EO-based environmental risk assessment in the Danube Catchment and EO-based services for the protection of the Black Sea

Vasile Crăciunescu | TERRASIGNA | Romania
Mr Con Costello | ICON | Ireland
Norman Kiesslich | GeoVille | Austria
Norman Kiesslich | GeoVille | Austria
Dr. Marius Budileanu | TERRASIGNA | Romania
Dr. Razvan Mateescu | NIMRD | Romania
Dr. Mariana Golumbeanu | National Institute for Marine Research and Development “Grigore Antipa” | Romania
Dr. Raquel Silva | Deimos Engenharia S.A. | Portugal
Dr. Nuno Grosso | Deimos Engenharia S.A. | Portugal
Dr. Joanna Staneva | Helmholtz-Zentrum Hereon | Germany
Sebastian Grayek | Helmholtz-Zentrum Hereon | Germany
Sorin Constantin | TERRASIGNA | Romania

Context

At present, the use of EO within these regional level activities is quite low. This is due to a number of factors including a requirement for customized processing of the EO data in each region, a requirement for fusion of a range of diverse datasets, modeling capabilities etc and a lack of familiarity by many of the regional actors with satellite Earth Observation. To address these issues and expand the uptake of Earth Observation, ESA started a number of Regional Initiatives, including the Black Sea and Danube region.

The Black Sea and Danube region is constituted of three parts – the sea basin, coastal areas and catchment areas. They must be understood as a whole for an accurate understanding of the region's dynamics in a systematic and holistic manner.

This presentation is about two parallel activities in ESA's Black Sea and Danube Initiative - Applications Line:

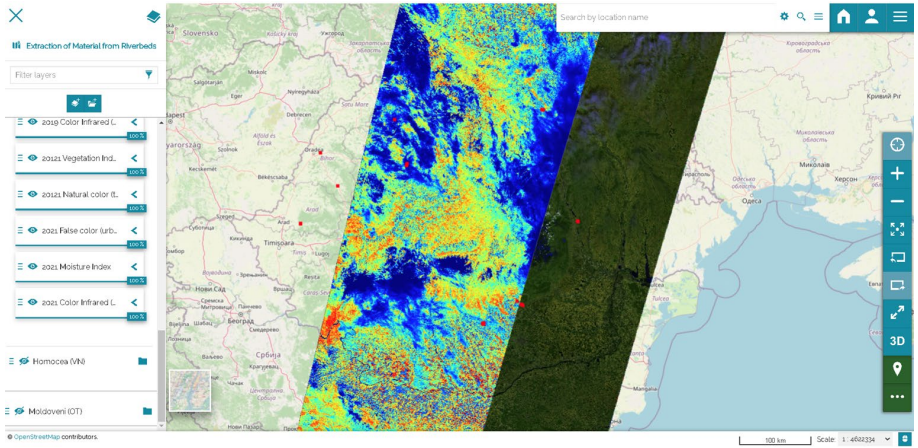
- **The Danube Environmental Risk Assessment Platform (DEAP) provides a suite of applications based on Earth Observation data to support environmental risk management within the Danube catchment.**

- **Earth Observation services for Black Sea Protection (EO4BSP) overlap the entire area of the Black Sea and propose a holistic approach that covers different elements with potential environmental impact.**

DEAP services

DEAP stakeholders include international agencies, national environmental protection agencies, management and development agencies, etc from 7 countries, benefiting from the following services:

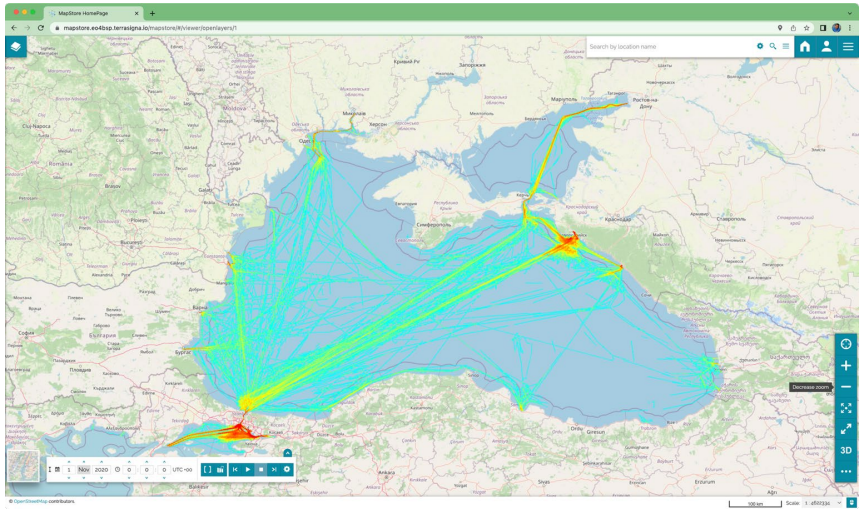
- **Monitoring of Vegetation Degradation due to Waste Discharge**
- **Waste Storage Reservoir Stability Monitoring**
- **Chlorophyll Information for Surface Water Quality Models**
- **Surface Water Dynamics in Agricultural Riparian Zones**
- **Monitoring of Illegal Extraction of Material from Riverbeds**
- **Urban Expansion Monitoring**



EO4BSP services

EO4BSP is implementing six services that are being delivered to a number of 13 stakeholders from the Black Sea riparian countries and one International organization - The Black Sea Commission:

- **Land Use Land Cover coastal changes**
- **Eutrophication**
- **Marin Front Identification and mesoscale circulation**
- **Oil Tankers path identification**
- **Oil spills identification and monitoring**
- **High-resolution water quality monitoring in anchorage areas**

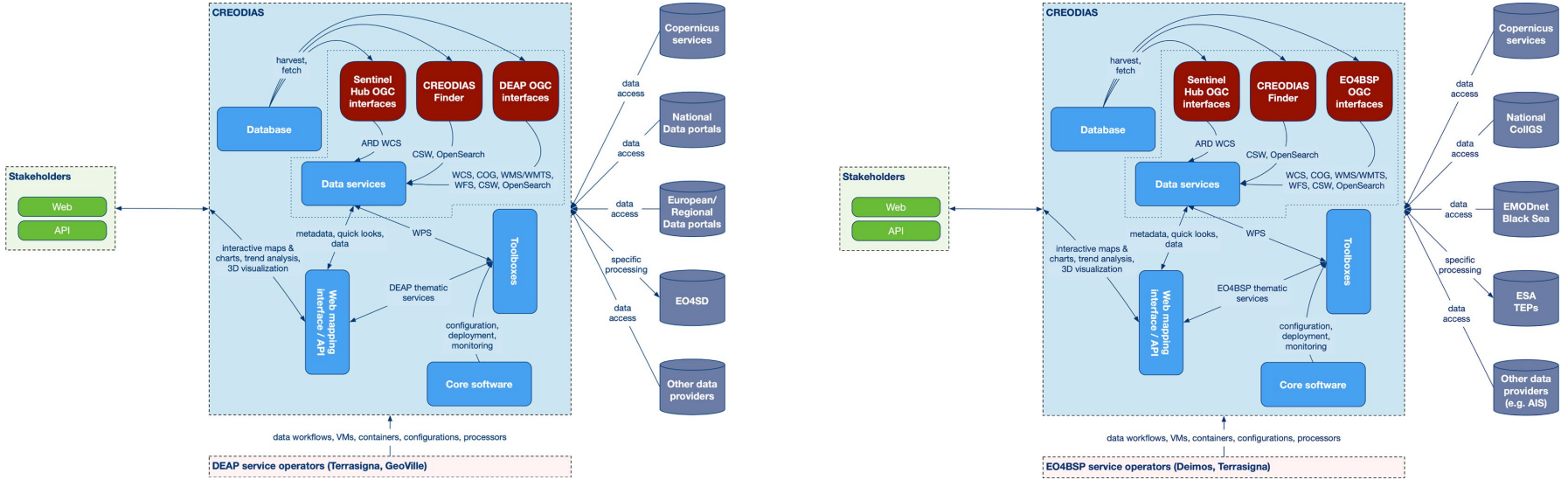


Common characteristics of DEAP & EO4BSP

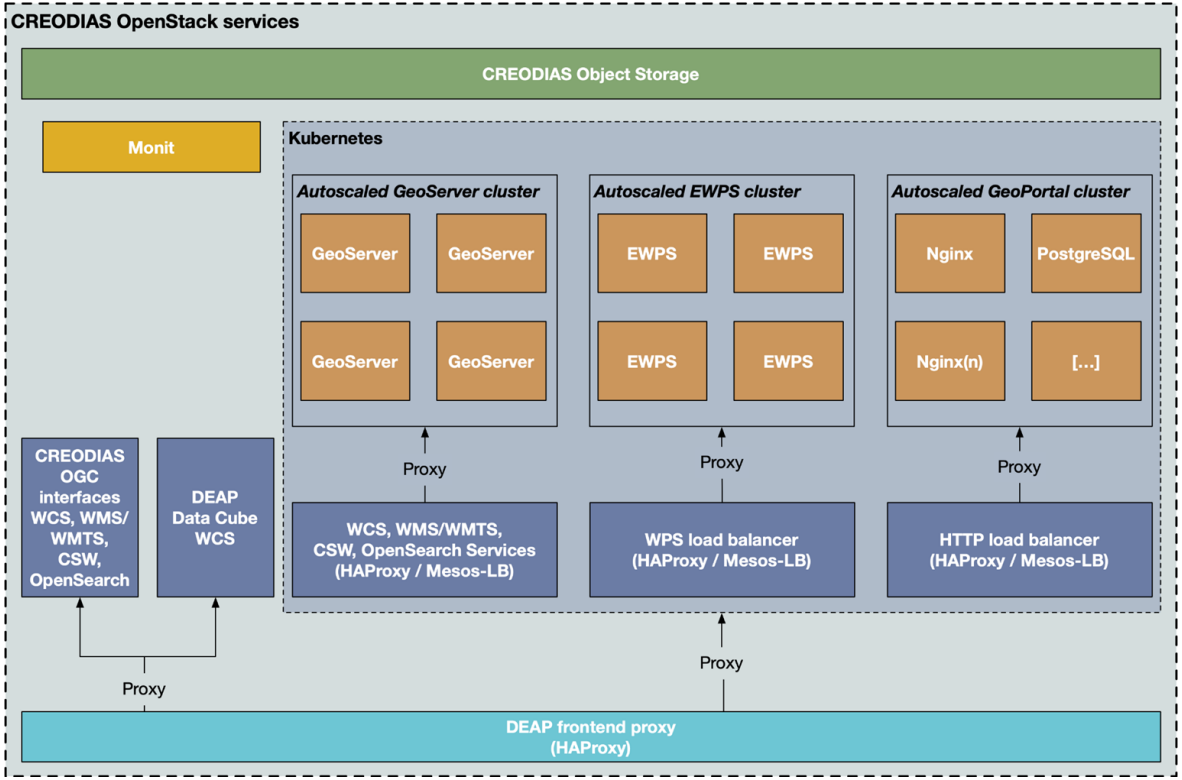
- **Friendly interfaces.** Our products are accessible through easy to use graphical user interface and intuitive workflows.
- **Powerful visualizations.** Effective data visualization methods, suitable for analysis of big volumes of multi-temporal data.
- **Modern architecture.** DEAP & EO4BSP architecture design is driven by service-oriented architecture design principles, and use open standards.
- **Open source based**. Both platforms are built completely with free and open source software.

Platform architecture

The architecture for both regional platforms are following the model proposed by ESA in the "EO Exploitation Platforms Common Architecture" initiative.

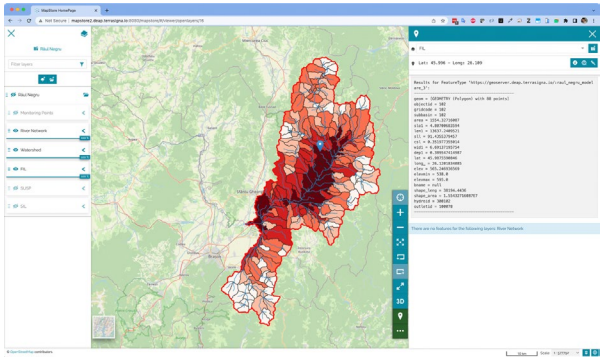


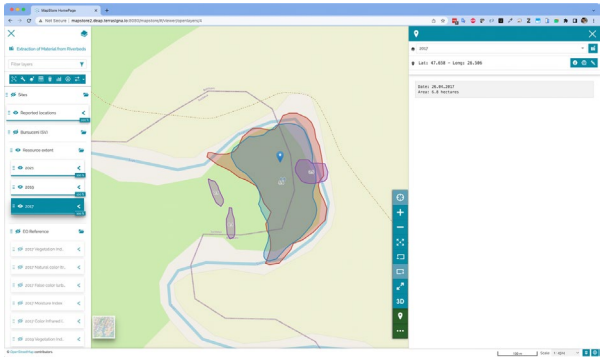
Data services integration



Information dissemination

- Web interfaces:
  - DEAP & EO4BSP geoportals with interactive maps;
  - Interactive dashboards;
  - Geostories.
- Standard web services:
  - OGC WCS/WMS/WFS - OGC API
  - Cloud Optimised GeoTIFF (COG)
  - SpatioTemporal Asset Catalog (STAC).



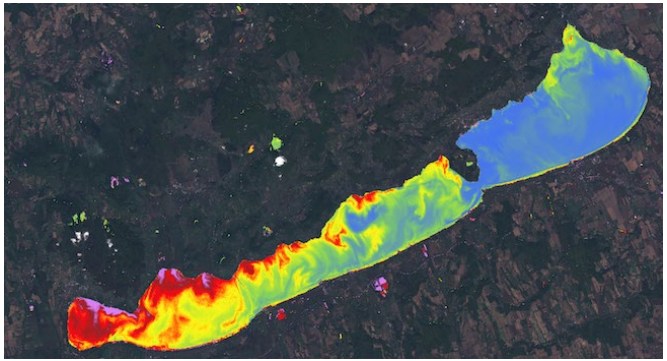


Challenges (one example)

Illegal aggregates extraction from Danube and tributaries Process implementation:

- Floodplain dynamics => natural sediment transport **versus** non-natural sediment removal
  - Copernicus - local, riparian zones
  - Riparian vegetation cover – bare land extent increase
  - Time series analysis on Sentinel 2 - changes in water depth
  - Flash flood event assessment (climate data)
  - Legal resources use => legal aggregate extraction **versus** illegal natural extraction
  - Legal Exploitation road network
  - Existing permits for aggregates resources use
  - Quantitative estimates of extracted volumes
- Illegal aggregates extraction => confirmation of illegal roads nearby + turbidity increase in nearby waters (environmental impact from emissions in waters)
  - Illegal road network
  - Short and medium time road transit (particulate matters suspension in nearby roads)
  - Short and medium time turbidity increase in nearby waters
  - Illegal aggregate resources use
- Illegal aggregate extraction validation => confirmation of illegal extraction by press or community awareness, validation based on field survey
  - Field survey
  - Press and community awareness
- Decision support alert systems => decision support alerts
  - Local environmental authorities alert
  - Regional water managers alert
  - National environmental authority alert

Current status and future work



- Services agreed with the stakeholders.
- Initial deployment of the services and testing.
- Basic product validation.
- Redesign of the data processors as OGC EO Application Packages.
- Performance assessment.

- Make all the services cloud native and separate from the old paradigm.
- Better user uptake and user experience.
- Expand the services and work for a better integration with the other services developed within the regional initiatives.

TERRASIGNA™

INCDM

TRACSIS | ICON GEO Earth Observation

deimos elecnor group

GeoVille

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Thank you for your attention!

Questions?