Ok, we can measure water depth with ICESat-2. What's the big deal?

Some use cases based on work at the Shallow Water Earth Observation Lab at the University of Ottawa

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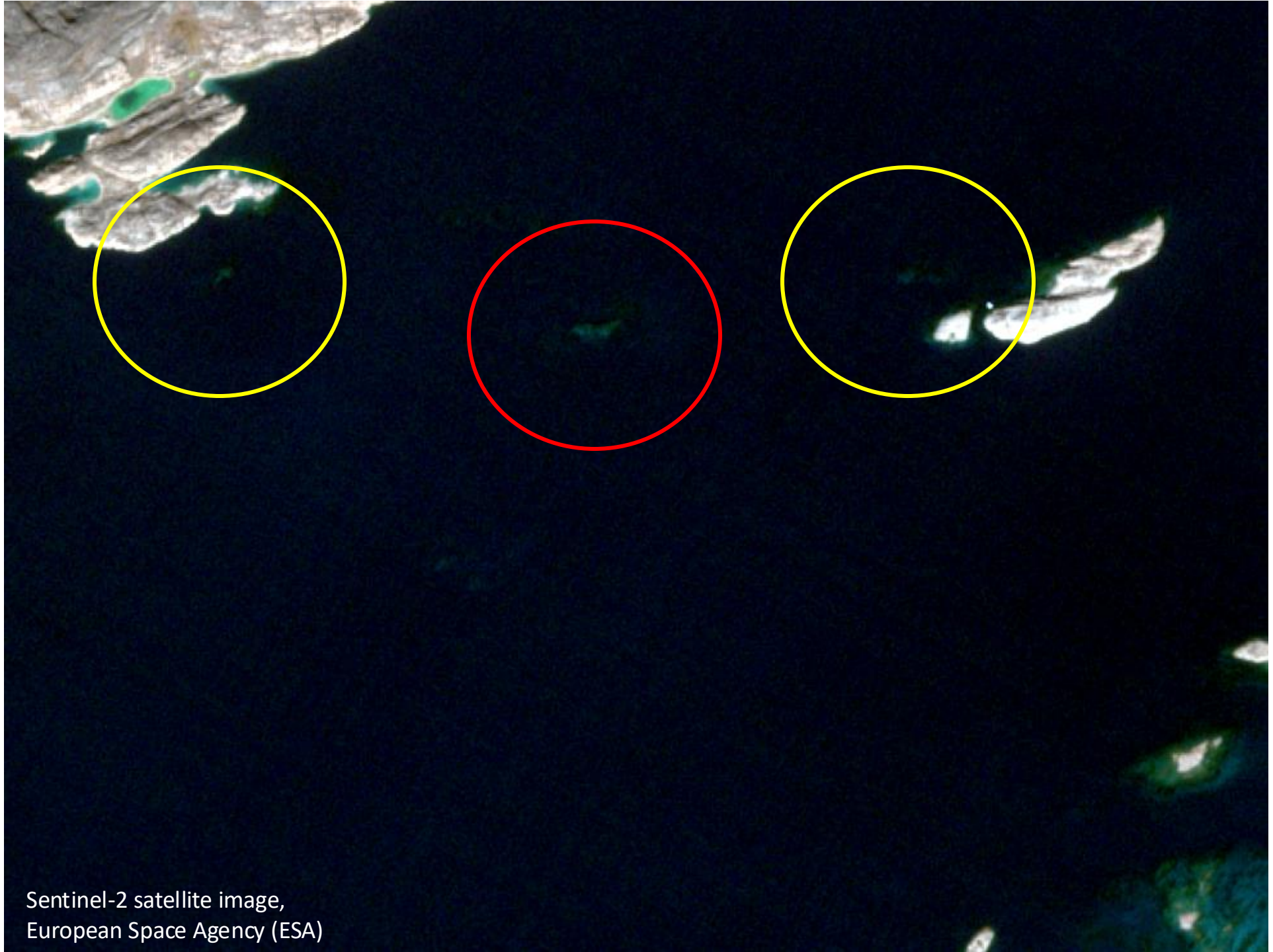
Liquid Geomatics

Akademik Ioffe, grounded 2018

Photo credit: @truedichotomy


A
B
71
92
Canadian Hydrographic Service chart
Sentinel-2 satellite image, European Space Agency (ESA)



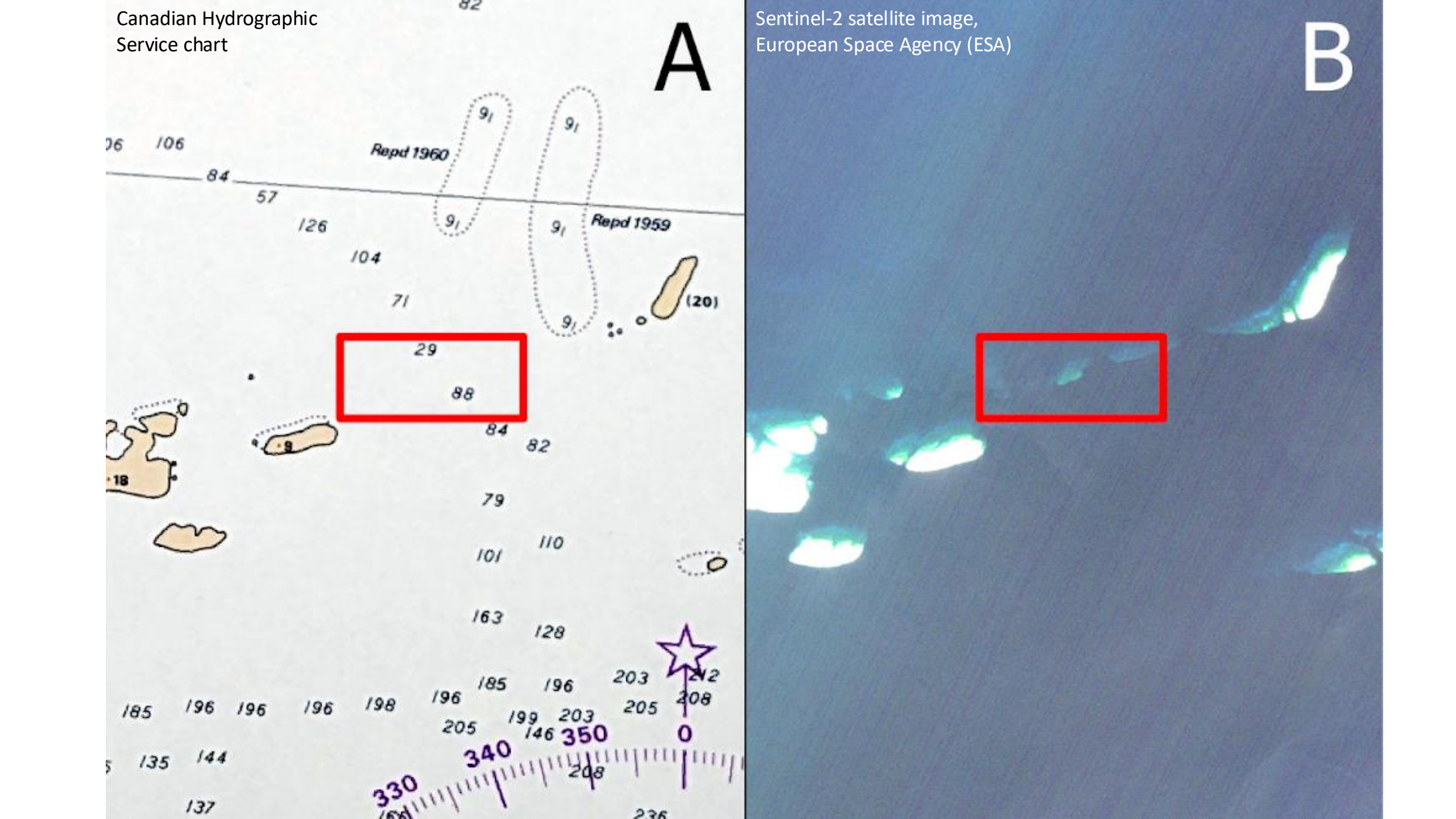
Sentinel-2 satellite image,
European Space Agency (ESA)

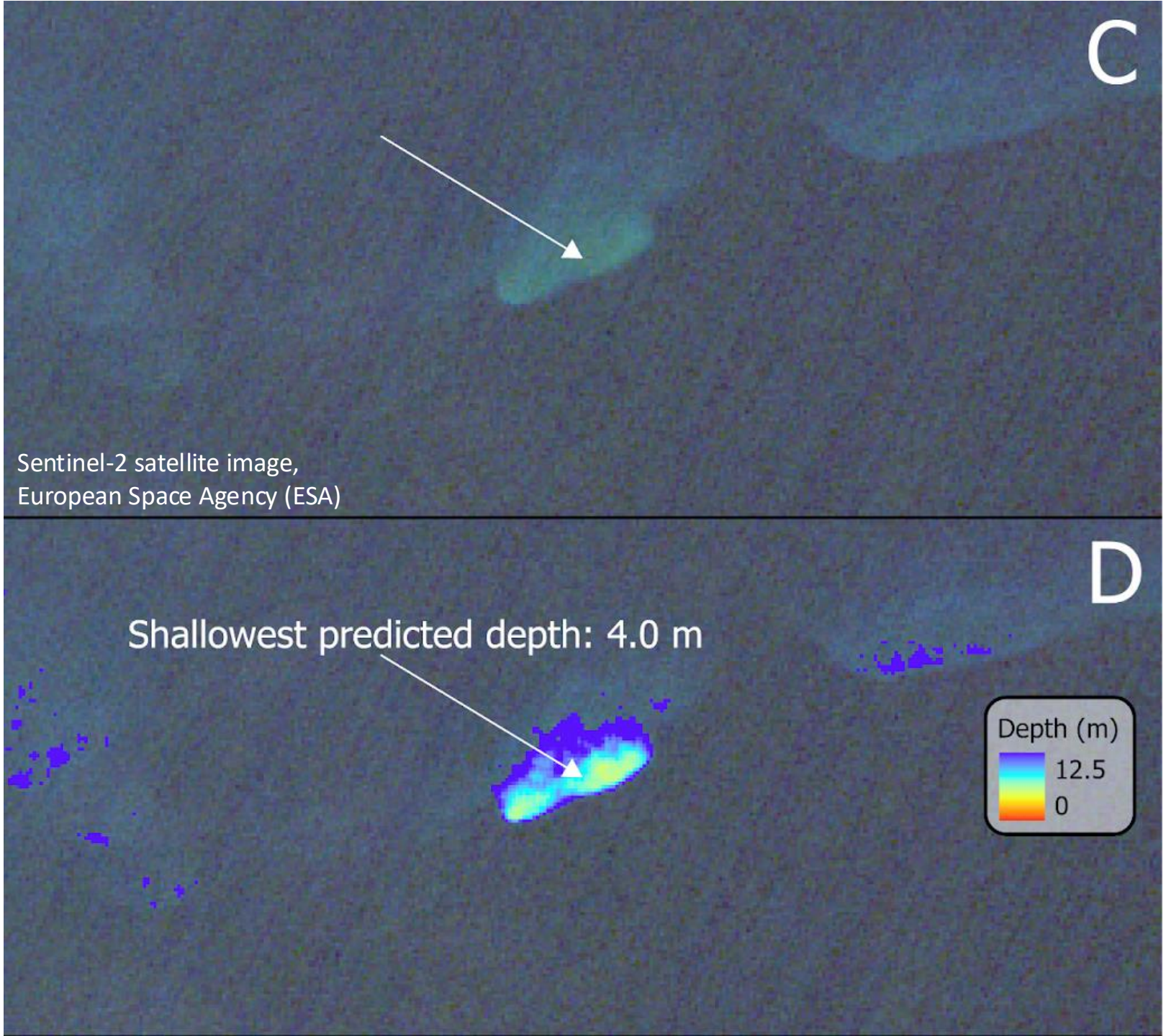
Clipper Adventurer, grounded 2010

Photo credit: The Canadian Press

Clipper Adventurer, grounded 2010

Photo credit: Transportation Safety Board


Canadian Hydrographic Service chart
A
Repd 1960
Repd 1959
(20)
Sentinel-2 satellite image, European Space Agency (ESA)
B


C
Sentinel-2 satellite image,
European Space Agency (ESA)
D
Shallowest predicted depth: 4.0 m
Depth (m)
12.5
0

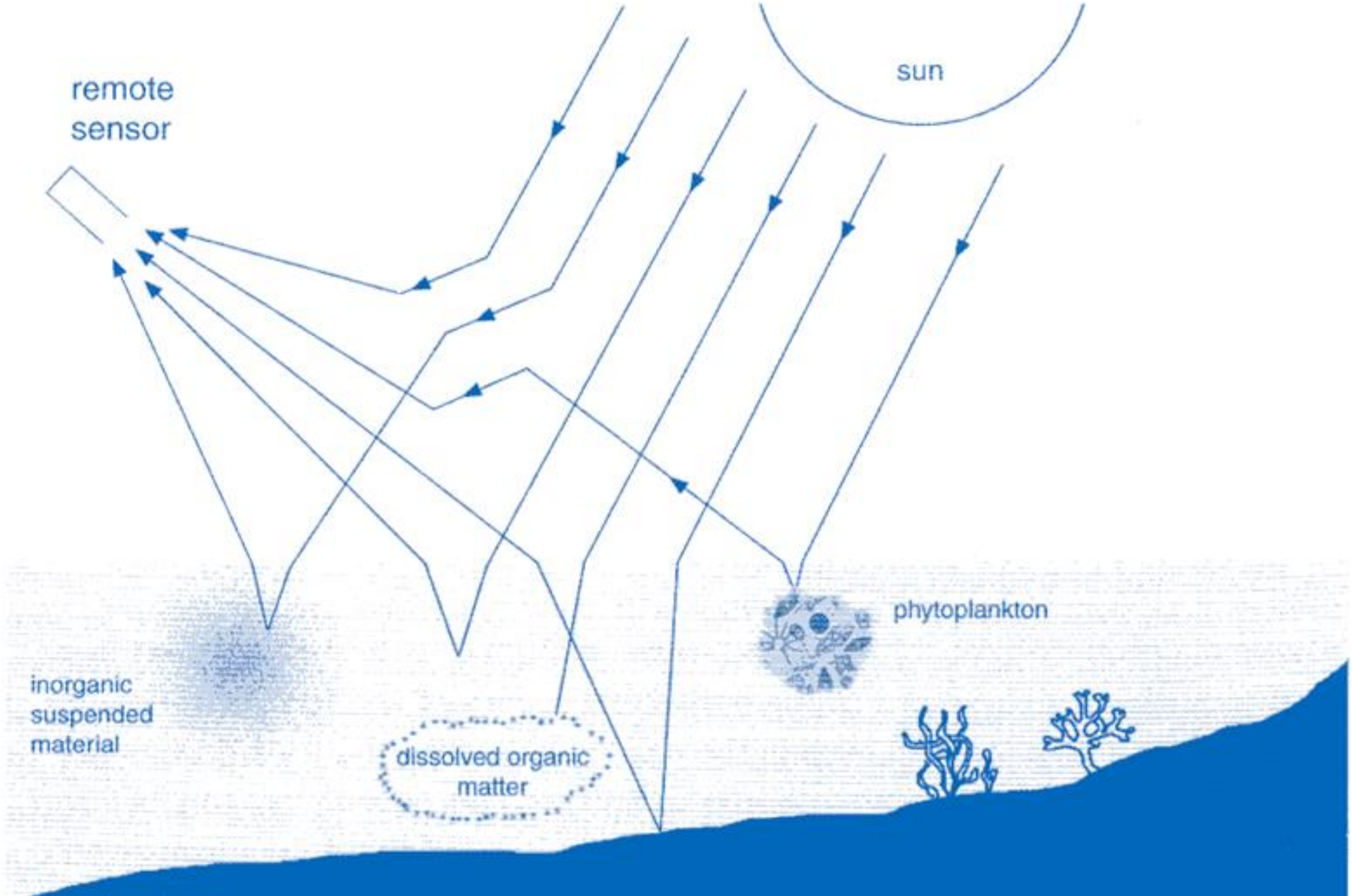


Figure from
Hedley 2018

Reflectance 443 nm	Reflectance 492 nm	Reflectance 559 nm	Reflectance 665 nm	Water depth (m)
0.06	0.07	0.04	0.01	0.50
0.05	0.06	0.03	0.01	1.23
0.02	0.03	0.01	0.00	5.79
0.02	0.02	0.01	0.00	8.26
0.04	0.06	0.03	0.01	2.61

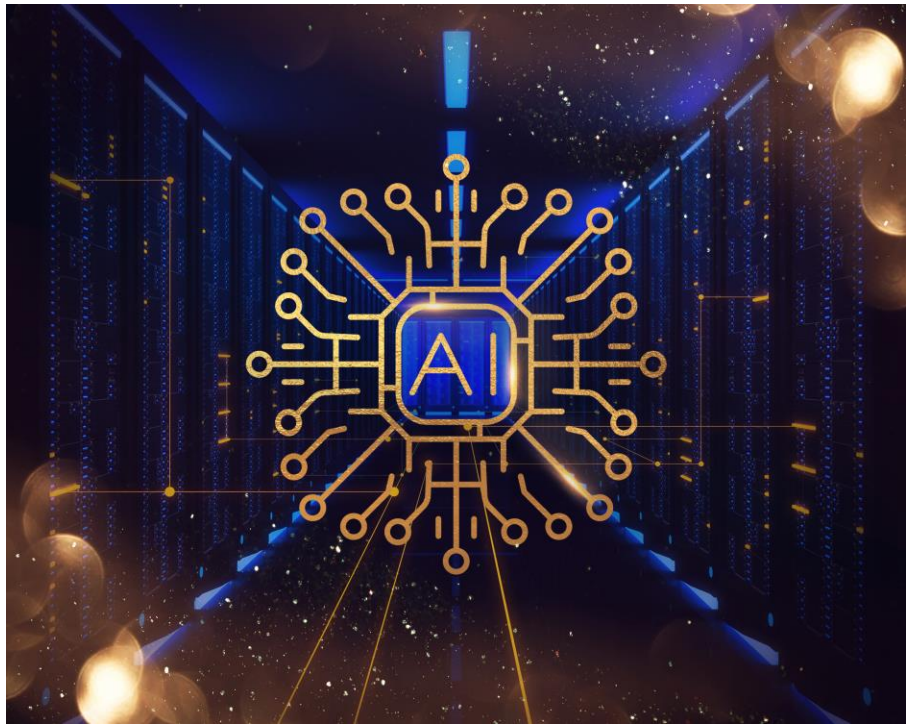


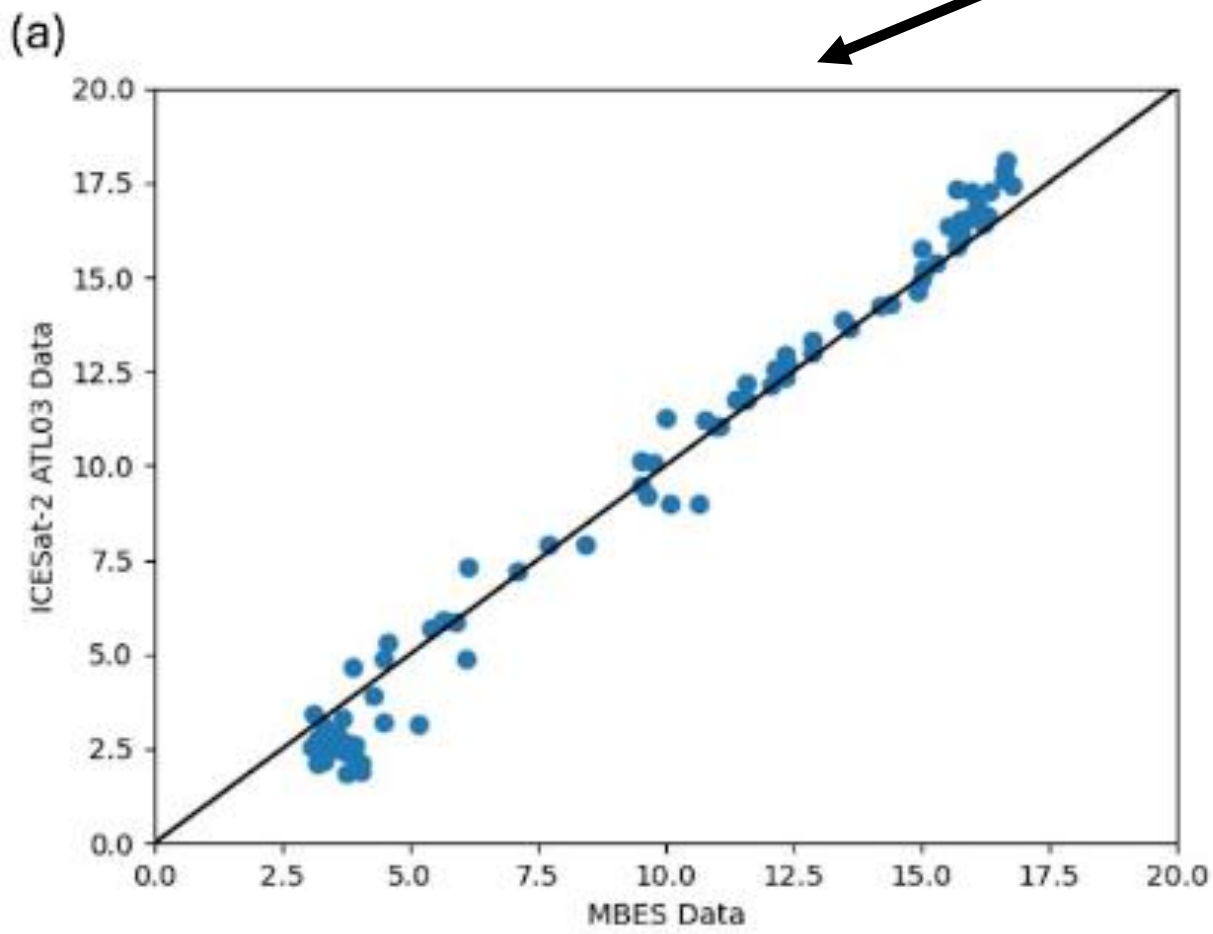
Image from Wikimedia Commons

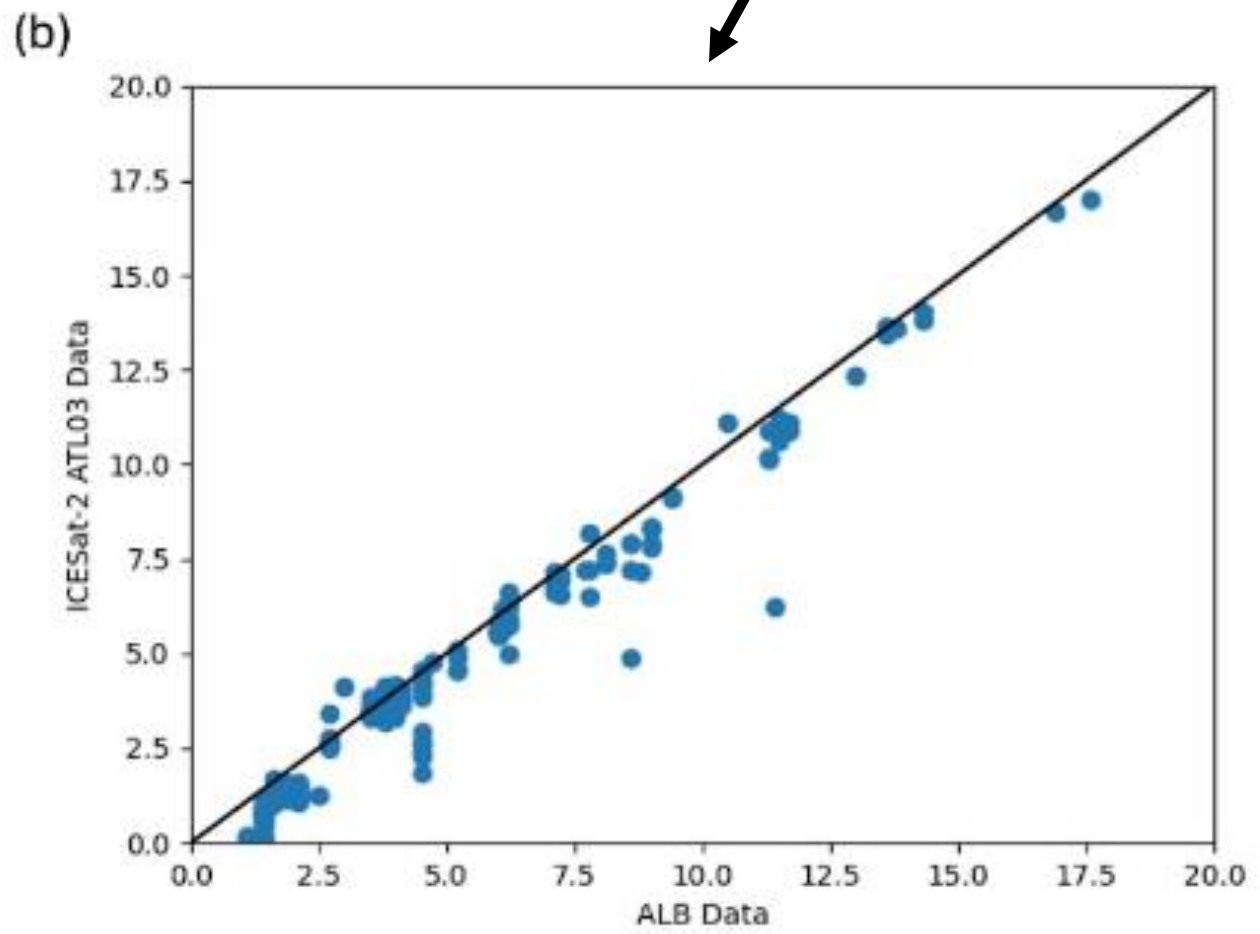
Predictions (of water depth) made from reflectance values

Sentinel-2 satellite image,
European Space Agency (ESA)

Sentinel-2 satellite image,
European Space Agency (ESA)

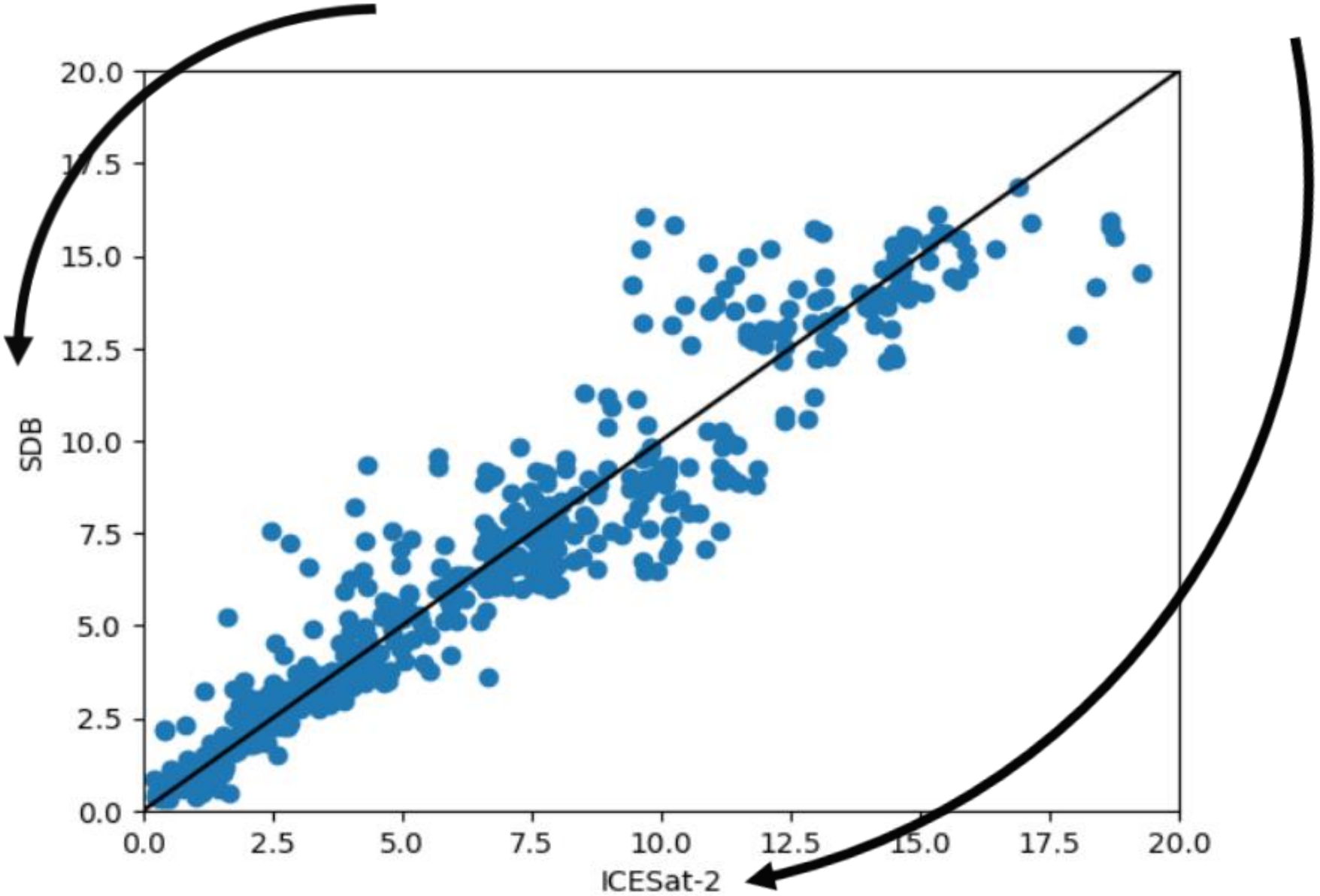
Comparing ICESat-2 bathymetry to multibeam and airborne lidar

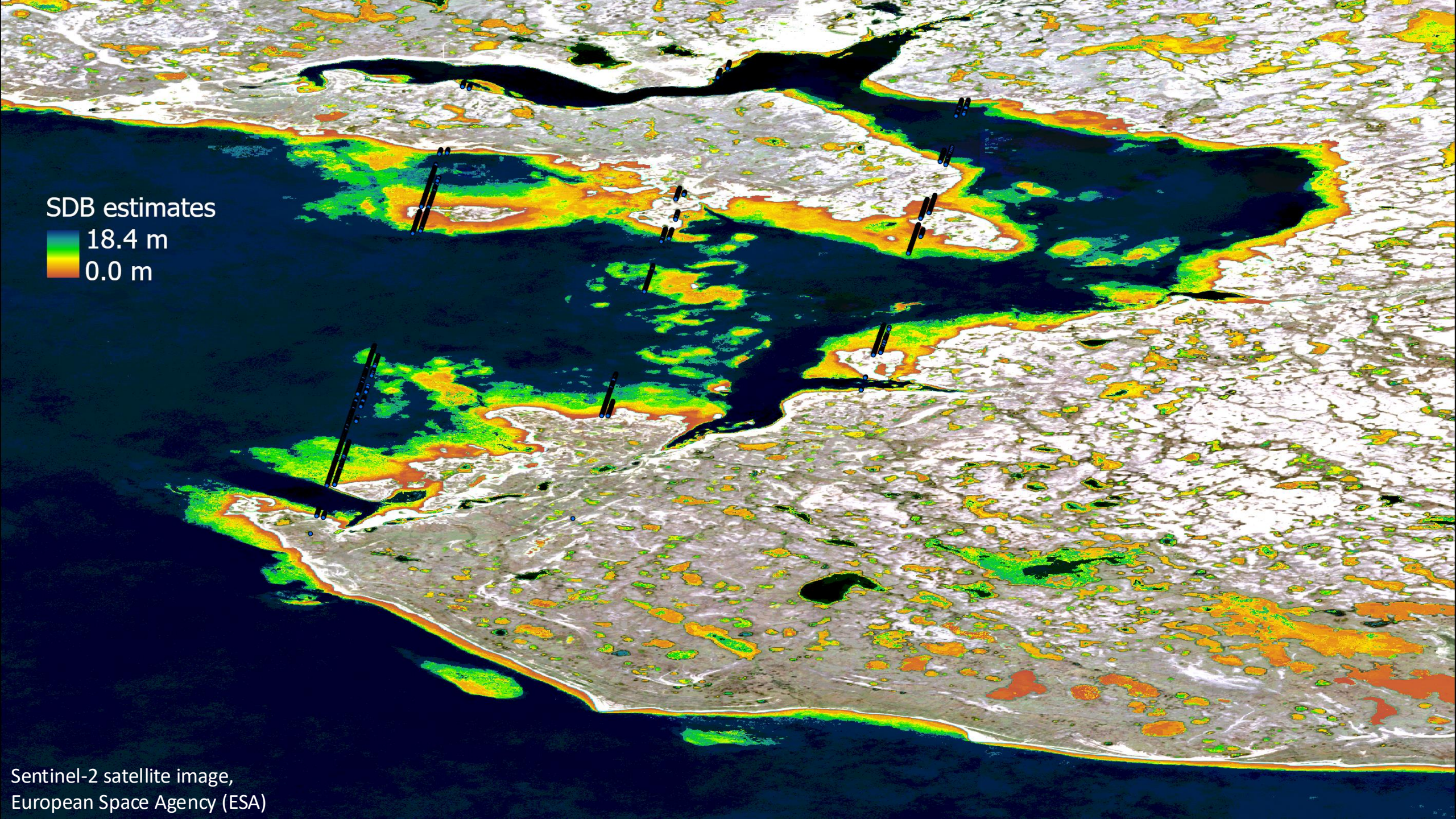


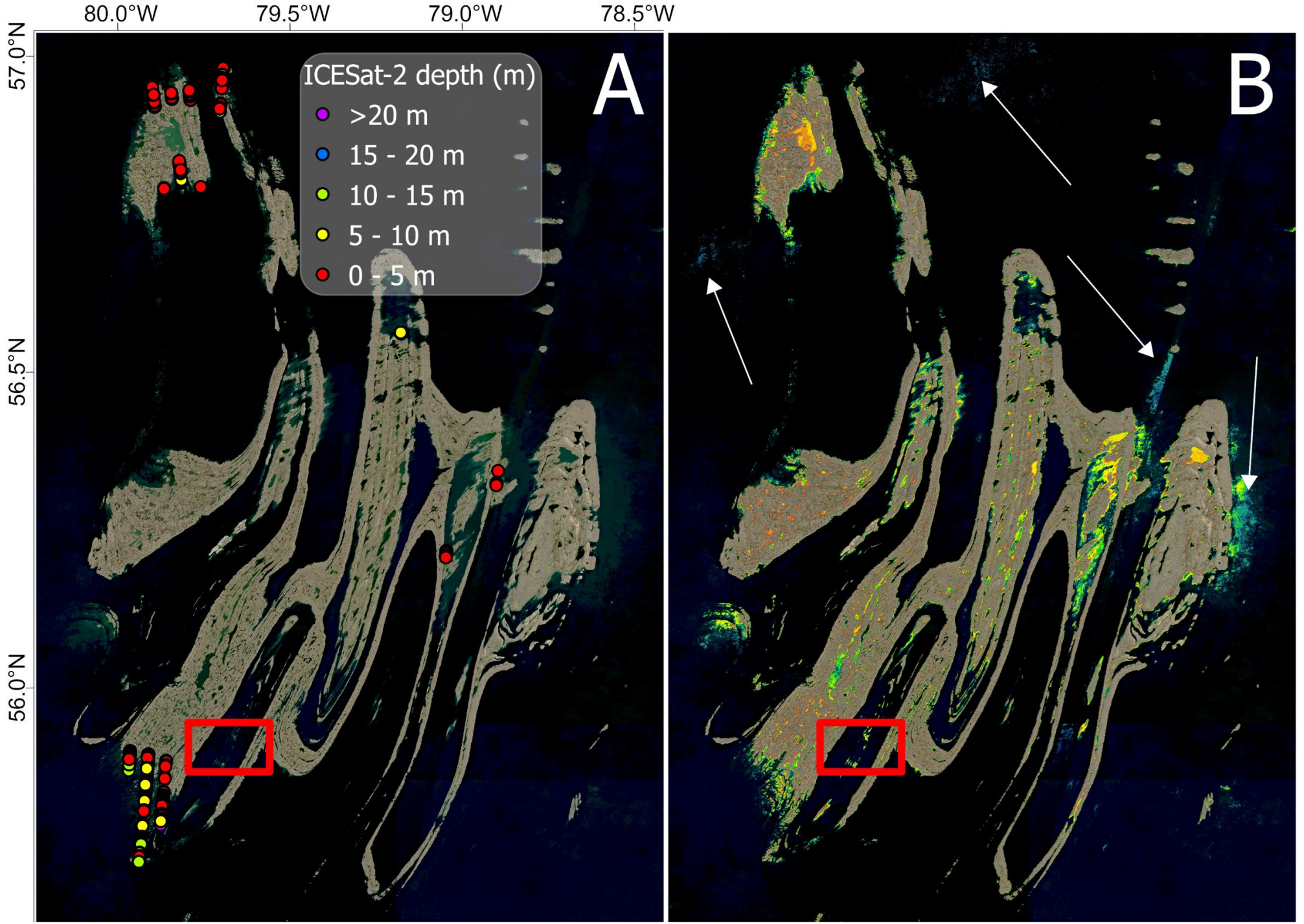


	b1	b2	b3	b4	b5	depth
0	0.004812	0.027208	0.044689	0.001387	0.001808	3.093920
1	0.004812	0.027444	0.050379	0.001547	0.002281	3.160245
2	0.004812	0.028150	0.043500	0.001994	0.002455	3.568195
3	0.004812	0.028317	0.044533	0.001579	0.001808	3.242617
4	0.004812	0.029283	0.050270	0.001628	0.002281	3.243683
5	0.004815	0.023767	0.039046	0.002660	0.001989	6.587730
6	0.004815	0.024056	0.040528	0.002748	0.001989	6.095595
7	0.004815	0.025540	0.038792	0.002469	0.004282	7.190985
8	0.004815	0.039309	0.040747	0.002949	0.002270	5.567390
9	0.004815	0.039673	0.040959	0.003318	0.002533	4.795798
10	0.004815	0.040690	0.041667	0.003416	0.002533	4.441499
11	0.004991	0.018667	0.043180	0.001575	0.002089	2.527400
12	0.004991	0.024822	0.051870	0.020550	0.002211	2.323857
13	0.004991	0.025191	0.057992	0.020975	0.002211	1.552312
14	0.004991	0.027256	0.050800	0.001323	0.001923	3.043950
15	0.005265	0.018700	0.044435	0.001683	0.002482	3.108060
16	0.005265	0.027656	0.042300	0.002297	0.002396	3.827913
17	0.005265	0.028361	0.043660	0.001919	0.002419	2.808780
18	0.005475	0.014533	0.023897	0.002104	0.002557	5.546830
19	0.005475	0.022881	0.025767	0.002512	0.002650	4.124783

Comparing SDB estimates to ICESat-2 bathymetry

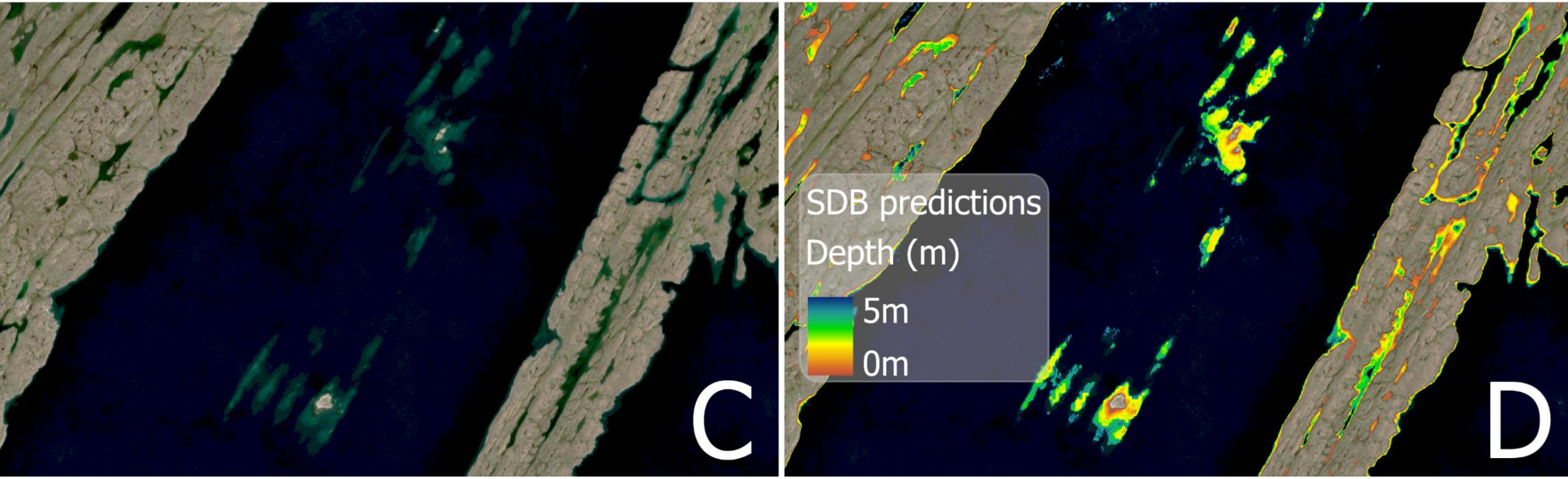



SDB estimates
18.4 m
0.0 m
Sentinel-2 satellite image,
European Space Agency (ESA)

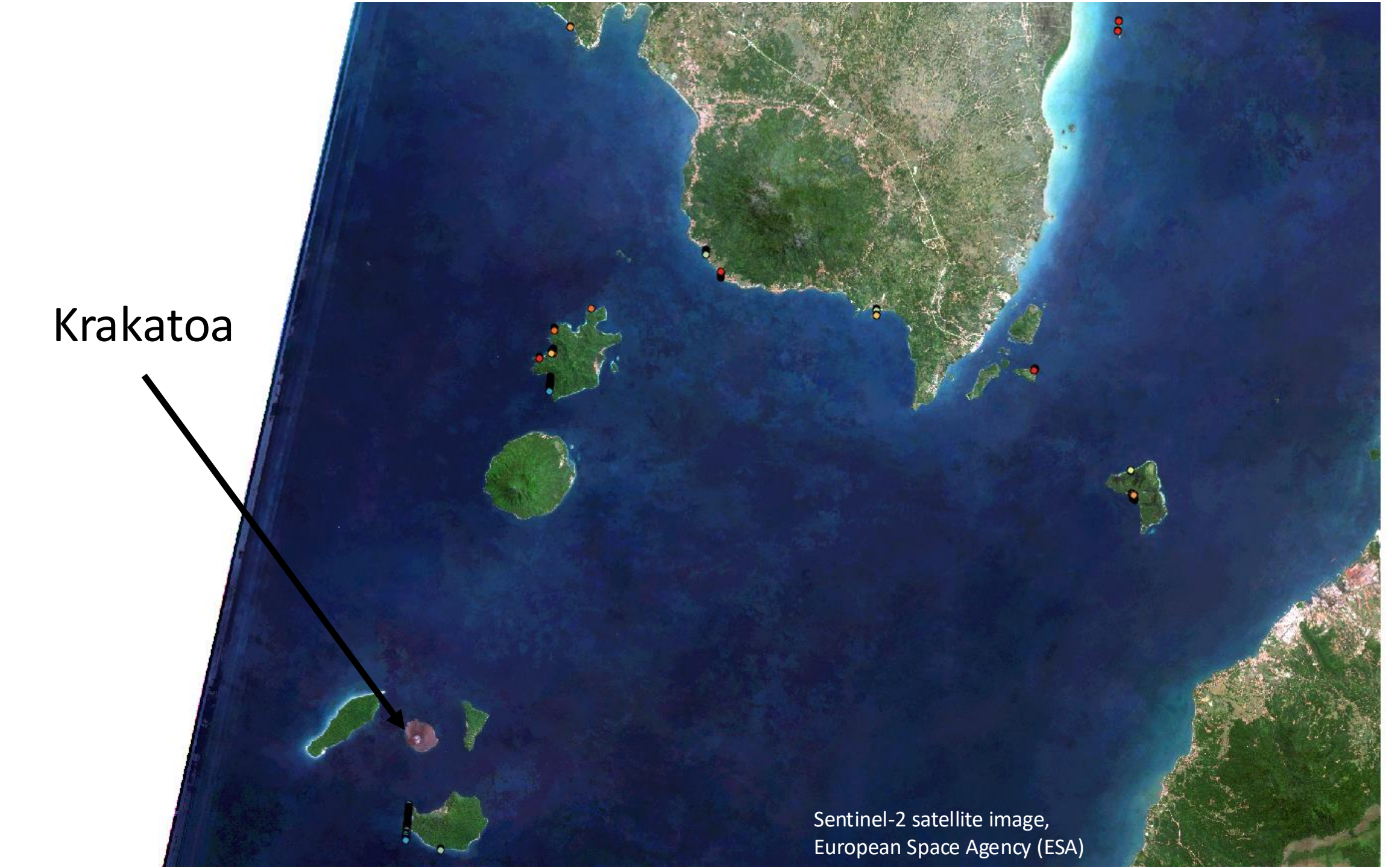


Points: ICESat-2 bathymetry

Image: Sentinel-2, European Space Agency (ESA)



Sentinel-2 satellite image,
European Space Agency (ESA)


Krakatoa
Sentinel-2 satellite image,
European Space Agency (ESA)

Thank you!

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