User Guide for Monte Carlo Analysis Script

This script has two modes: First, you will compute the optimized B parameters for each station, and then export them to an excel file and average them. Then you will input these parameters into a TR equation and compare the results with the TR calculations that use the standard parameters. This process allows for the determination of optimized TR Rs coefficients that are more accurate at estimating Rs than the standard coefficients for each basin/

**PART ONE**

1. Place all relevant files into the same directory.

     Main Script:

            mCarlo.m

     Supporting Scripts:

            custom\_emprso\_w\_TR.m

            empros\_w\_TR.m

            date2doy.m

            doy2date.m

            rmse.m

     Data Files

           This script uses MJ/m2 for units of solar radiation

2. Open up mCarlo.m and make the following changes:

     Set number of iterations by changing value of MC\_iterations.

          Expect about 15 seconds of runtime for every 1000 iterations.

     Ensure that Comparison\_flag = 0.

     Make sure that the columns being read in match up with the columns of data file.

3. Run mCarlo.m script, and provide it with required information.

     There will be a delay as the analysis executes.

     The output plot will display at the end, as well as the printout of any relevant statistics.

4. Go into the workspace and find the variable "zz\_final\_opt\_printout"

     The array stores the following variables in the following order:

          Optimized TR RMSE

          Standard TR RMSE

          b0 for minimized RMSE

          b1 for minimized RMSE

          b2 for minimized RMSE

          The slope of the optimized least squares regression line

          The intercept for the optimized least squares regression line

          The average ratio of (Optimized TR Rs/Measured Rs)

          The average ratio of (Standard TR Rs/Measured Rs)

          The percent bias with the optimized parameters

          The percent bias with the standard parameters

          The log10 percent bias with the optimized parameters

          The log10 percent bias with the standard parameters

The Optimized R^2

The Standard TR R^2

5. Paste the values contained in zz\_final\_opt\_printout into an excel file and repeat steps 1-5 with as many stations as you would like.

**PART TWO**

1. Average the values of all three b coefficients for all relevant stations in the excel file.

2. Open the script custom\_emprso\_w\_TR.m

3. At the top of the script, change the "bzero," "bone," and "btwo" values to match the averaged values from the excel file and then save the .m file.

4. Open up mCarlo.m and set Comparison\_flag = 1.

5. Run the mCarlo.m script, providing it with the same required information.

     The script will then output another plot, as well as relevant statistics.

6.  Go into the workspace and find the variable "zz\_final\_comp\_printout"

     This array stores the following variables in the following order:

          Optimized TR RMSE

          Standard TR RMSE

          The slope of the optimized least squares regression line

          The intercept for the optimized least squares regression line

          The average ratio of (Optimized TR Rs/Measured Rs)

          The average ratio of (Standard TR Rs/Measured Rs)

          The percent bias with the optimized values

          The percent bias with the standard values

          The log10 percent bias with the optimized parameters

          The log10 percent bias with the standard parameters

          The Optimized R^2

The Standard TR R^2

7. Past the values contained in zz\_final\_comp\_printout into the excel file and repeat steps 5-7 with every station used for part 1.

8. Average these new values across all stations.

9. You're done! All figures, variables, and input logs have been saved in the current working directory.

If you have any questions or problems, email me at [chrisdunkerly@gmail.com](mailto:chrisdunkerly@gmail.com,) .