MGM21 CMI Solver (v1_0) – User's Guide – December 14, 2021

Introduction

Mean Climate Moisture Index from 1981-2010 is required to run MGM's climate-sensitive survival functions (Cortini et al. 2017; Comeau 2021a) and maximum size-density relationship (Comeau 2021b). Climate Moisture Index (Hogg et al. 2013) must be calculated using the MGM CMI Solver and ClimateNA (Wang et al. 2016) Version 6.11 data. Other versions of ClimateNA may not be used to calculate CMI.

CMI Solver

The MGM CMI Solver workbook calculates mean CMI for the 30-year period between 1981-2010 using ClimateNA Version 6.11 data and a Microsoft Excel macro.

Notes

- All of the climate sensitive functions in MGM21 were calibrated using climate data from ClimateNA Version 6.11 or earlier.
- ClimateNA's historic monthly data underwent a major revision in Version 6.20. This revised climate data produces substantially different CMI values than those used to calibrate MGM. As a result, ClimateNA Version 6.11 must be used to calculate CMI for MGM21.
- The newest versions of ClimateNA (Versions 6.30+) directly output CMI. CMI values that are directly output from ClimateNA should not be used with MGM21. The newest versions of ClimateNA also include revised climate data that differs from ClimateNA Version 6.11.
- Please see the "MGM CMI Solver" section on the MGM Download page to get ClimateNA Version 6.11.

Using the CMI Solver

1. To calculate CMI for MGM, download and unzip ClimateNA.
2. Read the ClimateNA help file "help.rtf", and review the "How to install" section. In addition, review the use of ClimateNA under a "multi-location process".
3. Install ClimateNA. Note the directory where ClimateNA is located (e.g. C:\Climatena_v611\).
4. Determine the latitude, longitude, and elevation for each stand in your dataset. Latitude and longitude must be expressed in decimal degrees. Elevation must be expressed in metres.
5. Create a CSV spreadsheet with stand ID's, locations, and elevations (Figure 5.1). This CSV spreadsheet must contain the following columns: ID1, ID2, lat, long, and el (i.e. ID1 = identification variable 1, ID2 = identification variable 2, lat = latitude, long = longitude, el = elevation). Column order is important. The ID1 column must relate to your MGM Crop Plans and MGM Stands Worksheets. A dash or underscore delimited ID variable is recommended for ID1 (e.g. Area-Stand or Agency_Plot). The ID2 column must contain period "." placeholders (Figure 5.1), and the spreadsheet must be saved as a comma delimited file with a ".csv" extension.

	A	B	C	D	E
1	ID1	ID2	lat	long	el
2	Area1-Stand1	.	56.4738	-111.196	495
3	Area1-Stand2	.	56.4786	-111.19	491
4	Area1-Stand3	.	56.4829	-111.183	482
5	Area2-Stand1	.	53.5381	-117.829	1202
6	Area2-Stand2	.	53.4759	-117.812	1190
7	Area2-Stand3	.	53.4192	-117.743	1336
8	Area3-Stand1	.	55.3573	-113.637	647
9	Area3-Stand2	.	55.334	-113.576	663
10	Area3-Stand3	.	55.3882	-113.455	661

Figure 5.1. CSV spreadsheet with stand ID's, locations, and elevations.

6. Download the compressed file "MGM21_CMI_Solver_v1_0.zip". (Note: Steps 6 through 9 assume that you received a copy of the CMI Solver in an email or a download from the MGM website. Please ignore Steps 6 through 9 if you already have a copy of the CMI Solver.)
7. Cut and paste "MGM21_CMI_Solver_v1_0.zip" from your download directory into the ClimateNA directory (e.g. C:\Climatena_v611\).
8. Right-click on "MGM21_CMI_Solver_v1_0.zip", and select "Properties". In the new dialog (Figure 8.1), go to the "General" tab. If visible, check "Unblock" in the lower-right corner. Then, click "OK" (Figure 8.1). The CMI Solver will not run if "MGM21_CMI_Solver_v1_0.zip" is "Blocked" by Windows.
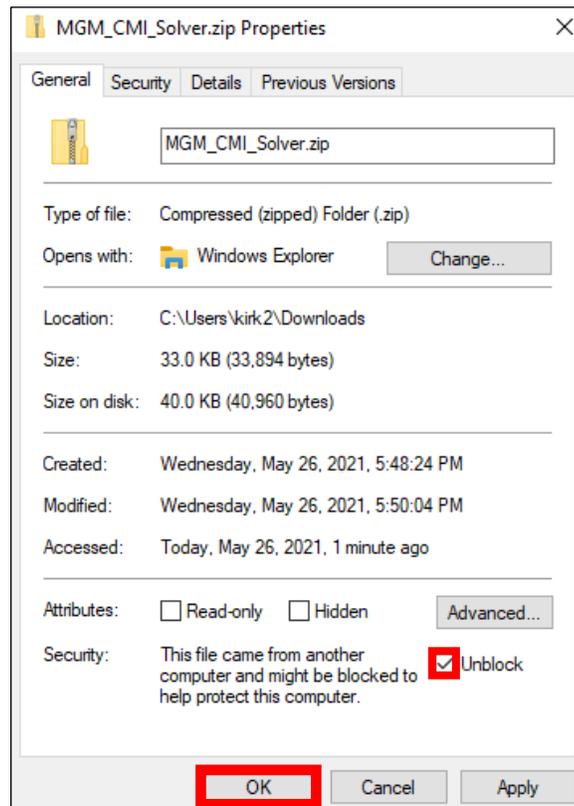
Figure 8.1. Unblock "MGM21_CMI_Solver_v1_6.zip".

9. Extract "MGM21_CMI_Solver_v1_0.zip".
10. Copy the extracted files (i.e. "MGM21_CMI_Solver_v1_0.xlsm" and "Demo_Dataset_CNA_Input.csv") and your new CSV spreadsheet into the ClimateNA directory (e.g. C:\Climatena_v611\).

11. Start ClimateNA (i.e. ClimateNA_v6.11.exe).
12. Under the "Multi-location" menu, select "Historical Time Series" from the first drop-down (Figure 12.1).
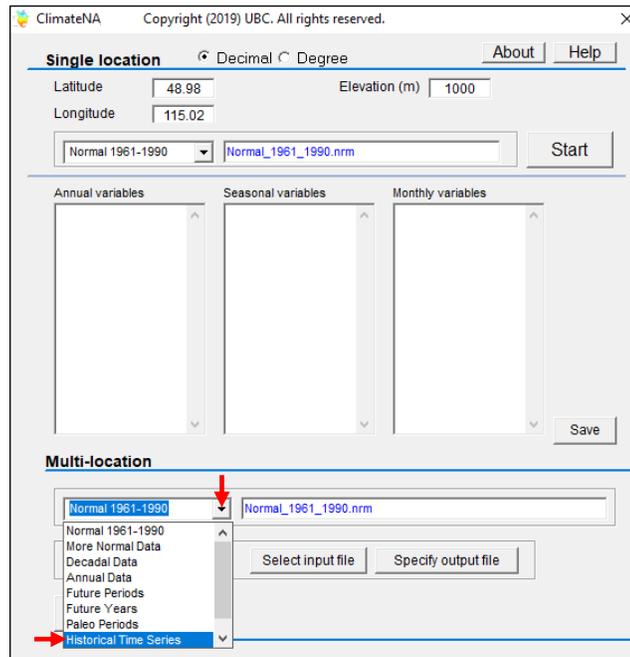

Figure 12.1. Select "Historical Time Series" from the first drop-down.

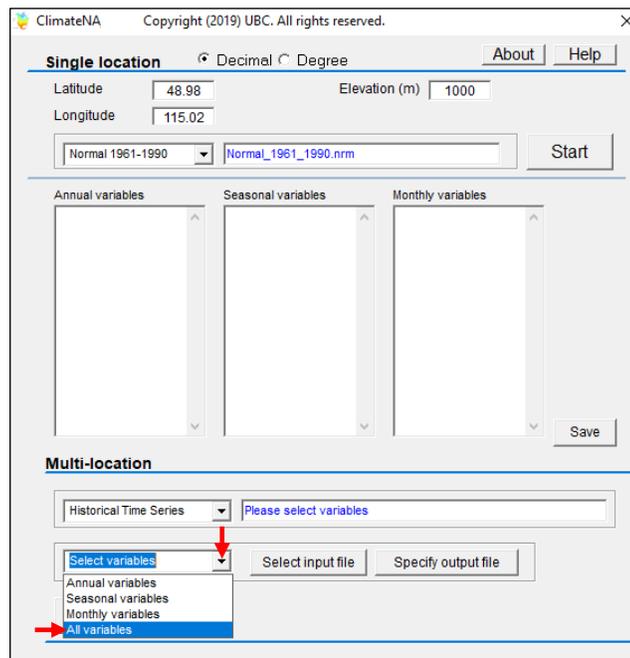13. Then, select "All variables" from the second drop-down (Figure 13.1).

Figure 13.1. Select "All variables" from the second drop-down.

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14. A new ClimateNA dialog will appear (Figure 14.1). <u>Make the starting year 1981.</u> Then, click "OK" (Figure 14.1).
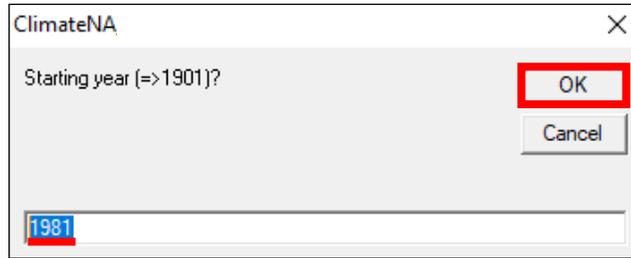
Figure 14.1. Make the starting year 1981. Then, click "OK".

15. Another ClimateNA dialog will appear (Figure 15.1). <u>Make the ending year 2010.</u> Then, click "OK" (Figure 15.1).
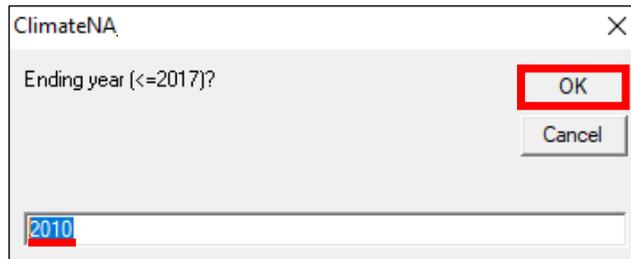
Figure 15.1. Make the ending year 2010. Then, click "OK".

16. Verify that the "Multi-location" menu displays a "Historical Time Series" between "1981-2010" for "All variables" (Figure 16.1).
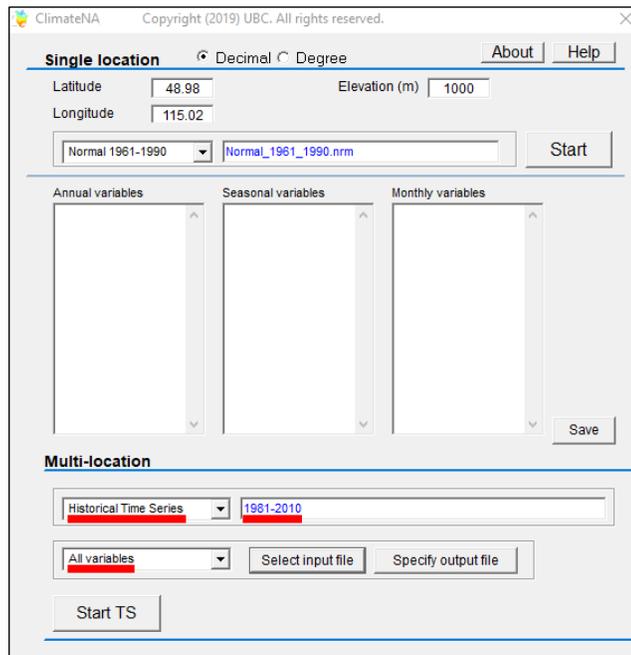
Figure 16.1. Verify that the "Multi-location" menu displays a "Historical Time Series" between "1981-2010" for "All variables".

17. Click the "Select input file" button (Figure 17.1), and a new ClimateNA dialog will appear (Figure 17.2). Select your CSV spreadsheet with stand ID's, locations, and elevations (e.g. Demo_Dataset_CNA_Input.csv). Then, click "Open" (Figure 17.2).
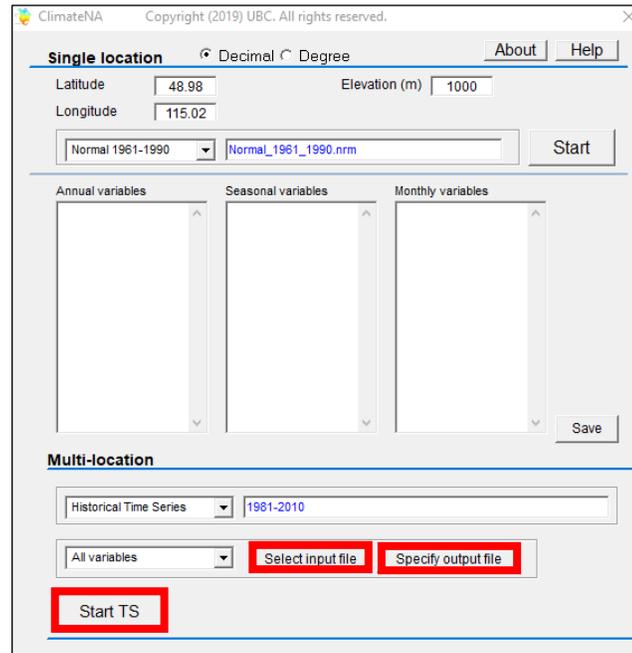

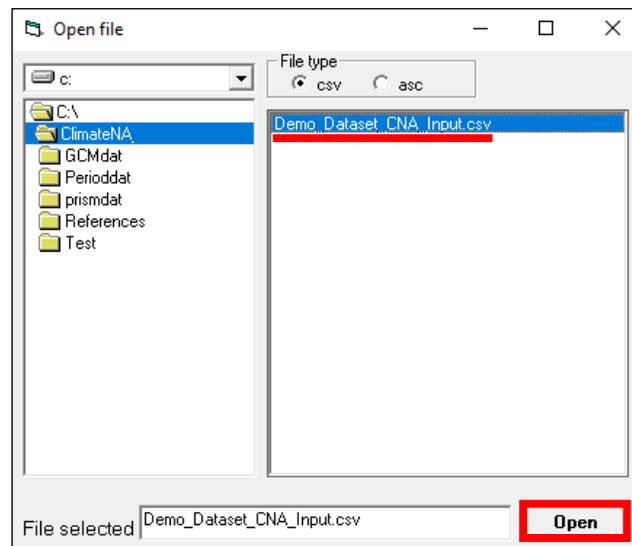Figure 17.1. The "Select input file", "Specify Output File", and "Start TS" buttons.

Figure 17.2. Select your CSV spreadsheet with stand ID's, locations, and elevations (e.g. Demo_Dataset_CNA_Input.csv).

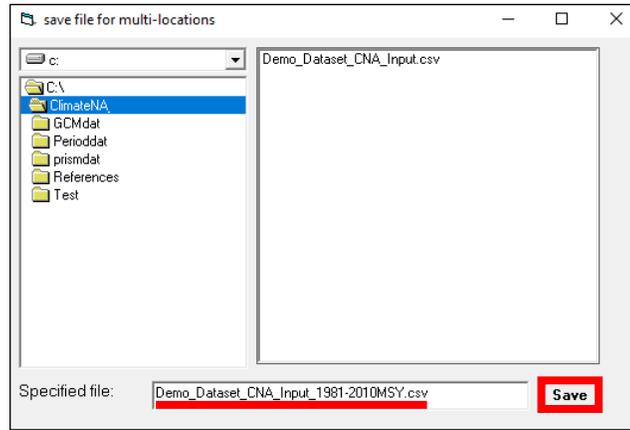18. Click the "Specify output file" button (Figure 17.1), and a new ClimateNA dialog will appear (Figure 18.1). Name your ClimateNA output file. Give this output file a representative name, indicating the ClimateNA version, the type of data output, and the reference period (e.g. Demo_Dataset_CNA_v611_All_Variables_1981-2010MSY.csv). Then, click "Save" (Figure 18.1).

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Figure 18.1. Name your ClimateNA output file. Give this output file a representative name, indicating the ClimateNA version, the type of data output, and the reference period (e.g. Demo_Dataset_CNA_v611_All_Variables_1981-2010MSY.csv).

19. Click "Start TS" (or "Start") under the "Multi-location" menu (Figure 17.1). Allow ClimateNA to output the climate data (Figure 19.1).
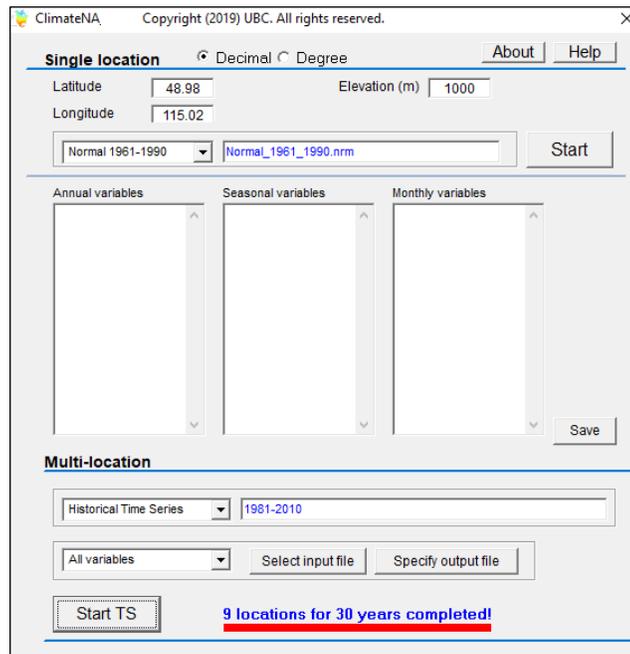

Figure 19.1. Allow ClimateNA to output the climate data.

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20. Open the CMI Solver "MGM21_CMI_Solver_v1_0.xlsm" in the ClimateNA directory (e.g. C:\Climatena_v611\). If security warning(s) appear, click "Enable Content" under the Excel Ribbon (Figure 20.1).
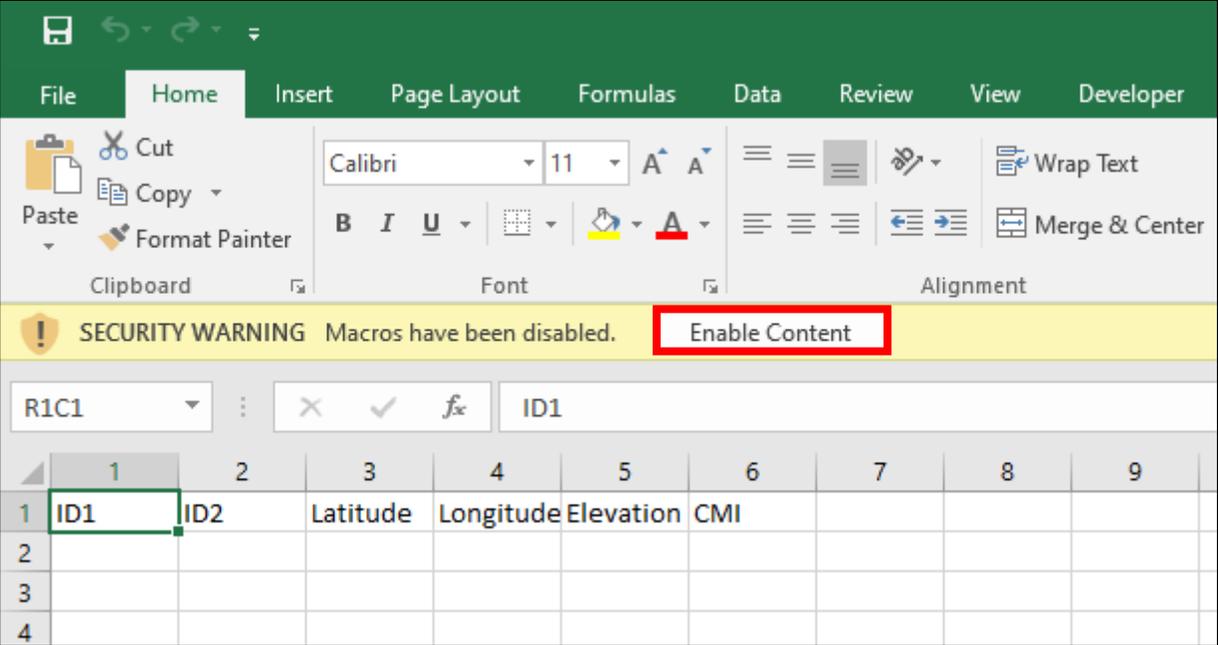

Figure 20.1. "Enable Content" under the Excel Ribbon.

21. To run the CMI Solver, select "View" on the Excel Ribbon. Then, select "Macros" and "View Macros" (Figure 21.1).
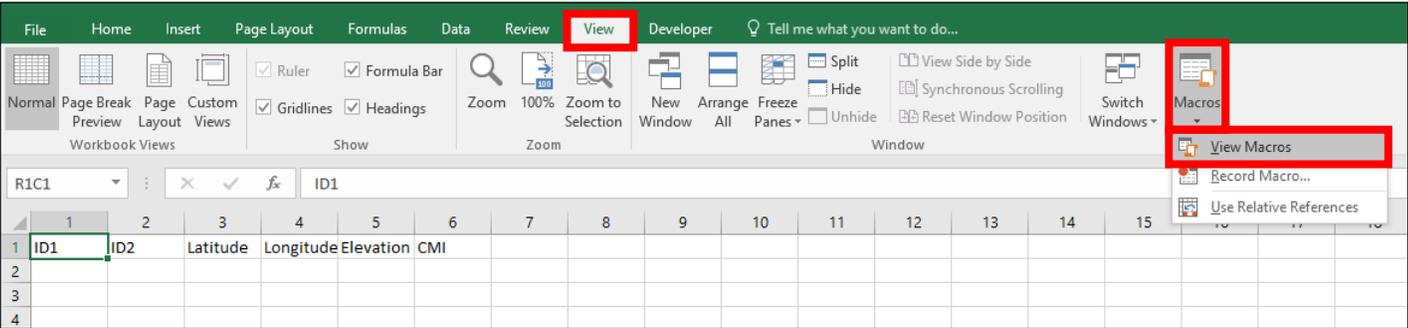

Figure 21.1. View Macros.

22. A "Macro" dialog will appear (Figure 22.1). Under "Macro name", select "MGM21_CMI_Solver_v1_0", and click "Run" (Figure 22.1).
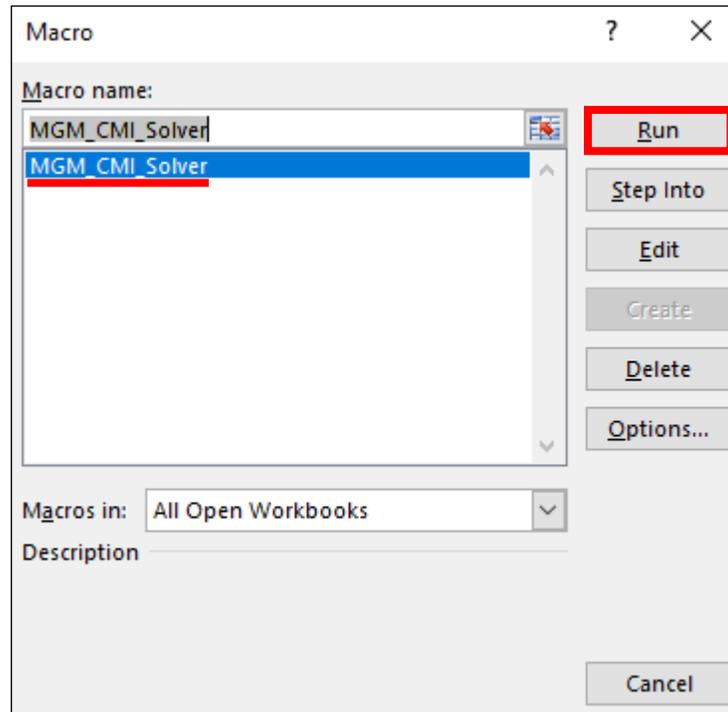

Figure 22.1. Running the CMI Solver.

23. The CMI Solver displays a warning message before deleting all preexisting climate records from your last CMI solution (Figure 23.1). Click "Yes" to start the CMI Solver and delete all preexisting climate records. Otherwise, click "No" to exit the CMI Solver (Figure 23.2). No climate records will be deleted if you exit the CMI Solver (Figure 23.2).
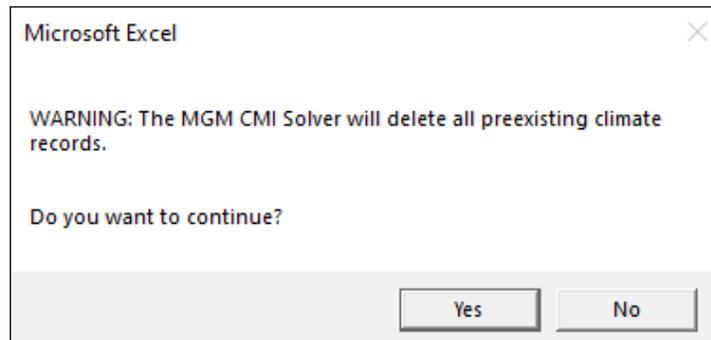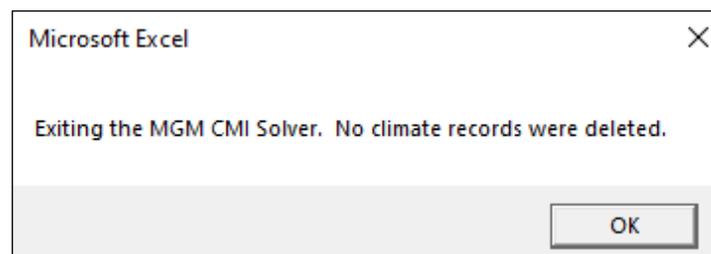

Figure 23.1. CMI Solver warning message.

Figure 23.2. Exiting the CMI Solver.

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24. A "Select ClimateNA Output" dialog will appear. Select the ClimateNA output file (e.g. Demo_Dataset_CNA_v611_All_Variables_1981-2010MSY.csv), and click "OK" (Figure 24.1).
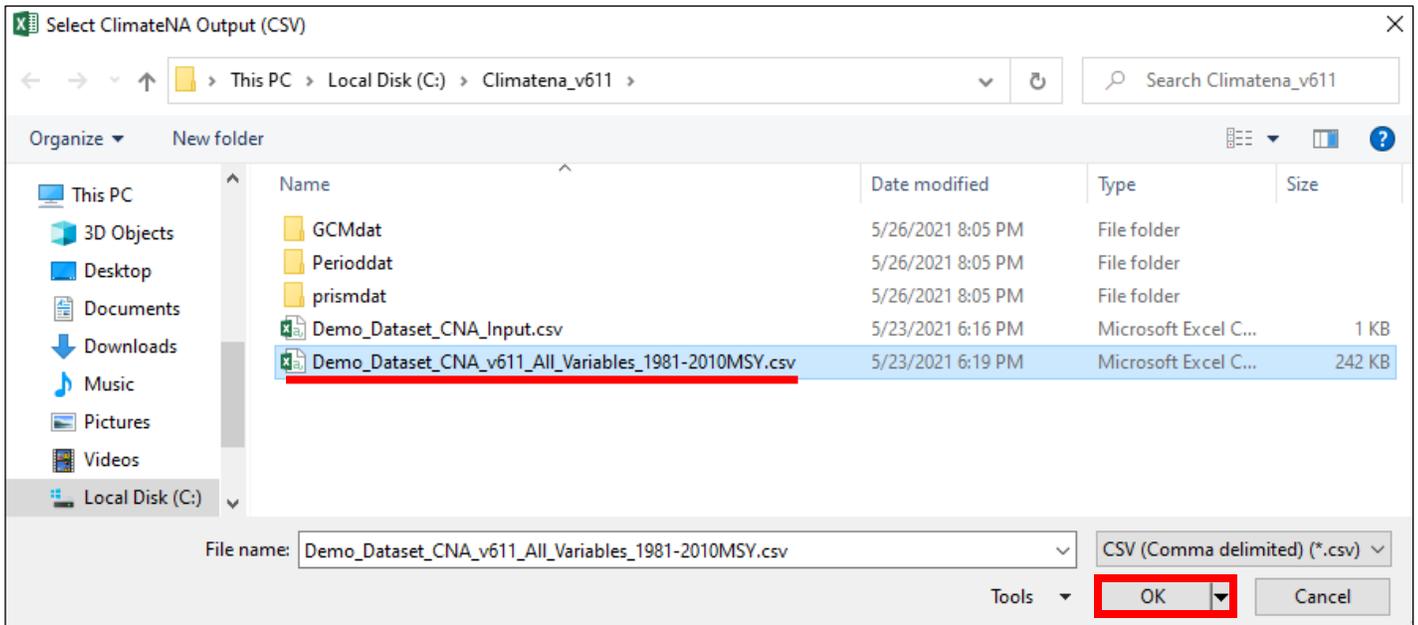

Figure 24.1. Select the ClimateNA output file (e.g. Demo_Dataset_CNA_v611_All_Variables_1981-2010MSY.csv).

25. If the CMI Solver is successful, the CMI output data will appear in the CMI worksheet with a "CMI Solver Complete" message (Figure 25.1). The "CMI Solver Complete" message includes the number of locations and basic CMI summary statistics (Minimum, Mean, Maximum) for the input dataset (Figure 25.1). The "ClimateNA_Output" worksheet contains a copy of the ClimateNA output file (e.g. Demo_Dataset_CNA_v611_All_Variables_1981-2010MSY.csv).
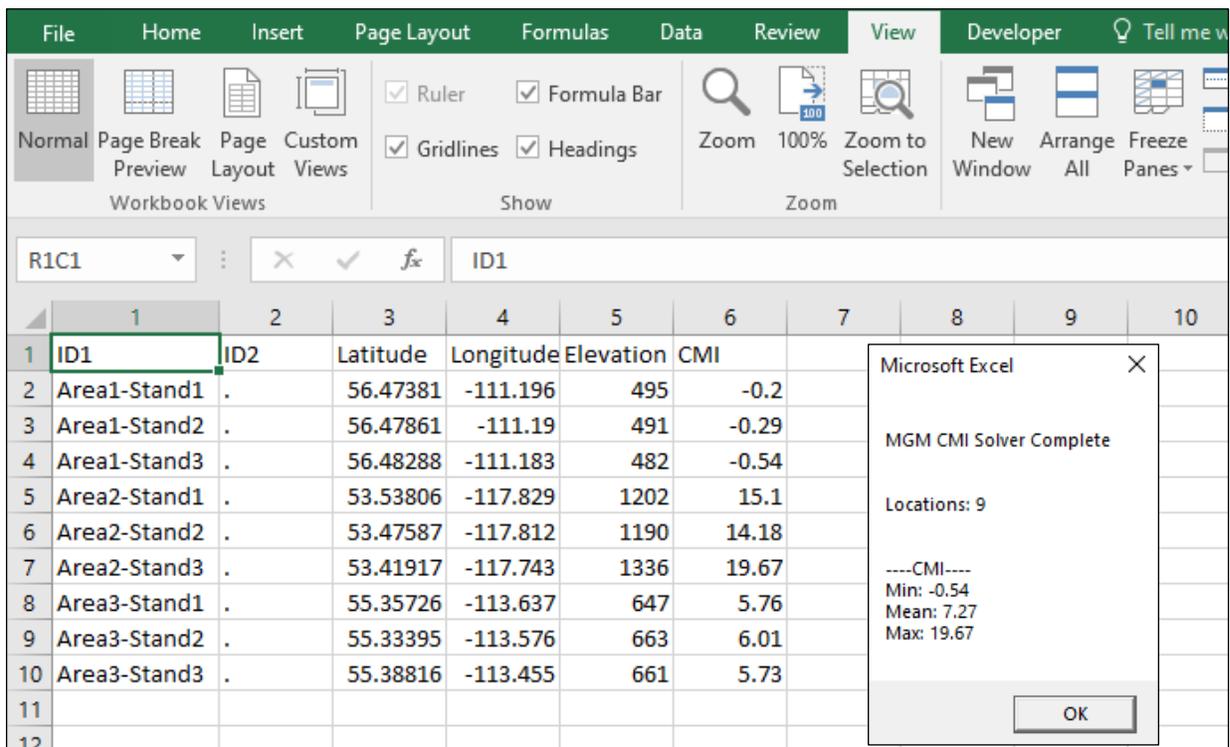

Figure 25.1. CMI Solver complete message.

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26. The CMI Solver will not complete if the ClimateNA output data does not match the 30-year reference period (1981-2010) used by MGM's climate-sensitive survival functions (Cortini et al. 2017; Comeau 2021a) and maximum size-density relationship (Comeau 2021b). Error messages are generated if improper ClimateNA outputs are used.
27. The CMI values in the CMI worksheet can now be used to create MGM Stands Worksheets with the "MGM Make Stands" macro or MGM's Tree List Generator (TLG).

References

Comeau, P.G. 2021a. Survival probability models for seven western boreal tree species. MGM Research Note #2021-1. Available online at: https://mgm.ualberta.ca/mgm21/research-notes/

Comeau, P.G. 2021b. Maximum Size-Density relationships for western boreal and montane forests. MGM Research Note #2021-2. Available online at: https://mgm.ualberta.ca/mgm21/research-notes/

Cortini, F., P.G. Comeau, V.C. Strimbu, E.H. Hogg, M. Bokalo, and S. Huang. 2017. Survival functions for boreal tree species in northwestern North America. Forest Ecology and Management. 402:177-185.

Hogg, E.H., A.G. Barr, and T.A. Black. 2013. A simple soil moisture index for representing multi-year drought impacts on aspen productivity in the western Canadian interior. Agricultural and Forest Meteorology. 178-179, 173-182.

Wang, T., A. Hamann, D.L. Spittlehouse, and C. Carroll. 2016. Locally downscaled and spatially customizable climate data for historical and future periods for North America. PLoS One 11:e0156720.