Software User Manual

For

Water Mass Analysis Software

Malysis v1.0

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Data: Aug 2024

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1. Introduction

1.1 Software Overview

Malysis is a water mass analysis tool designed to calculate the proportion of various water masses contained in local seawater in the ocean. '***Malysis***' is derived from the words 'mass' and 'analysis'. Developed by **Ziang Li**, this software offers a comprehensive set of features to assist users in calculating the mixing ratios of water masses in the ocean.

Key benefits include:

User-Friendly Interface: Easy to navigate and use.

Various Options: Convenient to fit the water mass analysis needs of single numerical values and list numerical values.

Seamless Integration: Works with Excel.

Intended Users:

Researcher and student majoring in oceanography.

Platforms Supported:

Windows and macOS.

1.2 Key Features

Feature 1: Custom water mass endmember values.

Feature 2: Calculate the mixing ratio of three/four water masses with a single numerical value and a list of numerical values.

Feature 3: Provide TS diagram of input Temperature-Salinity (T-S) data.

Feature 4: Users can upload data through an Excel spreadsheet and download the calculated results stored in Excel.

1.3 Version Information

Current Version: Version 1.0

Release Date: August 1, 2024

Version History:

Version 1.0 – First generation version

Update Instructions:

To update to the latest version, please visit our website (see Section 1.4).

1.4 Support and Contact Information

Support Email: ziang.li_ocean@sjtu.edu.cn

Phone: +86 13262511213
Support Hours: Monday to Friday, 9 AM - 6 PM CST
Support Website:
https://github.com/ZiangLii/Malysis-Water-Mass-Analysis-Software.git

2. Installation

2.1 System Requirements

Recommended system requirements for Windows:
Operating System: Windows 11
Processor: Intel Core i5 or higher
Memory (RAM): 8 GB
Storage: 4 GB of free disk space
Graphics: DirectX 12 compatible graphics card
Network: Stable internet connection

2.2 Installation Steps

Follow these steps to install ***Malysis*** on your system. Ensure that your system meets the **System Requirements** before beginning the installation.

Downloading the Software: Go to https://github.com/ZiangLii/Malysis-Water-Mass-Analysis-Software.git to download the latest version of ***Malysis***. There are two .exe files. "Malysis_Installer_web.exe" is the installation file prepared for users who already have Matlab runtime installed. If Matlab software and Matlab runtime are not installed, it is recommended to choose to download "Malysis_Installer_mcr.exe". (What is Matlab runtime?)

Follow the Installation Wizard:
1. Click "Next" to proceed through the installation wizard.

2. Choose the installation location or accept the default location; click “Next”.

3. Ensure the installation of Matlab runtime and click “Next”. If you have already installed Matlab, you will see the following interface. If not, follow the prompts to select the installation path and install it together with ***Malysis***.

4. Click “Install” and wait for minutes.

In these steps, review and accept the End User License Agreement (EULA) if necessary.

3. User Interface Overview

This section provides an overview of the main user interface of ***Malysis***, including the

primary panels and bars you will interact with.

3.1 Main Interface Introduction

The main interface of ***Malysis*** is designed to provide easy access to all the essential tools and features. Upon launching the software, you will see the following key areas:
Header: Contains the software name, logo.
Workspace: The central area where you can perform most of your tasks and view content, which include two panels, the left panel and the right panel.
Bottom Bar: Exit the ***Malysis***.

3.2 Left Panel

The Left Panel is designed to provide quick calculation of a signal T-S numerical value.
Input: *Numbers of endmember*, *Endmember value* and *T-S value*.
Output: *Mixing ratio*.

3.3 Right Panel

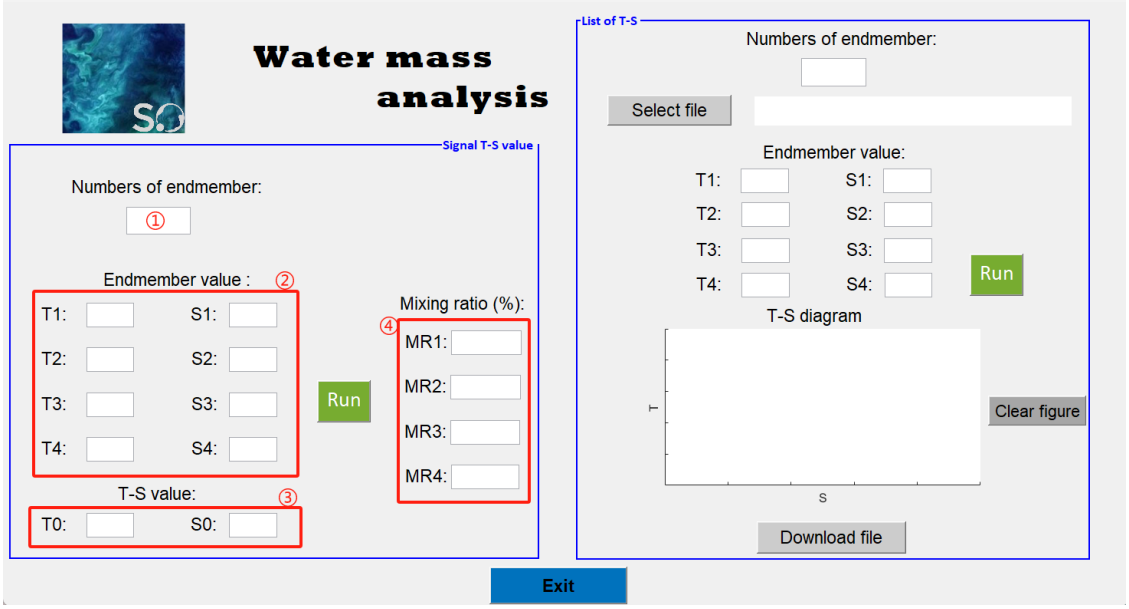
The Right Panel is designed to provide the calculation of a list of T-S numerical values. Users can upload an Excel file which conclude the T-S information, and download the calculated results.
Input: *Numbers of endmember* and A list of numerical T-S value. The input Excel template will be displayed in Section 4.2.
Output: A list of mixing ratio results.

4. Basic Operations

4.1 Signal T-S Value Calculation

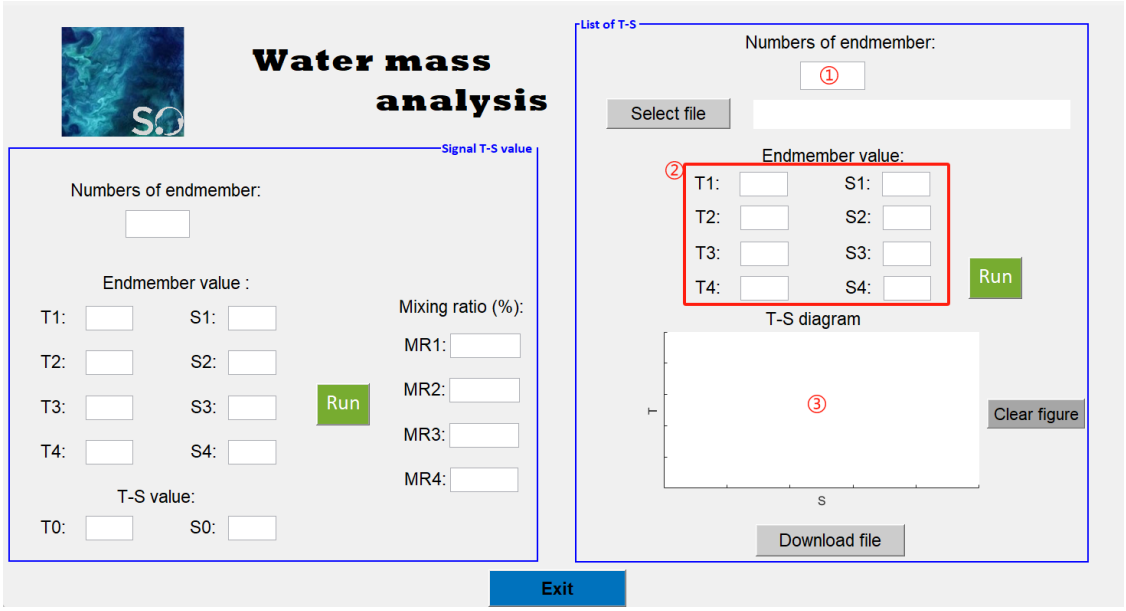
For the calculation of signal T-S value, it is necessary to operate within the left panel. Enter *Numbers of endmember*, *Endmember value* and *T-S value* at positions ①, ② and ③ respectively, and then click "Run" to output the calculated Mixing Ratio results at position ④.
Due to the fact that most water masses in the ocean do not mix more than 4, and the calculation of mixing two water masses is simple and convenient, **only "3" or "4" are allowed to be filled in the *Numbers of endmember* of this software**. When *Numbers of endmember* is filled in with 3, the values of *T4* and *S4* are left blank and the calculated result of *MR4* is NaN. To avoid unrealistic calculations, the result cannot be calculated when the temperature or salinity values of the *Endmember value* are equal (e.g., *T1=T2*).

The description in this paragraph also applies to the use of the right panel.



4.2 T-S List Calculation

For the calculation of a list of T-S value, it is necessary to operate within the right panel. Enter *Numbers of endmember* at positions ①. And click the *Select file* to choose a list of numerical T-S value. Then input the *Endmember value* corresponding to the *Numbers of endmember* at position ②. Click "Run" to calculate the Mixing Ratio results, and a T-S diagram corresponding to the selected file will be shown at position ③. Finally, click the *Download file* and download an Excel for mixing ratio results. If you want to clear the T-S diagram and redraw it in the right panel, click the *Clear figure*.



There are strict formatting restrictions when selecting input files. The file must be in the format of **'.xlsx'**, **with the first column showing the temperature of all data points and the second column showing the salinity**. It is allowed to have a header, but the order of temperature and salinity data cannot be changed, as shown in the example below.

	A	B
1	Temperature_ deg C	Salinity_PSU
2	7.6383	30.0601
3	7.6397	30.0621
4	7.6417	30.0649
5	7.6407	30.0633
6	7.6419	30.0658
7	7.6428	30.0666
8	7.6483	30.075
9	7.6492	30.0767
10	7.6541	30.0832
11	7.6549	30.086
12	7.6577	30.0904
13	7.6585	30.0922
14	7.6582	30.0916

4.3 Saving and Exporting Results

Click the *Download file* and download an Excel for calculated mixing ratio results. The downloaded table contains the mixing ratios of all water masses corresponding to all temperature and salinity data values. When *Numbers of endmember* inputs '3' or '4', it outputs three or four columns of data in the outputted Excel.

4.4 Exiting the Software

If you want to exit ***Malysis***, click *Exit* at the bottom to exit.

5. Frequently Asked Questions

Q1: Why doesn't the calculation result come out when clicking *Run*?
The calculation method of water mass mixing ratio in this software draws on Mao's multi endmember mixed-quadrilateral method proposed in 1964 (Mao et al., 1964). On this basis, revisions and supplements have been made, which can be referred to in the method section of Li et al. (2024).
At present, ***Malysis v1.0*** only supports calculating the temperature and salinity scatters that fall within and on a mixed polygon (a convex polygon formed by sequentially connecting all endmembers on the T-S diagram). When the scatters that need to calculate the mixing ratio are outside the mixed polygon, it is considered that

there are other water masses participating in the mixing, and the calculation cannot be achieved.
At the same time, theoretically, there is no situation where the temperature or salinity of the endmember values are the same. Therefore, when the temperature or salinity of two endmember values are the same, the calculation cannot be achieved.

Q2: Why are there missing values in the downloaded Excel?
Firstly, check if the input Excel meets the template requirements (see section 4.2). If only some of the calculated values are missing, it should be that some of the temperature and salinity scatters that need to be calculated fall outside the mixed polygon; if it is all missing, it should be a problem with the setting of the water mass endmember values. Please ensure that there are no water mass endmembers with the same temperature or salinity values, and that the polygons formed by all endmember values is a convex polygon.

6. Reference

Li, Z., Wang, C., & Zhou, M. (2024). Assessment of water mass distribution and intrusions of circumpolar deep water in the Amundsen Sea based on the ocean reanalysis product FOAM-GLOSEA5v13 [Original Research]. Frontiers in Marine Science, 11. https://doi.org/10.3389/fmars.2024.1358196

Mao, H., Ren, Y., & Wan, G. (1964). Preliminary Study on Quantitative Analysis of Shallow Water Mass by T-S Relation. Oceanology and Limnology(1), 1-22 (in Chinese).