Read Me—Version 3.23.18

Welcome to the MapMark4GUI Package.

This package includes the following files:

1. MapMark4GUIRun.R—The R script used to launch and run the graphical user interface (GUI).

2. InstallPackages.R—The R script used to automatically install the R packages required to run MapMark4.

3. MapMark4_1.0 (1).tar.gz—The MapMark4 R package that supports and implements the probability calculations and Monte Carlo resource simulations in R. This package is the November 2, 2017, version created by Karl Ellefsen of the U.S. Geological Survey and is the most recent update as of March 19, 2018.

4. GTmodel.csv— A sample grade tonnage model (GTM) input file in comma-separated values (CSV) format that can be used for a trial run of the GUI.

5. Estimates.csv—A sample estimates input file for the negative binomial probability mass function (PMF) option, which can be used for a trial run of the GUI.

6. ReadMe.docx—A step by step guide for using MapMark4GUI

7. UserGuide_MapMark4GUI.pdf—A copy of the MapMark4GUI user's guide.

Contents

Important Comments

- R Version Comments

  - The R script for MapMark4GUI and the steps described below have been verified to run in versions 3.3 and 3.4 of the 32- and 64-bit R console.

  - RStudio version 2.0.6 also worked with MapMark4GUI; however, using the GUI with RStudio requires several additional steps to install the packages and run all the lines together.

- Previous packages

- If you previously installed and ran the MapMark4 package, you will have to remove the package by typing the following code in the R console:

  remove.packages("MapMark4")

- If you previously installed and ran the package "gWidetsRGtk2," you will have to remove the package by typing the following code in the R console:

  remove.packages("gWidgetsRGtk2")

Downloading R

1. Open an internet browser.

2. Go to https://cran.r-project.org/bin/windows/base/.

3. Click on the "Download R for Windows" option.

   A. The version available for download will be the current release.

4. Click on the download file and save R to a common folder for programs.

Unzipping the MapMark4GUI Package

1. Download the MapMark4GUI package from the source file.

2. Unzip the GUI zip file to a folder where you can access it easily.

Installing R Packages

1. The R packages need to be installed only if they have not been installed previously.

2. Open the R console (the script was tested using RGui64, the 64-bit R console).

3. In the R console menu, click "File" and then click "Open script."

4. Browse for the unzipped GUI files.

5. Select "InstallPackages.R."

6. In the R console menu, click "Edit" and then click "Run all."

7. Select "Yes" when asked to create a new personal library.

8. Select a U.S.-based Comprehensive R Archive Network (CRAN) mirror (US_CA was used to test the GUI).

9. A file browse dialog will appear after several of the packages have been installed. Browse for the current version of the MapMark4 package (MapMark4_1.0 (1).tar.gz), which is provided in the GUI zip file.

10. Completing these steps will install the dependent packages required to run MapMark4GUI.

Launching the MapMark4GUI

1. Open the R console (RGui64 has been tested) if it is not already open.

2. In the R console menu, click "File" and then click "Open script."

3. Browse for and select the MapMark4GUI file (MapMark4GUIRun.R).

4. In the R console menu, click "Edit" and then click "Run all."

5. Completing these steps will run the GUI script and launch the MapMark4GUI dialog.

6. Wait until all the lines have been read and all the buttons in the dialog are shown, including the last button, "Plot Sim Matrix."

Filling out the MapMark4GUI Dialog

1. Working Directory Input

   A. The working directory is the folder where the output files will be saved.

   B. The working directory can be separate from the folder that contains the input files.

   C. Select the working directory.

I. Click the "browse" button.

II. Navigate to the folder where you want the output files to be saved.

III. Click "Make New Folder" or right click the browser folder list and click "Create New folder." Use a short name that gives a unique, logical description for the output file directory.

IV. Click on the output folder and make sure it is highlighted.

V. Click "OK" or "Select Folder."

D. Set the working directory.

I. Click on "Set Working Directory" to change the working directory to the selected folder.

II. You can confirm the selection by looking at the R console. If the address of the selected folder is not printed in the console, repeat the steps to select and set the working directory.

2. Background Information

A. Set the Tract ID.

I. The Tract ID is the name of the assessment tract.

II. The Tract ID is a string type input (integers and letters are allowed).

III. Click in the white text field box.

IV. Highlight the "Enter Tract ID here" text.

V. Delete the text.

VI. Type in a Tract ID.

B. Set the Run ID.

I. The Run ID is the name of the run trial. All of the output file names will include the Run ID. In this document, italic in file names is used to indicate where the user-entered Run ID will be incorporated (for example, *RunID*pmfPlot.jpg).

II. The Run ID is a string type (integers and letters are allowed).

III. Click in the white text field box.

IV. Highlight the "Enter Run ID here" text.

V. Delete the text.

VI. Type in a Run ID.

3. Input Files

A. Input the GTM file.

I. The GTM input is the file containing the GTM. A sample file (GTmodel.csv) is included in the zip file.

II. The GTM is required to be in CSV format with column headings. However, the file can be given any name.

III. Click the "browse" button to the right of the file input box.

IV. Navigate to the folder where the GTM is located.

V. Double click the file or single click the file and then click "OK."

B. Input the estimates file (required for the negative binomial PMF option).

I. The estimates file is a CSV table containing estimates of the numbers of undiscovered deposits at the 90-, 50-, and 10-percentile levels. The estimates file is required only for the negative binomial PMF model type.

II. A sample file (estimates.csv) is included in the zip file. The estimates file used should follow the format of the sample file.

III. The estimates file is required to be in CSV format with column headings. However, the file can be given any name.

IV. Click the "browse" button to the right of the file input box.

V. Navigate to the folder where the estimates file is located.

VI. Double click the file or single click the file and then click "OK."

4. Seed Information

  A. Create a random seed.

    I. This option will be used if you want to create a random seed number for the simulation run.

    II. If you do not want to use a random seed, skip to step 4.B.

    III. Click on the "Create Random Seed" button to generate a random seed number.

    IV. The random seed number will appear to the right of the "Set Specific Seed" button. Each time a new random seed number is generated, it will appear to the right of the previous seed number.

    V. Once the random seed number has been created and displayed, go to step 5.

  B. Enter a specific seed number.

    I. Use this option if you want to enter a specific seed number instead of generating a random number.

    II. Click on the "Set Specific Seed" button.

    III. A blank text box will appear to the right of the "Set Specific Seed" button.

    IV. Click in the white text field box.

    V. Type in a seed number (numerical format).

5. Model information

A. Select a PMF model.

    I.   The PMF model options are called "MARK3" and "NegBinomial."

   II.   Click on the drop down menu labeled "Select a model."

  III.   Click on the desired option.

B. If using the MARK3 option, enter the N90, N50, N10, N05, and N01 percentiles.

    I.   If running the negative binomial model, skip to Step 5.C.

   II.   Click in the text field box.

  III.   Highlight the "NA" text.

  IV.   Delete the text.

   V.   Type in an estimate for each of the percentiles (N90, N50, N10, N05, and N01). The numbers should be separated by spaces with no commas (for example, 0 1 2 3 4).

  VI.   If entries were not specified for the N05 and N01 percentiles, repeat the N10 value. If entries were not specified for the N01 percentile, repeat the N05 value

C. Select the truncation option.

    I.   This is where you select if the model will truncate the values to fall within the range of observed grade and tonnage values in the GTM (the "TRUE" option is recommended).

   II.   Click on the dropdown menu.

  III.   Select either "TRUE" or "FALSE."

D. Select a distribution type.

I. This is where you select if you would like to use a normal or kernel distribution to estimate the grade and ore tonnage probability density function (PDF).

II. Click on the dropdown menu.

III. Select either "normal" (normal distribution) or "kde" (kernel distribution).

Running the Processes

1. You can run the NDepositsPmf, TonnagePdf, GradePdf, Simulation, and Simulation Matrix processes.

2. You must run each of the processes in order. Make sure the PMF run was completed first, or none of the other processes will run.

3. A process is still running if the button is highlighted in blue. A process is complete when the plot appears on the R console screen.

4. If there is an error during the run, an error message will display on the R console.

5. Run the NDepositsPmf process.

   A. Click on the "Run Pmf" button.

   B. This process will generate the PMF for the estimated numbers of undiscovered deposits (Ellefsen, 2017, p. 2).

   C. This process will output a PMF plot on the R console screen and download the plot to the output folder (*RunID*pmfPlot.eps and *RunID*pmfPlot.jpg).

6. Run the TonnagePdf process.

   A. Click on the "Run TonPdf" button.

   B. This process will create a PDF for the undiscovered deposit ore tonnage (Ellefsen, 2017, p. 2).

C. This process will output a tonnage PDF plot on the R console screen and download the plot to the output folder (*RunID*TonPdfPlot.eps and *RunID*TonPdfPlot.jpg).

7. Run the GradePdf process.

A. Click on the "Run GradePdf" button.

B. This process will construct the PDF for commodity grades in undiscovered deposits (Ellefsen, 2017, p. 2).

C. This process will output a PDF plot on the R console screen and download the plot to the output folder (*RunID*GradPdfPlot.eps and *RunID*GradPdfPlot.jpg).

8. Run the Monte Carlo simulation.

A. Click on the "Run Simulation" button.

B. This process will run the Monte Carlo simulation for the model. The Monte Carlo simulation generates simulated deposits on the basis of the probability function results and the user input data (Ellefsen, 2017, p. 2).

C. This process will output a simulation plot and a table of results on the R console screen and download the plot and simulation results to the output folder (*RunID*SimTotalPlot.eps and *RunID*SimTotalPlot.jpg).

D. The simulation results are downloaded to include the simulation resulting deposits, which could support an economic filter analysis (*RunID*_05_SIM_EF.csv).

E. The deposits are then aggregated on the basis of their simulation run index, creating a contained mineral totals table (*RunID*_07_SIM_Contained_Totals.csv).

9. Create the simulation matrix

A. Click on the "Run Sim Matrix" button.

B. This process will create a simulation matrix of each of the simulation's resulting univariate and bivariate marginal distributions (Ellefsen, 2017, p. 13).

C. This process will output the simulation matrix plot on the R console screen and download the plot to the output folder (*RunID*SimMatrixPlot.eps and *RunID*SimMatrixPlot.jpg).

Downloading the Output Statistics

1. Download the input parameters and summary.

   A. Click on the "Download Parameters & Summary" button.

   B. This will download a CSV table that summarizes the input parameters (*RunID*_01_InputParameters.csv).

   C. This will also download a text file (TXT) that summarizes the process statistic results (RunID_Summary.txt).

2. Download the PMF statistics.

   A. Click on the "Download PMF Stats" button.

   B. This will download two files:

   I.   A CSV table of the numbers (N) of estimated undiscovered deposits and their relative probabilities for the PMF model (*RunID*_03_PMF_Probs.csv).

   II. A CSV table of the PMF run statistics, which includes the mean, variance, and information entropy of the number of undiscovered deposits (*RunID*_04_PMF_Stats.csv).

3. Download the simulation and GTM statistics.

   A. Click on the "Download Sim and GTM Stats" button.

B. This will download three files with statistics for the GTM and simulation results, including the means, maximums, minimums, medians, standard deviations, and the percentiles of the ore tonnage, grades, and contained resources.

    I. *RunID_02_GTM_Stats.csv*—GTM statistics of the ore tonnage and grades.

    II. *RunID_06_SIM_EF_Stats.csv*—Statistics for the simulation results, which could be used for economic filtering of the ore tonnage, and commodity grades, and contained resources tonnage.

    III. *RunID_08_SIM_Contained_Stats.csv*—The contained resources statistics. This is the simulated results aggregated on the basis of the simulation index.

Reviewing the Plots

1. You can review each of the plots from the processes on the R console screen by clicking the buttons in the "Plots" section.

2. When a button is clicked, the plot for that process appears on the R console screen.

3. The following plots can be viewed in any order:

A. Probability Mass Function—Click the "Plot PMF" button.

B. PDF for the tonnage—Click the "Plot Ton PDF" button.

C. PDF for the grades—Click the "Plot Grade PDF" button.

D. Total Monte Carlo simulated deposits—Click the "Plot Simulation Results" button.

E. Simulation Matrix of the undiscovered deposits—Click the "Plot Sim Matrix" button.

You can now analyze the output files in the specified working directory. You can also change the input parameters and run the model again. If you change the parameters, use a new Run ID.

Output File Directory

MapMark4GUI generates 14 files that are saved in the output folder, including input parameters, statistics, and plot graphics. The first eight files are output as CSV tables. The fifth and sixth files have "EF" in the names because they can support future economic filter analysis. The following files will be saved to the output folder throughout the MapMark4GUI processing.

- *RunID*_01_InputParameters.csv—The MapMark4GUI parameters that were entered for the simulation run.

- *RunID*_02_GTM_Stats.csv—Statistics for the input GTM that summarize the means, maximums, minimums, medians, standard deviations, and percentiles of the ore tonnage and commodity grades.

- *RunID*_03_PMF_Probs.csv—The numbers (N*) of deposits and relative probabilities for the PMF model.

- *RunID*_04_PMF_Stats.csv—Statistics for the PMF, including the mean number of deposits, variance, and information entropy.

- *RunID*_05_SIM_EF.csv—Simulation run results of each deposit that can be used for further data analysis, such as applying economic filters.

- *RunID*_06_SIM_EF_Stats.csv—Statistics for the information contained in the RunID_05_SIM_EF.csv file. This statistics file summarizes the means, maximums, minimums, medians, standard deviations, and percentiles of the simulated ore tonnages, commodity grades, and contained resources.

- *RunID*_07_SIM_Contained_Totals.csv—Contained ore and commodity tonnages aggregated by simulation run index.

- *RunID*_08_SIM_Contained_Stats.csv—Statistics for the simulation contained totals results summarizing the means, maximums, minimums, medians, standard deviations, percentiles of the ore and commodity contained resource tonnages, the probability of zero resources, and probability of resources greater than or equal to the mean.

MapMark4GUI also outputs five plot graphics in the encapsulated PostScript (EPS) and Joint Photographic Experts Group (JPEG) formats. These plots show the resulting probability functions and simulation plots.

- *RunID*GradPdfPlot.eps and *RunID*GradPdfPlot.jpg—A plot showing the PDF results for the grades.

- *RunID*pmfPlot.eps and *RunID*pmfPlot.jpg—A plot showing the PMF results representing the probability of the number of undiscovered deposits.

- *RunID*SimMatrixPlot.eps and *RunID*SimMatrixPlot.jpg —A matrix of plots representing the univariate- and bivariate-marginal distributions for the ore and commodity tonnages.

- *RunID*SimTotalPlot.eps and *RunID*SimTotalPlot.jpg—Plots showing the density and probability of the ore and commodity tonnages.

- *RunID*TonPdfPlot.eps and *RunID*TonPdfPlot.jpg—A plot showing the PDF for the ore tonnage.

MapMark4GUI also outputs a text file that contains the MapMark4 package process summary results, including the input parameters and the PDF and PMF statistics.

Data Requirements/Samples

1. GTM

   A. The GTM must be in CSV format.

B. Commodity grades should be in percent units.

C. The first two columns are required, unique identifiers for the individual deposits in the model. The first two columns can be given any names.

D. The next columns provide the deposit data. The third column lists the ore tonnage in metric tons and must be named "Ore." the remaining columns list the commodity grades in percent units, and the column headings must be the commodity abbreviations. There is no limit on the number of grades that can be included in the GTM.

E. An example of the GTM format is provided below:

Coded_ID	Name	Ore	Cu	Mo	Au	Ag
142pCu8704	Fengshandong	1.05E+08	0.38	0.05	0.000037	0.002
142pCu8704	Chengmenshan	4.09E+08	0.75	0.047	0.000024	0.00099
150pCu6004	Státiavnica Group	2.10E+08	0.35	0.001	0.000019	0.000952
003pCu9004	Continental/Butte	5.22E+09	0.673	0.028	0.0000042	0.00086
142pCu8502	Kyzyltu	6.58E+07	0.48	0.015	0.00002	0.000656
142pCu8003b	Kounrad	6.37E+08	0.589	0.011	0.000019	0.000628

2. Estimates file

A. The file must be in CSV format.

B. The column headings must be "Name," "Weight," "N90," "N50," and "N10."

C. Estimates can be entered only for the 90-, 50-, and 10-percentile levels.

D. The estimate table can have one estimate or a weighted set of estimates for multiple estimators.

E. An example of the estimates file format is provided below.

Name	Weight	N90	N50	N10
A	1	1	2	2

Reference Cited

Ellefsen, K.J., 2017, User's guide for MapMark4—An R package for the probability calculations

    in three-part mineral resource assessments: U.S. Geological Survey Techniques and Methods,

    book 7, chap. C14, 23 p., accessed December 27, 2017, at https://doi.org/10.3133/tm7C14.