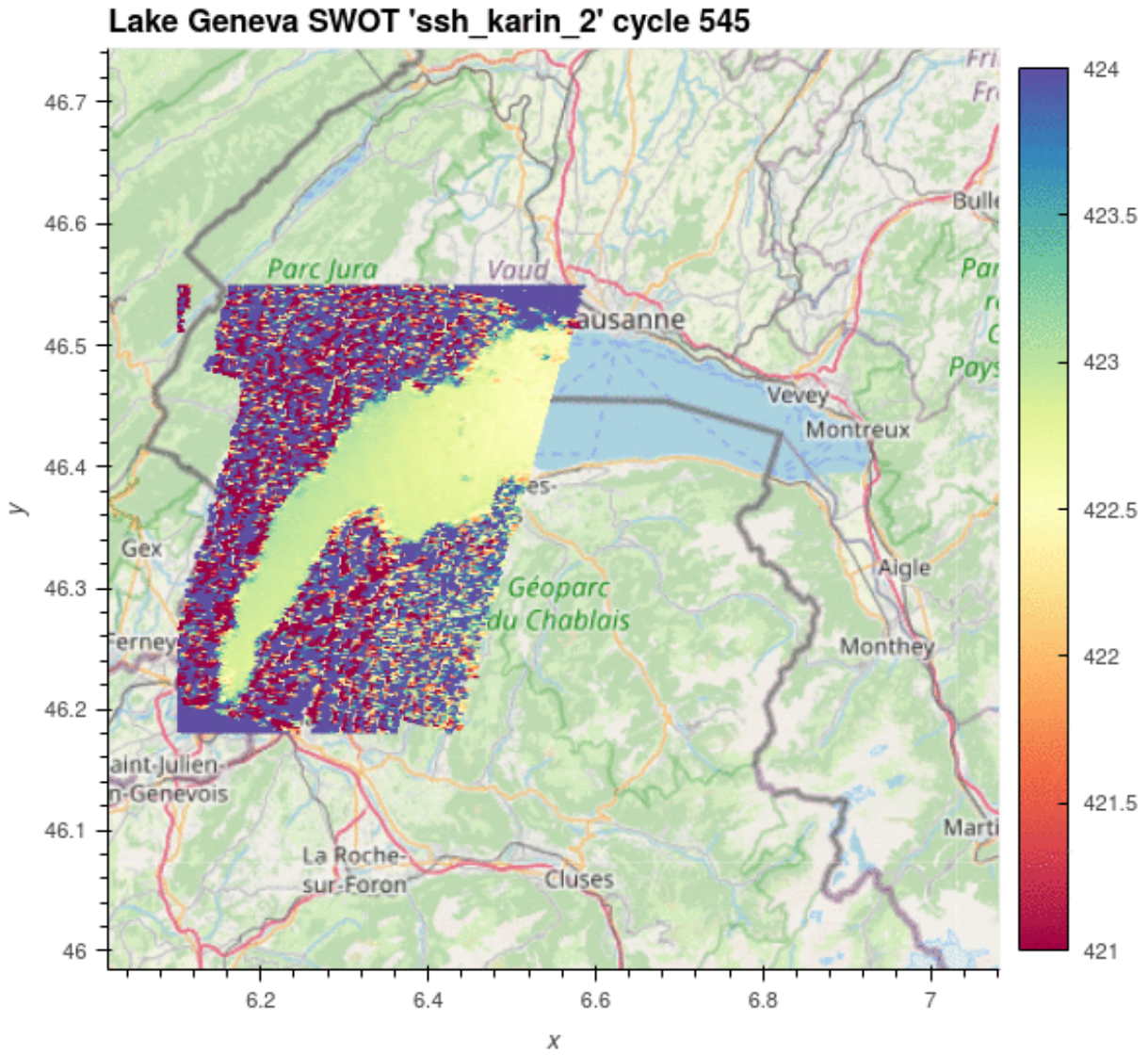
Geneva lake (blue from PLD database) and SWOT swath (green) during the CalVal phase

Geneva Lake in HR mode (PIXC) and LR mode (Unsmoothed 250m)

Surface height from HR mode (m)



Surface height from LR mode (m)



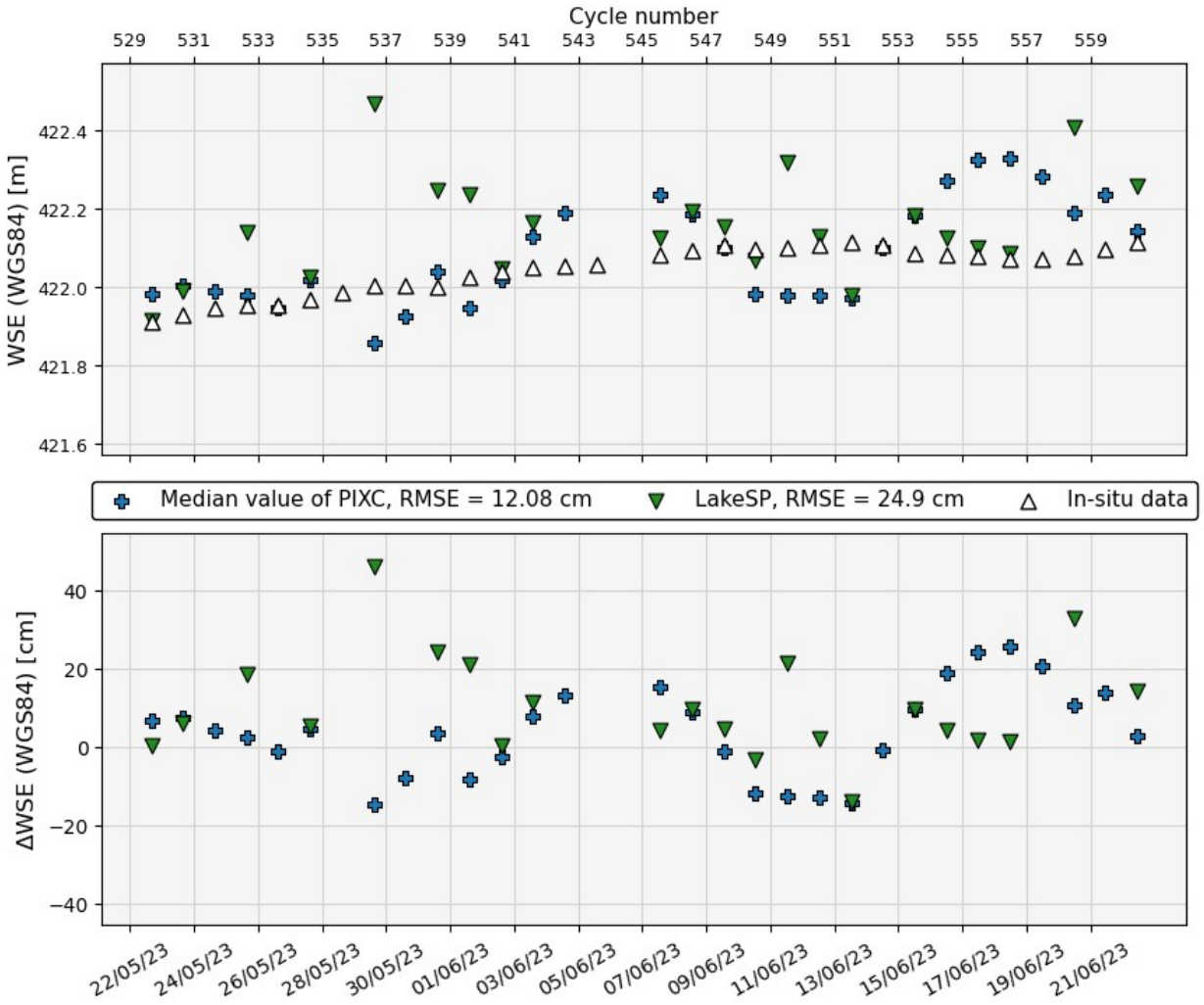
Noise is ~10 cm for (100m)² boxes

Comparison with in-situ measurements

SWOT HR

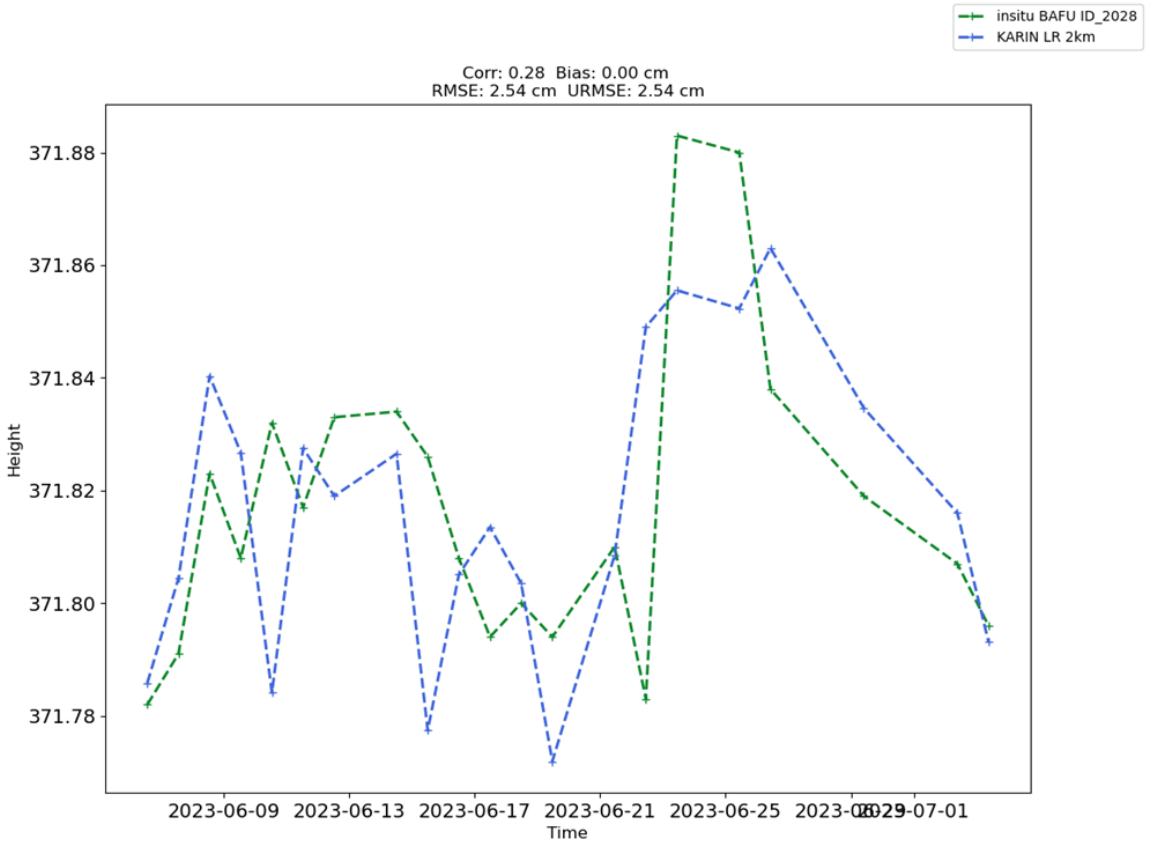
RMSE (w.r.t BAFU InSitu data):

- PIXC (median value over the lake): ~12 cm
- LakeSP: ~24.9 cm

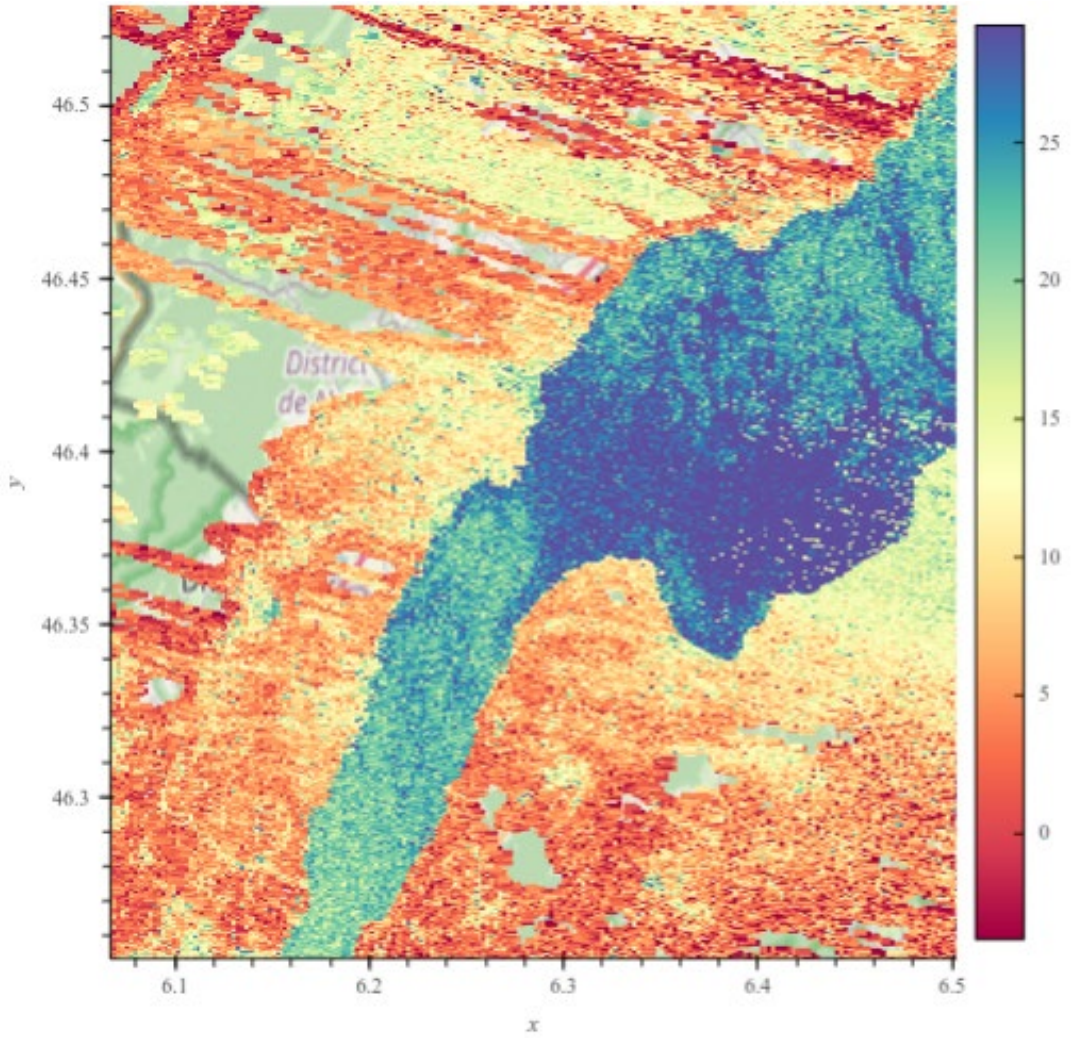


SWOT LR

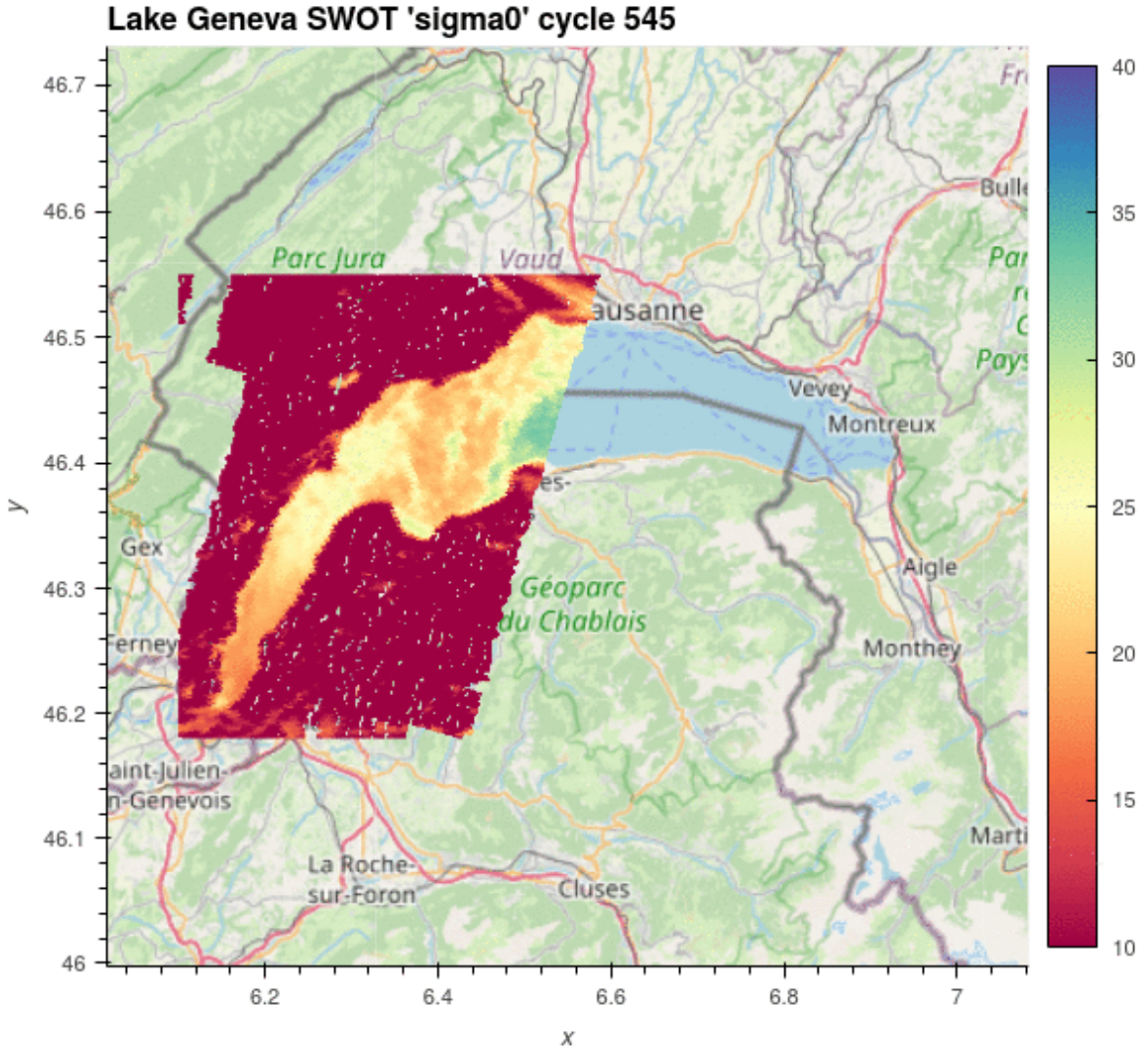
RMSE about 15 cm after XCAL L2 v4.2
7 cm after XCAL L2 v4.3 and 2.5 cm after XCAL L3 and bias removal (SWOT LR 2km)



Sigma0 from HR mode (dB)



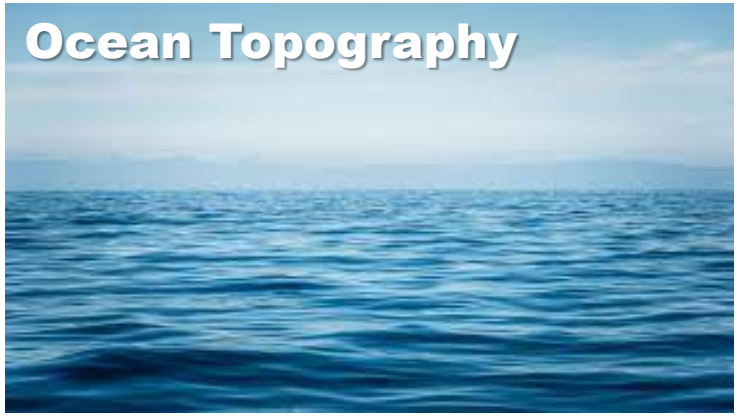
Sigma0 from LR mode (dB)

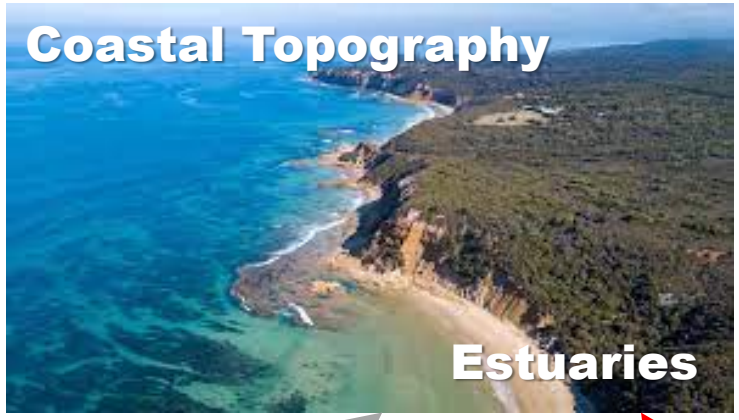


Example #2

Normandy in HR mode

SWOT Products VS Usage

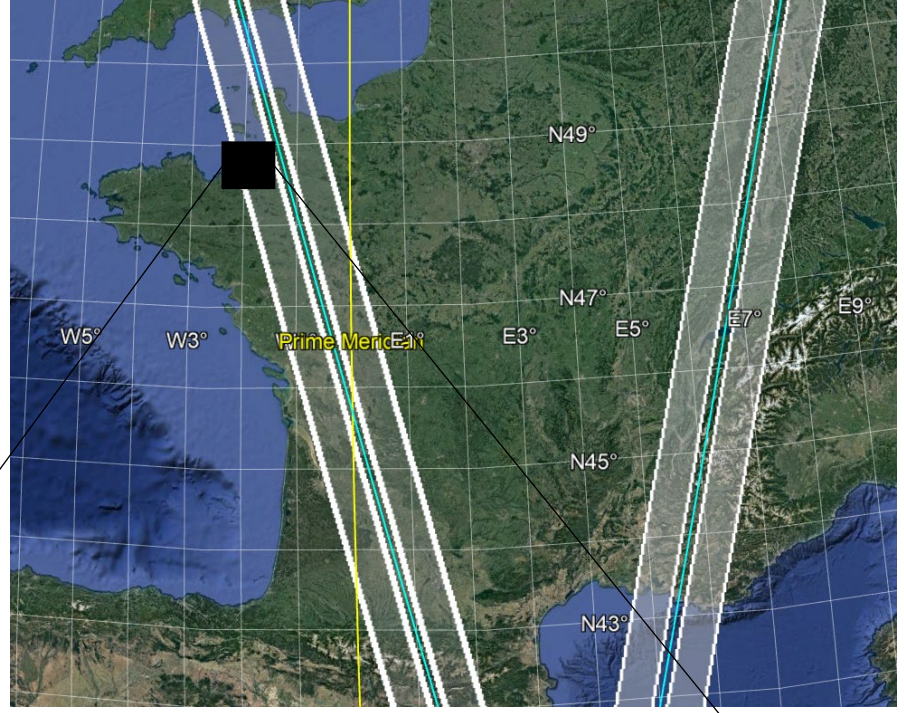


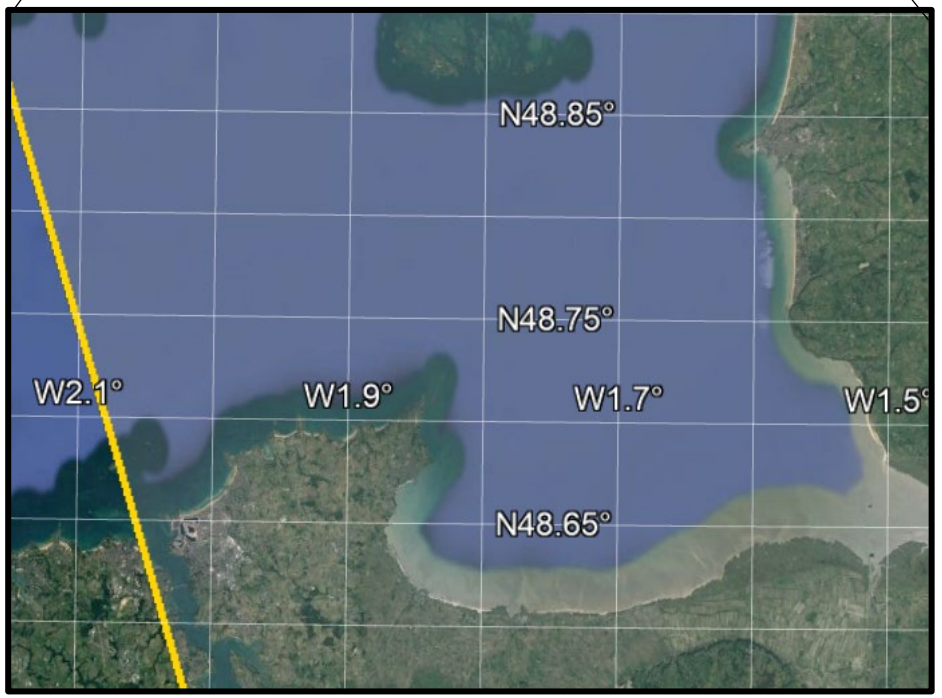


LR mode
2-km or 250-m

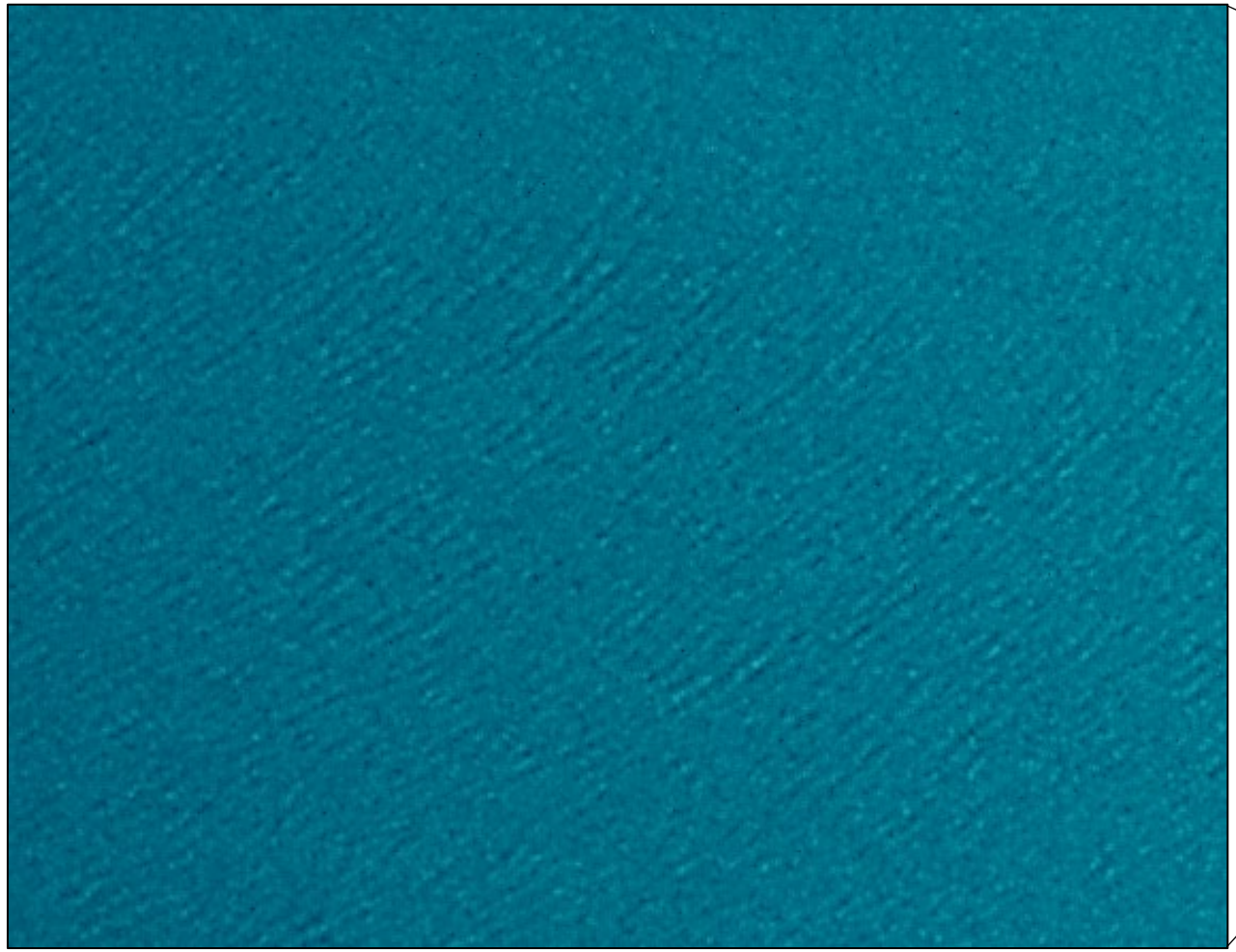
HR mode
Vector or PixC or Raster or L1B

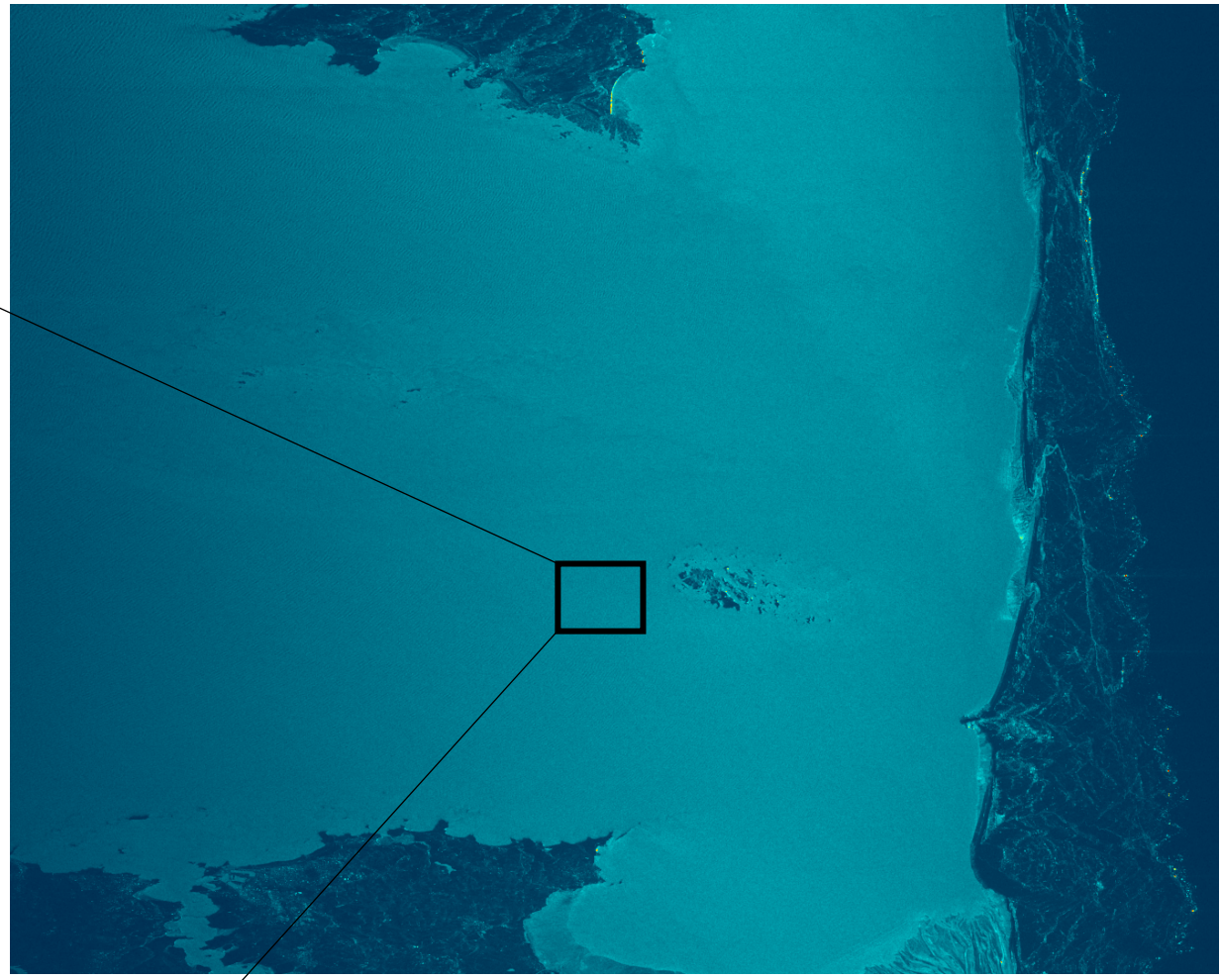
Normandy shore, HR sigma0



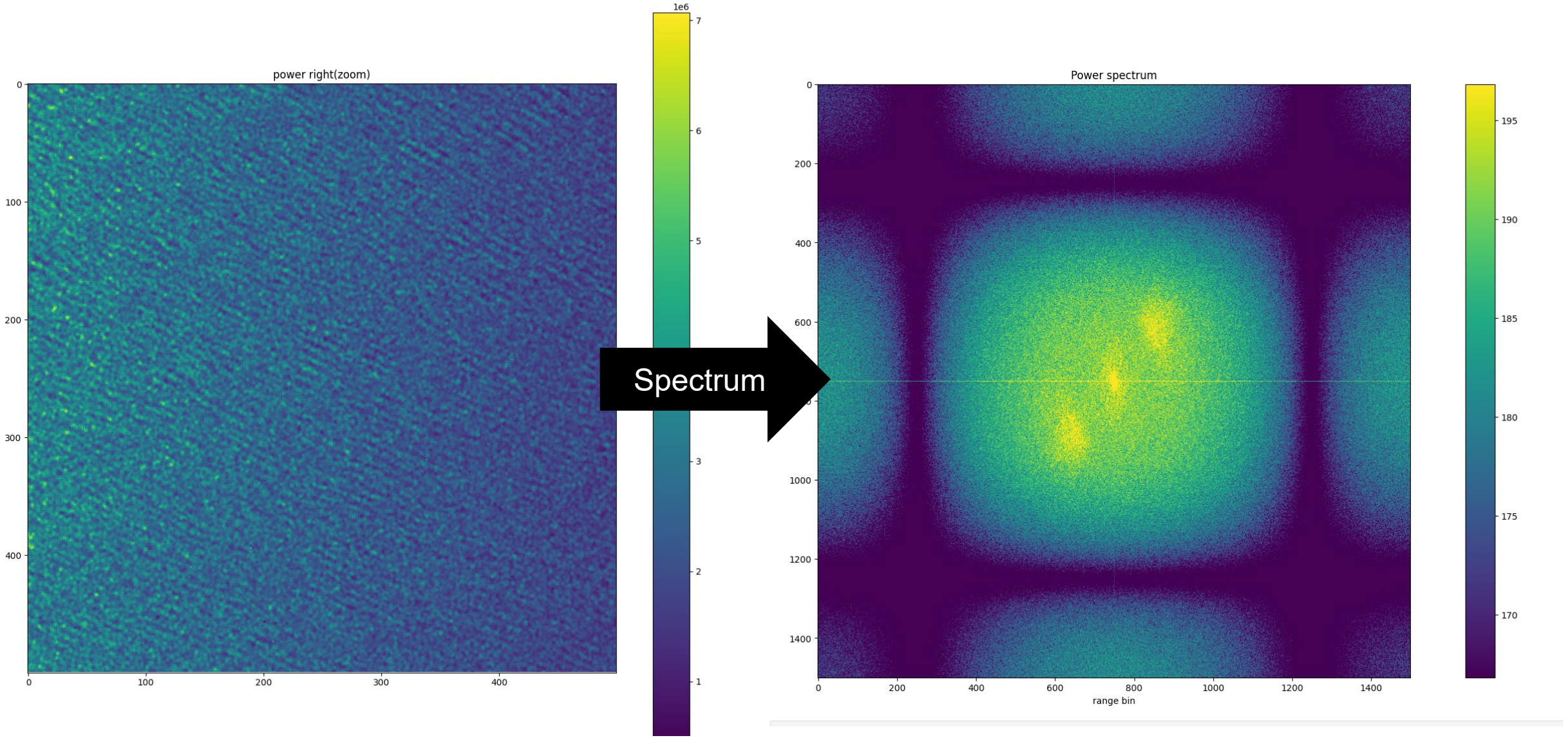


Swell signature in HR surface roughness

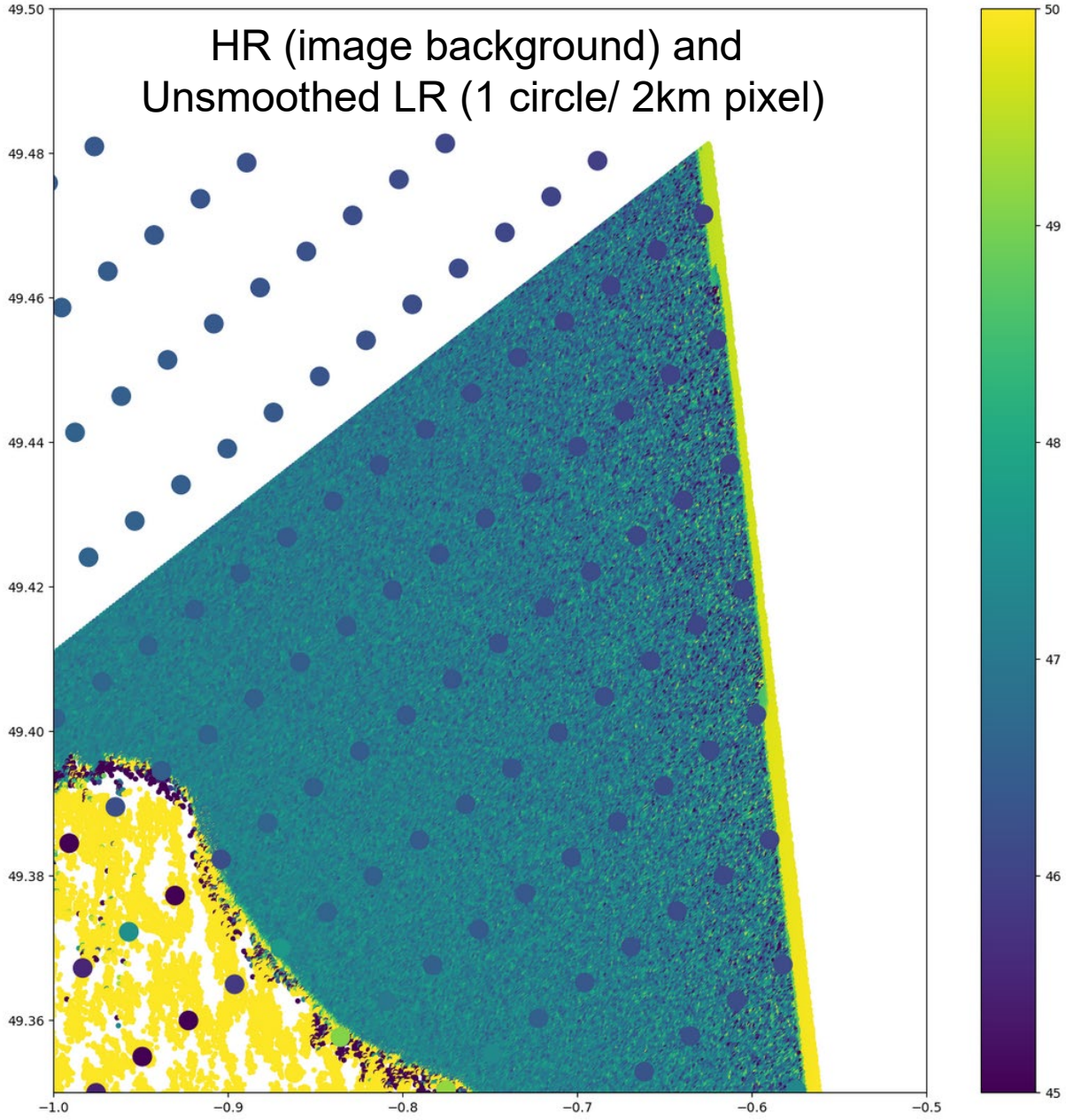




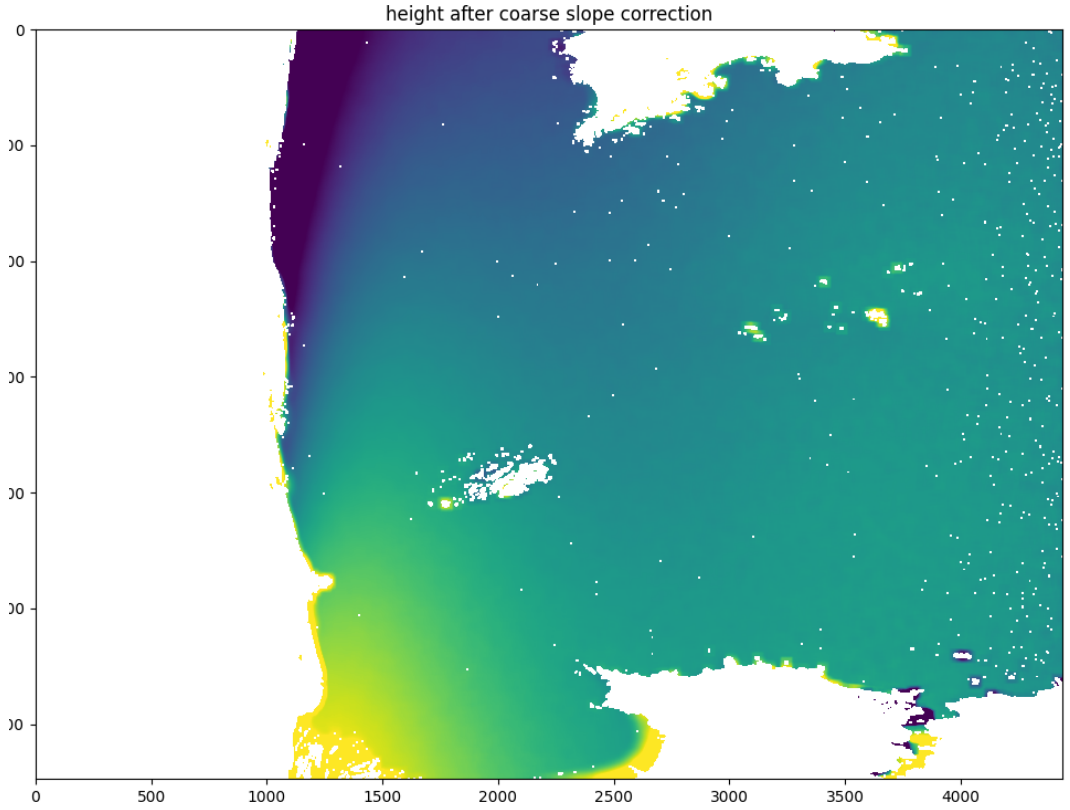
Maybe some sensitivity to shorter swells averaged in 250m/500m



HR tiles are probably overkill for ocean surface topography



o(1mm) noise in LR Expert (2-km)
o(1cm) noise in LR Unsmoothed (250m)
o(10cm) noise in HR PixC o(10m)

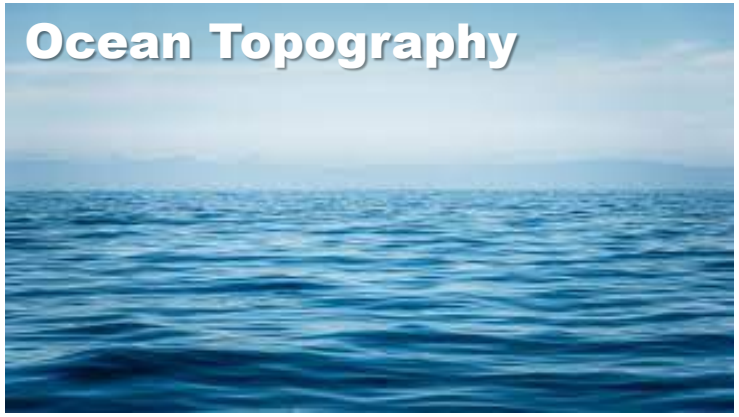


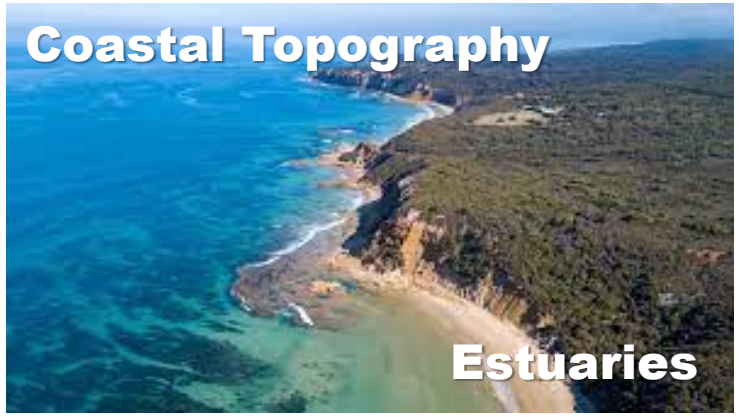
HR PixC in Normandy (noise ~ 30cm)

Example #3

Antarctica dunes in HR mode

SWOT Products VS Usage



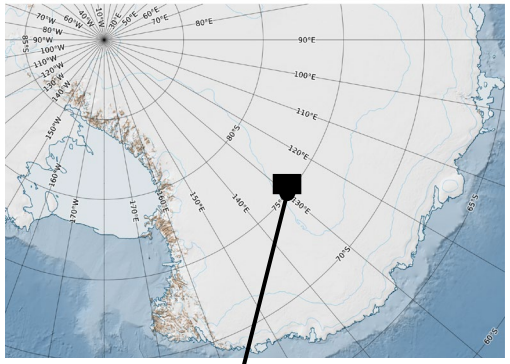


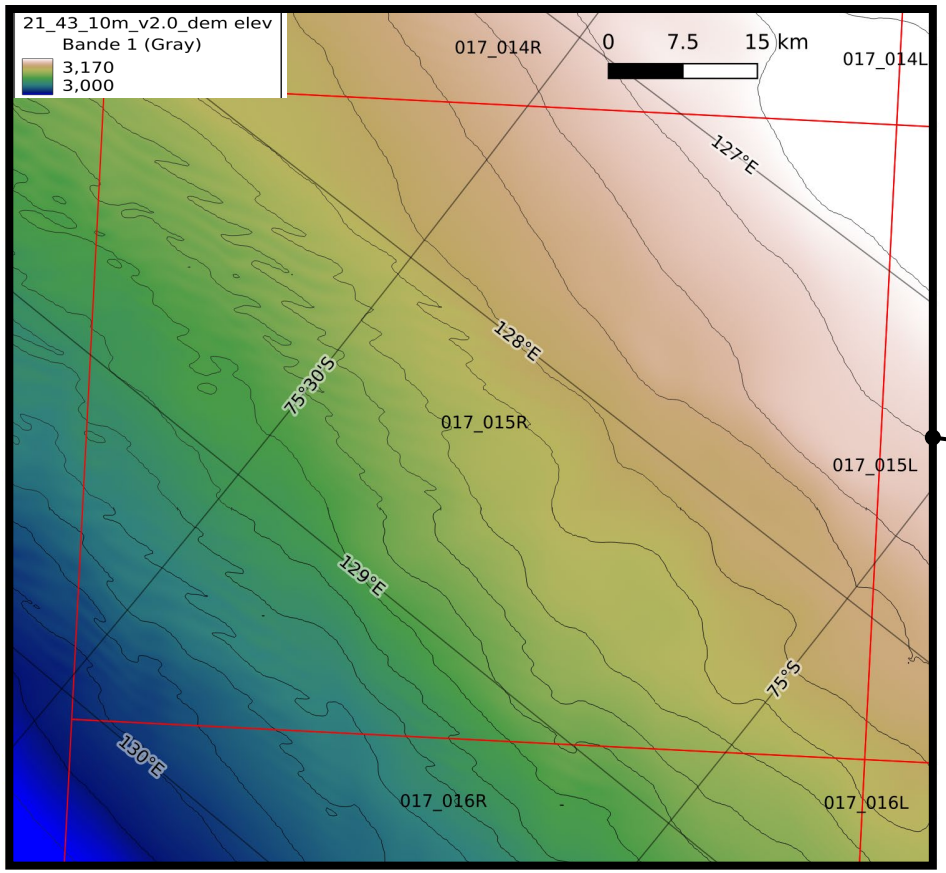
HR mode

Vector or PixC or Raster or L1B

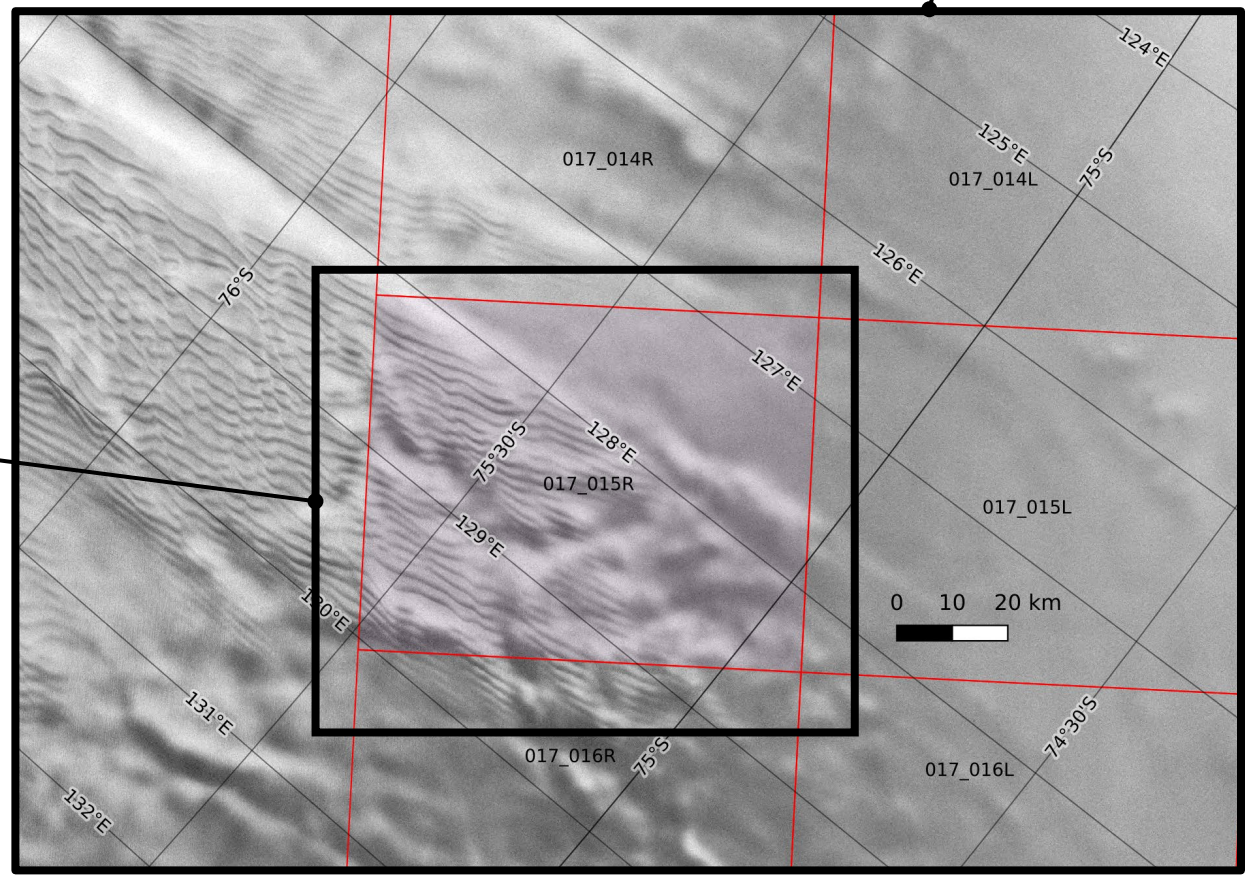
SWOT High-resolution PIXC over Antarctica (1/2)

- Antarctica's interior. SWOT « Pixel Cloud HR product » tile.
- This tile was chosen due to the presence of a megadune field
- Reference data: radarsat (right) and REMA 10-m digital elevation model (left)





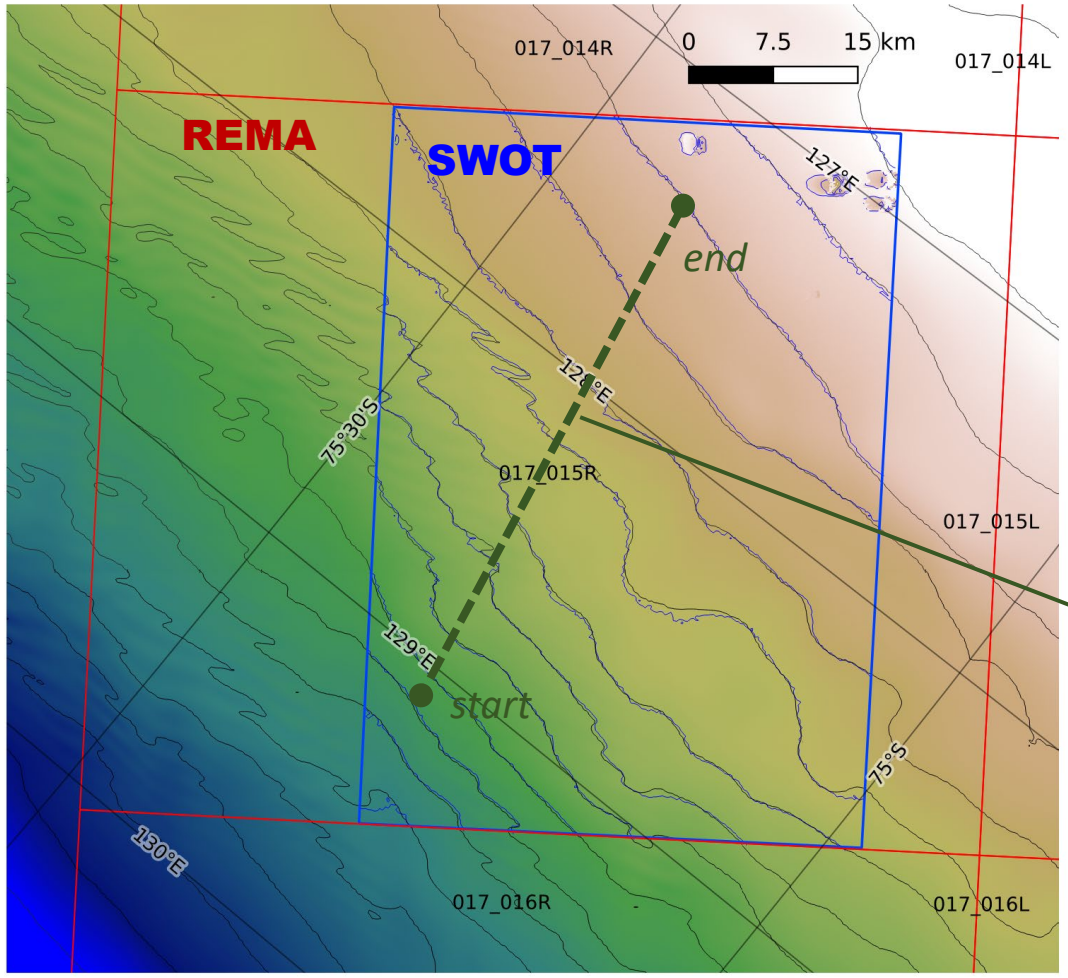
Surface elevation from REMA DEM (10 m resolution). The surface is varying from 3000 m blue) to 3170 m (white) over the area. Black lines are 10 m iso-elevations.



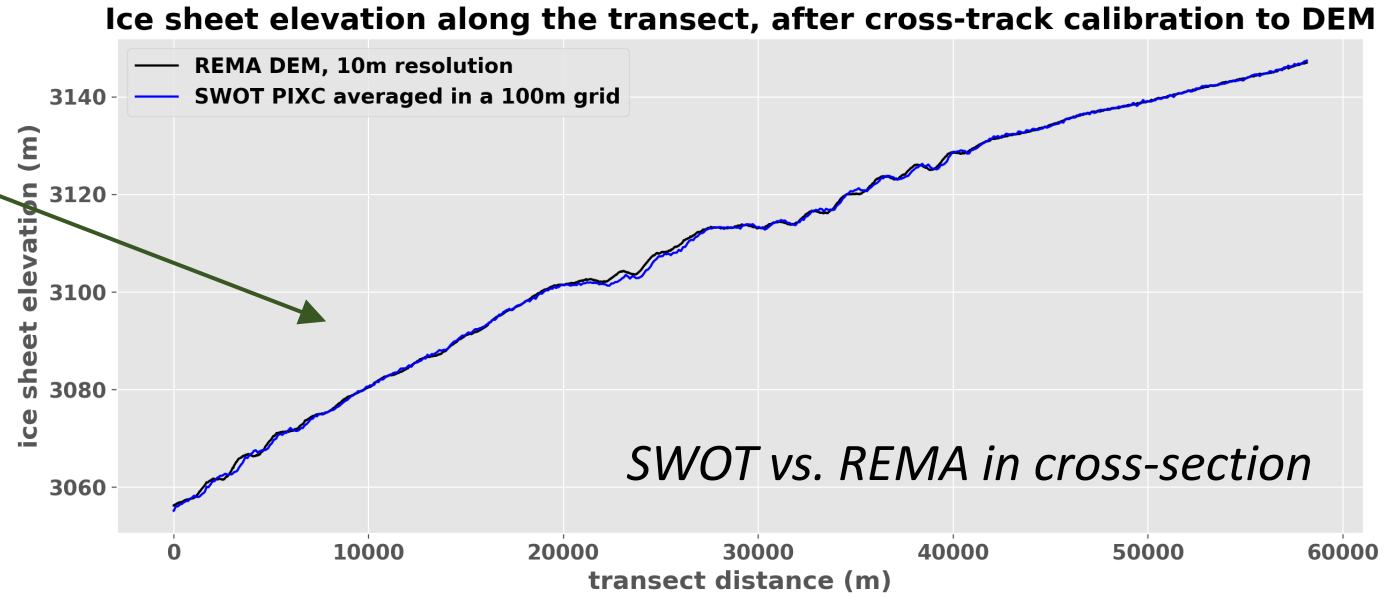
Background is a Radarsat image, showing the presence of megadunes. In red, the mask of SWOT HR acquisitions during commissioning phase.

SWOT High-resolution PIXC over Antarctica (2/2)

Hillshade view of SWOT (blue rectangle) and REMA DEM (red rectangle)
Black lines are 10 m iso-elevations.



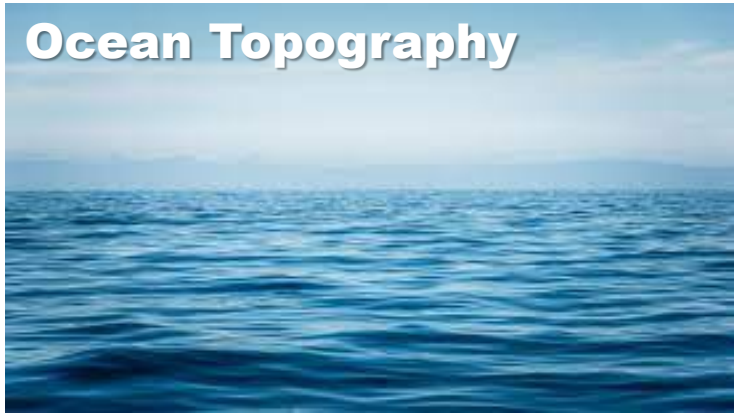
- Excellent qualitative consistency between SWOT and REMA (alignment of mega-dunes in the SWOT image overlay)
- Topography iso-lines from SWOT (blue) and REMA (black) are almost superimposed
- 1D transects confirm that
  - The general topography slope is retrieved
  - Each megadune is well observed by SWOT
- Small scale localization error in SWOT data (ongoing, static phase calibration is not yet applied in HR products)

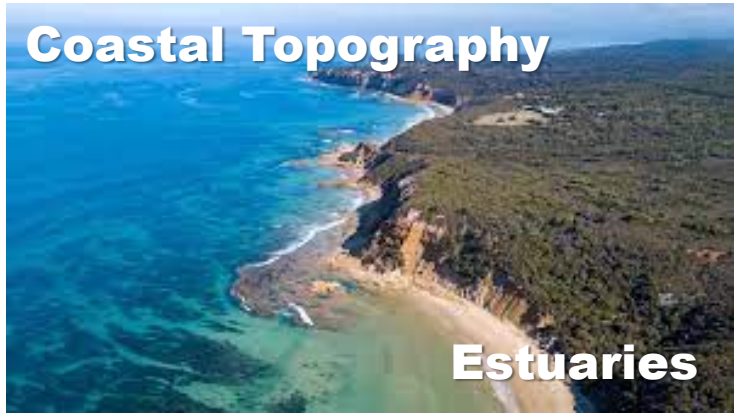


Example #4

Sea-ice in LR mode

SWOT Products VS Usage

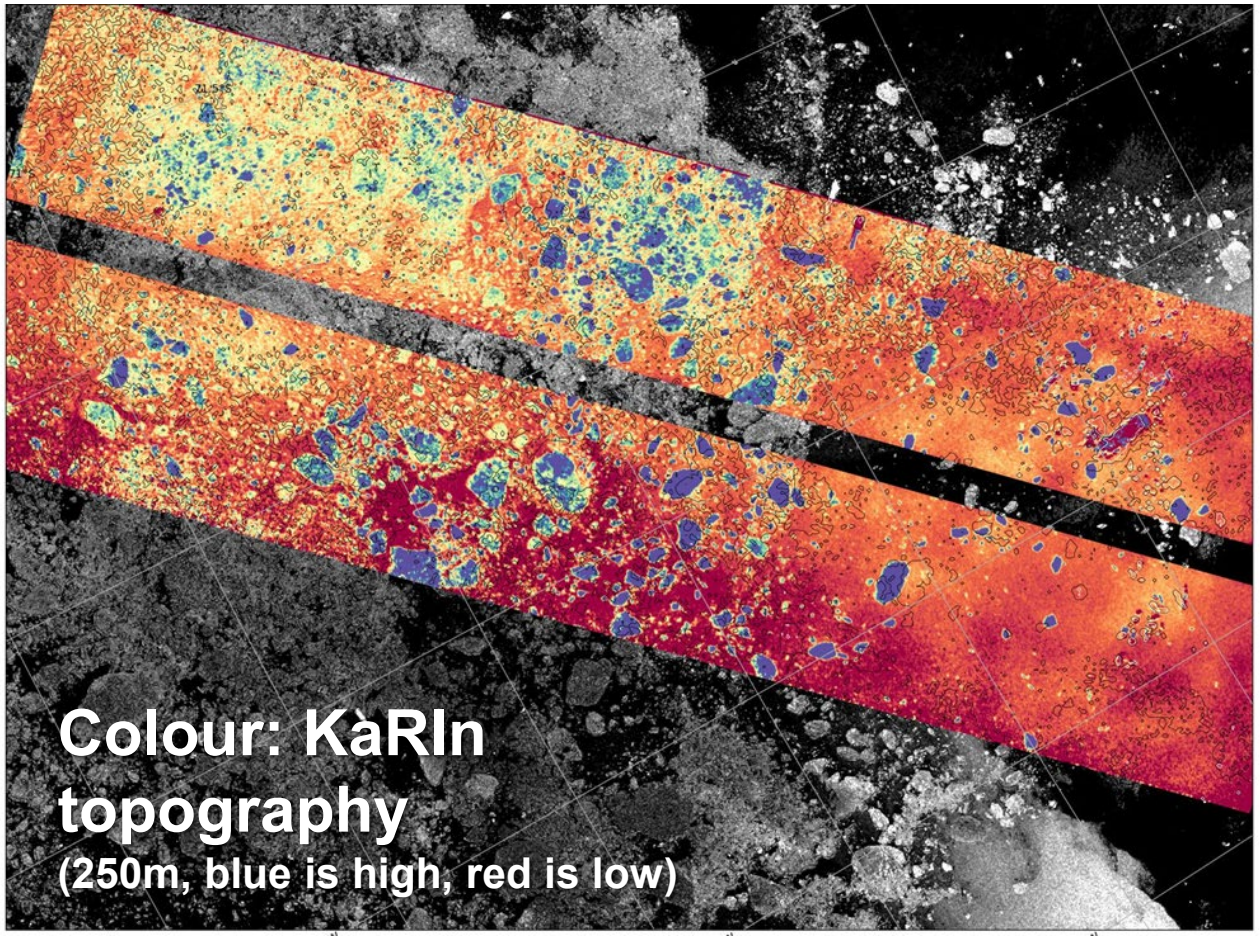


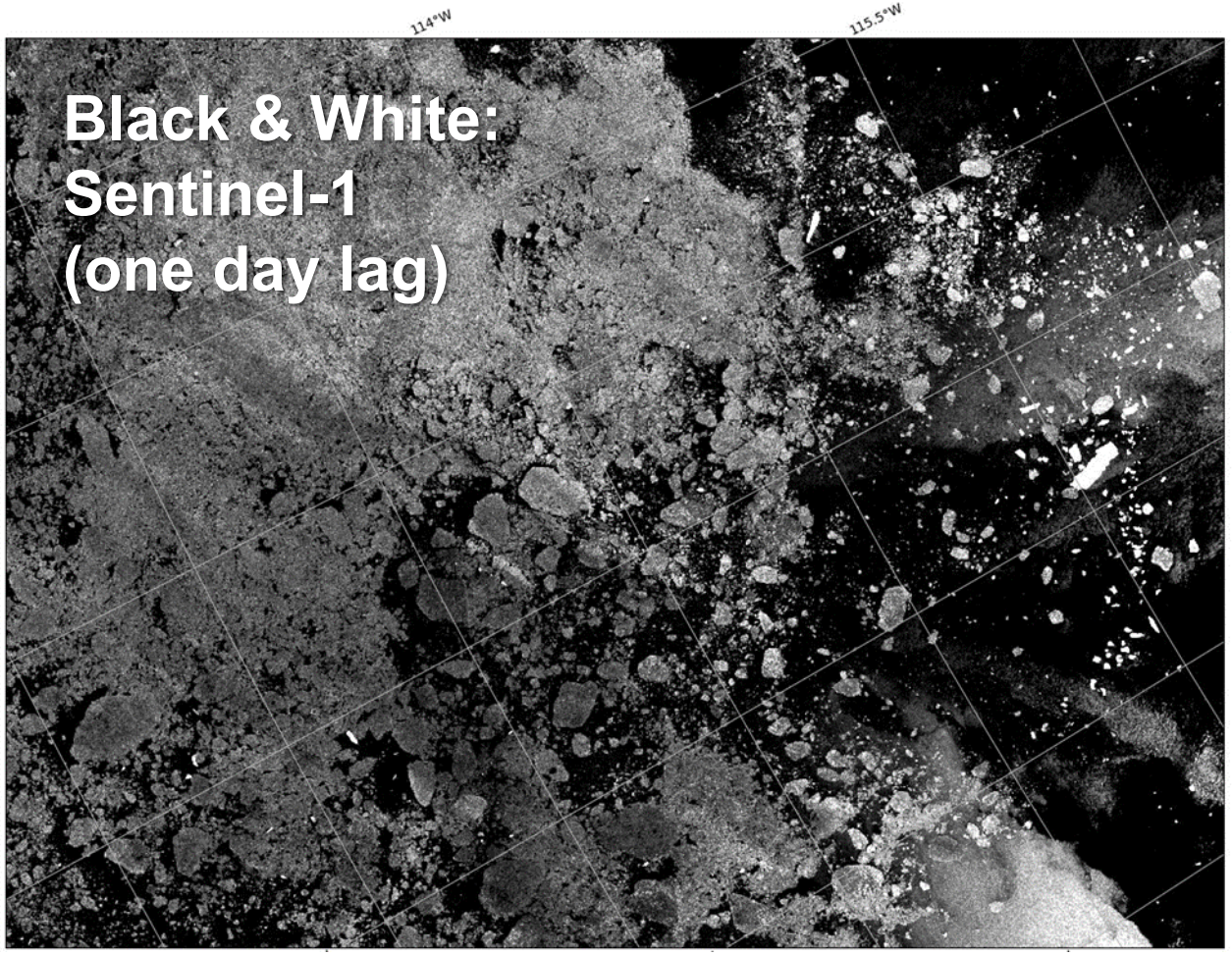


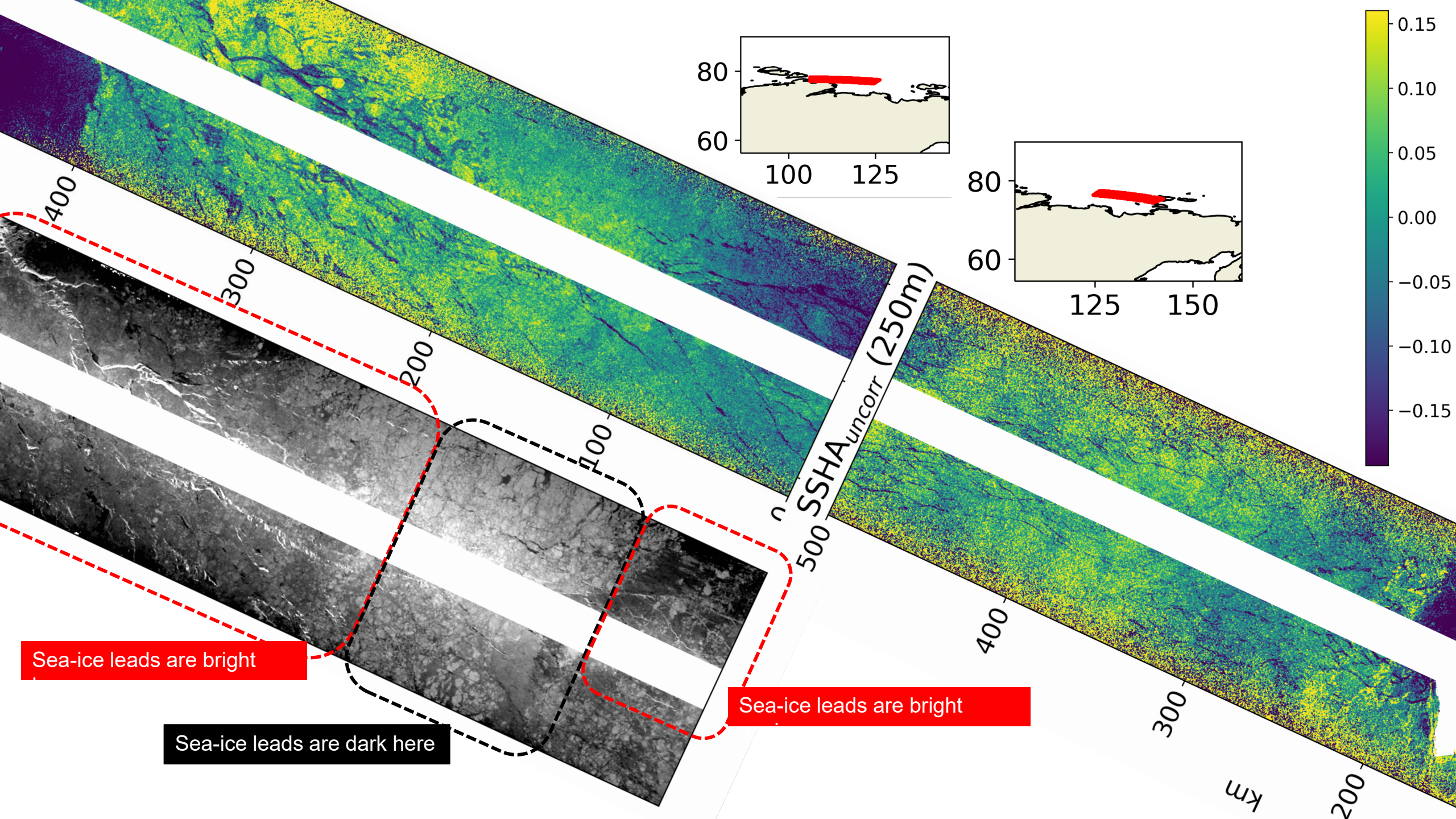
LR mode
2-km or 250-

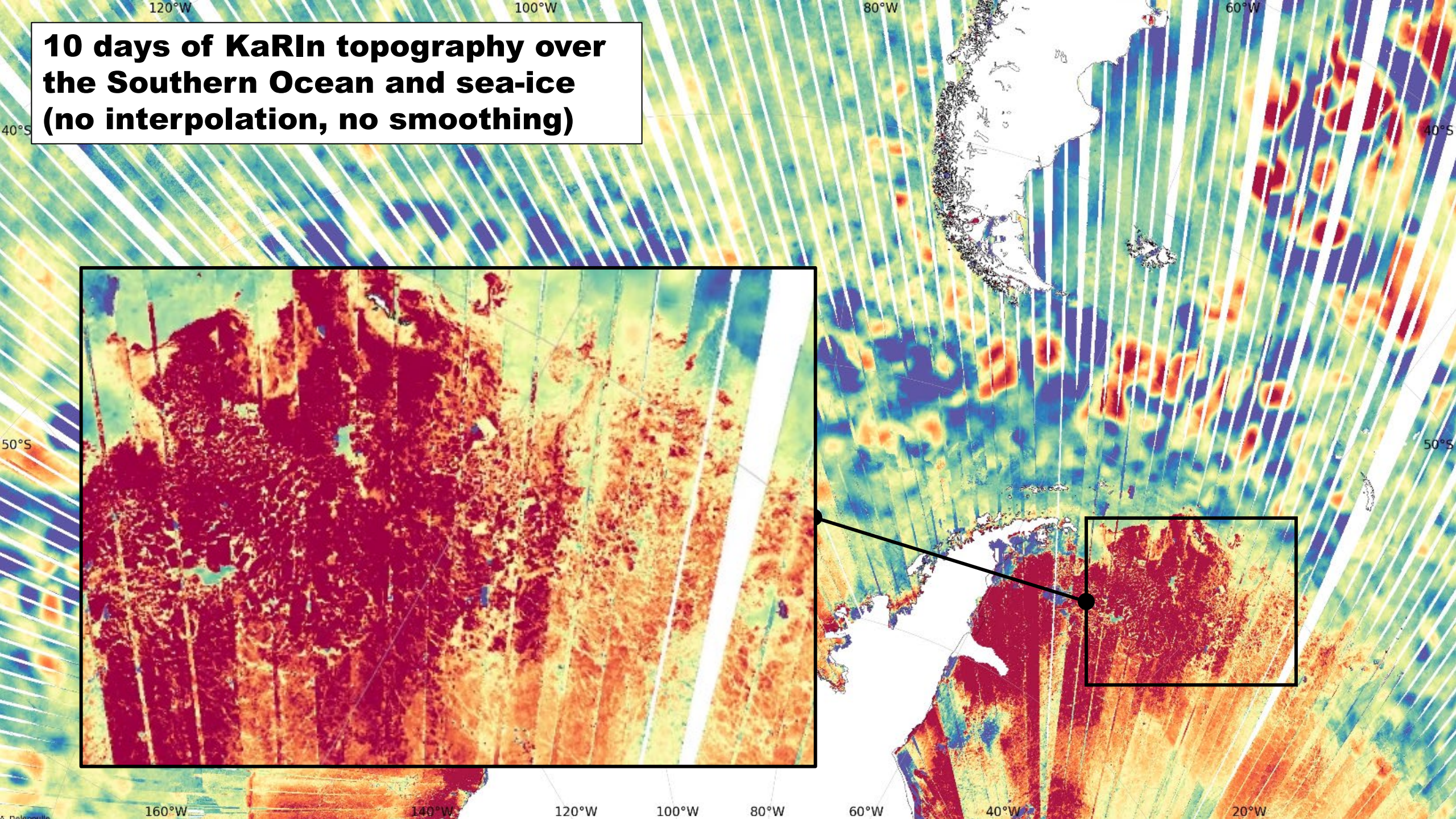
Glaciology: 250-m sea-ice thickness in 2D

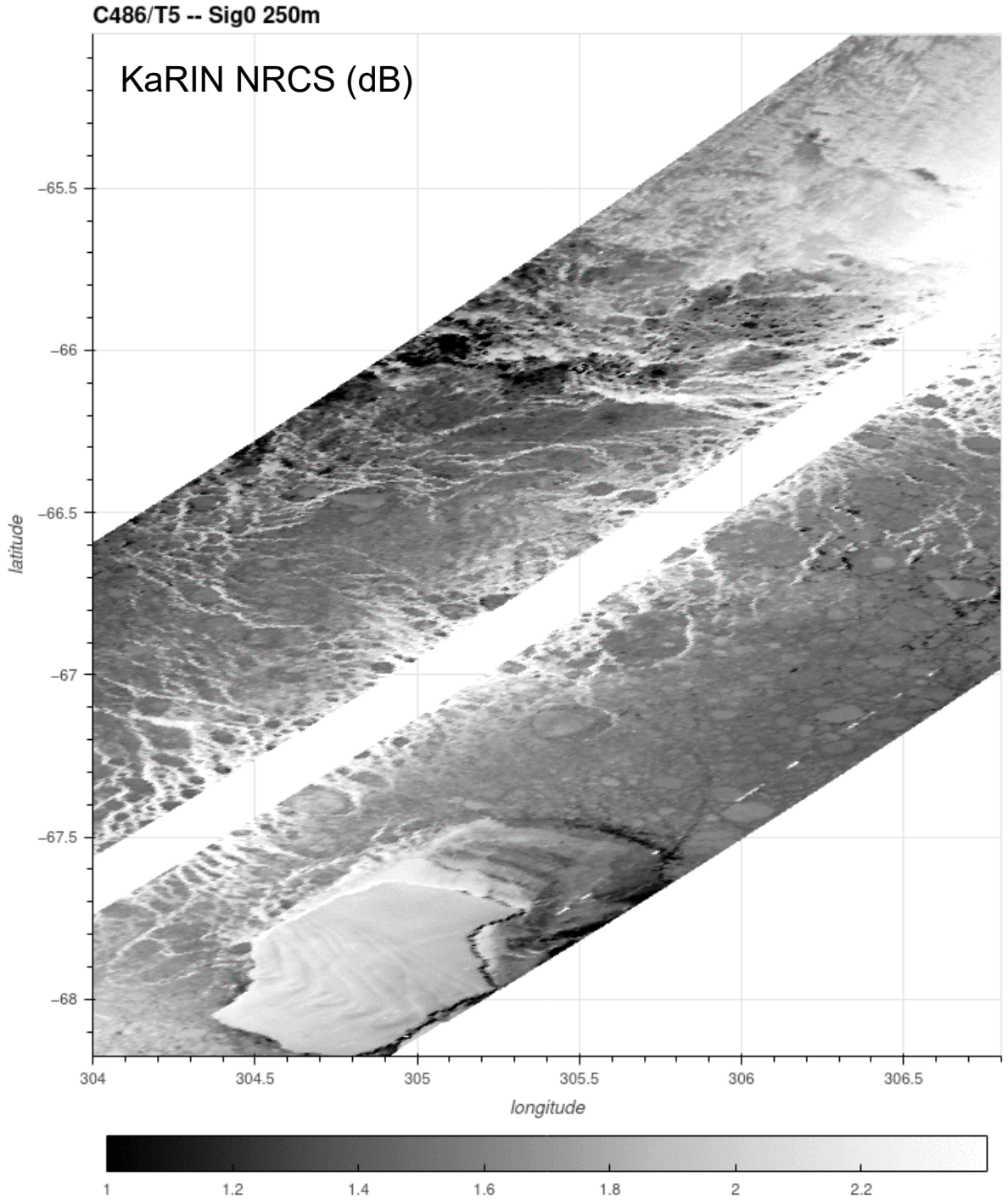
- 250-m products in polar regions: sea-ice topography and ocean topography in ice leads (2D sea-ice thickness)
- Location and shape of smaller icebergs is confirmed with Sentinel-1 (moved by ocean currents every day)
- SWOT's Ka-band bridges the gap between SARAL and CRISTAL (also complements Sentinel-3)

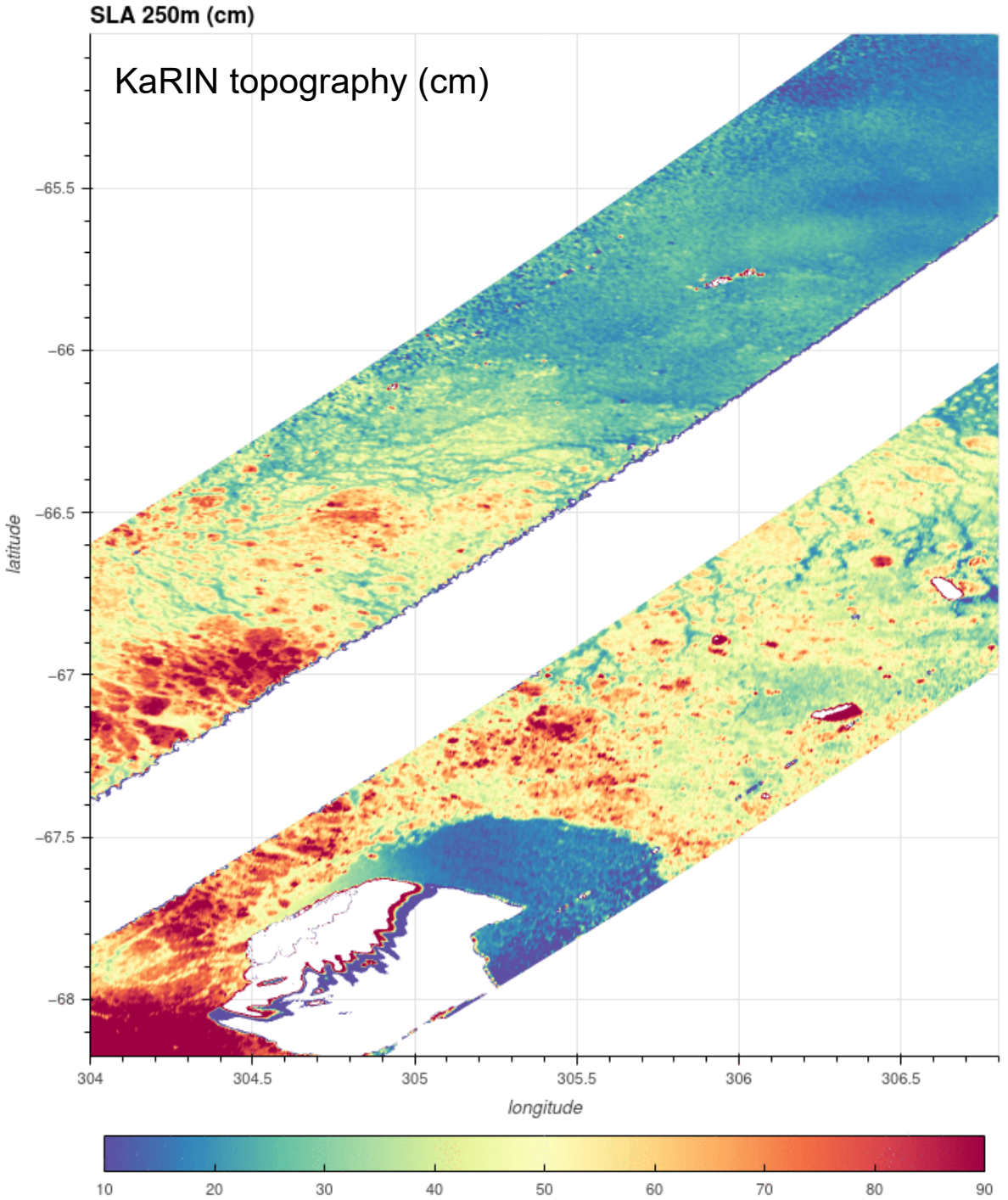


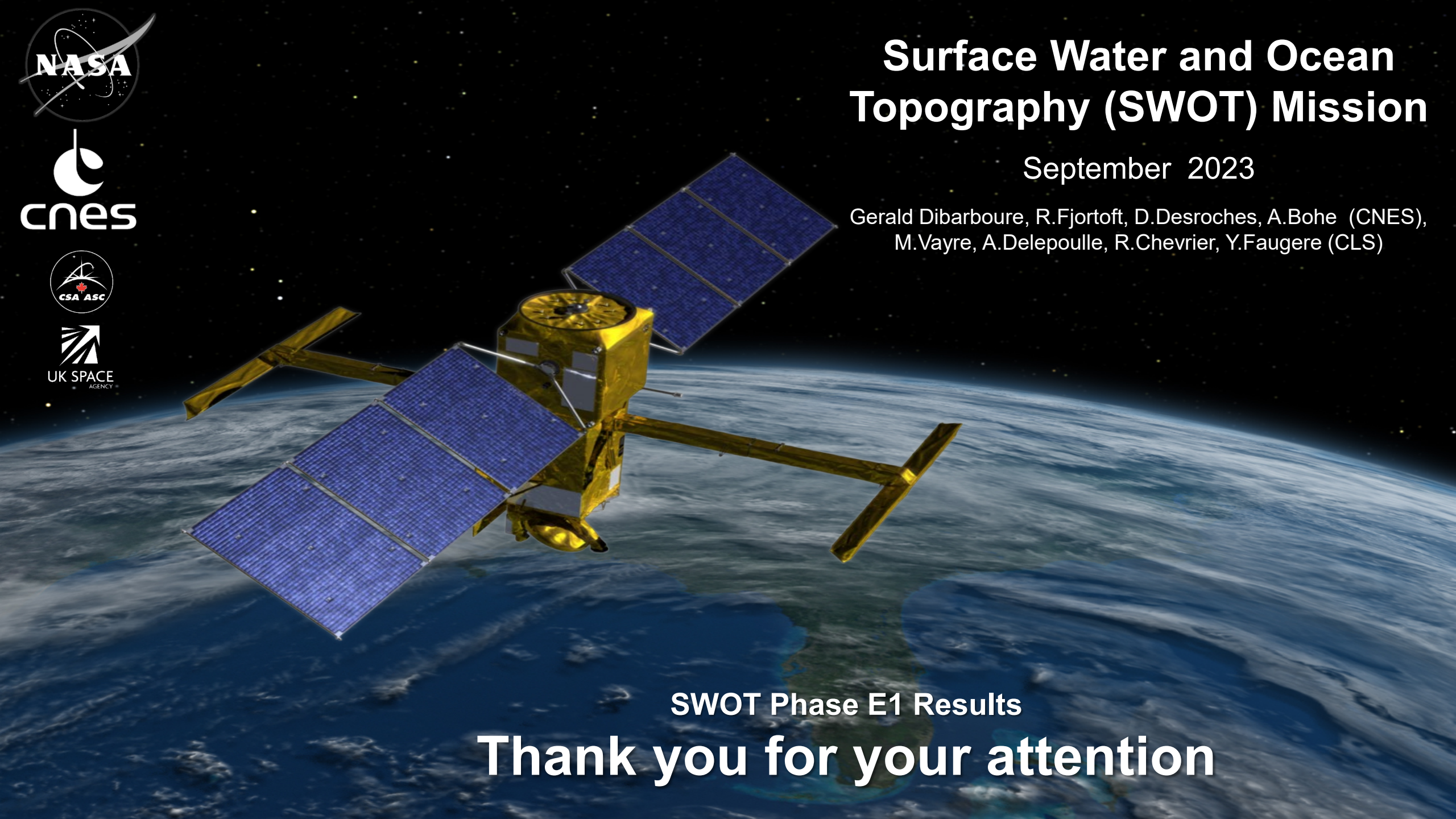



80
60
100
125
80
60
125
150
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
400
300
200
100
0
SSHA$_{uncorr}$ (250m)
500
400
300
200
km
Sea-ice leads are bright
Sea-ice leads are dark here
Sea-ice leads are bright


10 days of KaRIn topography over the Southern Ocean and sea-ice (no interpolation, no smoothing)
120°W
100°W
80°W
60°W
40°S
50°S
160°W
140°W
120°W
100°W
80°W
60°W
40°W
20°W


C486/T5 -- Sig0 250m
KaRIN NRCS (dB)
−65.5
−66
−66.5
−67
−67.5
−68
latitude
304
304.5
305
305.5
306
306.5
longitude
1
1.2
1.4
1.6
1.8
2
2.2


SLA 250m (cm)
KaRIN topography (cm)
−65.5
−66
−66.5
−67
−67.5
−68
latitude
304
304.5
305
305.5
306
306.5
longitude
10
20
30
40
50
60
70
80
90



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SWOT Phase E1 Results

Thank you for your attention