GROW, Interoperability, in situ sensors, Citizen Science and Crowd sourced data

Andy Cobley,

Mel Woods, Drew Hemment/ University of Dundee

Rianne Giesen/ Hydrologic Research BV

The GROW Project

- Overview

- The GROW Observatory (GROW) sets out to demonstrate an operational Citizen Observatory (CO) system for sensing soil.
- GROW attempts to monitor this key parameter for science at a continental scale over an extended period through a CO methodology.
- Soil moisture datasets are accessible and presented in visualisations that can improve decision-making for improved soil health across stakeholders.

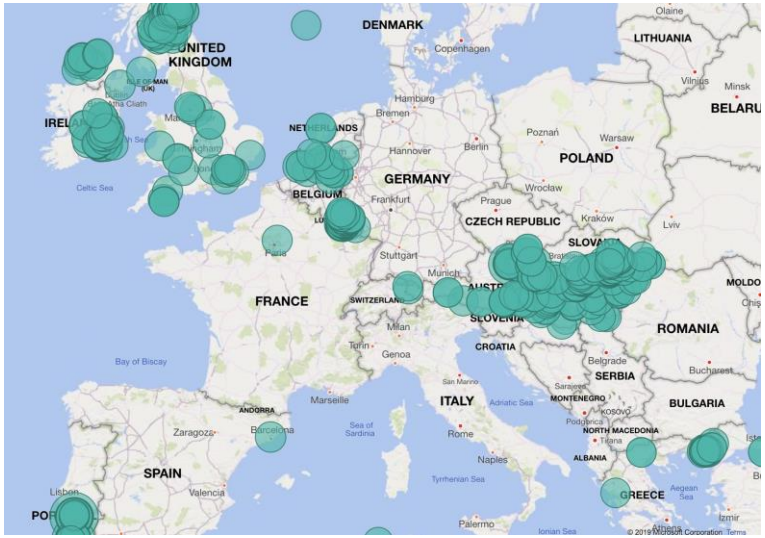
Importance of Soil Moisture

- Soil moisture plays an important role in regulating climate.
- Also climate events such as floods, droughts, heat waves, desertification and wildfires
- These are critical parameter to enable decision-making and changes to practice by citizens, local gov, decision-makers and scientists

Grow Sensor Locations

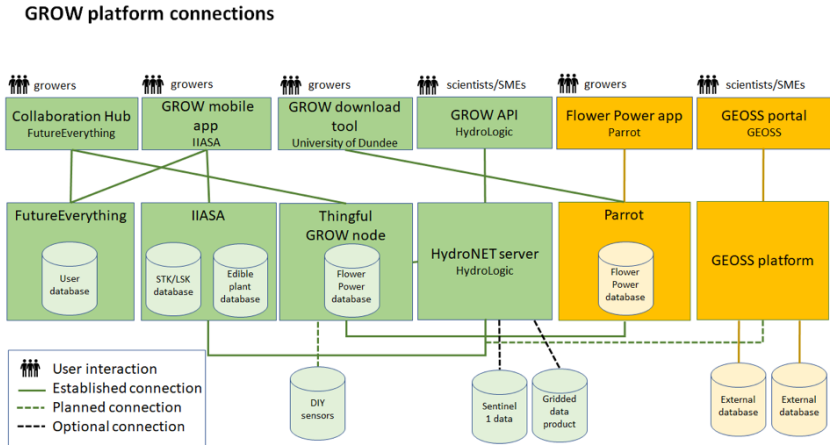
CO Sensors

- 4000 sensors in the ground (June 2019).
- 9 original Grow places extending to 16 in .2019
- Data is collected via mobile app.
- Criteria defined by Köppen-Geiger climate classification.



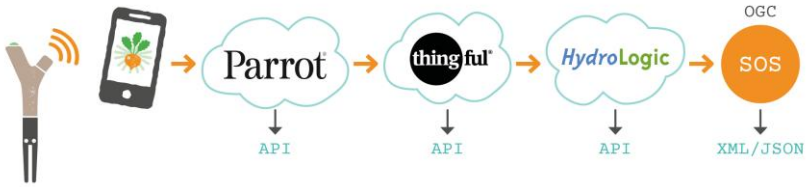
Grow Platform

- Cloud based Service across multiple vendors .
- Links GROW services to data consumers.
- Access points for Citizen Scientists, scientists, policy makers and other stakeholders interested in accessing and visualising data for information services and decision-making.



GROW Data Pipeline

- Four access points.
- **Parrot** for users own data.
- **Thingful**, fast data access for internal services / applications.
- **HydroLogic,** access to Scientific datasets.
- **SOS**, full live access to all GROW data.



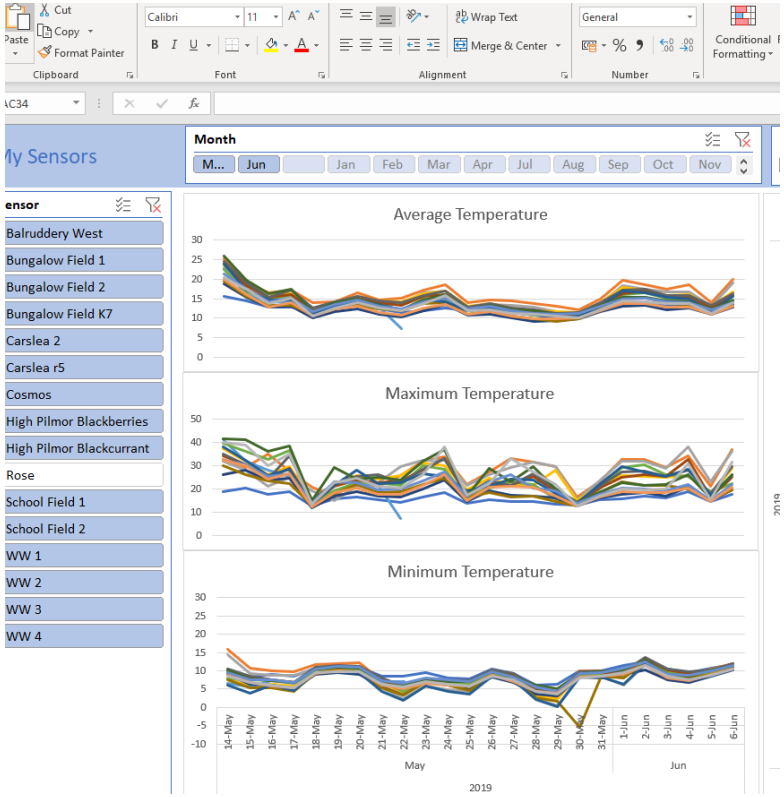
Access to individual data

- Simple Program available for Mac, Windows and Linux
  - Available from https://github.com/growobservatory/MyData/releases
    Download a dataset (CSV) from Citizen Scientist's own data
- Can be analyzed using Excel spreadsheet
- Citizen Scientists can create own Data Co-ops

Analyzing Citizen Scientist's data

Excel and Power Pivot

- Shows graphs of users data
- Aggregates users sensor data over time.
- Created by James Hutton Institute.



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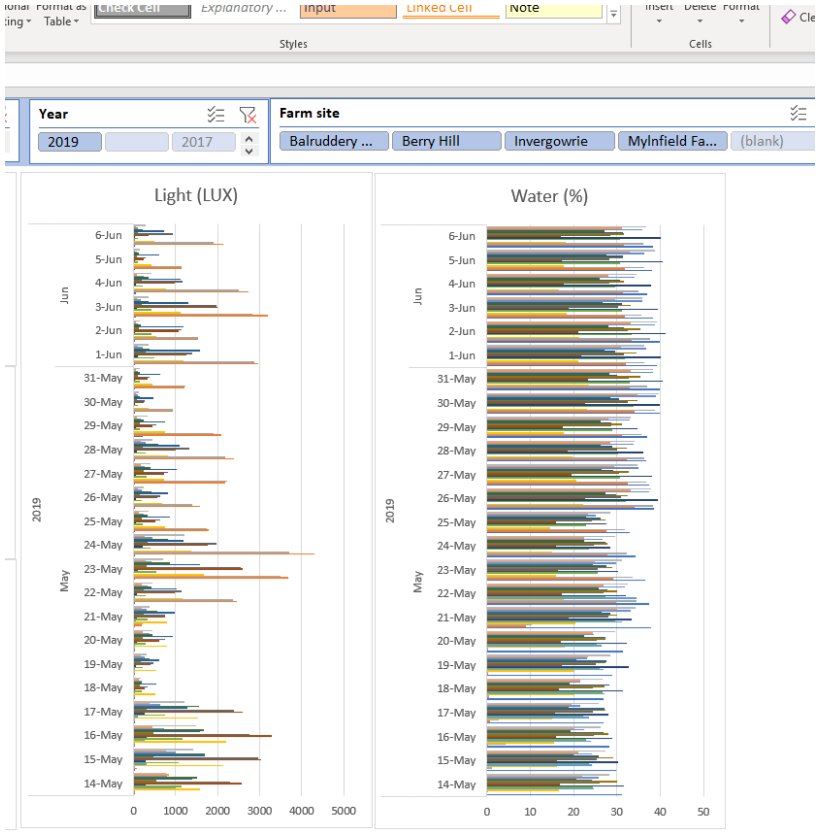
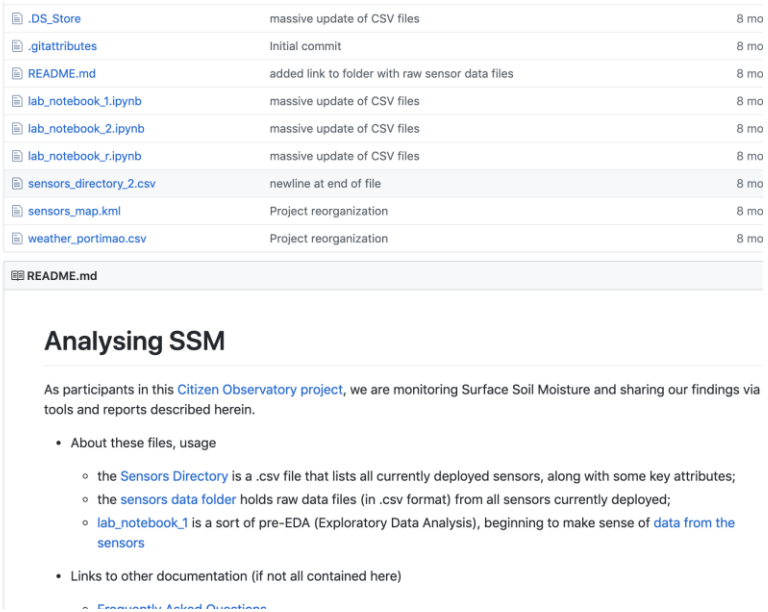


Citizen Scientist's data Co-ops

Github

- These Citizen Scientist's have created a github site to share data.
- Users upload their own datasets and give permission to use the data.
- Data is analysed by Citizen Scientist's own programs.
- Insights from GROW scientists assist the Citizen Scientist.



.DS_Store	massive update of CSV files	8 mo
.gitattributes	Initial commit	8 mo
README.md	added link to folder with raw sensor data files	8 mo
lab_notebook_1.ipynb	massive update of CSV files	8 mo
lab_notebook_2.ipynb	massive update of CSV files	8 mo
lab_notebook_r.ipynb	massive update of CSV files	8 mo
sensors_directory_2.csv	newline at end of file	8 mo
sensors_map.kml	Project reorganization	8 mo
weather_portimao.csv	Project reorganization	8 mo

README.md

Analysing SSM

As participants in this Citizen Observatory project, we are monitoring Surface Soil Moisture and sharing our findings via tools and reports described herein.

- About these files, usage
  - the Sensors Directory is a .csv file that lists all currently deployed sensors, along with some key attributes;
  - the sensors data folder holds raw data files (in .csv format) from all sensors currently deployed;
  - lab_notebook_1 is a sort of pre-EDA (Exploratory Data Analysis), beginning to make sense of data from the sensors
- Links to other documentation (if not all contained here)
  - Frequently Asked Questions

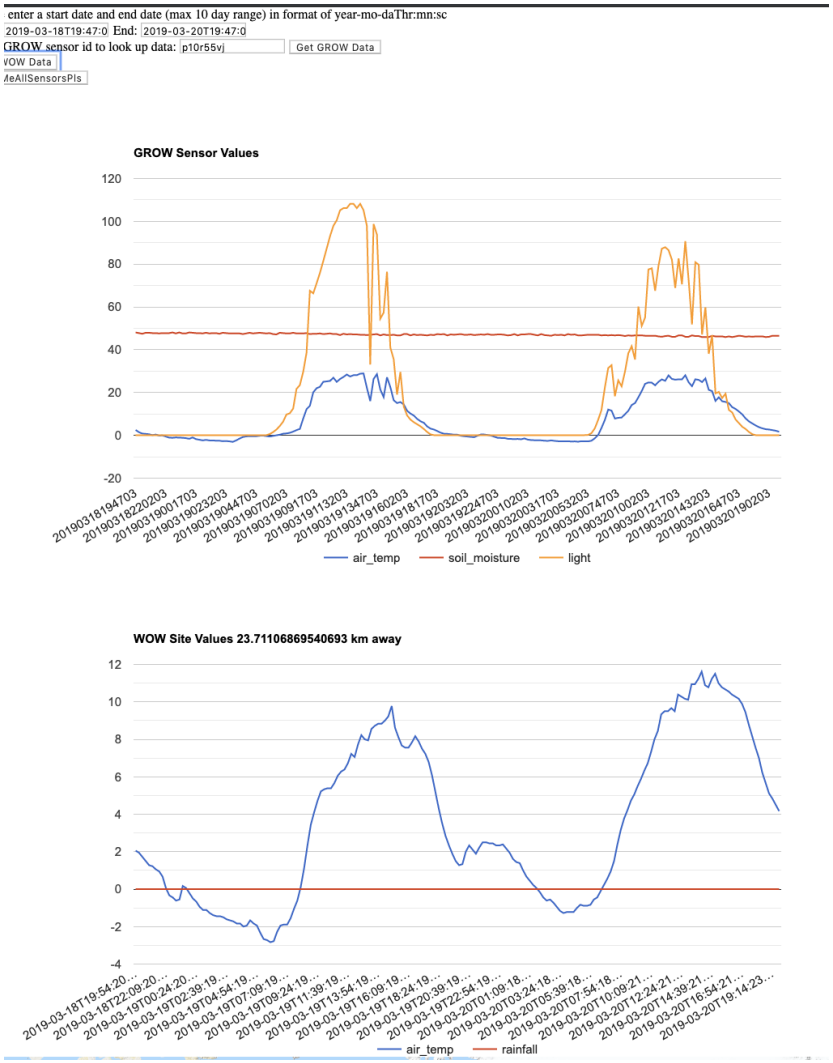
Live access to datasets

- Live Data from Thingful
  - Available from https://growobservatory.github.io/ThingfulNode/
- Access key needed
- Gives full access to all data as it arrives (JSON).
- Applications include:
  - The GROW collaboration hub.
    - Shows users own data
    - Shows locations of sensors
  - Combine GROW data with other datasets.
  - Works of Art (See “By the Code of the Soil”)

Live Data Combinations

Website

- Student project to combine GROW with UK met Office
- Uses Met office WOW interface.
- WOW data is cached because of rate limiting interface.
- Work by Anthony Delivanis.



Static Datasets

- Static data available from
  - Available from https://github.com/growobservatory/HN4SDemo (example)
  - Access key needed
- Gives full access to all data, may be a few days behind.
- Applications include:
  - Scientific analysis.
  - Artistic Visualisations.
  - Ground truthing of Sentinal-1 data

Artistic Visualisation

Web Application

- Visualisations to inspire and inform Citizen Scientists .
- Available at growobservatory.org/data
- This work by Moritz Stefaner.
- Coming soon, Soil moisture map by University of Hungary

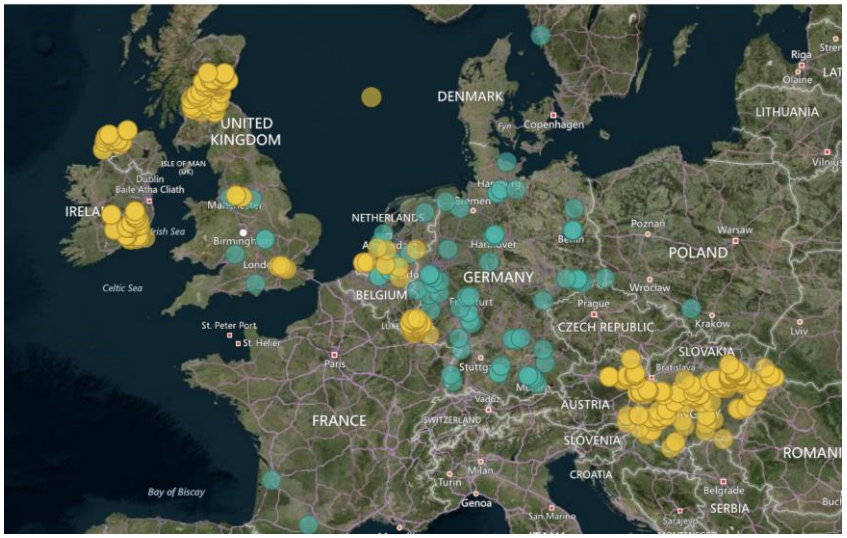
SOS interface

- Live Data in OGC Sensor Observation Standard format
  - Available from Hydrologic
- Access key needed
- Gives full access to all data.
  - Implements GetCapabilities, GetFeatureOfInterest.Describe Sensor and GetObservation
- Applications include:
  - Scientific analysis.
  - Live Applications.
  - Data Warehousing

SOS Interface Visualisation

Combining SOS interfaces

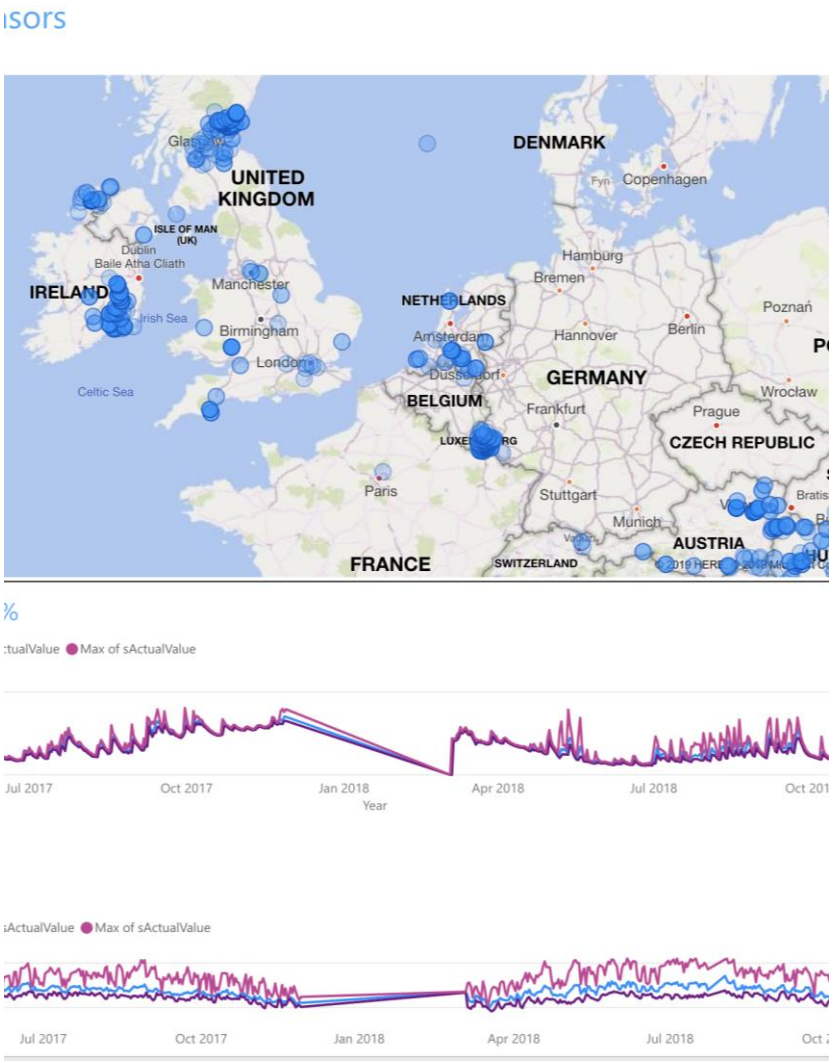
- Comines GROW data and Airhack data.
- Shows sensor locations for comparison.
- Uses Tabular Data Warehouse
- http://35.211.124.163/Circles/SOS.html



SOS Interface Visualisation

GROW SOS Data

- Exploration of GROW data.
- Shows sensor locations
- Also Sensor readings.
- http://35.211.124.163/Circles/Data.html



GROW's Data pipeline

- Data is available in format clients need
  - CSV, JSON, XML
- Privacy is maintained by security
- Data is "owned" by Citizen Scientists.
  - They can create their own data co-ops
- Future work includes:
  - Machine learning for "Bad Sensors"
  - Validation of Sentinal- 1
  - Open Data Challenge with WeObserve (end of 2019/start 2020)

THANK YOU!

Any Questions?

Andy Cobley

Senior Lecturer, University of Dundee

aecobley@Dundee.ac.uk

@andycobley

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