

# Easy Volcanic Aerosol (EVA v1.0): users guide

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## Structure

The EVA package is composed of:

1. The mo\_EVA.f90 FORTRAN module: this holds all the subroutines used to calculate volcanic forcing
2. Three input files in netCDF format:
  - a. EVA parameter set, specifying the values to be used for the parameterizations in the mo\_EVA routines
  - b. An eruption history file, specifying the date, location, stratospheric sulfur injection (in Tg S) and, optionally, the hemispheric asymmetry factor to be applied to each eruption.
  - c. A lookup table, containing the scaling factors to convert  $EXT_{550}$  and  $r_{eff}$  to wavelength dependent EXT, SSA and ASY based on Mie Theory.
3. The FORTRAN program “eva\_build\_sulfate\_file.f90”, which builds a “sulfate” file specifying the timeseries of sulfate in the equatorial, NH and SH regions based on the eruption history input file and EVA’s three-box model transport scheme.
4. The FORTRAN program “eva\_build\_forcing\_files.f90”, which builds aerosol property (or “forcing”) files from the sulfate timeseries.
5. A netCDF file containing specifications of the grids to be used in the output of EVA, i.e., latitude, and wavelength.

## Compiling

The FORTRAN routines all make use of the netCDF FORTRAN library, and so need to be linked to the library upon compilation. Use gfortran (as below), or your favorite FORTRAN compiler. The variable NETCDF=... (/usr in the example below) must point to your local netCDF installation:

```
>> NETCDF=/usr
>> gfortran -c mo_EVA.f90 -I${NETCDF}/include
>> gfortran -o eva_build_sulfate_file eva_build_sulfate_file.f90
mo_EVA.o -I${NETCDF}/include -L${NETCDF}/lib -lnetcdff
>> gfortran -o eva_build_forcing_files eva_build_forcing_files.f90
mo_EVA.o -I/usr/include -L/usr/lib -lnetcdff
```

Pay careful attention to the L and I flags required on your system.

For more information, see:

[http://www.csar.cfs.ac.uk/user\\_information/software/environment/guide.book.pdf](http://www.csar.cfs.ac.uk/user_information/software/environment/guide.book.pdf)  
<https://www.unidata.ucar.edu/software/netcdf/netcdf-4/newdocs/netcdf-f90.html>  
[http://web.utah.edu/thorne/computing/Examples\\_netCDF.pdf](http://web.utah.edu/thorne/computing/Examples_netCDF.pdf)

## Running

### Step 1: build sulfate file

The script “eva\_build\_sulfate\_file.f90” reads the eruption history file, and based on the parameter settings in “EVA\_v1\_parameter\_set\_v1.0.nc”, builds a timeseries of sulfate mass, saved in file “eva\_sulfate\_timeseries.nc”.

Once compiled, simply run the script:

```
>> ./eva_build_sulfate_file
```

### Step 2: build forcing files

The script “eva\_build\_forcing\_files.f90” builds yearly volcanic aerosol “forcing” files, with aerosol optical properties as a function of time, latitude, height and wavelength. Once the sulfate file is produced via step 1, and “eva\_build\_forcing\_files.f90” is compiled, simply run the script:

```
>> ./eva_build_forcing_files
```

As a default, this script produces forcing files for the years (YYYY) 1991 through 1995, as “eva\_forcing\_echam\_T63\_sw\_YYYY.nc”.

## Modifications

### New input files

Any of the input files can be readily swapped for alternative files, by changing the filenames given in the mo\_EVA.f90 module and recompiling the module. This can be done to change the source of eruption histories, change the parameter setting of EVA, or change the Mie lookup tables. Care must be taken that the variable names and dimensions of the new input files are identical to those of the default input files.

### Change time range

To modify the timespan of forcing files produced, simply adjust the start and end years in the “eva\_build\_forcing\_files.f90” script, recompile and run. Note that the start and end years given here must be within the years of the sulfate file produced prior. The time range of the sulfate file can be similarly adjusted in the “eva\_build\_sulfate\_file.f90” script.

### Different model set ups

Modifying the output of EVA to different model specifications is possible by supplying an alternate “grid file” in the running of the “eva\_build\_forcing\_files” routine. Care must be taken that the variables in the new grid file have the same names and dimensions as the default grid files (based on the ECHAM model specifications).