

FIG
2018
ISTANBUL



**Presented at the FIG Congress 2018,
May 6-11, 2018 in Istanbul, Turkey**

6-11 May 2018

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XVI FIG Congress 2018



**EMBRACING OUR SMART WORLD WHERE THE CONTINENTS CONNECT:
ENHANCING THE GEOSPATIAL MATURITY OF SOCIETIES**

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TERRESTRIAL 3D LASER SCANNING ON LIVINGSTON ISLAND, ANTARCTICA

Assist. Prof. Asparuh Kamburov

University of Mining and Geology „St. Ivan Rilski“ - Bulgaria
Department of Mine Surveying and Geodesy

M.Sc. Adil E. Arslan

Istanbul Technical University - Turkey
Department of Geomatics Engineering



Main Objectives

- Capturing of 3D geospatial data of the main buildings' interior and exterior;
- Monitoring of the dynamics and volume variations of a local glacier;
- Development of web-based resources for 3D visualization and virtual reality access to all buildings, including the first SCAR historical site on the island – the Lamae Dog hut, and the chapel "St. Ivan Rilski".



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First APECS Balkan Meeting, (October 2016, Bulgaria)

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www.polarresearch.center/en/



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Ross Sea Marine Protected Area

World's biggest marine reserve created in Antarctica as Russia drops objections

By polrec / October 29, 2016

The creation of a new international marine reserve in the Ross Sea was made possible after Russia dropped objections



News

- Turkey Hosts COMNAP/SCAR Photo Exhibition
- Graphic: Global warming from 1880 to 2015
- World's biggest marine reserve created in Antarctica as Russia drops objections
- Scientists develop interactive game on impact of climate change on the Antarctic Ice Sheet

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- Laser 3D scanner **Stonex X300**
- Two dual-frequency GNSS receivers – **Trimble R4-2** и **Stonex S8+**
- Tripod, rod, accessories
- Point cloud *in situ* data processing software:
 - **Stonex 3D Reconstructor;** **Trimble Business Center**

- Total Station **Zeiss Elta 50RS**
- Rod with prism
- Post processing point cloud software - **Leica Cyclone** (May-September 2017)

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ACTIVITIES (LiDAR)

- 82 scans (over 82 hours scan-time);
- Resolution - 1.350' Hz и V (accuracy at 10 m range ~ 4 mm, at 100 m ~ 40 mm);
- Sequential cloud-to-cloud registration, georeferencing, 3D mesh, and sections through a 30-day demo version of the JRC (Stonex) 3D Reconstructor software.

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ACTIVITIES (GNSS)

- 23-day period (21 Jan 2017 - 13 Feb 2017);
- Dual Frequency GPS / GLONASS measurements via Trimble R4-2 Receiver;
- Converting to RINEX format 2.11
- Data Exchange of the Spanish GNSS Research Group (University of Cadiz), maintaining a seasonal GNSS station on Livingston Island.
- Send data to the SCAR database (GIANT-REGAIN)

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Registration: chapel_Lmf1

Registration Edit ScanWorld Constraint Cloud Constraint Viewers Visual Registration Help

ScanWorlds' Constraints Constraint List ModelSpaces

Groupe/ScanWorlds/Constraint ID	Type	Status	Weight	Error	Error Vector
Ungrouped					
ChapelInteriorScan10_pts					
ChapelInteriorScan4_2pts					

Cloud Constraints Wizard

Cloud Constraint for ChapelInteriorScan10_pts and ChapelInteriorScan4_2pts

Pick corresponding points in the two Constraint viewers, then

- "Preview" the alignment based on the picked correspondances.
- "Constraint" the current pair and advance to the next pair.

Navigation:

- Go "Back" to the previous pair.
- Skip to the "Next" pair if there is not enough overlap.
- "Return" to the Cloud Constraints Wizard grid.

Preview Constraint Back Next Return

ChapelInteriorScan10_pts - ControlSpace [chapel_int1]

ChapelInteriorScan4_2pts - ControlSpace [chapel_int1]

Registration is out of date

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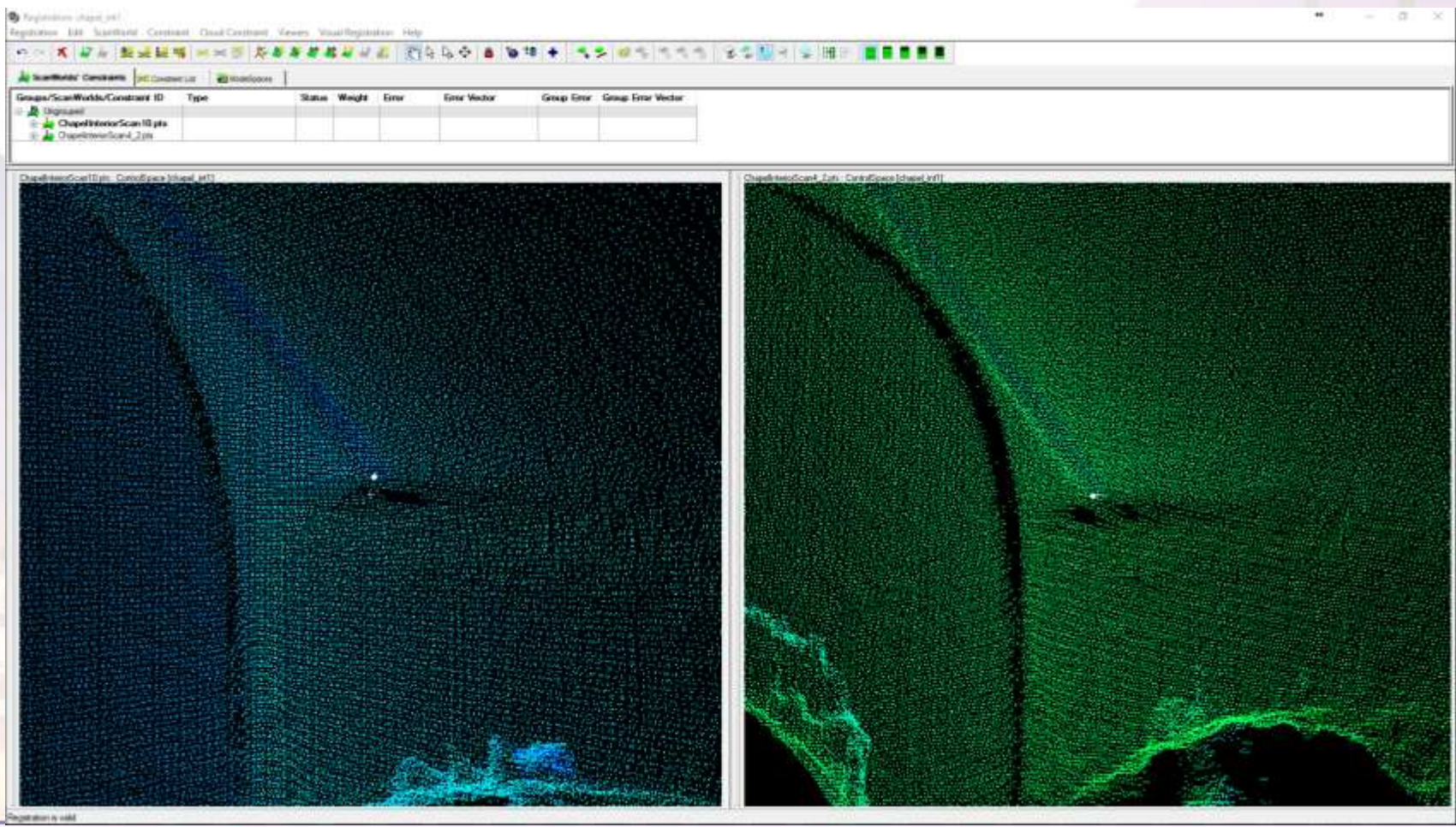


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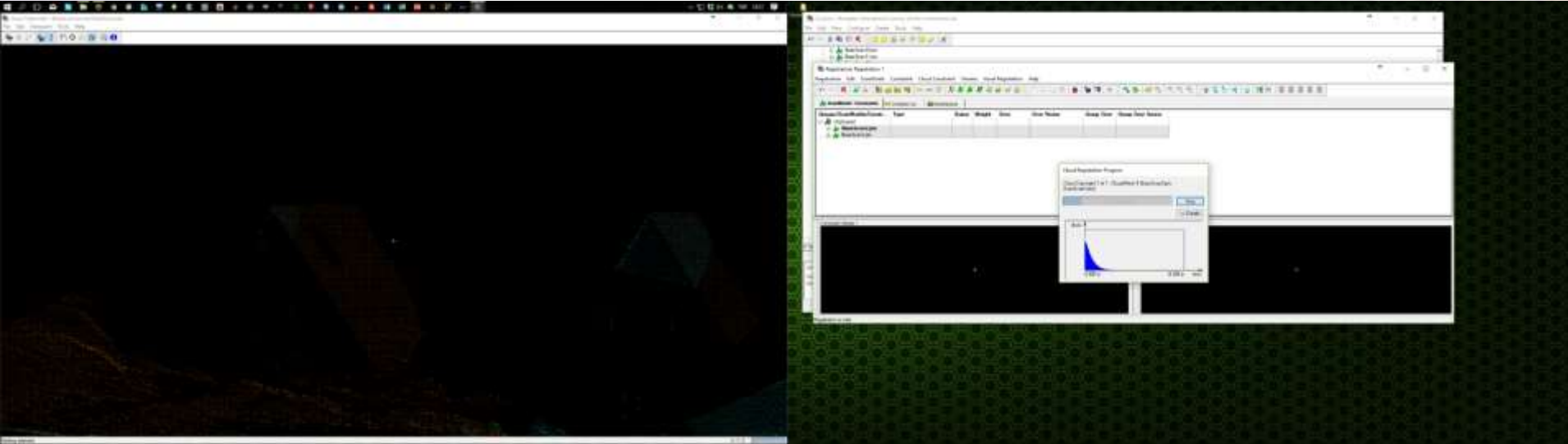
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CO-REGISTRATION



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Co-registration

Optimize Cloud Alignment Results

Constraint	Scanworld	Scanworld	Function Value (sq m)	RMS (m)	Avg (m)	Min (m)	Max (m)	Point Count	Status
Cloud/Mesh 1	BaseScan2.pts	BaseScan3.pts	0.00015326	0.014	0.011	0.000	0.050	302622	Aligned

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Geo-Registration SURVEYS



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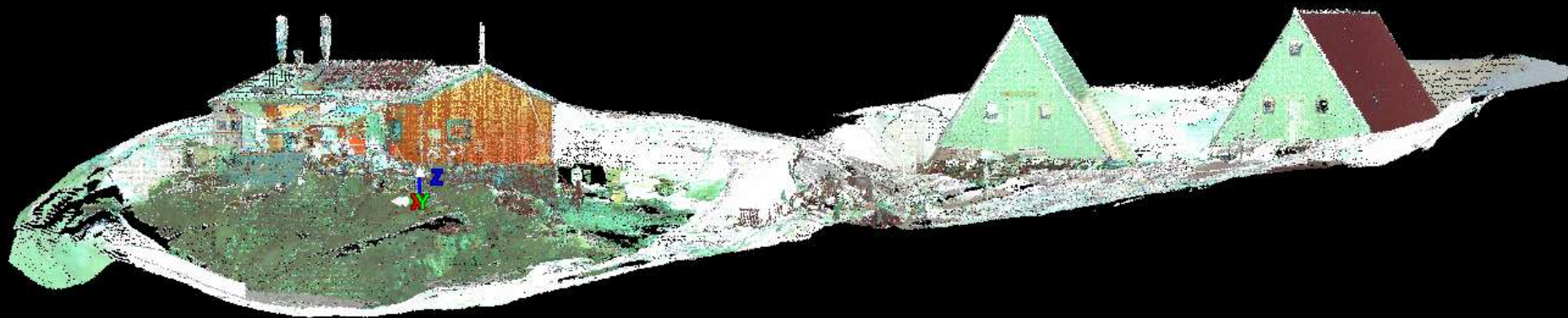


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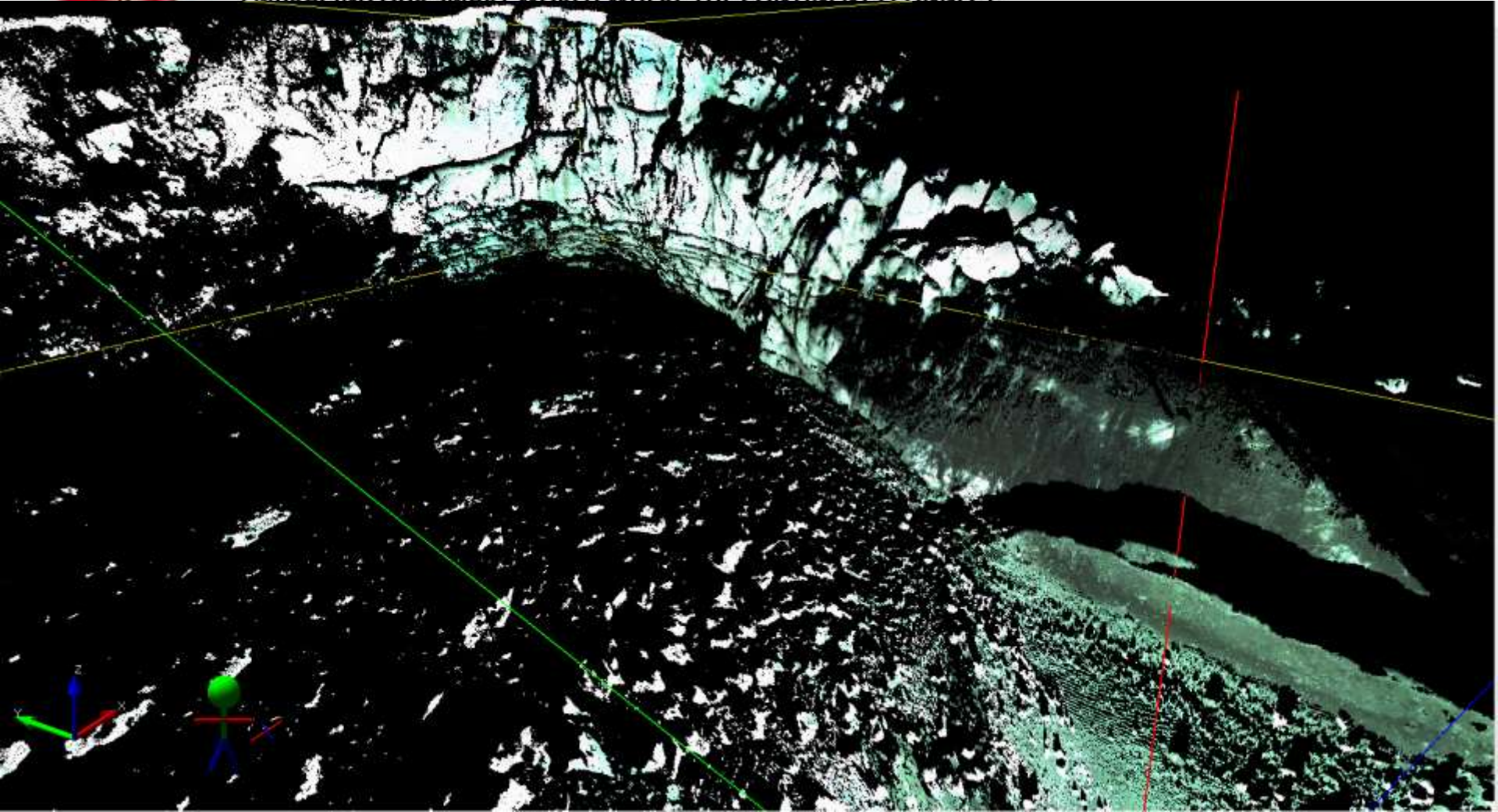




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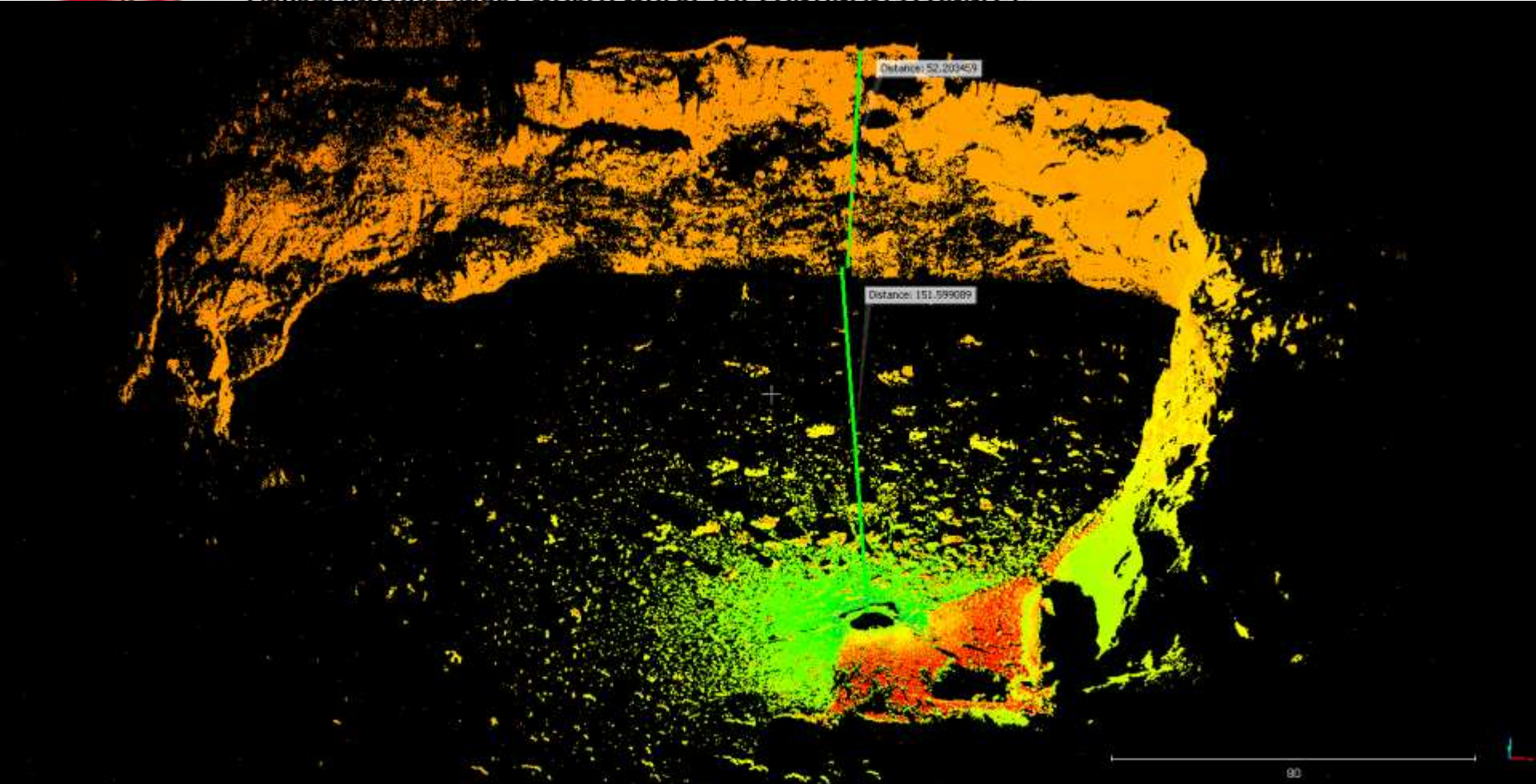




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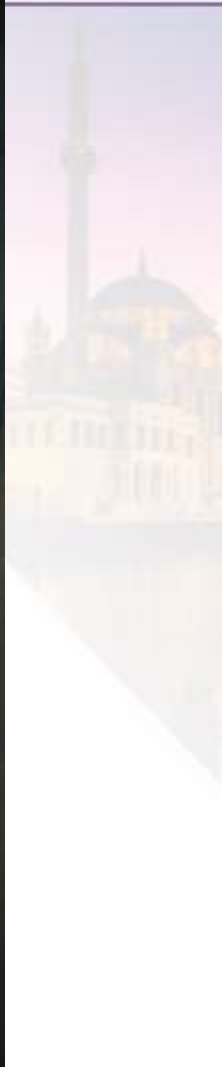




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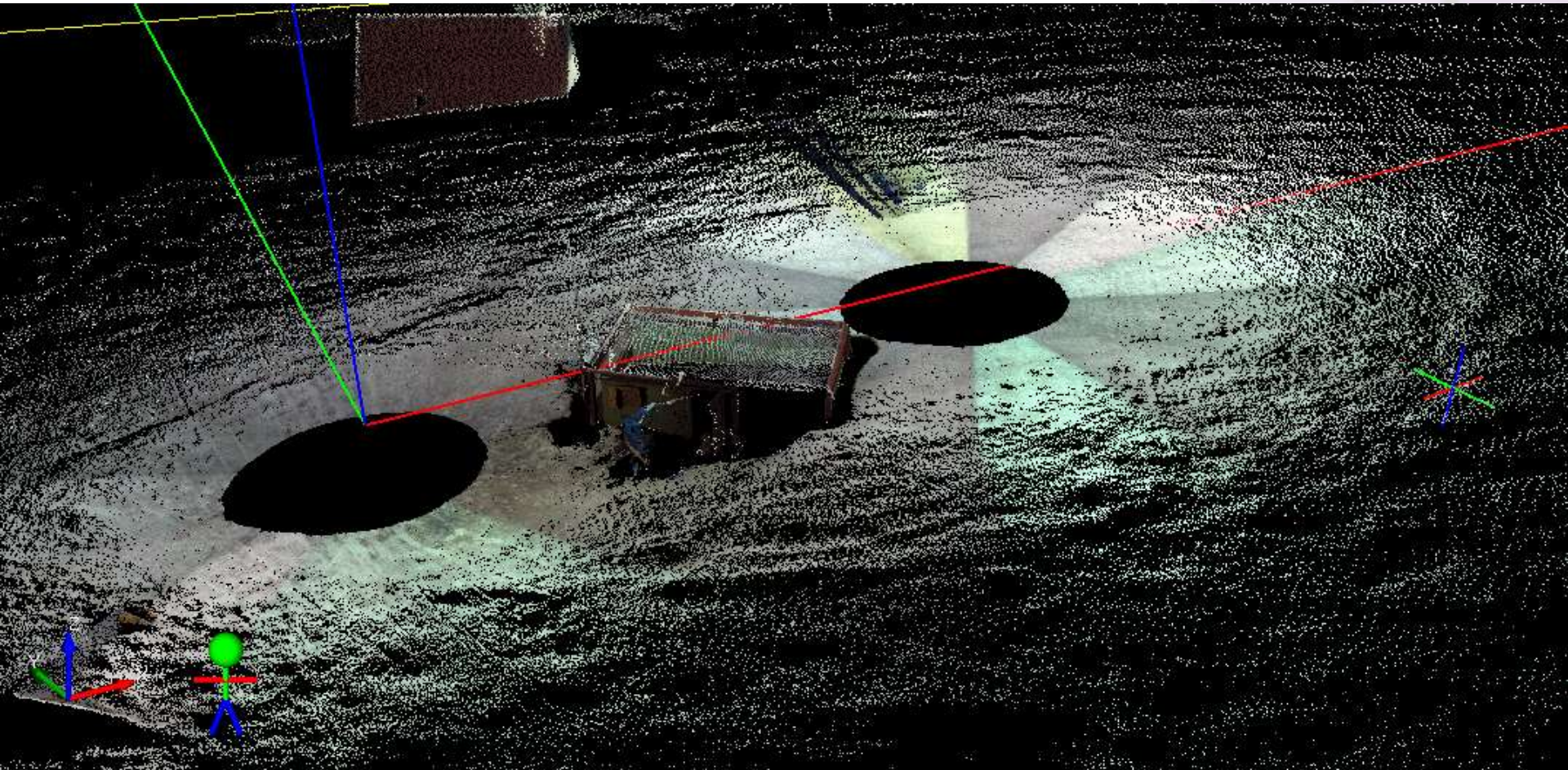


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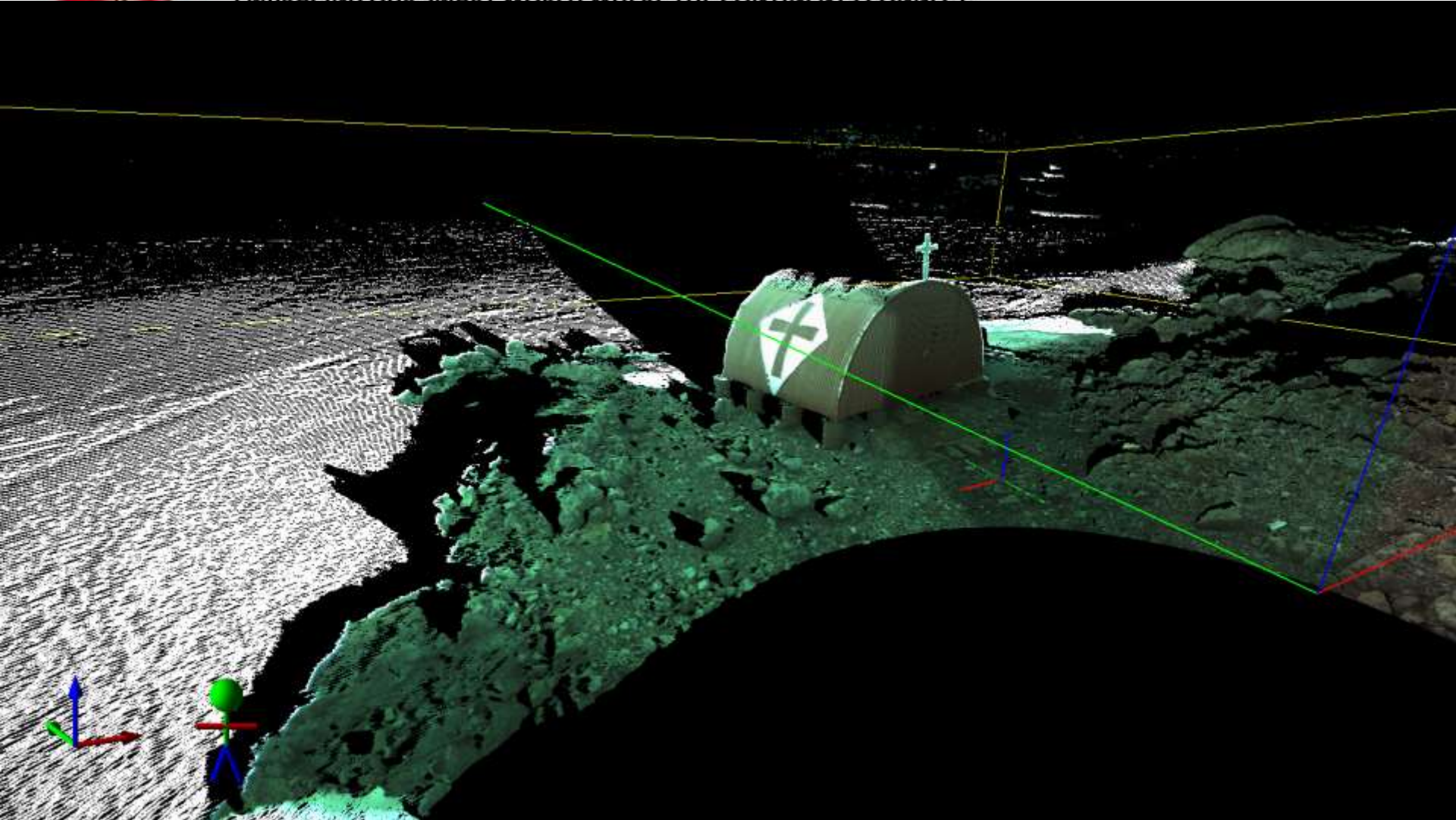




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Jesus Icona mesh model

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- Chapel Exterior Mesh model

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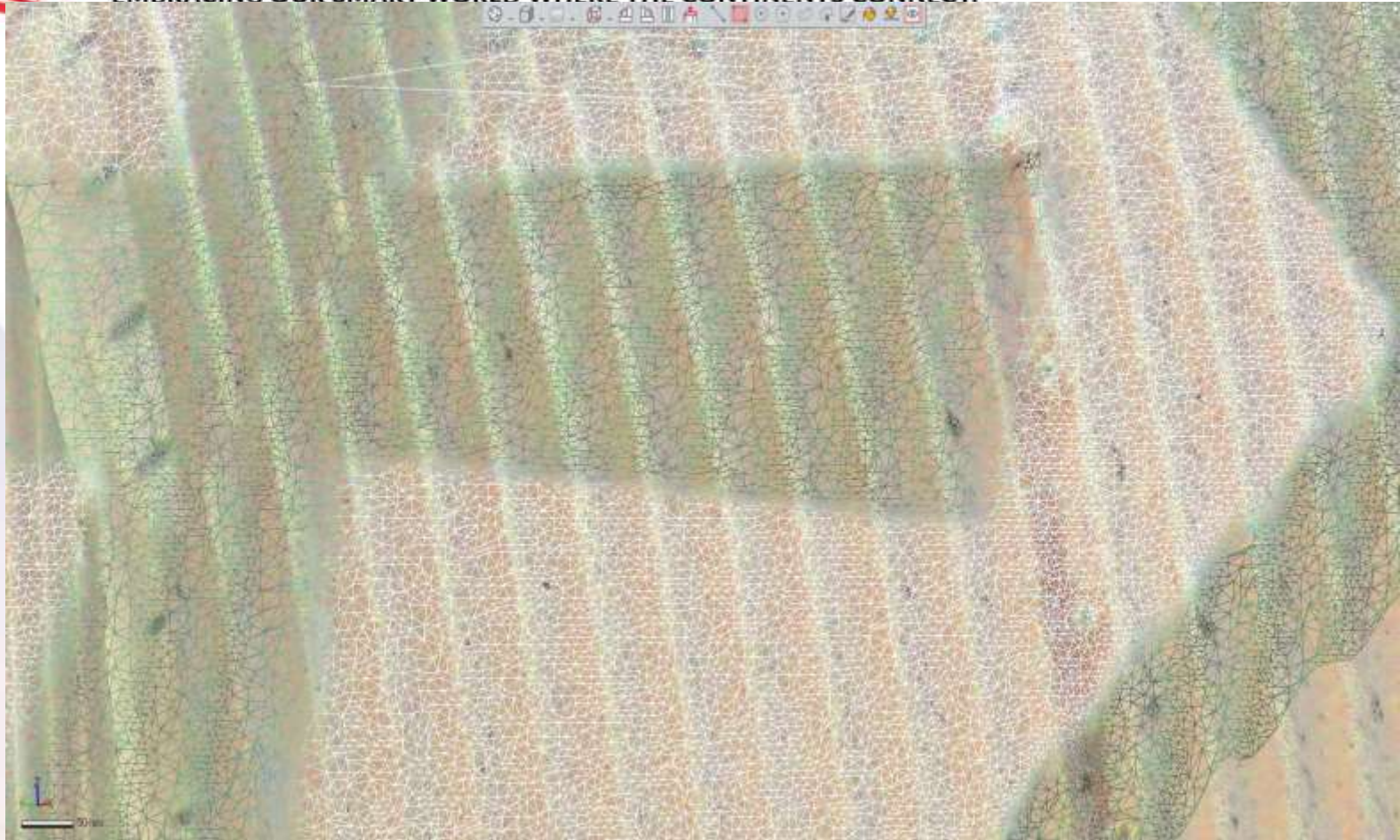


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- Chapel mesh model detail

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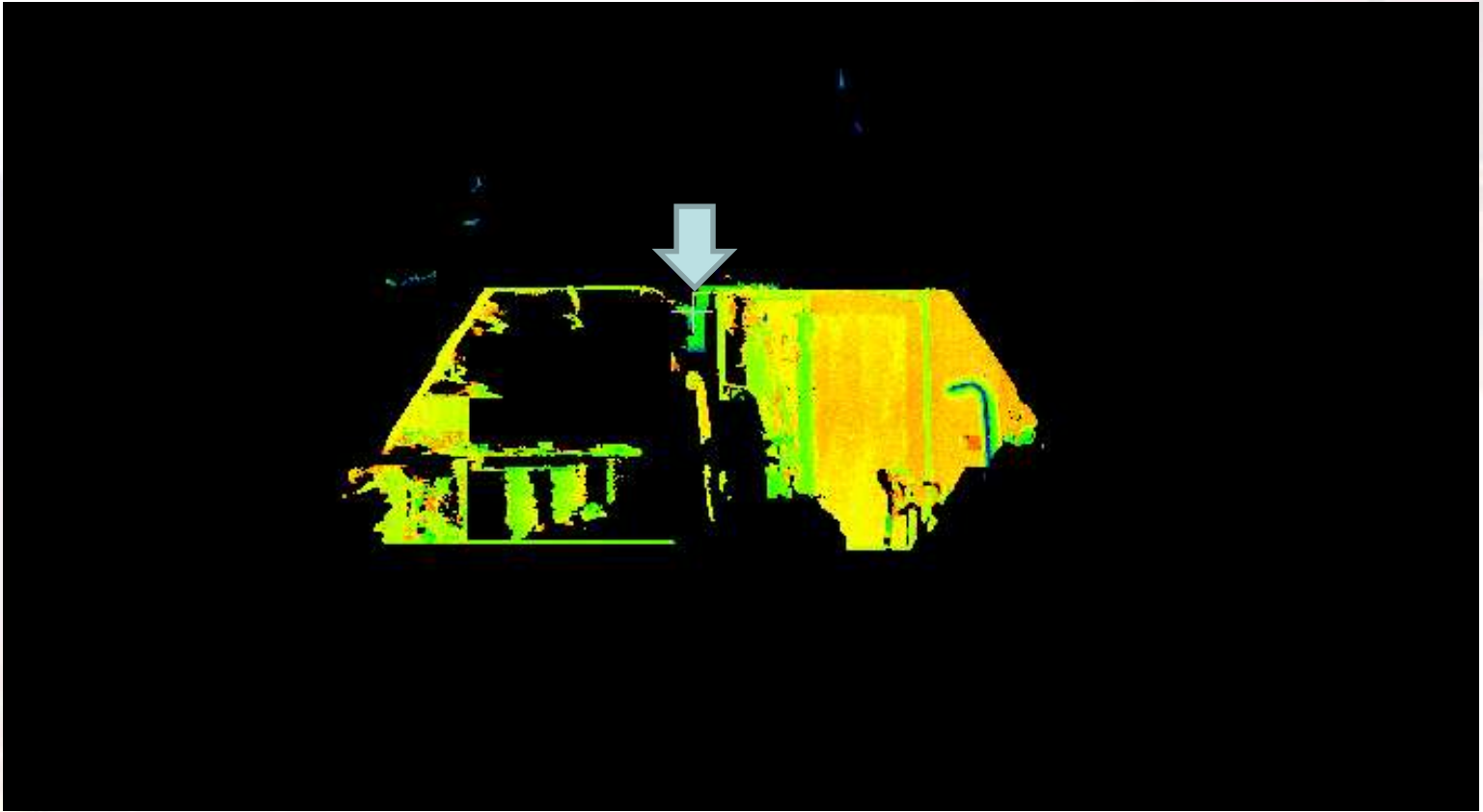


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Current Results

- 100 to 200 cubic meter Daily ice loss on perunika glacier
- Approximately 2 cm per day movement on glacier shelf
- Nearly 4 cm floor support beam deformation on main guest and laboratory housing.

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Future Potentials

- It is possible to conduct a longer period survey on the glacier movement and observe several glaciers in order to create a model for the movements
- It is also possible to try different geomatics techniques in order to determine their performance in extreme environments
- In cooperation with the remote sensing projects related to the area, ground samples can be provided and in situ spectro radio meter measurements can be performed
- Also densification of a geodetic network is essential for any location based/or related application regarding the area, so the geomatics discipline has a continuous potential in the area.

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Special Thanks to

- Bulgarian Antarctic Institute
- Istanbul Technical University Rectorate
- Istanbul Technical University PolREC Team
- Science Sponsor NETCAD



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