Instructions for running AEZ-EF

9/13/2018 (updated 12/12/2019)

Introduction

The Agro-ecological Zone Emission Factor (AEZ-EF) model is an emission accounting model originally designed for California Air Resources Board (CARB) for calculating induced land use change emissions based on GTAP-BIO results. The model has been updated several times since the very original version (Plevin, Gibbs, Duffy, Yui, & Yeh, 2014a). The current version of the AEZ-EF model was created in collaboration with Richard Plevin in May 2017, aiming to incorporate cellulosic crops and to provide model updates based on an earlier version from Plevin, Gibbs, Duffy, Yui, and Yeh (2014b). The AEZ-EF is compatible with the GTAP-BIO model which was used for estimating aviation biofuels induced land use change (ILUC) emissions for CAEP/AFTF tasks. This version of the AEZ-EF model runs in the Python environment. AEZ-EF reads GTAP-BIO results (.upd files) and calculates ILUC emission intensities for biofuel pathways. The model is documented in Plevin et al. (2014b) and an attached Note ("AEZ-EF Model Notes v4.pdf"). With default parameters, the Python version AEZ-EF should generate the same results with Excel version AEZ-EF v52 for non-cellulosic biofuel pathway. Cellulosic crops were not introduced into the excel version as the interpolated land transition matrices became considerably large after including cellulosic crops as new land covers. Furthermore, the new (Python) version of AEZ-EF that includes cellulosic crops were develop for the work for the Alternative Fuels Task Force (AFTF) of International Civil Aviation Organization (ICAO) by Richard Plevin, Xin Zhao, and Wally Tyner. Other important changes were made since the initial development, as documented in Zhao (2018), e.g., palm and cellulosic crops related biomass factors, peat oxidation, and unused crop land emissions. Though those parameter changes are not updated in this version of AEZ-EF, the parameters for cellulosic biomass carbon updated (to reflect the higher sequestration in perennial crops) in AFTF work are provided in cropspecAFTF7.har under the luc folder.

In this document, we provide instructions for running the Python version AEZ-EF for estimating biofuel ILUC emissions. Please contact Xin Zhao (xin.zhao@pnnl.gov) or Wally Tyner (wtyner@purdue.edu) for questions.

Software requirement

The current Python codes are compatible with Python 2.7.13. Note that part of the codes may not work with later versions of Python without installing new packages. Users are recommended to install Anaconda2-4.3.1 (https://repo.continuum.io/archive) in which Python 2.7.13 is included. Any Python IDE can be used per user's preference, while PyCharm (https://www.jetbrains.com/pycharm/) is recommended. Both Python and PyCharm are free of charge.

AEZ-EF installation and configuration

Once Python and IDE (PyCharm) are properly installed, the installation and configuration of AEZ-EF can be started with following steps:

1. Copy the "aez-ef" folder in Dropbox to user's home directory.
2. In "aez-ef" folder, open CMD Prompt to run commend "Python setup.py develop".
3. Open IDE (PyCharm) to check Working directory and Script path under "ci" configuration.
4. Copy the "aezef.cfg" from Dropbox to user's Home directory.
5. Open "aezef.cfg" with text to update the GtapDir and OutputDir paths. Note that GtapDir is the place GTAP-BIO results are stored and OutputDir is the place storing AEZ-EF outputs. The two can be the same. In the aezef.cfg, sample experiments (also see model notes v4) have been set up.
6. Users are recommended to create a folder for GtapDir for storing all GTAP-BIO results. In this folder, it needs to include GTAP-BIO basedata.har (need to rename basedata7.har to basedata.har), sets.har, and all .upd results from GTAP-BIO.
7. Then open CMD Prompt from home directory to run comment "ci –h", the following lines should show up.

Run the AEZEF model
Optional arguments:
-h, --help show this help message and exit
-d, --dumpData Dump intermediate data to a file for debugging.
Default is the value of config variable
LandChangeDumpData, currently "False"
-e name, --experiments name
The name of the GTAP experiments to evaluate. Default
is the value of config variable Experiments.
-L (debug,info,warn,error,critical,fatal), --logLevel (debug,info,warn,error,critical,fatal)

The logging level. Defaults to the value of config variable LogLevel, currently set to "warn".

-o OUTPUTDIR, --outputDir OUTPUTDIR
Where to save aggregated CSV files and resulting plots

-p, --plot Plot summary figures

Running AEZ-EF

Since the experiments have been set up in the configuration file, users can use comment "ci" in CMD Prompt to output emission result for the pathways run in GTAP-BIO. There are three experiments: USAVSWG, USAVPOP, and USAVPOP. The emission results for these pathways would show up directly in the CMD Prompt if using "ci" commend.

Users can also use "ci –e" plus the experiment name to run AEZ-EF for a specific experiment. Furthermore, two other options, "-d" and "-p", (e.g., "ci -d") would permit AEZ-EF to output more data information about land transitions and associated emissions. Besides the results provided in CMD Promopt, AEZ-EF automatically creates a folder for each experiment. The folder includes more detailed land transition and related emissions results (see datalog.xlsx and landchange.har).

Note that important parameter used in AEZ-EF are included in python codes and aezef.param under the aezef folder. For instance, the peat oxidation parameter, MalaIndoPeatEF, is 60.8, as updated in the AFTF work.

References

Plevin, R., Gibbs, H., Duffy, J., Yui, S., & Yeh, S. (2014a). *Agro-ecological Zone Emission Factor (AEZ-EF) Model (v47)*.

Plevin, R., Gibbs, H., Duffy, J., Yui, S., & Yeh, S. (2014b). *Agro-ecological Zone Emission Factor (AEZ-EF) Model (v52)*.

Zhao, X. (2018). *A Comprehensive Analysis of Estimating Land Use Change Emissions Induced by Global Aviation Biofuels Production Using Economic Equilibrium Models.* Purdue University, Retrieved from https://docs.lib.purdue.edu/dissertations/AAI10844380/