**Preparing DSSAT Input File and Running DSSAT Simulation (ntracker\_run.exe)**

Table of Contents

[**Source Code Location** 2](#_Toc473200300)

[**The Program Structure** 2](#_Toc473200301)

[**Summary** 2](#_Toc473200302)

[**Description** 2](#_Toc473200303)

[**ntracker\_run.m:** 2](#_Toc473200304)

[**import\_userdata.m:** 2](#_Toc473200305)

[**soil.m:** 3](#_Toc473200306)

[**weather.m:** 4](#_Toc473200307)

[**process\_filex.m:** 4](#_Toc473200308)

[**Program Flow Chart** 6](#_Toc473200309)

# **Source Code Location**

The source codes of the program is located in the following directory:

C:\Program Files (x86)\NMSU\RSET\wwwroot\ntrack\ ntracker.rar

The code may also be downloaded from the link:

// Add a link here

# **The Program Structure**

## **Summary**

A batch file daemon.bat located in “C:\Program Files (x86)\NMSU\RSET\wwwroot\ntrack” calls the file daemon.php which in turn calls the program exe file (ntracker\_run.exe) whenever there is a new request in the SQL database to prepare input data, run DSSAT simulation, and sends output back to the user as an email.

## **Description**

The source code of the exe file contains the following main functions, among others:

**ntracker\_run.m:** This function is the main entry point for the N-tracking program. The function defines hard coded directories for the following:

1. NWS daily weather data (main directory, e.g. ‘H:/2017Data/NWS/’)
2. DSSAT exe file (default is, 'C:/DSSAT46/')
3. Soil file (processed from gSSURGO, currently located in 'H:/SunY/Soildata/IL\_Soil\_Data\_Base\_Das.txt')

It then passes all the user defined variables to the import\_userdata.m (described below) for preparing data to be used to further steps. The following functions are called by the ntracker\_run.m and are presented in a sequence.

**import\_userdata.m:** This function creates a new structure with all the user data in DSSAT’s acceptable format. User defined input data that was stored in the SQL database is processed into the program useable format and it outputs a structure with the parameters that will be used in later functions. The followings are the processes that are performed in this function:

1. Planting date, end date, and fertilizer application dates are converted to ‘yyddd’ format, where ‘yy’ is the two digits year and ‘ddd’ is the three-digit number for day of the year. For example, 05/15/2017 will be converted to 17135 because May 15 is the 135th day of the year.
2. Nitrogen application rates are converted from lbs/acre to kg/ha.
3. Stores cultivar name, rmi, lat/ long as is in the struct.

**soil.m:** The soil function has twofold role. In the first part, the function uses lat/long coordinates to locate soil’s Map Unit Key (MUKEY) of the selected location. This is done by utilizing R’s spatial analysis capabilities. MATLAB’s soil function runs the R code to get the corresponding MUKEY. The source code for this is located at 'C:\Users\Administrator\Documents\R\extract\_mukey.R'. This code searches the MUKEY for the provided location.

**Notice: This file needs MUKEY raster which is currently located on \\swsatmossci (H:/SunY/Soildata/** **MapunitRaster\_IL\_10m1.tif). In addition, the ArcGIS needs to be installed on the system and the script will need to be update according to the current ArcGIS version installed on the system it is running on. To do that, on line 38 of extract\_mukey.R, change the version according to the installed version. For example for ArcGIS 10.4, change the ArcGIS10.3 (in red) to ArcGIS10.4 in the line 38.**

**Line 38: rpygeo.env <-rpygeo.build.env(python.path="C:/Python27/ArcGIS10.3",…**

The MUKEY is used to search the soil file for the corresponding soil records, which is then used to generates a soil file (UI.SOL) in “C:\DSSAT46\Soil\”. Not all of the MUKEYs have corresponding records in the soil database, so if the program fails to find a record against a MUKEY, it’ll search for the closest soil record to the user’s location and use that information to write the sol file.

The format and variable explanation in soil file (UI.SOL) can be found here:

<http://rsetserver.sws.uiuc.edu/docs/N%20Tracking%20Project/Soil%20Data/Champaign%20soil%20data%20sample.xlsx>

Next, the program decides the simulation start date. It is based on either planting date or first nitrogen application date. The program sets simulation date to 5 days prior to the planting or fertilizer application date, whichever is earliest. This simulation start date is also used in weather module to prepare daily weather data file for DSSAT simulations.

**weather.m:** Based on the simulation start and end dates for the user defined location, the weather module generates a weather file (UINT1601.WTH) in “C:\DSSAT46\Weather\” for the entire simulation period. For each day of each month of each year within the simulation period, the program reads a csv file ‘yyyy-mm-dd.csv’ inside of each day’s folder and find a record corresponding to the user’s selected location and writes that information to the DSSAT’s weather file, UINT1601.WTH. This continues until the simulation end date is reached.

The file structure and explanation of each variable in the weather file (UINT1601.WTH) is explained in the doc file “DSSAT Input Weather Data Format.docx” that can be downloaded from:

<http://rsetserver.sws.uiuc.edu/docs/N%20Tracking%20Project/Weather%20Data/WEATHER%20DATA%20file%20format.docx>

In addition to soil and weather data, DSSAT requires information about initial soil conditions at the site where simulations are needed to be run. This information however, is not readily available. The N-Track program has collected initial conditions for 6 sites scattered across Illinois and therefore complete DSSAT input files (FileX) exists only for these six sites. The program is set to use the initial conditions from one of the six sites that is nearest to the user’s location. This can be changed later as more data is available in future. The FileX from the nearest station is used in the process\_filex.m module to update the soil, weather, location information, along with planting date, end date, and fertilizer applications in the FileX.

**process\_filex.m:** This function will update required information in the DSSAT’s input file (FileX). The information includes cultivar ID and name, soil and weather information, lat/long, fertilizer application, planting date, and simulation starting date among other. The output from this function is a file ready to be used in the DSSAT.

The processes performed in this module include:

1. Checking existence of the selected cultivar in the database. If it is a new cultivar, a new record will be added to the cultivar file (C:/DSSAT46/Genotype/MZCER046.CUL).
2. Update the cultivar ID and name in the FileX
3. Update soil and weather IDs in the fileX
4. Add latitude and longitude to the FileX
5. Update fertilizer application(s) dates, rates and depths
6. Update planting and simulation start dates
7. Update initial condition date
8. Update simulation end date (harvest date)

The FileX’s file structure and explanation of variables are provided in the help document that can be accessed from the following link:

<http://rsetserver.sws.uiuc.edu/docs/N%20Tracking%20Project/FileX%20format.docx>

Finally, DSSAT simulations are run using the updated FileX, and a plot of output is generated in the user’s folder.

# **Program Flow Chart**

