

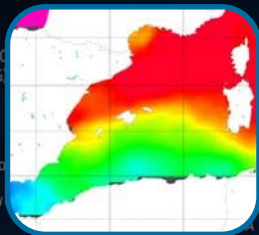
Scientific Exploitation WP 2021

EO Scientific Exploitation: Pushing the frontiers of science

The main catalyst of scientific excellence in EO and Earth system science, maximizing the scientific impact of ESA and European EO missions and establishing a solid scientific basis for novel EO products, new applications and future observation systems;



Engaging the community



New methods & products



Earth System Science



Scientific Campaigns



Training and Education



Open Science & Toolboxes

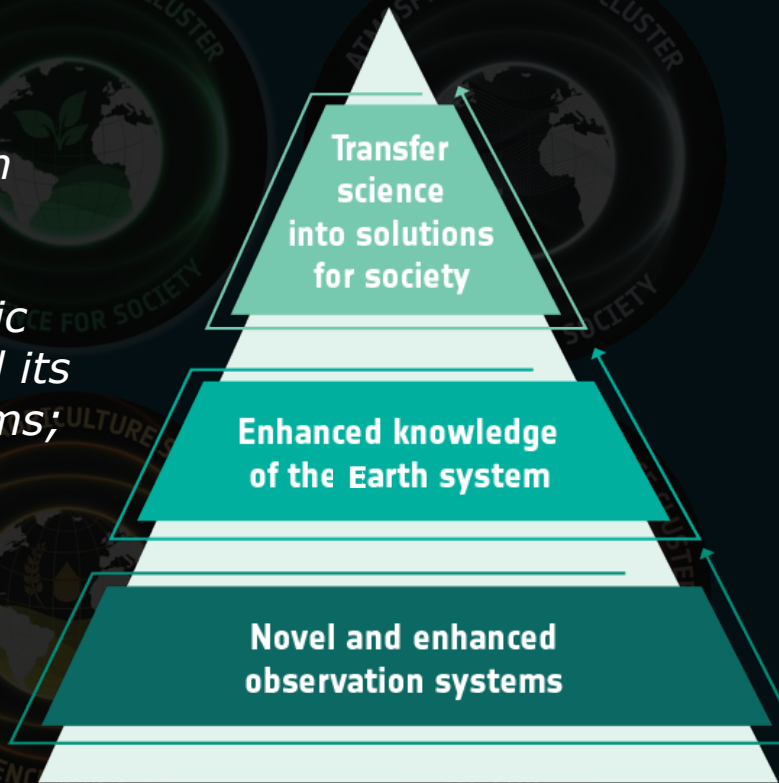


Networking & collaboration

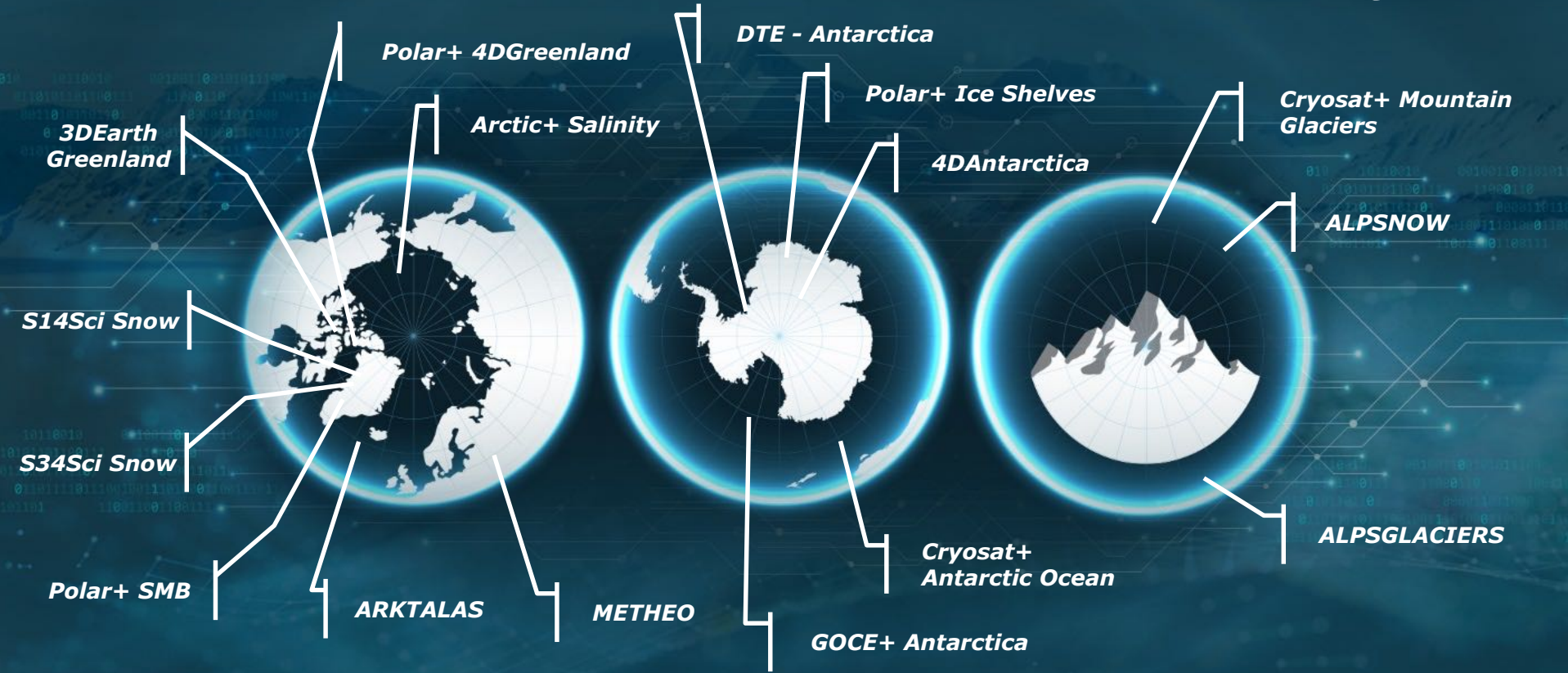


Driving future missions

- *Develop the next generation of EO products maximising the potential of the unique European EO capacity;*
- *Exploit novel EO capabilities to enhance the basic scientific understanding of the Earth system and its interactions with human activities and ecosystems;*
- *Translate new knowledge and novel scientific results into actionable solutions for society.*



ESA Polar Science Cluster Activities

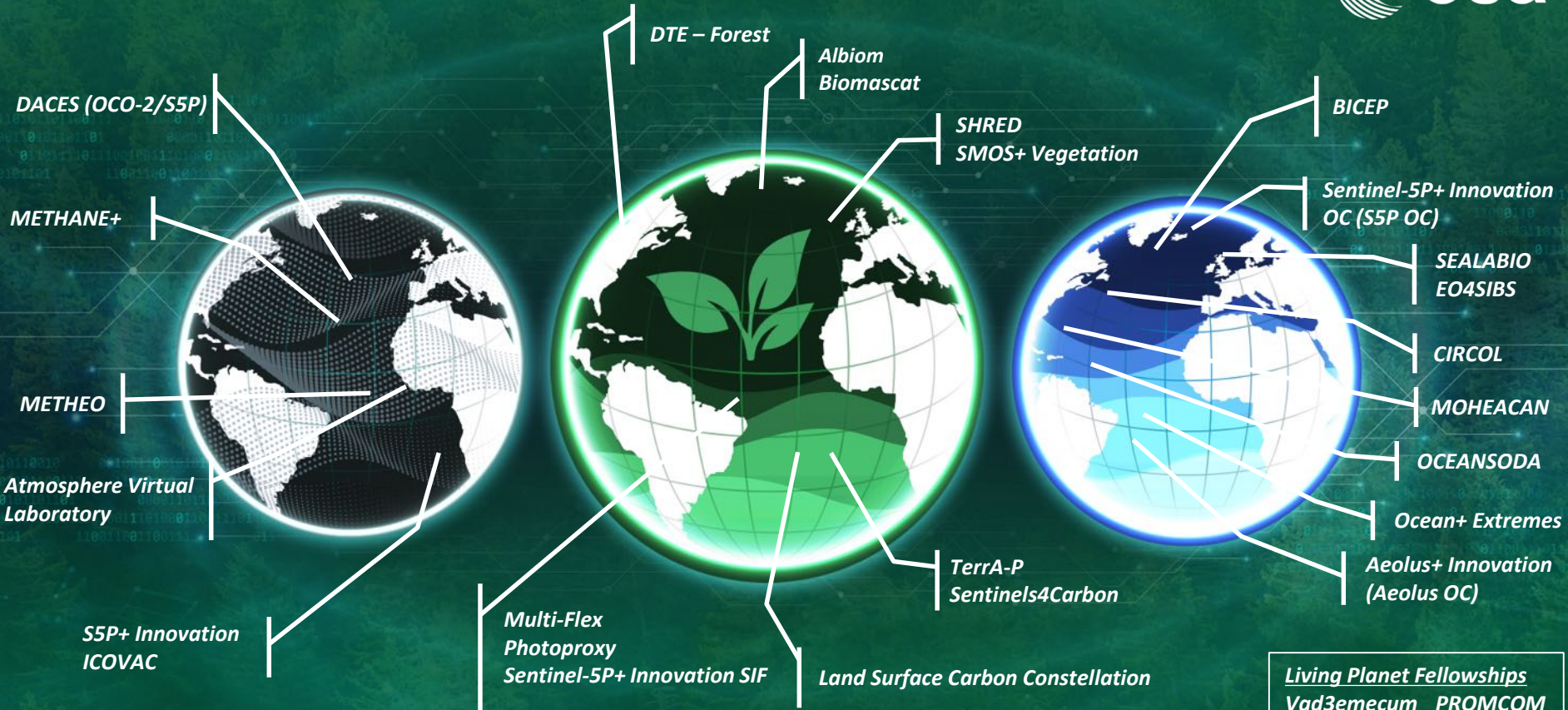


ESA UNCLASSIFIED – For Official Use



European Space Agency

ESA Carbon Science Cluster Activities



Living Planet Fellowships
Vad3emecum PROMCOM
PhysioGlob SMOWS

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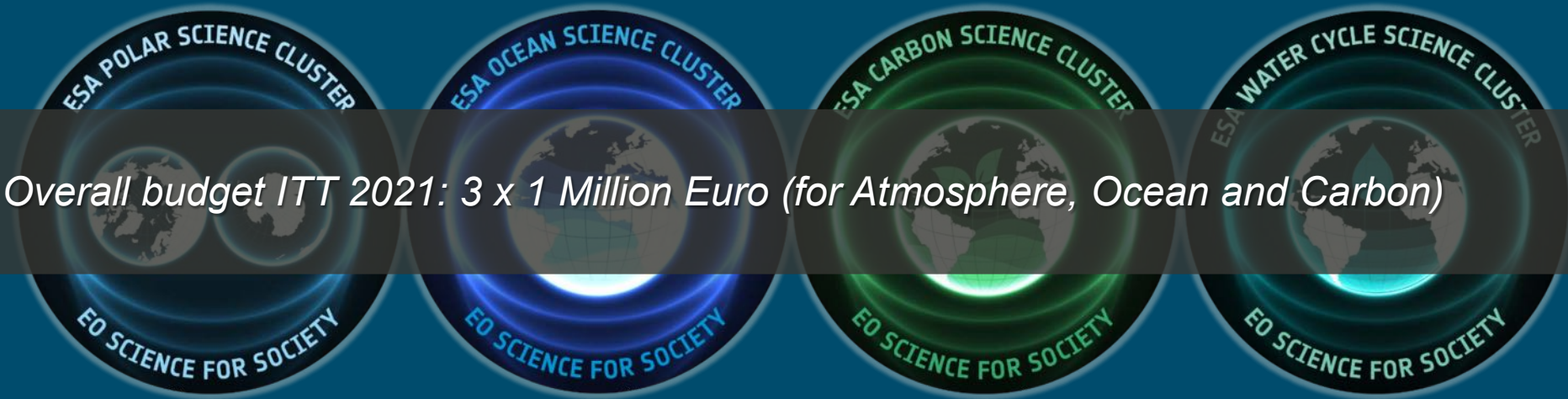


European Space Agency

Research & Networking Opportunities



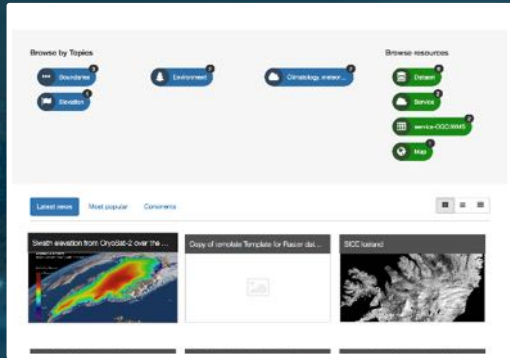
- Collaborative research actions bringing together different expertise, data and knowledge from different projects across Europe and beyond
- Community Networking actions: e.g., open science, data and knowledge sharing, synthesis reports, joint position papers, workshops, scientific agendas
- Scientific collaboration: e.g., new research activities undertaken partially in ESA



Overall budget ITT 2021: 3 x 1 Million Euro (for Atmosphere, Ocean and Carbon)

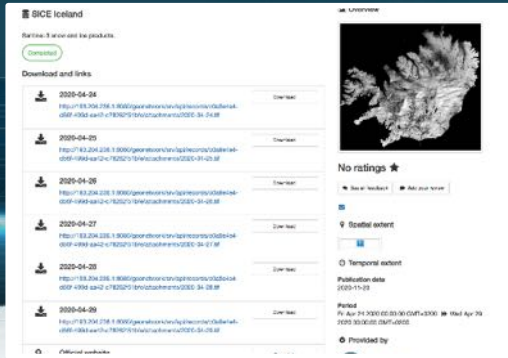


Science Cluster Data Catalogue & warehouse mechanism



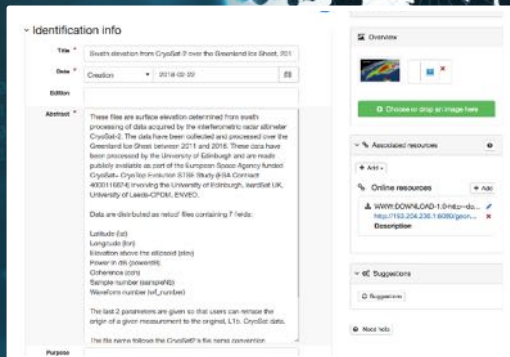
Metadata Catalogue

Discover and download content (redirect to resource origin through DOI)
Registered and non-registered users



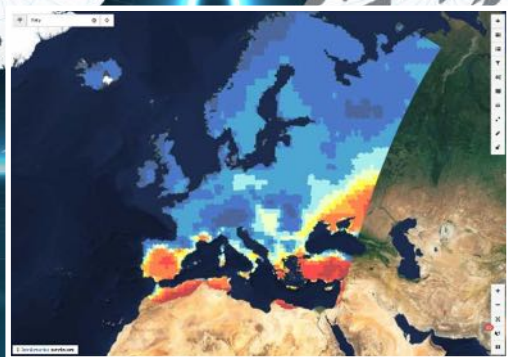
Data storage

File system and Spatial database for records not stored at source
Records stay at source as much as possible, in open repository exposing their metadata
Metadata records point to the location of the dataset



Metadata Editor

Serves to prepare metadata records
Final and reference versions of metadata are stored in the catalogue



Interactive map viewer based on [OpenLayers](#)

Provides access to OGC services (WMS, WMTS) and standards (KML, OWS).
Connected to the catalog, users can easily find new services, layers and even dynamic maps to combine them together. User maps can be annotated and printed and shared with others.



- **SEASAR:** Advancing Sentinel 1 WM and Tops sea state information including waves, wind and currents including synergies S1-S2 over marginal sea ice, coastal and the Mediterranean. (Q2, ~500KEuro)
- **SMOS10 VOD:** Exploiting 10 years of SMOS data to better characterise VOD and investigating the link between biomass soil moisture and vegetation water content. (Q2, ~500KEuro)
- **ATMOS Research Opportunities:** new set of research activities with focus on priorities from ATMOS 2019 conference (e.g., Integrated multisensory Air quality assessment at city level, Ozone recovery); (Q2, 1MEuro)
- **Aeolus+ Aerosols & Processes:** Set of activities to complement the Aeolus+ Innovation call with focus on novel aerosol retrievals and products and exploiting Aeolus for innovation in earth system science and process understanding; (Q3, 800 KEuro)



A common goal

*"... to jointly advance **Earth system science** and its contribution to **respond to the global challenges that society is facing** in the onset of this century"*

The European Commission's Deputy Director General for Research and Innovation, Patrick Child and ESA's Director of Earth Observation Programmes, Josef Aschbacher at the signing ceremony, January 2020.

Unique opportunity for Europe



ESA



FutureEO

ESA new Science and Innovation
Earth Observation Programme



EC-RTD

Horizon Europe

New EU Research and Innovation
Framework Programme



New ICT, Cloud Computing, AI, ...

Interdisciplinary & Open Science

Enhanced models and predictions

In-situ Networks/citizen data

ESA UNCLASSIFIED



European Space Agency

FLAGSHIPS ACTIONS



Kick-off in pilot phase (2020-2022)



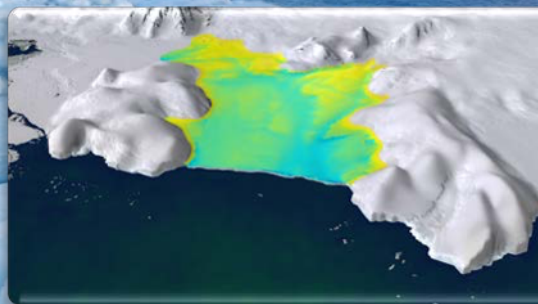
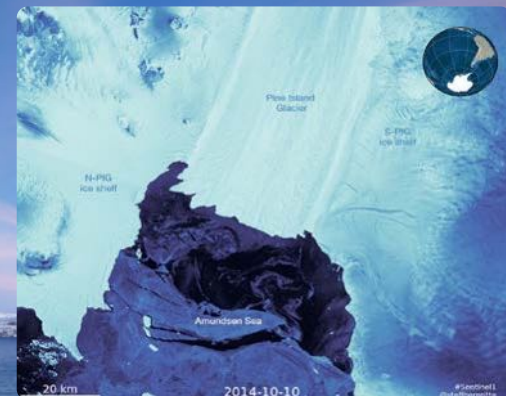
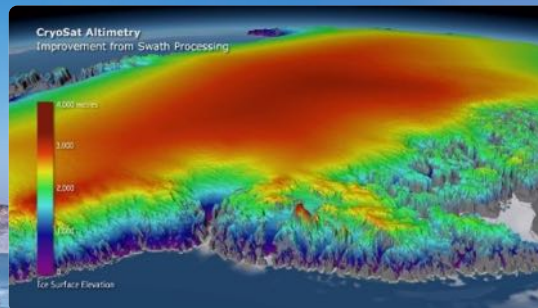
In preparation full implementation phase 2023+

Flagship Action on Polar Regions



Objectives

Advance our observation capabilities, basic understanding and prediction capacity of the different changes taken place in Polar regions, its interactions and feedbacks with the Earth and climate systems and its expected impacts from regional to global scales.



Polar Science Gaps:

Many of the natural physical processes occurring in the polar regions are potentially of profound significance in controlling conditions across the globe. This activity aims at enhancing our observing capacity and to better understand the complex physical and chemical processes governing Polar changes and its impact worldwide. Preliminary potential topics include: sea ice inter-comparison, multi-mission glacier mass balance, ESA-NASA Arctic methane and permafrost challenge, Arctic fresh water fluxes

Budget: ~1.5 Million Euro

ITT issued: Q2 2021 (based on results from EO4PolarScience2020)



Regional sea level and coastal hazards:

Exploit the huge capacity offered today by EO technology to complement in-situ networks and modelling approaches and develop novel advanced science-based solutions to enhance our capacity to observe, characterise and understand coastal processes, with special focus on coastal hazards and assess the of new science results to support adaptation efforts

Budget: ~1 Million Euro

ITT issued: Q1 2021

Coastal Hazards

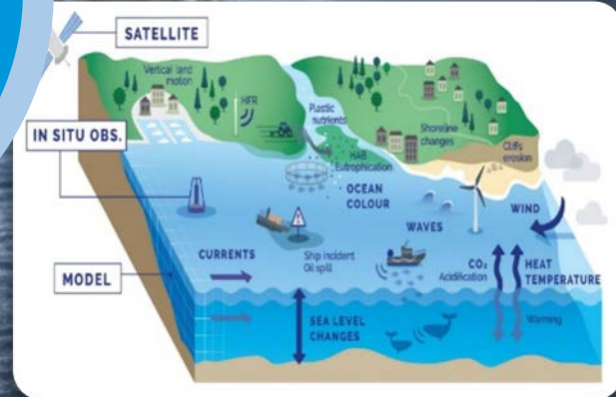
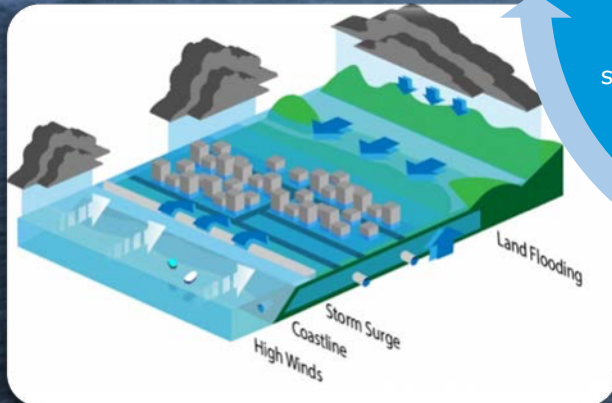
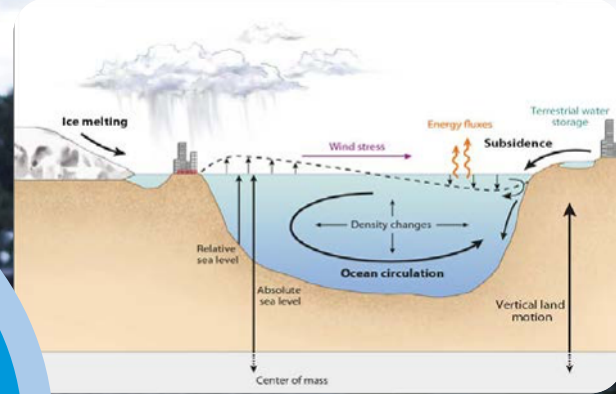


Societal
challenge

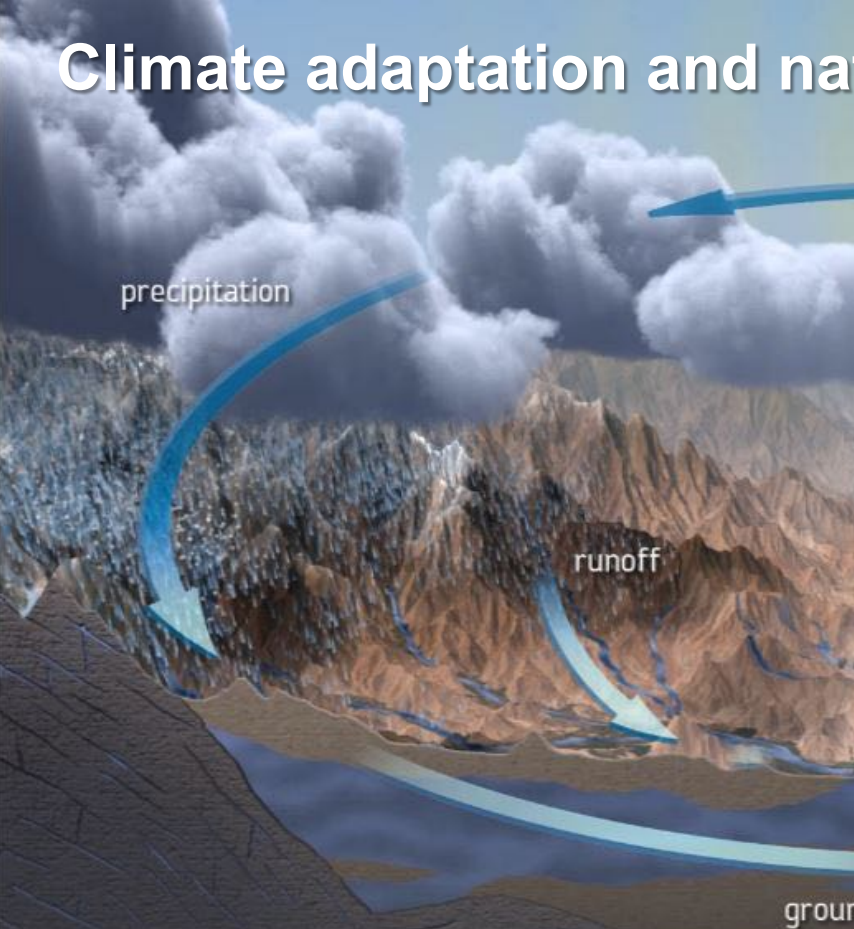
Scientific
challenge

Prototyping
science-based
solutions

Novel
observations,
knowledge,
gaps, process
understanding



Climate adaptation and natural disasters



Climate adaptation & natural disasters:

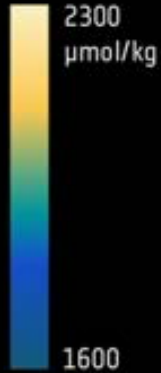
This activity aims at exploring the potential of multi-mission and multivariate EO data and products for the detection and attribution of extreme events such as heatwaves, droughts, extreme precipitation, **especially with respect to understanding and characterizing compound events and multi-hazards mechanism and their impact on society and ecosystems**

Budget: ~1 Million Euro

ITT issued: Q2 2021



Ocean Health



Dissolved Inorganic Carbon
2010 May



Ocean Health - Precursors:

The objective is to address 3-4 concrete science cases dedicated to Ocean Health and demonstrate the potential offered by the integration of the latest EO European satellite capacity together with in-situ observations, advanced models and novel technologies: e.g., marine ecosystem connectivity, ocean heatwaves predictions/impacts, ocean acidification, ocean deserts,...

Budget: ~1.5 Million Euro (3x500KEuro)

ITT issued: Q1 2021

Ocean Health



4DAtlantic

ESA DTO
Precursor

H2020
Green Deal Call
Digital Twin
Ocean

ESA ITT
Ocean
Health

4DMed

*Direct response to the HE
mission on Ocean Health*

*Common goal is to enhance
our observation capacity and
fundamental scientific
understanding of the ocean's
health and its role in the Earth
and climate system and
transfer that knowledge into
novel solutions for society and
a solid scientific basis to
develop a Digital Twin of the
Oceans*

Biodiversity & Vulnerable Ecosystems



Biodiversity Virtual Lab

New ITT to develop a Biodiversity Virtual lab in support of the ESA-EC Flagship action on Biodiversity. Biodiversity VL will offer scientist with an open science environment based on latest platform capabilities (e.g., TEPs) to support collaborative research and the sharing on knowledge, data sets, code and results in support of the EO biodiversity and ecosystem science community.

Budget: ~700 Keuro

ITT issued: Q4 2021

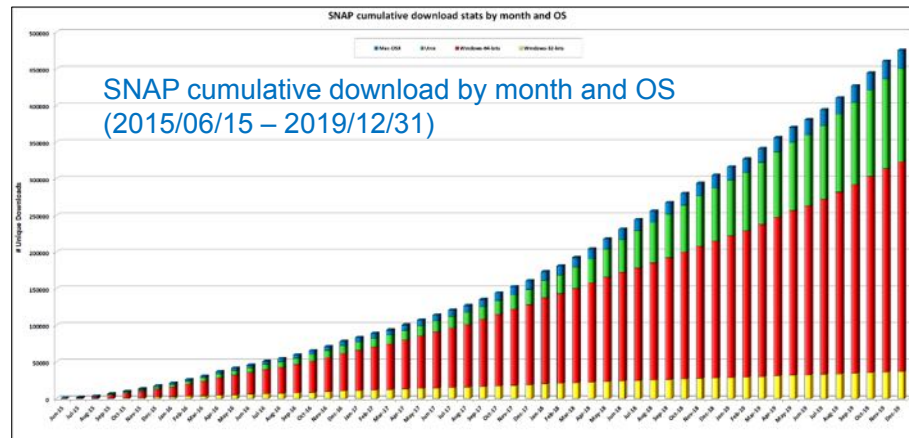
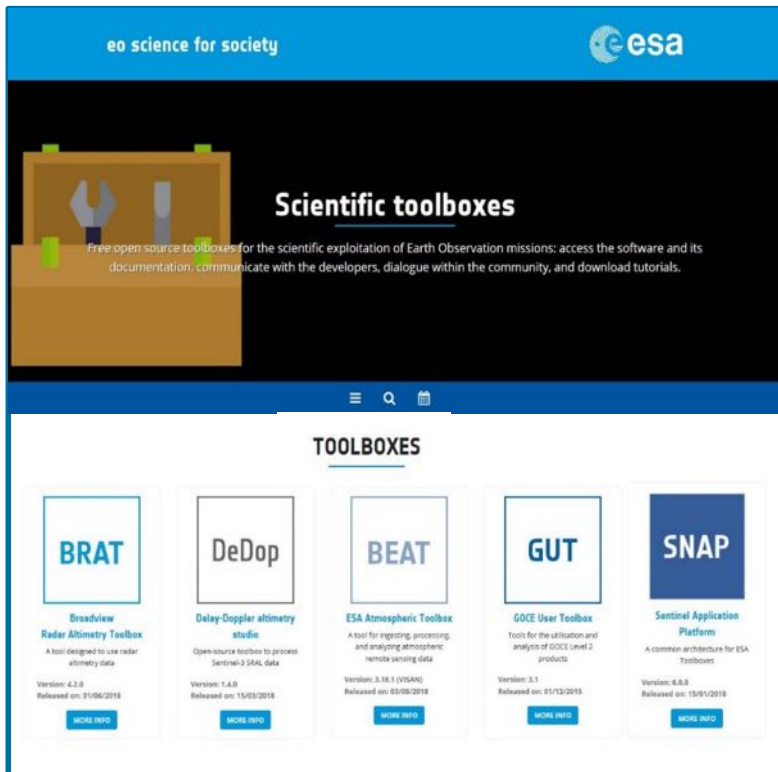


Source: National History Museum, UK

Other priorities and future EO missions



Activity	Description	Budget	Expected ITT
Agriculture under pressure	New ITTs Earth science for agriculture under pressure and sustainable food systems (based on the results of the ESA-EC workshop organised in 2020)	~1M€	Q3 2021
Water cycle science	New ITT on Earth science and water cycle research, water resource management and hydrology (based on recommendations from EO for water Science 2020 workshop)	~1M€	Q3 2021
4DEarth geo-hazards	New ITT on geo-hazards with focus on connecting solid earth modelling and advanced surface dynamics (e.g., for volcanoes and earthquakes).	~1M€	Q4 2021
Science for the Green Deal (precursors)	New ITTs supporting a new set of feasibility and precursor activities focusing on new topics under development including Earth science for health.	~1M€	Q4 2021



Great SNAP Success: More than 700,000+ downloads

Needs to define evolution:

- Upgrade baseline SW and technology (faster)
- Towards a community project
- Integration of other toolboxes (e.g., Altimetry)
- New 3rd party community plug-in approach
- Improve compatibility with cloud computing environments

New ITT for SNAP Evolution in 2021: 1.6Million Euro

Living Planet Fellowship



- New Call in 2021. Q3
- New approach to support collaborative research and networking
- New opportunities for visiting periods in Europe
- New opportunities to interact with ESA



Scientific Workshops

ESA EO PHIWEEK 2019



More than 2100 participants
16,000 view of youtube channel



More than 1000 participants
3500 unique views



More than 700 participants
3200 unique views



More than 500 participants

Preliminary plan for 2021

- **Phi week 2021, TBD**
- **POLINSAR, March 2021**
- **ATMOS, November 2021**
- **Hydrospace, June 2021**
- **FRINGE, 31 May-4 June 2021**
- **Carbon from Space 2021, TBC**
- **EO4Biodiversity, TBD**
- **Climate Adaptation and Natural Disasters, TBD**
- **Ocean Health, TBD**

Regional Initiatives Science



Regional Initiatives



Activity	Description	Budget	Note
4DMed – Land	<i>Focused on developing an advanced 4D high resolution integrated reconstruction of the Mediterranean terrestrial hydrological cycle and land surface processes</i>	~0.7-1M€	Q2 2021
4DMed – Ocean	<i>Focus on developing an advanced 4D high resolution reconstruction of the Mediterranean ocean and its dynamics connecting physical oceanography and biochemistry</i>	~0.7-1M€	Q2 2021
Baltic+ 2	New ITT on Baltic science based on the discussions and interactions with Baltic Earth	~1 M€	Q3 2021
Black Sea & Danube+ 2	New ITT on science for the Black sea and the Danube region.	~1 M€	Q3 2021