

LASS 專案 - Simulator

LASS Simulator

Current code: <https://github.com/LinkItONEDevGroup/LASS/tree/master/LASS-Simulator>

開發步驟

- 確認執行環境
- 架構設計
- 系統基礎帶起
 - CLI start*
 - Log start*
 - CFG start*
 - simulation installation check*
 - unit test start*
 - start car, Deposition, status with simulation*
 - plot total value*
 - export ESRI for single and animation*
 - 支援初始化地理位置設定
 - limited wind effect*
 - load pm2.5 data from LASS*
 - site filter by lat,lon. load 2 day history*
 - output sensor value to ASC format of recent 2 days in specific area*
 - map initial value load by LASS sensor data average which locate in the map*

需求

希望能有效模擬 PM2.5 感測現象，進而提供一些實驗設計參考

規格

模擬功能

能模擬因人口，車輛的影響

能模擬特定燃燒，工廠排放的影響

能模擬境內與境外之間的移動特性，比方說境外污染影響
能區分高空與低空污染
能模擬下雨，沈積，風，颱風的效應
能模擬特定氣候效應
能模擬特定區域現象
模擬區域特性如地理特性能有標準介面以提供匯入定義
模擬結果能與目前實際感測值做比較
能做小時，天，週，月的模擬

現實結合

匯入目前 LASS 感測值
感測值修正模擬值的歷史記錄
模擬與感測值比對分析功能

系統功能

開源，分享
主設計使用 Python
 使用 SimPy , NumPy
使用者參數集中管理與設定
核心使用 Command line interface
方便客製化設計
支援結果繪出 **ESRI ASCII Raster format**, 能支援動態模擬
工廠資訊匯入

設計

基本

時間單位：分鐘
空間單位：1m 平方，1m 立方
Cfg : 設定參數，包含各個 Producer 的常態特性，動態特性參數
有邊界

Producer

Village : 一般性的，內含人車以及基本產生量
Population : 人口
Car : 車輛
Factory :
Combustion : 特定燃燒

Consumer

Climate : 下雨，颱風等

Deposition : 沈積

Effect

Wind :

Diffusion :

Boundary

邊界只有平均值，沒有累積量

Status

Map : 整張地圖

Position : 固定長寬的空間，用 X@Y 來 index

pm_total : pm 總量

pm_value : pm 量測值 ug/m³

Area : 一堆 Position 的組合

設定

地理

以經緯度範圍設定模擬區域

精細度可選

100m, 1km, 10km

基本演算法

持續 monitor status

Producers 純予特定的產生條件，持續產生

Consumer 持續減少數值

Apply effects

total ↔ value

固定空間大小來當除數

配上高度比例，分成生活段（可量測）與高空段（未量測）

跨邊界效應

邊界以 value 標示，total 無限

污染離開邊界，會更新邊界 value 值

污染由邊界傳入，需計算 value * 時間為傳入量
邊界值可以依模擬條件，隨時更新，或由模擬條件漸進更新

Files/Directories Definition

doc

 README.txt : release note

Codes : codes

Include :

 sim.ini

Output

 ESRI export naming rule:

 output/name_timestamp.asc (ex: abc_20160708210000.asc)

 output/name.xml

 sim.log : system log

Lib : the code that may easy to be reused

test:

sim.py : startup program

帶起步驟設計

Basic fundation, classes/cfg/reporting

車輛與沈積效應的平衡

Wind effect + boundry handler

大地圖， grouping → 走向全台灣模擬

Climate effect

Real data input, real data comparsion

Versions

V0.0.1

 Basic application fundation, CFG, logging, CLI, unit test, simulation

 Quick support Deposition, Car, Population

V0.1

 Export ESRI

 Some setting from file

 Quick wind effect

V0.2

quick load sensor data from LASS
output sensor data by ASC, CSV format
map corner support and device filter
2 day LASS true-data simulation and output for animation

Installation

We use python 3
pip3 install simpy
pip3 install configobj
pip3 install matplotlib
pip3 install numpy
install QGIS (QDSL included, [QGIS web](#))
pip3 install simplejson
pip3 install vincenty

執行

python3 sim.py

Export CSV Format

timestamp,device_Id, SiteName, gps_Ion , gps_lat, PM2_5, PM10, temperature, humidity

timestamp format: yyyy-MM-dd HH:mm:ss

```
# "timestamp": "2016-10-25T00:00:00Z",
# "temperature": 31.61,
# "humidity": 81.14,
# "PM2_5": 7.62,
# "PM10": 9.15
```

Study

[Plot Data Points on a Map](#)

[How to make a movie from a ascii grid files?](#)

[gdal tutorial](#)

[ASCII to Raster](#)

Current Progress

```
wuulong$ python3 sim.py
```

```
FastCLI> help
```

Documented commands (type help <topic>):

```
=====
```

```
about help quit save_esri save_esri_xml set show simrun test
```

```
FastCLI> help about
```

About this software

```
FastCLI> about
```

G.Fast Monitor version: v0.1

```
FastCLI> help save_esri
```

Save map to RSRI ASCII format

```
    save_esri [ name ]
```

; name: export file name prefix

ex: save_esri map

ESRI export naming rule:

name_timestamp.asc (ex: abc_20160708210000.asc)

```
FastCLI> help save_esri_xml
```

Save map to RSRI ASCII xml format

```
    save_esri_xml [ name ]
```

; name: export file name prefix

ex: save_esri_xml sim

ESRI export naming rule:

name.xml

```
FastCLI> help set
```

set scli variable, can be new or update.

```
    set var_name var_value
```

ex: set mac_addr 001122334455

```
FastCLI> help show
```

show simcli variables, if miss variable name, show all

```
    show variable_name
```

system variables list:

```
;log level definition, DEBUG=10,INFO=20,WARNING=30,ERROR=40,CRITICAL=50
log_level_console=20    #the console message log level
log_level_file=40      #file message log level
;device console real time display
dev_console_display=1  #(0) don't display (1) display
```

ex: show mac_addr

FastCLI> help simrun

Start simulation

FastCLI> help test

current debug command

FastCLI>

root : INFO G.Fast Monitor version: v0.0.1

FastCLI> simrun

root : INFO Simulation start!

Simulation Descriptor:

1* deposition -10 every time unit.

1* windset setup wind every 10 time unit.

1* wind process every time unit.

5* population +1 every time unit.

1* factory +10 at (5,5).

root : INFO Map Descriptor:

Current positions count = 100

2016-10-21 16:00:00

2016-10-21 16:01:00

2016-10-21 16:02:00

2016-10-21 16:03:00

2016-10-21 16:04:00

2016-10-21 16:05:00

2016-10-21 16:06:00

2016-10-21 16:07:00

2016-10-21 16:08:00

2016-10-21 16:09:00

2016-10-21 16:10:00

2016-10-21 16:11:00

2016-10-21 16:12:00

2016-10-21 16:13:00

root : INFO Map Descriptor:

Current positions count = 100

200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	

200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	
200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	
200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	
200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	
200.764102	359.642367	467.530781	525.391415	549.639635	1035.
560427	960.594151	835.912018	710.898803	624.919409	
200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	
200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	
200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	
200.764102	359.642367	467.530781	525.391415	549.639635	557.5
50659	559.550197	559.937512	559.993745	559.999596	

pm_total history: [4120.0, 8160.000000000001, 12120.0, 15999.99999999996, 19799.99999999996, 23519.96799999999, 27159.808, 30719.34079999997, 34198.300160000006, 37596.34201599997, 40913.062664191944, 44148.02169651198, 47300.76613795842, 50370.85319979004]

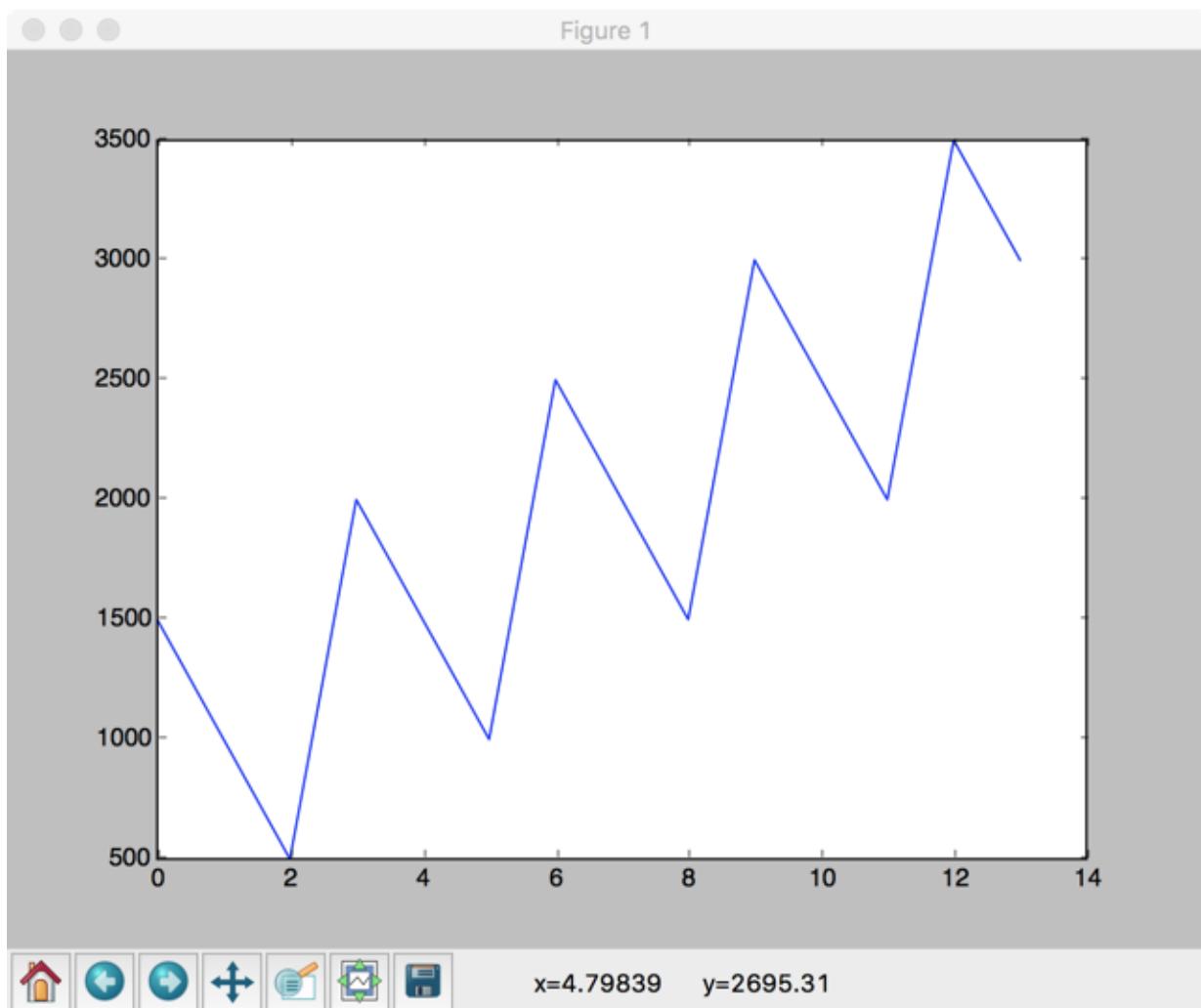
FastCLI>

Documented commands (type help <topic>):

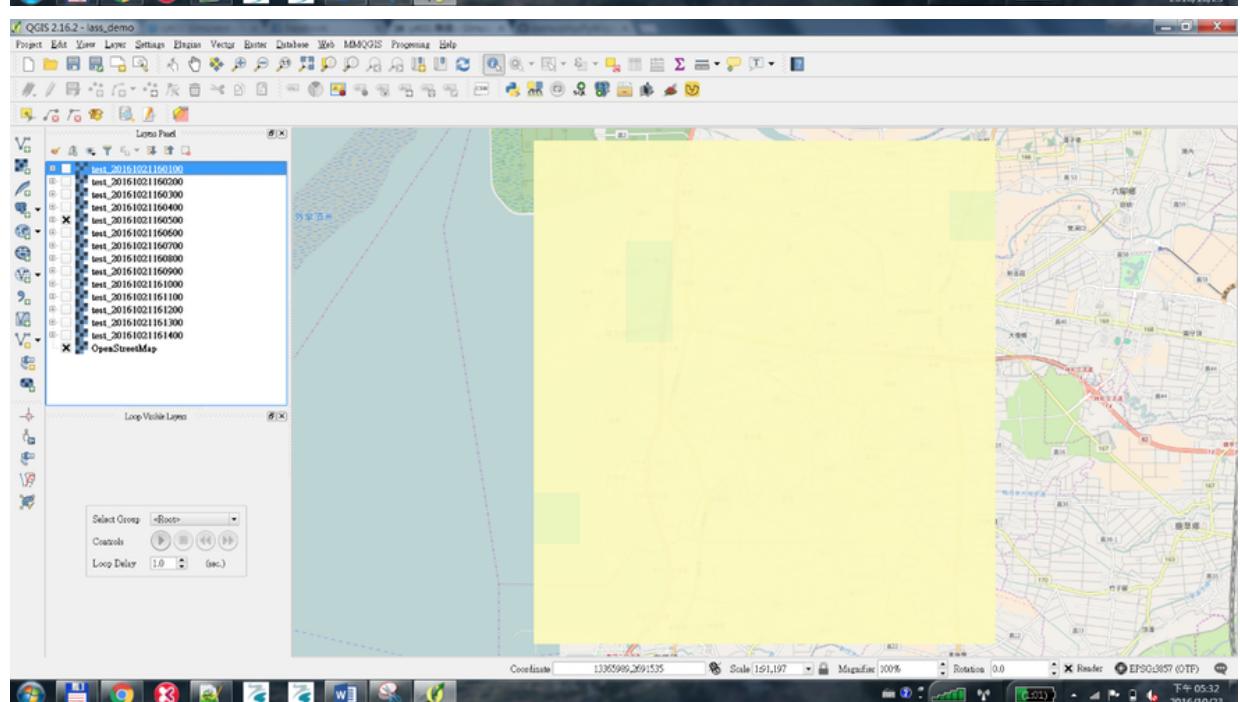
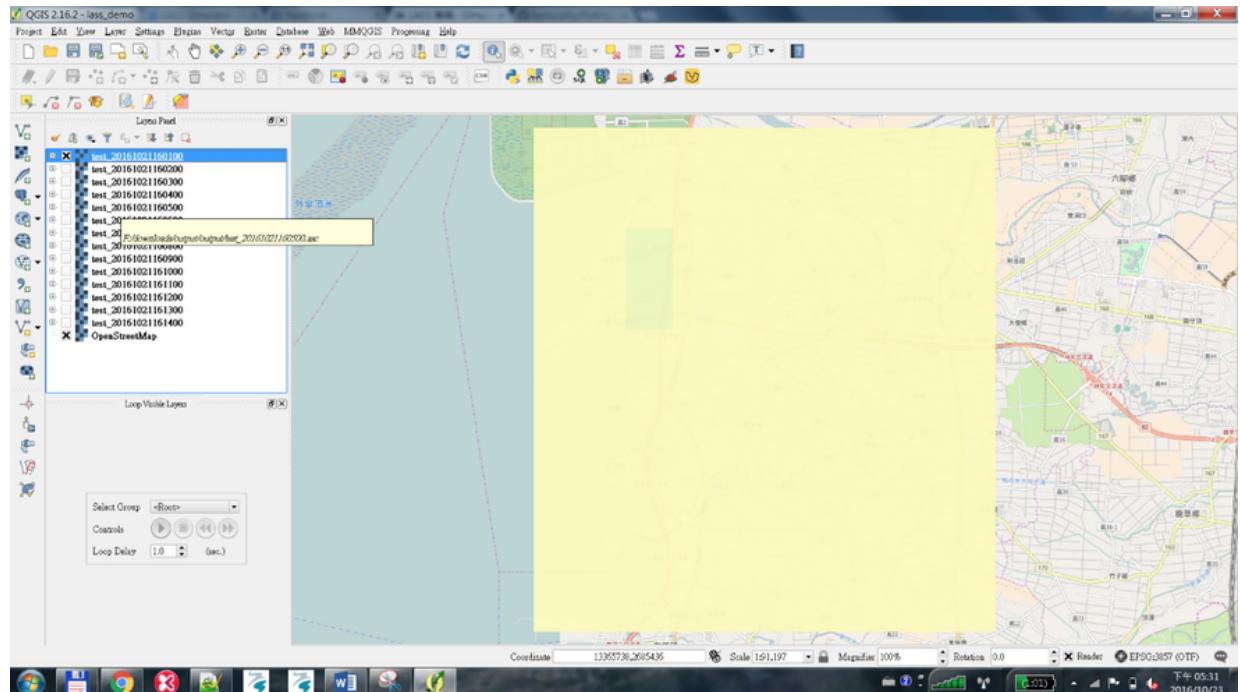
=====

about help quit save_esri save_esri_xml set show simrun test

FastCLI> save_esri_xml test

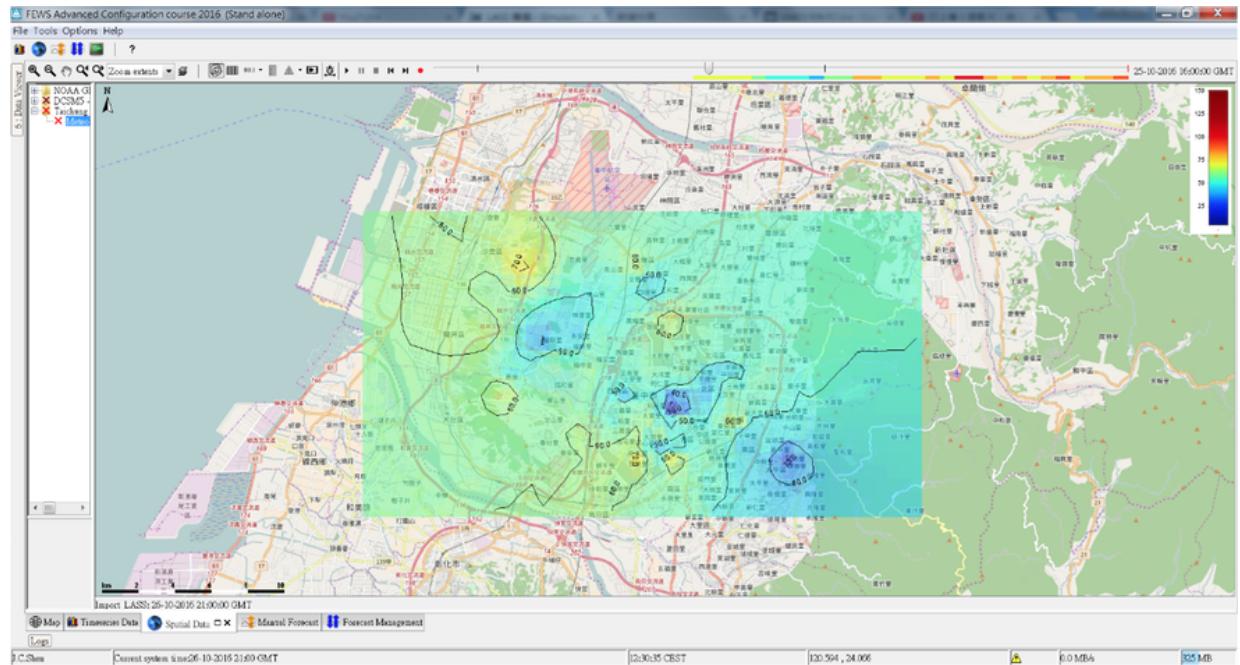


2D Raster Display Sample by QGIS



動態展示方式(內插參數還需修正)

<https://youtu.be/mGEg9AtpmAo>



Problems

3D 問題

基礎參數收集

要讓模擬能稍微接近現實，需要收集滿多相關的參數，這個部分嘗試儘量收集一些資訊，歡迎夥伴補充

資料格式

show the hourly average of a particuylar PM25 device in the past two days:

http://nrl.iis.sinica.edu.tw/LASS/history-hourly.php?device_id=FT1_001

```
{
  "device_id": "FT1_001",
  "feeds": [
    {
      "timestamp": "2016-10-25T00:00:00Z",
      "temperature": 31.61,
      "humidity": 81.14,
      "PM2_5": 7.62,
      "PM10": 9.15
    },
    ...
  ]
}
```

}

參考資料

工具

[SimPy](#)

[GNOME](#)

GNOME (General NOAA Operational Modeling Environment) is the modeling tool the Office of Response and Restoration's (OR&R) Emergency Response Division uses to predict the possible route, or trajectory, a pollutant might follow in or on a body of water, such as in an oil spill.

演算法

[Inverse Distance Weighted \(IDW\) Interpolation with Python](#)

[Pykrige](#)

經緯度坐標轉換與距離計算

距離

[結果例子](#)

[python vincenty](#)

[Difference in destination location between pyproj and geopy](#)

坐標轉換

[TWD97轉WGS84](#)

[Global Forecast System \(GFS\)](#)

