

Exploitation Platforms Architecture and Technology

Antonio Romeo, RHEA Systems S.A. c/o ESA-ESRIN

With content from: S. Pinto (RHEA), C. Lopes (ESA), S. Loekken (ESA), P. Bally (ESA)

WIGSS#44 | Beijing | 27 Sep 2017

Earth Observation Ground Segment Evolution Concept

→ From Data Online to Platforms



One-stop **community** data access

- Relevant data & resources (toolboxes)
- GEO Geohazards Supersites ...

Managed **community user services**, processing on demand

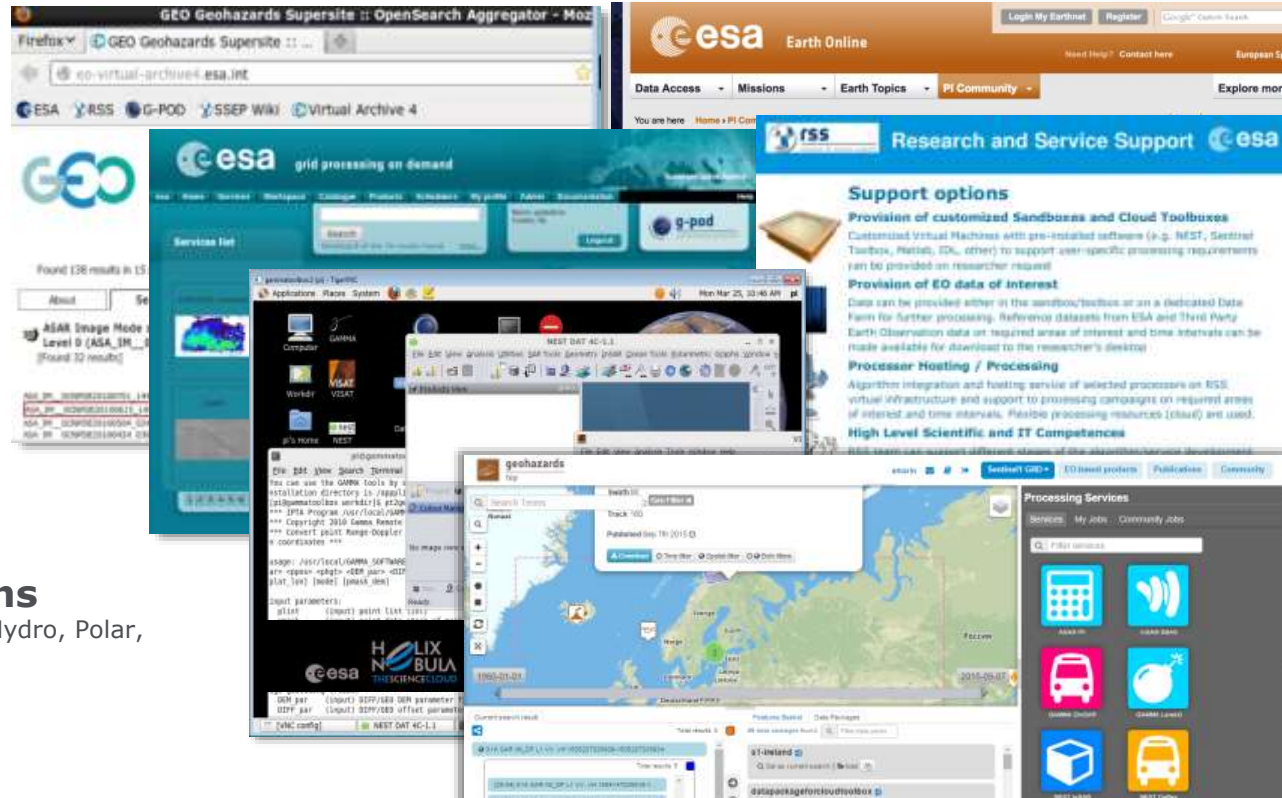
- Services and ICT resources
- GPOD & RSS

Cloud models, embryonic collaborative **virtual workplaces**

- Helix Nebula
- CIOP sandboxes
- SuperSites Exploitation Platform, EP4SM
- SNAP

Full fledged **exploitation platforms**

- Thematic - Coastal, Forestry, Geohazards, Hydro, Polar, Urban, Food Security, Atmosphere (TAMP)
- Proba V, BioMass MEPS
- **Right now: TEPs Pre-ops to ops**



ESA UNCLASSIFIED - For Official Use



So: From distributing data and tools to providing access to complete work environments

- Each a step in a logical progression
- Concept evolves – **technology, partnerships, programmatics, funding models ...**

Thematic and other Exploitation Platforms



and others in development and planned...



Relations with international activities



WGDisasters Pilots
FDA Pilot



Charter Platform
prototypes



GEO Supersites
GEOSS Portal



Exploitation Platforms -> Architecture

- Open Source Software components
- Open Standards for interoperability
- Reference model, **Open architecture**
- Several Big Data technologies, with advances in TRLs and SRLs on various topics e.g. integrated accounting

⇒ Initial draft of the Open Architecture released 1 year ago with CC-BY-SA 4.0 license, on <http://tep.eo.esa.int>

⇒ Update to be released in Q4 2017

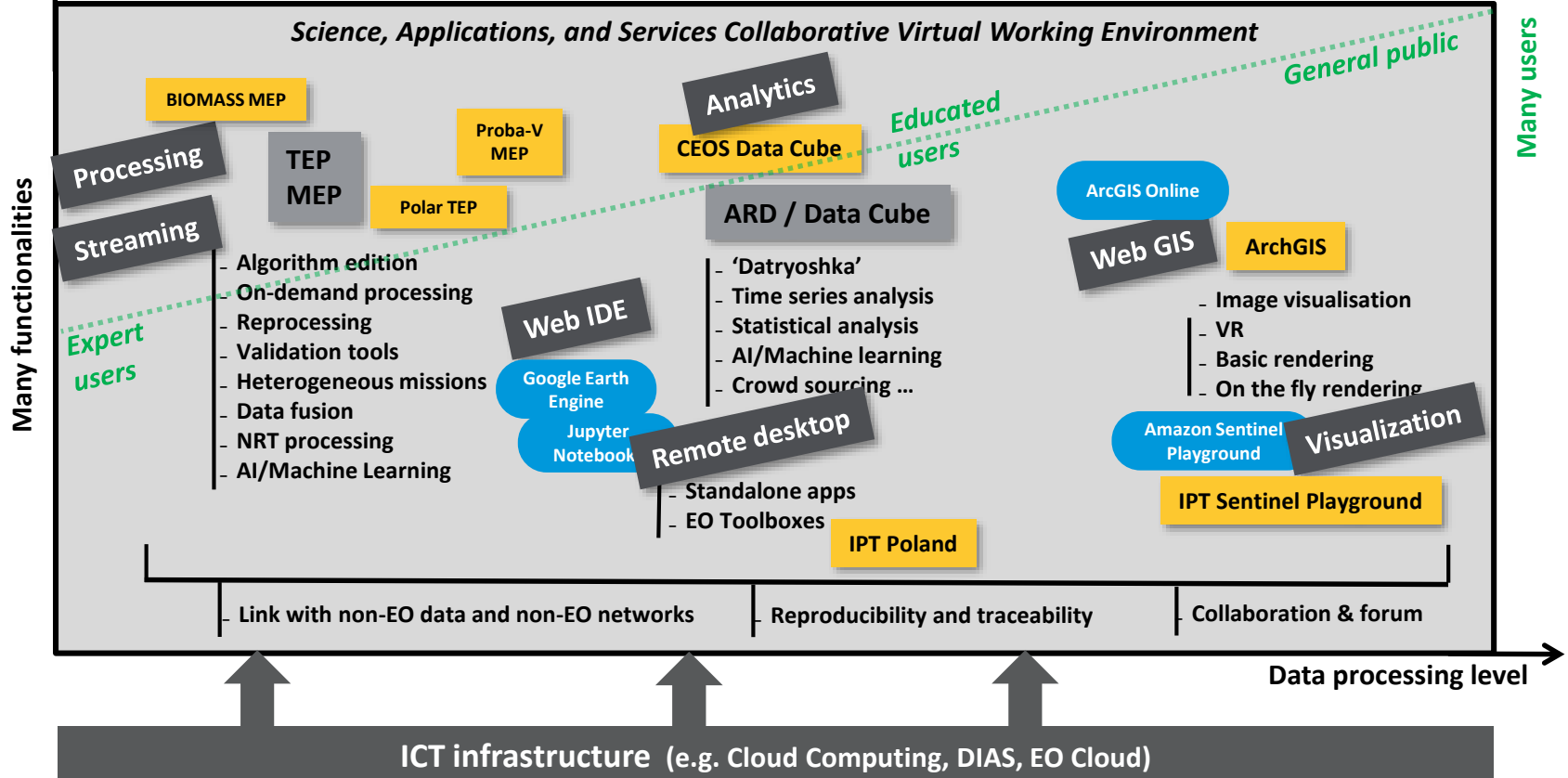
⇒ Architecture to be further consolidated via dedicated industrial contract from 2018 onwards



Figure 2-4 Architecture macro-components general overview



Exploitation Platforms -> Technology



(Thematic) Exploitation Platforms -> OSS reuse



docker



kubernetes



GeoServer



GeoNetwork
opensource



52north
exploring horizons



GeoWebCache

deegree

PostGIS



PostgreSQL



Shibboleth



elasticsearch



GitLab



Jenkins



Drupal

, and many more...



Thematic Exploitation Platforms -> OSS development



- coastal**
tep
- food security**
tep
- forestry**
tep
- geohazards**
tep
- hydrology**
tep
- polar**
tep
- urban**
tep

```
#!/usr/bin/env python
import sys
import os
import subprocess
import logging
import argparse
import time
import shutil

def main():
    parser = argparse.ArgumentParser()
    parser.add_argument('input', help='Input file name')
    parser.add_argument('output', help='Output file name')
    parser.add_argument('--verbose', action='store_true', help='Verbose mode')

    args = parser.parse_args()

    if args.verbose:
        logging.basicConfig(level=logging.INFO)

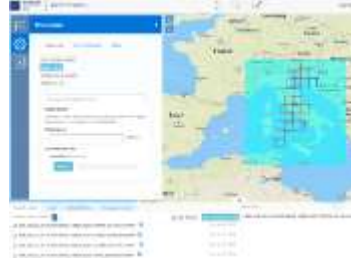
    # ... (rest of the code) ...
```

Interactive Application Service,

Service	
SWAP	Sentinel Toolbox Start new
Ukuba	Virtual Desktop Start new
OGES	Free and Open Source GIS Start new
ipython	Python Notebook Start new

Wispy: modular Python WPS implementation,

PUMA: Platform for Urban Analysis and Management,



Web Browser Interfaces,



ElasticCAS: an EO OpenSearch engine,
Data Access Gateway,
WPS server and Execution Environment,
and many more...

If you want to know more, contact us at tepcoreteam@esa.int



An example -> GeoHazards Exploitation Platform



The screenshot displays the GeoHazards Exploitation Platform interface. At the top, there is a navigation bar with the 'geohazards' logo, a search bar, and links for 'Sign in', 'Register', 'Contact', 'EO data', 'EO-based products', 'Publications', and 'Community'. The main area features a map of the Balkans region, overlaid with a grid of orange rectangles representing search results. The map includes labels for various countries and cities, such as 'Bosnia and Herzegovina', 'Serbia', 'Kosovo', 'Macedonia', 'Albania', 'Greece', and 'Turkey'. A search bar at the top left contains the text 'EO Free Text Search' and 'earth observation'. Below the map, there is a search results section with a list of data packages. The first result is '5-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-12T16:43:00 2017-09-10T16:42:53'. The second result is '5-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-12T16:42:43 2017-09-10T16:42:28'. The third result is '5-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-12T16:42:18 2017-09-10T16:42:03'. The fourth result is '5-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-12T16:39:49 2017-09-10T16:39:33'. The fifth result is '5-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-10T16:59:46 2017-09-10T16:59:30'. The sixth result is '5-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-10T16:59:21 2017-09-10T16:59:05'. The seventh result is '5-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-10T16:59:57 2017-09-10T16:59:41'. On the right side, there is a 'Data Packages' section with a search bar and a list of packages. The first package is 'datapackageforcloudtoolbox' with a search bar and a 'Set as current search' button. The second package is 'test5' with a search bar and a 'Set as current search' button. The third package is 'ENVISAT 1P' with a search bar and a 'Set as current search' button. At the bottom right, there is a yellow box with the text 'Data discovery and visualization'.

An example -> GeoHazards Exploitation Platform



geohazards
Salvatore Pinto

EO data EO-based products Publications Community

EO Free Text Search

2015-08-31

2017-09-20

Lon: 112.678 Lat: 64.548

Current search result

Result for OpenSearch query over type ... Total results: 103056

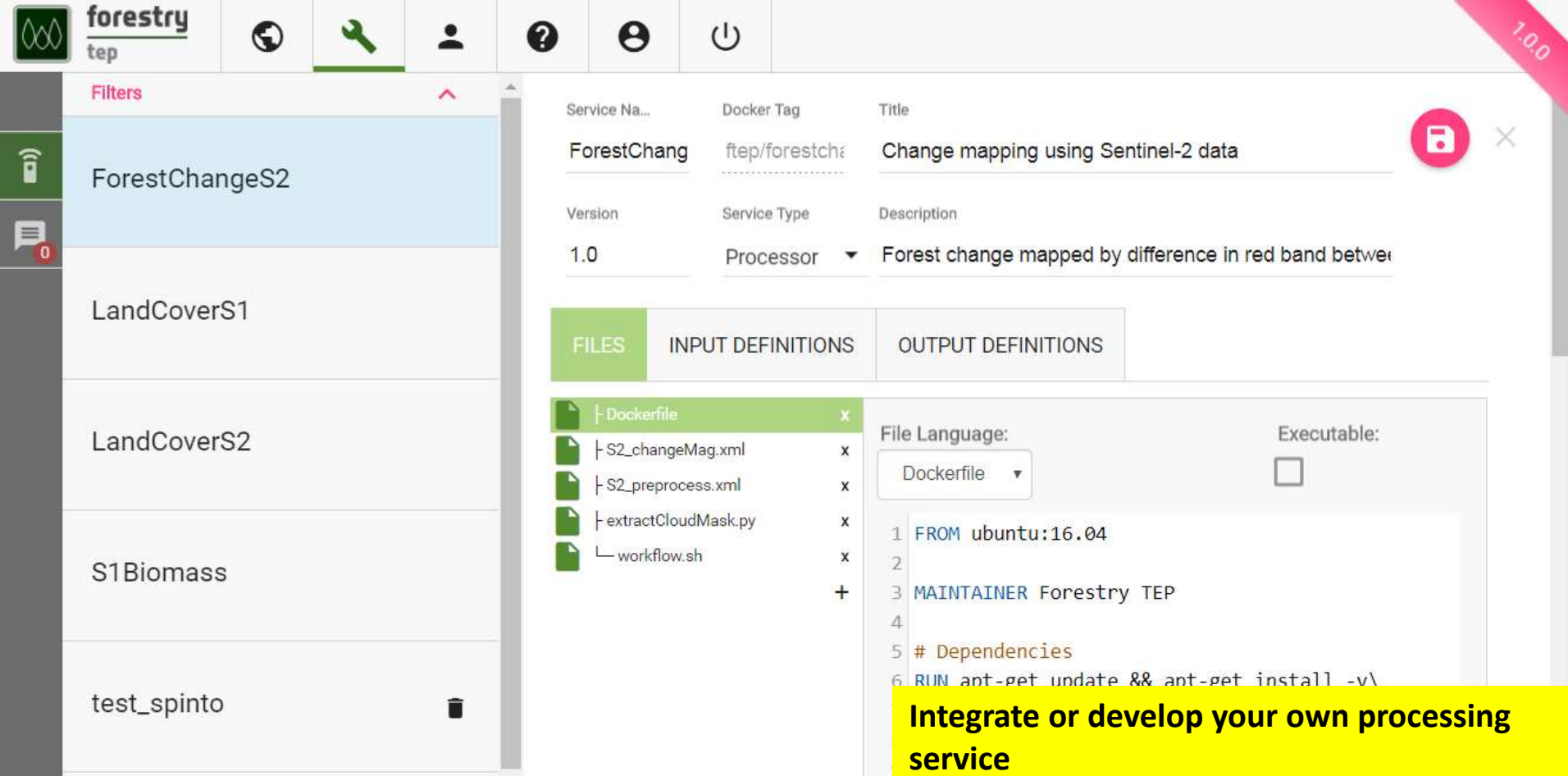
- S-1 Medium-Resolution InSAR Browse Service - Interferometric Phase Terrain Corrected - 2017-09-07T00:31:24 2017-09-19T00:31:55
- S-1 Medium-Resolution InSAR Browse Service - Coherence Terrain Corrected - 2017-09-07T00:31:24 2017-09-19T00:31:55
- S-1 Medium-Resolution InSAR Browse Service - Coherence Amplitude Composite - 2017-09-07T00:31:24 2017-09-19T00:31:55
- S-1 Medium-Resolution InSAR Browse Service - Amplitude Change Composite - 2017-09-07T00:31:24 2017-09-19T00:31:55
- S-1 Medium-Resolution InSAR Browse Service - Slave Amplitude - 2017-09-19T00:31:25 2017-09-19T00:31:55

Services grid:

- ADORE DORS Interferom...
- Repeat Orbit Interferom...
- StaMPS Permanent Scat...
- GRTSAR Interferometric p...
- InSAR SBAS
- DIAPASON InSAR Sentinel-1 TOPSAR (W/E/W)
- STEMUSI
- LAND SE workflow
- DIAPASON InSAR - Strip
- LAND SE workflow
- Basic Workflow
- DIAPASON InSAR - Strip
- VEGAN Vegetation Vep...
- INAP Sentinel-1 Coheren...
- LAND-Stat workflow

Data processing services

An example -> Forestry Exploitation Platform



The screenshot displays the Forestry Exploitation Platform (TEP) interface. The top navigation bar includes the 'forestry tep' logo and several icons: a globe, a wrench, a person, a question mark, a profile, and a power button. A pink ribbon in the top right corner indicates version '1.0.0'. On the left, a 'Filters' sidebar lists services: ForestChangeS2 (selected), LandCoverS1, LandCoverS2, S1Biomass, and test_spinto. The main content area shows details for 'ForestChangeS2' with a table of metadata:

Service Na...	Docker Tag	Title
ForestChange	ftep/forestch...	Change mapping using Sentinel-2 data
Version	Service Type	Description
1.0	Processor	Forest change mapped by difference in red band betwe...

Below the table are tabs for 'FILES', 'INPUT DEFINITIONS', and 'OUTPUT DEFINITIONS'. The 'FILES' tab is active, showing a file explorer with the following items:

- Dockerfile (x)
- S2_changeMag.xml (x)
- S2_preprocess.xml (x)
- extractCloudMask.py (x)
- workflow.sh (x)

On the right, a configuration panel for the 'Dockerfile' is shown, including a 'File Language' dropdown set to 'Dockerfile' and an 'Executable' checkbox. Below this is a code editor with the following content:

```
1 FROM ubuntu:16.04
2
3 MAINTAINER Forestry TEP
4
5 # Dependencies
6 RUN apt-get update && apt-get install -y
```

A yellow banner at the bottom right contains the text: **Integrate or develop your own processing service**

An example -> Urban Exploitation Platform



Data Sources

Layers

Maps

Documents

People

Groups

Type your search here ...



DATA EXPLORATION

Scope: Local

Place: Surabaya

Theme: Land Cover

Year (+/-): 2000

2010

Analysis level: +

Visualization: LC structure - overview

Select in map Snapshot

Selection color

Layers

Layers available Layers selected

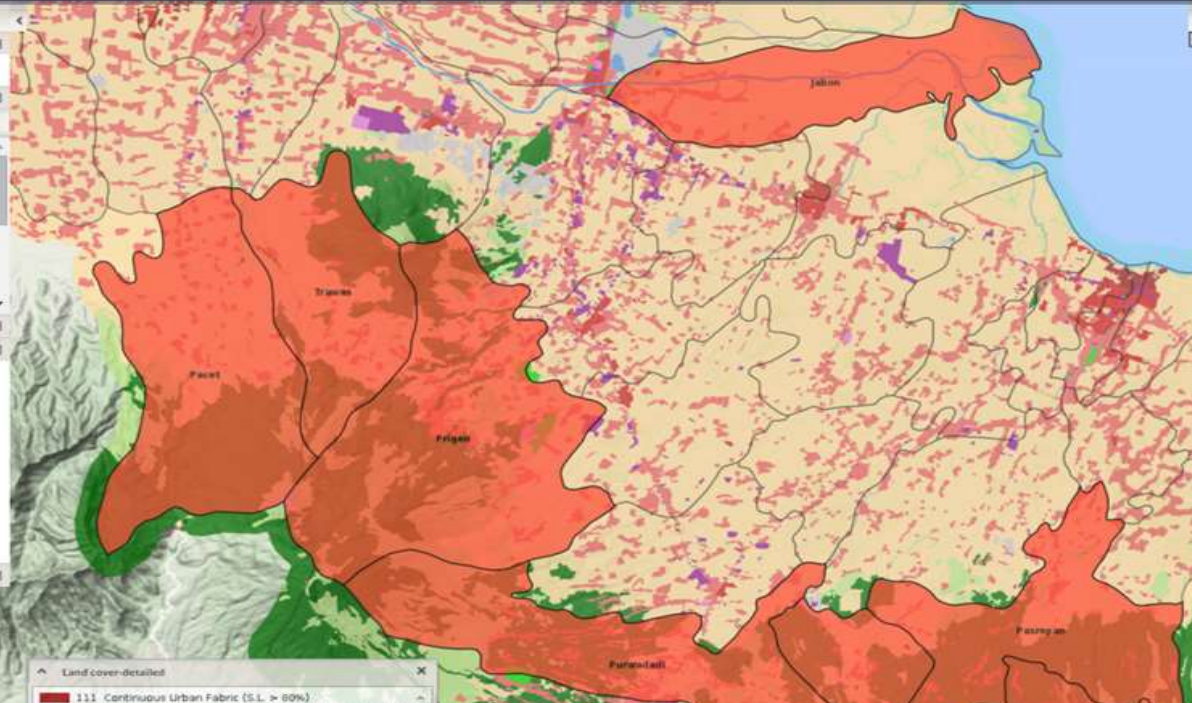
- Analytical units
- Selected areas
- Selected areas filled
- Area outlines
- Thematic maps
- Share of artificial area (%)
- Share of agricultural land (%)
- Share of (semi) natural area...
- Share of forest land (%)
- Information Layers
- Population density grid
- Land cover - detailed
- Land cover - aggregated

Areas

Map tools

- Hover
- Zoom selected
- Measure line
- Measure polygon
- Multiple maps
- Save as image

Advanced filters



Land cover - detailed

- 111 Continuous Urban Fabric (S.L. > 60%)
- 112 Discontinuous High Dense Urban Fabric (S.L. 50% - 60%)
- 113 Discontinuous Low Dense Urban Fabric (S.L. 10% - 50%)
- 120 Industrial, Commercial and Transport Units
- 121 Industrial, Commercial and Transport Units (roads)
- 130 Construction sites

Land cover types - structure

Displaying 1 - 15 of 104

Damar Blandong Dudukuksampayan Jabon Pacet Pasirpan

Prigen Purwodadi Pongor Trusmi Toun

Ademrawe Sabung Simo Batangpanggung Bergi Bergul

Land cover types - percentage of total area

Artificial land x Natural areas

test

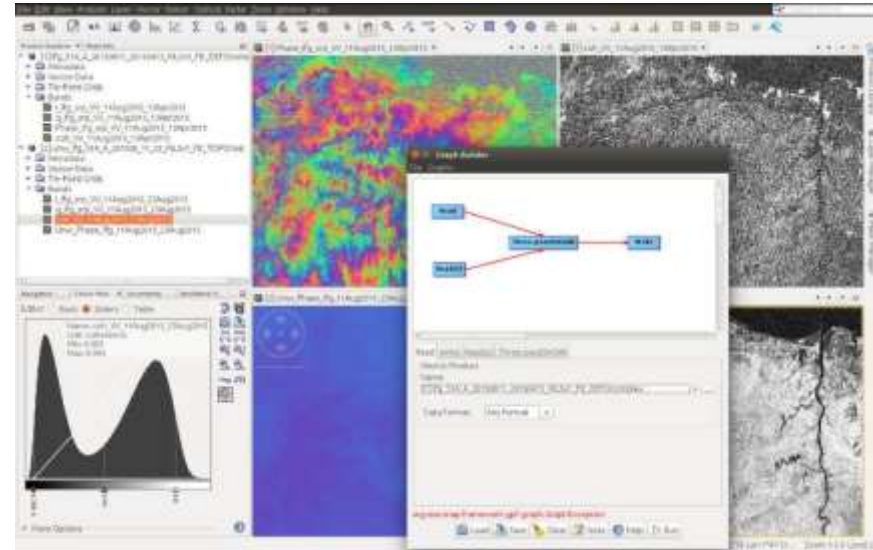
EO and non-EO data analytics

An example -> Coastal Exploitation Platform



Service

SNAP	Sentinel Toolbox	Start new
Ubuntu	Virtual Desktop	Start new
QGIS	Free and Open Source GIS	Start new
Jupyter	Python Notebook	Start new



Interactive applications hosted on the cloud and accessible via the browser

Thanks !

(ask tepcoreteam@esa.int if you want to know more)

Antonio.Romeo@esa.int

tep.eo.esa.int