

HESfire model

Readme file: general documentation of the model and support to run it.

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Model description

The description of the HESfire model and its parameterization procedure are detailed in the following publication:

Le Page, Y., Morton, D., Bond-Lamberty, B., Pereira, J. M. C. and Hurtt, G.: HESFIRE: an explicit fire model for projections in the coupled Human–Earth System, Biogeosciences Discussions, 11(7), 10779–10826, 2014.

Running the model

1. Software requirements

You will need a python installation (tested on Python 2.7) with the numpy and scipy modules.

2. Input data

An example of input data is provided with the model over a few grid-cells to illustrate the format they should have. There's 3 types of data:

- Static: their value doesn't change in time within a single run: GDP, landuse and landcover
- Monthly: monthly precipitation as a fuel proxy, and monthly observation-derived burned areas for the optimization algorithm.
- Daily: night-time and day-time data (one file each) for soil moisture, relative humidity, temperature, lightning strikes and wind.

All these data are formatted in 2-D matrices, with grid-cells as rows and time slices as columns. The first 2 rows are used to store time information, while the first 4 columns are used to store geographical coordinates. The rest is the data:

				Time A	Time A	Time A
				Time B	Time B	Time B
Latitude index	Longitude index	Latitude	Longitude	1.2	3.2	1.6
Latitude index	Longitude index	Latitude	Longitude	2.1	6.8	9.01
Latitude index	Longitude index	Latitude	Longitude	0.1	2.3	2.2

IMPORTANT: The model does not check whether your different files contain the same grid-cells in the same order. All your input files should have the same number of rows in the same order.

For all 3 types of files, Time A is the year. Time B is irrelevant in the case of static data, but indicates the month for monthly data, and is again irrelevant for daily data.

Latitude and longitude are in degrees. They are important in the model to calculate the size of the grid cells (changes with latitude).

Latitude index and longitude index are irrelevant to the model, I use them for mapping purposes.

The first 8 cells left blank in the table are irrelevant to the model (again I store some information there for other purposes).

3. User inputs (see 1. User inputs in the code)

The code is commented but efforts will be made to improve user-friendliness. Overall, here are the main things you will have to modify:

- Paths for input/output files.
- Spatial/temporal extent of your run. By default, the model will run with all the grid-cells you've provided in the input files. However, you can provide a "maskfile", which is a global map (at the resolution of your run), with 1 in the grid-cells you want to include, zero or any other value otherwise.
- Parameters: you can modify the value of the parameters, and can also decide which fire-drivers you want to include in your run. For example, if you don't want to include soil moisture as a driver, turn it off with changing the value of "usemoist" to 0. This is possible with a limited number of drivers.
- Optimization: in that section, you can decide which parameter you want to optimize, and change some parameters of the optimization.