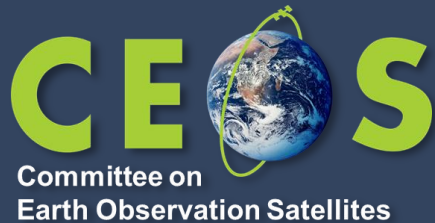


LSI-VS-19

Resilience

Interoperability

Demonstrator



David Borges, SEO
Agenda Item A5.2
LSI-VC-19
Irvine, CA, USA
24 April 2026

Deliverables

Priority 1: Water Planet - Seeing Earth's Water from Space

1. Guidance on integrating multiplatform, multispectral data for enhanced water variables and decision-support solutions
2. Water thematic section contribution to the updated CEOS-ARD strategy
3. Stakeholder engagement and outreach programming like the Water Quality Workshop (2026, co-led with CEOS Chair)
4. Use Cases illustrating socio-economic benefits and useability of satellite-based water solutions

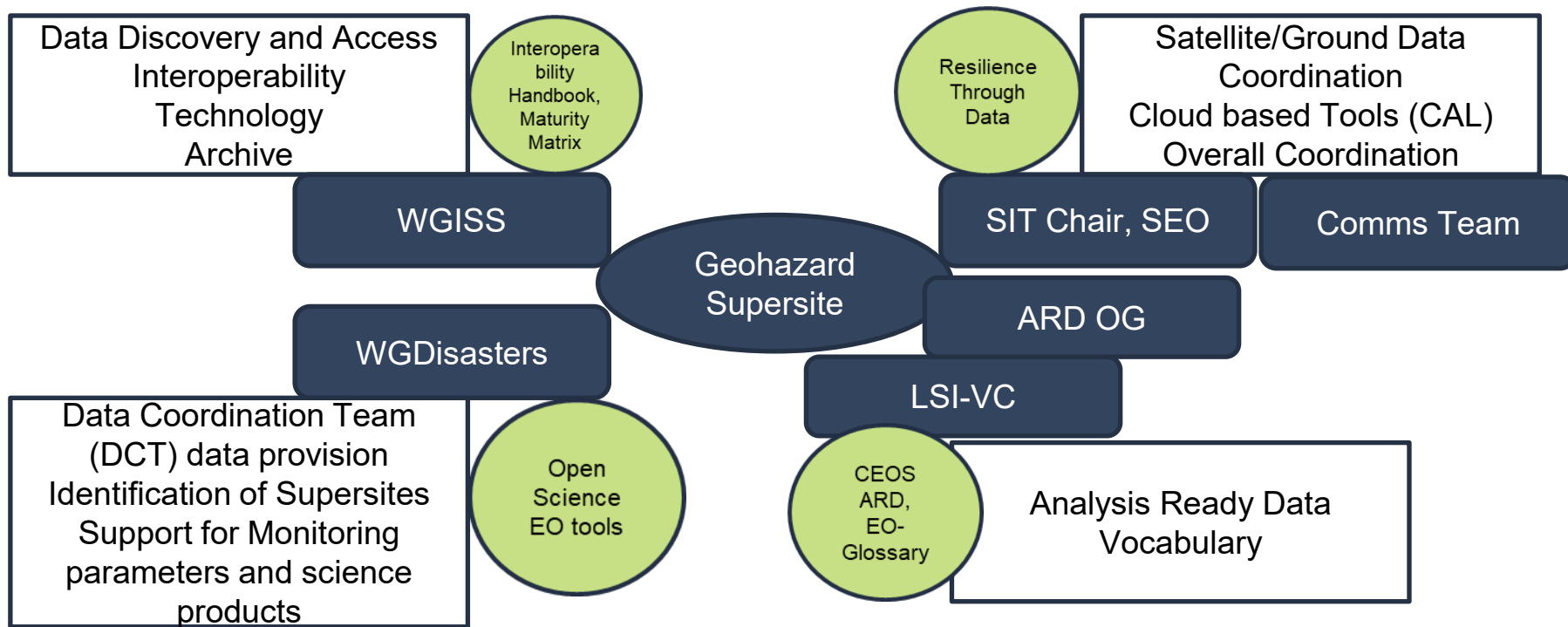
Priority 2: Connected Data for Community Resilience

1. Impact Assessment of current resilience-related activities, identifying lessons learned
2. Interoperability Demonstrator developed in collaboration with WGISS and other partners
3. Updated Data Value Chain to reflect modern CEOS functions and collaborations
4. Resilience Data Partner Workshop featuring practical demonstrations and feedback from stakeholder
5. Comprehensive Resilience Findings Report guiding scaling efforts for resilience applications

Call for Collaboration

- ❖ Are all/any CEOS data sources provisioned by WGDDisasters DCT and consumed by GEO GSNL CEOS-ARD compliant?
- ❖ Do these data, and the existing data provision mechanisms, observe all/any of the recommendations in the CEOS Interoperability Handbook 2.0?
- ❖ Determine the answers to both questions by creating an artificial supersite processing environment within CAL.
- ❖ If not, demonstrate what tangible benefits GSNL community could realize if these objectives were realized.

- ❖ Utilize concepts of Interoperability, CEOS-ARD, and Open Science to evaluate the capability for monitoring Geohazard supersites and generation site-specific science products for use by stakeholders for disaster risk reduction and community resilience and identify aspects that could be optimized.
- ❖ Use Demonstrator findings to improve/update the Interoperability Handbook, inform the Maturity Matrix, and the CEOS-ARD specification evolution.



Tasking



Task	Lead	Actions
Identification of possible Supersite/s	WGDisasters	Interactions with the Stefano (GSNL) and Supersite Coordinators to check possible interests and feasibility
Identification of Satellite and Ground Based Observations for the Selected site/s	WGISS, SEO, WGDisasters	Check metadata for availability of satellite data for the selected sites, spatial and temporal extents, revisit, Real time availability
Check CEOS ARD compliance of the products	ARD-OG, LSI-VC, Individual Mission Science Teams	Use CEOS ARD self assessment tools, Interactions with Data providers for Compliance through LSI-VC
Develop/Modify Geohazard vocabulary in CEOS EO Glossary (on GitHub)	LSI-VC, WGISS, WGDisasters, SEO	Find existing Vocabulary for Geohazards and integrate them in CEOS EO Glossary, or add terms required
Load/Access data from CEOS Analytics Lab	SEO, WGISS	Policy, Security. Document ease of ingest according to Interop Handbook recommendations
Document Requirements and algorithms for Site specific Monitoring parameters and Science Products	WGDisasters	Requirements Documents and Algorithm theoretical basis document (ATBD)

Tasking



Task	Lead	Actions
Aggregation of existing / development of new Jupyter Notebooks on CAL	SEO WGISS	Based on ATBD and Requirements document, develop Jupyter Notebooks for Monitoring and Analysis of Supersites
Demonstrate Jupyter Notebooks to GSNL Stakeholders for feedback	WGDisasters SEO	Modify Jupyter Notebooks based on feedback
Migrate the Jupyter Notebooks to GitHub	SEO	Provide better access to Stakeholders and involvement of community for upgradation/enhancements
Study and Document the Impact of the Interoperability Demonstrator	SEO, WGISS, Comms Team	Generate a Report, Newsletter, executable paper and CEOS-external communications materials
Synthesize results to inform SIT Chair Priority 2: Connected Data/Community Resilience	SIT Chair, SEO	Contribute to NASA SIT Chair Comprehensive Resilience Findings Report (2027)

Data sources for evaluation



Data Sources

Including all data sources listed below is likely not possible. Intent is, at minimum, include sources covering optical and sar, civil and commercial, sources.

Open Access, Open License

- Landsat Surface Reflectance and Surface Temperature
- Sentinel-2
- Sentinel-1
- NISAR
- ALOS-PALSAR

Proprietary (access through WGD DCT or NASA CSDA)

- Pleiades
- Terra SAR-X
- CSK
- SAOCOM
- RCM

- ICEYE
- Umbra
- Capella
- PlanetScope
- Worldview-3

- Cloud native geospatial analysis platform available to all CEOS activities that might otherwise not have group access to similar resources
- Resource to showcase the art of the possible when EO data is made cloud native and observes interoperability best practices

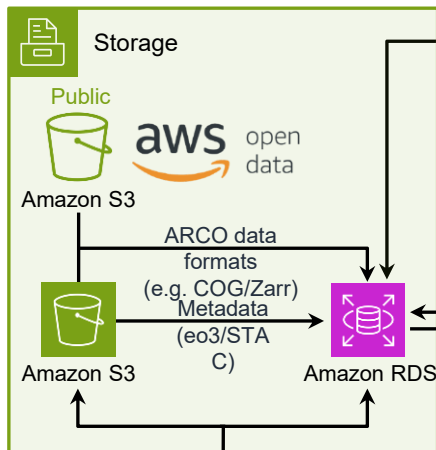


The screenshot shows the CEOS Analytics Lab website. At the top left is the CEOS logo. To the right, there are links for "JupyterHub", "Explorer", "Support Request", and "Data Request". The main heading is "CEOS Analytics Lab" with a globe icon. Below this is the tagline "Empowering exploration and scalable analysis of Earth observation data". A paragraph describes the lab as a multiuser gateway for spatial data science, powered by the CEOS Systems Engineering Office and CSIRO, providing a customized JupyterLab environment. Two buttons are visible: "Login" and "Request Account". At the bottom, there is a section for partners with logos for CEOS, CSIRO, DATAOBSERVATORY, and UNIVERSIDAD ADOLFO IBÁÑEZ. A footer note states "CAL is powered by CSIRO's FASIS technology."



Analytics Laboratory

<https://cal.ceos.org>



In addition to:



Amazon Cognito



Amazon EFS



Amazon DynamoDB



Amazon CloudFront



Elastic Kubernetes Service



OGC Web Services

- WMS, WMTS and WCS
- Horizontal Pod Autoscaler (HPA) adjusts to user demand
- Customisable, on-the-fly functions and calculations



Data visualisation

- Handles OGC, ESRI, other map services and geospatial files
- 2D, 3D and 4D visualisations
- Above and below ground
- Charting and time-series



Amazon EC2 Auto scaling



Analytics environment

- 32GB, 8CPU default capacity
- >500 pre-installed python libraries
- Optional extra CPU/RAM
- Optional GPU



Amazon EC2 Auto scaling



Flexible, scalable workers

- Powerful parallel processing
- Optional GPU, extra CPU or extra RAM (per worker)



Argo Workflows

- Powerful workflow engine
- Hugely scalable
- Automated data and product updates
- Customised, on-demand data workflows

Powered by:



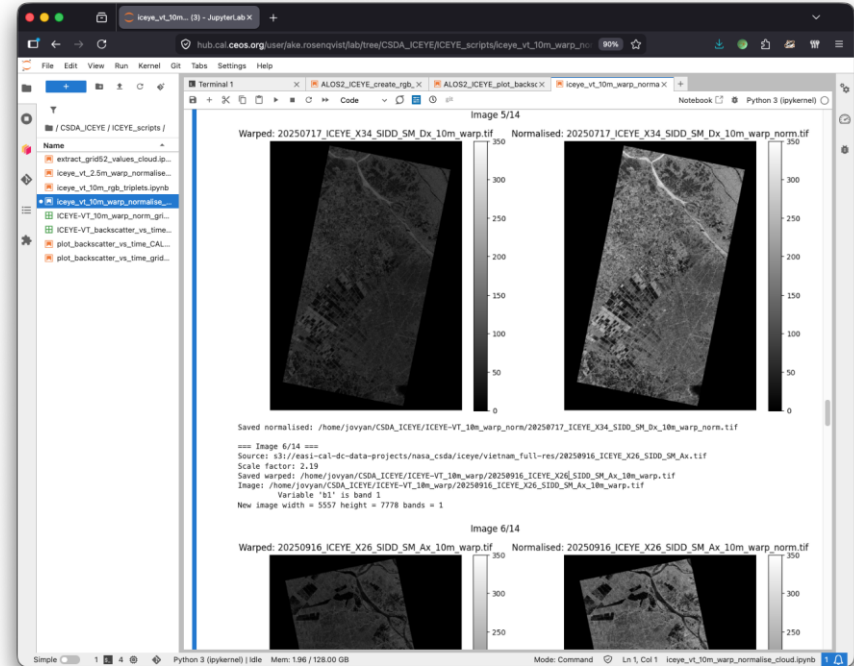
Automation and orchestration



CAL interoperability test



- **Test 1:** Use CAL to ingest and analyze proprietary (SAR) data
 - Commercial SAR (ComSAR) data assessed: ICEYE, Capella, Umbra (VHR X-band SAR)
 - Level 1 formats (SLC, GRD). Non-calibrated.
 - Accessed at no-cost through NASA's Commercial Satellite Data Acquisition (CSDA) program
- Feasible to ingest in the CAL (GRD)
- CAL facilitates use of a private s3 bucket to comply with non-public data licenses
- Notebooks developed for simple processing and analysis

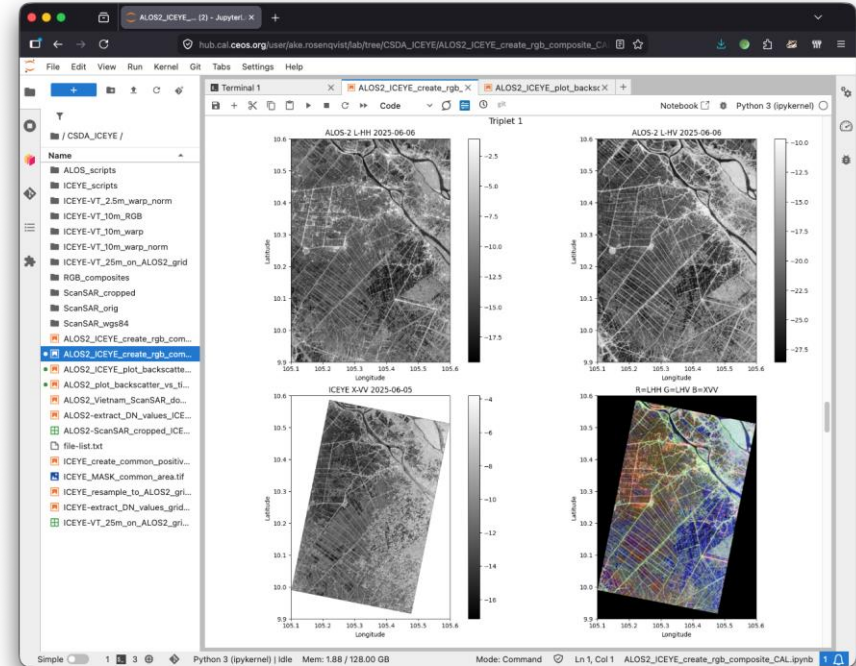


ICEYE proxy calibration in CAL, using CAL "SARCaNet" environment

CAL interoperability test



- **Test 2: Multi-source interoperability.** Joint analysis of data from different sensor (public & commercial)
- ICEYE (X-band VV)
 - Level 1 (GRD)
 - Manual uploads to CAL
- ALOS-2 PALSAR-2 (L-band HH/HV)
 - CEOS-ARD (NRB)
 - Cloud native and Public storage as per WGISS CEOS Interop. Handbook 2.0
 - Direct CAL access from AWS Open Data Repo
- CAL notebooks developed for simple joint ICEYE-ALOS analysis



*ALOS-2 L-HH (UL); ALOS-2 L-HV (UR);
ICEYE X-VV (LL); Multi-source composite (LR)*

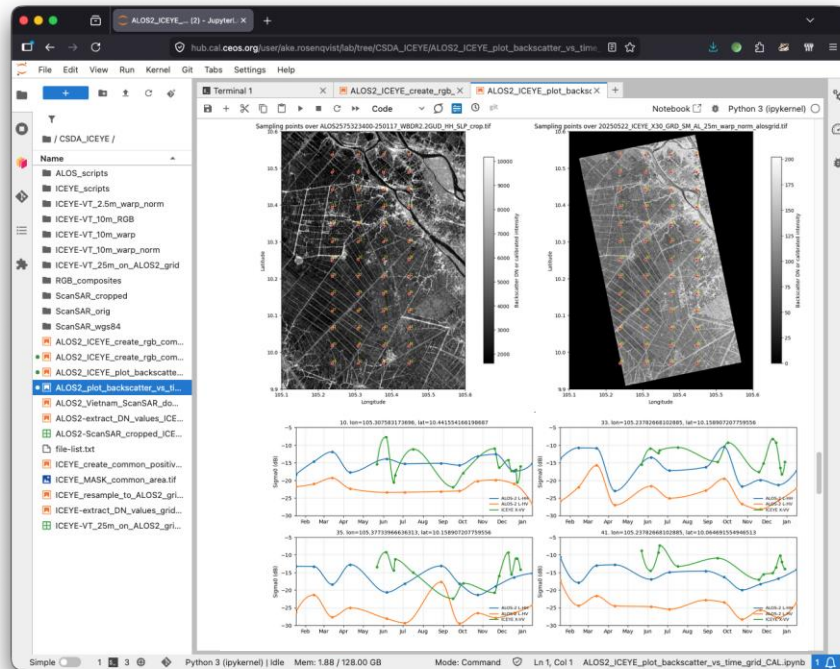
CAL interoperability test



- **Initial findings:**

- CEOS standards (CEOS-ARD & Interoperability best practices) of ALOS-2 data facilitate seamless access and utilization in the CAL.
- Minimal additional processing of ALOS-2 data
- ComSAR (ICEYE) data could be ingested and analyzed in CAL, *however* the data found to be far from analysis-ready.
- Lack of geometric and radiometric calibration present major limitations on the level of analysis feasible.

- Strong tangible case for Interoperability Handbook & CEOS-ARD, and further engagement with the private sector.



Joint ICEYE/ALOS-2 temporal analysis in CAL

❖ Actions

WGISS-61-12	WG-Disaster to help in identifying the pilot supersite for Resilience Interoperability demonstrator.	WGD
WGISS-61-13	Interoperability Handbook to be circulated to WG-Disaster team.	DIIG
WGISS-61-14	Proposal for Resilience Interoperability Demonstrator to be prepared and presented during SIT meeting.	DIIG and SEO

- ❖ Additional joint WGISS/WGDisasters actions expected pending finalization

- ❖ 2026, Q1, Q2 (Definition and concept proving), **SIT-41**
- ❖ 2026 Q3, Q4 (Implementation), **SIT-TW 2026, Plenary**
- ❖ 2027 Q1, Q2 : Fine tuning with Supersites feedback, **SIT-42**
- ❖ 2027 Q3: Demonstration, and Capacity building for stakeholders using deliverables, **SIT-TW 2027**
- ❖ 2027 Q4: Publications, **Plenary 2027**