SPACE AS A CONTEXT IN THE CLASSROOM

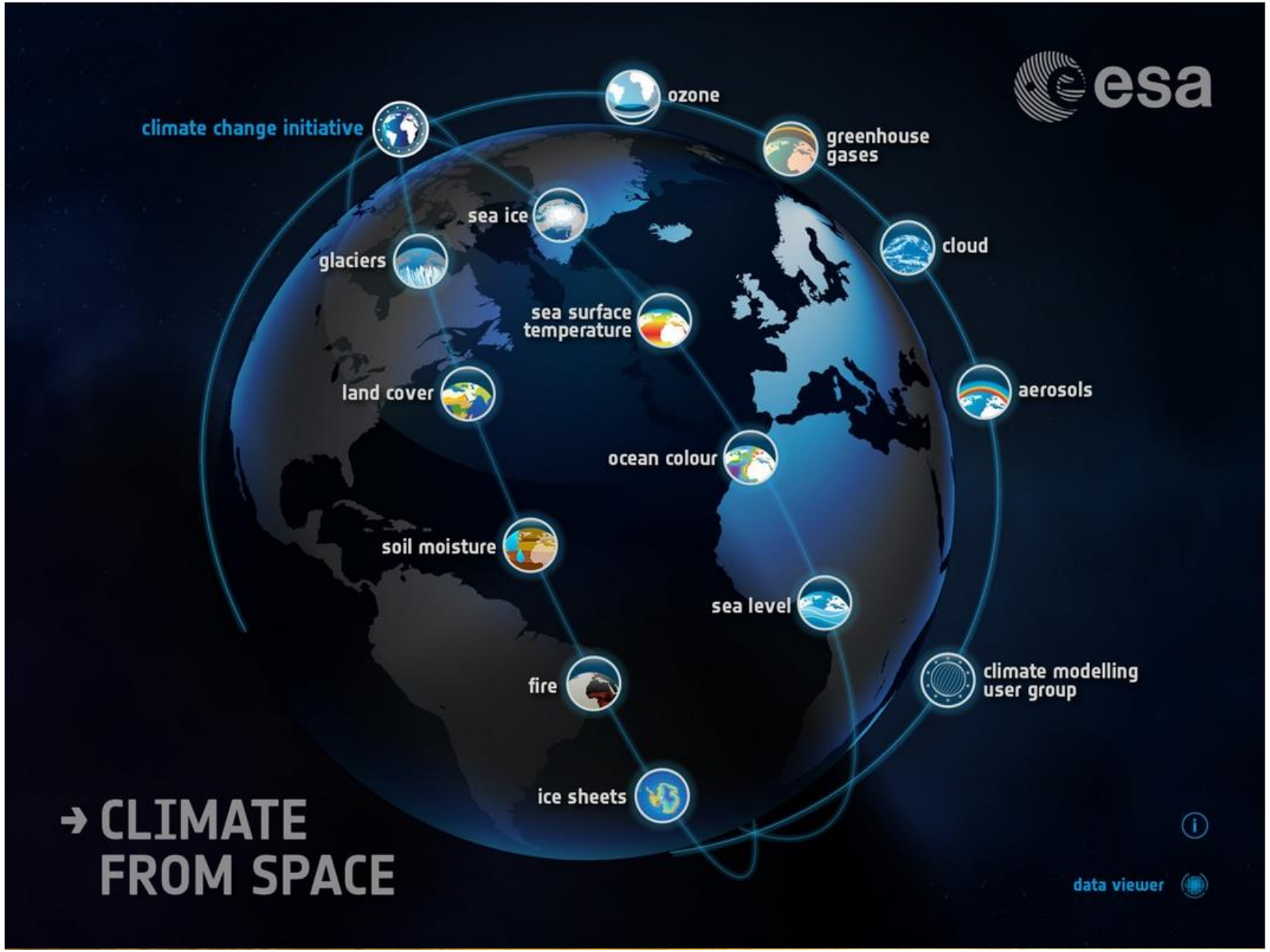
Cristina Stancu

ESERO Romania – Deputy Manager

Romanian Space Agency (**ROSA**)

INTRODUCTION

- Climate from Space
- Research on the ISS
- Research in the classroom
- ESA Education Portfolio on EO Educational Activities (case studies)
- Astro Pi
- Climate Detectives (project)
- Mission X (Train like an astronaut)
- CanSat
- Exo-Ro



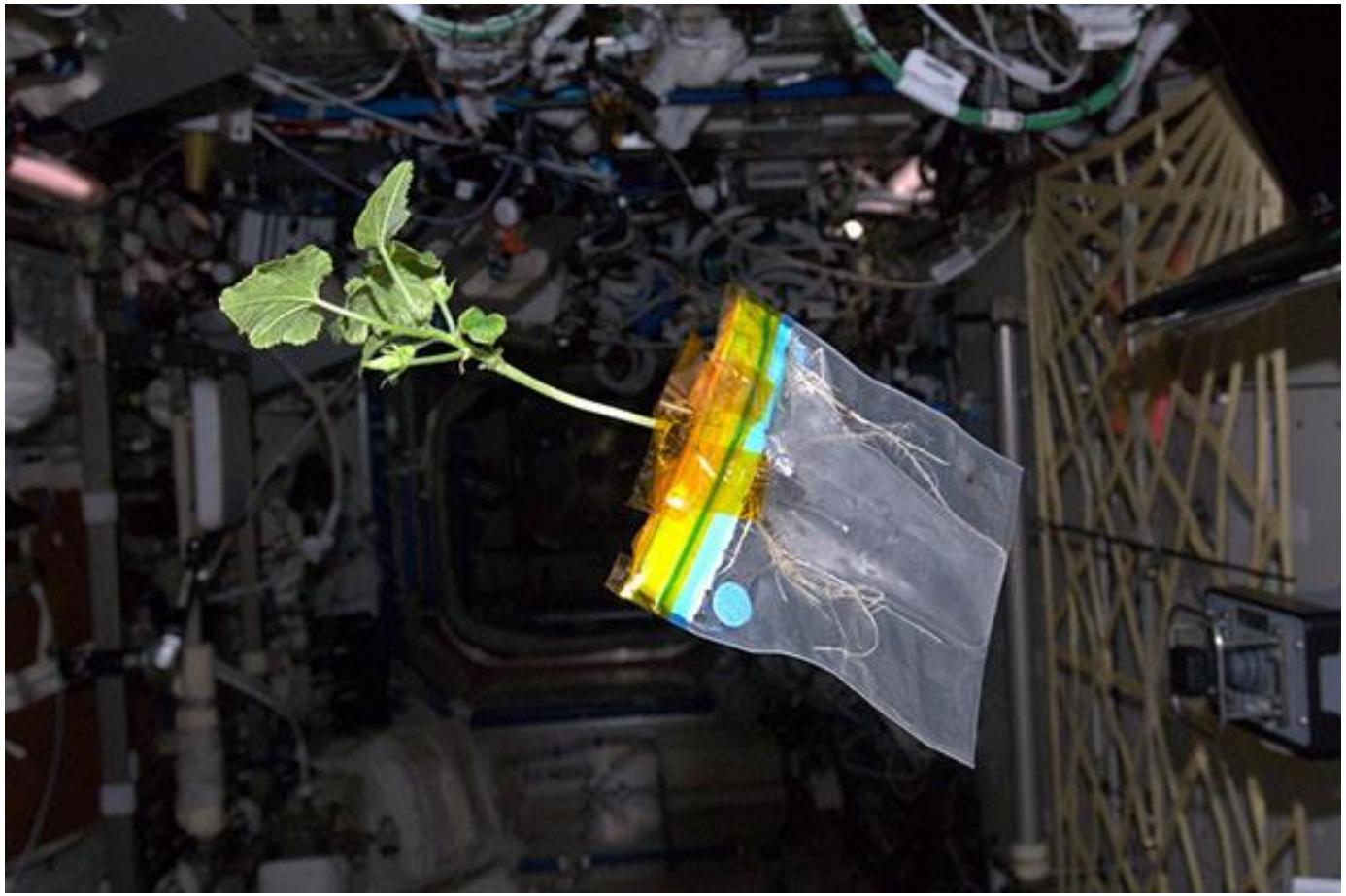
http://cci.esa.int/content/tablet-app

EXPERIMENTS ON PLANTS IN SPACE

ARABIDOPSIS THALIANA
Credit:NASA/ESA

Arabidopsis thaliana (also known as Thale Cress)	model organism for plant biology and genetics.	first plant to ever have its genome fully sequenced
grown on the International Space Station and first flowered in the 1982s aboard Soviet Salyut 7.	**Arabidopsis is critical to** spaceflight plant biology research.	small genome (5 chr, 27k genes)
first plant genome sequenced	small size	rapid lifecycle (6 weeks)

DIARY OF A SPACE …

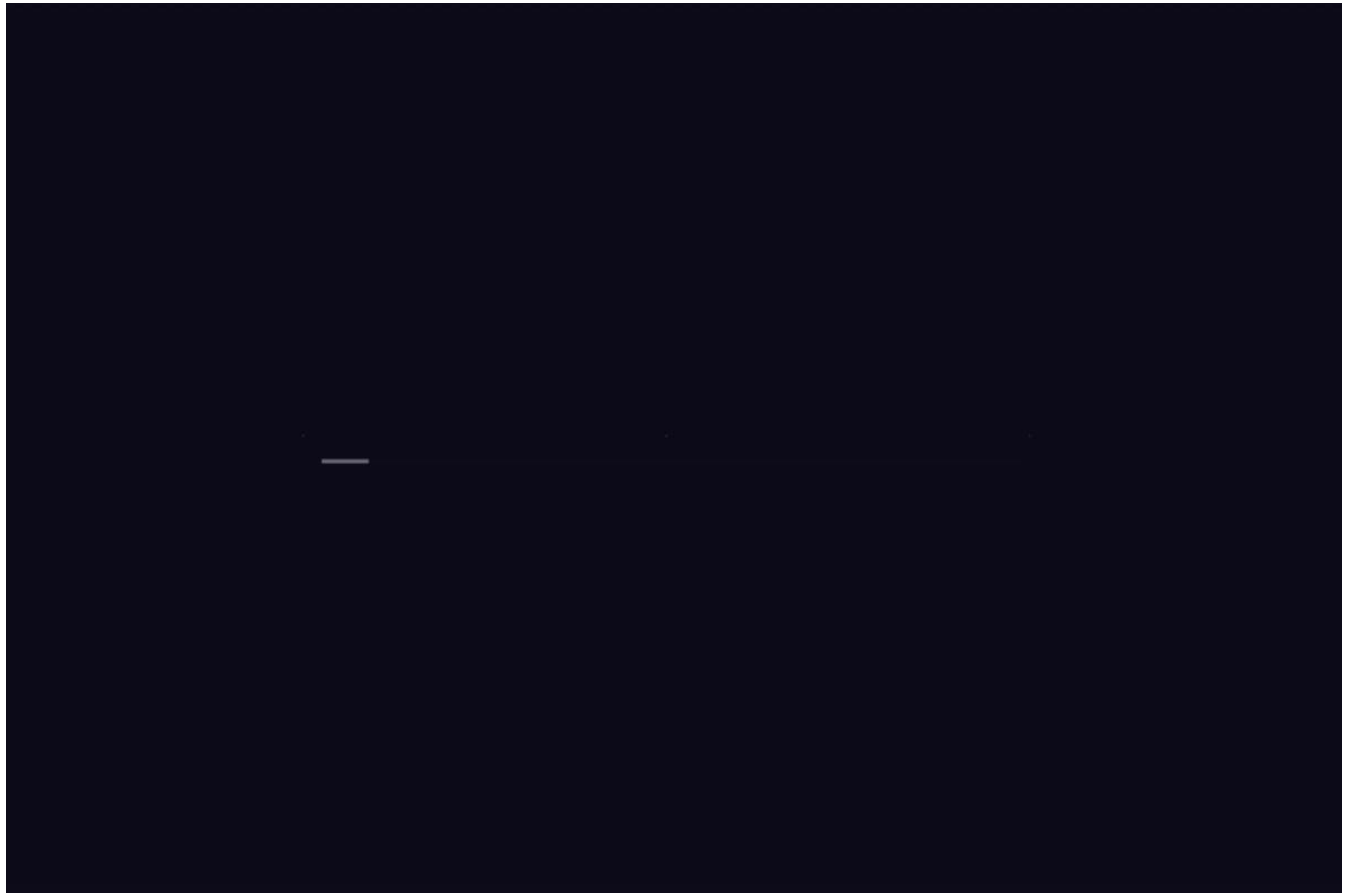


Credit: https://blogs.nasa.gov/letters/2012/04/03/post_1333471169633/

VEGETABLES AND LETTUCE ON ISS

Credit:NASA astro Peggy Wilson with a lettuce

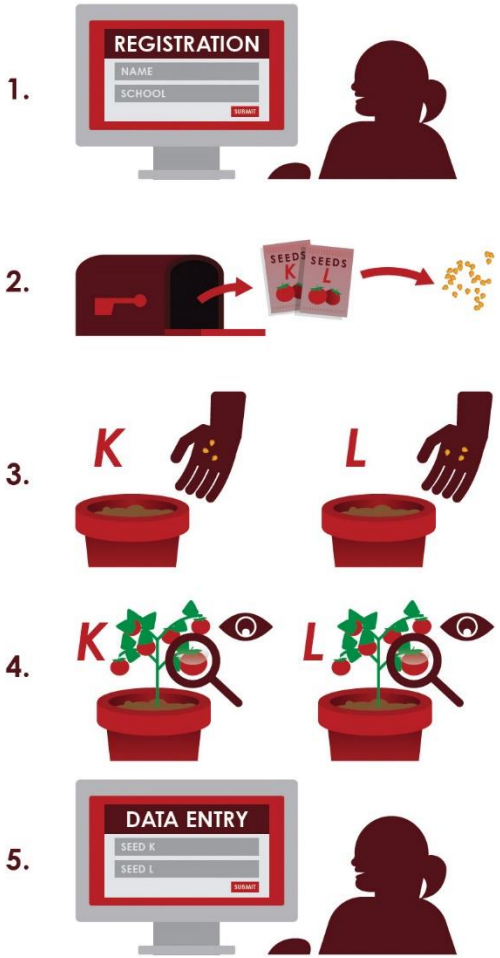
GROWTH SYSTEMS



credit: verge.com

TOMATOSPHERE™

TOMATOES ON ISS



credit:NASA/ESA

BEAN SPROUTS ON EARTH

Credit:Consula Coltan’s facebook page

SEND YOUR CODE TO THE ISS

- **Mission Zero**, the simpler level of the Astro Pi Challenge, also offers you the chance to have your code run on the ISS, in the form of a simple program that displays a message to the astronauts on-board.
- **Mission Space Lab** gives you the chance to have your scientific experiment run on the ISS. Your challenge is to design and code an experiment using the environmental sensors and cameras of the Astro Pi computers, called Ed and Izzy, aboard the ISS.

CLIMATE DETECTIVES

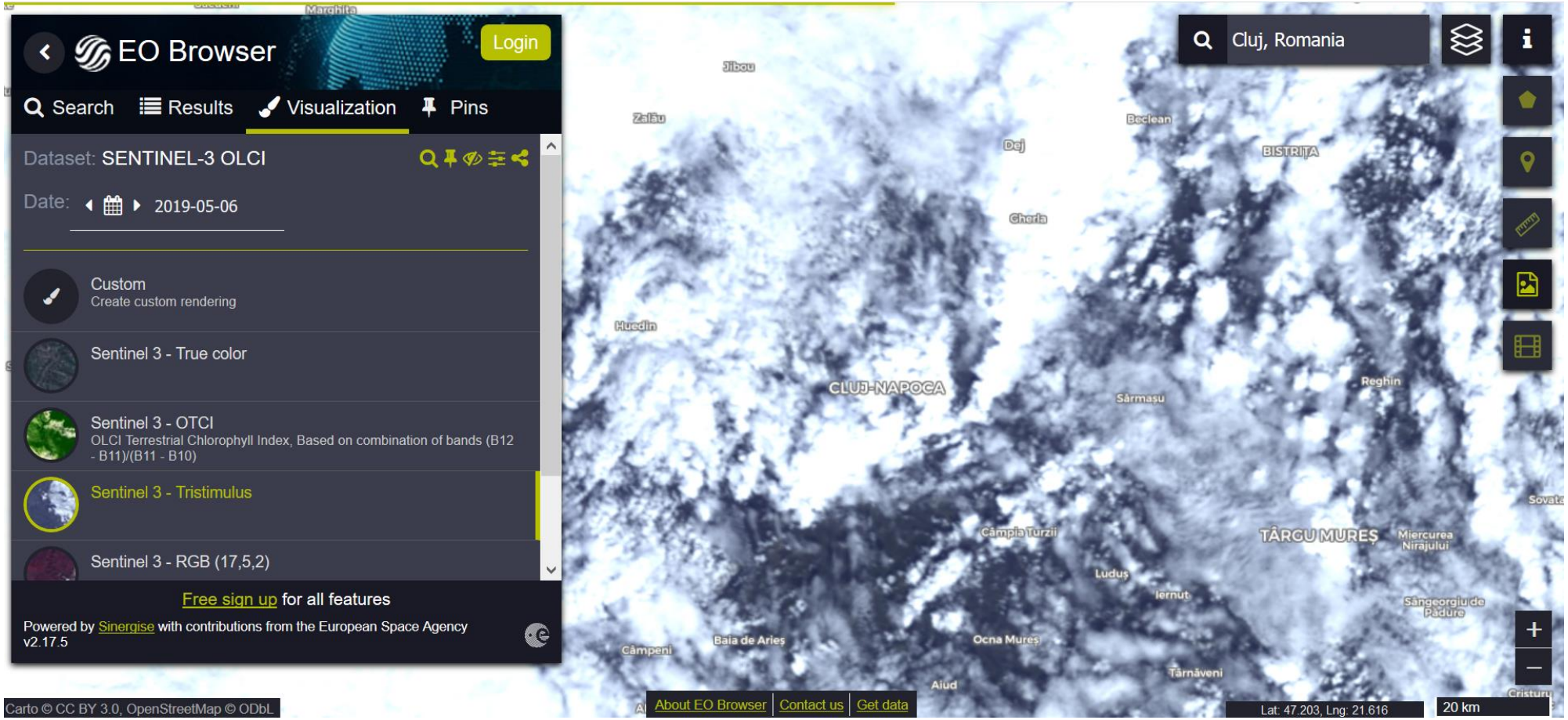
→ CLIMATE DETECTIVES

- School project for 8-15 years old.
- to ‘make a difference’ in understanding and protecting Earth’s climate.
- Identify a climate problem by observing their local environment and also using available **Earth Observation data** or take measurements on the ground.
- Based on their investigation, teams will propose a way to help reduce the problem. The students will learn about climate on Earth as a complex and changing system and the importance of respecting our environment.

EDU SPACE

credit: ESA

EO BROWSER



https://apps.sentinel-hub.com/eo-browser/?lat=46.810&lng=23.354&zoom=9&time=2019-05-06&preset=3_TRISTIMULUS&datasource=Sentinel-3%20OLCI

PRIMARY RESOURCES

Primary

From the ground and from the sky – Analysing and understanding images of planet earth taken from space | Teach with space PR10

The ice is melting – How can we investigate the effects of melting ice? | Teach with space PR13

Earth under the lid - Understanding the greenhouse effect | Teach with space PR15

One year on Earth - Understanding seasons | Teach with space PR45

Nose up high in the sky - Observing and measuring weather conditions | Teach with space PR48

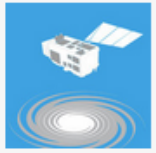
SECONDARY RESOURCES

Secondary

Highways of the Oceans - Sea currents and the connection to climate| TEACH WITH SPACE G02

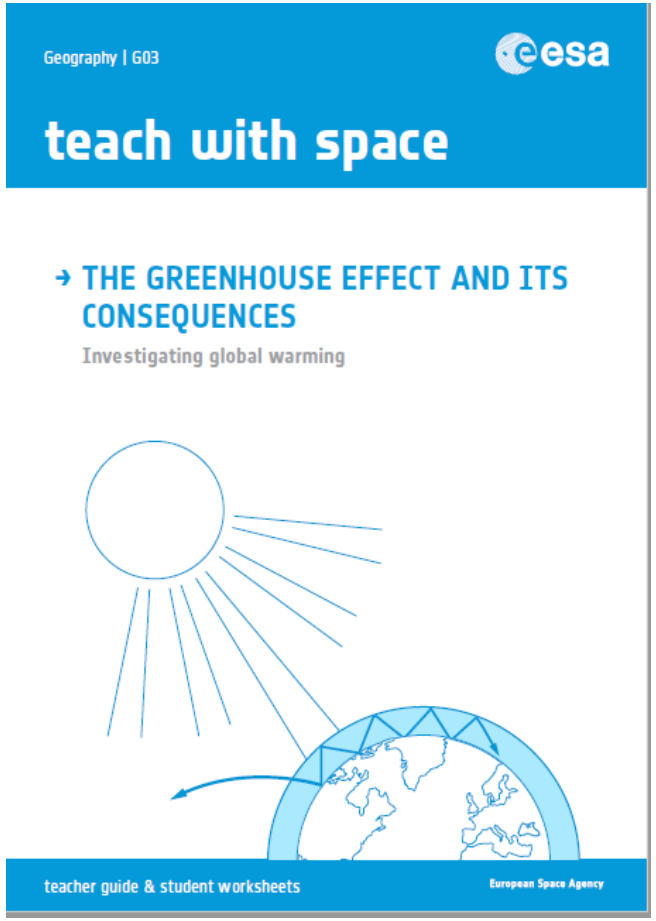
The greenhouse effect and its consequences - Investigating global warming | Teach with space G03

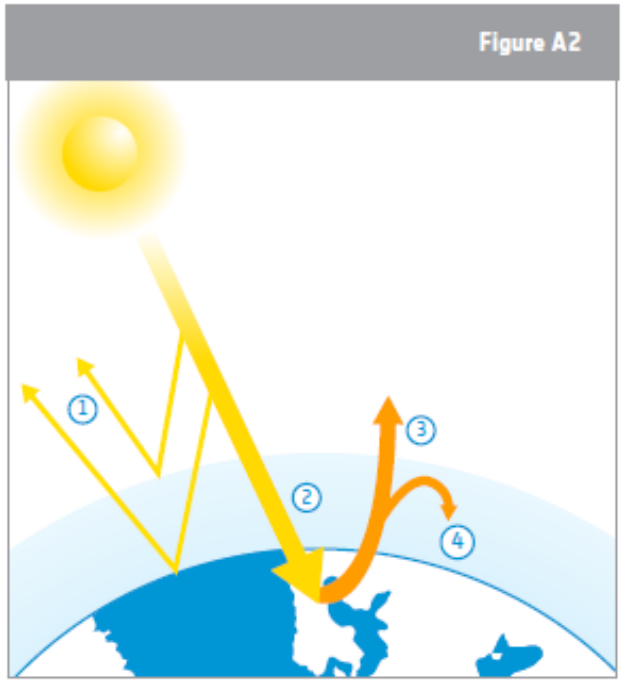
Infrared Webcam Hack - Using infrared light to observe the world in a new way | Teach with space P15



After the storm – Tracking Hurricane Matthew and analysing its impact | Teach with space G05

GREENHOUSE EFFECT





↑ Earth's radiation budget.
1 - Some radiation is reflected by the atmosphere, clouds and Earth's surface.
2 - Some radiation is absorbed by the atmosphere, clouds and most of it is absorbed by the land and oceans, heating the Earth.
3 - Infrared radiation is emitted by Earth's surface. Some of this radiation escapes to space.
4 - Some is trapped by the greenhouse gases in the atmosphere.

GREENHOUSE EFFECT

→ THE GREENHOUSE EFFECT AND ITS CONSEQUENCES

Investigating global warming

Fast facts

Subject: Geography, Physics, Science
Age range: 12-15 years old
Type: hands-on student's activity
Complexity: easy
Lesson time required: 45 minutes per activity
Cost: low (0 – 10 euros)
Location: indoors and outdoor
Includes the use of: computer, internet, infrared thermometer
Keywords: Greenhouse effect, Carbon dioxide, Global warming, Sea level, Albedo, Climate, Geography, Physics, Science

Brief description

This set of activities includes hands-on experiments and the interpretation of satellite images for better understanding the overall effects of global warming.
In activity 1 students will make a model to demonstrate the greenhouse effect by showing that a higher level of carbon dioxide (CO_2) means a higher temperature. The experiment will be complemented by the interpretation of satellite images showing the Earth's CO_2 levels at different time periods.
Students will then learn about some of the consequences of an increased greenhouse effect – ice melting and changing albedo values. Students will explore these topics in activities 2 and 3.

Learning objectives

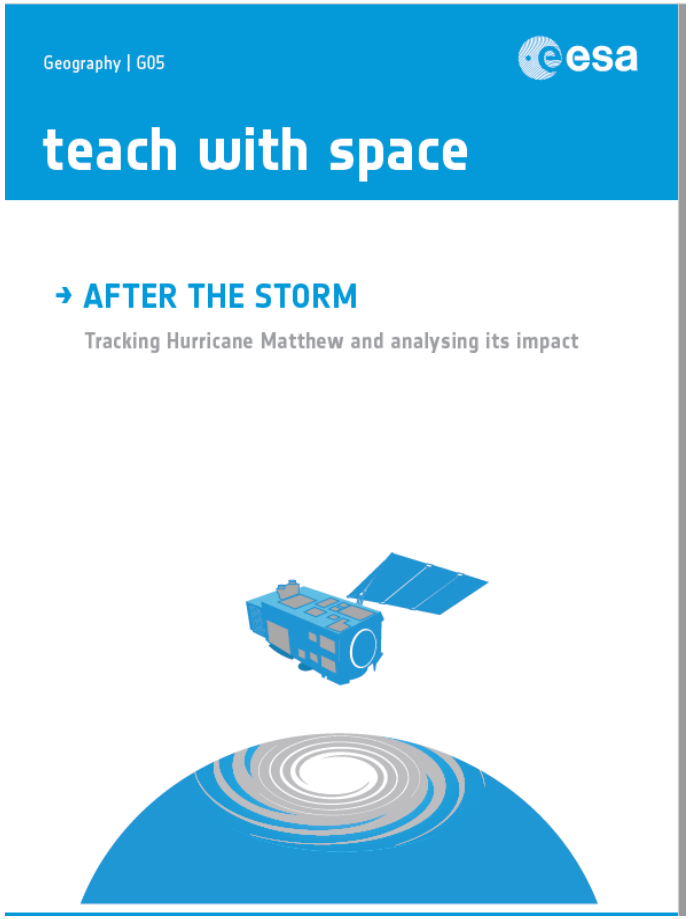
- What the greenhouse effect is and how human activity changes the energy balance in Earth's atmosphere.
- The potential effects of increased levels of carbon dioxide on the Earth's climate.
- Possible consequences of the increased greenhouse effect.
- The different consequences of flooding and rising sea water level due to melting sea-ice and melting ice sheets and glaciers.
- What albedo is and how the reflectivity of different surfaces affect temperature.
- How Earth observation can be used to monitor Earth's climate.

→ Summary of activities

Summary of activities

	Title	Description	Outcome	Requirements	Time
1	Greenhouse effect – what is that?	Students produce the greenhouse gas CO_2 through a simple chemical reaction, measure the effect of the gas on air temperature, and relate their conclusions to the greenhouse effect in our atmosphere.	Understanding CO_2's role as a greenhouse gas and what the greenhouse effect is.	None	45 minutes
2	Sea level as an indicator of global warming	Students explore by means of hands-on activities the effects of the melting of land ice and sea ice.	Understanding the effect on flooding from melting sea ice versus melting glaciers and ice sheets.	None	45 minutes
3	How changes in albedo can affect the climate	Students measure the reflectivity of different surfaces and investigate how the reflection from surfaces of different colour affects their temperature.	Better understanding of albedo and its role in the Earth's energy budget.	None	45 minutes

AFTER THE STORM



→ AFTER THE STORM

Tracking Hurricane Matthew and analysing its impact

Fast facts

Subject: Geography, Science
Age range: 12 – 15 years old
Type: student activity
Complexity: easy
Lesson time required: 1 hour
Cost: low (0-10 Euros)
Location: indoors
Includes the use of: computer and internet
Keywords: Earth observation, Climate, Extreme weather, Hurricane, Geography, Science

Brief description

These activities use the example of Hurricane Matthew to explore the applications of Earth observation data in tracking hurricanes and assessing their aftermath. Students will learn how a hurricane develops and the impact that extreme weather can have on the society. They will do this by comparing satellite images.
The activity could be completed either in an ICT suite in which students complete independent learning about the images or could be taught using a more active learning style in the classroom.

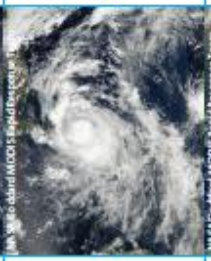
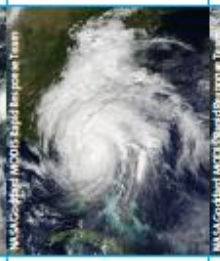
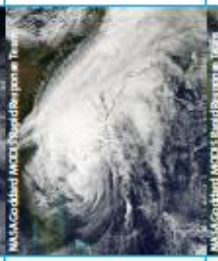
Learning objectives

- Explain how hurricanes develop.
- Understand the impact that extreme weather can have on society.
- Understand how Earth observation can be used to track incoming weather and assess the damage caused by extreme weather.
- Understand how countries work together to supply aid and relief to affected areas.

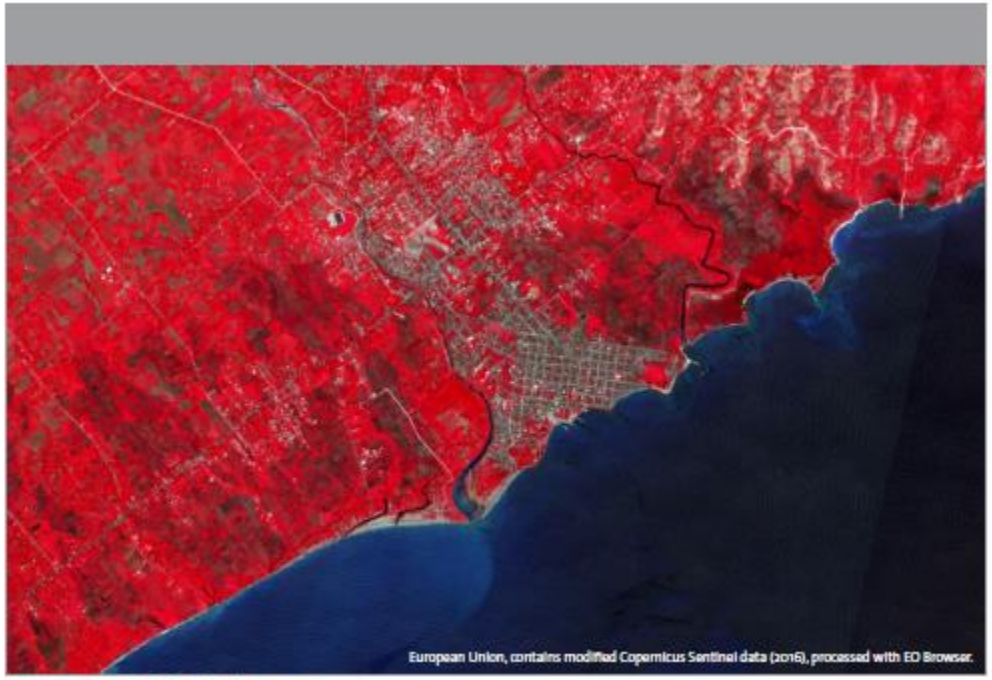
AFTER THE STORM

→ Summary of activities

Summary of activities					
	Title	Description	Outcome	Requirements	Time
1	Track the hurricane	This activity uses satellite images to develop students' Earth observation skills. The task is to investigate the development of Hurricane Matthew.	Students will learn: • How a hurricane develops • How Earth observation can enable weather tracking and predictions of its effects	None	20 minutes
2	Impacts of Hurricane Matthew	This activity is based upon remotely sensed data and encourages students to investigate how Earth observation can be used to examine the impacts of natural disasters such as Hurricane Matthew. By annotating images and identifying changes, students will develop their geographical skills of observation and analysis.	Students will learn: • The impact that an extreme weather event can have on society • The extent of the damage caused by extreme weather • The potential for Earth observation to be used to help recovery after an extreme weather event	Completion of activity 1	40 minutes

28th September 2016 14:30	5th October 2016 18:30	7th October 2016 16:00	8th October 2016 18:20	9th October 2016 15:45
				
D	A	B	E	C
Tropical storm evident. Movement – west in the direction of Haiti. Location – centre of circulation just east of the Lesser Antilles. Weather – Strong thunderstorms surrounding the centre with heavy clouds in the Caribbean Sea. Wind speeds are around 80km/h.	Hurricane now visible. Movement – north-west direction towards the Bahamas. Location – eye is visible north of Cuba and heading toward the Bahamas. Weather – the anticlockwise spiralling of cloud is visible. This produces high winds, gusts and heavy downpours for the areas affected. Haiti, the Dominican Republic, Jamaica and Cuba continue to be affected. Weather warnings issued for the Bahamas.	Category 3 hurricane. Movement – north-west direction heading toward the US coast. Location – central vortex is visible off the coast of Florida. Here, there is high density cloud and a clear hurricane structure. Weather conditions – strong winds of around 180km/h affecting Florida and Georgia.	Hurricane Matthew becomes a post-tropical cyclone with a visible change in structure. Movement – north-easterly direction along the SE coast of the USA. Location – off the coast of North Carolina. Weather conditions – winds of around 130km/h with some stronger gusts and heavy rainfall. Conditions will only begin to improve over the next 48 hours.	Post-tropical cyclone. Movement – now being absorbed by a cold front along the US Eastern Seaboard as evidenced by the decreased cloud density. Location – around 320km east of North Carolina. Weather conditions – winds beginning to weaken.

AFTER THE STORM



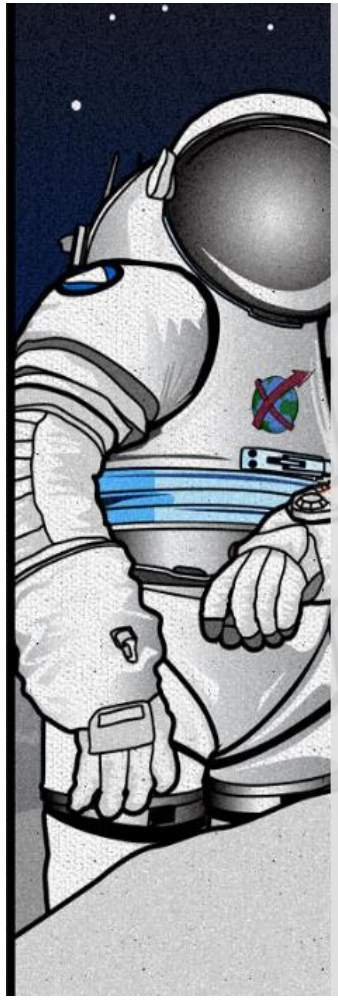
↑ Les Cayes, Haiti before the hurricane.

↑ Les Cayes, Haiti after the hurricane.

MOON CAMP CHALLENGE

- focus on learning-by-design and science experimentation.
- develop a number of curricular scientific experiments related to the Moon and apply the acquired knowledge in an interdisciplinary manner to design a Moon Camp using a 3D modelling tool (Tinkercad or Fusion 360).

MISSION X: TRAIN LIKE AN ASTRONAUT



Romania News

SCOALA GIMNAZIALA CONSTANTIN BRANCUSI

Wed, 03/09/2016 - 12:38 – sirius

ALTE ACTIVITATI DESFASURATE IN CADRUL MISSION X

SHARE

Like 0

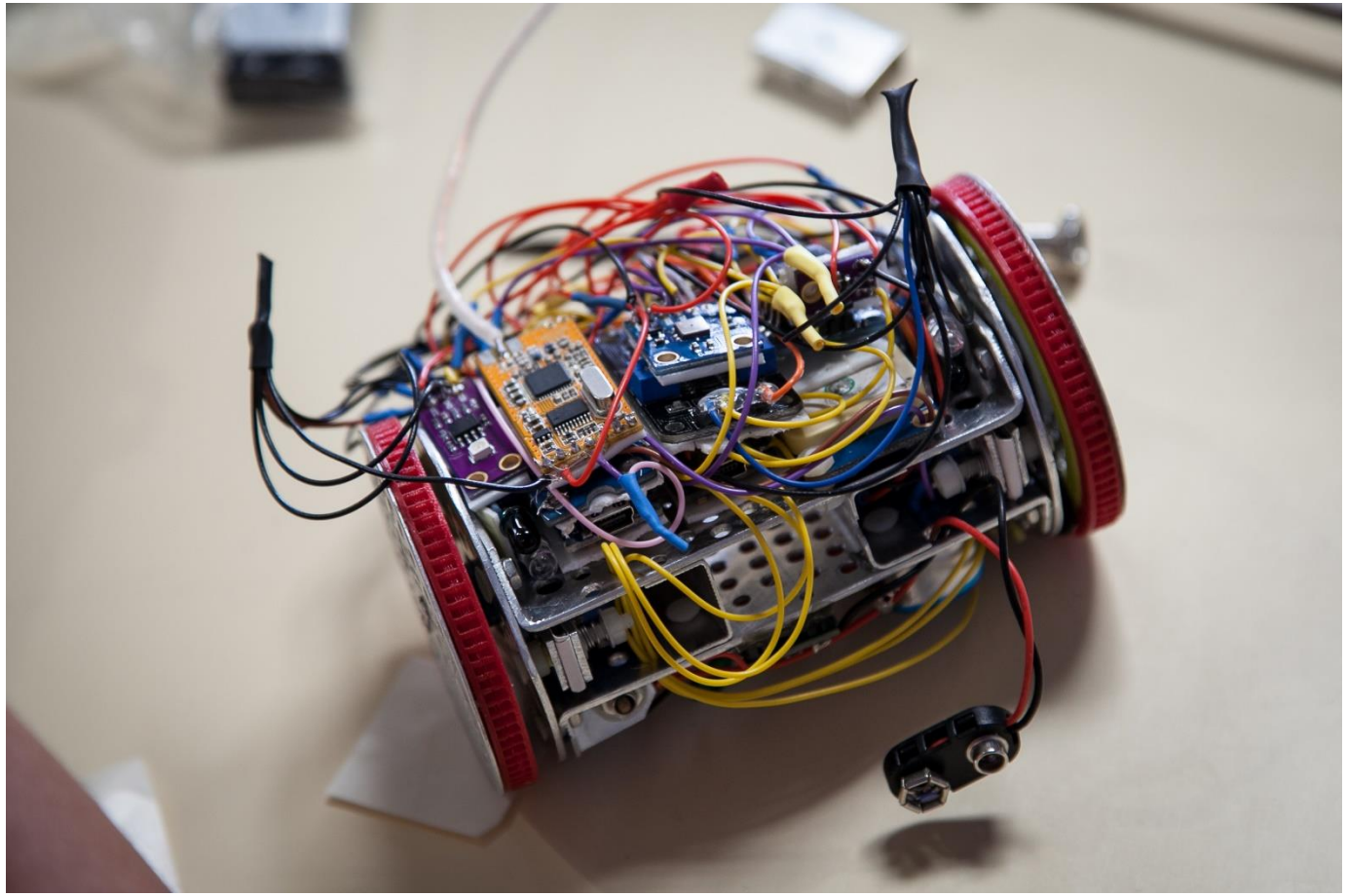
SCOALA GIMNAZIALA CONSTANTIN BRANCUSI

Wed, 03/09/2016 - 12:31 – sirius

FORMAREA ECHIPAJULUI

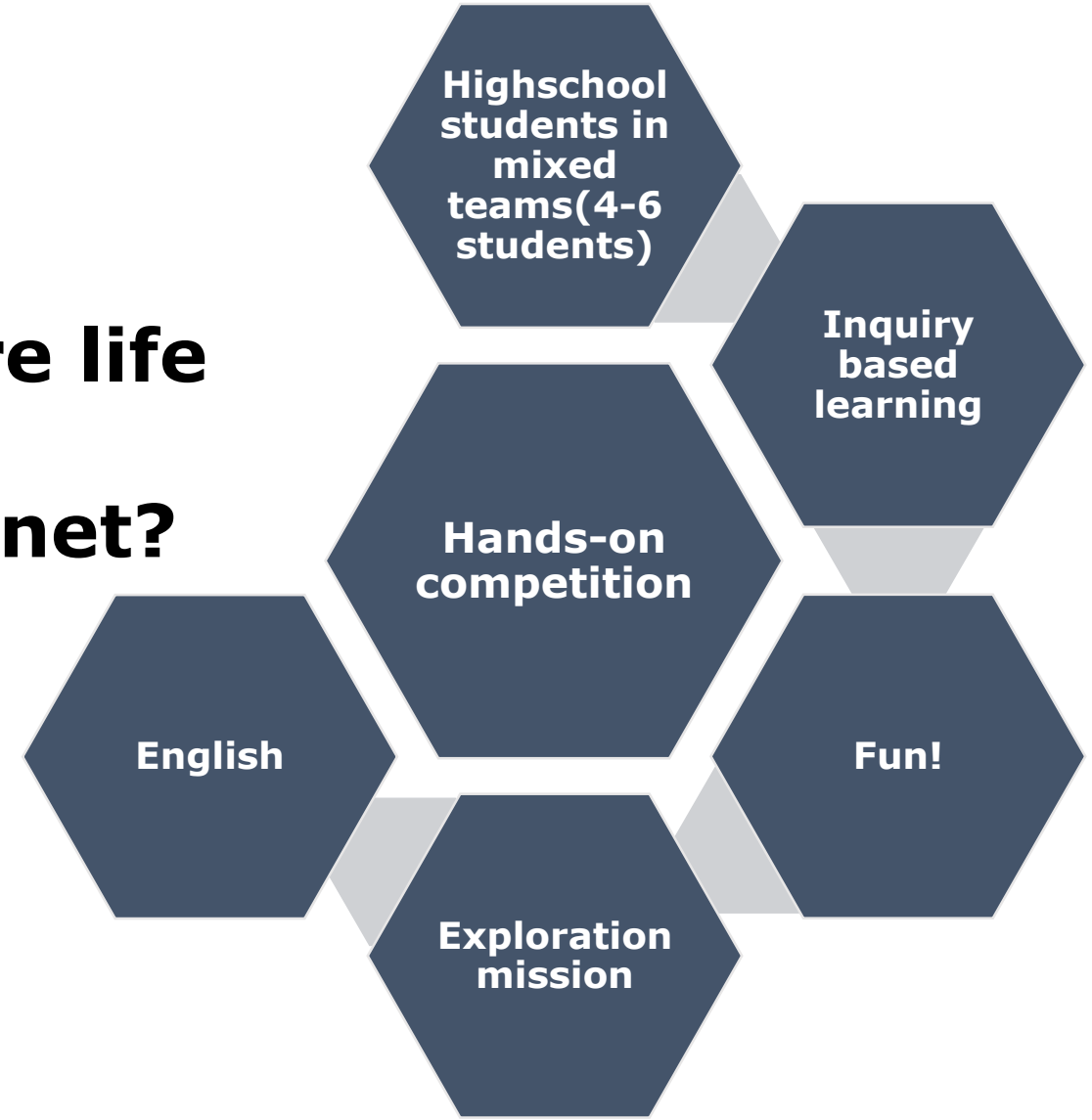
ROMANIAN NATIONAL CANSAT COMPETITION

WHAT IS A CanSat?

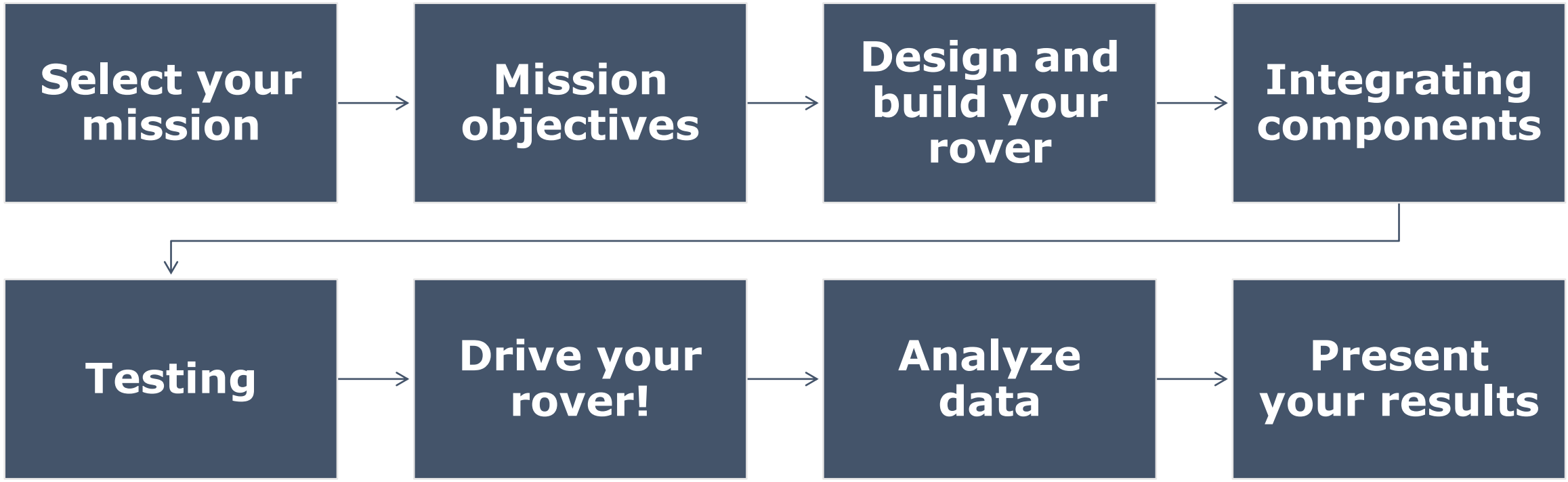


THE ADVENTURE BEGINS…

Is there life on an exoplanet?



THE ADVENTURE BEGINS…



THE ADVENTURE BEGINS…

DIMENSIONS

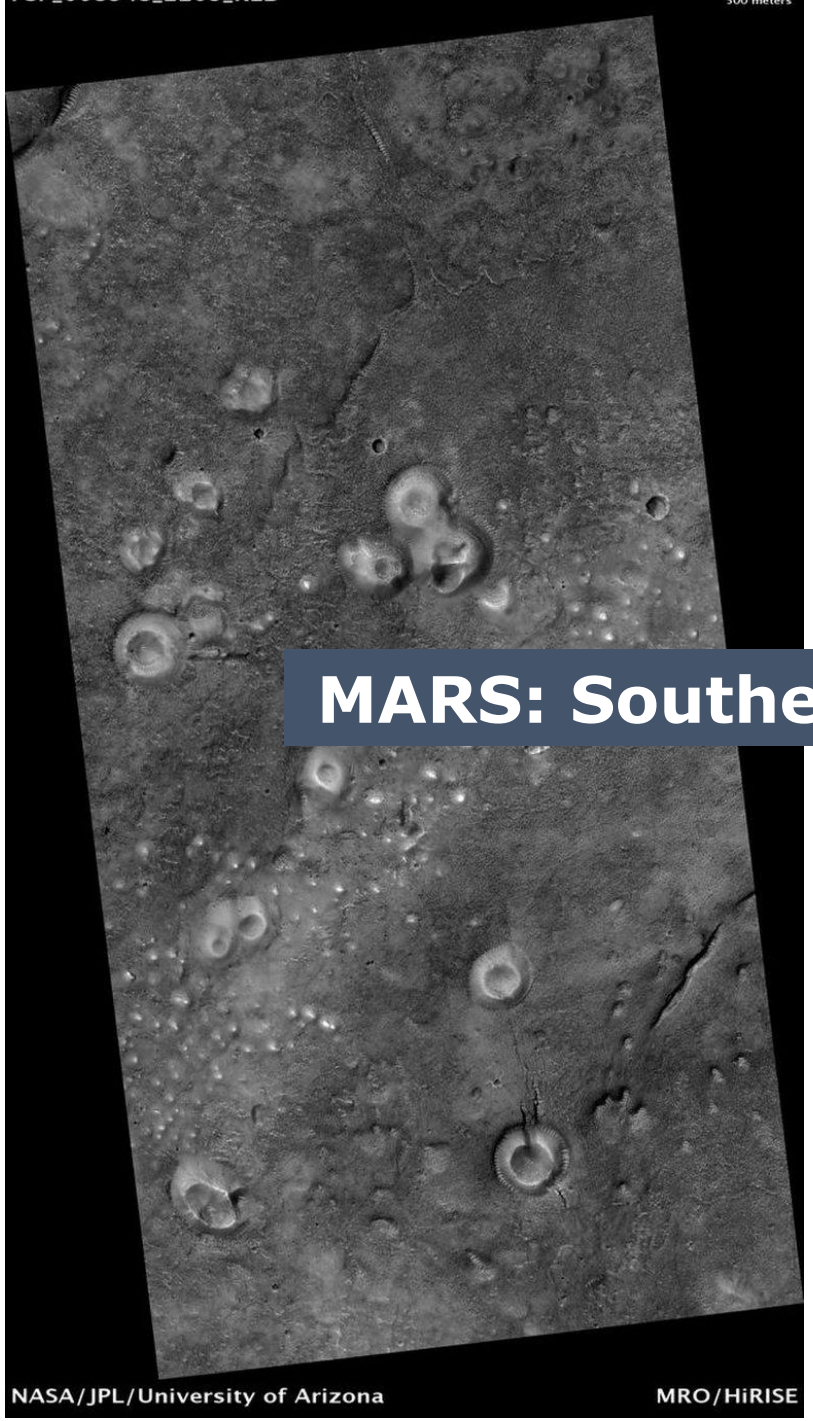
- Weight: 2.5 kg
- Length 40 cm
- Height 30 cm
- Width 20 cm

MAIN MISSION

- moving the rover by remote-control to a fixed point
- measurement of parameters (atmospheric pressure and temperature of the environment)
- sending images.

SECONDARY MISSION

- Collect samples
- Measure other environmental parameters using an array of sensors



MARS: Southern Acidalia Planitia

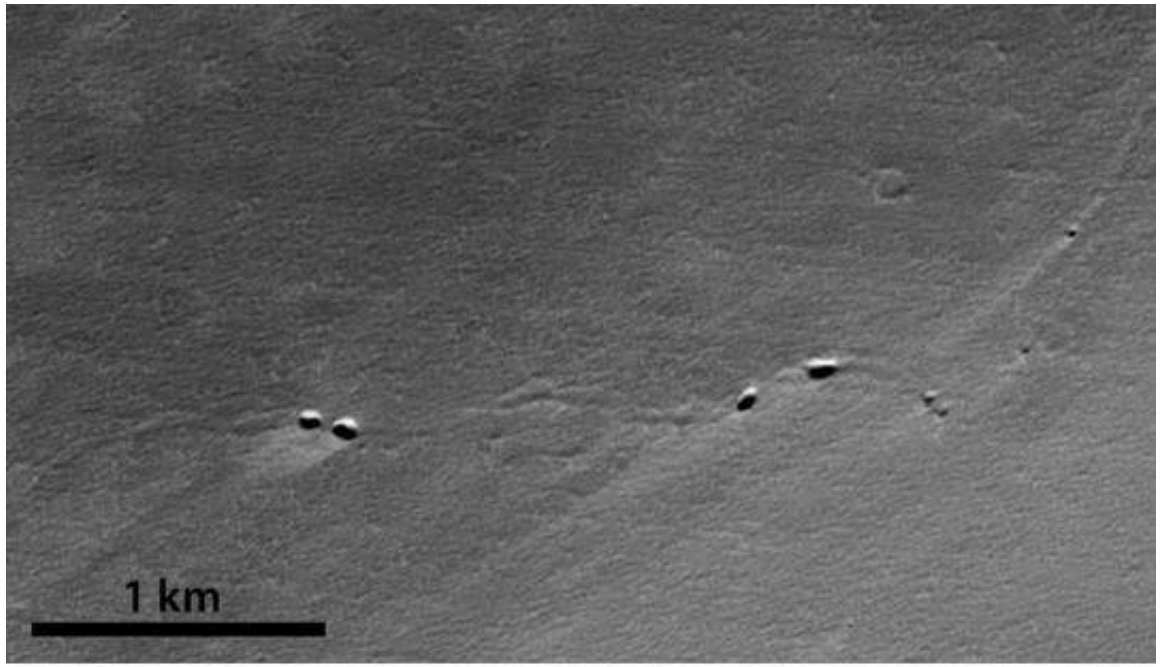
ROMANIA: MUDDY VOLCANOS, BUZAU COUNTY 2015

FIRST EDITION: MUDDY VOLCANOS, BUZAU COUNTY 2015

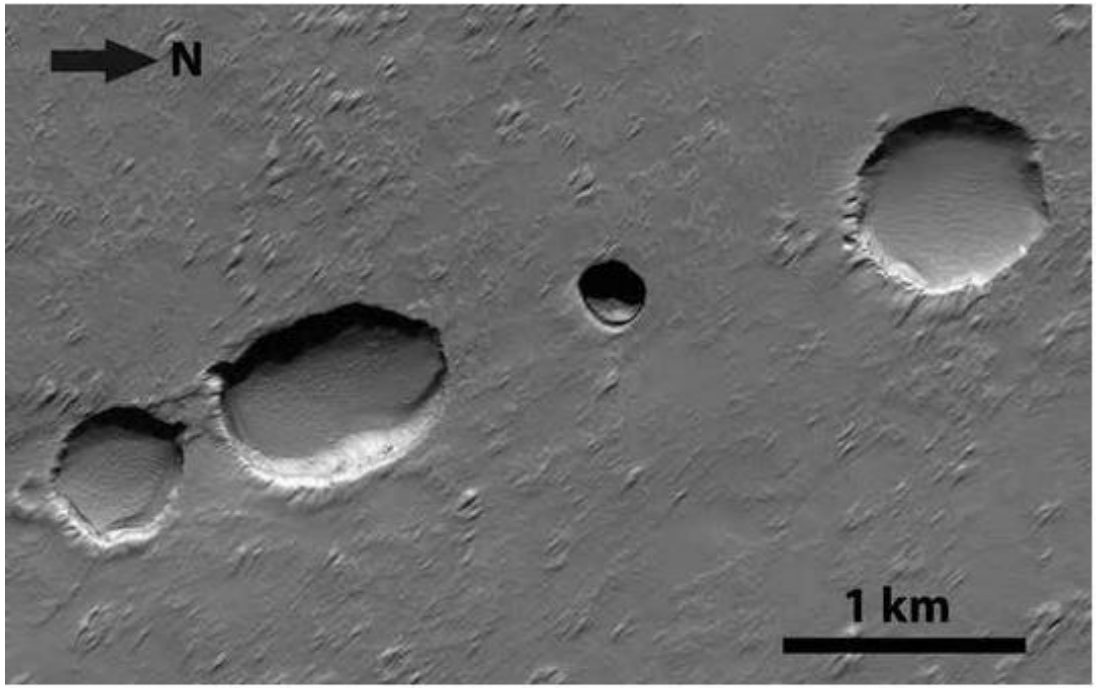
- Harsh environmental conditions
- Dynamic atmospheric data
- Naked eye navigation
- Robotic arm soil sampling

DRIVE YOUR ROVER!

SECOND EDITION: SALTMINE



A skylight in between two atypical pit craters on the southern flanks of Arsia Mons. The skylight is around two hundred meters wide and 80 meters deep. (credits NASA/JPL /University of Arizona)



A typical overcrusted lava tube on the northern side of Arsia Mons in the Tharsis volcanic province of Mars. The dark circle are skylights open on the underground conduit. (credits NASA/JPL/University of Arizona)

Exploring inner space for outer space

SECOND EDITION: SALTMINE, TG. OCNA, BACĂU COUNTY 2017

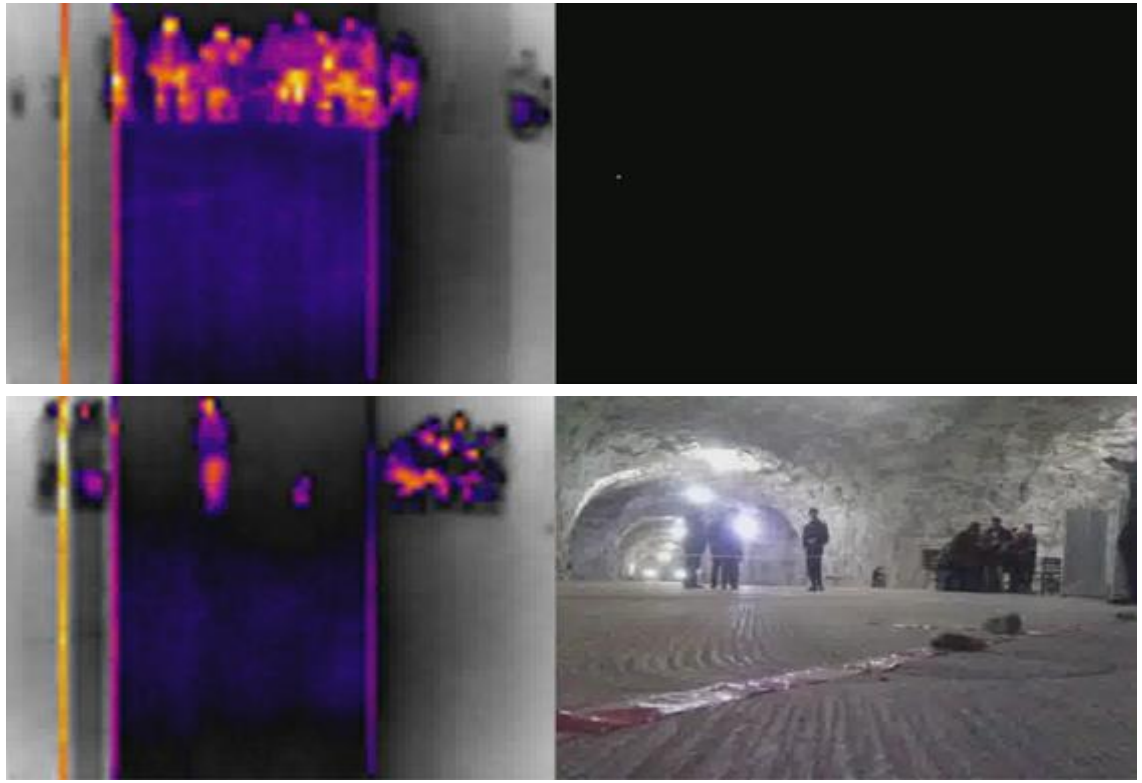
- Controlled environmental conditions
- Slight dynamic atmospheric data
- Bling navigation (only through the optical instruments on board)
- Improved maneuvrability

SECOND EDITION: SALTMINE, COORDINATES

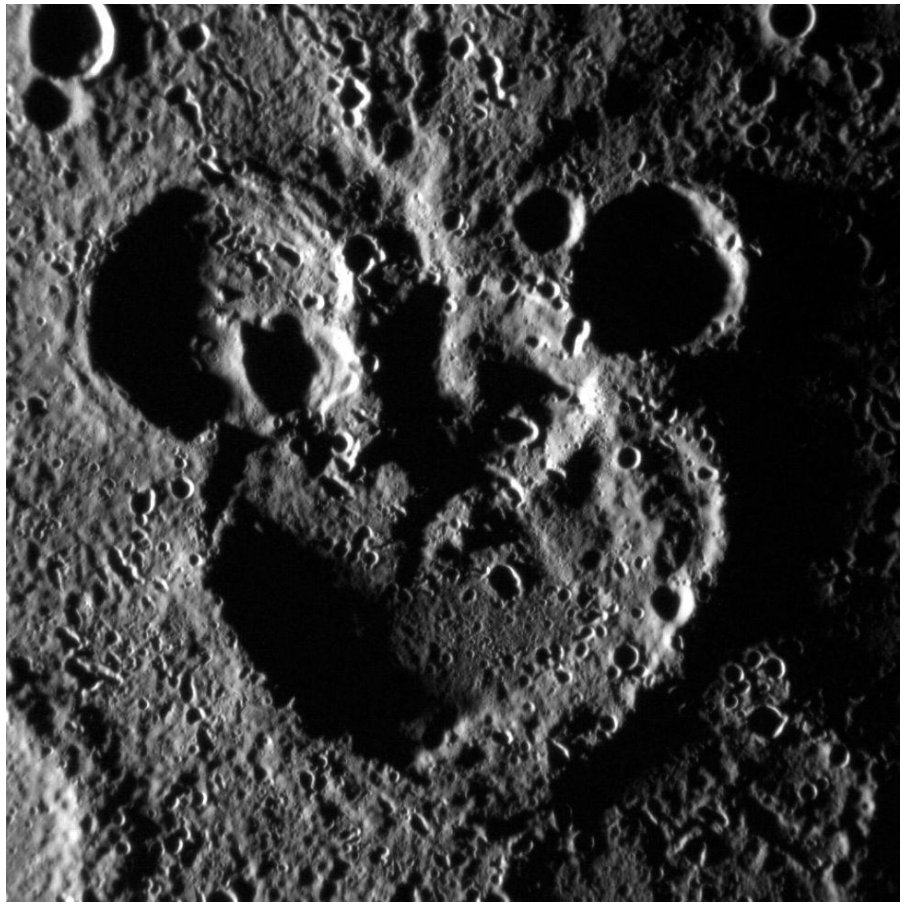
ENVIRONMENTAL CHARACTERISTICS:

- temperature between 12-13 degrees
- distance to starting point = 3.1 km
- vertical depth = 240 m
- level difference from entry point = 136 m
- altitude above sea level = 138 m
- usable area = 8900 sqm
- useful volume = 6100 m3
- room height = 8m

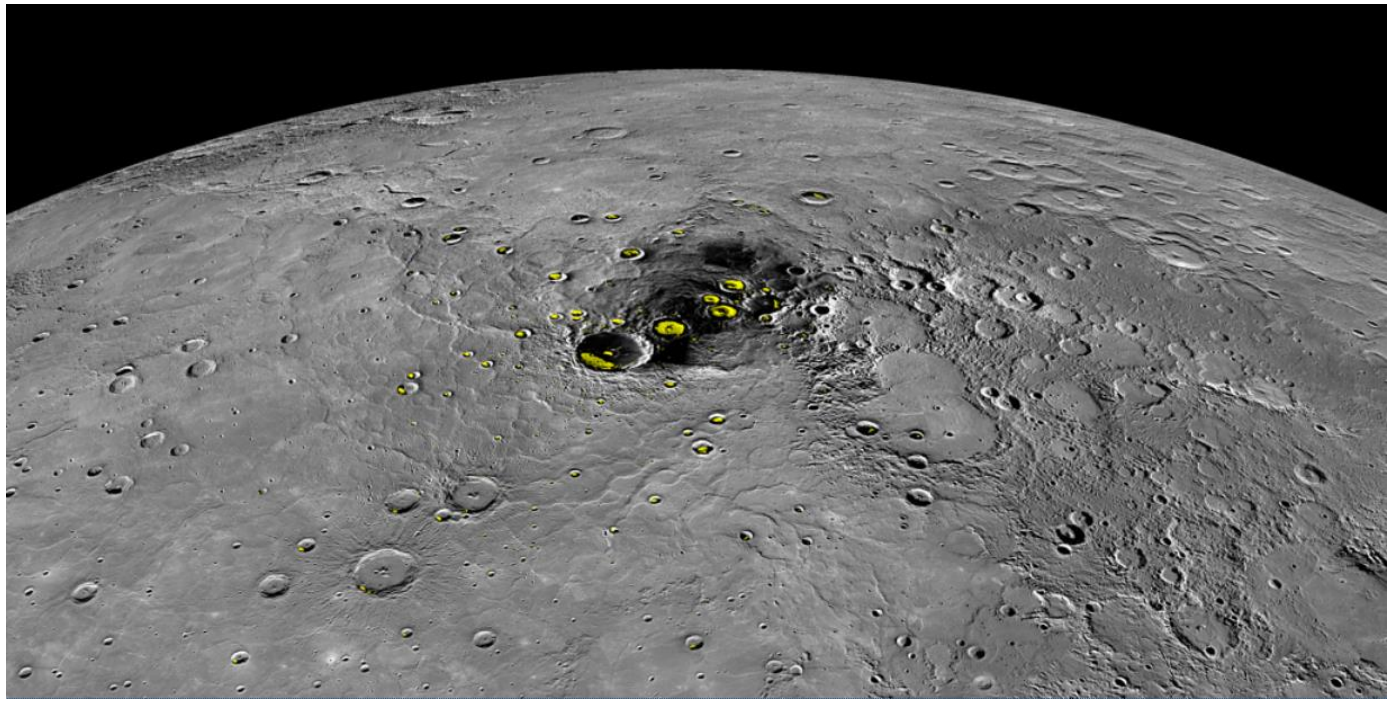
SECOND Edition: SALTMINE



THIRD EDITION: WATER CRATER 2018



(Image: © NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington 2012)



Instrument: Messenger Mercury Dual Imaging System (MDIS)
Arecibo Radar Image: In yellow (Harmon et al., 2011, Icarus 211, 37-50)
Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

THIRD EDITION: WATER BASIN, TIMISOARA, TIMIS COUNTY 2018

- Harsh environmental conditions
- Water present in solid and liquid state
- Dynamic atmospheric data
- Blind navigation (only through the optical instruments on board)
- Trouble with maneuvrability
- Sample collection

THIRD EDITION: WATER BASIN, TIMISOARA, TIMIS COUNTY 2018

THANK YOU!

Contact @ rosa.ro and esero.ro