

ROck slope Kinematic Analysis

Step-by-step guide

Version 1.0

Update at 3rd February 2021



1) Download the ROKA algorithm, the example datasets and the User manual from
<http://github.com/nicmenegoni/ROKA>

The screenshot shows the GitHub repository page for 'nicmenegoni / ROKA'. The repository has 1 star and 0 forks. The 'Code' tab is selected. A red dashed circle highlights the 'Code' dropdown menu, with a red arrow pointing to it labeled 'Click on Code'. Another red dashed circle highlights the 'Download ZIP' button, with a red arrow pointing to it labeled 'and then on 'Download ZIP''.

GitHub - nicmenegoni/ROKA: RO... x +

github.com/nicmenegoni/ROKA

Why GitHub? Team Enterprise Explore Marketplace Pricing

Search Sign in Sign up

nicmenegoni / ROKA Watch 1 Star 0 Fork 0

Code Issues Pull requests Discussions Actions Projects Security Insights

master 1 branch 0 tags

nicmenegoni Example datasets ...

ROKA_algorithm Add files via upload

example_datasets Example datasets

ROKA_user_manual.docx ROKA code

Go to file Code

Clone HTTPS GitHub CLI
https://github.com/nicmenegoni/ROKA.gi

Use Git or checkout with SVN using the web URL.

Open with GitHub Desktop

Download ZIP

About

ROck slope Kinematic Analysis (ROKA) algorithm wrtitten in MATLAB language

Releases

No releases published

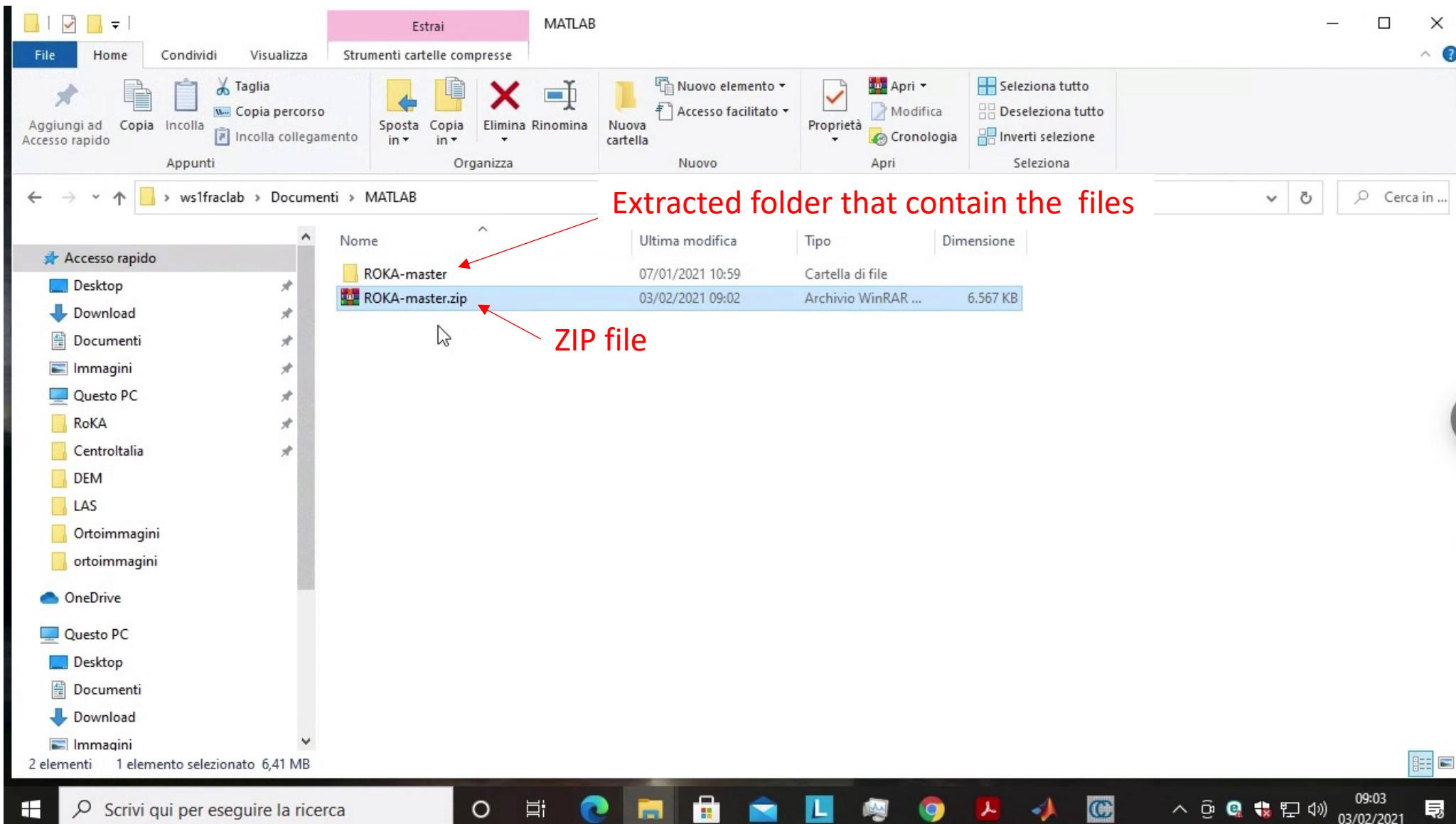
Packages

No packages published

Scrivi qui per eseguire la ricerca

09:02 03/02/2021

2) Extract the files in the selected path. It is suggested to extract them into the main MATLAB folder.





3) Explore the 'ROKA-master' folder

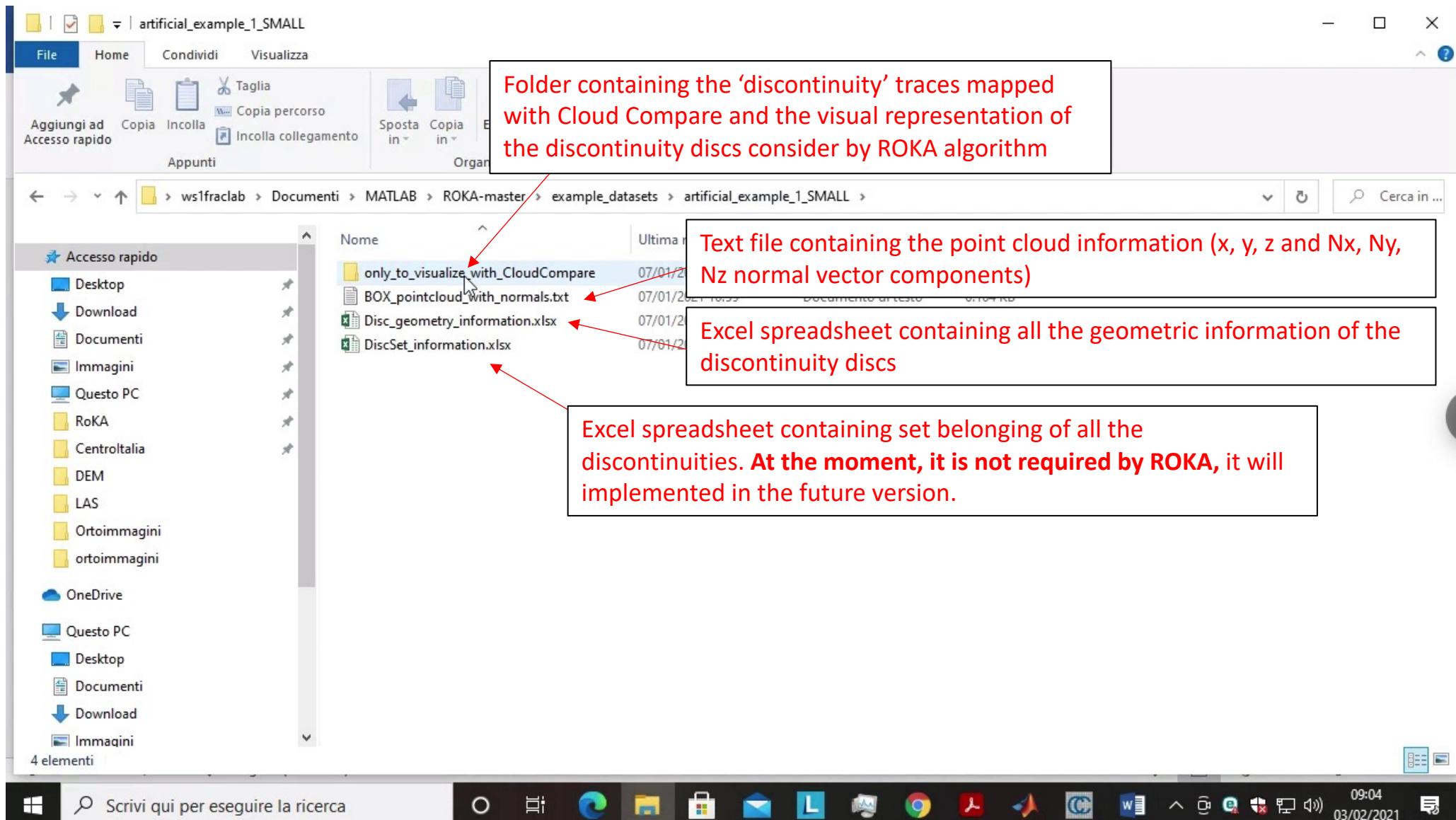
The screenshot shows a Windows File Explorer window with the following details:

- Path:** ws1fraclab > Documenti > MATLAB > ROKA-master
- Content:** The folder contains three items:
 - example_datasets** (Folder)
 - ROKA_algorithm** (Folder)
 - ROKA_user_manual.docx** (Word document)
- Toolbar:** Standard Windows file operations (File, Home, Condividi, Visualizza), clipboard (Taglia, Copia, Incolla, Incolla collegamento), organization (Sposta in, Copia in, Elimina, Rinomina), and context menu (Nuova cartella, Nuovo element, Accesso facilitato, Proprietà, Apri, Selezione).
- Search Bar:** Cerca in ...
- Bottom Taskbar:** Shows various open applications including Microsoft Edge, File Explorer, MATLAB, and others.

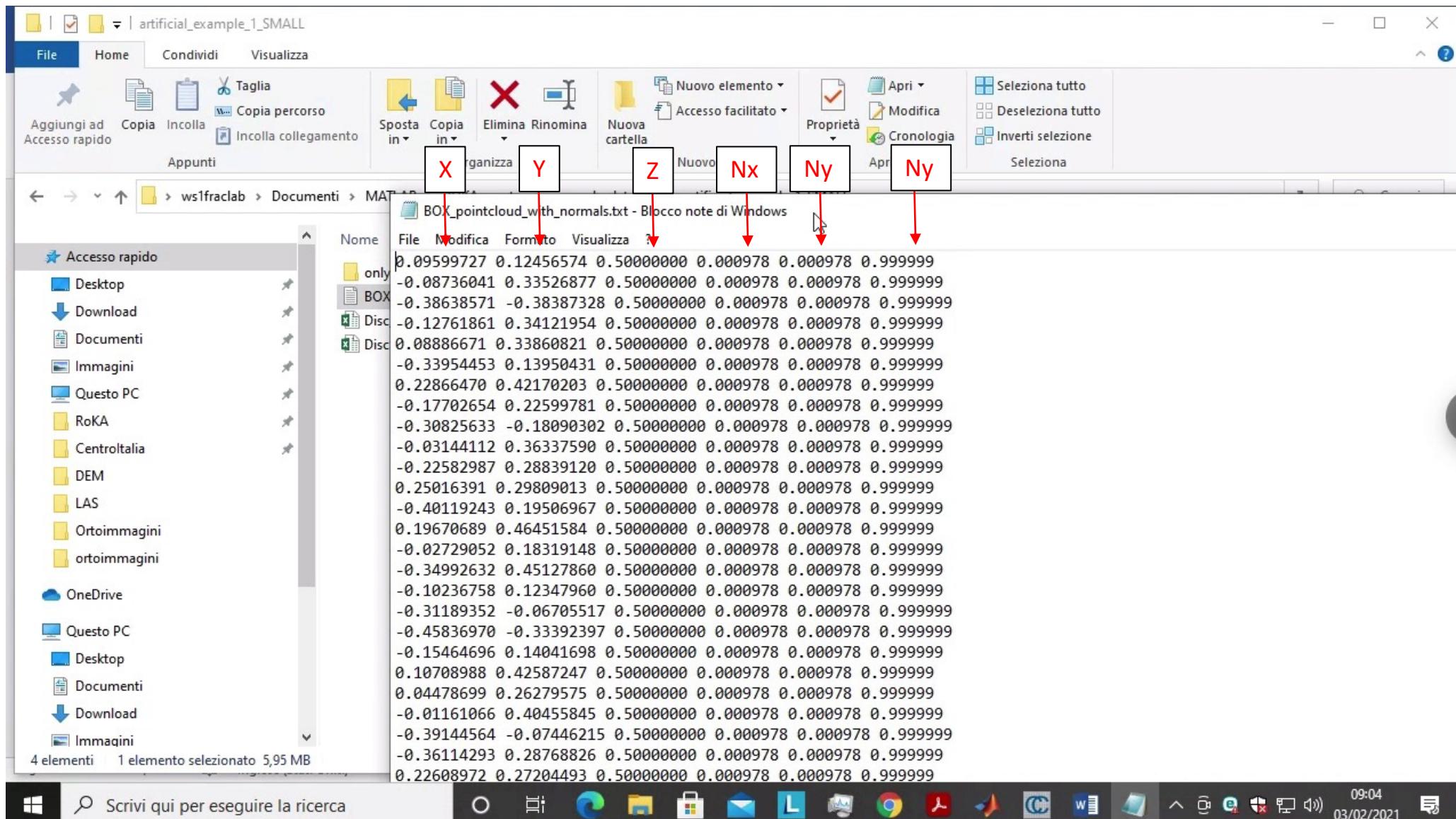
Annotations in red text and arrows point to specific items:

- An arrow points to the **example_datasets** folder with the text "Folder containing the example datasets".
- An arrow points to the **ROKA_algorithm** folder with the text "Folder containing the ROKA scripts".
- An arrow points to the **ROKA_user_manual.docx** document with the text "User manual".

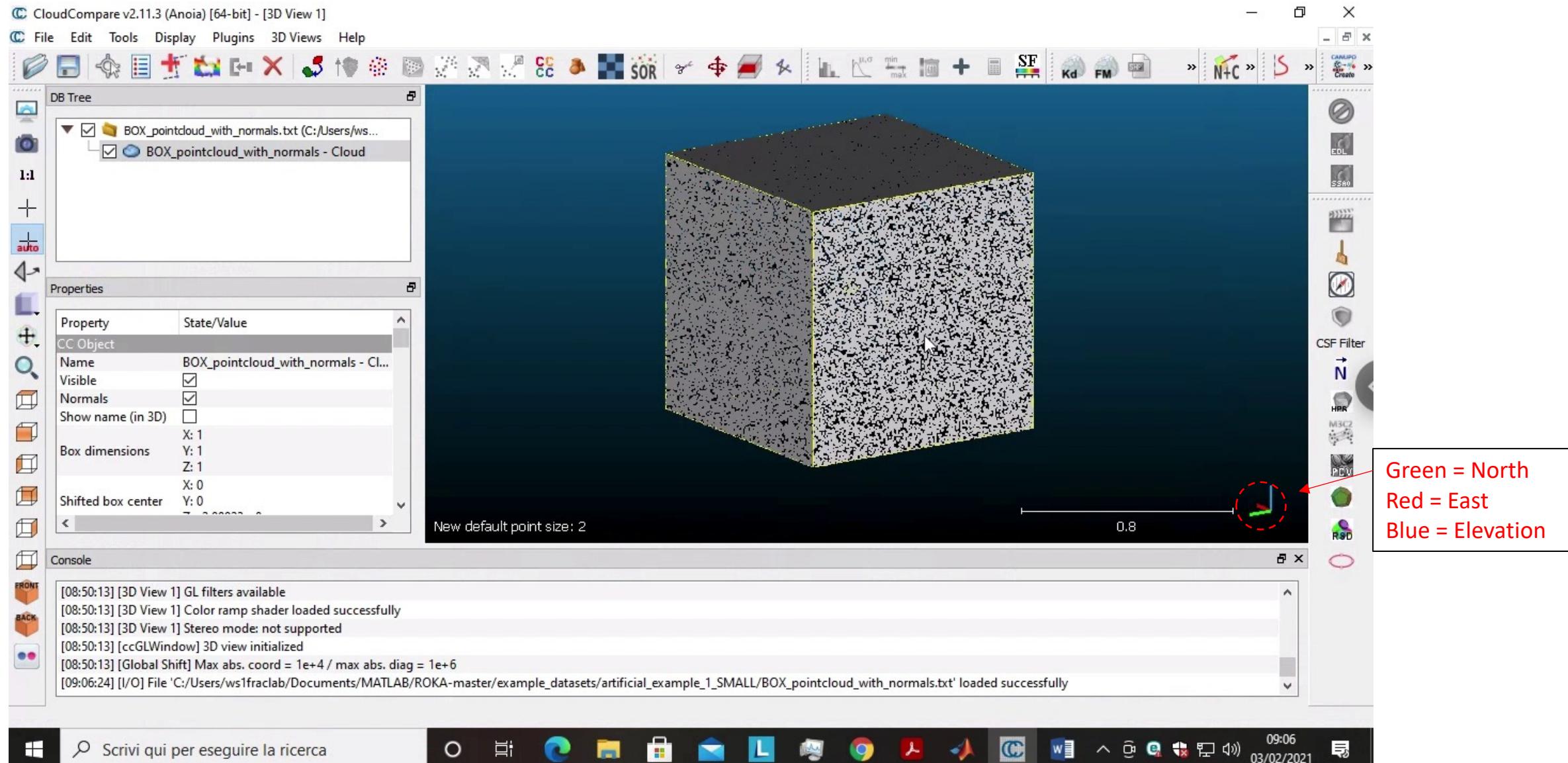
4) Explore the 'artificial_example_1_SMALL' folder. Here the example dataset is stored.



5) Open the text file 'BOX_pointcloud_with_normal.txt' that describe the point cloud



6) Load the same file on Cloud Compare software to visualize the point cloud.





7) Open the text file 'Disc_geometry_information.xlsx' that describe the geometry of the considered discontinuities.

Disc_geometry_information.xlsx - Excel

File Home Inserisci Layout di pagina Formule Dati Revisione Visualizza Che cosa si desidera fare? Accedi Condividi

Calibri 11 A A Testo a capo Generale

Incolla G C S Unisci e allinea al centro % 000,00,00

Appunti Carattere Allineamento Numeri

Formattazione condizionale Formatta come tabella Stili cella

Inserisci Elimina Ordina e Trova e filtra seleziona

Formato Modifica

A1 Dip

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Dip	DipDirection	Radius	Xcenter	Ycenter	Zcenter	Nx	<th nz<="" th=""><th>Mcoplanarity</th><th>Kcolinearity</th><th>MeanAbsError</th><th>StDevAb</th></th>	<th>Mcoplanarity</th> <th>Kcolinearity</th> <th>MeanAbsError</th> <th>StDevAb</th>	Mcoplanarity	Kcolinearity	MeanAbsError	StDevAb
2	35.37169994	180.0830819	0.790019503	-0.000999391	-0.000282973	0.029244661	-0.000839404	-0.578877878	0.81541382	9.020304773	0.096953651	0.00859971	0.007
3	75.79588923	330.7342315	0.823232677	-1.49012E-08	-0.021543592	0.001356214	-0.473915753	0.845691443	0.245376939	7.940455804	0.026111325	0.01244815	0.011
4	6.720224491	359.6217416	0.706546708	-0.001652777	0.002564535	0.152609996	-0.000772552	0.117018753	0.993129405	12.3399235	0.008352411	0.000947399	0.000
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Sheet1

Scrivi qui per eseguire la ricerca

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

09:05 03/02/2021

Fields required by ROKA. You can produce your own file using other software or methodologies (e.g. Polyworks, 3DM Analyst) using the header format.



8) Open MATLAB software, set 'ROKA_algorithm' folder as Current folder, open the 'ROKAmain.m' script

The screenshot shows the MATLAB R2020b interface with three windows open:

- Top Window:** MATLAB R2020b - academic use. The menu bar includes HOME, PLOTS, APPS, FILE, VARIABLE, CODE, SIMULINK, ENVIRONMENT, and RESOURCES. The toolbar has icons for New Script, New Live Script, New, Open, Find Files, Import Data, Save Workspace, New Variable, Open Variable, Favorites, Analyze Code, Run and Time, Preferences, Set Path, Add-Ons, Help, Community, Request Support, Parallel, Learn MATLAB, and Clear Commands.
- Middle Window:** MATLAB R2020b - academic use. The menu bar includes HOME, PLOTS, APPS, EDITOR, PUBLISH, and VIEW. The toolbar includes Insert, Comment, Indent, Go To, Breakpoints, Run, Run and Advance, Run Section, and Run and Time. The left pane shows the Current Folder path: C:\Users\ws1fraclab\Documents\MATLAB\ROKA-master. A red box highlights the 'Current Folder' button in the toolbar. A red circle highlights the 'ROKA-master' folder in the Current Folder list. A red box labeled "Open MATLAB" surrounds the entire window.
- Bottom Window:** MATLAB R2020b - academic use. The menu bar includes HOME, PLOTS, APPS, FILE, NAVIGATE, EDIT, BREAKPOINTS, and RUN. The left pane shows the Current Folder path: C:\Users\ws1fraclab\Documents\MATLAB\ROKA-master\ROKA_algorithm. A red circle highlights the 'ROKA_algorithm' folder in the Current Folder list. A red box labeled "Set 'ROKA_algorithm' as Current Folder" surrounds the entire window.

In the bottom window's editor pane, the code for 'ROKAmain.m' is displayed:

```
%> Rock slope Kinematic Analysis (ROKA)
% close all; clear variables; tic
% disp('##### ROKA algorithm has been launched #####') % Display a
% % 0) DEFINITION OF SOME PARAMETERS
% userSPr=0.1;%radius of the scan-volume and scan-plane
%
% discutoff=2*userSPr*0.9;%define the cutoff value of the intersection between
% %the default value is 75% of the diameter of the scan-plane
%
% uselatlimits=1;% Define if you use the lateral limits or not, and give a val
%
% latlimits=20;%Define lateral limits (Godmann report 20°)
%
% frictionangle=30;%Define the friction angle (commonly 30°)
%
% ExportAllIntersection=0;%Define if you want to export all the discontinuity
```

The bottom window also features a Command Window, a Details pane, and a search bar at the bottom.



9) Define the calculation parameters as described in the User manual

MATLAB R2020b - academic use

HOME PLOTS APPS EDITOR PUBLISH VIEW

FILE NAVIGATE

SEARCH DOCUMENTATION SIGN IN

Current Folder

Editor - C:\Users\ws1fraclab\Documents\MATLAB\ROKA-master\ROKA_algorithm\ROKAmain.m

```
%> ROck slope Kinematic Analysis (ROKA)
close all; clear variables; tic
disp('##### ROKA algorithm has been launched #####'); % Display a
% 0) DEFINITION OF SOME PARAMETERS
userSPr=0.1;%radius of the scan-volume and scan-plane
discutoff=2*userSPr*0.9;%define the cutoff value of the intersection
%between discontinuities and scan-plane used to perform or not the KA (
%the default value is 75% of the diameter of the scan-plane
uselatlimits=1;% Define if you use the lateral limits or not, and give a val
latlimits=20;%Define lateral limits (Godmann report 20°)
frictionangle=30;%Define the friction angle (commonly 30°)
```

Workspace

Command Window

New to MATLAB? See resources for [Getting Started](#).

f>> ROKAmain

09:10 03/02/2021



10) Launch the algorithm

MATLAB R2020b - academic use

HOME PLOTS APPS EDITOR PUBLISH VIEW

FILE NAVIGATE

Breakpoints Run Run and Advance Run and Time

Editor - C:\Users\ws1fraclab\Documents\MATLAB\ROKA-master\ROKAlgorithm\ROKAlgorithm.m

```
%> ROck slope Kinematic Analysis (ROKA)
% close all; clear variables; tic
% disp('##### ROKA algorithm has been launched #####') % Display a
% 0) DEFINITION OF SOME PARAMETERS
userSPr=0.1;%radius of the scan-volume and scan-plane
discutoff=2*userSPr*0.9;%define the c
%between discontinuities and scan-plan
%the default value is 75% of the diam
uselatlimits=1;% Define if you use the
latlimits=20;%Define lateral limits (G
frictionangle=30;%Define the friction angle (commonly 30°)
```

Workspace

Current Folder

ROKAlgorithm.m (Script)

Command Window

New to MATLAB? See resources for [Getting Started](#).

f>> ROKAlgorithm

Click on Run

or

Digit and enter 'ROKAlgorithm' in the Command Window



11) Click on OK to load the discontinuities geometry data

MATLAB R2020b - academic use

HOME PLOTS APPS EDITOR PUBLISH VIEW

FILE NAVIGATE EDIT BREAKPOINTS RUN

Current Folder Editor - C:\Users\ws1fraclab\Documents\MATLAB\ROKA-master\ROKAlgorithm\ROKAlgorithm.m

Name Value

OK

ROK slope Kinematics

close all; clear var;

Select fracture geometry data (XLSX file) to load

OK

% Display a

0) DEFINITION OF THE GEOMETRY

userSPr=0.1;%radius of the scan-volume and scan-plane

discutoff=2*userSPr*0.9;%define the cutoff value of the intersection

%between discontinuities and scan-plane used to perform or not the KA (

%the default value is 75% of the diameter of the scan-plane

uselatlimits=1;% Define if you use the lateral limits or not, and give a value

latlimits=20;%Define lateral limits (Godmann report 20°)

frictionangle=30;%Define the friction angle (commonly 30°)

Command Window

New to MATLAB? See resources for [Getting Started](#).

>> ROKAlgorithm

ROKA algorithm has been launched

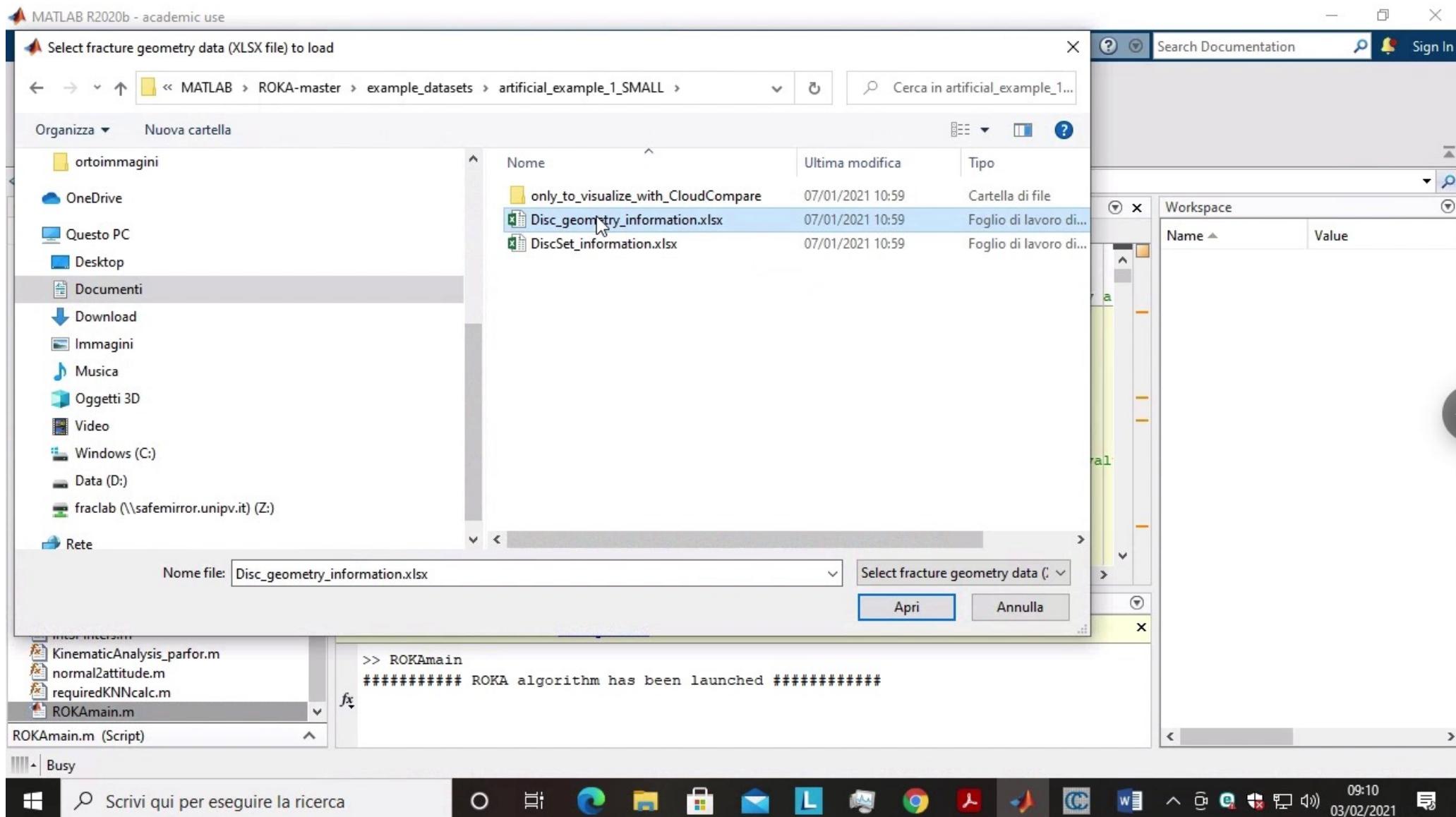
Busy

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09:10 03/02/2021

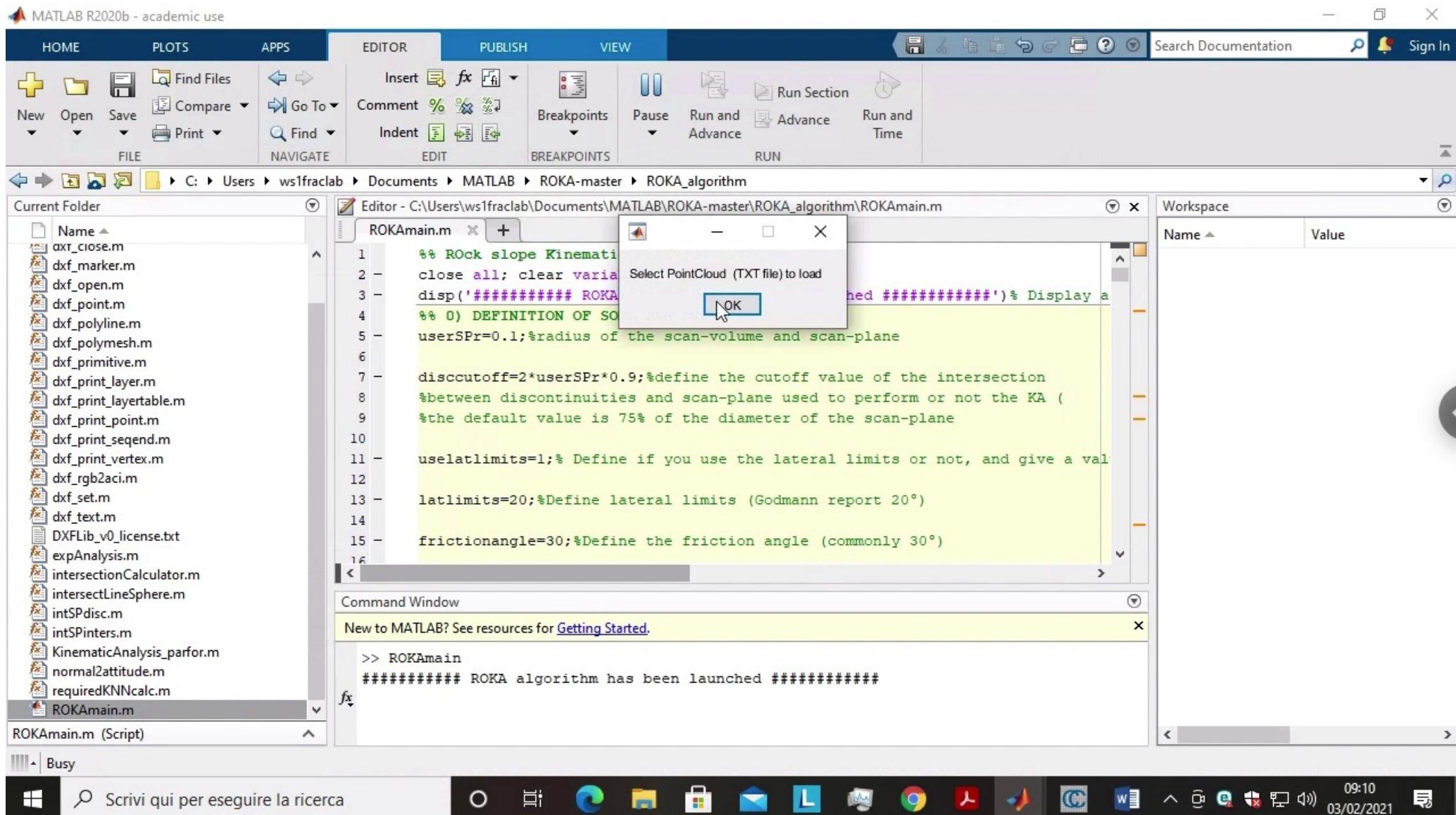


12) Select and open the XLSX file containing the discontinuities geometry information



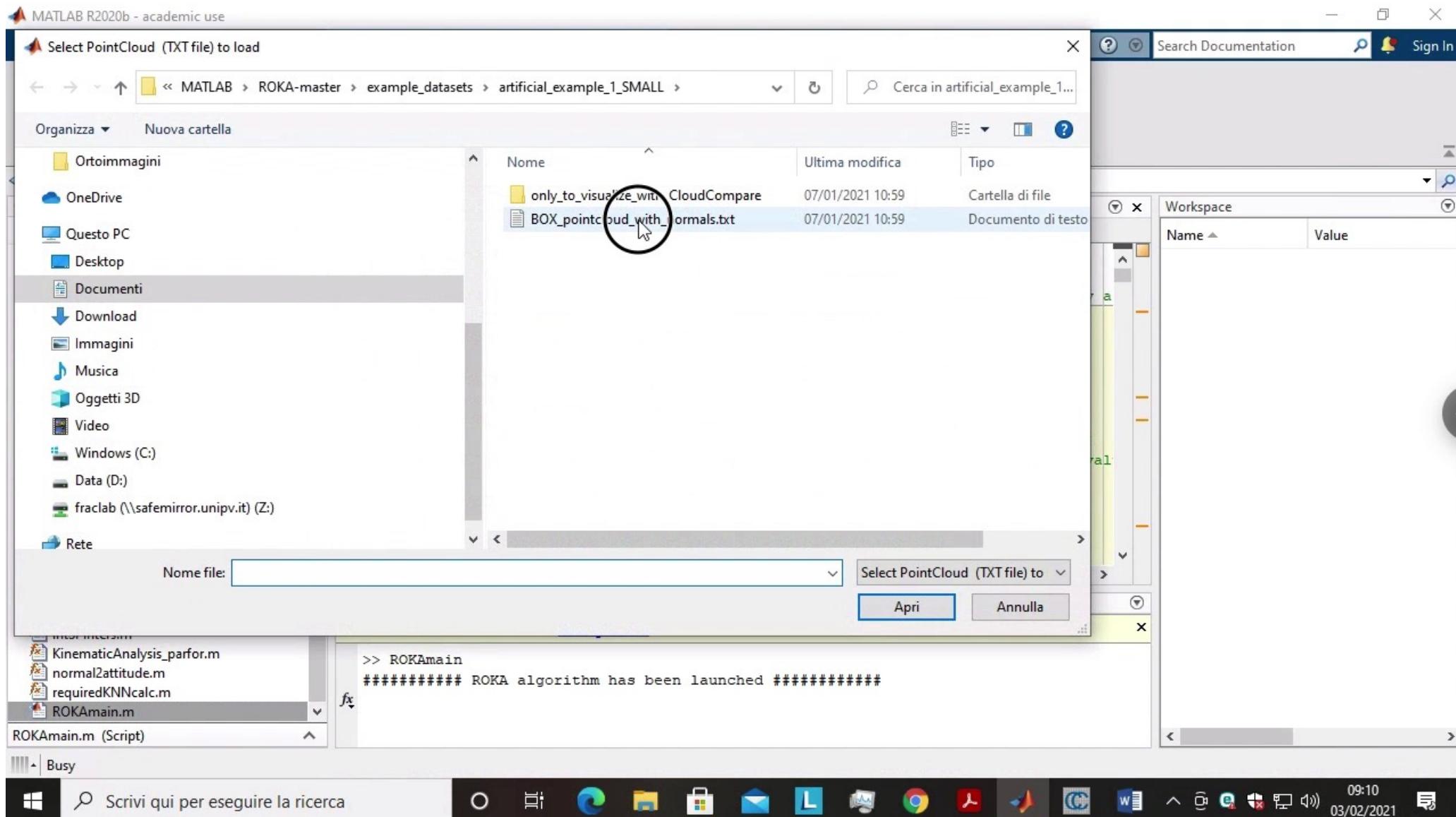


13) Click on OK to load the point cloud data





14) Select and open the TXT file describing the point cloud (see step 5)





15) Wait for the end of the ROKA calculation

MATLAB R2020b - academic use

HOME PLOTS APPS EDITOR PUBLISH VIEW

FILE NAVIGATE

Search Documentation Sign In

Current Folder Editor - C:\Users\ws1fraclab\Documents\MATLAB\ROKA-master\ROKA_algorithm\ROKAmain.m

Name

- axt_close.m
- dfx_marker.m
- dfx_open.m
- dfx_point.m
- dfx_polyline.m
- dfx_polymesh.m
- dfx_primitive.m
- dfx_print_layer.m
- dfx_print_layerable.m
- dfx_print_point.m
- dfx_print_seqend.m
- dfx_print_vertex.m
- dfx_rgb2aci.m
- dfx_set.m
- dfx_text.m
- DYELib_v0.license.txt

ROKAmain.m

```
1 %< ROck slope Kinematic Analysis (ROKA)
2 close all; clear variables; tic
3 disp('##### ROKA algorithm has been launched #####')% Display a
4 %% 0) DEFINITION OF SOME PARAMETERS
5 userSPr=0.1;%radius of the scan-volume and scan-plane
6
7 discutoff=2*userSPr*0.9;%define the cutoff value of the intersection
8 %between discontinuities and scan-plane used to perform or not the KA (
9 %the default value is 75% of the diameter of the scan-plane
10
11 uselatlimits=1;% Define if you use the lateral limits or not, and give a val
12
13 latlimits=20;%Define lateral limits (Godmann report 20°)
14
15 frictionangle=30;%Define the friction angle (commonly 30°)
16
```

Workspace

Name	Value
------	-------

Command Window

```
New to MATLAB? See resources for Getting Started.
End of the calculation of the discontinuities intersections at 0.58812 minutes
Starting the kinematic analysis at 0.58824 minutes
Time to calculate the best Knn points number 0.02043 min.
Starting parallel pool (parpool) using the 'local' profile ...
```

Busy

Scrivi qui per eseguire la ricerca

09:10 03/02/2021

A red box highlights the text "Busy" in the Command Window status bar. A red arrow points from the text "Busy means that algorithm is working" to this box.

'Busy' means that
algorithm is working



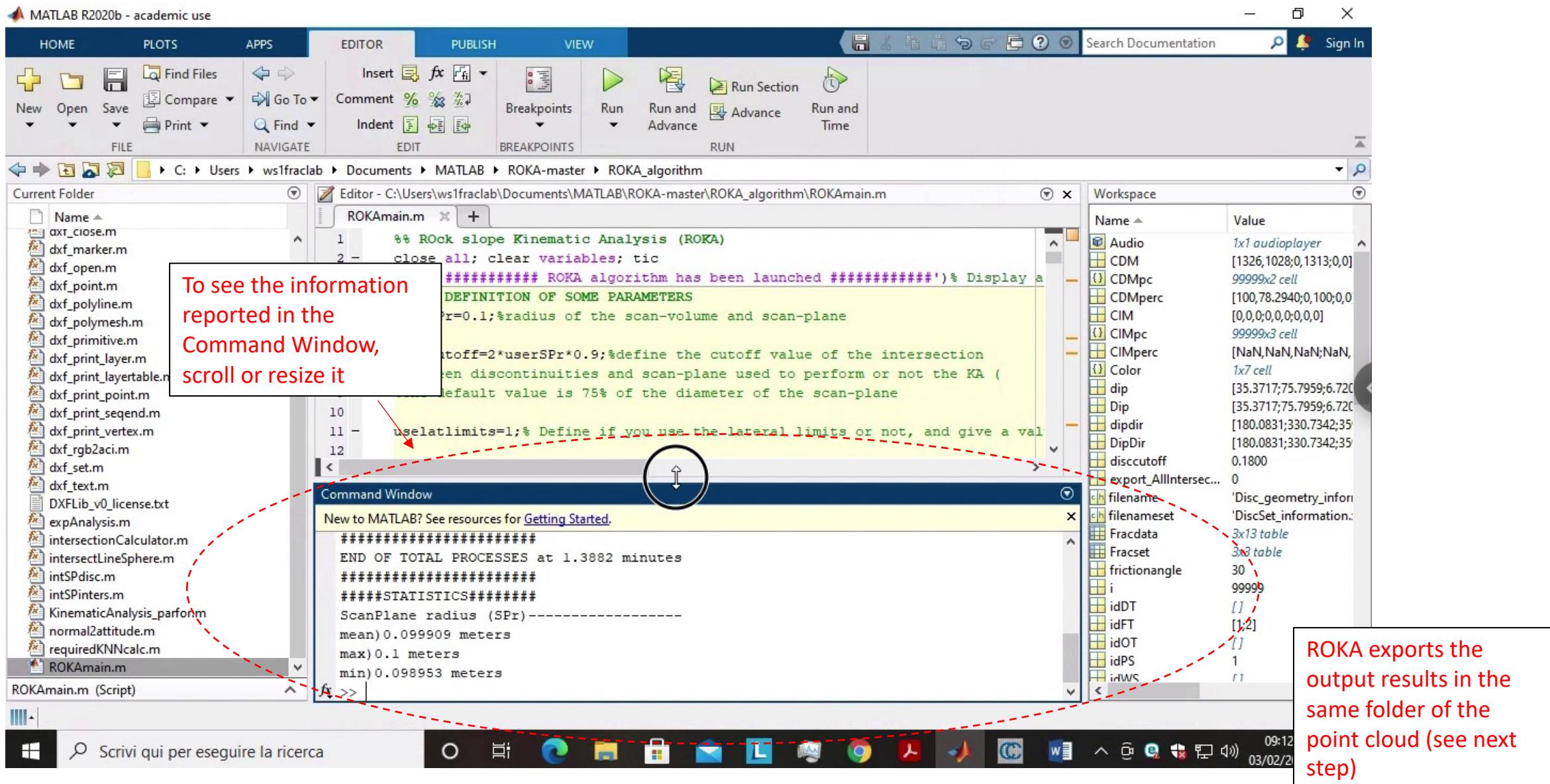
16) An empty figure and a beep alarm will inform you about the end of the ROKA calculation

The screenshot shows the MATLAB R2020b interface. The top menu bar includes HOME, PLOTS, APPS, EDITOR, and Figure 1. The FILE menu is open, showing options like New, Open, Save, Compare, Print, Insert, Comment, Indent, Go To, Find, and Navigate. The Current Folder browser on the left lists files such as axt_close.m, dxf_marker.m, dxf_open.m, dxf_point.m, dxf_polyline.m, dxf_polymesh.m, dxf_primitive.m, dxf_print_layer.m, dxf_print_layerable.m, dxf_print_point.m, dxf_print_seqend.m, dxf_print_vertex.m, dxf_rgb2aci.m, dxf_set.m, dxf_text.m, DXFLib_v0_license.txt, expAnalysis.m, intersectionCalculator.m, ROKAmain.m, and ROKAinters.m. A red box highlights the 'Busy' status in the bottom-left corner. The central workspace contains a plot titled 'Figure 1' with axes from 0 to 1. The Command Window at the bottom displays the following text:

```
New to MATLAB? See resources for Getting Started.  
ScanPlane radius (SPr)-----  
mean) 0.099909 meters  
max) 0.1 meters  
min) 0.098953 meters
```

The right side of the interface shows the Workspace browser with variables like Audio, CDM, CDMpc, CDMperc, CIM, CIMpc, CIMperc, Color, dip, Dip, dipdir, DipDir, discutoff, export_AllIntersec..., filename, filenameset, Fracdata, Fracset, frictionangle, i, idDT, idFT, idOT, idPS, and idWS.

17) Close the figure and read the calculation information in the Command Window. IN the future version a statistic of the ad-hoc Kinematic Analysis performed by ROKA will be added



The screenshot shows the MATLAB R2020b interface with the following components visible:

- Toolbar:** HOME, PLOTS, APPS, EDITOR (selected), PUBLISH, VIEW.
- File Explorer:** Current Folder pane showing various MATLAB files (e.g., dxr_close.m, dxr_marker.m, dxr_open.m, etc.) and the ROKA_main.m script.
- Editor:** Editor window titled "ROKAmain.m" containing the MATLAB code for the ROKA algorithm.
- Command Window:** A small window below the editor showing the execution results of the script.
- Workspace:** A pane listing variables and their values.

A red callout box points from the text "To see the information reported in the Command Window, scroll or resize it" to the Command Window area.

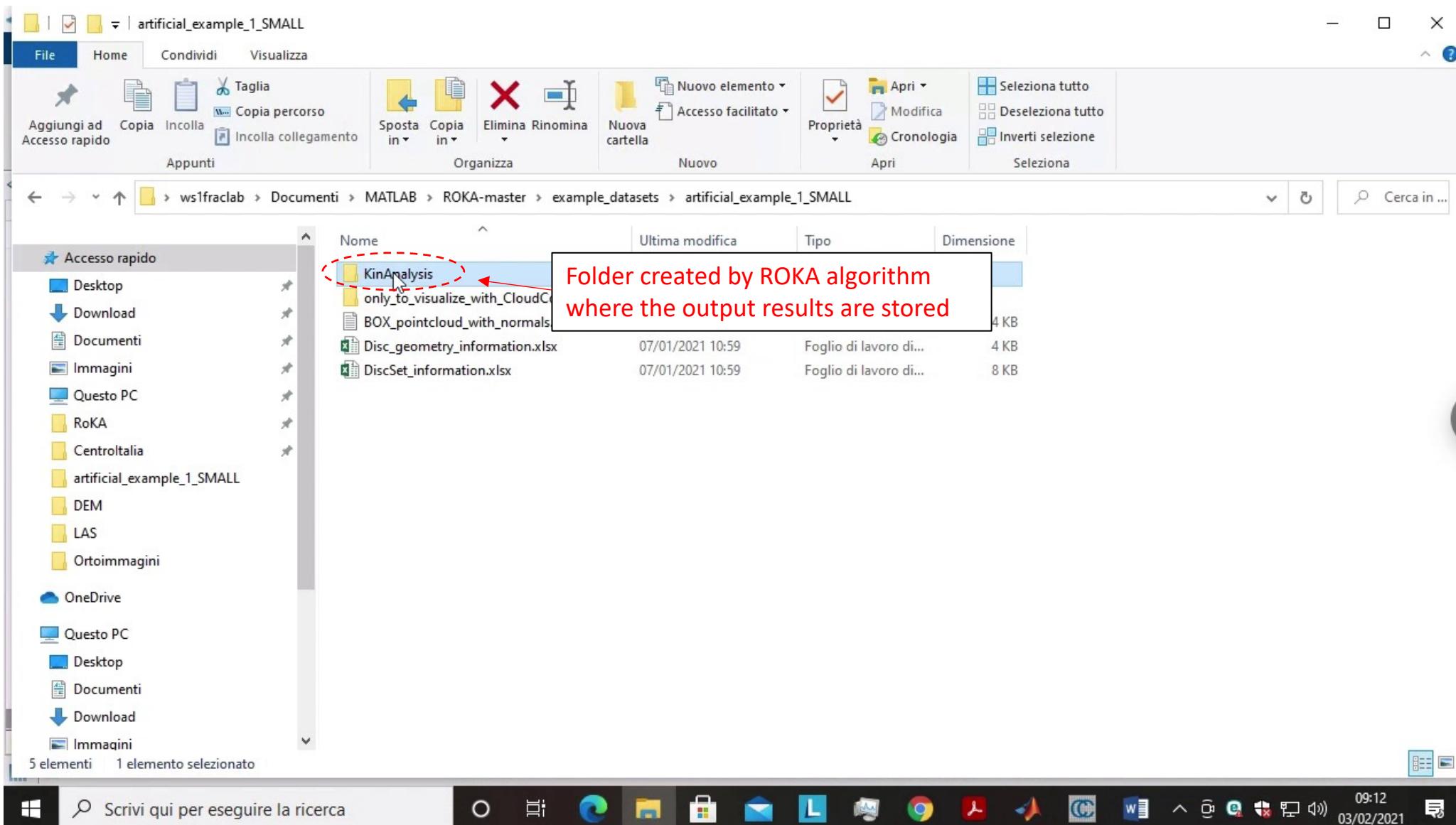
The ROKA_main.m script code includes comments about launching the algorithm and defining parameters like radius and cutoff values.

The Command Window output shows the end of processes and statistical information about the scan plane radius:

```
#####
END OF TOTAL PROCESSES at 1.3882 minutes
#####
#####STATISTICS#####
ScanPlane radius (SPr)-----
mean) 0.099909 meters
max) 0.1 meters
min) 0.098953 meters
```

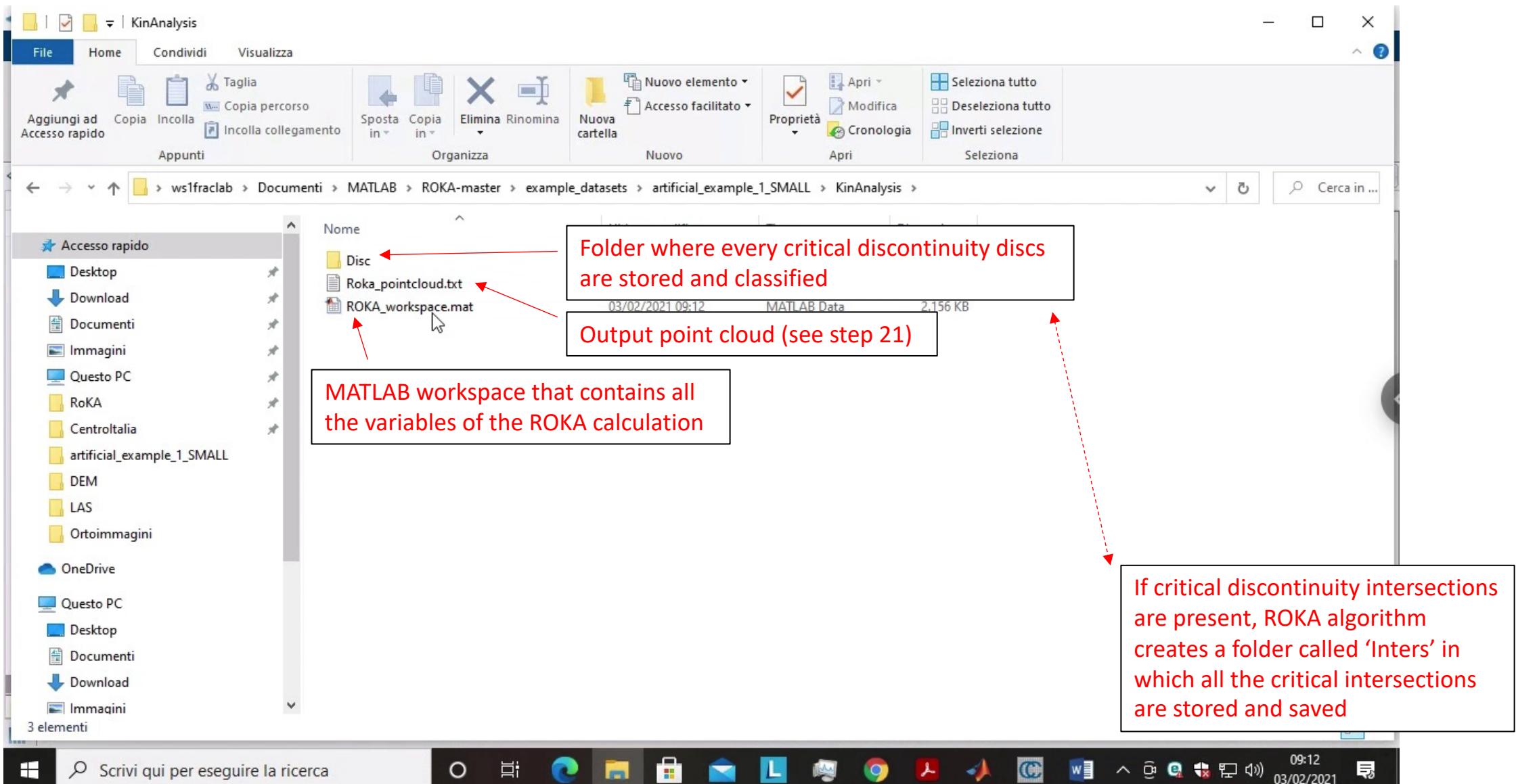
A red callout box points from the text "ROKA exports the output results in the same folder of the point cloud (see next step)" to the workspace pane, which lists variables like Audio, CDM, and various IDs.

18) The output results are stored in a folder called 'KinAnalysis' located at the same path of the point cloud input text files





19) Inspect the Output folder called 'KinAnalysis'





20) Inspect the critical discontinuity folder (called 'Disc')

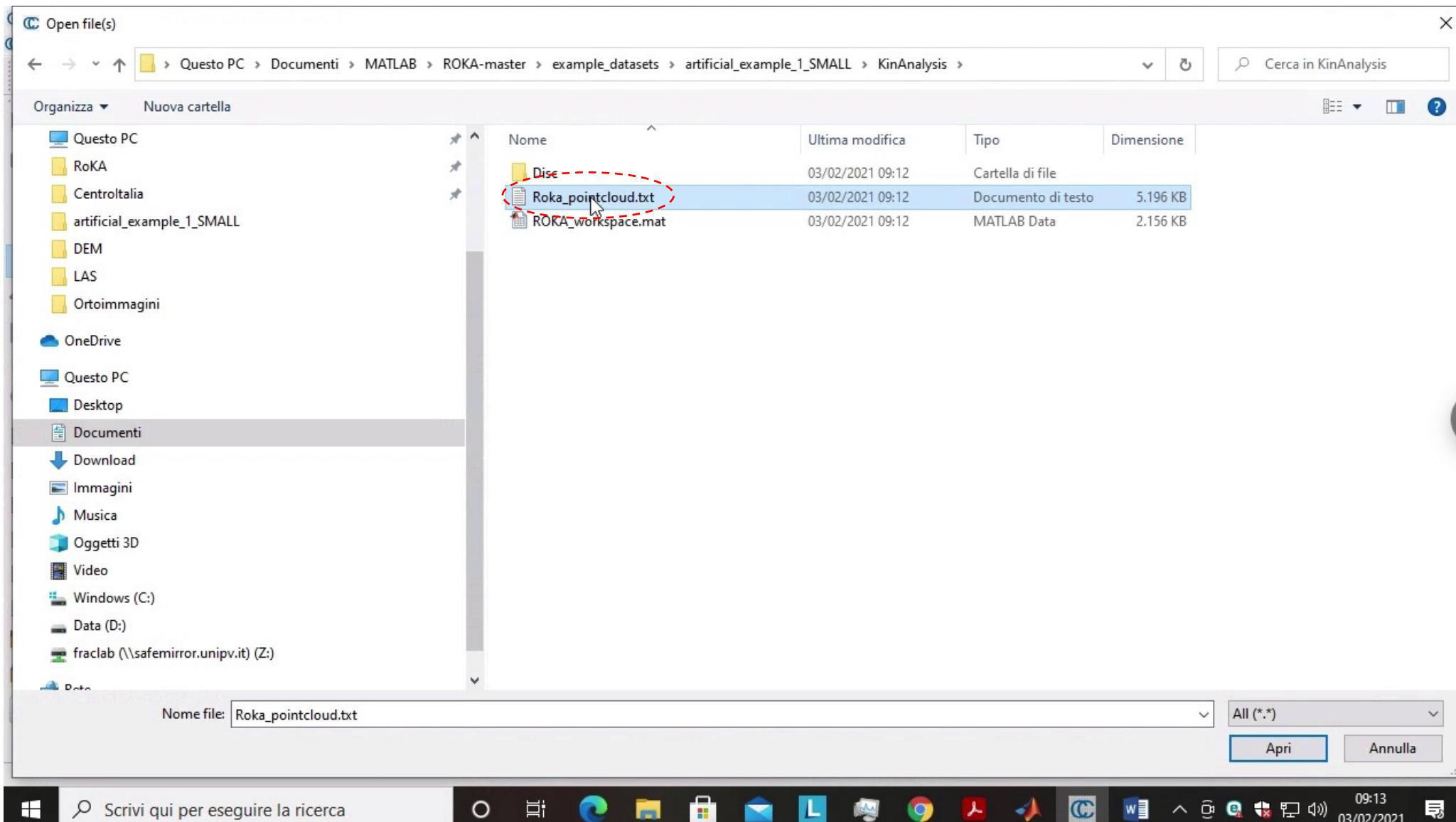
The screenshot shows a Windows File Explorer window with the following details:

- Title Bar:** Disc
- Menu Bar:** File, Home, Condividi, Visualizza
- Toolbar:** includes icons for Aggiungi ad Accesso rapido, Copia, Incolla, Taglia, Copia percorso, Incolla collegamento, Sposta in, Copia in, Elimina, Rinomina, Nuova cartella, Nuovo elemento, Accesso facilitato, Proprietà, Apri, Selezione tutto, Modifica, Deseleziona tutto, Cronologia, Inverti selezione, and Seleziona.
- Breadcrumb Bar:** ws1fraclab > Documenti > MATLAB > ROKA-master > example_datasets > artificial_example_1_SMALL > KinAnalysis > Disc >
- Search Bar:** Cerca in ...
- Left Sidebar:** Accesso rapido (Desktop, Download, Documenti, Immagini, Questo PC, RoKA, Centrotalia, artificial_example_1_SMALL, DEM, LAS, Ortoimmagini, OneDrive, Questo PC, Desktop, Documenti, Download, Immagini).
- Table View:** Shows two items in the 'Disc' folder:

Nome	Ultima modifica	Tipo
FlexuralToppling	03/02/2021 09:12	Cartella di file
PlanarSlidingLatLimits	03/02/2021 09:12	Cartella di file
- Text Callout:** A red box highlights the 'PlanarSlidingLatLimits' folder with the text: "The critical intersections are stored as a 3D DXF file inside the folder representing the mode of failure".
- Taskbar:** Shows various pinned icons including Microsoft Edge, File Explorer, Mail, LinkedIn, Google Chrome, MATLAB, and others.
- System Tray:** Shows the date (03/02/2021), time (09:13), and battery status.



21) Open the output point cloud using Cloud Compare

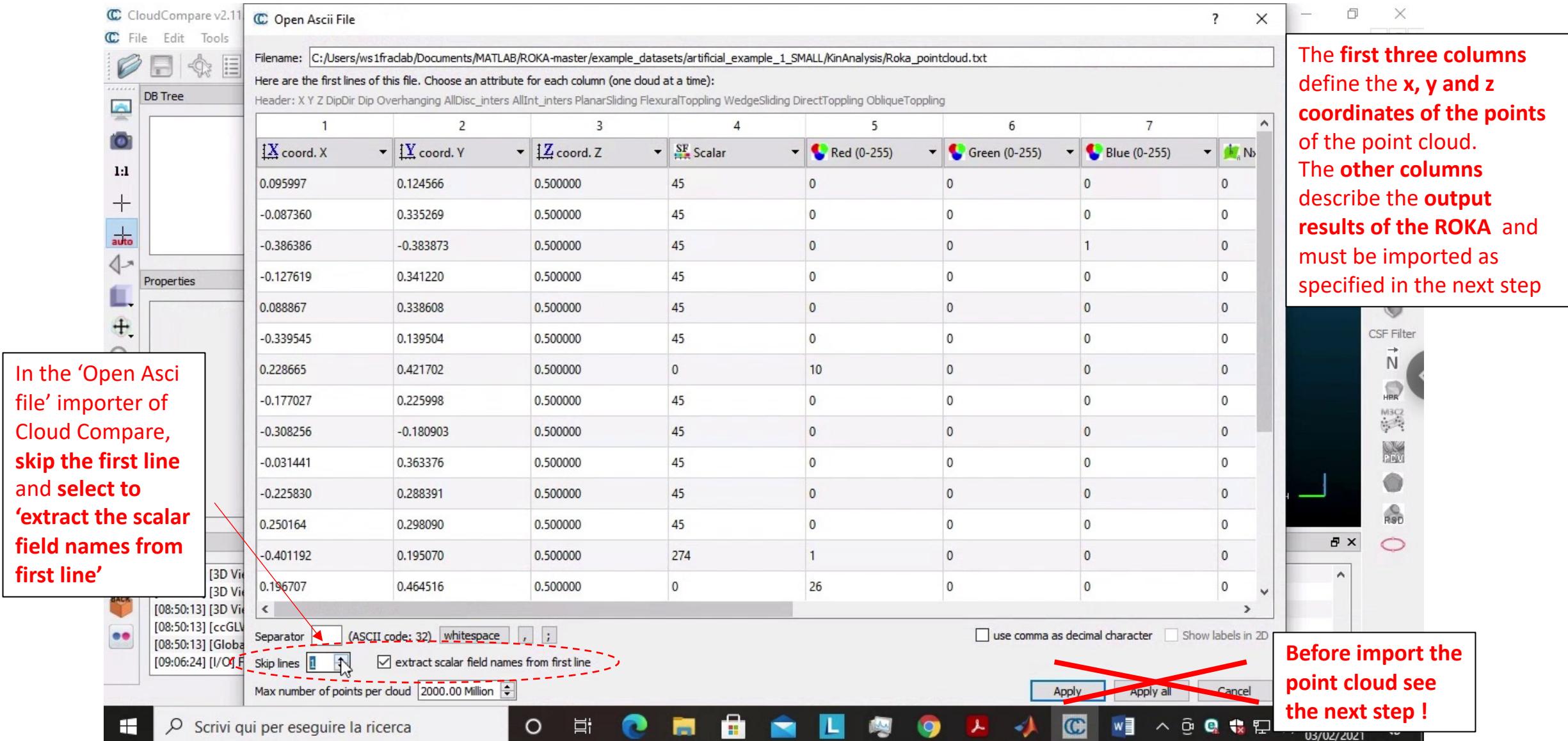


22) Use correctly the 'Open Ascii file' importer of Cloud Compare (part1)

In the 'Open Ascii file' importer of Cloud Compare, skip the first line and select to 'extract the scalar field names from first line'

The first three columns define the x, y and z coordinates of the points of the point cloud. The other columns describe the output results of the ROKA and must be imported as specified in the next step

Before import the point cloud see the next step !



1	2	3	4	5	6	7
0.095997	0.124566	0.500000	45	0	0	0
-0.087360	0.335269	0.500000	45	0	0	0
-0.386386	-0.383873	0.500000	45	0	0	1
-0.127619	0.341220	0.500000	45	0	0	0
0.088867	0.338608	0.500000	45	0	0	0
-0.339545	0.139504	0.500000	45	0	0	0
0.228665	0.421702	0.500000	0	10	0	0
-0.177027	0.225998	0.500000	45	0	0	0
-0.308256	-0.180903	0.500000	45	0	0	0
-0.031441	0.363376	0.500000	45	0	0	0
-0.225830	0.288391	0.500000	45	0	0	0
0.250164	0.298090	0.500000	45	0	0	0
-0.401192	0.195070	0.500000	274	1	0	0
0.196707	0.464516	0.500000	0	26	0	0

23) Use correctly the 'Open Ascii file' importer of Cloud Compare (part2)

CloudCompare v2.11

Open Ascii File

Filename: C:/Users/ws1fradab/Documents/MATLAB/ROKA-master/example_datasets/artificial_example_1_SMALL/KinAnalysis/Roka_pointcloud.txt

Here are the first lines of this file. Choose an attribute for each column (one cloud at a time):

Header: X Y Z DipDir Dip Overhanging AllDisc_inters AllInt_inters PlanarSliding FlexuralToppling WedgeSliding DirectToppling ObliqueToppling

1	2	3	4	5	6	7
X coord. X	Y coord. Y	Z coord. Z	Scalar	Scalar	Green (0-255)	Blue (0-255)
0.095997	0.124566	0.500000	45	0	Ignore	Nb
-0.087360	0.335269	0.500000	45	0	X coord. X	0
-0.386386	-0.383873	0.500000	45	0	Y coord. Y	0
-0.127619	0.341220	0.500000	45	0	Z coord. Z	0
0.088867	0.338608	0.500000	45	0	Nx	1
-0.339545	0.139504	0.500000	45	0	Ny	0
0.228665	0.421702	0.500000	0	10	Nz	0
-0.177027	0.225998	0.500000	45	0	Red (0-255)	0
-0.308256	-0.180903	0.500000	45	0	Green (0-255)	0
-0.031441	0.363376	0.500000	45	0	Blue (0-255)	0
-0.225830	0.288391	0.500000	45	0	Alpha (0-255)	0
0.250164	0.298090	0.500000	45	0	Red.float (0-1)	0
-0.401192	0.195070	0.500000	274	1	Green.float (0-1)	0
0.196707	0.464516	0.500000	0	26	Blue.float (0-1)	0

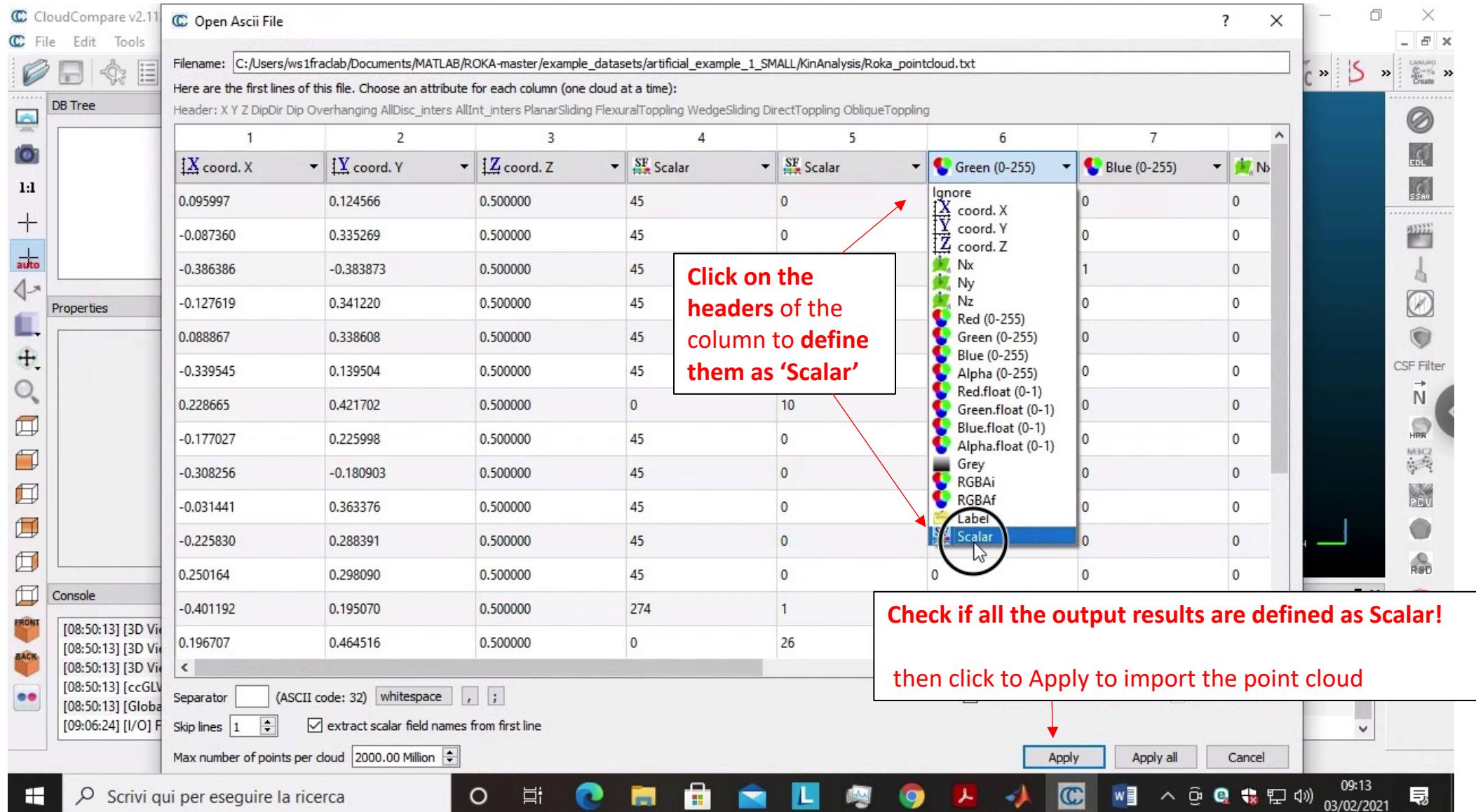
Click on the headers of the column to define them as 'Scalar'

Check if all the output results are defined as Scalar!

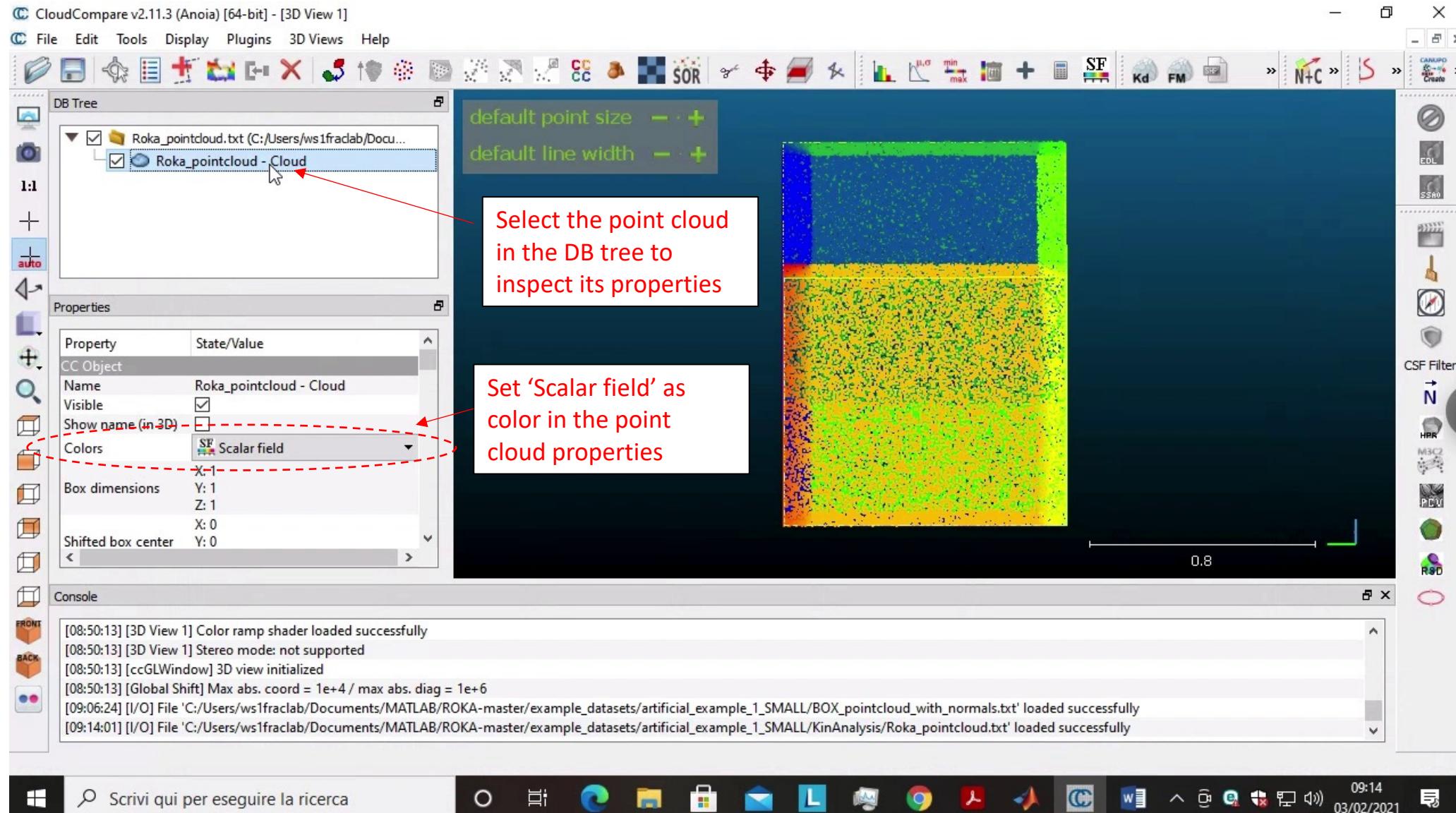
then click to Apply to import the point cloud

Separator (ASCII code: 32) whitespace , ;
 Skip lines 1 extract scalar field names from first line
 Max number of points per cloud 2000.00 Million

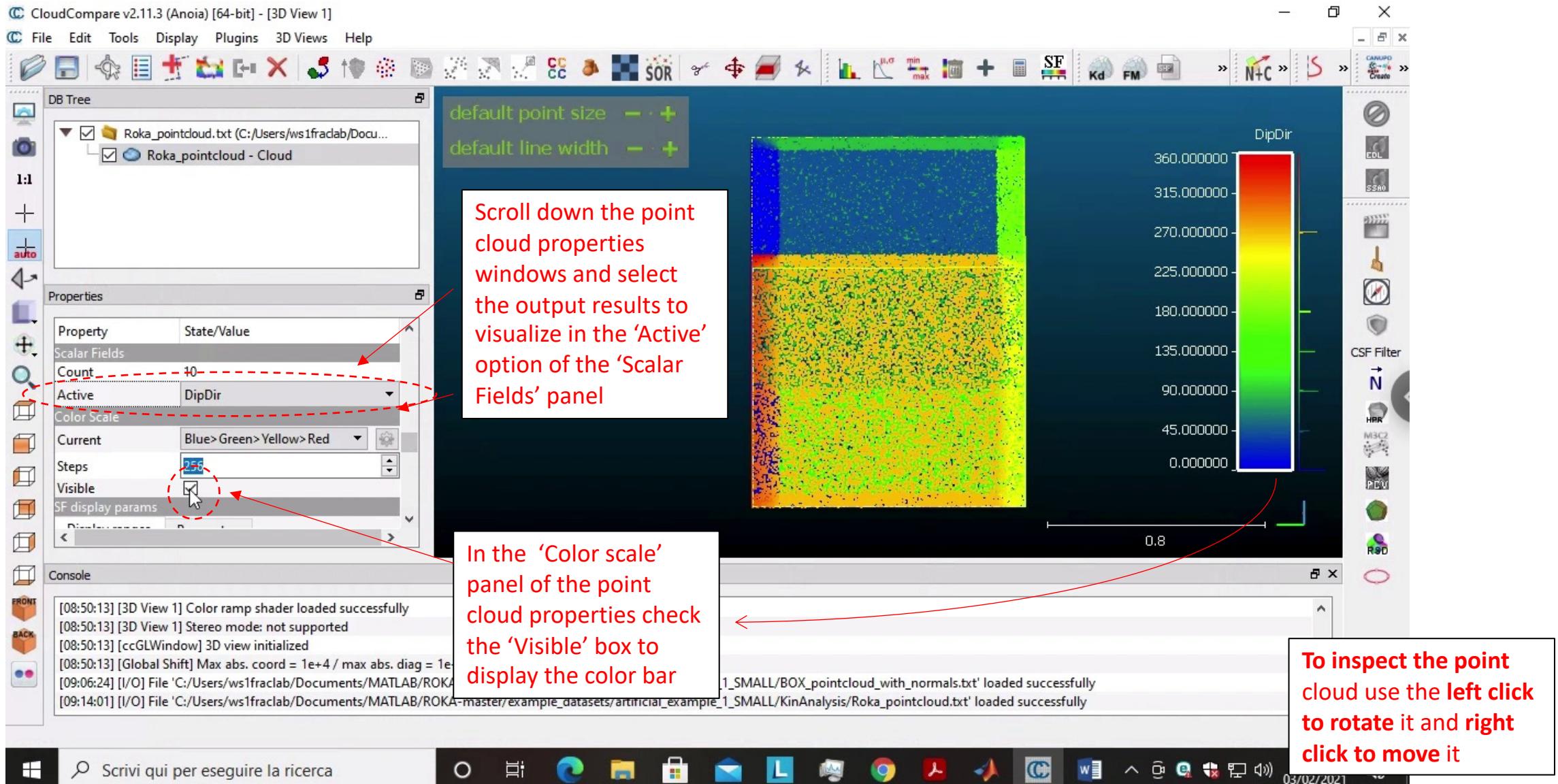
Apply Apply all Cancel



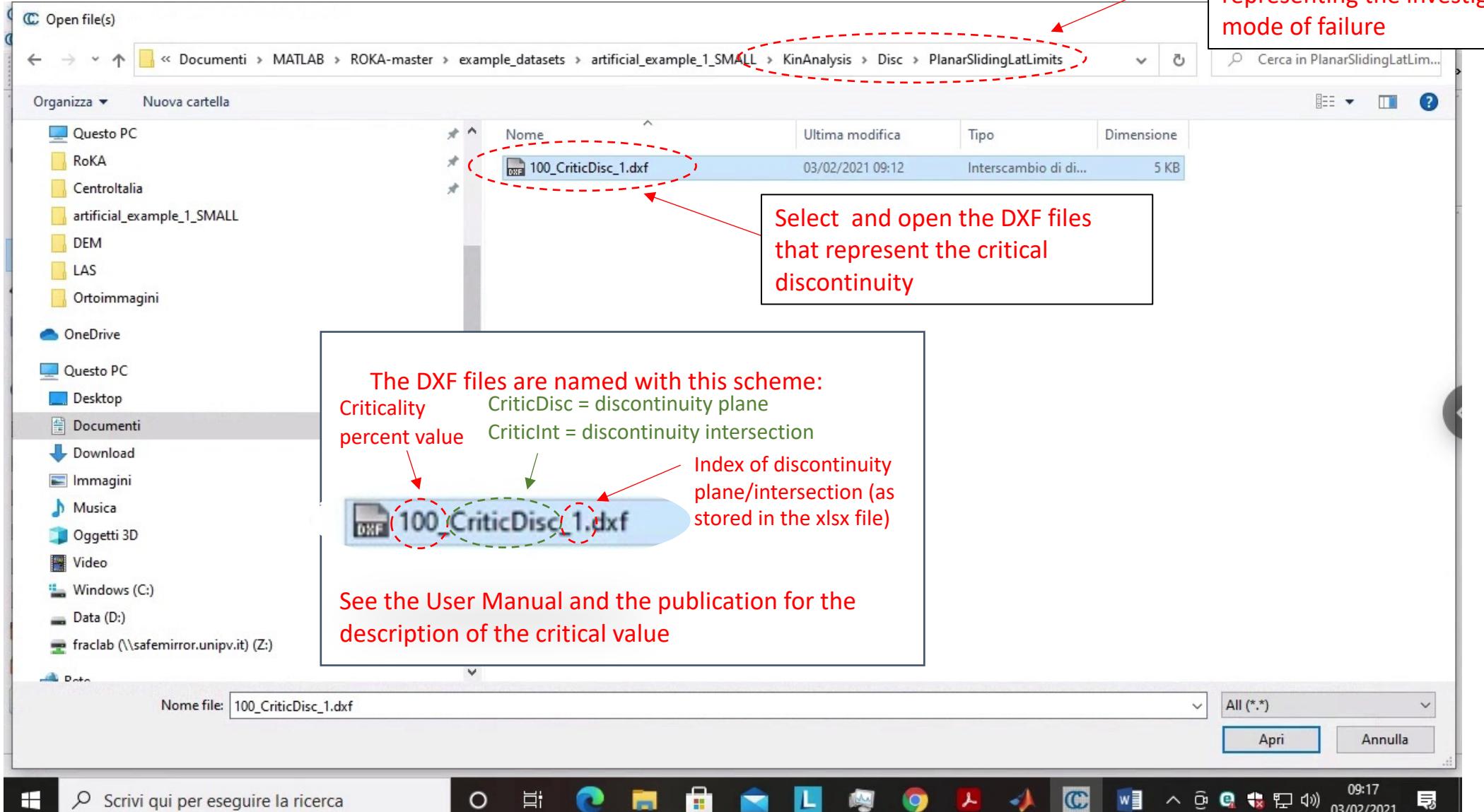
24) Visualize the point cloud and the ROKA output information (part 1)



25) Visualize the point cloud and the ROKA output information (part 2)



26) Open the critical discontinuity planes and/or intersections



Enter in the output folder
representing the investigated
mode of failure

Select and open the DXF files that represent the critical discontinuity

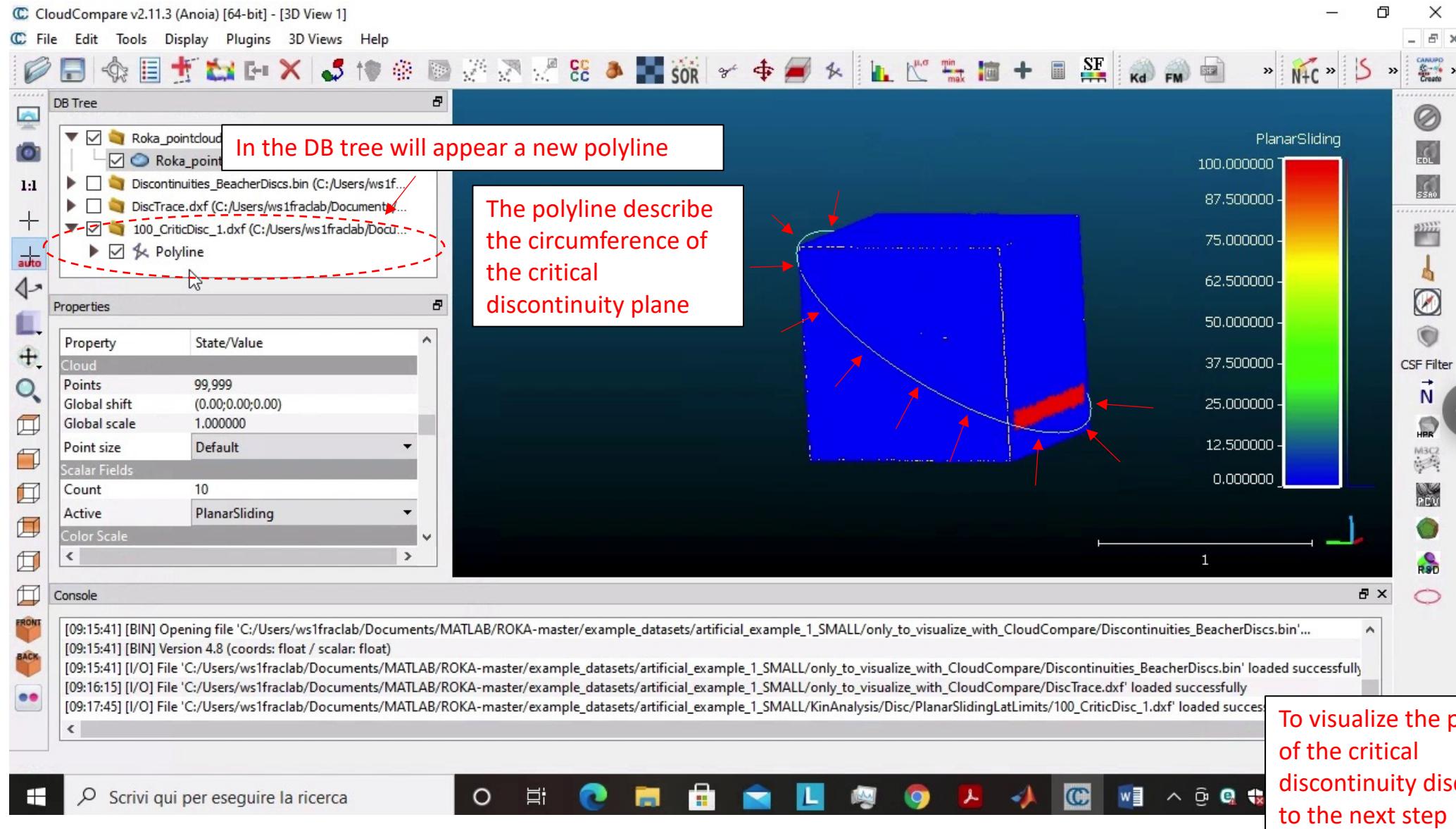
The DXF files are named with this scheme:
Criticality CriticDisc = discontinuity plane
percent value CriticInt = discontinuity intersection



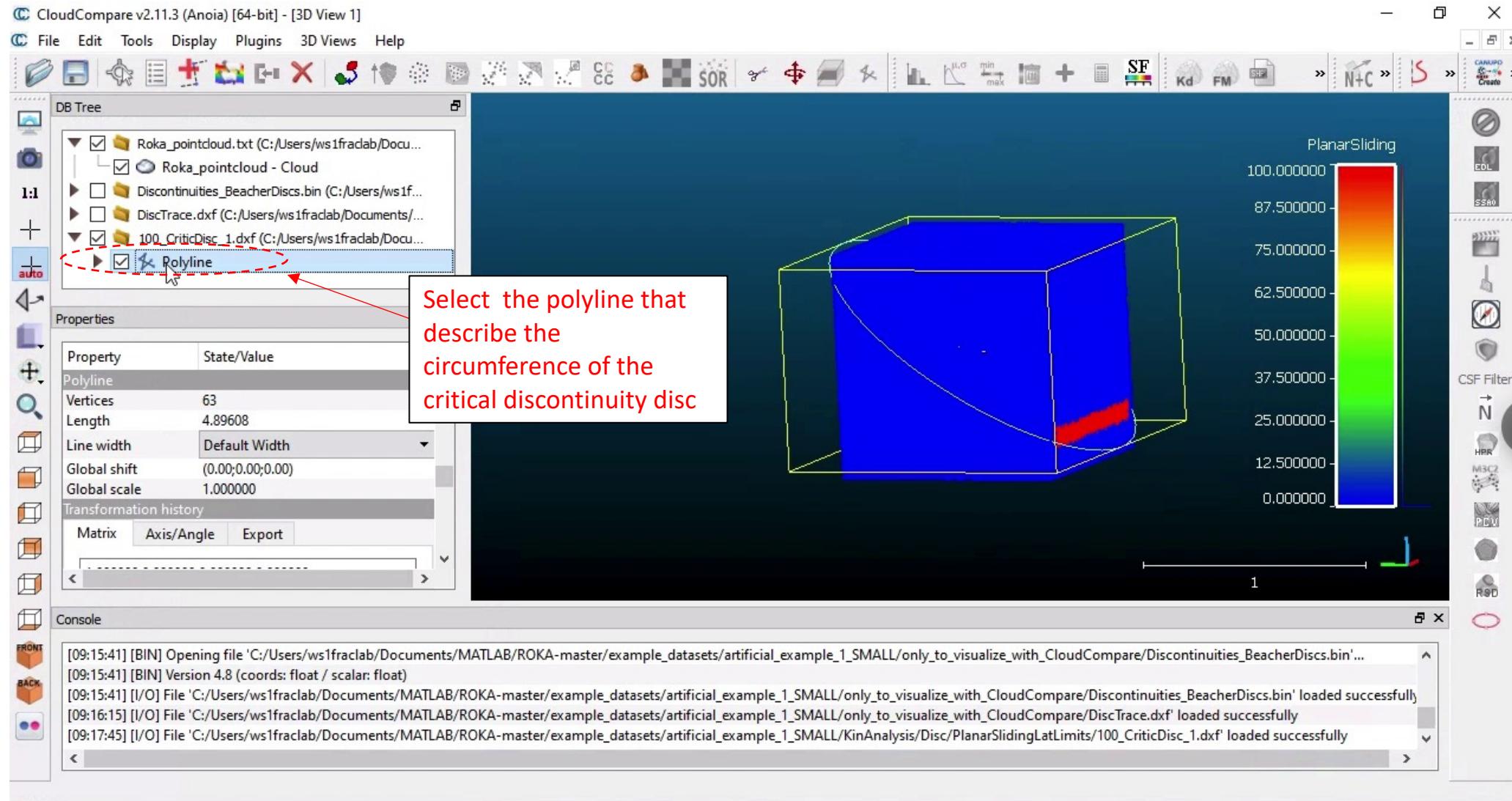
100 CriticDisc 1-dxf

See the User Manual and the publication for the description of the critical value

27) Visualize the critical discontinuity planes (part 1)

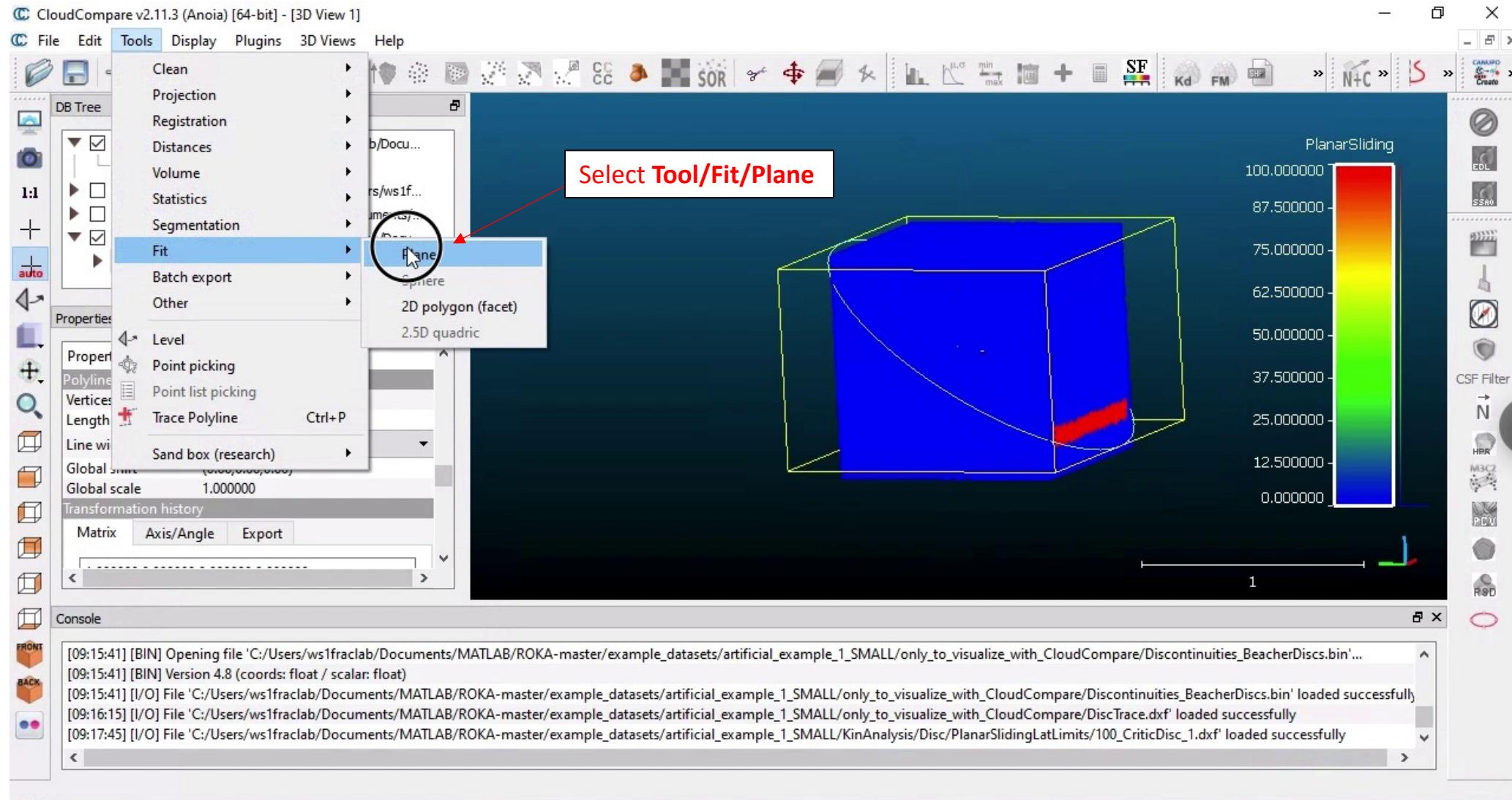


28) Visualize the critical discontinuity planes (part 2)



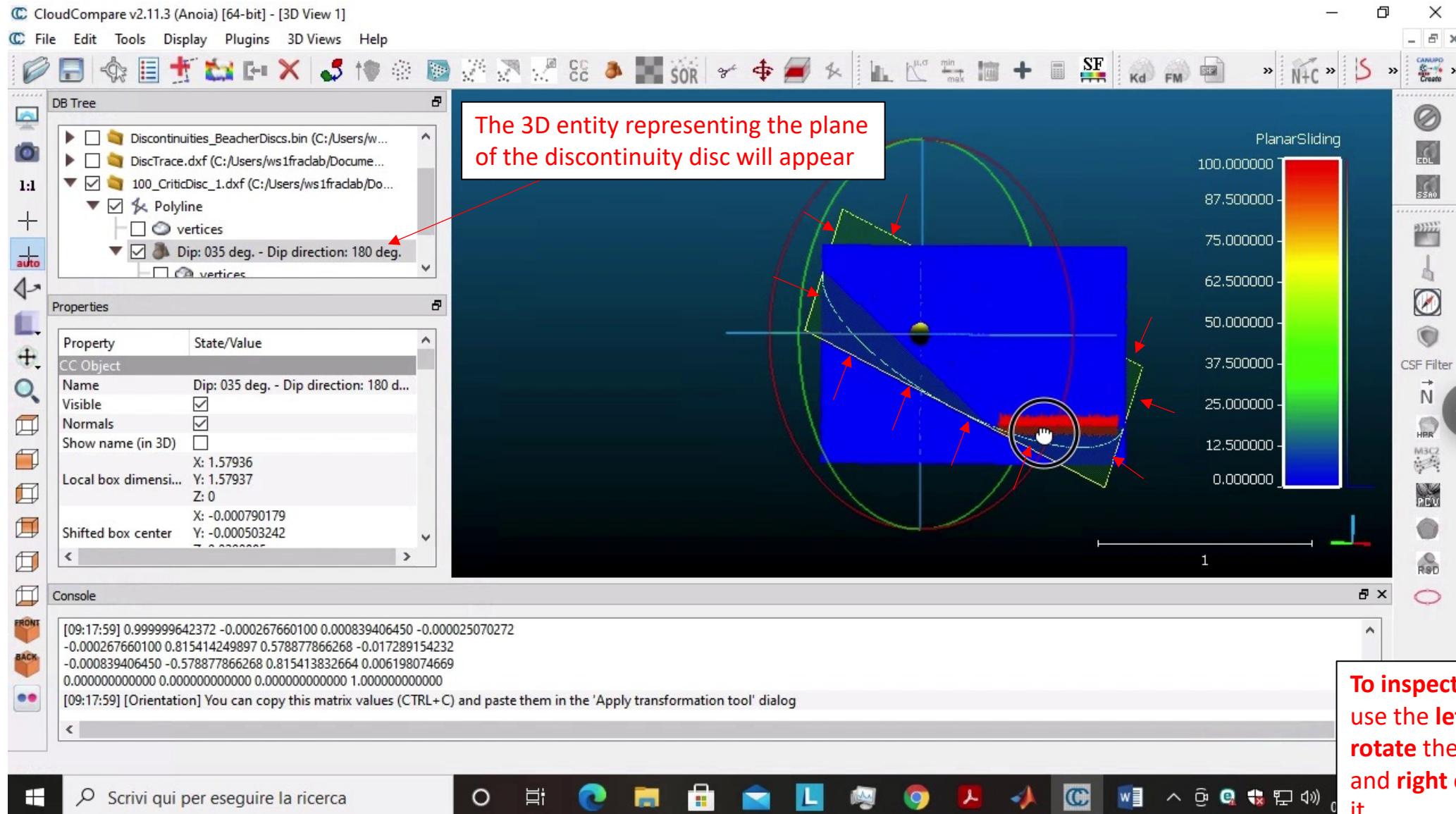
go to the next step in
the next page

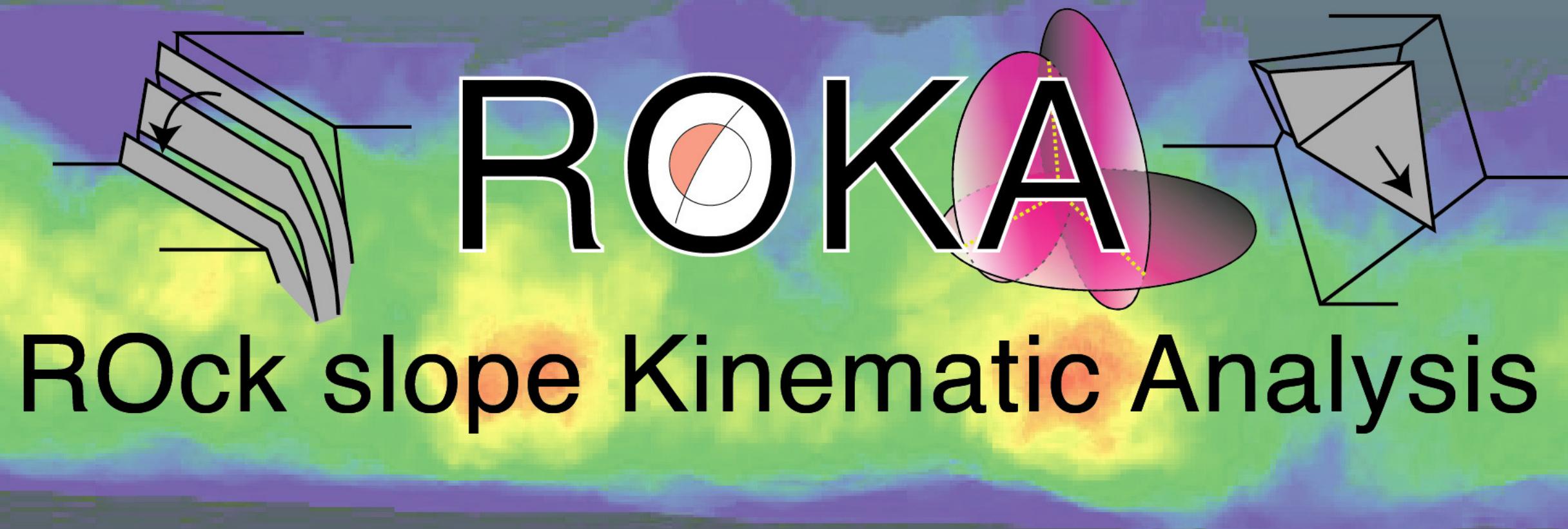
29) Visualize the critical discontinuity planes (part 3)



go to the next step in
the next page

30) Visualize the critical discontinuity planes (part 4)





ROck slope Kinematic Analysis

1. To download the algorithm and the material go to <http://github.com/nicmenegoni/ROKA>;
2. For a more detailed explanation of the algorithm read the User Manual and the publication cited below.

Menegoni, N.; Giordan, D.; Perotti, C. An Open-Source Algorithm for 3D ROck Slope Kinematic Analysis (ROKA). *Appl. Sci.* **2021**, *11*, 1698.
<https://doi.org/10.3390/app11041698>

Thank you for your interest
in ROKA algorithm