**Scripts for Probabilistic maps – by ALESSANDRO TADINI**

* Check whether all the python and .sh files are into the working directory
* In the “parameters\_range\_Probmap.py” you have to set the ranges of the parameters
  + The paroxysm duration, the rest of the eruption duration, the Mass flow rate of the paroxysm, the Mass flow rate of the rest of the eruption and the Plume Height have three values for a sampling from a triangular distribution: these values will be most likely the elicited ones, for which we will have three values corresponding to the 5th, 50th and 95th percentiles
  + There are two “flags”, the “paroxysm\_flag” (if it is 1 then the eruption will be considered with an initial “paroxysmal” phase with a higher mass flow rate and the rest of the eruption with a lower constant mass flow rate; if it is 2 the eruption will be considered with a fixed mass flow rate) and the “plumeheight\_flag” (with 1 the code will use the mass flow rate, with 2 the code will use plume height as input instead of mass flow rate)
  + Water mass fraction, rho1, rho2, cp\_part, shapefactor are sampled randomly at each iteration
  + For the Total Grain Size Distribution (TGSD) at each iteration it is sampled a distribution starting from a mean, a standard deviation, a skewness and a kurtosis
  + In this file it has to be defined the number of iterations, the folder name where the python scripts are located, the 5 values of mass loadings for which you want to create the probabilistic maps, the meteo file name, the meteo data source (different meteo databases, like the GDAS, the REANALYSIS or the ECMWF ), the start/end year of the meteo data
* In the “input\_file\_template\_Probmap.py” you can edit the fixed parameters.
* There are two versions of the executable:
  + the “run\_prob\_map.sh”:
    - Check the number of iterations given into the parameters\_range\_Probmap.py
    - Check the meteo\_type (line 24), the paroxysm flag (line 25), the plumeheight flag (line 26) given into the parameters\_range\_Probmap.py
    - Sample the durations (“python sample\_duration.py”, line 27)
    - Sample the emit times (start/end/endemission dates, in the format yy, monmon, dd, hh, minmin) at line 28 (sample\_emittimes\_1.py, sample\_emittimes\_2.py, sample\_emittimes\_3.py according to the meteo type)
    - Sample the Mass flow rate (line 29, sample\_mfr\_1.py if paroxysm is included, sample\_mfr\_2.py if paroxysmn is not included)
    - Sample the TGSD (line 30, sample\_TGSD\_sk\_kur.py). There are also older version that simply sample a TGSD with a normal distribution starting from a mean and a standard deviation (sample\_TGSD.py) and with mean, std and skewness only (sample\_TGSD\_sk.py)
    - It creates a new input\_file choosing between “input\_file\_generator\_Probmap\_1.py” (Mass Flow Rate) or “input\_file\_generator\_Probmap\_2.py” (Plume Height)
    - It runs PLUME-MoM+HYSPLIT (lines 21-77)
    - It creates a file with 1 or 0 if at each node of the sampling grid the value of mass loading is overcome or not. It does this for each of the mass loadings defined in the parameters\_range\_Probmap.py (line 79, python create\_file\_for\_Probmap.py)
    - It cleans the unnecessary file after each iteration (line 81, “python clean\_all\_intermediate.py”)
    - After the end of all the iterations it joins all the files created after each iteration into a single one (line 84)
    - It clean all the unnecessary files after the end of the process (line 85)
  + the “run\_prob\_map\_months.sh”:
    - basically it does the same things as the basic version except that it runs the same number of iterations in each month – in this case it should be considered that the number of iterations should be divisible per 12