Space Universities Network
Supporting the Space Higher Education Community

CASE STUDY

Title

GEOSS/HACK Space Hackathon – European Space Agency

Summary

The European Space Agency (ESA) have run a Space Hackathon in partnership with the Group on Earth Observations (GEO). 30 participants split into 6 teams had 30 hours to create an open-source solution to 1 of 6 challenges focused around meeting the Sustainable Development Goals (SDGs) using Earth Observation data from the GEOSS portal.

Aims/Objectives

Hackathons offer an intense, innovative and interactive challenge for participants to develop novel solutions to a problem question in a limited space of time. The primary objective of the GEOSS/HACK hackathon was to challenge participants to develop innovative tools to use satellite data to benefit society, engage more people in the use of Earth Observation data and tackle the Sustainable Development Goals.

What was the context / background?

The hackathon was run as a part of the 3rd GEO Data Providers Workshop (executive summary of event can be found here). The workshop brought together 200 data providers and users from 130 organizations from 33 countries and 5 continents and provided a space to share experiences and knowledge to improve the ways in which Earth observations are managed, communicated, disseminated and used to enhance the Global Earth Observation System of Systems (GEOSS). The hackathon was held between 4th and 5th May 2018 and it was the first time that a hackathon was run as a part of the GEO Data Providers Workshop.

Figure 1 – GEOSS/HACK [Image credit: ESA]

How was it organised and who was involved?

This was a staff-led extra-curricular challenge for students. Organisation of the event was split between ESA and the GEOSS secretariat. The first discussions between ESA and GEOSS secretariat were held in September 2017 and the event itself was held in May 2018. The process to organise the hackathon was as follows:

- Devise a challenge to be set to participants
- Judging criteria
- Contact potential judges
- Decide upon venue and book
- Decide upon the following:
    - What tools will be given to participants?
    - Will a coding language be specified, or will participants be allowed to choose?
    - Will the event be open to everybody or only to a specific group?
    - Will there be an opportunity to participate remotely? How will this work?
- Put together an event schedule and arrange logistics on site

What resources did you need?

The following resources were required:

- Problem questions to set participants
- Venue booked for duration of hackathon with power outlets for personal computers and layout to promote group interaction and discussion
- 4 facilitators with experience using the GEOSS portal (2 in Italy, 1 in the Netherlands and 1 in the UK)
- 4 judges to review the submitted entries

Describe the activity (Max 1000 words)

The organisation of GEOSS/HACK consisted of 4 phases:

1. Devising the Challenges
2. Hackathon Challenge Day
3. Entry Submission and Presentation
4. Judging and Prizes

1. Devising the Challenges

At the GEOSS/HACK Space Hackathon there were 6 challenges that the participants could decide to undertake – these were all sourced from communities that had needs that could be addressed using satellite data. Challenges were focused on non-typical users of satellite data such as rural or polar communities. Sourcing these challenges was very work-intensive. The process to do so was as follows:

Figure 2 – Tweet by ESA Earth Observation

[Image credit: @ESA_EO]

- Find researchers and NGOs working in remote communities by searching online.
- Make contact and propose a time to call and discuss.
- Explain over the phone the benefits that could be derived from using Earth Observation data to support their project's efforts.
    - This was found to vary largely with some project having a great awareness of the potential of satellite data and others needing a lot more information.
- Send through an application form for the organisation to propose a challenge to the hackathon.
- Receive proposals and write up challenges for the event.

This process was found to be successful with 6 interesting proposals being entered. There were other proposals that had been discussed, however, they did not get their application in on time. The challenges that were set to participants were as follows:

1. Designing for Accessibility
    - Make an application that maps accessibility information and allows the users to add new information about cities and points of interest. The application should include a social feed that searches for georeferenced posts, tweets, etc. associated with a set of keywords and shows the results in a tab and/or maps them all together.
2. Cloud Detection Game - Increasing the amount of classified data for machine learning
    - The goal is to develop a game (doesn't have to be on a mobile platform) where the player classifies Sentinel-2 image pixels.
3. Astro-ecology - the solution from the skies to save Earth's biodiversity
    - A key part of the system is developing software to automatically detect and identify animals and humans in aerial thermal video footage.
4. Connecting Arctic voices
    - Develop a tool to allow young people living in the Arctic to engage with satellite images, weather data and in-situ observations in new ways, to promote sharing of information with their Elders and help to identify data that could be used to predict environmental hazards.

Figure 3 – Connecting Arctic Voices Challenge [Image credit: Gordon Ikayuak Brower]

5. Protecting the Forest
    - Develop a biodiversity monitoring tool to motivate local patrols in Madagascar to engage with satellite images and encourage them to contribute in-situ observations. Clear evidence of illegal activities per location is urgently needed to improve law enforcement and natural

resource management. Georeferenced in-situ data could provide authorities and regional government services with useful data to halt deforestation.

6. Understanding Child Malnutrition in Sudan using Geographical Data
    - There is variation in the level of malnourished children in Sudan at the level of the states. The challenge involves using satellite images together with open source geographical data to understand the spatial disparity/patterns of malnutrition between states.

More information on the challenges can be found here.

2. Hackathon Challenge Day

- The hackathon was held at ESRIN's headquarters in Frascati, Italy on 4th – 5th May 2018 as well as being streamed to ESTEC in the Netherlands and ECSAT in the UK. The event was open to anybody with an interest.
- There were 30 participants: 17 in ESRIN, 5 in ESTEC and 8 in ECSAT.
    - Most participants were in their early 20s. Only a few of the participants had extensive coding experience.
    - Most participants had no experience using satellite data.
    - Most participants had at least a Bachelor's degree but there were some undergraduate students.
- The day was started with an introductory presentation introducing all the challenges (found here). Following this, the 30-hour hackathon was commenced.
- Participants could use any coding language as long as it was open-source. They were shown how to access data from the GEOSS portal by hackathon facilitators. 2 facilitators were present at ESRIN as well as 1 at both ESTEC and ECSAT.

Figure 4 – Participants at ESRIN [Image credit: ESA]

- The GEOSS Platform
    - The Global Earth Observation System of Systems' Platform links existing and planned observing systems around the world. The GEOSS Platform promotes the use of common technical standards so that data from thousands of different instruments can be combined into coherent data sets. (More information here) The data may be accessed by anybody for

free.

- The GEOSS Portal offers a single Internet access point to Earth observation data, information and knowledge from all over the world for users with different backgrounds and from different disciplines.
- The GEO Discovery and Access Broker (GEO DAB) is the primary mechanism by which all data and information is discovered and accessed. The GEO DAB implements the necessary mediation and harmonization services through Application Program Interfaces (APIs). These APIs allow data providers to share resources without having to make major changes to their technology or standards.
    - The GEO DAB API allows data access from the backend server – this can be downloaded as a RESTful or Javascript library here.

3. Entry Submission and Presentation

At the end of the challenge, all participants were asked to present a 2-minute video, uploaded to YouTube, explaining their application plus a small description of their solution together with their code on github. Some example entries:

- Seeku: Connecting Arctic Voices
- Cloud Eater (github code available here)
- Roots
- DAFNI

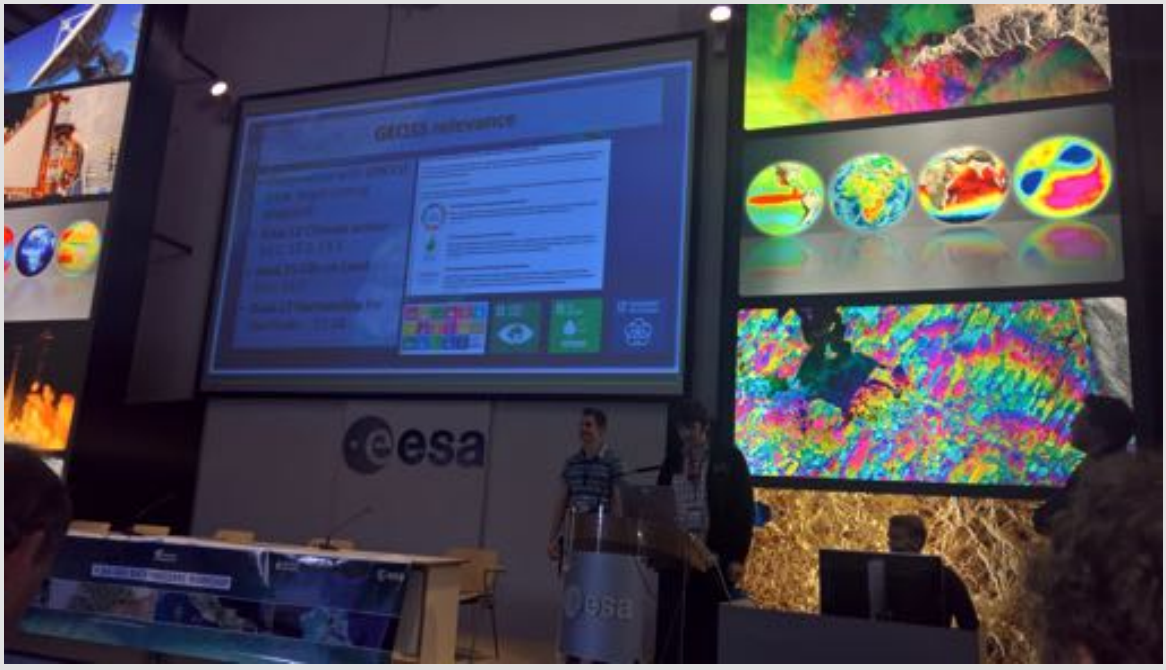

Figure 5 – Team presentation [Image credit: ESA]

4. Judging and Prizes

Judges were given just under 2 weeks to decide upon a winner. They each viewed the submissions remotely. The judging criteria was as follows:

- Societal Value (40%)
    - Does it offer a real solution with potential impact on the societal challenge being tackled?
- Originality/Novelty (20%)
    - Has it been tried or done before? Is the idea disruptive?
- Use of GEOSS resources and tools (10%)
    - Novelty and creativity in the use of existing resources and functions of the GEOSS Platform

- GEOSS relevance (10%)
    - Is the idea scalable to other GEOSS projects?
- Feasibility/Sustainability (10%)
    - Does the idea have a realistic chance of being implemented?
- Usability and user interface (10%)
    - Is the proposed application user-friendly?

The winning team were given the following prizes:

- Special interview by GEOS
- Opportunity to refine code with Development Seed
- Ticket to FOSS4G 2018
- One day consulting with SBIC Noordwiijk
- Exposure to the ESA Space Solutions Community
- Opportunity to present at Φ-week

Has it been evaluated? What feedback have you had?

Feedback from participants included the following comments:

- "It was a fun experience and I learned a lot about satellite data as well as data broker services."
- "The Hackathon was a great opportunity for innovation. Creating and supporting the global challenges was a fabulous experience. Excellent management and organisation. Felt supported all the 30 hours and now I have a deeper understanding of the possibility to access satellite data."
- "The Hackathon was a success. Many participants joining from many different places, showing commitment and ingenuity in their ideas. On the last hour of the 3rd GEOSS Data Providers Workshop the Hackathon came to a close and the participants could finally relax for a moment. Soon afterwards, however all the submissions were collected and presented in the ESRIN Big Hall, by the participants themselves. On stage, many novel approaches to important environment and social security problems were shown to the audience."

Key Learning Points

There were some significant lessons learned:

- The event was run on a Thursday running into a Friday, there were many who couldn't participate due to the event running during the week. If the hackathon were to be run again, it would be done on a weekend.
- At ESRIN, the building closed at 7pm and all participants had to leave the vicinity and come back at 8am the following day. This cost them a lot of time; therefore, it would be best to conduct an event like this in a 24-hour access building.
- Between 30 and 48 hours would be the best amount of time for a challenge like this, anything less than 30 hours would be very stressful for the participants.

Thematic Categories (tick any that apply to your case study)

Method		Topic	
Online Text and Notes	☐	Orbits and Trajectories	☐
Assessment Materials	☐	Rocket Propulsion	☐

Video and Audio Lectures	☐	AOCS/ADCS	☐
Lecture Slides	☐	Payloads	☐
Curricula	☐	Power	☐
Video and Audio Clips	☐	Communications	☐
Recommended textbooks	☐	On Board Data Handling	☐
Useful software	☐	Systems	☐
Worksheets and Projects	☐	Mechanical	☐
Simulations	☐	Thermal	☐
Tutors' Guides	☐	Astronomy	☐
	☐	Earth Observation	☒
	☐	History of Spaceflight	☐
	☐	Other	☐

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