





# Crowd Sourced Bathymetry

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**Crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call.**

Jeff Howe, Wired, 2005

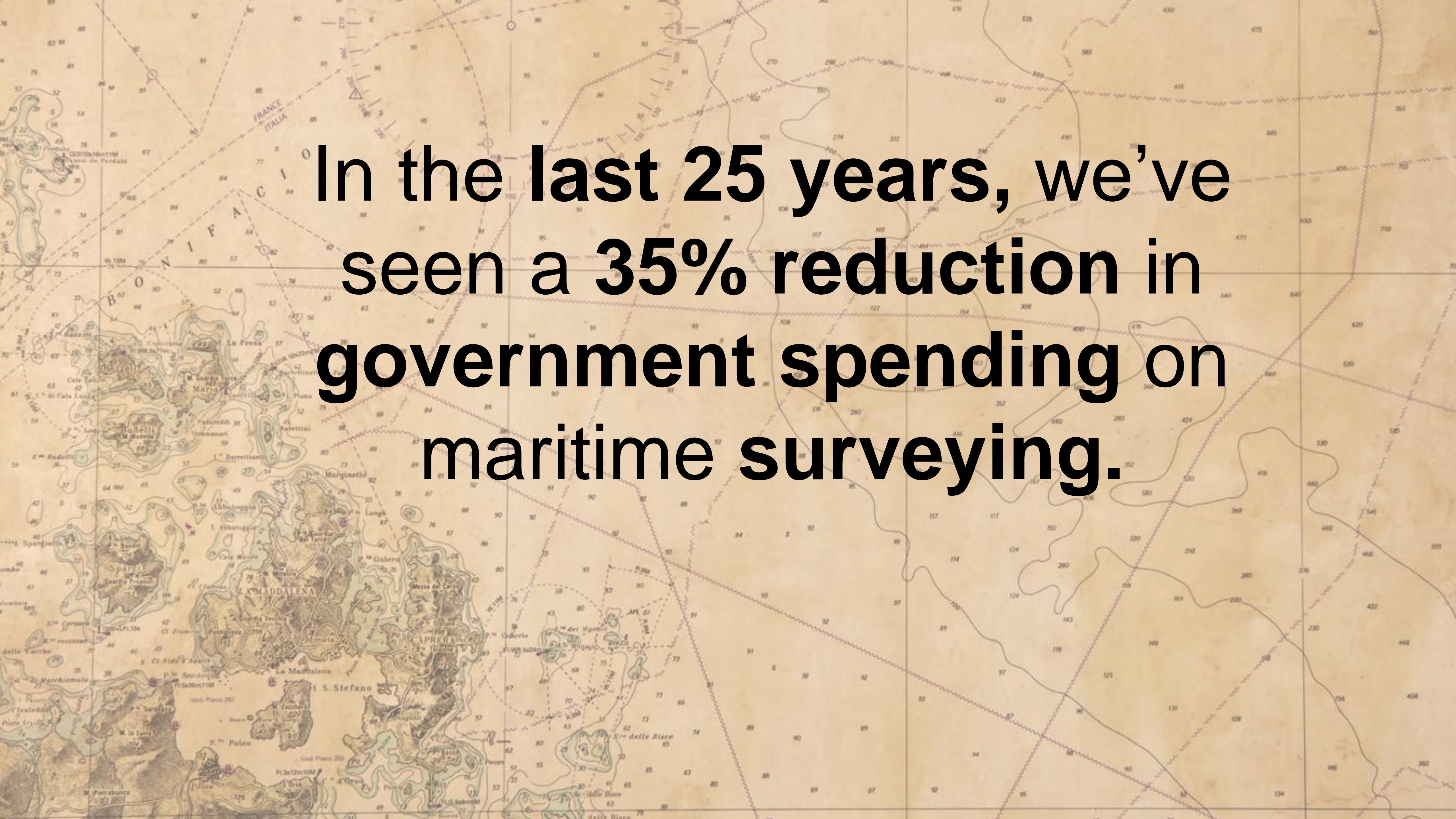




## Missing data from 0 to 200 meters

Southwest Pacific	> 95%
Polar regions	> 95%
West Africa	> 80%
Caribbean	> 80%
Australia	~ 65%
Greece	65%
United States of America	~ 40%
United Kingdom	30%
France	19%





**In the last 25 years, we've  
seen a 35% reduction in  
government spending on  
maritime surveying.**





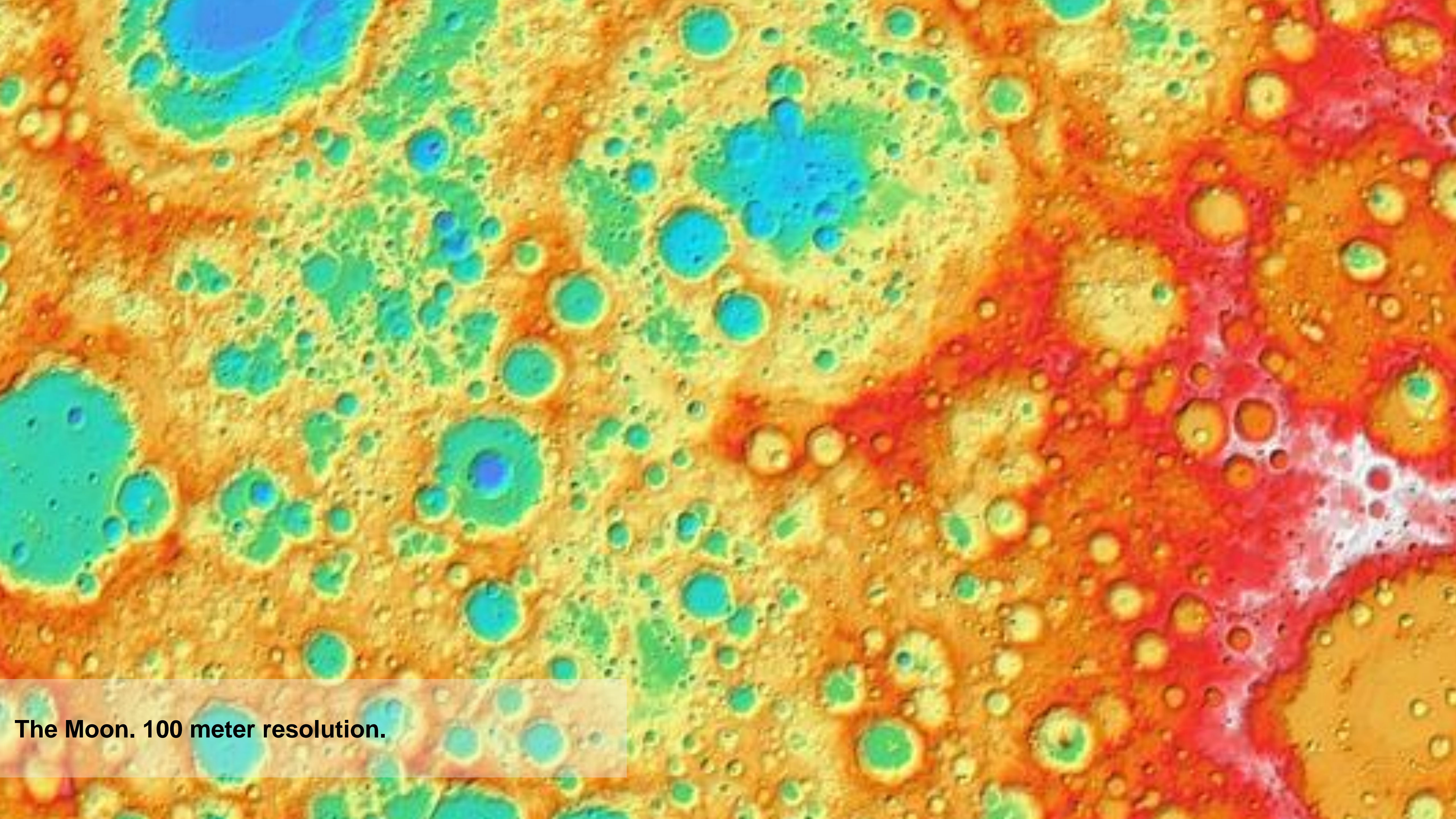
# **Captain Cook leadline soundings!**





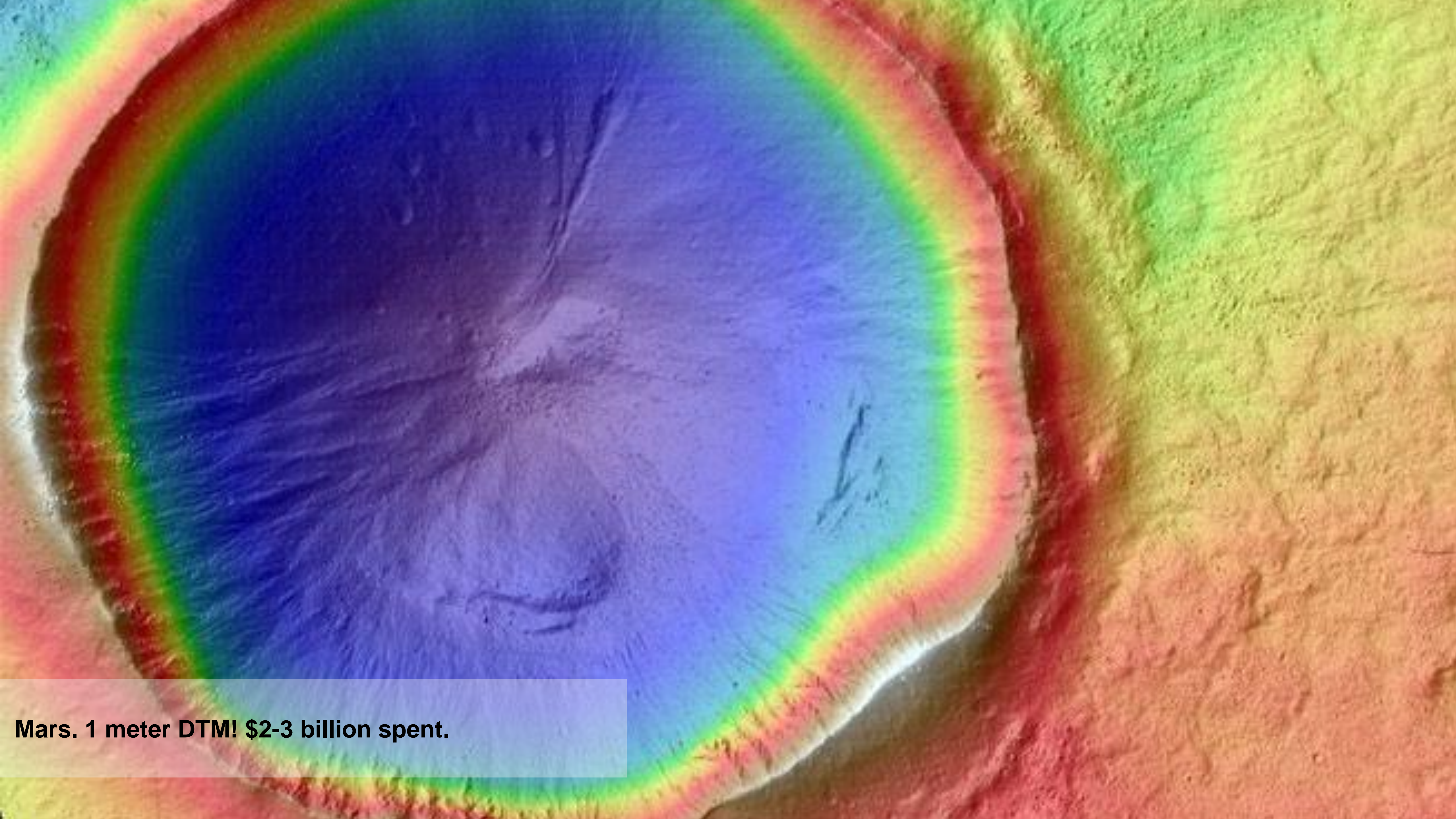
**“We have better maps of  
the Moon and Mars than  
of the ocean.”**





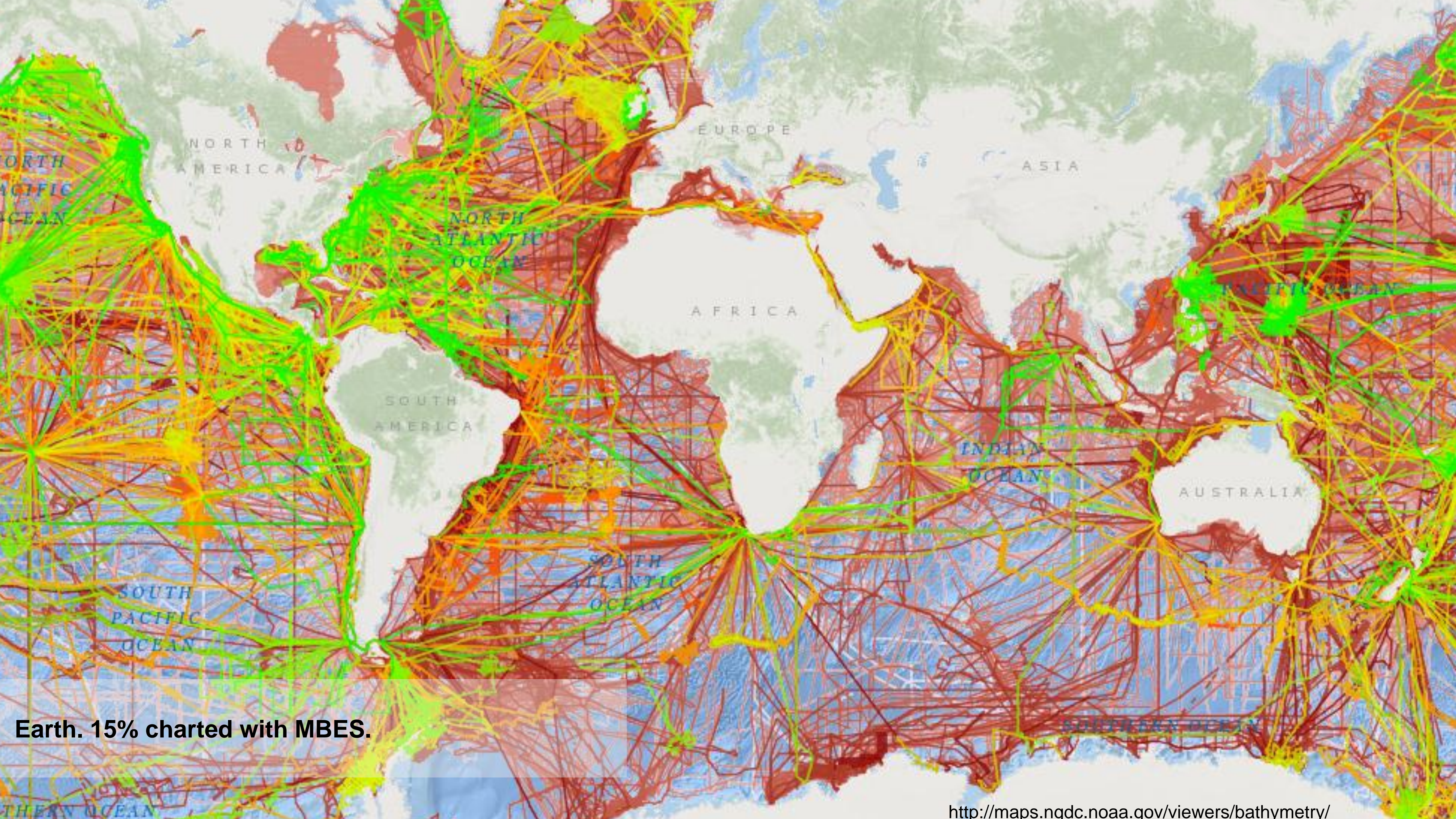
The Moon. 100 meter resolution.





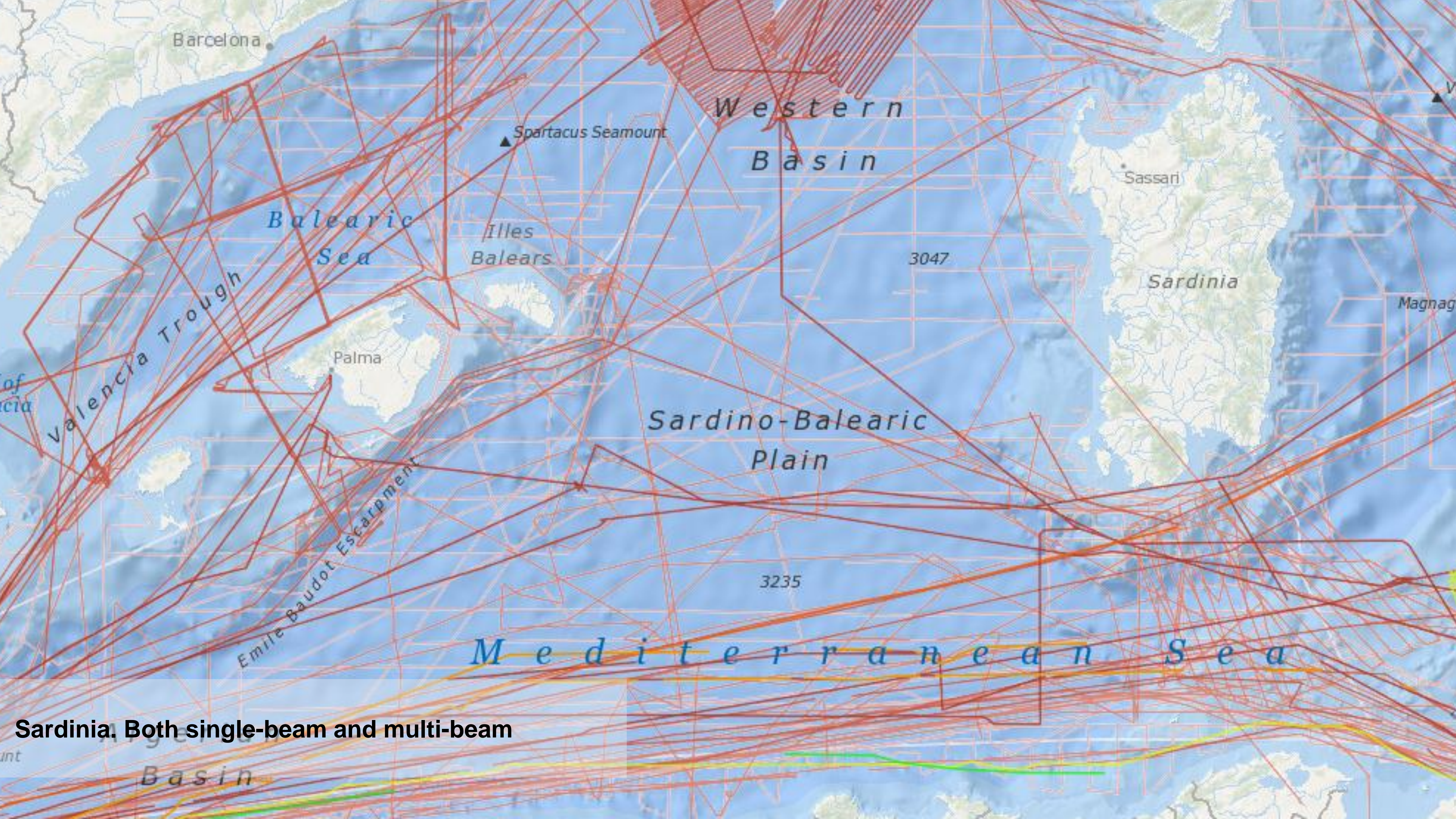
**Mars. 1 meter DTM! \$2-3 billion spent.**





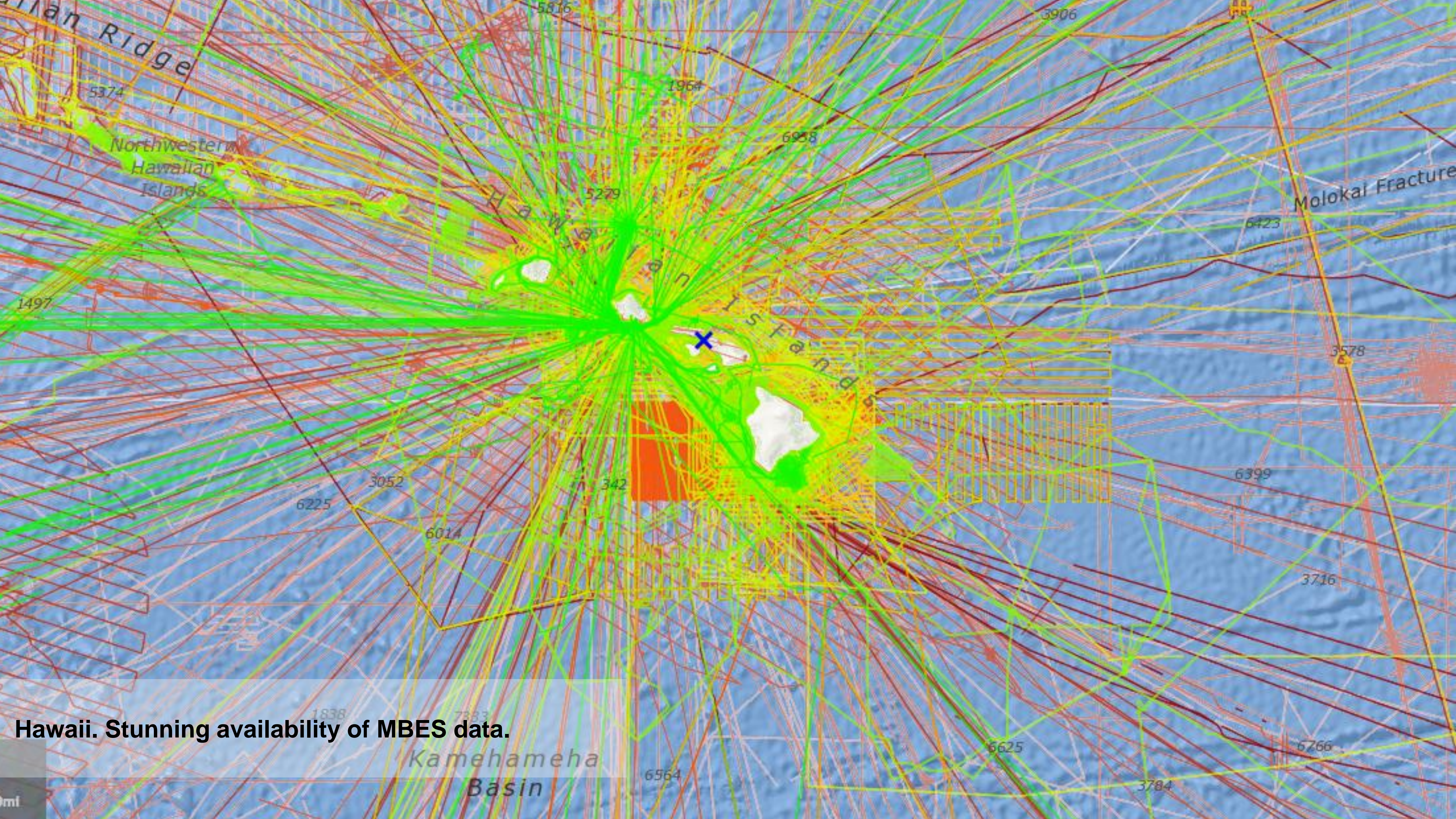
Earth. 15% charted with MBES.





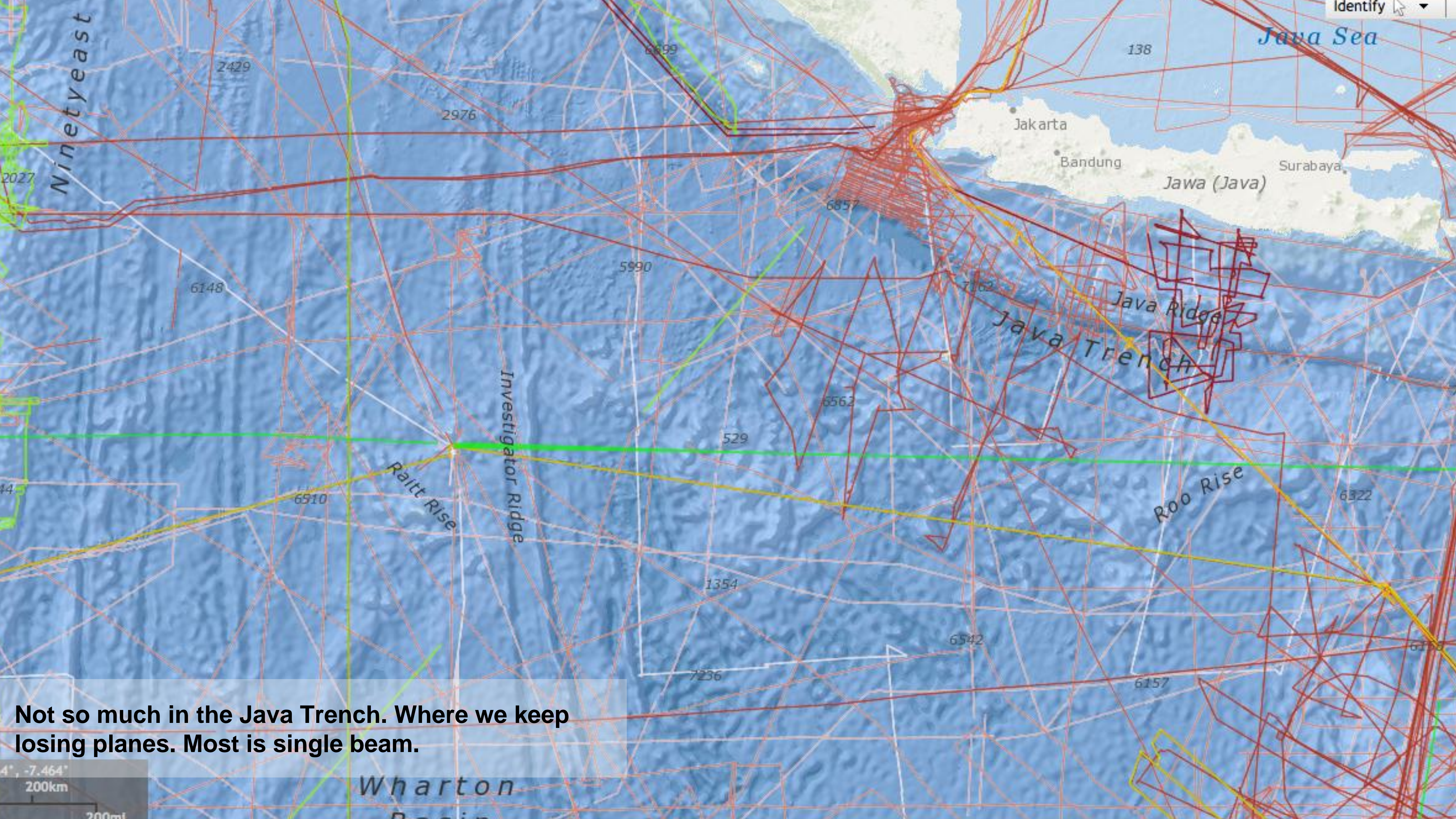
Sardinia. Both single-beam and multi-beam





Hawaii. Stunning availability of MBES data.





Identify

Java Sea

Ninetyeast

Jakarta

Bandung

Surabaya

Jawa (Java)

Java Ridge

Java Trench

Roo Rise

Investigator Ridge

Raitt Rise

Wharton

Basin

Not so much in the Java Trench. Where we keep losing planes. Most is single beam.

4°, -7.464°  
200km  
200mi



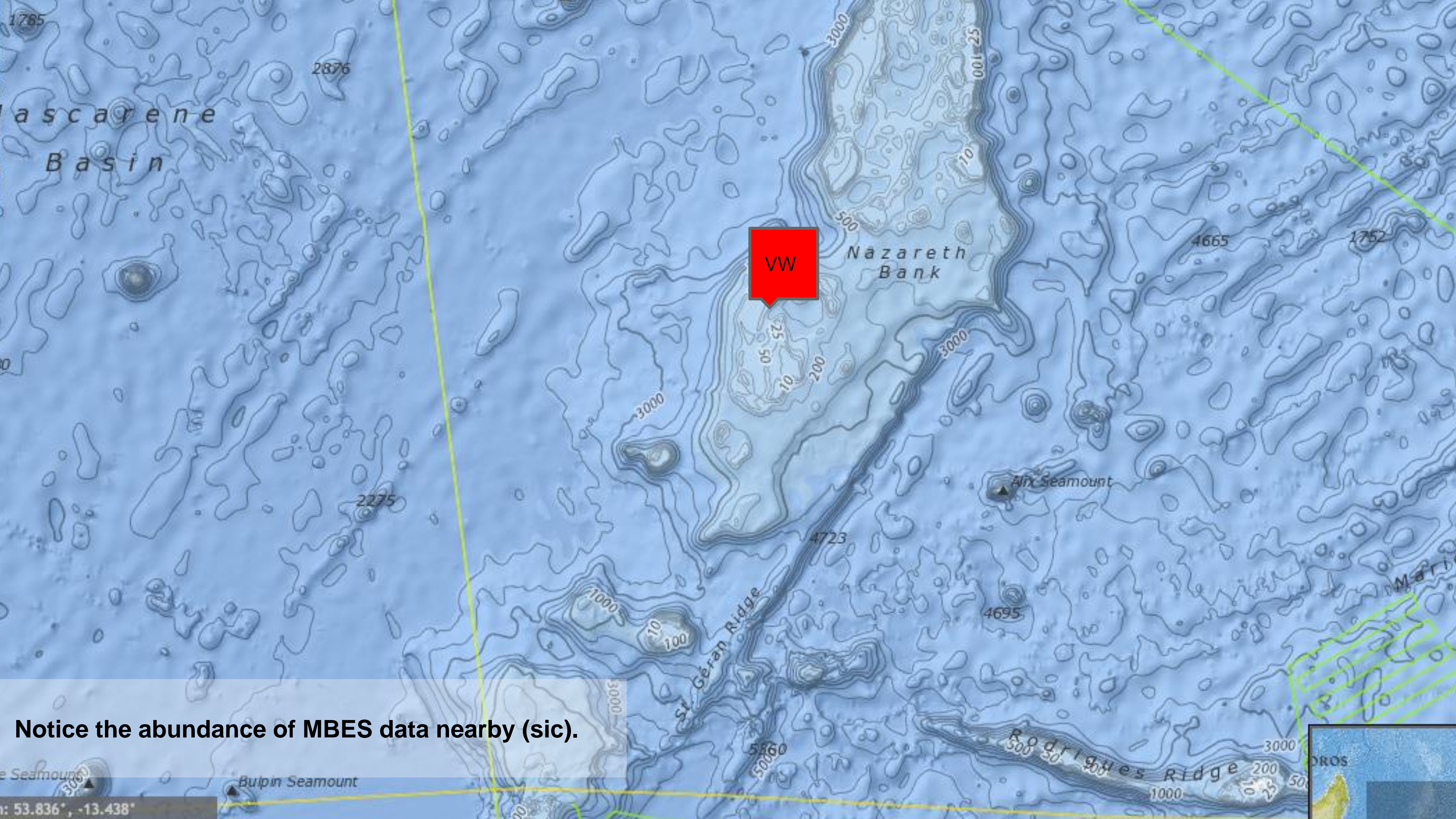
**But surely what we've got  
is good enough, right?**





**Grounding of VESTAS WIND during the 2014 Volvo Ocean Race (2014-11-29).**





VW

Notice the abundance of MBES data nearby (sic).



**So what can Crowd  
Sourcing deliver?**





Sea ID

RoHS  
CE FC  
Q.COK B210400



\$SDDBT,	25.9,f,	7.88,M,	4.3,F
\$SDDBT,	25.9,f,	7.88,M,	4.3,F
\$SDDBT,	26.1,f,	7.96,M,	4.4,F
\$SDDBT,	25.9,f,	7.88,M,	4.3,F
\$SDDBT,	26.0,f,	7.92,M,	4.3,F
\$SDDBT,	26.1,f,	7.96,M,	4.4,F
\$SDDBT,	26.0,f,	7.92,M,	4.3,F
\$SDDBT,	26.2,f,	8.00,M,	4.4,F
\$SDDBT,	26.1,f,	7.96,M,	4.4,F
\$SDDBT,	26.0,f,	7.92,M,	4.3,F
\$SDDBT,	25.9,f,	7.88,M,	4.3,F
\$SDDBT,	25.8,f,	7.85,M,	4.3,F
\$SDDBT,	25.6,f,	7.81,M,	4.3,F
\$SDDBT,	25.6,f,	7.81,M,	4.3,F
\$SDDBT,	25.8,f,	7.85,M,	4.3,F
\$SDDBT,	26.0,f,	7.92,M,	4.3,F
\$SDDBT,	26.0,f,	7.92,M,	4.3,F
\$SDDBT,	26.1,f,	7.96,M,	4.4,F
\$SDDBT,	26.0,f,	7.92,M,	4.3,F
\$SDDBT,	26.1,f,	7.96,M,	4.4,F
\$SDDBT,	26.0,f,	7.92,M,	4.3,F
\$SDDBT,	26.1,f,	7.96,M,	4.4,F
\$SDDBT,	26.1,f,	7.96,M,	4.4,F
\$SDDBT,	26.2,f,	8.00,M,	4.4,F





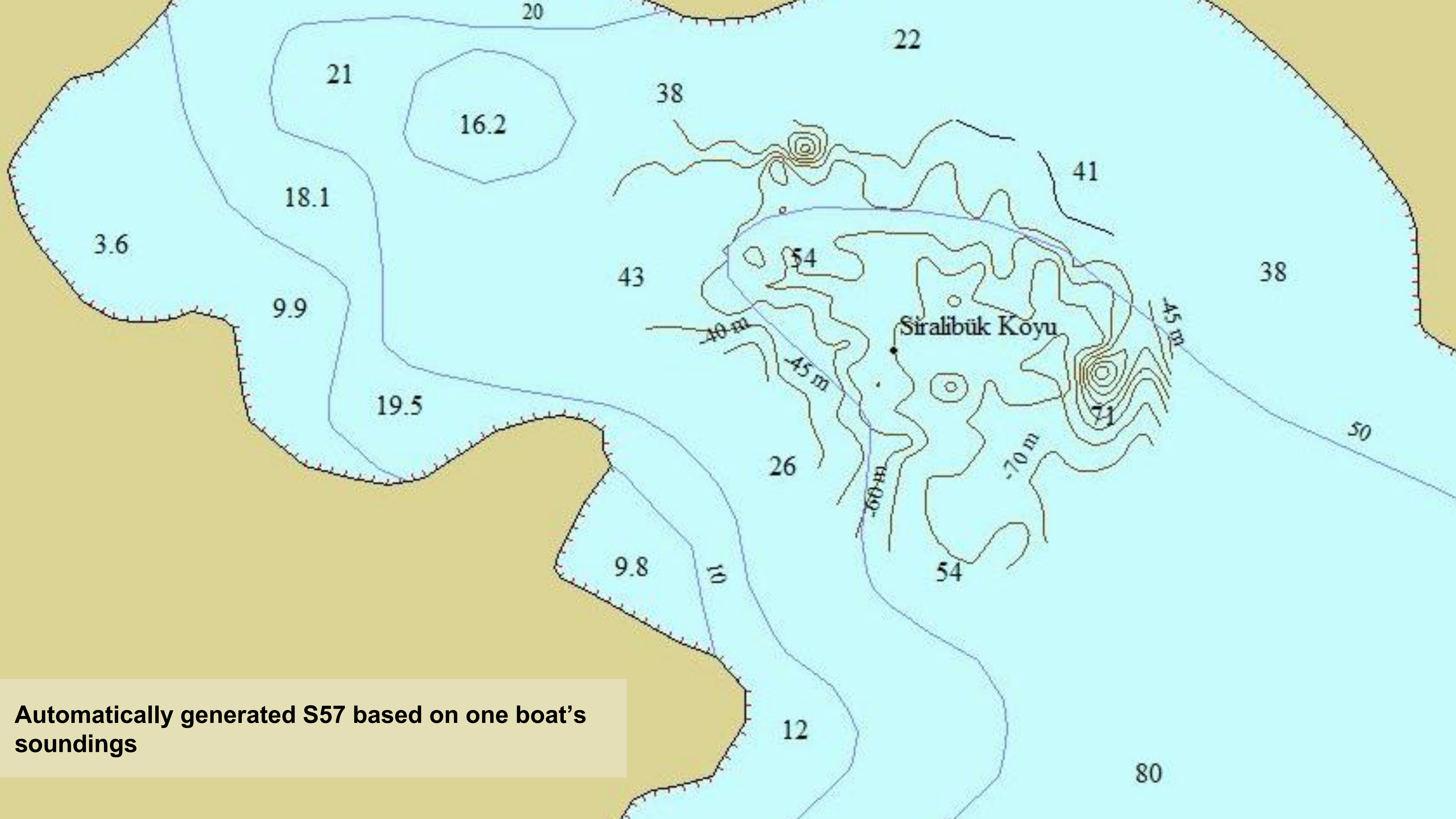
Example of collected data  
Tomb Bay, Turkey





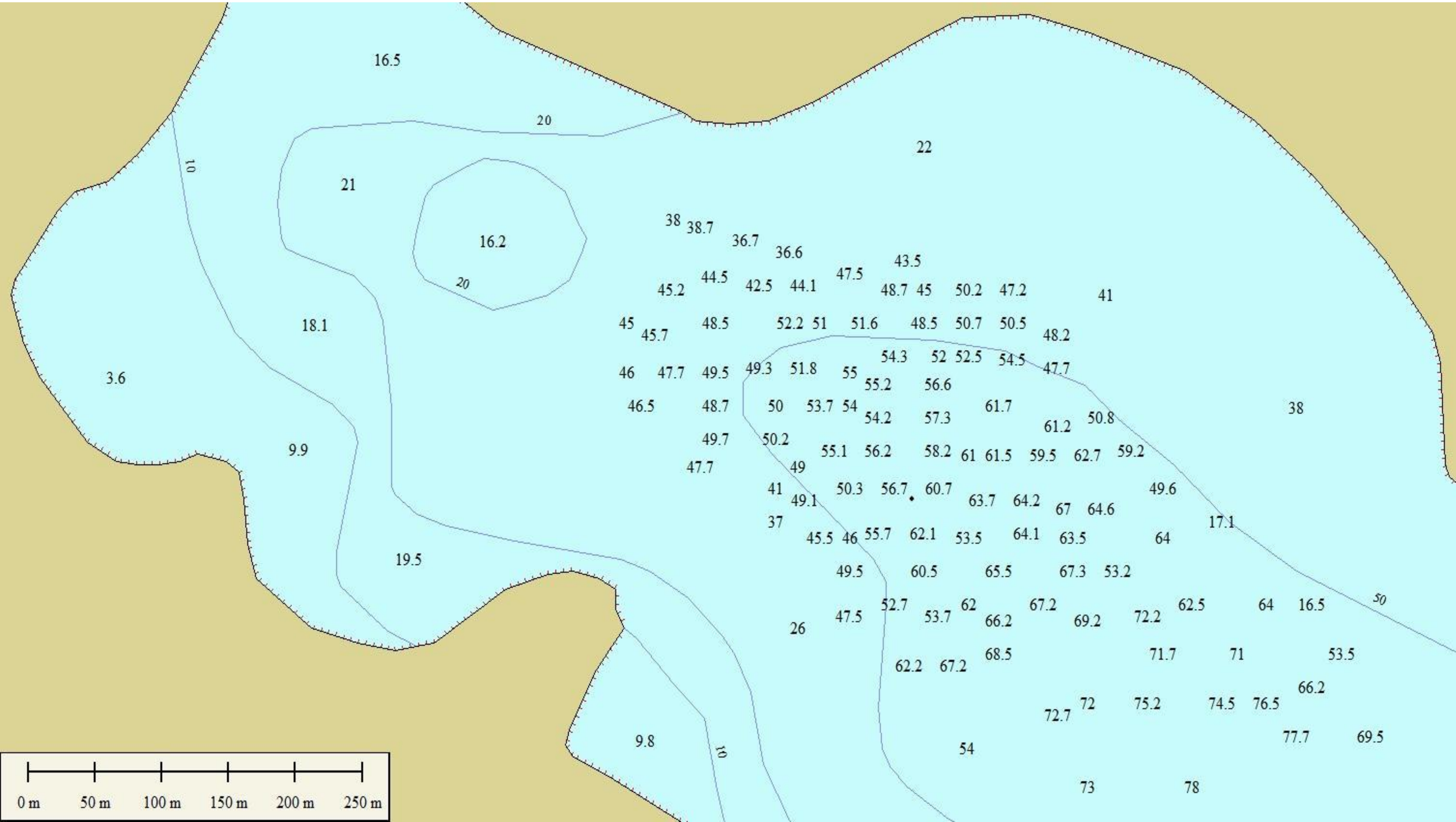
When scaled, and after curation, this is what we can accomplish



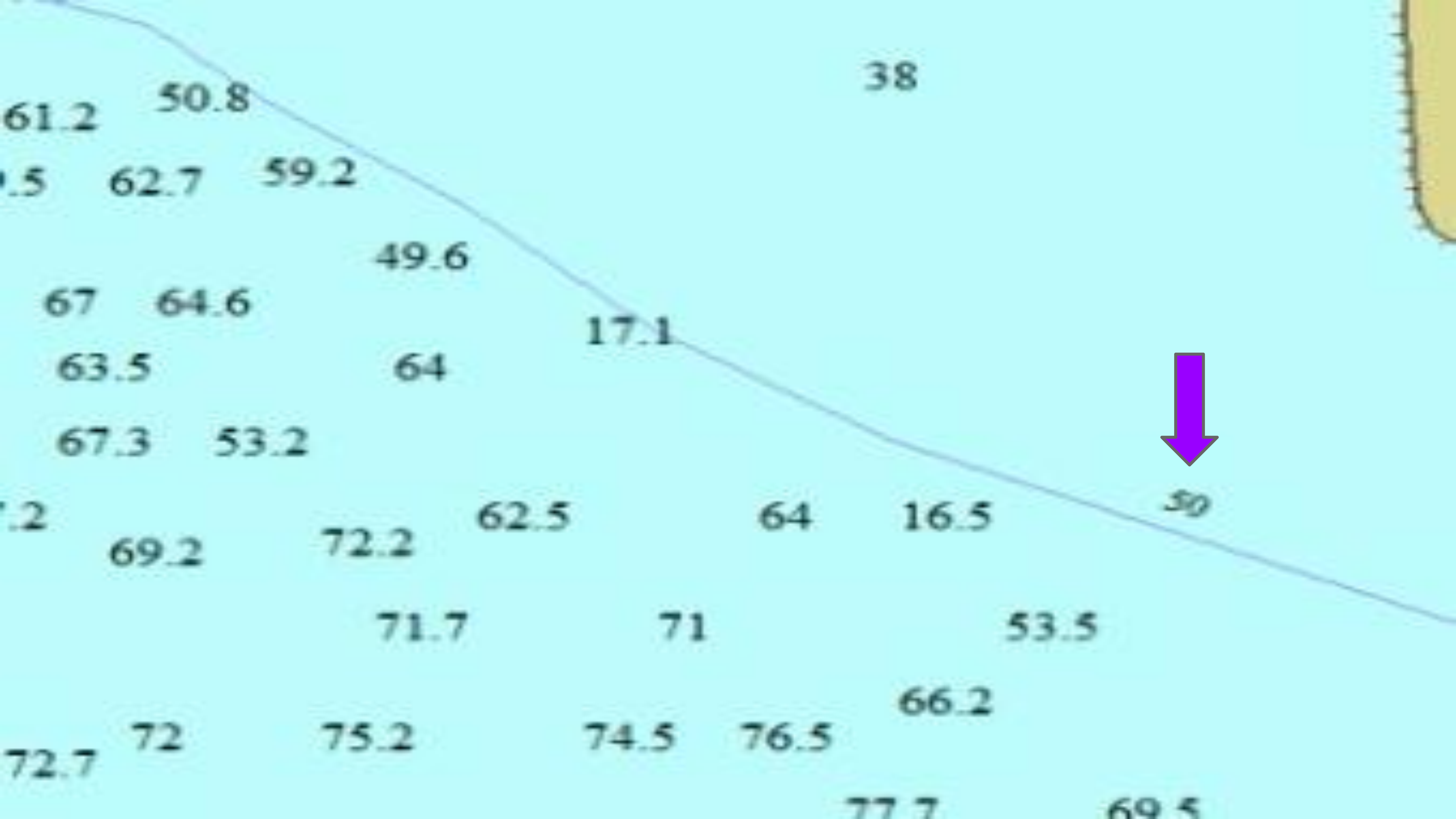


Automatically generated S57 based on one boat's soundings





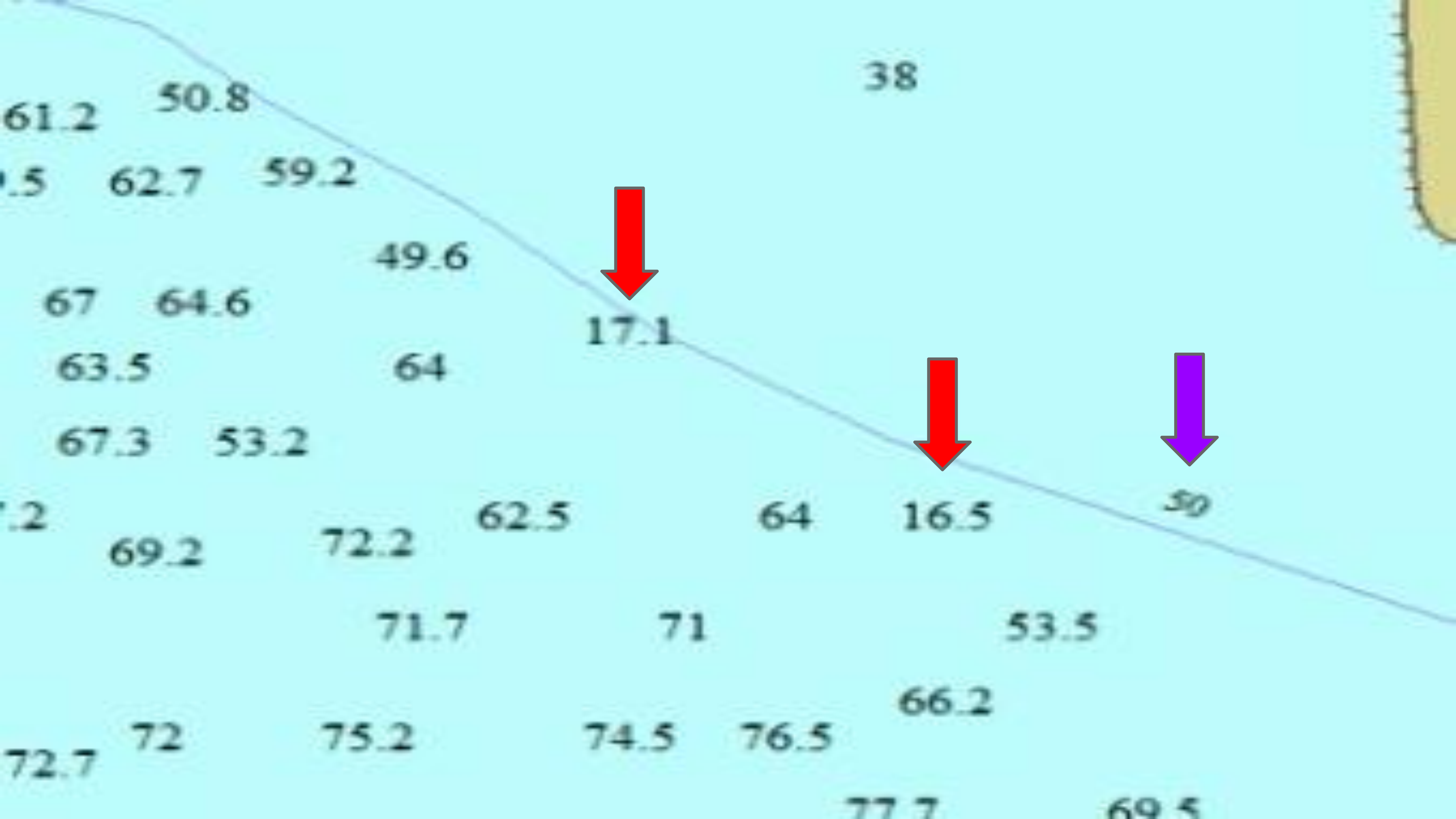




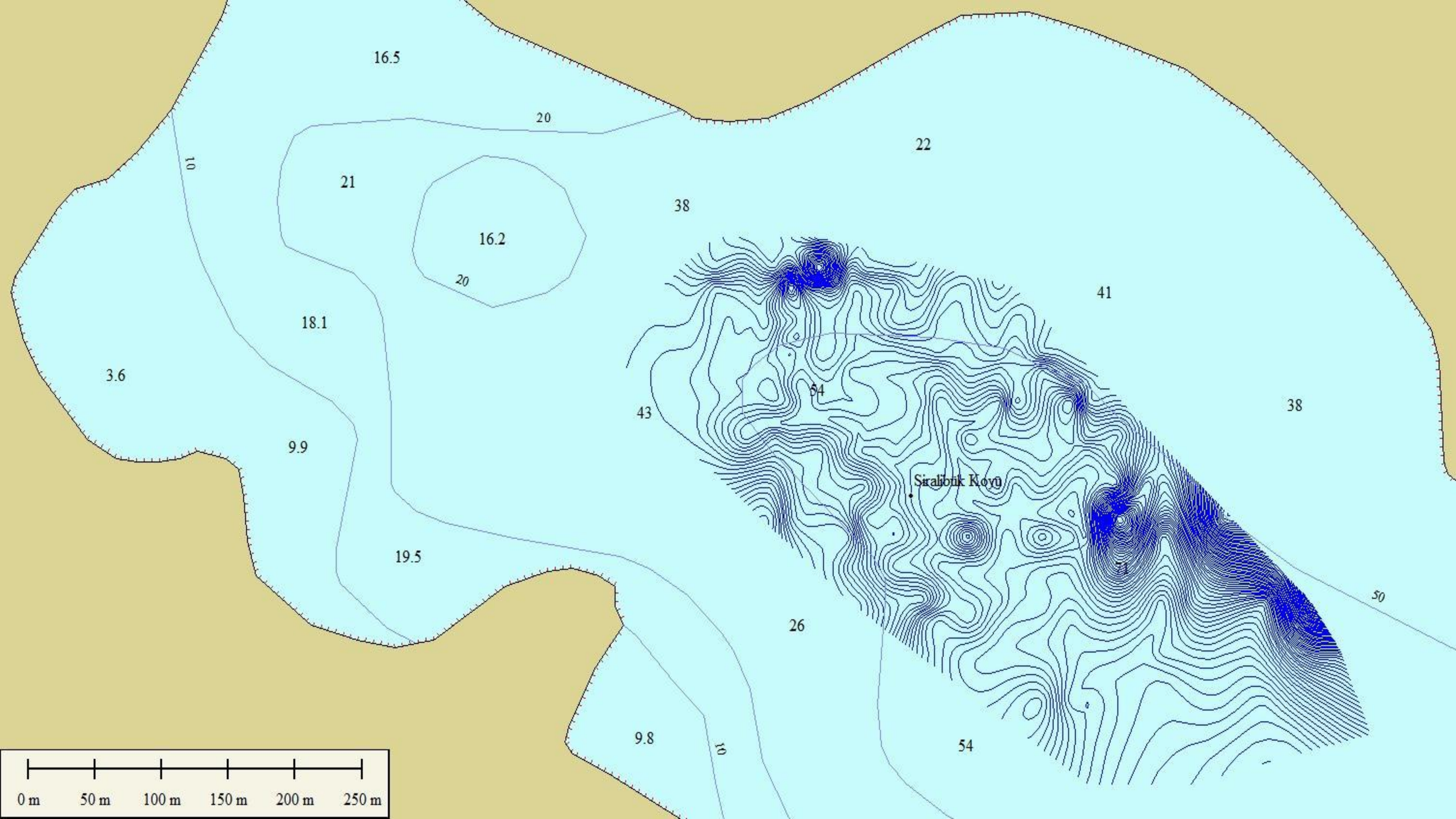
















Germany

Belgium

Luxembourg

Czech Republic

Slovakia

Ukraine

France

Switzerland

Austria

Hungary

Moldova

Bay of Biscay

Monaco

Italy

Croatia

Bosnia and  
Herzegovina

Serbia

Romania

Montenegro

Kosovo

Bulgaria

Black Sea

Georgia

Andorra

Macedonia  
(FYROM)

Albania

Greece

Turkey

Portugal

Spain

Gibraltar

Tyrrhenian Sea

Malta

Mediterranean Sea

Cyprus

Syria

Lebanon

Iraq

Tunisia

Jordan

Israel

Visited regions (6 ships)



**34 million soundings**

**26000 nautical miles traveled**

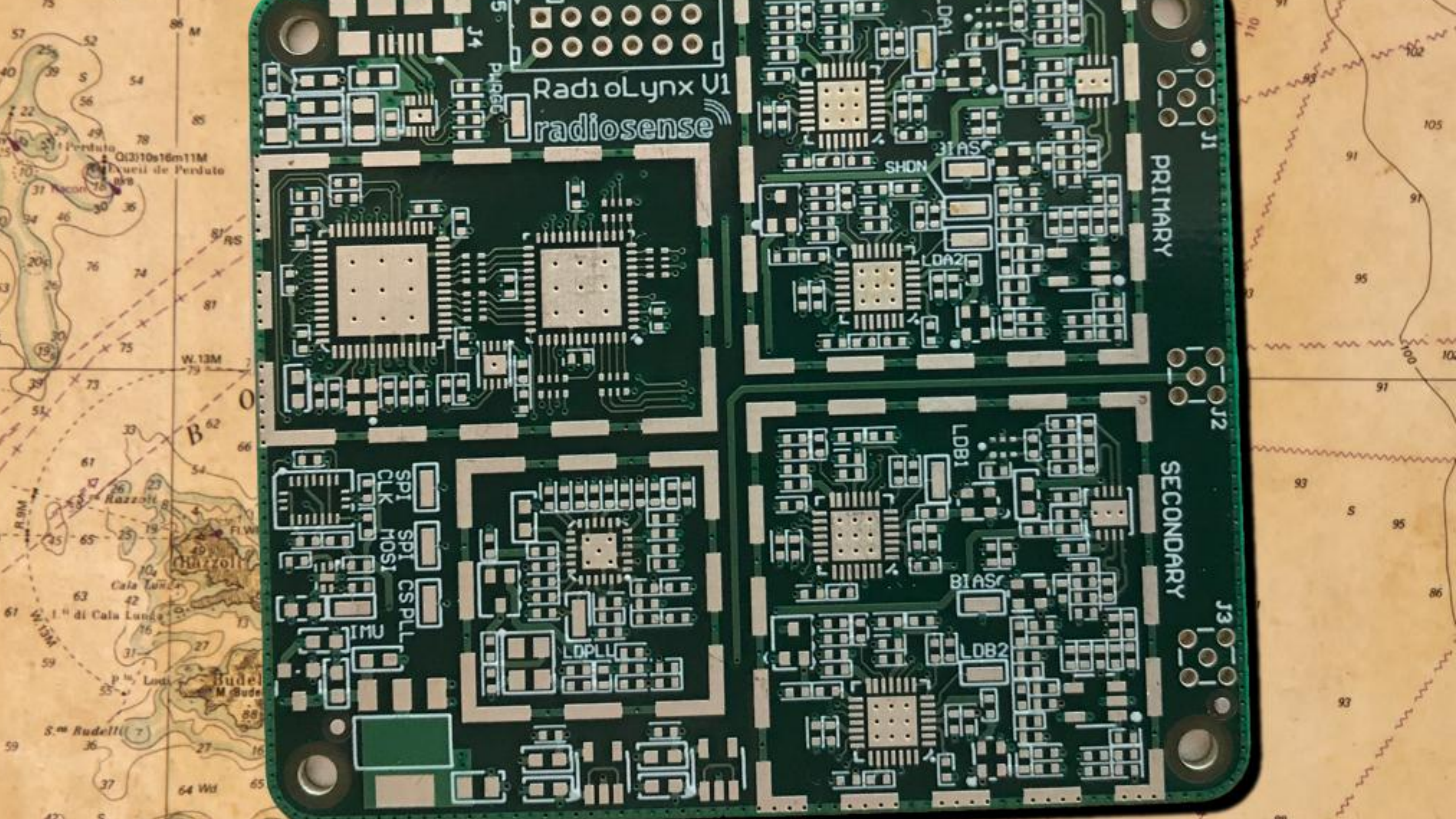


The Next Step



# Precise Point Positioning





RadioLynx V1  
radiosense

PRIMARY

SECONDARY

J1

J2

J3

J4

PWRG

SHDN

DA1

LDA2

LDB1

BIASr

LDB2

LDPLL

IMU

SPI

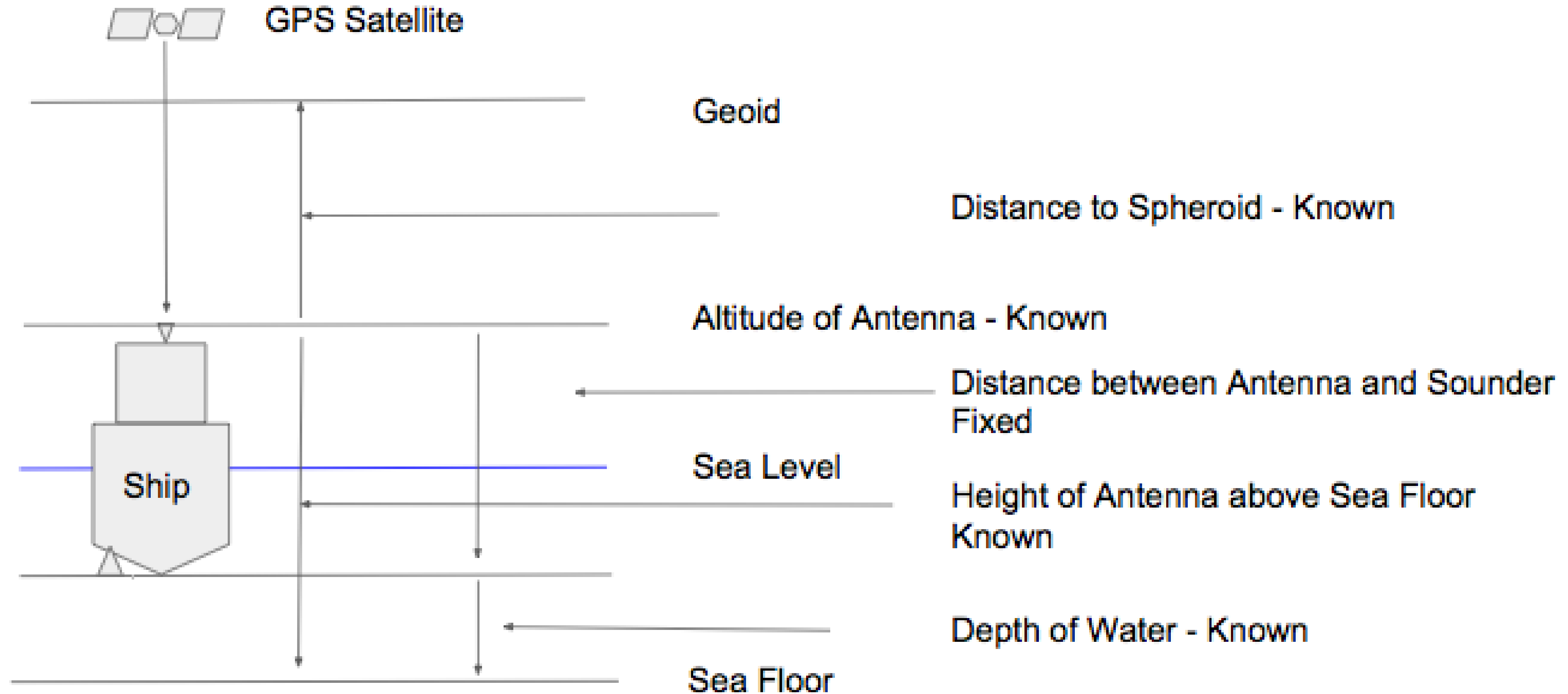
CLK

MOSI

CSPL



# Precise Point Positioning





# Crowd Sourced Survey





Bathymetric effects on the 2004  
Indian Ocean tsunami striking  
the east coast of Sri Lanka

submarine  
ridge

Kalmunai  
(8,500 dead)

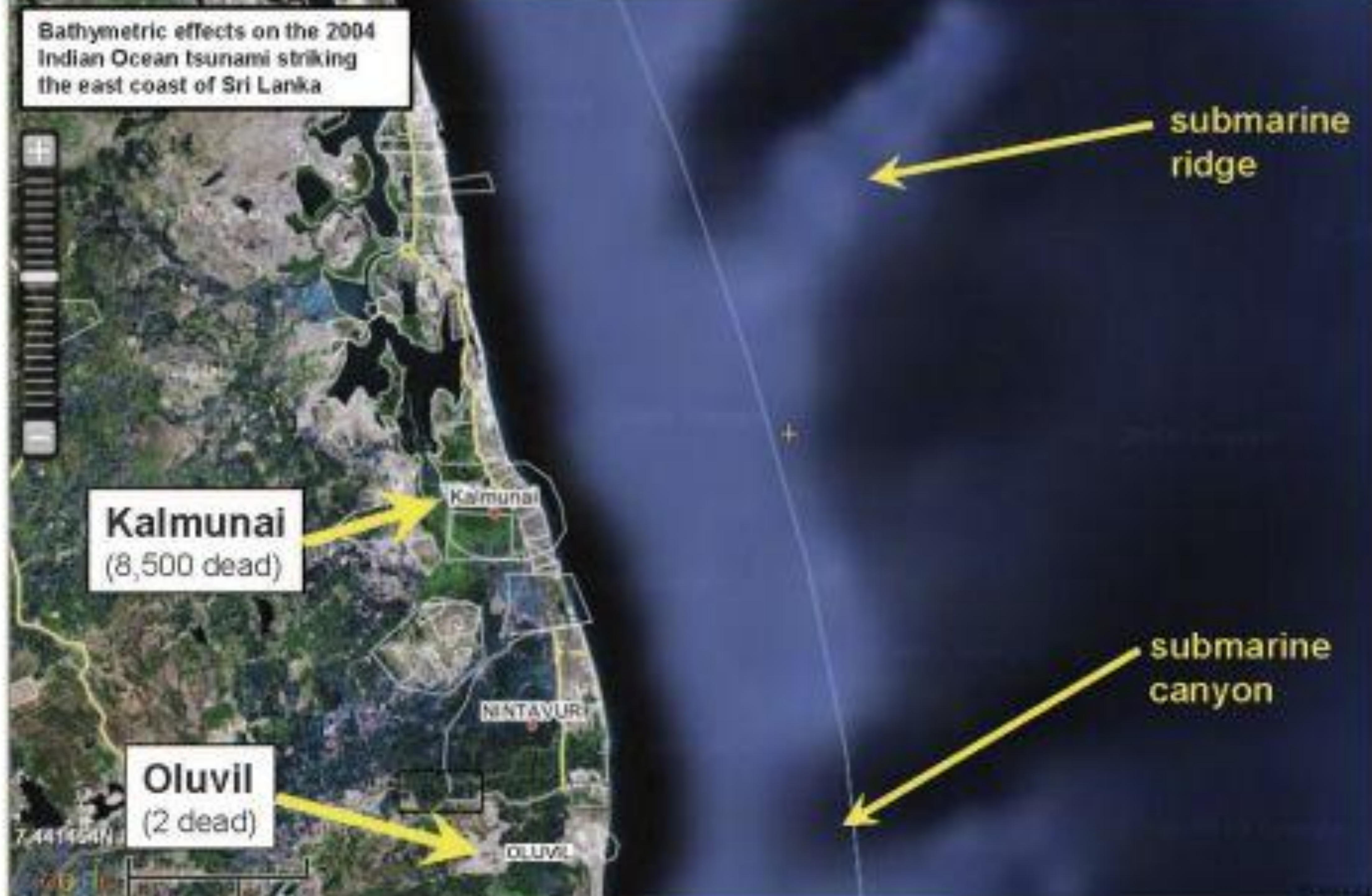
Kalmunai

NINTAVUR

Oluvil  
(2 dead)

OLUVIL

submarine  
canyon





Navigationa! Note

or

Illegal Survey?