GROW Citizens' Observatory

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GROW Citizens' Observatory: Leveraging the power of citizens, open data and technology to generate engagement, and action on soil policy and soil moisture monitoring

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Abstract. Citizens' Observatories (COs) seek to extend conventional citizen science activities to scale up the potential of citizen sensing for environmental monitoring and creation of open datasets, knowledge and action around environmental issues, both local and global. The GROW CO has connected the planetary dimension of satellites with the hyperlocal context of farmers and their soil. GROW has faced three main interrelated challenges associated with each of the three core audiences of the observatory, namely citizens, scientists and policy makers: one is sustained citizen engagement, quality assurance of citizen-generated data and the challenge to move from data to action in practice and policy. We discuss how each of these challenges were overcome and gave way to the following related project outputs: 1) Contributing to satellite validation and enhancing the collective intelligence of GEOSS 2) Dynamic maps and visualisations for growers, scientists and policy makers 3) Social-technical innovations data art.

1. Introduction

The scale and application of Citizen Science (CS) is evolving in response to society-policy challenges and new widely available sensing technologies that enable an increased potential of citizens' role in environmental monitoring. Citizens' observatories (COs) scale up CS activity by facilitating the collection and application of open data generated by these technologies to progress science and inform changes in practice and policy. GROW is the first attempt to deliver an operational CO at a continental scale and with a long term, sustained commitment [1]. GROW demonstrates an operational CO system for sensing soil, in particular soil moisture, and its effects on climate and food growing practices. Soil moisture levels play an important role in regulating climate and triggering extreme weather events. GROW has leveraged the power of open and decentralised knowledge creation to validate satellite-based soil moisture products, e.g. based on the Sentinel-1 satellites of the European Earth Observation Programme Copernicus, and create information and visualisations that can improve the way people grow food and care for soils. Additionally, there is an urgent need to support and disseminate best practice around food production techniques that regenerate soils.

2. Contributing to satellite validation and enhancing the collective intelligence of GEOSS

Technically, GROW builds on existing state-of-the-art platforms and components as well as in the application of established methodologies for collecting and analysing data on soil and land cover/land use through the use of mobile apps, DIY and consumer sensors, and data mulling infrastructure [1]. GROW's data quality strategy includes design mechanisms and checks at two stages, i.e. before and after data collection. Preliminary evaluation between remotely sensed soil moisture products and citizen-generated ground observations show good agreement, especially when investigating coarse scale products based on SMAP, ASCAT and ESA CCI SM. A slightly weaker agreement was found when validating high-resolution products, i.e. from Sentinel-1, thus the high density of sensor observations poses the potential of further investigating and improving the underlying algorithms of these high-resolution soil moisture products.

3. Dynamic maps and visualisations for growers, scientists and policy makers

GROW has developed a number of interfaces and visualisations of its datasets designed to meet the requirements of farmers, scientists and policy makers for applications in agriculture and climate forecasting and policy. Visualisations such as Dynamic Soil Moisture Maps are accessible to individual users, and also in an aggregated format on the GROW website. Additionally, sensor data are available in the Open Geospatial Consortium Sensor Observation Service (SOS) standard form, which may be used by scientists to construct large scale maps; this allows interoperability of GROW data with other databases (such as the UK Met office WOW service).

4. Social-technical innovations

GROW contributes to CS and earth sensing by addressing the common problem of increasing scale in CS without compromising the level of participation, data quality and uptake. To achieve this we take a blended approach, combining place-based interactions and face to face meetups across EU focus areas - named GROW Places - led by local Community Champions, with online tools such as Massive Open Online Courses and a knowledge base [2]. GROW has run a series of multi-stakeholder events and Insights Workshops to bring together growers, scientists and policy makers. Additionally, GROW citizen-generated data have been communicated through art for wider public engagement. Soil data submitted by users have been used to construct artwork such as By the Code of Soil, a desktop app that artistically visualises data when Sentinel-1 is overhead.

5. Conclusions

This paper summarises how GROW has demonstrated the concept and potential of Citizens' Observatories to up-scale environmental monitoring through CS and open data, resulting in social and scientific benefits: from mass online education, creation of a network of 15 GROW Places, to an innovative contribution to GEOSS, as well as data art and a variety of policy and community events.

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