Unlocking the potential for coastal innovation growth using Earth Observation data and cloud infrastructure

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1. Background | Need for cloud infrastructure

- Dating from the 1970s, the generation of polar-orbiting satellite data that cover the entire globe can be as frequent as every 12 hours.
- Satellite Earth Observation (EO) is a **major contributor** of Big Data, suitable for wide range of marine and coastal applications, including long-term climate studies and near-real-time (NRT) applications, such as disaster risk assessment and monitoring.
- Big EO Data have grown in precision, volume, acquisition velocity and variety, which imposes **challenges** in data exploitation and calls for immediate change in the technical support provided to the scientific community
- Full potential of satellite Big Data remains **unexploited** because scientists are limited by general lack of computing facilities capable to deal with (a) such large datasets and (b) need for faster processing. This can **hamper** knowledge and innovation growth.

*The European Commission (EC) H2020 Co-ReSyF (Coastal Waters Research Synergy Framework) project and the European Space Agency (ESA) Coastal Thematic Exploitation Platform (C-TEP) aim to tackle these issues, by developing **EO data cloud platforms for combined data access, processing, visualisation and output** in one place.*

EO data cloud platforms should provide a **collaborative**, **interactive** and **user-friendly** environment, where users can use existing tools (or develop their own) to integrate EO data with auxiliary information for the deployment of research applications (Fig 1). Key characteristic is the **faster (cloud-based) processing of Big Data** compared to desktop-based software.

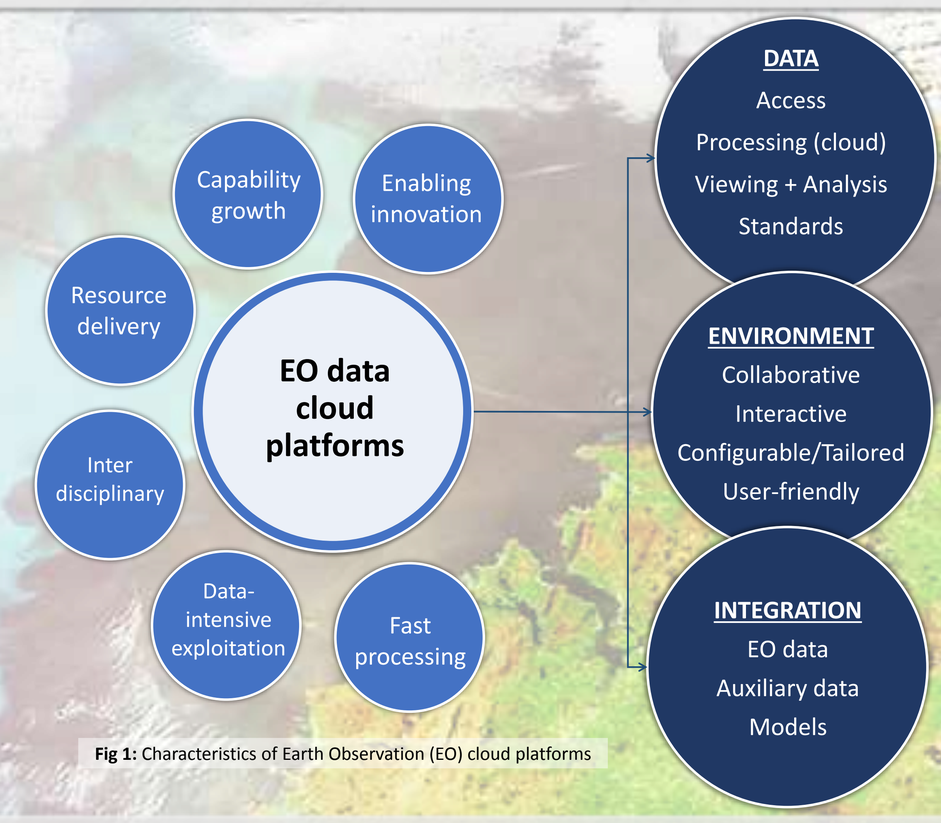

Fig 1: Characteristics of Earth Observation (EO) cloud platforms

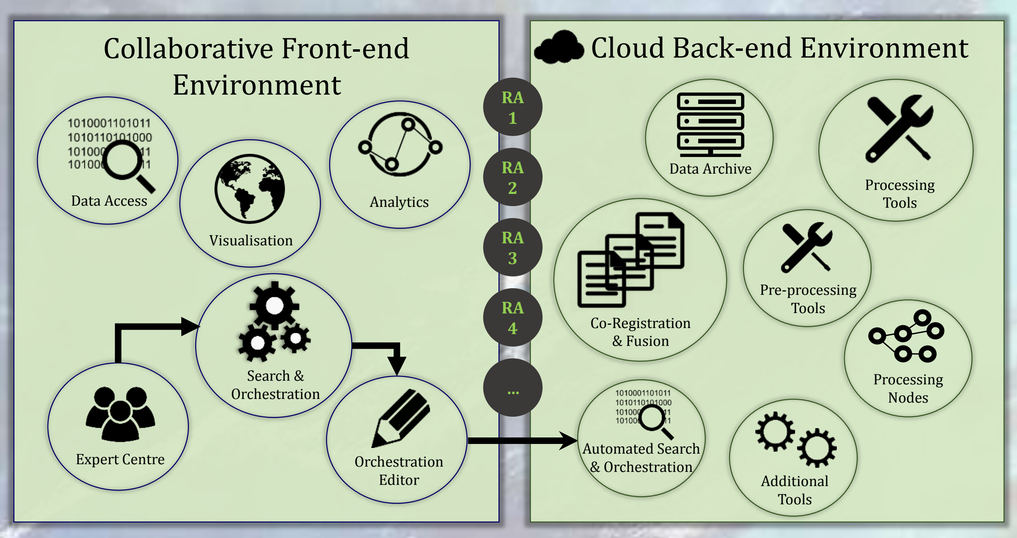

Fig 2: Co-ReSyF development and testing environment, including inter-dependence of platform components (RA denotes Research Application)

2. **Co-ReSyF platform | Overview**

Project duration: 2016-2018

- EO data access and retrieval, with capability for users to upload own data (EO, in-situ, other) (Fig 2)
- Parallel processing on virtual machines on the cloud, task orchestration, processing chain manipulation
- Existing (pre-)processing tools, with capability for users to build own tools
- User-friendly interface accessible to inexperienced users, with advanced functionalities for EO experts and algorithm developers
- Developed with users in mind, based on extensive user requirement gathering through facilitated workshop consultations and online survey
- Open source, including expert centre for interaction, problem solving and collaboration
- *Aims to be a research and education resource*

Research Applications

Co-ReSyF will implement six core coastal water research applications (Fig 3). These applications use a range of optical, thermal and Synthetic Aperture Radar (SAR) satellite data, and will be complemented by new applications developed later on by the platform early adopters and various users.

Advisory Board and Current Stakeholders

Co-ReSyF is kindly supported by an Advisory Board that constitutes of the following organisations:

GEO GROUP ON EARTH OBSERVATIONS | NOAA STAR CENTER FOR SATELLITE APPLICATIONS AND RESEARCH | futureearth coasts land-ocean interactions in the coastal zone | eurOcean | CSIRO | WCRP World Climate Research Programme

3. **C-TEP platform | Overview**

Project duration: 2015-2017

- Focuses on a geophysical theme (i.e. coastal) globally, as opposed to a region, a mission or a tool (Fig 4)
- One of 6 thematic exploitation platforms (TEPs) currently developed within the ESA context (food security to be initialised soon) (Fig 5)
- Front-end and cloud back-end very similar to Co-ReSyF (see for example Fig 2), including (but not limited to):
  - EO data access, fusion, analytics
  - Cloud processing
  - Existing tools and core applications, with functionalities for users to develop their own
- Developed based on user requirement gathering through facilitated workshop consultations, one-to-one interviews and online survey
- *Aims to provide operational services in coastal water science*

Research Applications

C-TEP is currently implementing two core coastal research applications:

- Collaboration with Corpo dei Carabinieri (Italy) for early detection of illegal construction activity in the coastal zone
- Incorporation of the EU FP7 SAFI (Supporting our Aquaculture and Fisheries Industries) tool for the retrieval of water quality in support of aquaculture development and fisheries

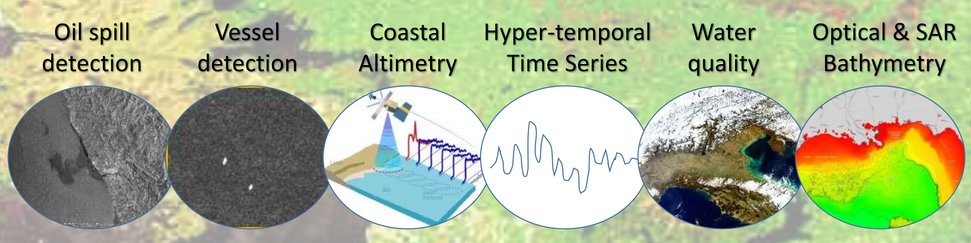

Fig 3: Co-ReSyF core research applications

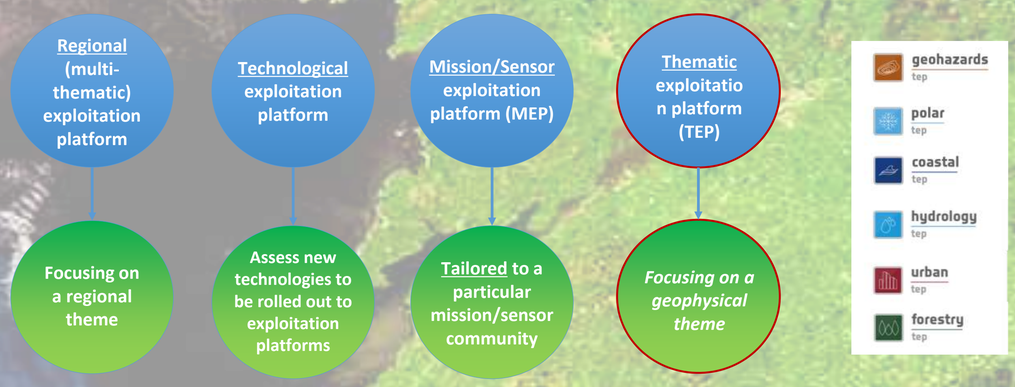

Fig 4: Types of ESA exploitation platforms

Fig 5: Six ESA TEPs

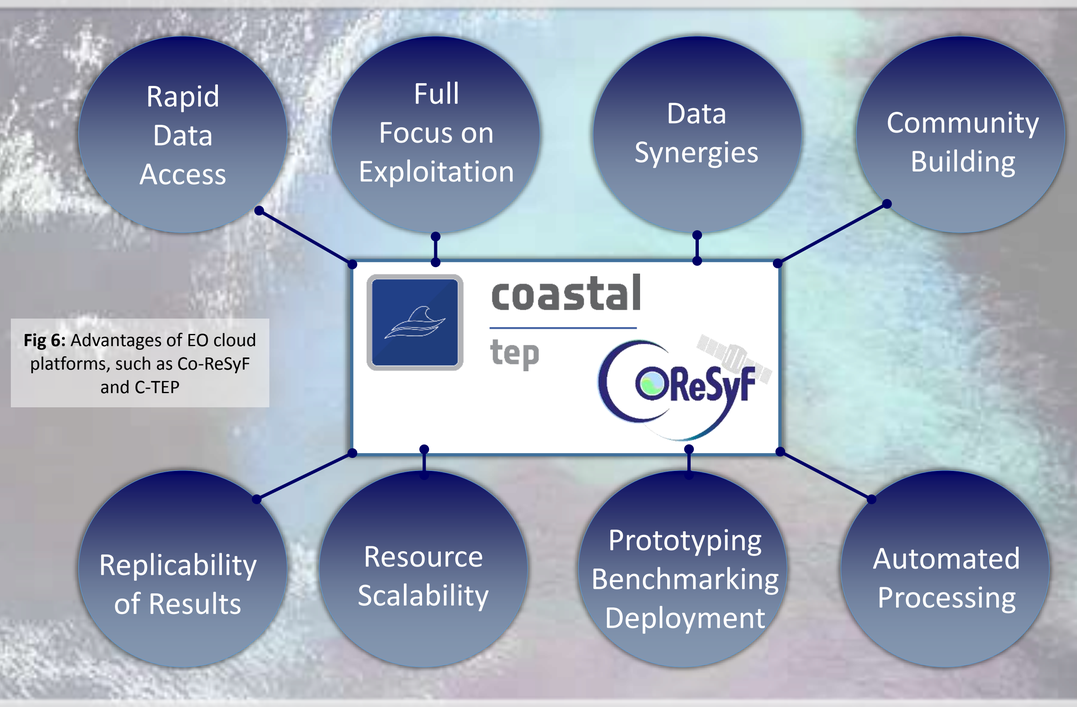

Fig 6: Advantages of EO cloud platforms, such as Co-ReSyF and C-TEP

4. Advantages of EO cloud platforms

Co-ReSyF and C-TEP intend to:

- **Eliminate** many of the **barriers** related to the use of EO data (Fig 6), identified by both inexperienced and advanced users
- Lead to a wider **integration** of EO datasets in a research context
- Raise awareness to the potential of EO data, and encourage **innovative** thinking and development of new algorithms, EO products and services
- Act as facilitators for scientific **knowledge generation and innovation growth**, supporting the advancement of science and allowing ideas to be tested and explored at a scale not previously accessible to all researchers

For more information:
http://coastal-tep.eo.esa.int
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C-TEP is funded by the European Space Agency (ESA). The partners are:

DLR | Catalysts | ThalesAlenia Space | ACRI ST | Daithi O'Murchu Marine Research Station | cnes | UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh | planetek italia | TERRASIGNA | Consiglio Nazionale delle Ricerche

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