

MEGAN3 Data Portal and Pre-processor Users Guide

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The latest version of this guide and any updates to the code and input data availability are described at the MEGAN website:
sites.google.com/uci.edu/bai/megan.

The Model of Emissions of Gases and Aerosols from Nature version 3 (MEGAN3) modeling system illustrated in Figure 1 was developed to estimate time series of local, regional and global geogridded estimates of biogenic emissions. The MEGAN modeling system consists of three main components:

- Input Data (CSV and NETCDF) and pre-processor (FORTRAN code)
- MEGAN Emission Factor Processor (python code)
- MEGAN Emission Estimator (FORTRAN code)

This document describes the MEGAN3 Input data and Pre- Processor code. Additional User guides are available for the MEGAN Emission Factor Processor and the MEGAN Emission Estimator.

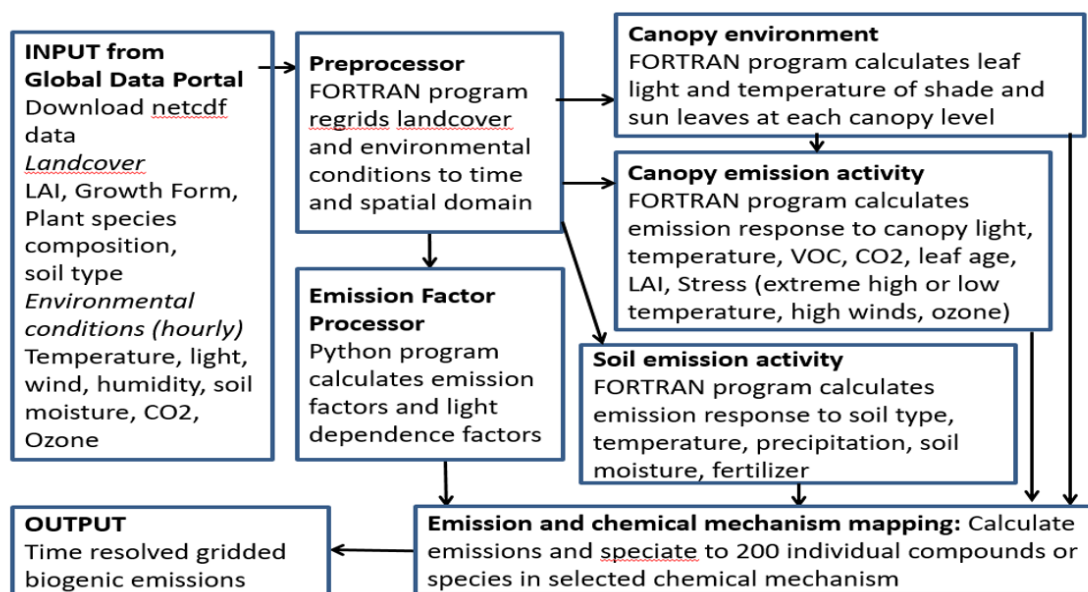


Figure 1. Schematic of the MEGAN3 modeling system.

MEGAN3 Data Portal and Preprocessor: Data sets required to drive MEGAN3 and MEGAN3EFP are provided in the MEGAN3 data portal. FORTRAN code for regridding the base data to provide the average values for each location within a user specified grid is also provided. Guidance for using MEGAN3 base data and regridding is given in the MEGAN3 Data Portal and Preprocessor User Guide.

MEGAN3 Emission Factor Processor (MEGAN3EFP): MEGAN3 driving variables includes estimates of emission factors (EF) and light dependence factors (LDF) for each of the 20 MEGAN3 emission categories (e.g., isoprene, monoterpene type 1, carbon monoxide, etc.) for each location in a model domain. The MEGAN3EFP generates these geogridded EF and LDF inputs using procedures described in this document (the MEGAN 3.0 Emission Factor Processor User Guide). The MEGAN3EFP also compiles lists of vegetation specific emission factors and light dependence factors that can be used for assessing the values used in a MEGAN3 simulation.

MEGAN3: This is a FORTRAN code that inputs driving variables and outputs biogenic emission rates. Guidance for running MEGAN3 simulations is given in the MEGAN3 Users Guide.

Introduction

The driving variables for the MEGAN model are described here along with directions for accessing regional to global datasets. This includes input and output data for a MEGAN3 case study. This document also describes the pre-processor that can be used to regrid the MEGAN3 base data to a user defined domain.

I. MEGAN Data and Code

The MEGAN Data Portal has the following folders and data:

User Guide Folder

This folder contains a User Guide for each of the three MEGAN3 components

Code Folder

This folder contains code for the three MEGAN3 components:

- *MEGAN_PP3.zip* is the pre-processor that regrids the base data to provide the average values for each location within a user specified grid.
- *MEGAN_EFP3.zip* is the emission factor processor that generates EF and LDF inputs. The MEGAN3 preprocessor (i.e. *MEGAN_PP3.zip*) needs to be run before the emission factor processor.
- *MEGAN3.zip* contains FORTRAN code for the MEGAN3 emission estimator component that inputs driving variables, calculates emissions and outputs biogenic emission rates. The MEGAN3 Emission Factor Processor (i.e. *MEGAN_EFP3.zip*) needs to be run before the emission estimator.

Input Folder

This folder contains gridded landcover and other variables (e.g. W126, soil moisture) used to drive emission variations in MEGAN. The data are currently available in NETCDF format with spatial resolutions ranging from ~1 to 36 km.

Data format and spatial resolution:

All input files (except the optional W126 data) are in netcdf format with a spatial resolution of 30 seconds latitude X 30 seconds longitude (about 1 km). W126 has a spatial resolution of 36 km.

Case Study:

This folder contains inputs and outputs for an example case study that users can use to test their implementation of MEGAN.

II. Preprocessor for re-gridding MEGAN input data

The input files accessed from the MEGAN data portal have a spatial resolution of 30 seconds latitude by 30 seconds longitude. Users can use the preprocessor FORTRAN code to re-grid these base data to fit with the domain definition of their model simulation.

Software Requirements

Running the preprocessor will need to following system and software requirements:

- LINUX/UNIX operating system
- csh/sh scripting language
- FORTRAN90 compiler, i.e. pgi
- Netcdf 3.6.0 or greater
-

Data Requirements

- (1) LAI data: Leaf Area Index (LAI) averaged over vegetation covered surfaces.
LAIgl2008.ncf.zip contains monthly global LAI data for 2008
LAIlna2013.ncf.zip contains 30 arc-second and 8-day average LAI input files for North America for 2013 based on NASA MODIS data.
- (2) Growth form data: global 30 arc-second growth form data for trees (trees30s_reorder_lat.nc), shrubs (shrb30s_reorder_lat.nc), grasses (gras30s_reorder_lat.nc), and crops (crop30s_reorder_lat.nc). Two additional files (NTfrac_reorder_lat.nc and tropfrac_reorder_lat.nc) are used to differentiate broadleaf vs needleleaf trees and tropical vs temperate trees.

- (3) Ecotype data: global 30 arc-second ecotype data (`ecotyp30s_reorder_lat.nc`).
- (4) W126 data (optional): US 36km W126 data (`W126_RPO36_0.3degree.nc`). This input file is optional. If user does not want to enable air quality stress on emissions, this input file is not needed.
- (5) `wrfinput_d<nn>` or `wrfoutput_d<nn>`: Initial condition file or output file from WRF; `<nn>` represents a two-digit integer number, indicating the WRF domain. This file is simply used for grid definition.
- (6) a namelist file: see `prepmegan4cmaq.inp` as an example. This namelist file defines the subdomain of WRF on which to run MEGAN and other variables related to directory settings.

Program operation

(1) Compilation

- Modify the file `make_util` under `/src` to set user's own FORTRAN compiler and NetCDF library path
- Run the following commands to compile the code:

```
>make_util prepmegan4cmaq_lai.x  
  >make_util prepmegan4cmaq_grwform.x  
  >make_util prepmegan4cmaq_ecotype.x  
  >make_util prepmegan4cmaq_cantype.x  
  >make_util prepmegan4cmaq_w126.x
```

(2) Modifying namelist file (`prepmegan4cmaq.inp`)

(3) Running the pre-processor

```
>./prepmegan4cmaq_lai.x < prepmegan4cmaq.inp >  
lai.log  
  >./prepmegan4cmaq_grwform.x < prepmegan4cmaq.inp >  
grwform.log  
  >./prepmegan4cmaq_ecotype.x < prepmegan4cmaq.inp >  
ecotype.log  
  >./prepmegan4cmaq_cantype.x < prepmegan4cmaq.inp >  
cantype.log  
  >./prepmegan4cmaq_w126.x < prepmegan4cmaq.inp >  
w126.log
```

Output files: all output files are in csv format. Note that regridded growth form and ecotype files are needed as inputs for the MEGAN3 Emission Factor Processor.