SWAMPS Version 1.5

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I. Overview

This document presents the Systems model in Wetlands to Allocate water and Manage Plant Spread (SWAMPS) version 1.5 and its Graphical User Interface (GUI). SWAMPS identifies ways to allocate water and recommend invasive vegetation control to improve bird habitat for select species at the Bear River Migratory Bird Refuge, Utah.

II. Software Requirements

To run SWAMPS, you will need the following software installed on your computer:

a. General Algebraic Modeling System (GAMS) version 24.1.3 and a license for the Conopt solver. Download from www.gams.com.
b. Matlab,
c. Microsoft Excel, and
d. SWAMPS data and modeling files available on GitHub.

See Appendix 1 (p. 6) for instructions for how to download, install and configure GAMS, MATLAB, and the data and modelling files so all the programs correctly interact with each other and the model data. A comprehensive description of the model is provided in the paper and in the GitHub repository at https://github.com/alminagorta/Systems-model-in-Wetlands-to-Allocate-water-and-Manage-Plant-Spread.

III. Activities: Run base case scenario and explore results

In this exercise, you will use existing base case input data for the Refuge to run the model and explore how the model recommends water allocation and invasive vegetation control in the Refuge's 25 wetlands units.

1. Type GUI_GAMS_v1 at the Matlab prompt.

2. In the **GUI_GAMS_v1** window, select the **Input Type** option in the menu bar and check the option '**To use Excel data Spatial Water Depth**' (Figure 1). This option allows input data using the pre-populated input data of the Refuge.

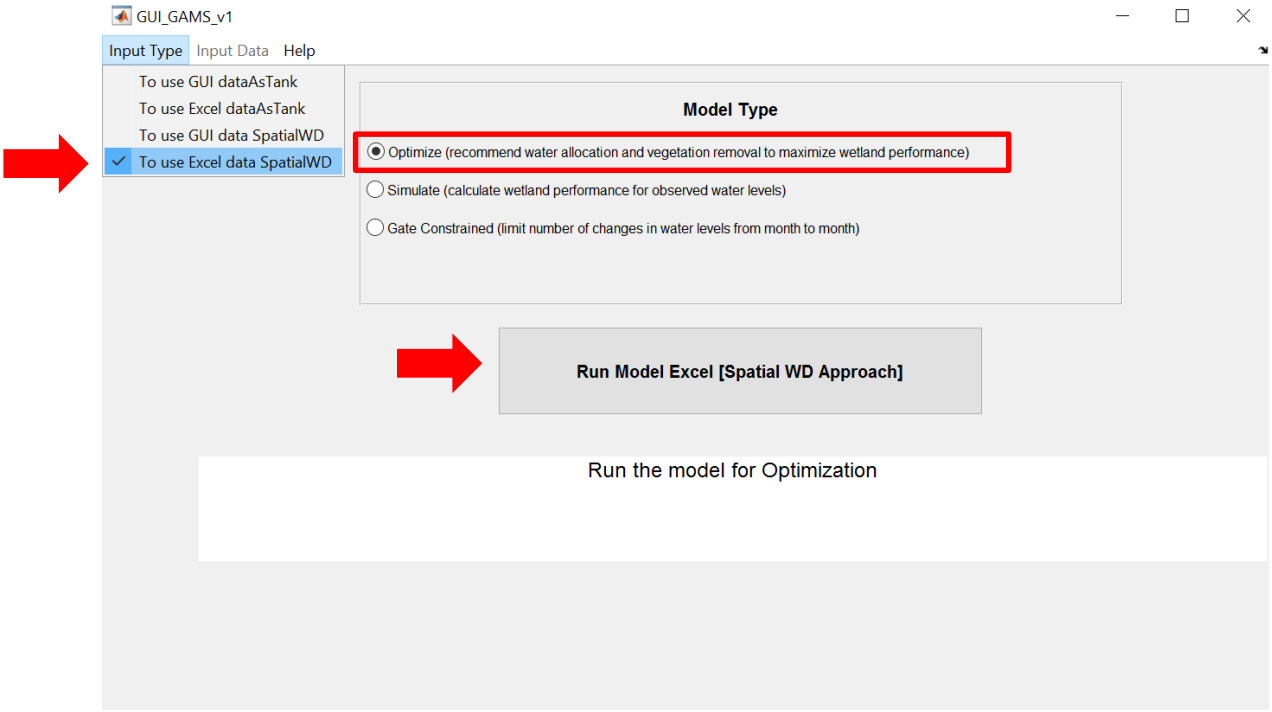

Figure 1. Selecting GUI options

3. Then select the model type as **Optimize** and click the **Run Model** button. Over the course of a minute, intermediary optimization results will appear in the Matlab command line window.

4. When the model run finishes, five figures will appear:

   - Water depth for each wetland unit and per month (Figure 2),
   - Invasive vegetation cover for each wetland unit (Figure 3),
   - Habitat suitability for invasive vegetation cover (Figure 4),
   - Weighted usable area for each wetland unit and per month (Figure 5),
   - Spatial and temporal wetland performance (Figure 6).

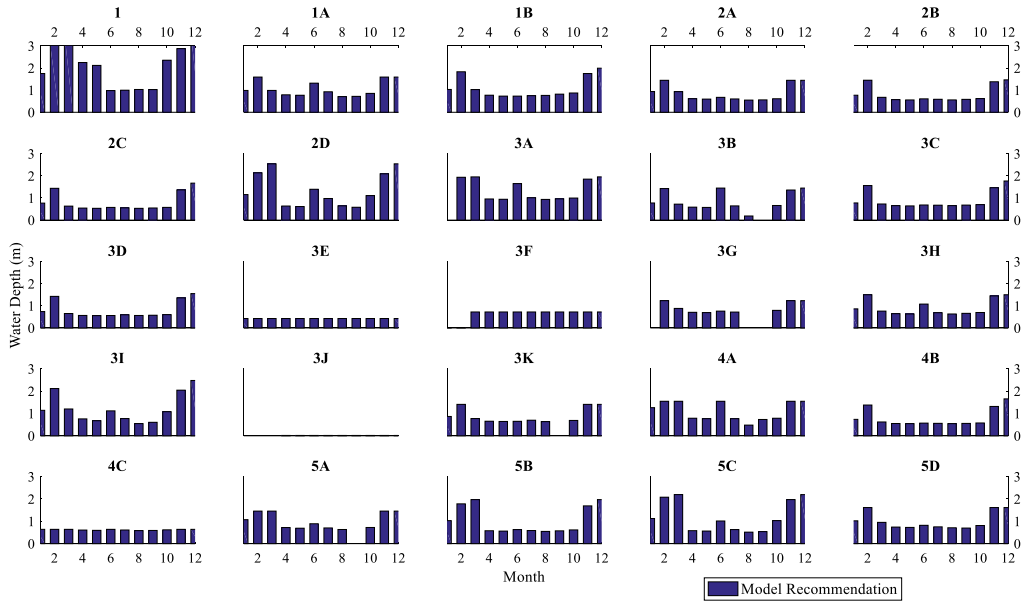

Figure 2. Model recommended (optimized) water allocations by month and wetland unit during 2008

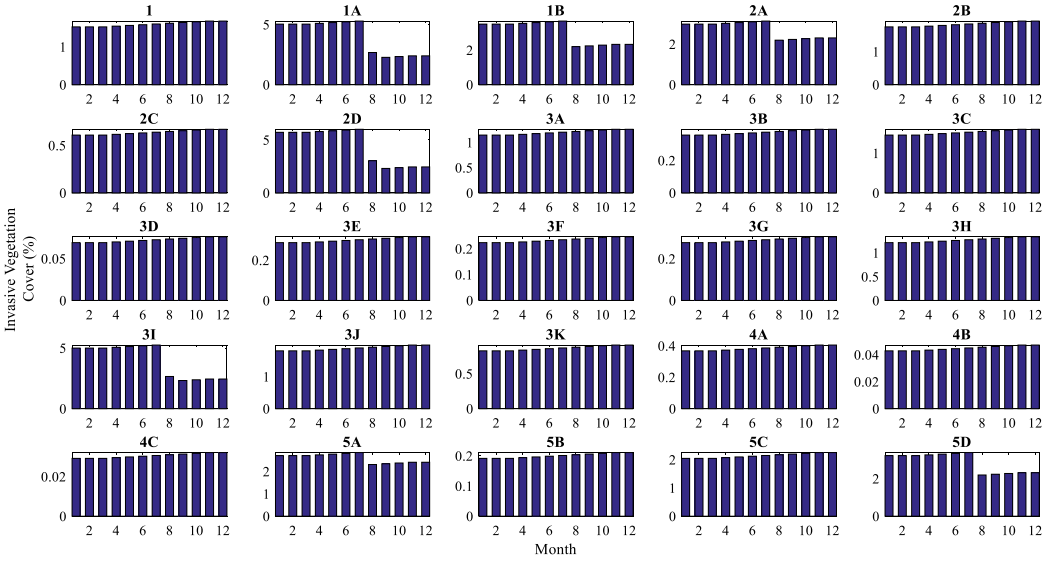

Figure 3. Invasive vegetation cover (Phragmites) over time in the Refuge wetland units

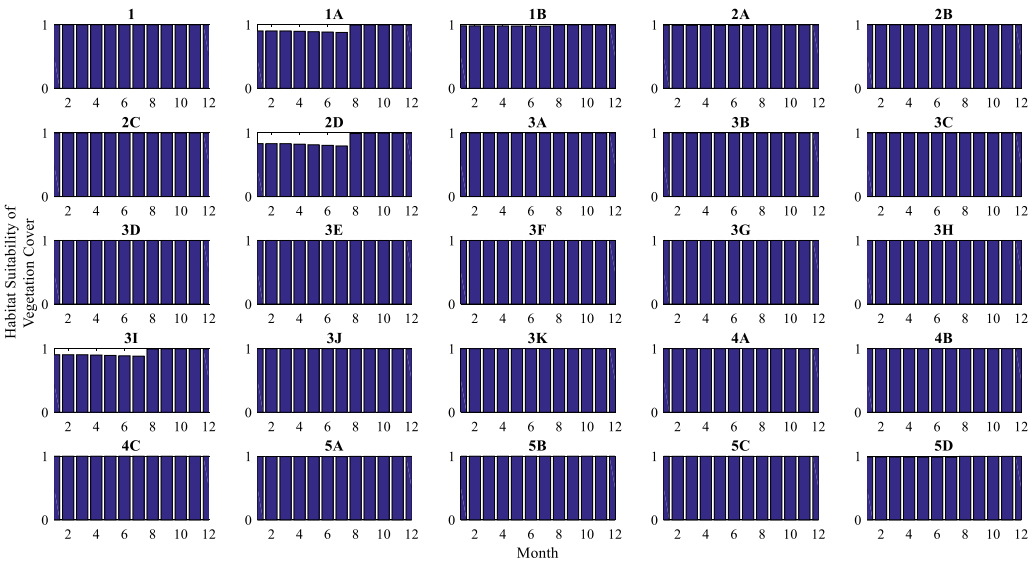

Figure 4. Habitat suitability of vegetation cover over time in the Refuge wetland units. 1=Excellent habitat quality; 0=Poor habitat quality.

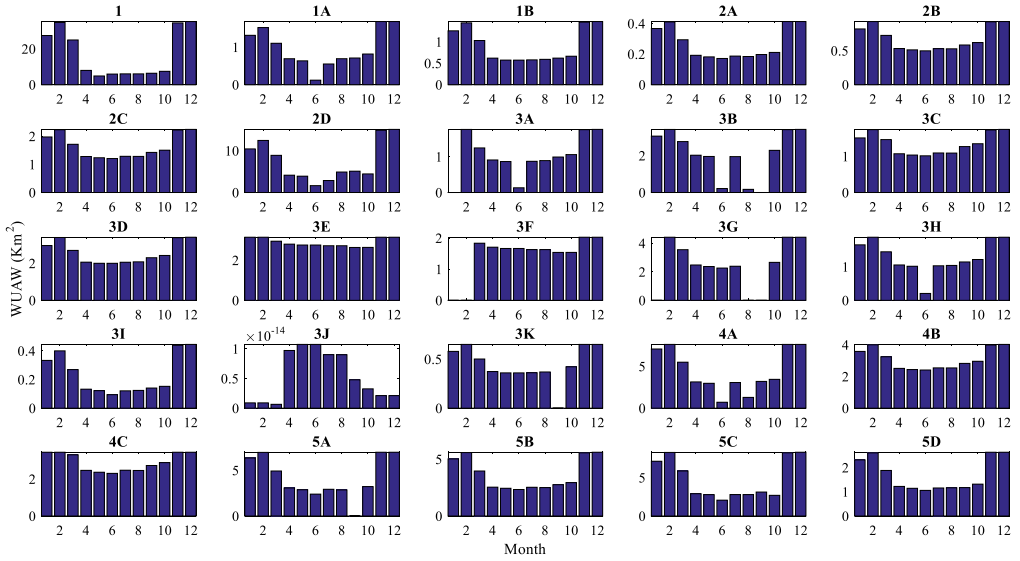

Figure 5. Weighted usable area for wetlands (WUAW) at the Refuge

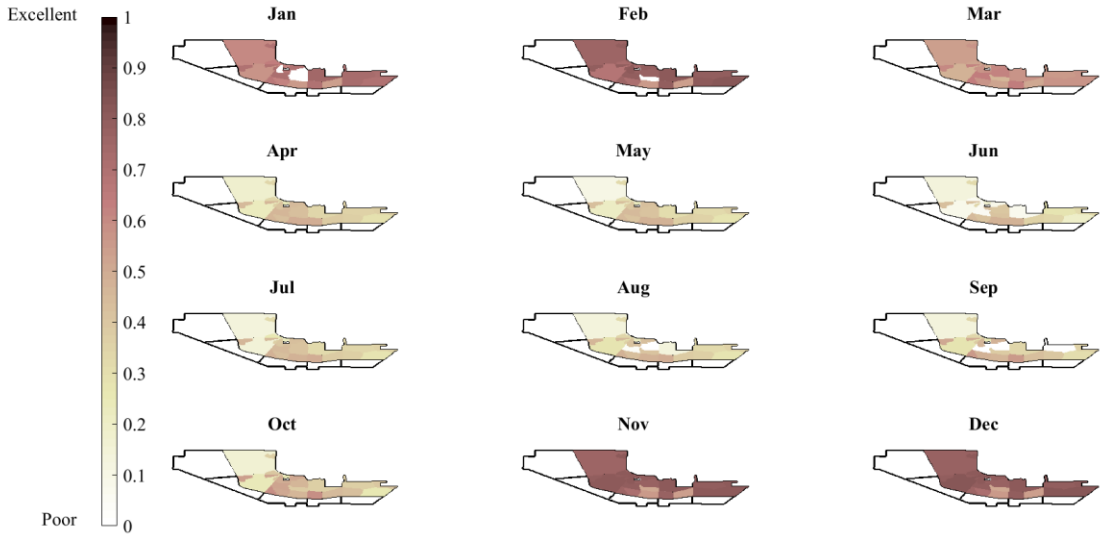

Figure 6. Spatial and temporal distribution of composite habitat suitability index (HC) for optimized case. Dark shading denotes areas with water depths and vegetation cover more suitable for the three priority bird species.

Changes on input data are similar to previous SWAMPS version (v1.2) [for more exercises see previous documentation]

Appendix 1: Set-up the SWAMPS model on your computer

A. Set GAMS path in Windows

For Windows interact with GAMS in Matlab, it is necessary to add the GAMS directory to the path environment in Windows. To do that:

1. Identify the directory where GAMS was installed. For example: 'C:\GAMS\win64\24.1';
2. Open your **System Properties** (Figure 10) and then open **Advanced system settings** and **Environment Variables** (Figure 11)
3. Select path in the **system variables** list and **Edit**. Then add a semicolon (;) and paste the GAMS installation directory (e.g., C:\GAMS\win64\24.1) recorded in step B1, without any backslash (\) [See Figure 12]
4. OK all windows
5. To check the correct settings, Open the **command prompt** and type **gams** (A message similar to Figure 13 should appear)

This GAMS-Windows set up will allow you use all the optimization capabilities of GAMS in Matlab and allow visualization of GAMS models directly within MATLAB.

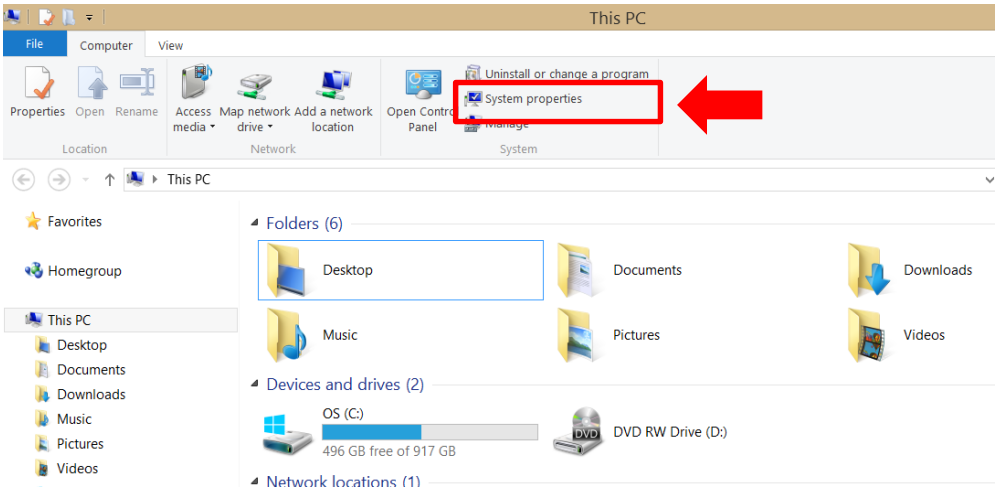

Figure 1A. Screenshot to access System properties in Windows 8

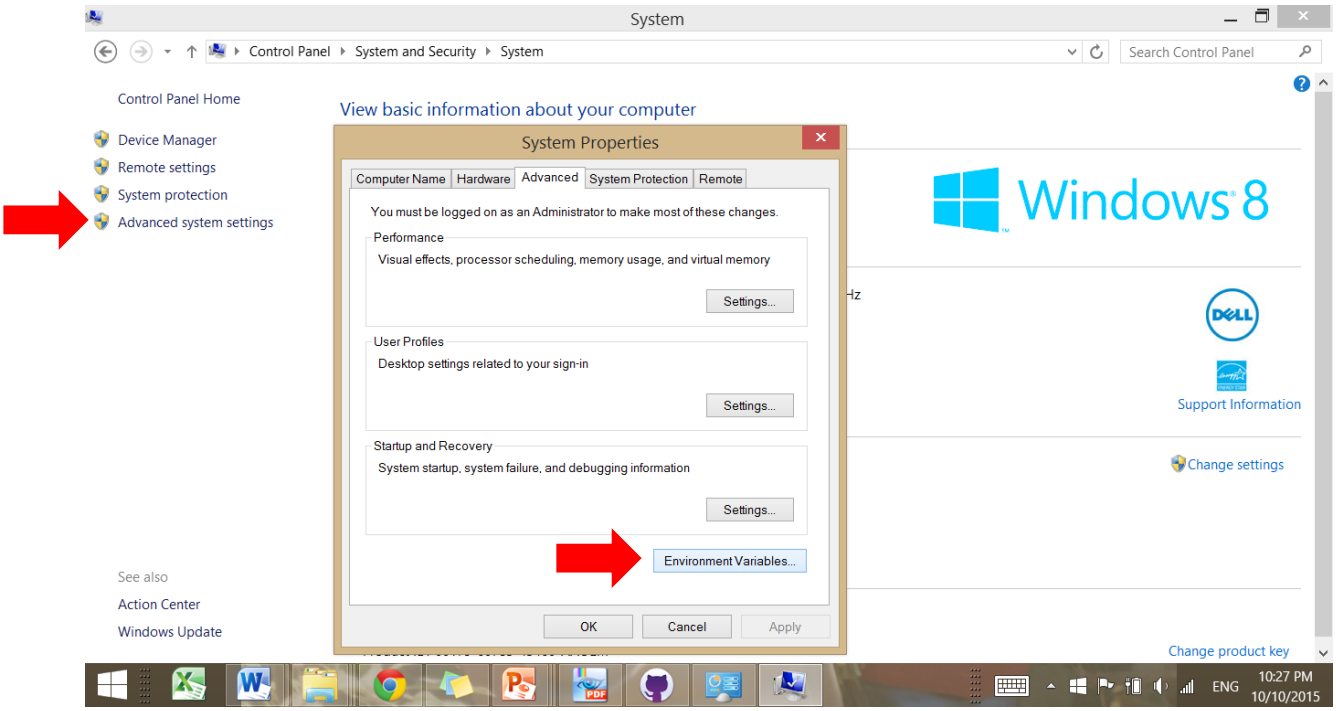

Figure 2A. Screenshot of the Environment Variables

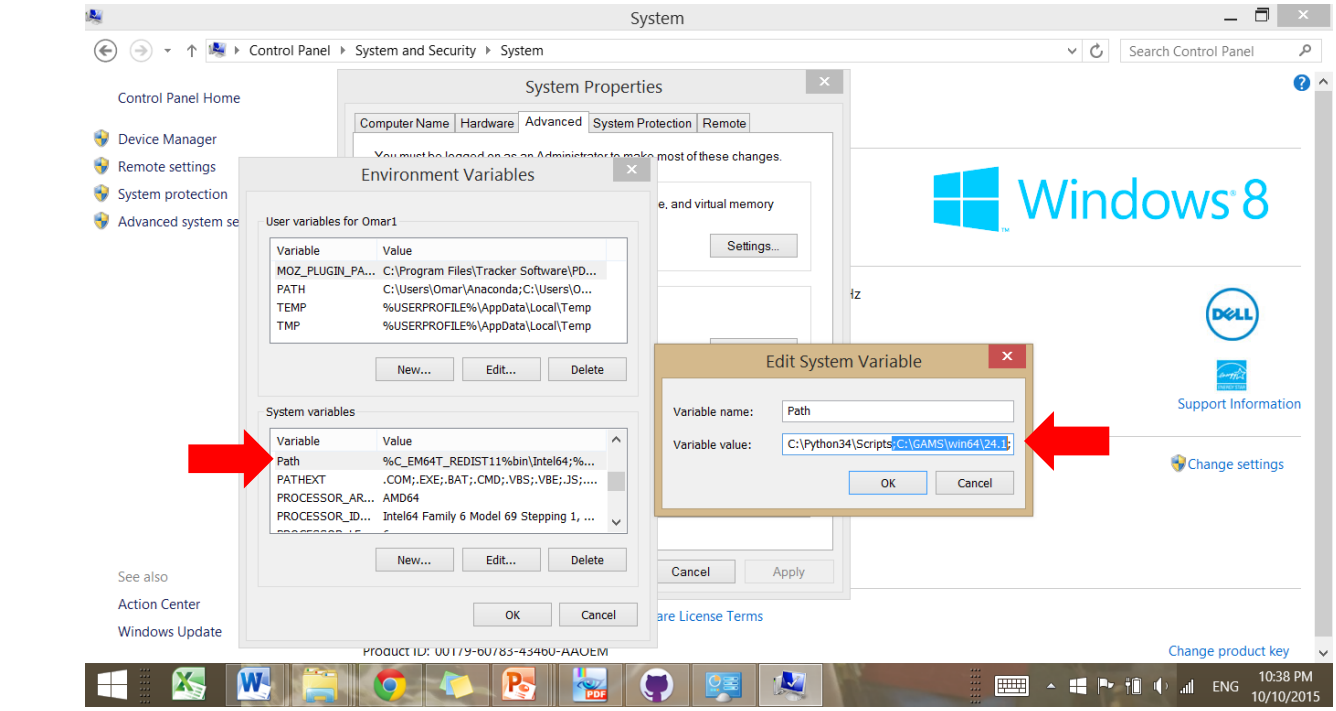

Figure 3A. Screenshot to add GAMS path

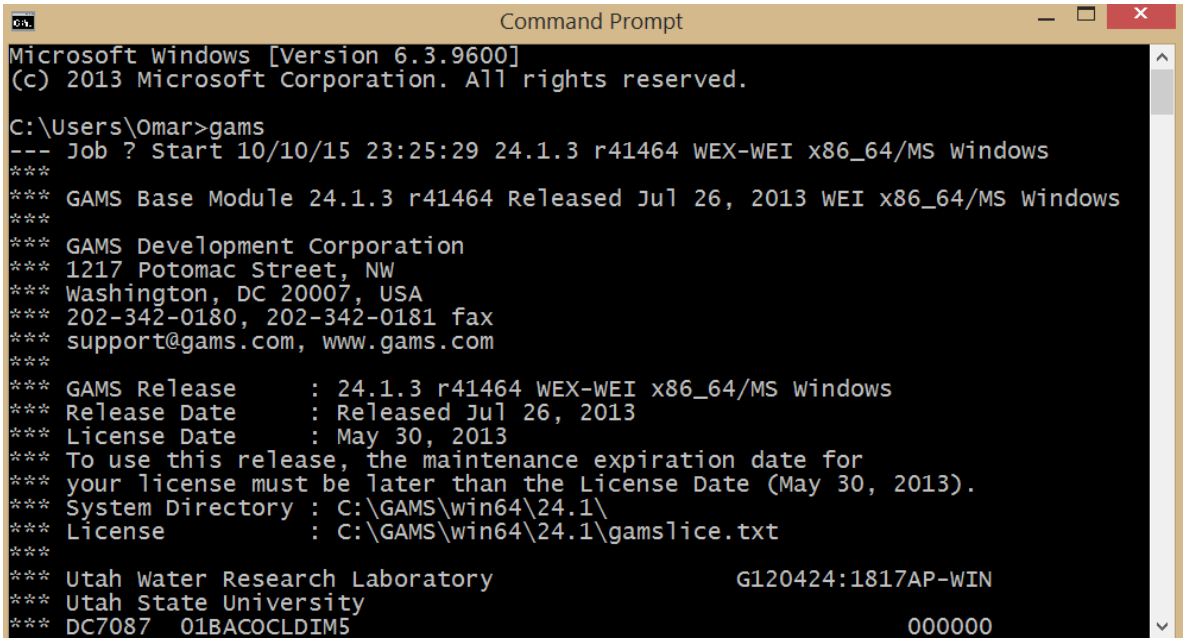

Figure 4A. Expected message in the command prompt after setting up the GAMS path

B. The Graphical User Interface

1. On the GitHub repository for the SWAMPS model, click the **Download ZIP** icon and save the zip file to a location that has a short name (like the Desktop).

2. Use WINZIP to unzip the file.

3. The GUI is located in the folder “SupplementaryDocumentation\Graphical User Interface”
4. Open Matlab and select the folder created in step B2 as the current directory (Figure 14). Then, in the MATLAB command window, type

   >> **GUI_GAMS_v1**

5. If you experience any error, test that the GAMS path is listed correctly in Matlab. In the Matlab command Window type which gams. The command should return

   C:\GAMS\win64\24.1\gams.mexw64

6. If the model runs but does not show the figures of results, check the GAMS version installed on your computer. You should have only version 24.1. Avoid having additional GAMS versions on your computer; it can create problems on the GUI.

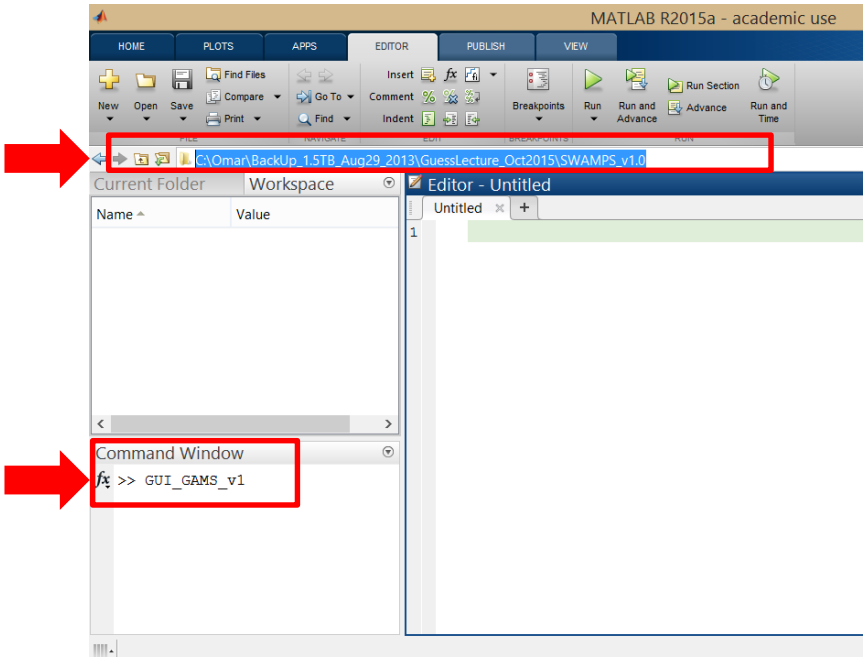

Figure 5A. Screenshot to select the appropriate folder and execute the GUI

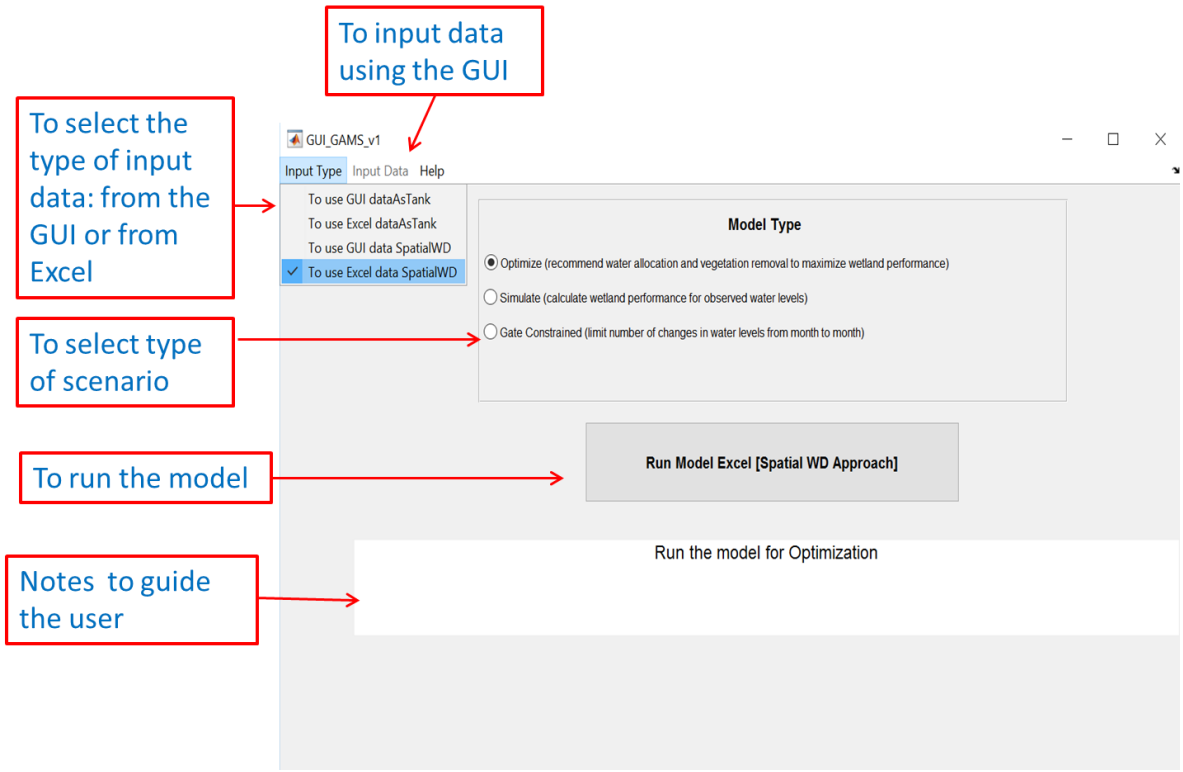

Figure 6A. Main components of the GUI