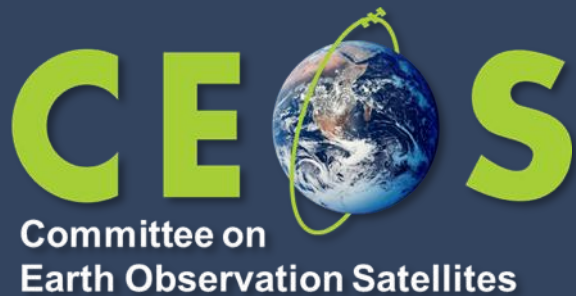# Earth Analytics Interoperability Lab (EAIL) Status Update

David Borges, CEOS SEO
Jonathan Hodge, CSIRO Chile
WGCV-52
07 June 2023

CEOS
Committee on
Earth Observation Satellites

CEOS Earth Analytics Interoperability Lab

Working Group on Information Systems and Services and Systems Engineering Office

20 April 2020

Robert Woodcock, CSIRO, WGISS Chair
*Brian Killough, NASA, SEO Director*

Situation

A significant number of CEOS activities are now engaged in the CEOS ARD and FDA strategies and in Integrated Earth observation data analysis (COAST, SDG, WGClimate, LSI-VC, WGDisasters, GEO Aquawatch and GEOGLAM). There is strong collaboration between groups with both WGISS and SEO being sought for technical advice and coordination on issues related to interoperability of all kinds including data standards, formats, analytics and discovery services.

To date coordination has taken the form of project linkages, development of common terminology (e.g. CEOS Interoperability Terminology Report), and joint development and use of best practice approaches (e.g. The LSI-VC CARD4L specification and process is being used as a template for the for CARD4Water). This has worked well for more isolated outputs like data standards.

Current project activities are seeking to improve data discovery and analytics interoperability with often subtle impacts on CEOS services be they provided by WGISS, SEO or CEOS agencies. The CEOS community has reached a point where ARD and FDA activities need to become demonstrable and testable in a live service ecosystem in order to validate interoperability throughout the EO value chain from Discovery through to Analytics outcome.

Earth Analytics Interoperability Lab (EAIL)

- Initiated in April 2020 as a CEOS WGISS initiative, **EAIL** is a data and analytics platform that uses **AWS Cloud and Open Data Cube**. Its advantages are Jupyter Hub, Dask scaling, customized ARD pipelines and GPU processing. There are currently 59 registered users.

- **Jonathan Hodge** (CSIRO-Chile) is the primary EAIL lead and architect. The SEO is working with CSIRO in 2023 to become trained on EAIL operations to support users.

- **EAIL** currently supports two active CEOS projects > **COAST** (Chesapeake Bay study) & **Flood Pilot**. Other projects interested in using EAIL include: **WGCV** (DEMIX Cal-Val campaigns), **DE-Americas** (Caribbean Pilot project), and CEOS **Ecosystem Extent** Pilot Project.

- **Datasets** include: Landsat, Sentinel-2, MODIS, Sentinel-3, Sentinel-1 (CARD4L with RTC), Copernicus DEM, and NASA DEM.
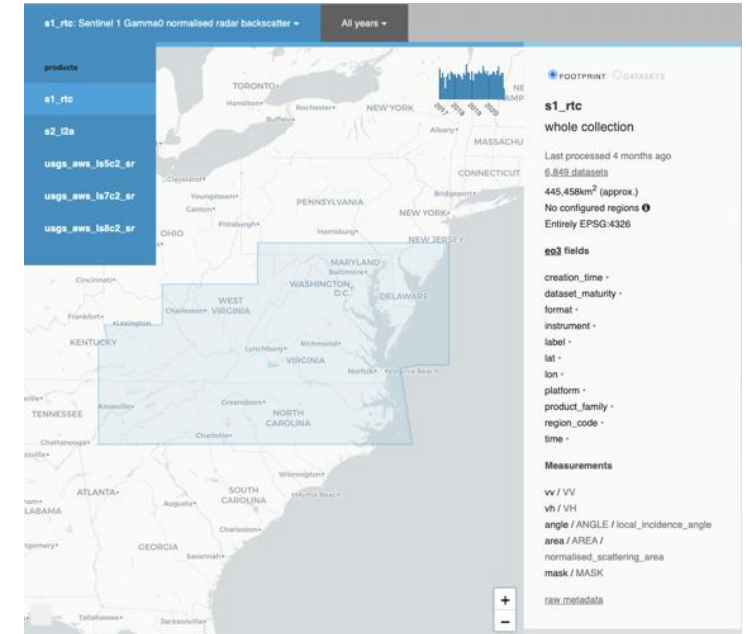
EAIL

❖ EAIL is built using the Open Data Cube software and CSIRO's Earth Analytics, Science and Innovation platform

OPEN DATA CUBE

jupyter

terria
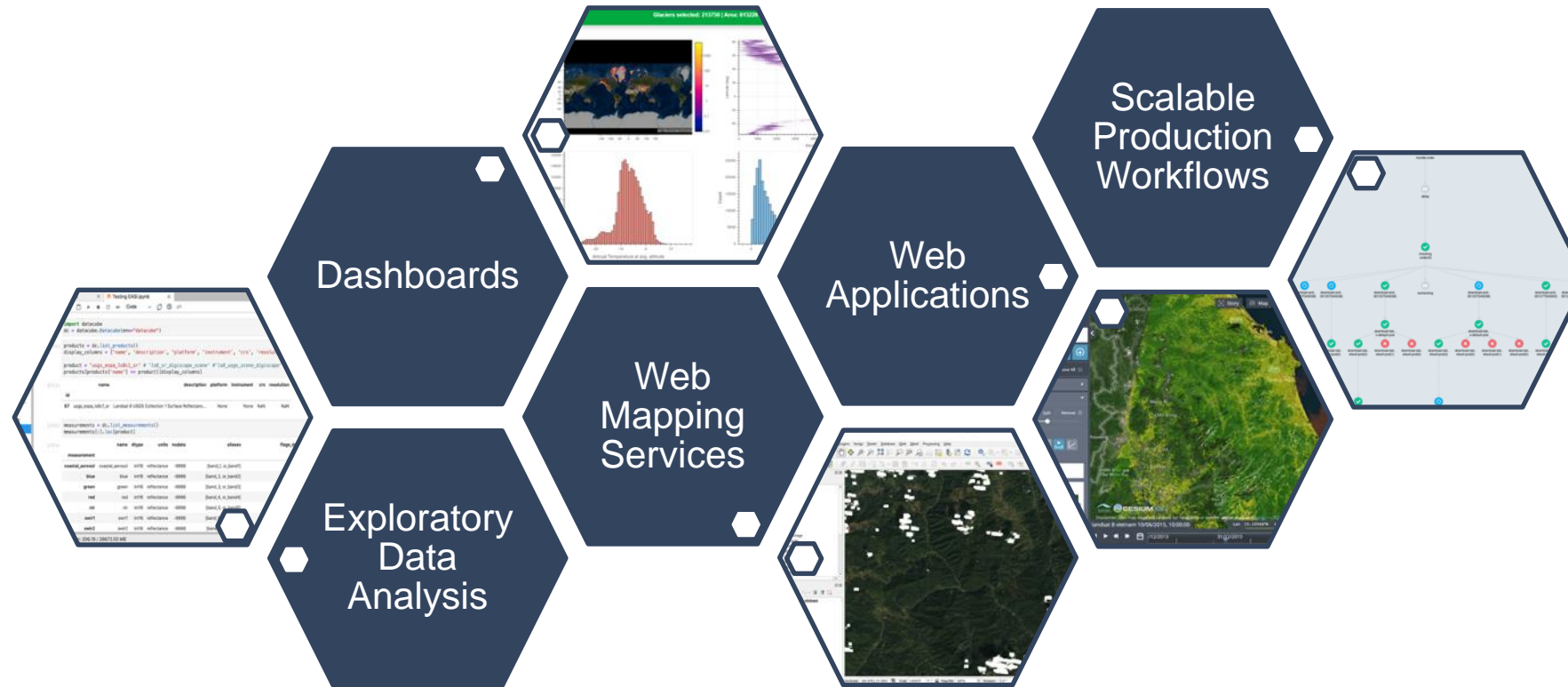
Powered by Open Data Cube and the Python data science ecosystem

EAIL

❖ EAIL is operated by CSIRO Chile with significant support from the Chilean Data Observatory, a public-private-academic partnership founded by the Chilean Government (Ministry of Science, Ministry of Economy), Adolfo Ibáñez University and AWS.
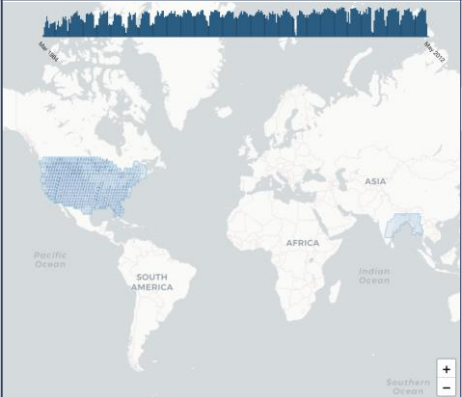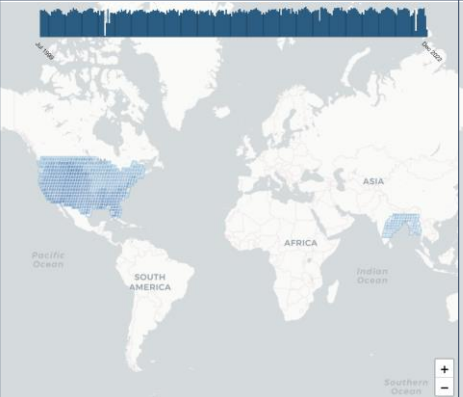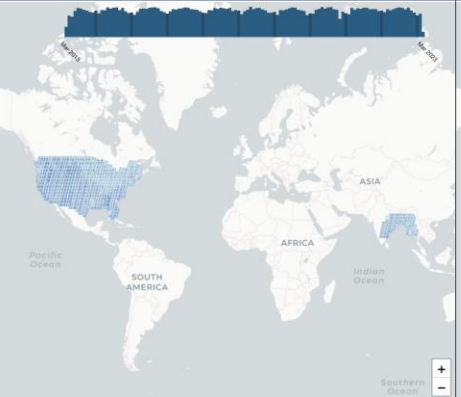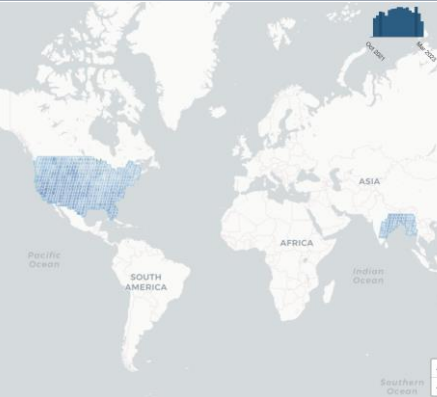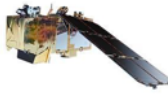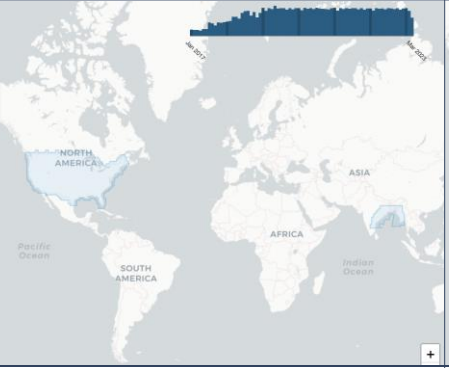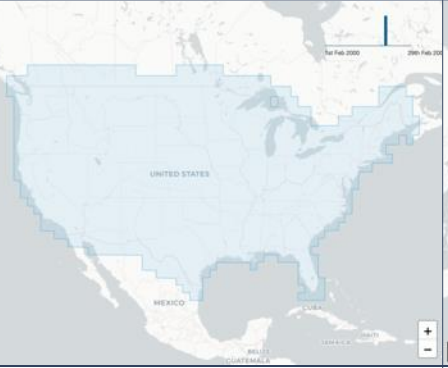
Data update

Landsat 5	Landsat 7	Landsat 8	Landsat 9
Contiguous USA Bay of Bengal	Contiguous USA Bay of Bengal	Contiguous USA Bay of Bengal	Contiguous USA Bay of Bengal
Surface reflectance and surface temperature **1984 – 2011**	*Surface reflectance and surface temperature* **1999 – 2022**	*Surface reflectance and surface temperature* **2013 – 2023** updated daily	*Surface reflectance and surface temperature* **2021 – 2023** updated daily

Data update

Sentinel 1	Sentinel 2	SRTM & NASADEM	Copernicus DEM
Focus areas in USA, Canada, South America, eastern Europe	Contiguous USA Bay of Bengal	Contiguous USA	USA Canada
2017 – 2021	2017 – 2022 updated daily	latest version	latest version

Additional data sources

❖ Sentinel 3
  ▪ New workflows ready to process Sentinel 3 data from EUMETSAT
  ▪ Currently tested with:
    ▪ OLCI Level 1B full resolution (**OL_1_EFR** - EO:EUM:DAT:0409)
    ▪ OLCI Level 2 full resolution (**OL_2_WFR** - EO:EUM:DAT:0407)
    ▪ OLCI Level 2 full resolution reprocessed (**OL_2_WFR** - EO:EUM:DAT:0556)

❖ Sentinel 1
  ▪ New Sentinel 1 workflows also available to process data from ASF
  ▪ New capabilities can include:
    ▪ GRD RTC backscatter
    ▪ Polarimetric decomposition
   ▪ More to come

Additional data sources

❖ Numerous other data sources either under development or in operation in related projects which could benefit EAIL, including:

- MODIS (numerous products)
- Sentinel 5P
- GEDI
- Seasonal and annual geomedians (Landsat or Sentinel-2)

❖ Related projects (e.g. Aquawatch Australia) are improving integration with time-series data sources, enabling improved connection with sensor and cal/val data.
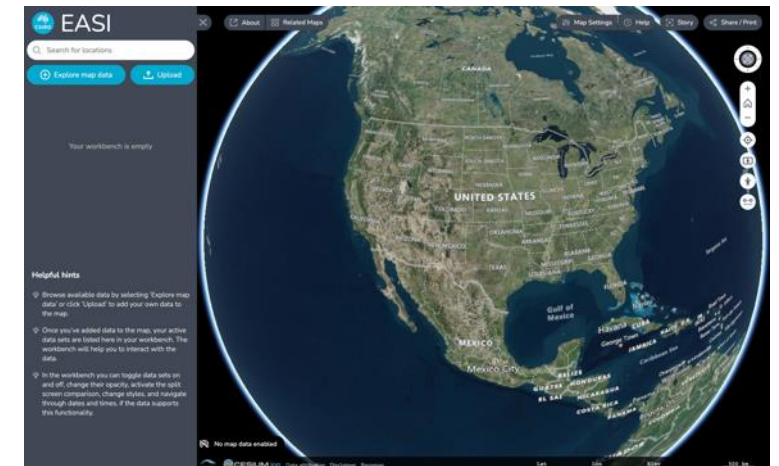
Additional capabilities

❖ **OWS service layer ready for implementation**
- WMS, WMTS and WCS services
- Exposes data cube layers to the outside world
- Supports multiple styling options, band combinations and index generation
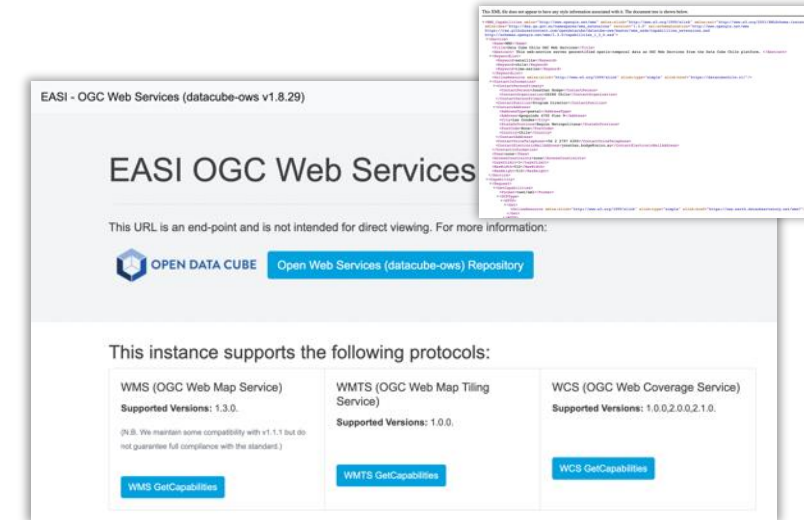
❖ **Terriamap web visualization tool**
- Connects directly to WMS services above
- Supports over 30 data and services type including time-series data and processing services (WPS)

New & potential analytics capabilities

- ❖ GPU processing with AWS GPU nodes
- ❖ Additional scientific programming options with R
- ❖ New machine learning capabilities

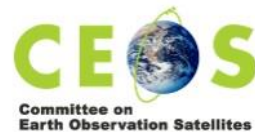# Current EAIL Interface

What's next: CEOS Analytics Lab

❖ Updates to backend infrastructure in January/February 2023

❖ Update of data holdings to latest workflows – February/March 2023

❖ Addition of demonstration datasets for Sentinel 1 and Sentinel 3

❖ Improved user interface / user experience

❖ New helpdesk / support function provided by SEO

❖ Need to prioritize new data products and new capabilities based on user interests and requirements

❖ Need to identify options for ongoing operation of EAIL

CEOS Analytics Lab

The CEOS Analytics Lab is a multiuser spatial data science platform enabling scalable exploration and analysis of Earth observation data. Each user is served an individual JupyterLab environment connected to the Open Data Cube to enable easy loading of the provided data products and a Dask gateway for access to additional computational nodes. Data products and extents can be browsed through the Open Data Cube Explorer.

Hub Login

* Currently GPU enabled machine learning instances are not available by default. These can easily be enabled by request. Please get in touch if your analysis requires machine learning.

Additional EAIL Services

Future use cases
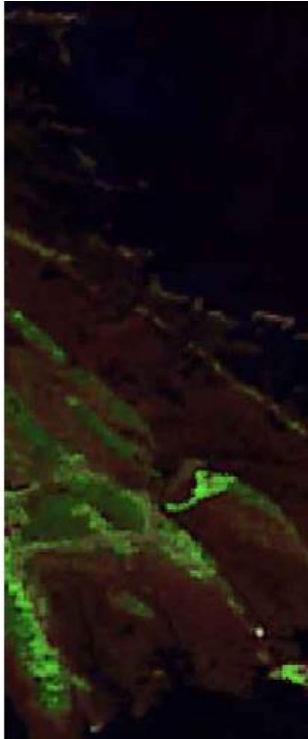
❖ In addition to supporting an array of current use cases, these new capabilities could enable improved functionality, including:
  - Analysis, modelling and integration of Cal/Val data
  - Dynamic analytics via web-based processing services
  - Improved aquatic remote sensing products and inter-comparisons
  - Improved classification options (via ML as well as with new radar products)
  - Multi-platform analyses and product generation