Integrated 3D Mapping in Terra Nova Bay (Antarctica) with PROTEUS, Portable RObotic TEchnology for Underwater Surveys – RESTORE Project

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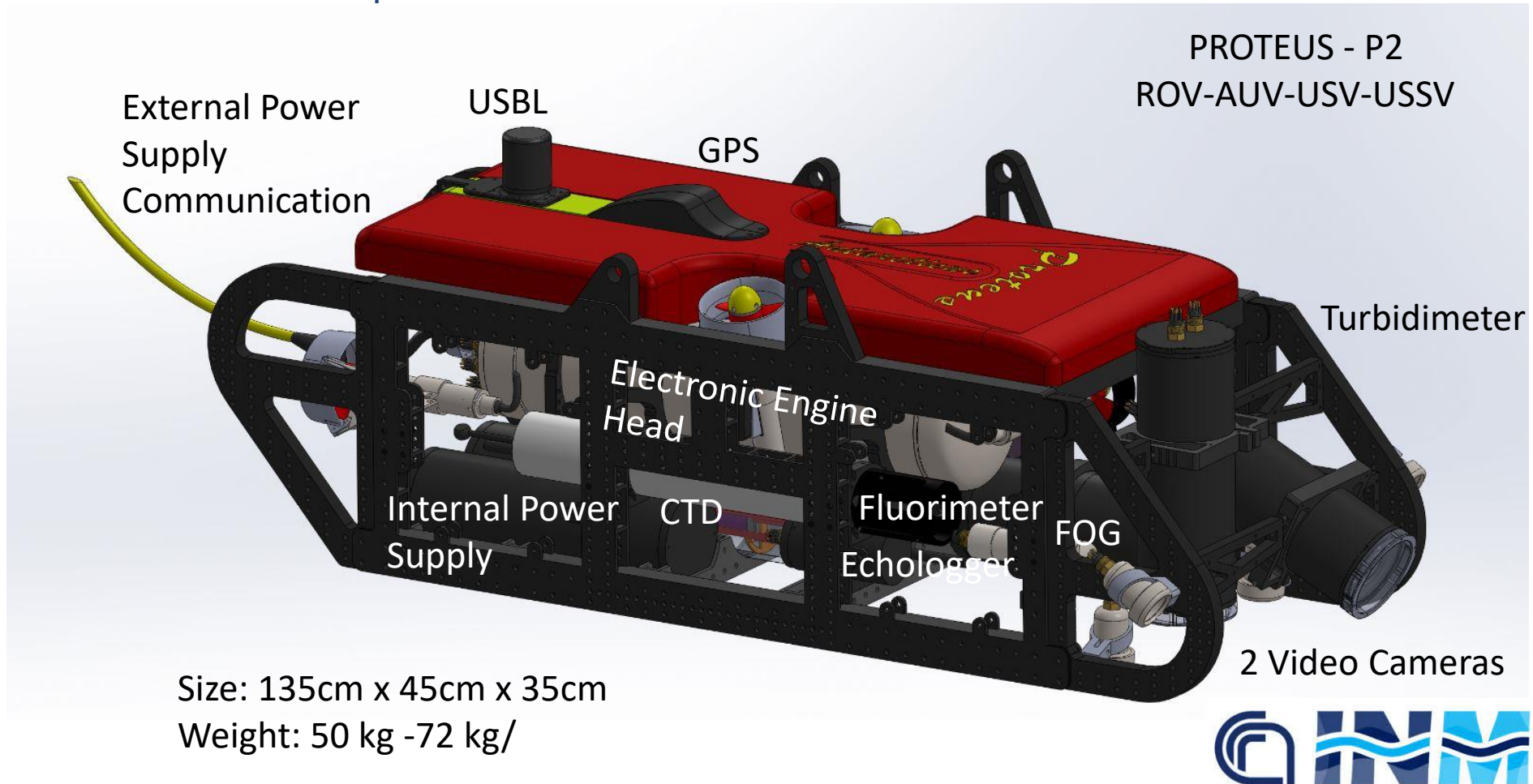AWI – Bremen, Germany & online
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During the XXXVIII Italian Expedition in Antarctica, in the framework of the PNRA RESTORE (Robotic-based invESTigation and mOnitoring Ross sEa) project the PROTEUS (Portable RObotic TEchnology for Underwater Surveys) unmanned marine vehicle (UMV) was used for carrying out an integrated 3D mapping of a portion of the Tethys Bay in the Ross Sea.

ESA Sentinel-2 Oct 30 2022
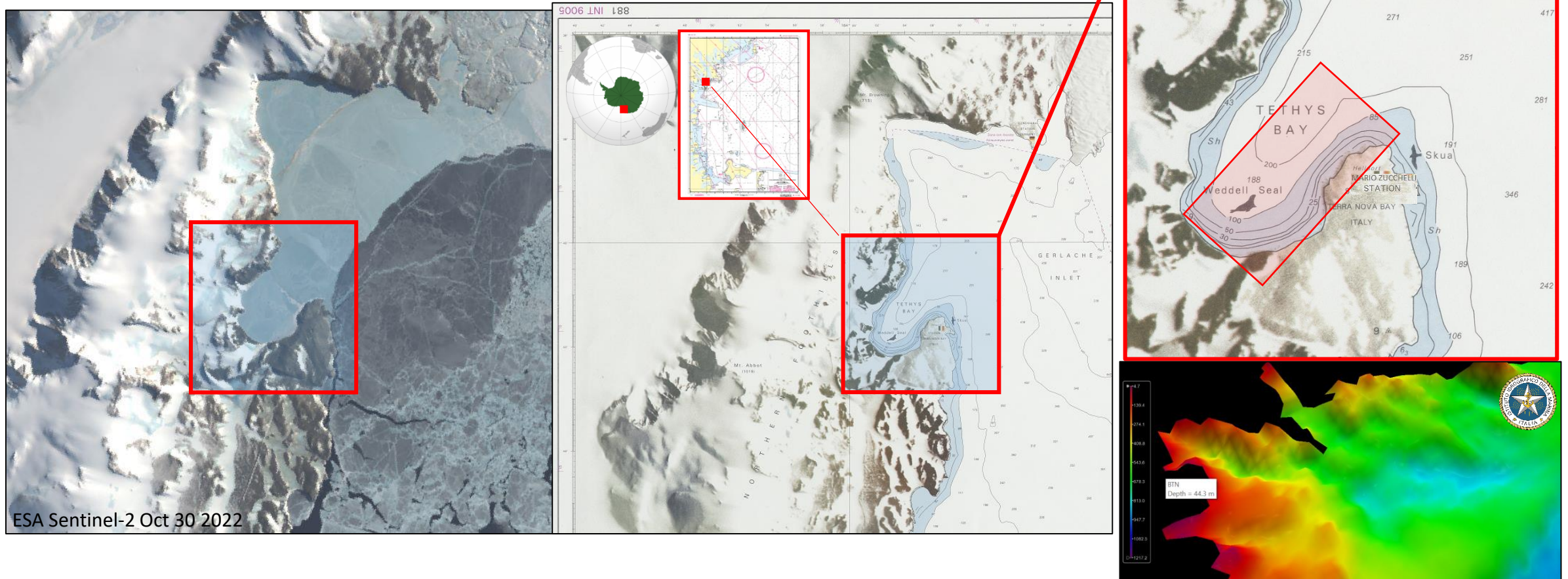
PROTEUS is an innovative UMV developed by the Marine Robotics research group of CNR-INM which is particularly suitable, with its reduced size and weight, modularity, reconfigurability, and open hardware and software architectures, to operate in extreme environments as the polar ones.
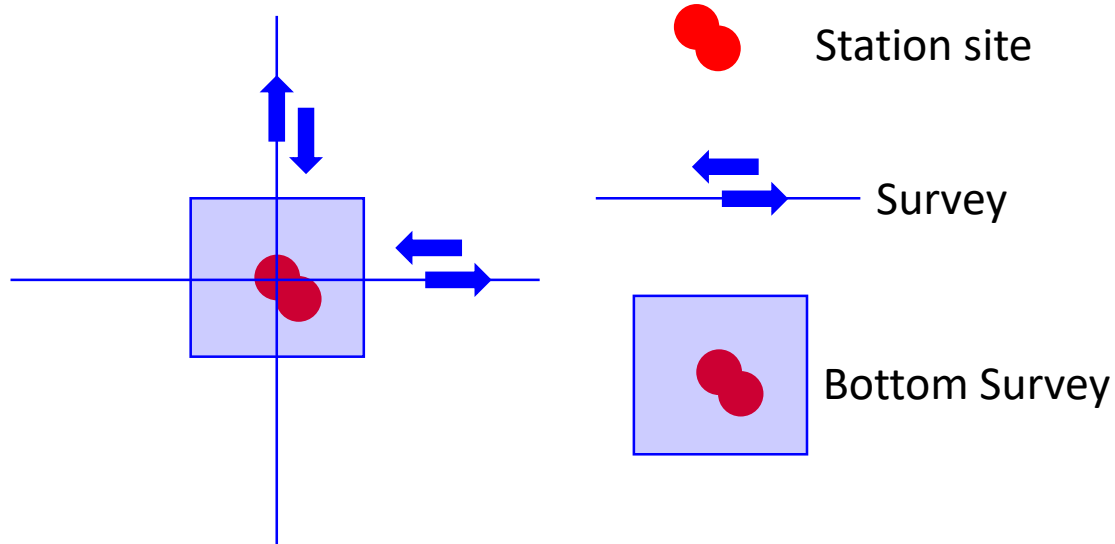

PROTEUS - P2
ROV-AUV-USV-USSV

External Power Supply Communication

USBL

GPS

Turbidimeter

Electronic Engine Head

Internal Power Supply

CTD

Fluorimeter
Echologger

FOG

2 Video Cameras

Size: 135cm x 45cm x 35cm
Weight: 50 kg -72 kg/

- For performing the survey seven holes were drilled in the ice pack from which it was possible to deploy the robot in the water.

- Thanks to the versatility of PROTEUS, it was possible to acquire a comprehensive collection of bio-geo-chemical and physical parameters of the water column (acoustic, conductivity/salinity, temperature, depth, dissolved oxygen, turbidity and chlorophyll), acoustic and video data of the ice and the seabed.

- All the collected data, once processed, will be made available to the scientific community by means of FAIR (Findable, Accessible, Interoperable and Reusable data) techniques following the UN Ocean Science Decade directives.

PROTEUS CALIBRATION Exp

PROTEUS Survey

● ● Station site

← → Survey

Bottom Survey
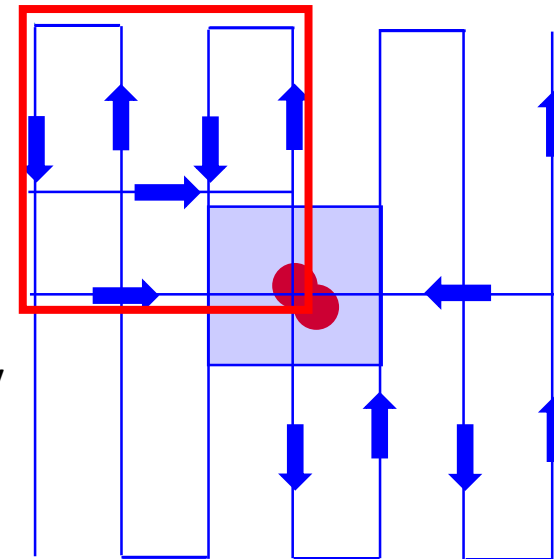
Ice & Bottom
HR Video images

Ice & Bottom
Video images Acoustic data
Water CTD
Biogeo-chemical variables

PROTEUS Survey Depth:
10 m (Ice) 100 m (Bottom)
- 7 Lines max lenght ~ 500 m
- 1 Control line

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STATION	LAT	LONG	DEPTH
	(Deg ' "S)	(Deg ' " E)	(m)
RES 1	74 41 35.7	164 04 31.9	80
RES 2*°	74 41 39.9	164 04 13.2	174
RES 3*	74 41 40.9	164 04 45.4	46
RES 4	74 41 44.7	164 04 35.6	60
RES 5	74 41 45.5	164 04 17.0	130
RES 6	74 41 48.7	164 03 55.0	170
RES 7	74 41 53.0	164 04 10.2	77

RES 7

Water column

Sea ice

Temperature (°C)

Salinity (PSU)

Acoustic Speed (m/s)
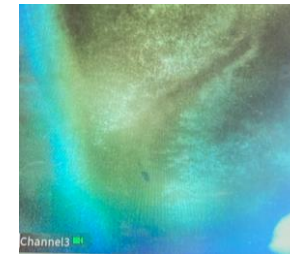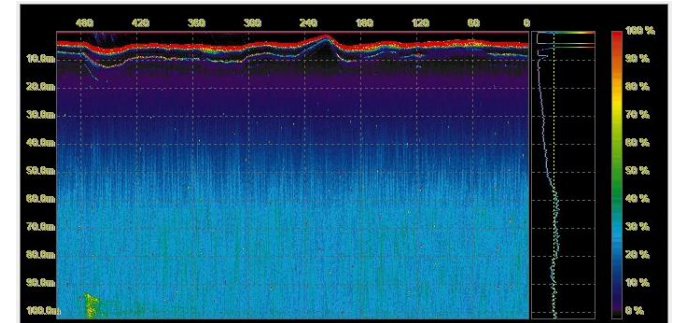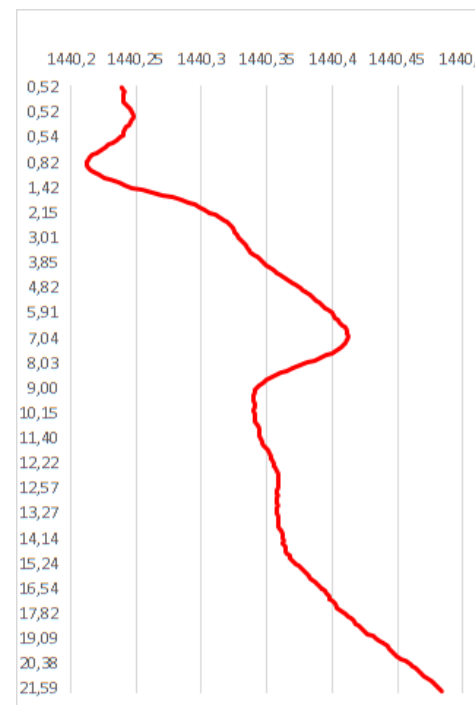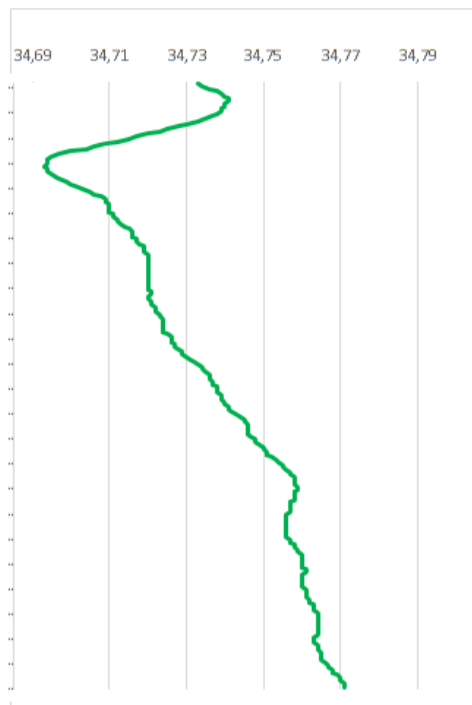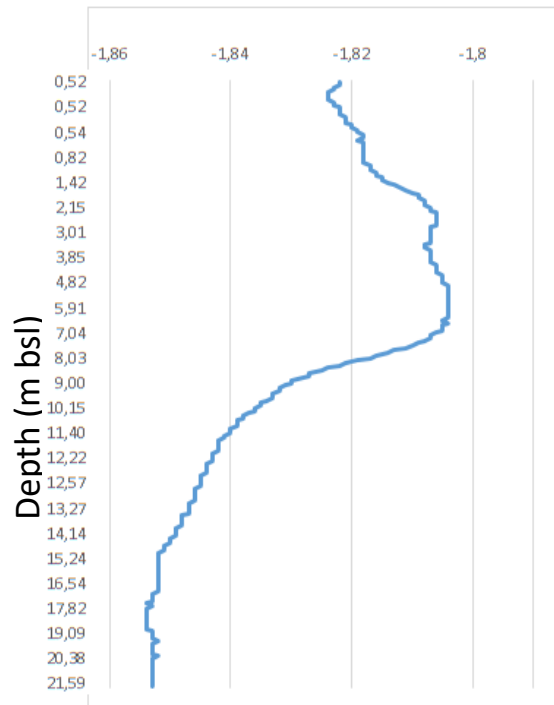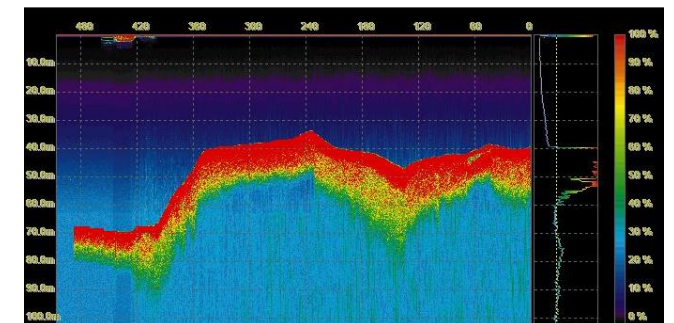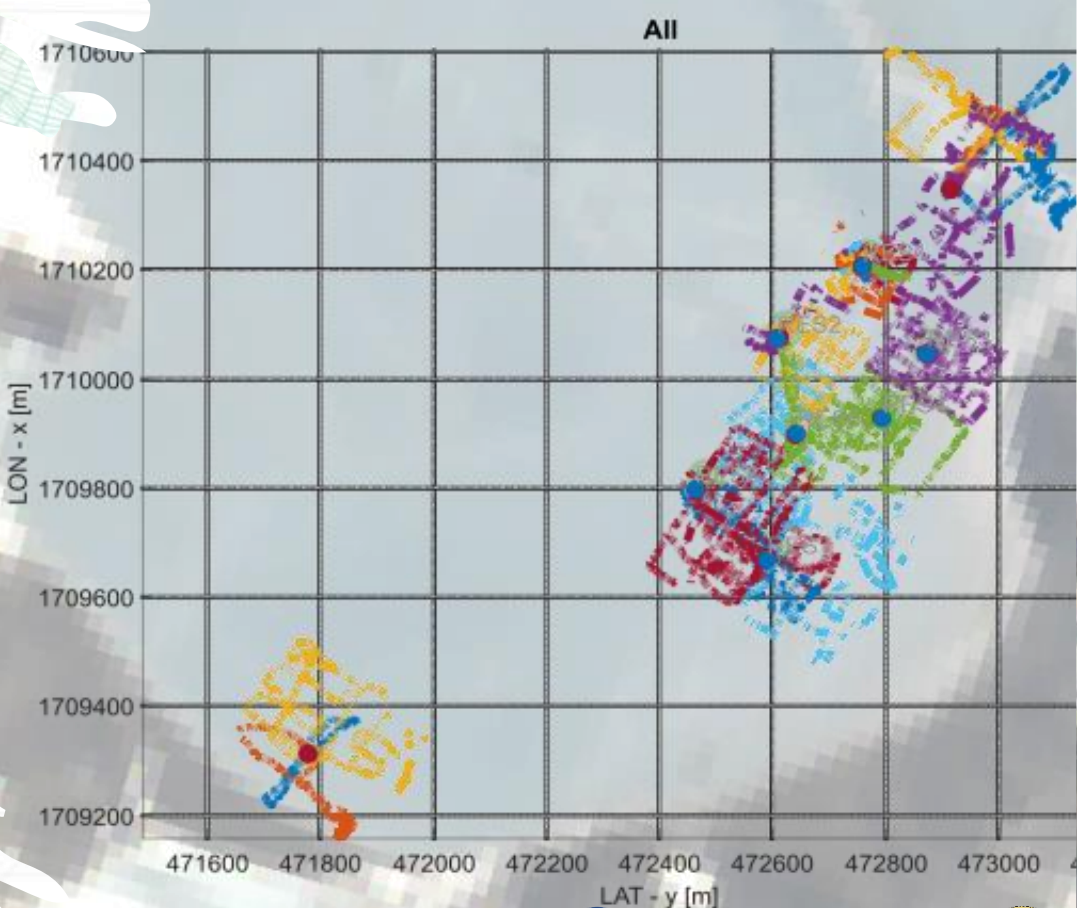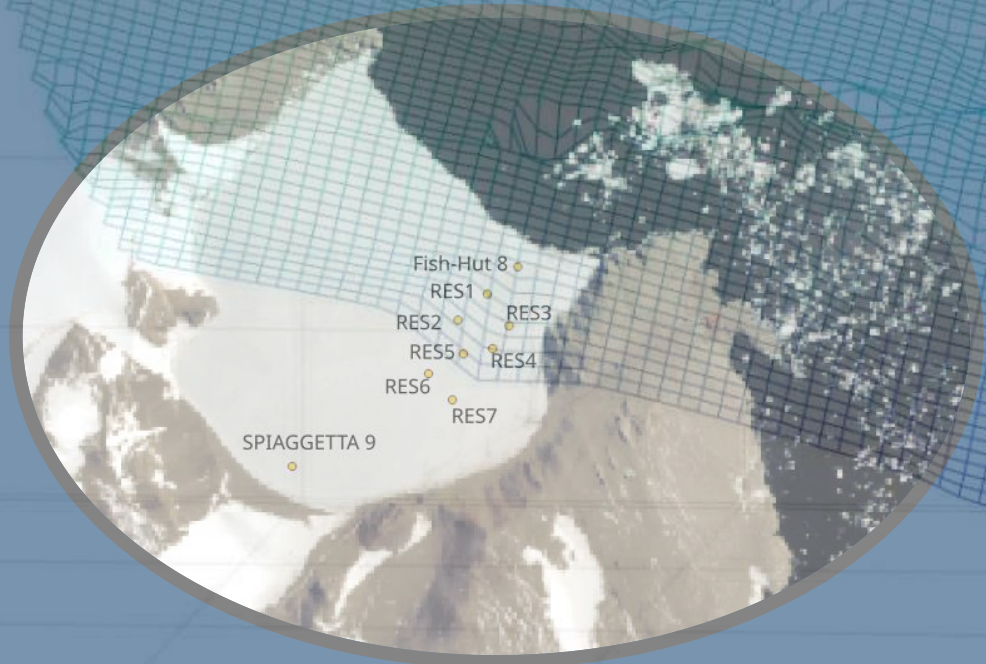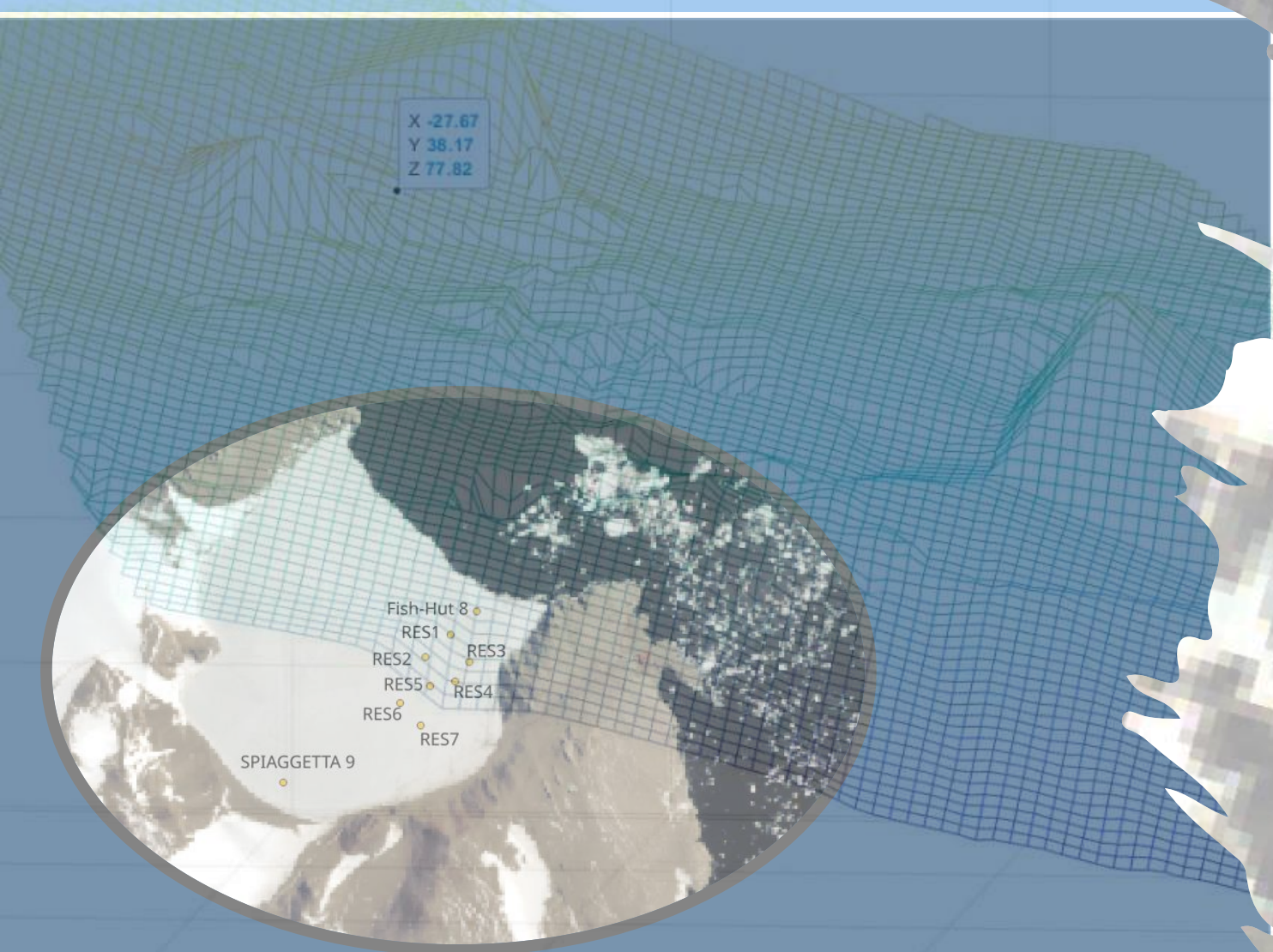
Depth (m bsl)

Bottom

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3D integrated Mapping

XXXVIII Italian Expedition in Antarctica 2022/2023

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ARCTIC

Ivaldi et al., 2022

The need for a visualization to aid in the comprehensive analysis of all elements of this imaginary box is the main reason behind this research. Consequently, it seeks to integrate in situ and remote sensing measurements in order to provide an integrated mapping of the study area as a one single product. In order to achieve this goal, it is essential to optimize the process by standardizing the file formats so that all data can converge into a complete 3D depiction of the elements that compose the ocean: ice, sea surface, water column and seafloor.
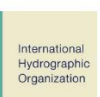
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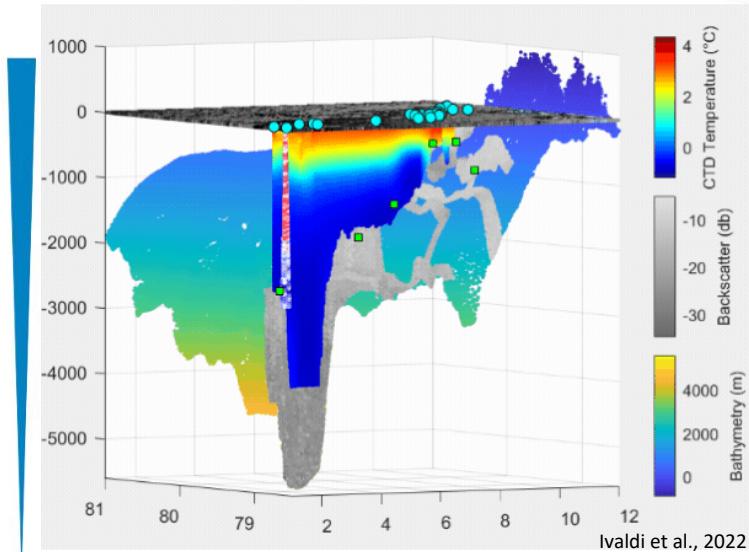ARCTIC

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Thank you