Stochastic Weather Generator MultiWG User Guide

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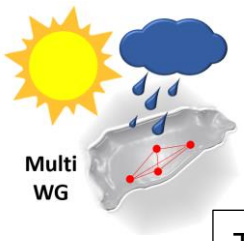
Program by request to the author.

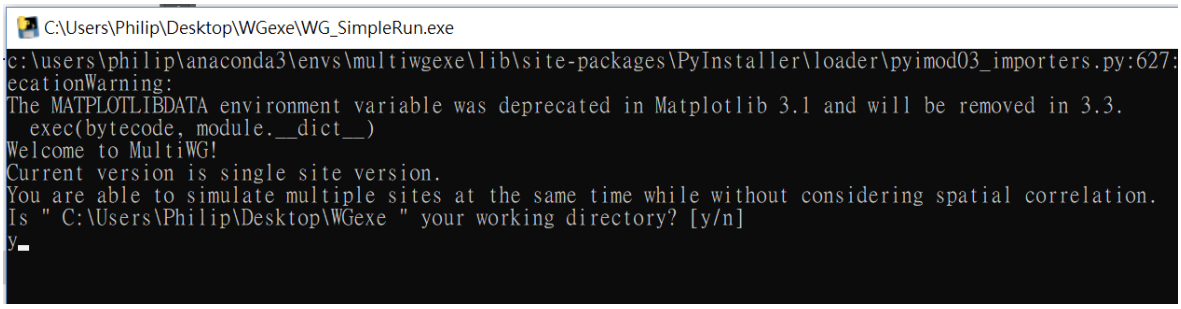


This version only supports single site.
Multi-site will be simulated independently.

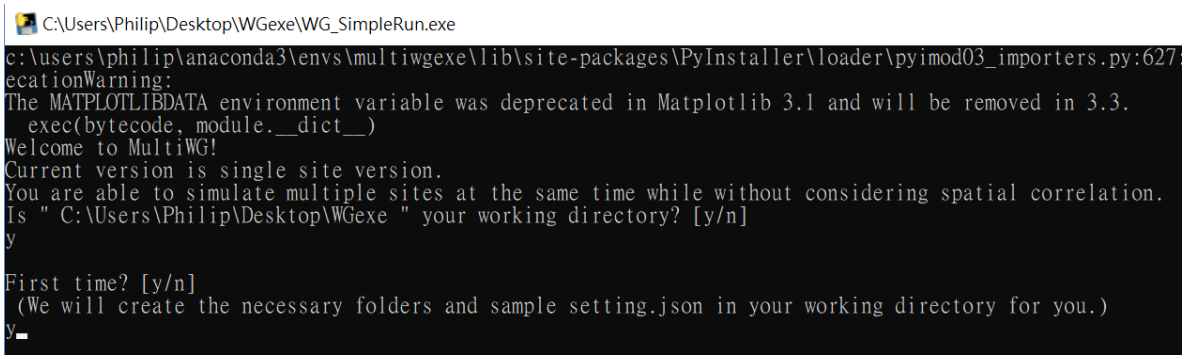
Operating procedures:

1. Click WG_SimpleRun.exe and wait the program to start

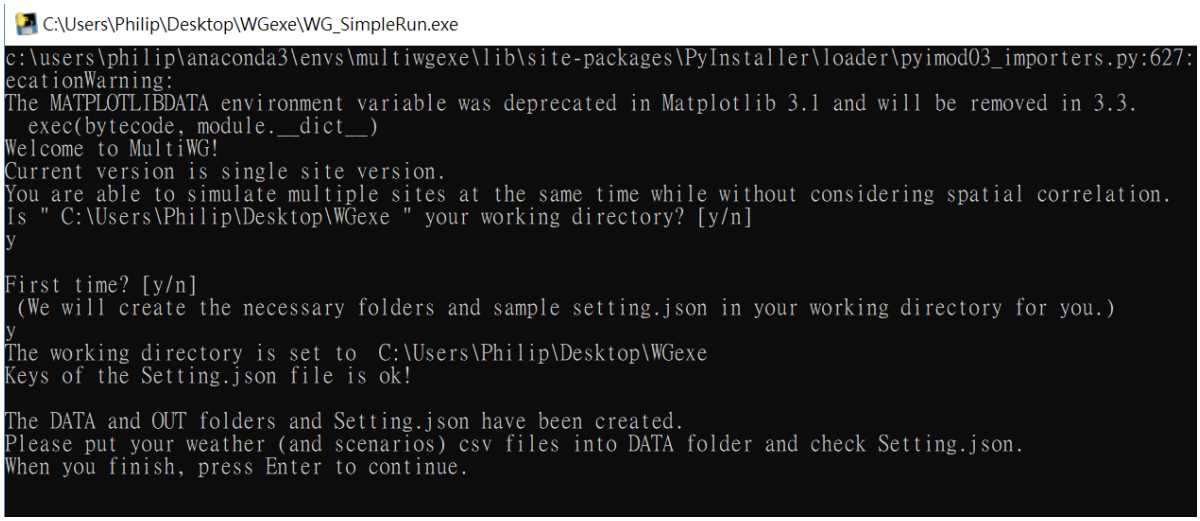
2. Check your working directory (WD). MultiWG will use current directory as default working directory. If not enter "n" and provide your WD.



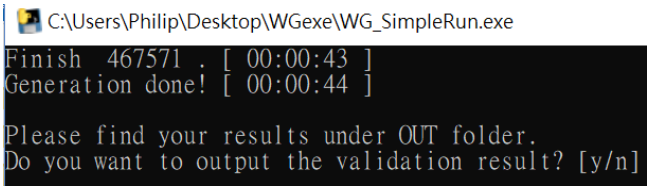
3. If this is your first time using this WD then enter " y". The program will create file and folders for you.



4. Following the instruction check Setting.json (open with notepad++) and put observed data (and scenario data) into DATA folder. (Sample files for observed weather data and scenario data are provided. Please make sure the column names (for weather variable please see appendix) are same as sample files.



5. All output files will be in “OUT” folder. If it is Baseline simulation ("ClimScenCsvFile":None), MultiWG will ask you weather to conduct validation. If “y”, validation outputs will be in “OUT” folder as well.



6. Press “Enter” to quit the program.

Output files:

1. Generated weather data file 467571_20190824_153708.csv. **Notice that the year in column A is only for distinguishing leap year.** Wth_gen_20190824_153708.pickle is the same output in python data format, pickle.

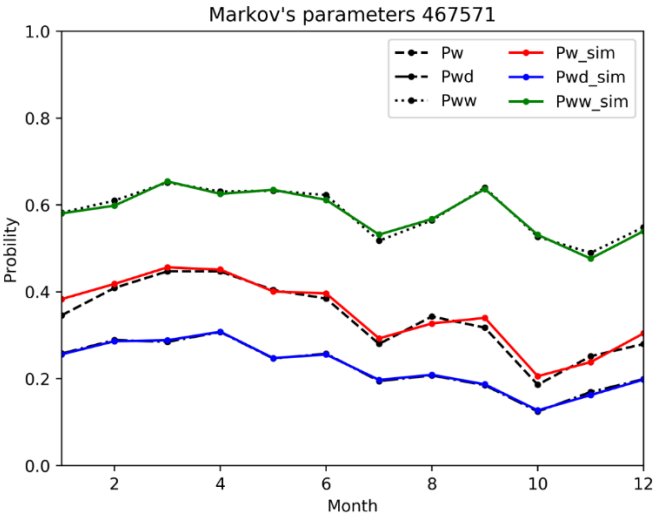
	A	B	C	D	E	F	G
1		PP01	P_Occurai	TX02	TX04	TX01	
2	2001/1/1	0	0	19.04602	13.8976	15.81171	
3	2001/1/2	1.38606	1	14.01367	10.93783	13.41666	
4	2001/1/3	3.258332	1	11.83628	10.89485	11.36556	
5	2001/1/4	0.755899	1	15.29001	11.91641	13.53764	
6	2001/1/5	0.166833	1	17.11414	11.44976	15.5196	
7	2001/1/6	6.858009	1	12.90692	11.09507	12.05495	
8	2001/1/7	4.007794	1	9.842909	8.662683	9.252796	
9	2001/1/8	3.029688	1	11.07253	9.244052	10.2732	
10	2001/1/9	0	0	13.8093	9.833326	12.37234	

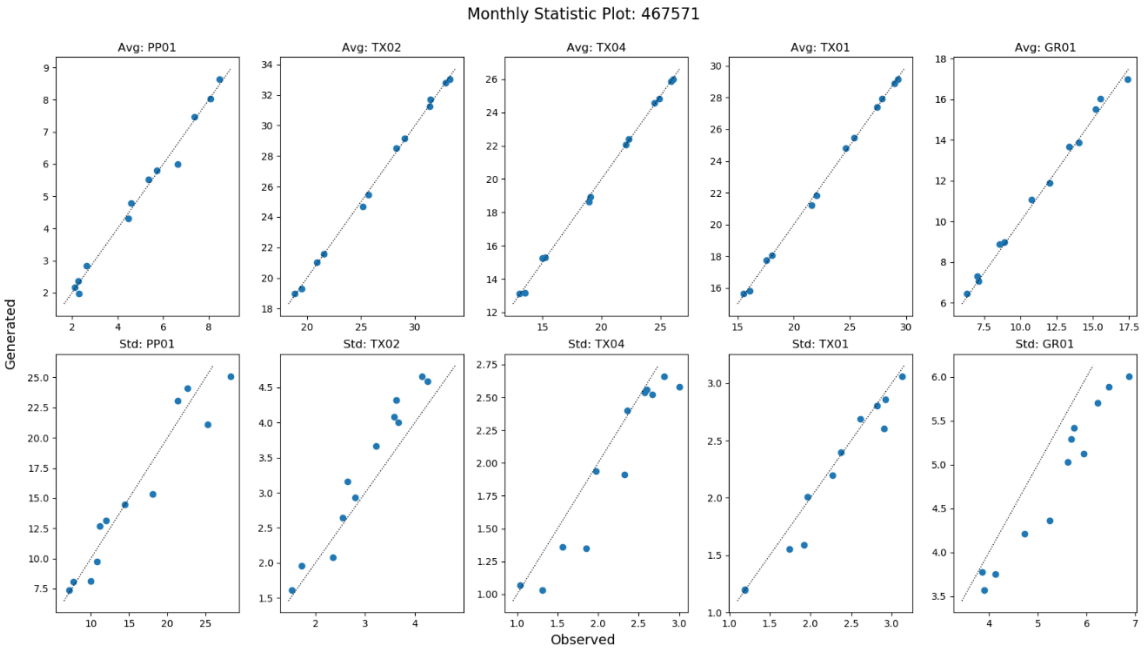
2. Validation results (1000-year simulation)

KruskalPrepDistTest467571_20190824_152459.csv
MCplot 467571_20190824_152513.png
MonthlyStatPlot 467571_20190824_152454.png

They are Kruskal test for consistency of rainfall distribution between the observed and generated data, Markov' s parameters for rainfall events, and monthly mean and standard deviation.

	pvalue	statistic	result
0	0.22182	1.492555	Pass
1	0.571857	0.319586	Pass
2	0.236632	1.400547	Pass
3	0.948929	0.004103	Pass
4	0.854886	0.033448	Pass
5	0.148423	2.088382	Pass
6	0.944842	0.004787	Pass
7	0.236697	1.400161	Pass
8	0.477161	0.505344	Pass
9	0.580351	0.305667	Pass
10	0.541623	0.37254	Pass
11	0.284792	1.144081	Pass





Appendix Setting.json instruction

```
Setting_template = {"WDPath": "Working directory",
                    "StnID": ["467571"],
                    #(list of Weather station ID)
                    "WthObvCsvFile": None,
                    #(Default None, which filename = StnID.csv / {"StnID": "filename.csv"})
                    "ClimScenCsvFile":None,
                    #(Default None, which no parameters will be updated / {"StnID":"filename.csv"})
                    "Var": ["PP01", "TX01", "TX02", "TX04"],
                    #(Weather variables: Using Taiwan's Central Weather Bureau standard code.)
                    "P_Threshold": 0.01,
                    #(Seperate dry day and wet day [mm].)
                    "P_Distribution": "Auto",
                    #(Default Auto: Select dist base on BIC and consistency. /
                    # Assign distribution manually => Options: "exp", "gamma", "weibull", "lognorm".)
                    "GenYear": 200,
                    #(Total generation years. If leapYear = True, it has to be a multiple of 4.)
                    "Condition": True,
                    #(Default True for ensuring the order of Tmin & Tmax and Tavg are correct.
                    # If False, the order of generated data (Tmin & Tmax and Tavg) needs to be
                    # checked afterward.)
                    "LeapYear": True,
                    #(Default True. Options for the generated weather data.)
                    "Smooth": False,
                    #(Default False (not open yet!).
                    # Smooth precipitation occurrence and amount coefficients
                    # If P_Distribution = Auto, it will be forced to be False.)
                    "FourierOrder": 2,
                    #(Default 2. The order of the Fourier fitting lines for non-precipitation
                    # variables. Value can be 2 or 3 or 4.)
                    "DumpCheck": True,
                    #(Default True. Check the order of min max mean temperature are right if
                    # Condition is set False. Check other non T or P variable. If it < 0 then
                    # we interpolate it with values of index -2~+2.)
                    "Plot": {"FourierDailyTFit": False,
                             "KSTestCDFPlot": False},
                    #(Default False. Plot control.)
```

"StatTestAlpha": {"PDistTest": 0.05,
"Kruskal_Wallis_Test": 0.05}}
#(Default 0.05. The alpha values for statistic test.)

Appendix Taiwan Central Weather Bureau weather variable code

* CD01 平均雲量(10 分量)	* ST06 固態降水 1
* EP01 箱內蒸發量(mm)	* ST07 固態降水 2
* EP02 箱外蒸發量(mm)	* ST08 固態降水 3
* EP03 A 型蒸發量(mm)	* ST09 視障 1
*** GR01 Radiation (MJ/m2)**	* ST10 視障 2
* GR02 小時最大全天空日射量(MJ/m2)	* ST11 光象 1
* GR03 小時最大全天空日射量時間	* ST12 光象 2
*** PP01 Precipitation (mm)**	* TD01 最高露點溫度(℃)
* PP02 降水時數(hr)	* TD02 最高露點溫度時間
* PP03 十分鐘最大降水量(mm)	* TD03 最低露點溫度(℃)
* PP04 十分鐘最大降水量時間	* TD04 最低露點溫度時間
* PP05 一小時最大降水量(mm)	* TG01 最低草溫(℃)
* PP06 一小時最大降水量時間	* TS01 地中溫度 0cm(℃)
* PS01 平均測站氣壓(hPa) -9999 -9999	* TS02 地中溫度 5cm(℃)
* PS02 平均海平面氣壓(hPa)	* TS03 地中溫度 10cm(℃)
* PS03 最高測站氣壓(hPa) -9999 -9999	* TS04 地中溫度 20cm(℃)
* PS04 最高測站氣壓時間	* TS05 地中溫度 30cm(℃)
* PS05 最低測站氣壓(hPa)	* TS06 地中溫度 50cm(℃)
* PS06 最低測站氣壓時間	* TS07 地中溫度 100cm(℃)
* PS07 最高海平面氣壓(hPa)	* TS08 地中溫度 200cm(℃)
* PS08 最高海平面氣壓時間	* TS09 地中溫度 300cm(℃)
* PS09 最低海平面氣壓(hPa)	* TS10 地中溫度 500cm(℃)
* PS10 最低海平面氣壓時間	*** TX01 Mean temperature (℃)**
*** RH01 Relative humidity (%)**	*** TX02 Max temperature (℃)**
* RH02 最大相對濕度(%)	* TX03 最高氣溫時間
* RH03 最大相對濕度時間	*** TX04 Min temperature (℃)**
* RH04 最小相對濕度(%)	* TX05 最低氣溫時間
* RH05 最小相對濕度時間	* TX06 平均露點溫度(℃)
* SD01 雪深(cm)	* TX07 平均濕球氣溫(℃)
* SS01 日照時數(hr)	* TX08 黑球溫度(℃)
* SS02 日照率(%)	* TX09 氣溫日較差(℃)
* ST01 天空狀況	* VP01 平均水氣壓(hPa)
* ST02 地面狀況	* VP02 最大水氣壓(hPa)
* ST03 雷暴	* VP03 最大水氣壓時間
* ST04 液態降水 1	* VP04 最小水氣壓(hPa)
* ST05 液態降水 2	* VP05 最小水氣壓時間

* VS01 平均能見度(Km)	* WD05 最大平均風風向(360 degree)
* WD01 平均風風速(m/s)	* WD06 最大平均風時間
* WD02 平均風風向(360 degree)	* WD07 最大瞬間風風速(m/s)
* WD03 平均風程(m)	* WD08 最大瞬間風風向(360)
* WD04 最大平均風風速(m/s)	* WD09 最大瞬間風時間