

# ESA's Earth Observation Programme following Space '19+

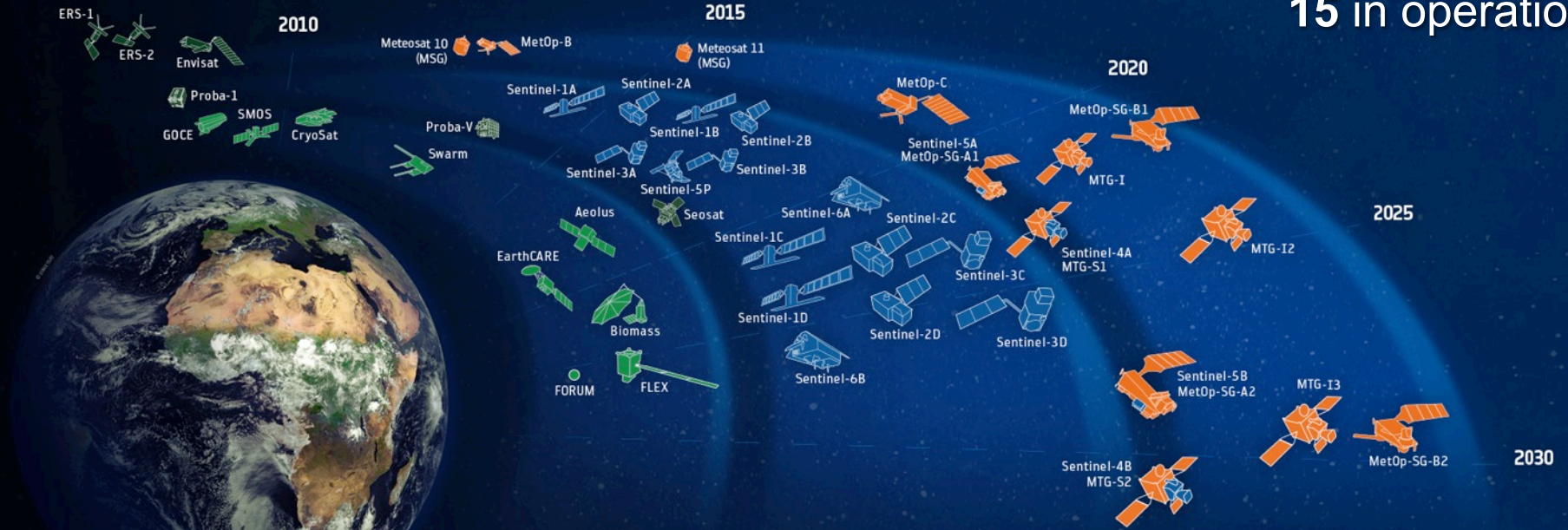
GEWEX SSG-32,  
CalTech, Pasadena, CA  
27-30 January 2020

D. Fernandez, M. Rast,  
ESA ESRIN, Frascati

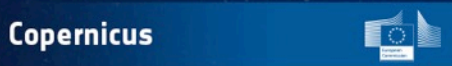
# ESA-Developed Earth Observation Missions



25 under development  
15 in operation



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European Space Agency



# Space19+ Outcomes for Earth Observation



Programme	Proposed (M€)	Subscribed (M€)	Subscription Rate
FutureEO	650	553	85%
CSC-4	1402	1811	129%
EW-ALTIUS pH E	55	55	99%
EW-InCubed+	150	61	41%
EW-GDA	50	30	60%
EW-TRUTHS	32	32	101%
EW-AW	42	42	100%
Proba-V Exploitation	13	13	97%
Seosat	-	11.4	-
CCI+	-	0.7	-
<b>TOTAL</b>	<b>2394</b>	<b>2610</b>	<b>109%</b>

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European Space Agency

EO Missions funded at

Space19 



## Earth Explorer 9

# FORUM

Far-infrared-Outgoing-Radiation  
Understanding and Monitoring

## Small Missions



2 SCOUTS  
and  
2-4  $\Phi$ -sats



## Copernicus



6 ESA-funded Sentinels  
(+ 6/7 EU-funded recurrent)



## TRUTHS

Phase A/B1

ARCTIC  
WEATHER  
SATELLITE

## ALTIUS

Phase E

## Proba-V

Extension + 2 Smallsat

## Preparation of future Missions

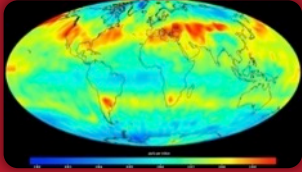
Sentinels Next Gen. Phase A/B1  
Aeolus follow-on, Earth Explorer-10,  
Next Generation Gravity Mission with NASA



# Copernicus new Missions

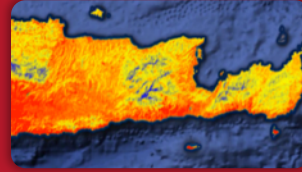


## CO2M - Anthropogenic CO<sub>2</sub> Monitoring



Causes of  
Climate Change

## LST – Land Surface Temperature Mission



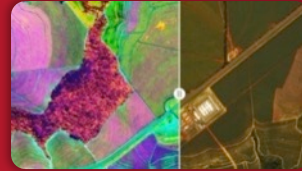
Agriculture & Water  
Productivity

## CRISTAL – Polar Ice & Snow Topography



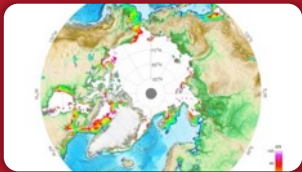
Effects of  
Climate Change

## CHIME – Hyperspectral Imaging Mission



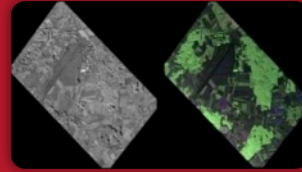
Food Security, Soil,  
Minerals, Biodiversity

## CIMR – Passive Microwave Radiometer



Sea: Surface Temp.  
& Ice Concentration

## ROSE-L – L-band SAR Mission



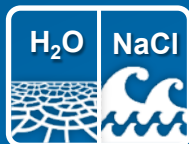
Vegetation & Ground  
Motion & Moisture

## Flying Missions

**GOCE**  
2009-2013



**SMOS**  
2009



**Cryosat**  
2010



**Swarm**  
2013



**Aeolus**  
2018



**Science & Innovation**



**4.700+**  
Reg. Users

## Future Missions

**EarthCare**  
2022



**Biomass**  
2022



**FLEX**  
2023



**FORUM**  
2025



**EE-10**  
2027

**3**  
Cand.



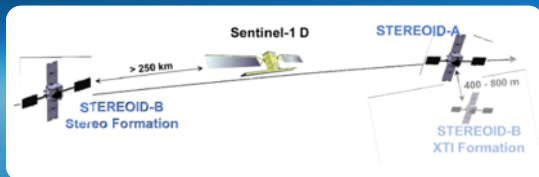
**300+ Publ.**  
per Year

**High Risks for Great Rewards**



# Earth Explorer 10 – Three Candidates

## Harmony

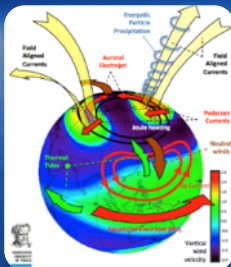


Bistatic SAR as passive followers of Sentinel-1  
Two <500kg spacecraft

### Applications

- Cryosphere
- Oceanography
- Geosphere

## Daedalus



Explore mesosphere, lower thermosphere & Ionosphere

Four cubesats at 120 km altitude

Focus on temperature, heating processes & composition structure

## Hydroterra



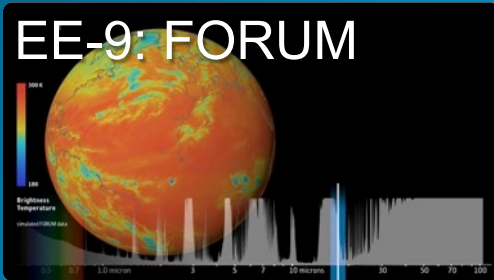
Science on daily water cycle

Geostationary C-band SAR

Benefits for weather forecasting, hydrology, mountain cryosphere

## Hardware & Technology

EE-9: FORUM



Scouts &  $\phi$ -Sats



HAPS

## Operations

Increased Data Diversity & Volumes



EO AFRICA



## Science & Applications



Grand Science Challenges

AI4EO



Resilient Society



## Safety & Civil Security

EO contribution to ESA-wide pillar



# FutureEO response to Grand Challenges



Paris Agreement



UN SDGs



Disaster Risk Reduction

*The **grand challenges** that humankind is facing require more than ever that scientists advance their understanding of the planet, its processes and its interactions with human activities and translate that knowledge into information, policy advice and services for the benefit of citizens, their business and their lives.*



# EO excellence shall go beyond observations



**ESA**



## FutureEO

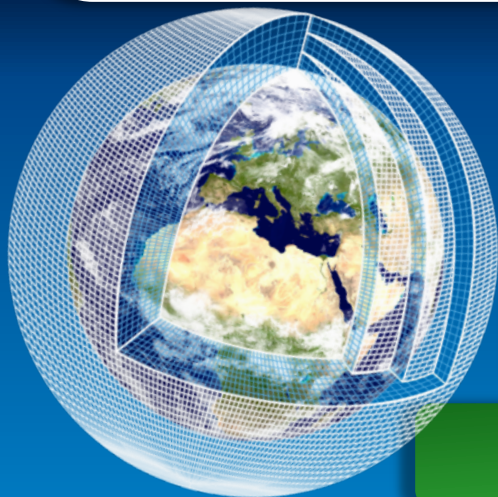
ESA new Science and Innovation  
Earth Observation Programme



**EC-RTD**

## Horizon Europe

New EU Research and Innovation  
Framework Programme



**New ICT, Cloud Computing, AI, ...**

**Interdisciplinary & Open Science**

**Enhanced models and prediction**

**In-situ Networks/citizen data**



## Flagship Action areas

- Ad...
- Ad... capacity
- of... standing
- Ac... ems
- pre...
- Inf... ation
- De... s for
- cit...



Joint Planning Working Group (JPWG)

Common Scientific Agenda

Flagship Actions

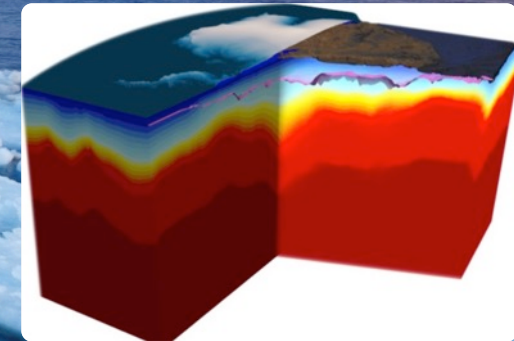
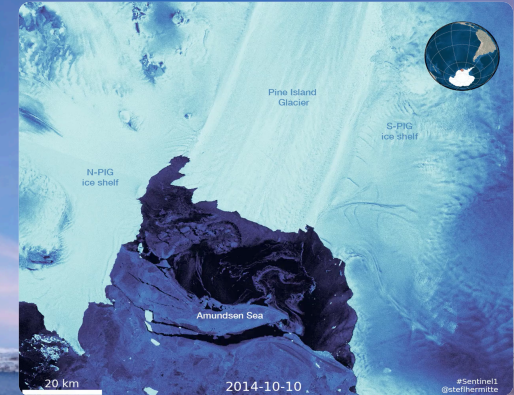
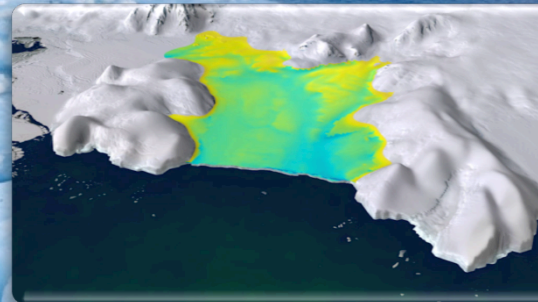
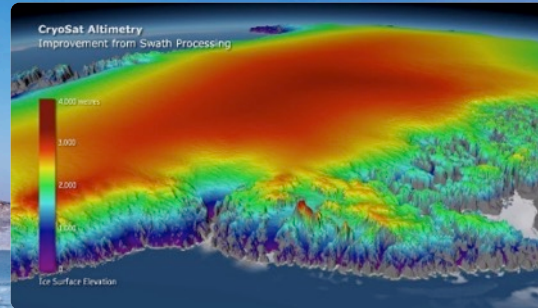


Only an integrated approach to Earth system science involving novel EO capabilities, enhanced in-situ networks, advanced modelling and cross-disciplinary research will help us to give concrete solutions to one of the major challenges of our time

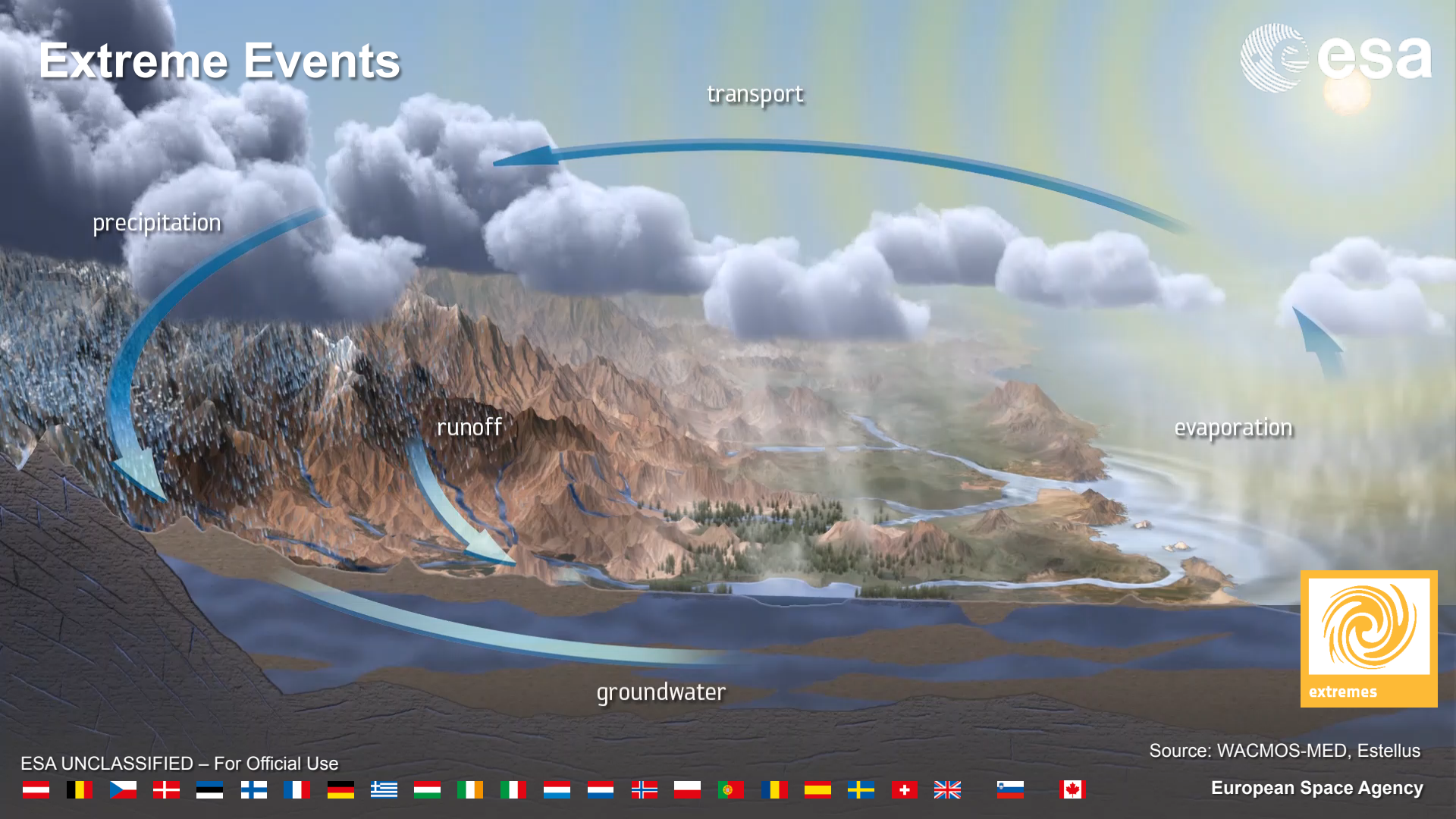


## Objectives

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.



# Extreme Events



Source: WACMOS-MED, Estellus

European Space Agency

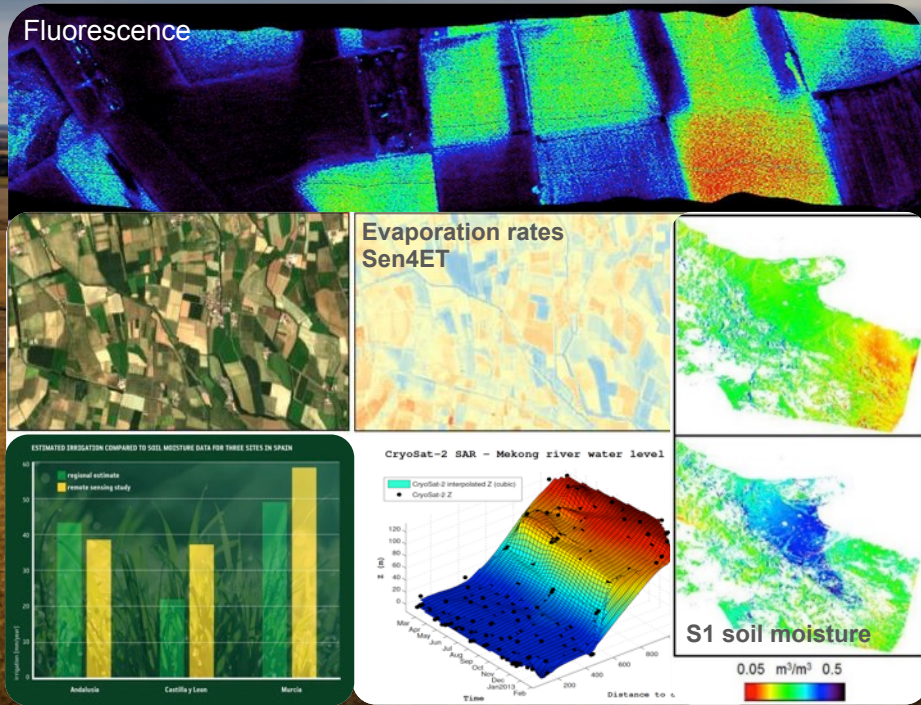
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# Water & Food systems and climate adaptation



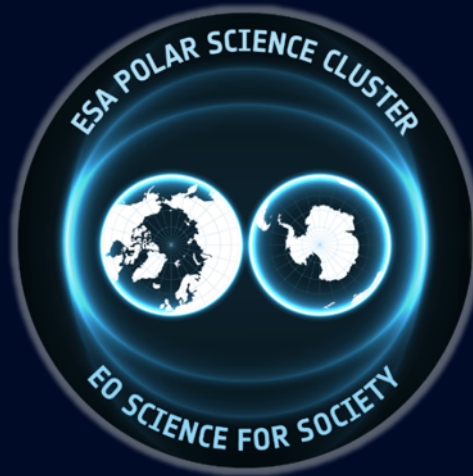
Novel EO capabilities are opening the door to better understand, characterise and predict the **vegetation behaviour** and its links with **carbon, water and nutrients**, specially under extreme conditions



# ESA Science Clusters



- Bring together different expertise, data and resources with synergy
- Promote networking, collaborative research, and foster international collaboration
- Contribute to stronger European research area in close collaboration European and international partners



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European Space Agency



## Call for scientific activities 2020

- River discharge & coastal areas (kicked-off)
- Irrigation+ (link to LIAISE)
- New snow products & hydrology (INARCH)
- Novel HR water products – Med (link to LIAISE)
- Hydro-climatic extremes
- Dedicated action in support of PanneX

## Addressing Key Science Challenges



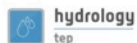
New calls in 2021

## ESA-GEWEX EO for Water Cycle Science Workshop

*16th-18th November, Congress center, Versailles, France*

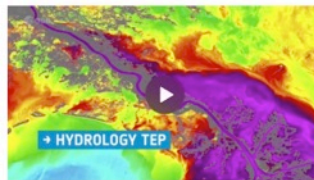
*Co-organized in collaboration with CNES, CNRS/IPSL, the University of Versailles*

# The Hydrology TEP - <https://hydrology-tep.eu/>



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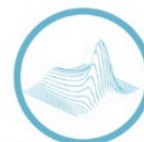
Community Platform

An open, collaborative and inclusive community where users can **SHARE** information, knowledge, algorithms, methods, tools, results, products, services.



Service Platform

A portal providing **LARGE SCALE EO SERVICES & PRODUCTS** customised for hydrology applications. Flood monitoring and small Water bodies mapping, Water quality and level, Hydrological models.



Enhancing Platform

A workspace based on the Cloud where users can discover, access, **PROCESS, UPLOAD**, visualise, manipulate and compare data.

Hydrology Thematic Exploitation platform is a project sponsored and initiated by European Space Agency. The goal of this project is facilitating the access and use of Earth Observation data to water community users. Please see <https://tep.eo.esa.int/> for further information about other Thematic Exploitation Platforms.







Thank you for your attention!

@AschbacherJosef

[www.esa.int](http://www.esa.int)