EuroGEO 2019 Citizen Science roadmap "Lisbon Declaration"

This document has been created by the community of Citizen Observatories and Citizen Science practitioners, as well as key collaborators that attended the Citizen Science working session in the EuroGEO Workshop taking place on July 3-5th, 2019 at the Pavilhão do Conhecimento in Lisbon (Portugal). The event was co-organized by the Portuguese Foundation for Science and Technology (FCT) and the European Commission (EC).

The Lisbon Declaration was edited by Joan Masó (CREAF) building on an initial idea from Steffen Fritz (IIASA).

Introduction

This document summarizes the current status of Citizen Science in GEO/GEOSS, reflects the vision, and objectives, identifies issues that are blocking its progress and proposes a way forward shared by the Citizen Observatories and Citizen Science projects under the EuroGEO community. Then, it proposes a shared vision, a clear set of objectives and some actions that will pave the way to progress towards that shared vision, based on aggregating citizen science into a federation of data services supported by the Citizen Science community activity in the GEO work program that represents the citizen science community. Finally, it defines a list of recommendations to the European Commission to improve the integration of the European Citizen Science and Citizen Observatories into GEOSS. It thereby emphasises regional strength and competences without losing sight of global collaborations.

Scope

This document is structured as follows:

- Summarizes the state of play of Citizen Science with GEO/GEOSS
- Recognizes the current situation and highlights the main issues blocking progress
- Introduces a shared vision
- Outlines a roadmap towards a shared vision
- Offers recommendations to the European Commission

State of play

In 2014, Citizen Science had no visibility in the GEO Work Program. As requested from the EC 7th Framework program (FP7), Citizens Observatories projects were included in the

Task IN-04 GEOSS Communication Networks. In 2016, at the St. Petersburg GEO Plenary, the European Commission proposed the creation of a community activity stating that "Citizen-generated data can fill in important gaps in in-situ Earth Observations, strengthen environmental capacities and trigger innovation" resulting in the current Earth Observation Citizen Science Community Activity (GEO CitSci). The Horizon 2020 (H2020) project WeObserve has enabled this activity by contributing chairs and dedicated participants and stimulating regular meetings and constant presence in the GEO events. In addition, important European contributions in favor of Citizen Science integration include the following:

- The FP7 project COBWEB project suggested a way to use the Open Geospatial Consortium (OGC) Sensor Web Enablement suite of standards for citizen science to share well documented datasets.

- The FP7 project CITCLOPS proposed to use the OG) Sensor Web Enablement suite for Do-It-Yourself (DIY) instruments.

- The *Volunteered geographic information (VGI) and Citizen Observatories INSPIRE Hackathon* was organized by Karel Charvat, Arne J. Berre, Tomas Mildorf and Sven Schade. It united the FP7 and the H2020 Citizen Observatory projects and other activities in a three day event (26-28 September 2016).

- The H2020 WeObserve project has created Communities of Practice (CoP) on different aspects of Citizen Science. The interoperability CoP has produced the first Citizen Science Engineering Report [1].

- The H2020 Scent project has completed the registration process to connect their Citizen Observatory into the GEOSS platform, while offering their resources as standardised web services as well as via novel standards such as the OGC SensorThings API, facilitating integration with existing information systems and legacy data sources.

- The H2020 GROW project completed the registration process which connects their Citizen Observatory into the GEOSS platform.

- The H2020 GroundTruth 2.0 project demonstrated interoperability among the 7 citizen Observatories created with Scent and GROW data.

- The H2020 Landsense project has produced an open Citizen Science Federation with privacy protection and GDPR compliance.

- The H2020 Cos4Cloud project is planning to develop interoperable (OGC based) services for Citizen Observatories in the framework of the European Open Science Cloud (EOSC).

Some additional efforts are undertaken jointly by European and international partners that are worth mentioning here.

- The U.S. Based Citizen Science Association (CSA) supports a Data and Metadata Working Group, who are responsible for producing the Public Participation in Scientific Research (PPSR Core) Metadata standard.

- The Citizen Science European COST Action (15212) has produced an evolution of the PPSR metadata standard.

- Earth Challenge 2020 is an initiative led by Earth Day Network, the Wilson Center, and the U.S. Department of State that leverages the work described above to create a suite of linked technologies for data collection, discovery, and access that helped support a coordinated global citizen science campaign in April 2020. International partners include GEO, ESA and the OGC.

Recognizing the current situation

We have identified the following issues that impede the integration of citizen science into GEOSS:

- The interoperability requirements requested by the GEO Data Access Broker (DAB) are reasonable for a data producing agency but may be too demanding to apply for citizen science projects with limited budget and personnel. In addition, the technical specifications are written for a certain audience and may be difficult for the average citizen-science initiative/project to quickly understand.

- Citizen Science projects are often more concerned about discoverability by web crawlers and web search engines than about applying geospatial standards. In addition, current standards recommended by the GEO DAB are not the ones that best fit earth observation data in general and in-situ data in particular. Sensor Web Enablement standards are the current OGC recommendation (e.g. Sensor Observation Service and SensorThings API), but these are not widely supported by the GEO DAB in the same way as the classical Web Map Service and Web Feature Service.

- The integration of a Citizen Observatory into the GEO Platform is a manual process that has several steps and tests (i.e. administrative registration, interoperability tests, service enhancements, etc) that are quite time consuming. This might not scale up when considering the number of Citizen Science data sets that are at least potentially relevant for GEO resulting in bottlenecks.

- Most citizen science projects have a local extent and, alone, might not be of interest for the global problems addressed by GEO, so work is needed to understand how, on the one hand, data from local projects can be combined to support GEO, and on the other hand, how GEO and the EO community can help support local citizen science.

- Citizen science projects often use simplified methodologies and inexpensive sensors that provide data with some limitations that need to be carefully documented. In cases where data are quality checked and enhanced, mechanisms must support provenance tracking and link back to an initial data set, as well as document key improvements

- Citizen science projects rely on contributions made by individuals (not by organizations) and individuals deserve privacy (protected by the GDPR) as well as attribution and recognition.

- In the view of GDPR, citizens should be in control of their data and their personal data is given for specific purposes only. In consequence, citizens request recognition (a process that requires personal information) for their contributions, they need to opt-in to make existing contributions available for new purposes, e.g. GEO needs. This requires interoperable, open standards-based user authentication and authorization protocols as well as a mechanism to extend the initial terms of use each time a new initially unauthorized purpose emerges. In addition, citizens will truly be in control of their own data if there is a mechanism to trace where citizens' data is being used.

- There is no federation and registration infrastructure dedicated to making citizen science contributions available in EuroGEO.

- The benefits citizens get back from their participation in GEO are unclear.

- Citizen Science does not only may provide data; in many existing projects immense value added is contributed by annotation and more advanced forms of analysis done by citizens. An appropriate mechanism that allows Citizen Scientists to access and analyse data from GEOSS in missing.

In addition, there are other non technical issues affecting the integration of Citizen Science into GEO. For example, Citizen Science is still not considered as a complement to in-situ and remote sensing data inputs yet. GEO should recognize the opportunity that Citizen Science offers for empowering people to make a difference at local level and complement actions at national level based on better knowledge about the problems the planet is facing.

Work is needed to better estimate the resources needed to support citizen science, and how to manage effective resource allocation (e.g., to a single project, as compared to possible benefit from a support centre in place).

A Vision for EuroGEO

Our vision is to have citizens, scientists and agencies contribute Earth Observations to create comprehensible sets of data and information that inform decisions for the benefit of humankind.

The EuroGEO mission should connect European Citizen Scientists (collaborating in Science initiatives) with channels that make its contributions open, discoverable, accessible and ready to process (exploitable) in the GEOSS platform and offer benefits to citizens in return, while preserving their individual privacy.

Objectives

Objective 1: facilitate guidance and tools for projects to implement and follow the GEOSS data management principles

Objective 1.1: Describe data quality to increase trust in Citizen Science data by enabling data users to evaluate fitness for use

Objective 1.2: Make the data available with the documentation of the concepts, sensors and processes used and facilitate their consumption from third party applications

Objective 1.3: Make available organisational and technical means to facilitate integration of citizen-science projects with GEOSS, including examples and templates for Citizen Scientists

Objective 1.4: Allow for contributions beyond pure data gathering and consider their role in data validating, analytics and local knowledge contributors.

Objective 2: enrich the GEOSS platform with a mechanism to manage citizen contribution that secures privacy

Objective 2.1: Secure personal data flow and sensible data protection

Objective 2.2: Make the registration process of citizen science projects and citizen observatories in the GEOSS platform easy enough for every initiative willing to participate

Objective 2.3: Enable citizen access to a common interconnected space for integrated data capture, retrieval, validation and analysis.

Objective 3: provide benefits to the citizens contributing to projects

Objective 3.1: Provide open knowledge products and services created in a transparent way providing validated scientific evidence.

Objective 3.2: Empower the weight of citizens in the GEOSS work program

Objective 3.3: Stimulate citizens to use the GEOSS infrastructure by serving the content citizens need focussed on knowledge supported by data visualizations.

An architecture supporting Citizen Observatories in GEOSS

In the same way that small farmers are organized in agrarian cooperatives and unions to overcome issues such as the cost of big machinery or lobbying in favor of their interests, Citizen Science and Citizen Observatories projects need to cooperate and create both federations of technical resources and supporting community associations that can provide several advantages for them in terms of cost reductions while removing data silos.

Technically speaking:

- Federations can host services that can be shared by several citizen science projects such as data translations, data sharing and data discovery.

- Federations can translate services and act as brokers, amplifying the interoperability of the project offerings.

- A federation can constitute a single entry point to the GEOSS platform, providing immediate connection to many projects and adapted to the dynamics of the sector

- Thematic federations can work to create common vocabularies and procedures that aggregate citizen science projects into bigger datasets. The GBIF biodiversity datasets are an example of this practice..

- Federations can provide specific data quality tools to assess and filter the quality of the data. Thematic federations can better offer pools of experts in specific research areas that can increase trust in the data and better generate and supervise knowledge.

- Federations can have centralized and trusted authorization servers that can be used by Citizen Science projects as single entry points to all services. Their identity is protected by the authorization servers which only release the minimum agreed information necessary for the projects to function as required by the GDPR

- Federations can use authorization services to control their data. Federations keep data decentralized and within the Citizen Science projects' selected infrastructures as required by INSPIRE.

- Federations can provide hosting to projects that do not have the capacity to manage their data with their own resources.

- Federations can act as preservation facilities when citizens science projects are discontinued.

- Federations can provide services to citizens based on the exploitation of current and future GEOSS data.

Beyond technical aspects, **Associations** (e.g. ECSA) can provide additional benefits:

- Associations can evaluate and disseminate the value of being included in GEOSS and study the benefits that citizens get back from their participation in GEO.

- Associations can better represent the interests of citizens in GEOSS as contributors to the system.

- Associations can react in an agile way to recommend the co-design of solutions for identified gaps in GEO.

- Associations release documents and recommendations to educate current and future Citizen Science projects in the GEOSS data sharing principles and data management principles, and the standards and tools to implement the principles.

- Associations can articulate communities of practice that help each other.

- Associations can help to visualize the influence of citizens in GEOSS and promote the GEOSS infrastructure useful for citizens

- Associations can setup the governance structures to run effective federations in support for citizen science

Roadmap and Recommendations to the European Commission

Many efforts have been done in laying the foundation for Citizen Observatories contributing to GEOSS. The participants in the EuroGEO 2019 Citizen Science workshop recommend the European Commision to secure the integration of Citizen Science and Citizens Observatories into GEOSS by enabling the following steps:

- Creating an supporting an EuroGEO showcase on Citizen Science that continues the legacy of the above mentioned H2020 projects

- Creating a pilot of the proposed European wide Federation for Citizen Science where citizen science and citizen observatories can be connected. The federation will provides services to Citizen Science, provides privacy protection under the GDPR and acts as a connection node to the GEOSS platform while respecting a decentralized approach stipulated in the INSPIRE directive

- Supporting the consolidation of the federation as a research infrastructure that includes strong governance and continuity by linking to to the European Citizen Science Association

- Connecting the federation to the EOSC as a scientific infrastructure and to GEOSS as a decision making support infrastructure

In addition, the following aspects are recommended to take into consideration in the general strategy:

- Encouraging the continuation of data services after the end of Citizen Science projects in the same manner as is currently done for data archives in data management plans.

- Supporting initiatives to aggregate Citizen Science projects by sharing common vocabularies and methodologies and ensuring their seamless integration with conventional and legacy data sources.

- Boosting the utilisation of Citizen Science data as a complement to in-situ and remote sensing in downstream applications and operational use cases.

- Promoting the European Citizen Science Association, as a participant organization in GEO that can have a voice in the GEO Plenary.

- Sponsoring the GEO CitSci community activity to consolidate it in GEO and secure its continuity as a prerequisites to become a GEO initiative.

- Coordinating with other Regional GEO Activities to ensure global relevance and impact.

- Making the GEOSS offerings more attractive to citizens and citizens scientists by focussing on transmitting facts supported by data visualizations (e.g. story maps and dashboards).

- Incentivise the use of open source solutions and ensuring protection of citizen science projects.

The following list of Citizen Observatory and Citizen Science practitioners ratify the content of the Lisbon Declaration:

- Rob Atkinson, OGC
- Lucy Bastin, Aston University, UK
- Anne Bowser, Woodrow Wilson International Center for Scholars
- Peter Brenton, Atlas of Living Australia
- Luigi Ceccaroni, Earthwatch
- Andy Cobley, University of Dundee.
- Steffen Fritz, IIASA
- Margaret Gold, European Citizen Science Association, (ECSA)
- Joan Masó Pau, CREAF
- Andreas Matheus, Secure Dimensions
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- Valantis Tsiakos, Institute of Communication and Computer Systems
- Eveline Wandl-Vogt, Austrian Academy of Sciences, exploration space & Ars Electronica Research Institute "knowledge for humanity (k4h+)
- Uta Wehn, IHE Delft Institute for Water Education

References

[1] Citizen Science Engineering Report: http://docs.opengeospatial.org/per/19-083.html

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