Soil Moisture and Time-lapse Visualization

2023S2 CITS5206
**Group 11**
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| Project Purpose	Requirements	Pain Points	Solutions
ERT sensor data preprocessing	Automate managing large sensor data	Before the project began, there was only the capability to process individual files of specific formats.	A user-friendly **GUI** resolution; An automated system to preprocess individual data files, as well as supporting the **automated batch processing** of a large number of data files.
	Deal with different data format		Detect target variables and values automatically **for different data formats**
	Correct missing values and outliers		Correct **missing values and outliers** automatically
Calculation of resistivity and water content	Simplify data analysis with multiple adjustable variables related to resistivity and soil moisture calculations	Before the project began, users had to search for these variables in the code themselves, and the variable names in the code were often not complete words, requiring users to be familiar with the code and geophysics formulas	Distribute **adjustable variables** related to resistivity and soil moisture calculations across corresponding operational stages, ensuring users need to set only a few variable values at a time; Add **mouse-hover tooltips** to guide users on the meaning of each variable and the range of values they should set.
	Simplify data analysis with diverse electrode layouts		Extract variables related to **electrode layouts**, allowing users to set these parameters based on the source of sensor data in the 'Domain and Mesh' feature.
Time-lapse Animation	Visualize resistivity and soil moisture changes over time	Before the project began, this feature has not be implemented	Name the corresponding resistivity and soil moisture visualization images according to the date information contained in the sensor data file names, and **sort** them by date; Loop the dynamic images for display and automatically save the **GIF files** by timestamps of creation.

02 Demonstration
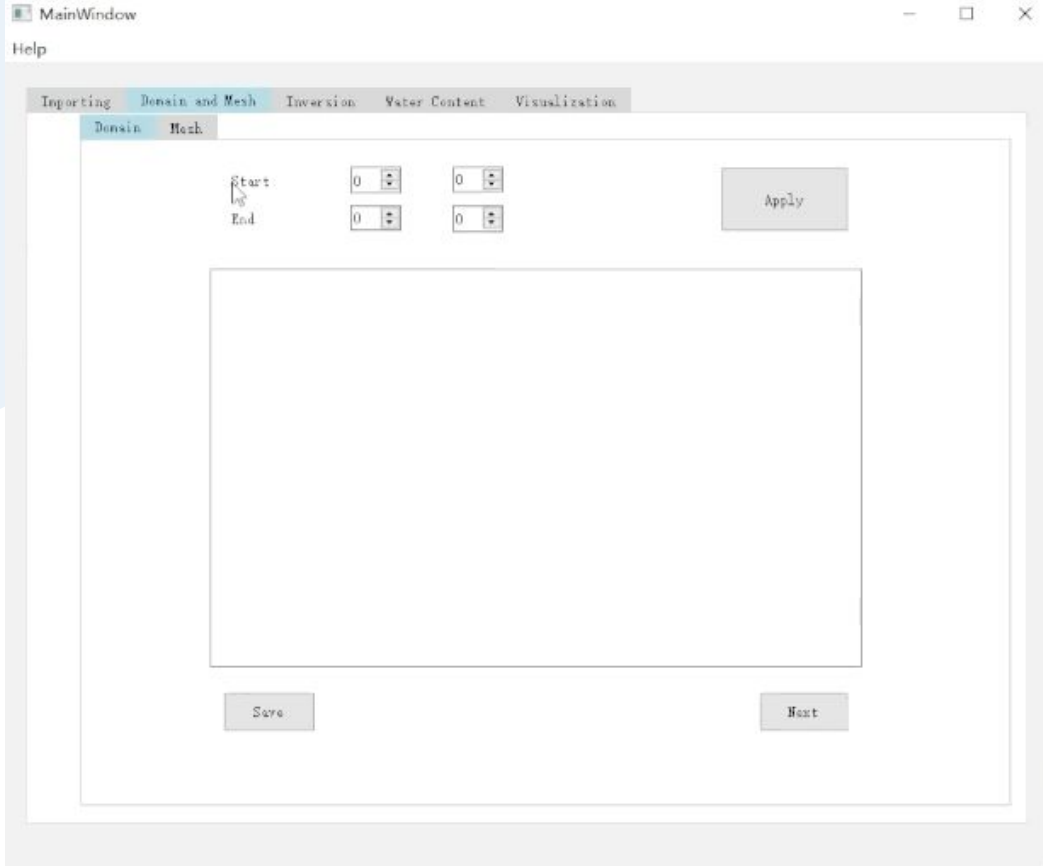
Mouse-hover tooltips:
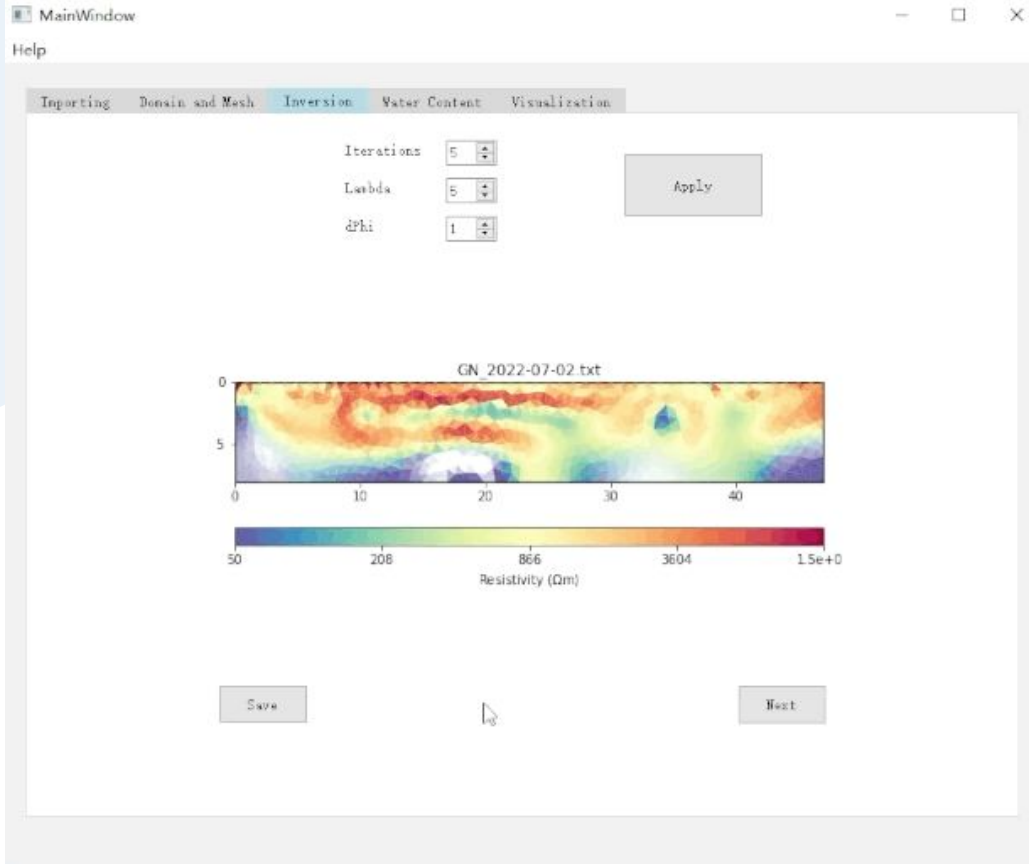meaning of variable;
range of values.
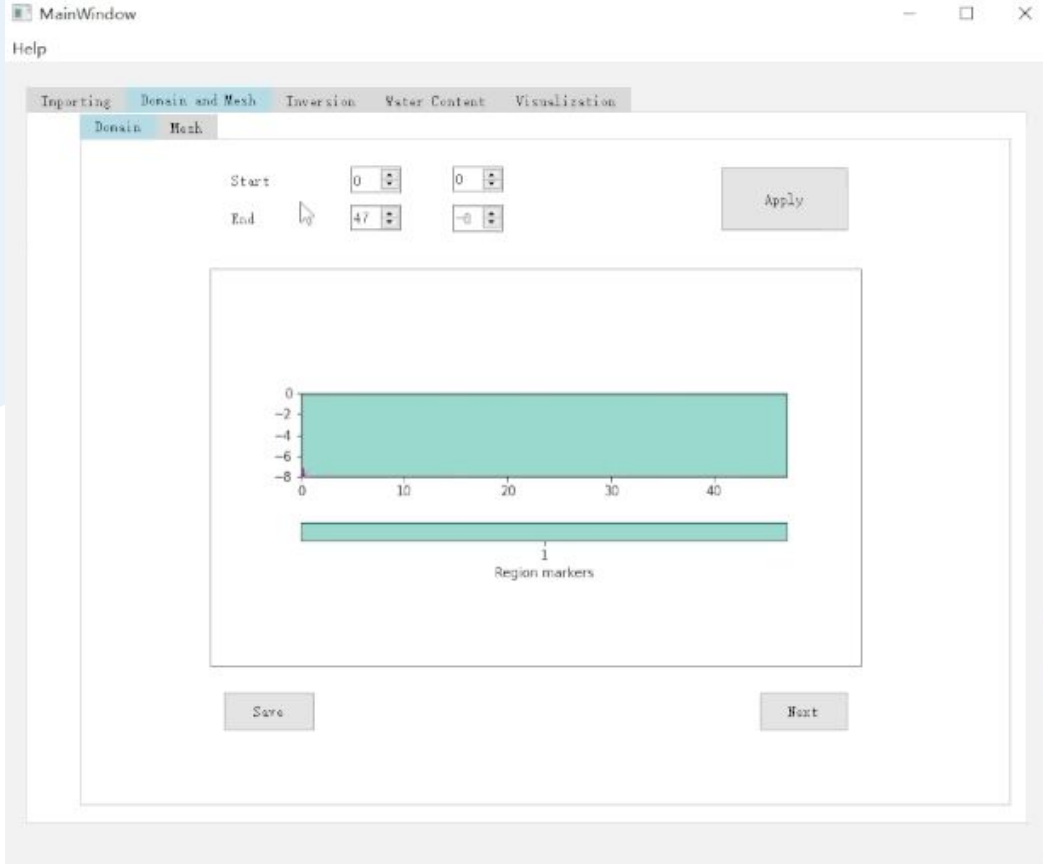
For **different electrode layouts** of the ERT sensors:
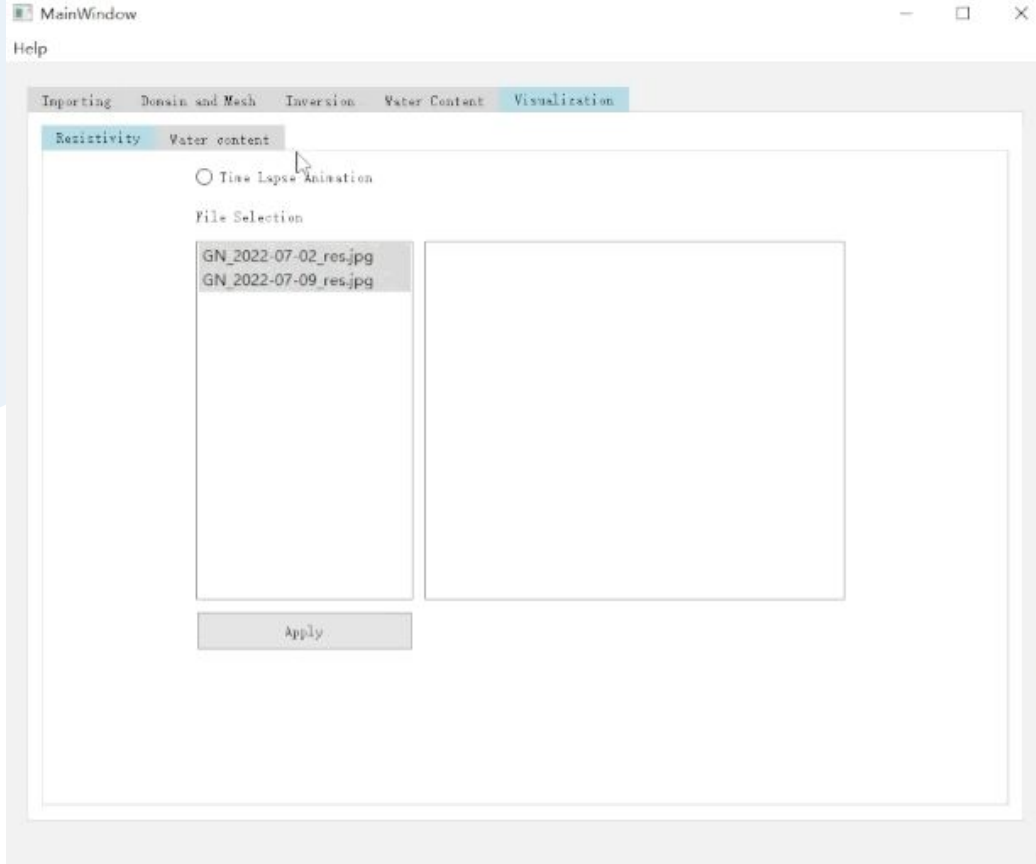   Custom variables

02 Demonstration

Calculation and visualization:
Resistivity;
Water content.

02 Demonstration

Time-lapse animation:

Automatically sort, generate and save.

Project Purpose	Future Plan	Analysis
ERT sensor data preprocessing	Optimize the algorithm for handling outliers	Potentially using **interpolation algorithms.**
Calculation of resistivity and water content	Refine the algorithm for converting ERT sensor data into soil resistivity	Given that the calculations from ERT sensor data are based on assumptions about the principles of soil conductivity and are influenced by a variety of factors such as temperature, pollution, and tree roots, there is a lack of "true values" at different soil depths and locations to aid in calculations. In the future, it may be possible to adopt a **calibration approach** using data from **multiple sensors** and to employ **unsupervised deep learning algorithms** for data analysis and computation.
	Enhance the algorithm for converting soil resistivity into soil water content	Improving the **temperature field effect algorithm**.
Time-lapse Visualization	Conduct automatic clustering analysis based on soil depth and location information	Integrating **machine learning clustering algorithms** and **GIS technology**.

Thank you!