Minutes v1.0
LSI-VC-10 Teleconference #3: Looking Forward on CEOS ARD

19 May 2021

Participants

Catalyst (PCI):	Wolfgang Lueck
CEO:	Marie-Claire Greening
CSA:	Paul Briand
ESA:	Ferran Gascon
EC/JRC:	Peter Strobl
GA:	Adam Lewis
IEEE:	Chris Durell, Brandon Russell
ISRO:	Keerthi, Radhika
JAXA:	Takeo Tadono, Ake Rosenqvist
LSI-VC Sec:	Matt Steventon, Libby Rose
NASA:	Jim Irons, Ed Armstrong
SEO:	Brian Killough
UK Catapult for UKSA:	Electra Panagoulia
USGS:	Steve Labahn, Chris Barber, Chris Barnes, Timothy Stryker, Thomas Cecere

The presentation slides compiled for this meeting are here, and attached in Appendix A.

Introduction

Adam Lewis (GA, LSI-VC Co-Lead) welcomed everyone to the third of four teleconferences that make up the virtual LSI-VC-10 meeting. This meeting was focused on looking forward on CEOS ARD and covered CARD4L Advisory Note progress as well as CEOS ARD beyond land. Discussions were also held regarding CEOS ARD Strategy v2, VH-RODA, commercial sector involvement, and assessment streamlining/revision of the peer review process.

CARD4L Advisory Note Progress

Matt Steventon (LSI-VC Secretariat) presented on CARD4L Advisory Note progress. Advisory Notes are intended to provide guidance on aspects such as data formats, without compromising the non-prescriptive nature of the CARD4L Framework. It is suggested that these will be developed by various expert groups within CEOS, as need arises. To date WGISS and WGCV have been engaged on topics previously raised (e.g., STAC/COG format, uncertainty measures).

Discussion

- Ake Rosenqvist (JAXA) supported the concept of Advisory Notes. He has been discussing educational resources (for data producers and providers) with the SAR group and has been working on a note for the community on how to use SAR per-pixel metadata. This note could also be useful for data providers. He suggested that the name 'Advisory Note' be reconsidered if they are intended for a broader audience.

- Steve Labhan (USGS, LSI-VC Co-lead) noted that a lot of this is about implementation and communication, and he would be interested in maintaining that context.
- IVOS have proposed a modification to the CARD4L Framework to introduce additional levels between Threshold and Target to increase uncertainty measures. Steve noted that Advisory Notes could be a good way to bridge this information gap rather than making the PFS more complex. The interoperability continuum is a key driver.
- Steve added that Planet is onboard with CARD4L, and are discussing with USGS regularly. Steve will be briefing Planet in June. Ignacio has left the company, leaving a bit of a knowledge gap. Maxar users are looking at higher level products, such as Level 5 products. Steve asked whether the team needs to start exploring whether to move beyond the 'Level 2' PFS products used currently.
- Adam Lewis suggested that a specific section should be made for the Advisory Notes in the PFS. It is important that there is a clear purpose for each note, which should involve the context of moving people along the 'interoperability continuum'. Discussions about a year ago highlighted that technical guidance on file formats would be helpful for data providers.
- Adam suggested that the considerations regarding higher level products could be something to add into the forward strategy for CEOS ARD.

LSI-VC-10-11	LSI-VC Leads and Matt to consider an input for CEOS ARD Strategy v2 about the 'Level' of CEOS ARD, and whether CEOS needs to investigate the inclusion of PFS relating to products that are further along the production chain (e.g. so called Level 3/4/5 information products.	**In time for the first draft of CEOS ARD Strategy v2 (July timeframe)**

- Ed Armstrong (NASA) questioned if there has been any consideration of Advisory Notes for data packaging of cloud datasets, to which Matt Steventon noted this question would have to be directed to WGISS. Discussion followed on the concepts of data packaging vs. formatting, and buckets of data vs. individual files. This is a potential Advisory Note topic.
- Steve Labhan noted that there is some guidance material already in the PFS that should be reviewed with the emergence of Advisory Notes. It was noted that many of the points raised are applicable to multiple PFS, so general advisory notes could be considered, instead of embedding the content into the PFS. This would ensure consistency and avoid replicating advice across multiple PFS, which could become hard to update.
- It was noted that the definition of 'Level 5' data is vague, and there is inconsistency regarding definitions of Levels. Jim Irons (NASA) noted that NASA is just starting to use Level 5 terminology to classify data products derived from assimilated data into Earth system models, implying the use of multiple observations to create a model product. Adam Lewis noted that this ambiguity is one reason 'Levels' are not referenced in the CARD4L Framework.
- Ferran Gascon (ESA) suggested publishing CEOS-endorsed Level definitions. Steve Labhan noted that these definitions are in a WGISS document, but its visibility is limited.

LSI-VC-10-12	Matt to follow up with WGISS regarding increasing the visibility of their processing Level definitions.	**ASAP**

CEOS ARD Beyond Land

Adam Lewis presented the outputs from the group working on the concept of CEOS ARD 'beyond land' in response to the CEOS ARD Strategy.

From the 2020 CEOS Plenary, decision CEOS-34-13 involved:

> *SIT Chair and Ed Armstrong (SST-VC Co-Lead) to form a team of experts to review the CEOS ARD Framework (Definition, Specifications and processes around CEOS ARD) for completeness and suitability (including looking at changes that make it amenable to non-land domains).*

The team was formed from Virtual Constellation and Working Group stakeholders. There has been lots of discussion around what defines ARD and finding a common language and understanding of the existing CARD4L Framework. The next steps will focus on moving the discussion from 'divergence' to 'convergence'.

A generalised CEOS ARD Governance Framework and a 'barebones' PFS template are currently in development. New concepts have emerged/solidified from this work:

1. Establishment of a committee of Virtual Constellation Leads or representatives that jointly oversee the CEOS ARD Governance Framework;
2. The role of VCs in assessing compliance against specifications and developing and supporting specifications in their own thematic areas.

Adam walked through the CEOS ARD Governance Framework Draft from May 2021, which aims to capture all aspects of the governance of CEOS ARD. The document will be presented to the SIT Technical Workshop later this year, ahead of a targeted endorsement at CEOS Plenary 2021.

He also presented the 'bare bones' PFS. This document was formed by taking the SR PFS and stripping out as much as possible, leaving the main components that are seen to be critical to all PFS. Parameters can be added as needed for particular measurements. The document aims to provide some guidance while also maintaining the flexibility needed.

The Governance Framework and 'bare bones' PFS drafts will be shared with the LSI-VC team shortly for comment.

Discussion

- Adam Lewis noted that the team is trying to make it clear that for a new product family it is up to the community to work out what parameters make sense for their specific use case. This would depend on the type of instrument used and the types of data collected. Matt Steventon further noted that in the past the Surface Reflectance PFS has been given out as a basis to work off to draft a new PFS, however now the bare bones document would be a minimum level template for those interested in developing a new PFS. Ake Rosenqvist questioned whether there should be different templates for different sensor types, for example optical and SAR.
- Steve Labhan commented that to maintain interoperability, there should be a common level of requirement for what is considered CEOS ARD. This should be something that is consistent across all

different types of CEOS ARD. Not sure exactly what this would look like, but hopefully there is a common level. Adam Lewis reinforced that interoperability and the definition of CEOS ARD need to be our guides.

- The underlying objective is to make sure ARD has value to data providers and users. That is, to make sure there's enough structure around the CEOS ARD definitions. Achieving the threshold level ensures all of the important elements are included in a product.
- Adam Lewis suggested that the team could include in the Framework or bare bones PFS some guidance on what is meant by Threshold (known to be currently technically achievable) and Target (aspirational).
- Ake Rosenqvist expressed interest in helping to review the Governance Framework document.

LSI-VC-10-13	Adam/Ed to develop a timetable and process to mature the draft CEOS ARD Governance Framework for SIT/Plenary. This process should include sharing the Framework and 'bare bones' PFS with the LSI and other VCs for feedback.	**ASAP**

DECISION 03	The 'Threshold' level of a PFS should be developed with consideration of whether the Threshold is achievable with current technologies and science, and with an expectation that providers exist who are likely to produce data to the Threshold specification. Target levels may reflect aspirations for greater rigour that may require leading edge capabilities to be met.

CEOS ARD Strategy v2

Matt Steventon presented the 2020-2021 CSIRO/GA Australian SIT Chair priorities timeline and recalled the goal of presenting the CEOS ARD Strategy v2.0 at the 2021 CEOS Plenary.

CEOS ARD Strategy v1.0 was presented at the 2019 CEOS Plenary and has been a helpful resource to direct and focus CEOS efforts on ARD. Version 2.0 will be an update that reflects progress and provides direction for the next few years. In general, the focus for v2.0 is foreseen to be accessibility and utilisation of CEOS ARD, which will increase the impact of CEOS data, including via an increased scope of the CEOS ARD concept (i.e., beyond land).

Discussion

- Adam Lewis noted that CEOS ARD Strategy v2.0 will provide direction for CEOS after the CSIRO/GA SIT Chair term. The incoming SIT Chair won't have the same priorities as the current team, so the Strategy will need to be higher-level and hands off from a SIT Chair perspective. It should be something that the incoming SIT Chair is comfortable with too, and make sense for LSI-VC as a whole.
- Adam noted that the team aims to have a draft ready for the SIT Technical Workshop, and may hold a meeting in the weeks before (in the second half of August) to discuss the final draft. The SIT Chair

team will discuss the process for development of the document and the timeline for community input (including from LSI-VC).

- Wolfgang Lueck commented in chat: "*It will be interesting to see how infrastructures will develop to fully harness these ARD products. New data formats, computational infrastructures, multitemporal analysis algorithms and methods. How will the consumption of ARD data change? (e.g., evolution of Data Cubes). Might be something v2.0 should look at.*"

CARD4L "Inclusivity vs. Scientific Rigour" Discussion

Ake Rosenqvist led a discussion regarding the balance of CARD4L specifications, and the issue of inclusivity vs. scientific rigour. The team should be aware that CARD4L specifications should provide products that meet a certain standard (scientific rigour), while at the same time accommodating broad adoption of the CARD4L specifications by data providers (in particular CEOS Agencies).

Discussion

- Adam Lewis noted that a lot of these issues should come back to the definition, and whether the process results in a useful product that is accessible to a large group of users. These are the guidelines teams should use when making their specifications. A driver behind this should involve the targeted user community. If there is enough scientific rigour in the specifications, then more expert users would use the data. However, the cost is that some data providers or missions may not be able to meet the requirements. Hence, CARD4L has to be compromised to some extent. SAR expert users would have their own data processing systems, so they would probably choose Level 1 data – that is not the community that we want to serve here.
- Ake suggested that we can put footnotes on the parameters to highlight where deficiencies might exist. For example, any deficiency to geolocation accuracy due to rough terrain and ionospheric effects could be added as a footnote, to indicate the data may not be good for use in highly topographic areas. This would help ensure inclusivity of the maximum number of missions/datasets, while still serving the target community.
- Adam noted that the above description of the user community is where the team started with the land surface PFS, however in areas such as sea surface temperature, the user community may only consist of experts. In these scenarios, the same user community focus may not be well-suited.
- Wolfgang Lueck commented in chat: "*Isn't it a big objective to make ARD data consumable by machines. Machines probably have some of the same requirements as non-expert users. Supporting large datasets to be fully utilized has to be done in an automated fashion and not by specialists / experts. So all of these standards should make it possible for data to be consumed in an automated way.*"
- Chris Durell commented in chat: *"Agree that we need to get away from the human concept of ARD. In reality there is no way to keep up with the data without machine intervention. Accordingly the standards for ARD need to be rigorous and the CEOS community needs to challenge the industry to meet those standards."*
- Jim Irons commented that the data providers have to trust that the user understands the level of accuracy required for their application. If a standard of information is set by CEOS, that the geolocation accuracy needs to be specified without a threshold, the user needs to decide if that is right for their purpose. It is important to note the implication of different geolocation errors.

- Ake noted that some of the thresholds exclude some missions in general. The PFS could be made more inclusive by removing absolute requirements (specifically referring to cases like the SAR geolocation accuracy), while adding supporting information for users about the parameter, providing uncertainties incurred in calculations to get to the level required, etc. There could be benefits to not specifying a threshold for certain parameters in a product family, instead providing guidance to users so they can make an informed decision.
- Wolfgang Lueck commented in chat: "*In the optical field we have seen that some data providers that have either VHR data or wide swath data have problems meeting ARD standards. They have problems because they are using conventional techniques that are not able to correct the data sufficiently. That does not mean that methods don't exist that allow for sufficient corrections. We should not compromise too much in favour of data vendors.*"
- On the threshold for per-pixel metadata, Adam noted that there would be concerns if some of the data points are not valid and the data provider did not specify which pixels. Adding too much per-pixel metadata bloats the size of the product and reduces the utility of the product, for example, for developing countries. The per-pixel metadata requirement needs to be considered in this context.
- Chris Durrel noted that a lot of the discussion seems targeted at the 'human expert', but the machine-to-machine process is really now critical, and machines don't have the ability to make a decision on the sufficiency of a dataset parameter. At some point there will be a need to set clear levels such that machine processing is achievable.
- Adam suggested this machine-to-machine topic would fit well into the CEOS ARD Strategy v2. CEOS ARD needs to be anticipating topics like this and ensure it is moving in that direction. Machine-to-machine will likely drive us toward some sort of uncertainty measure requirement.

LSI-VC-10-14	LSI-VC Leads and Matt to consider an input for CEOS ARD Strategy v2 about machine-to-machine processing.	**ASAP**

VH-RODA Follow-up; Commercial Sector Involvement with CEOS ARD

Matt Steventon gave a summary of the feedback from the VH-RODA meeting regarding commercial sector involvement with CEOS ARD (original content from Ferran Gascon, ESA). Issues raised included the notion of ARS (Analysis Ready Services) and the need to move towards product Levels 4 and 5.

The CEOS Analysis Ready Data: Involving the Private Sector document was endorsed at CEOS Plenary 2020. This document could be revisited and an action plan for LSI-VC devised.

The establishment of an email list for more regular communication was proposed, as was a third CEOS ARD Webinar, targeted specifically at the commercial sector.

Discussion

- Ferran suggested that LSI-VC could do more in following private/commercial companies that are trying to adopt CARD4L. At the moment there is Sinergise and Element84. One-on-one meetings with these teams to discuss with them their progress/problems could help develop a relationship. This could facilitate more private companies to pursue CARD4L (e.g., Planet). They will not adopt the

specifications if it is not easy for them, and if it is not beneficial to their clients. Getting support from CEOS could accelerate the process on the private side.

- Ake Rosenqvist, Adam Lewis and Brian Killough are working closely with Singergise on their Sentinel-1 CARD4L product. Sinergise are also now participating in the CARD4L SAR team calls. Singergise desired the help of the LSI-VC team to guide the process, and to work out what detail was needed to achieve CARD4L.
- Christ Durell commented in chat: "*FLARE is also trying to bring fully compliant ARD reporting, uncertainty and data results to the industry. Would appreciate some help with this.*"
- Steve Labhan noted that there are a couple of layers to this process: initial communication and awareness through multilateral forums, for example conferences, webinars, etc. Then what it comes down to is that there is an interest and willingness from individual companies, to date this has been done via different POCs. Steve is working with PCI, Pinkmatter, Planet and Maxar.
- First the team has to get the message out and articulate the benefits, then provide assistance through direct contact. Matt Steventon asked whether the team could add value by connecting these different bilateral discussions that are going on and bring together these different groups.
- The synergy with WGCV IVOS needs to be continued. Continuing to engage through VH-RODA and JACIE is good (noted the CARD4L session at the last JACIE meeting). The uncertainty and Level discussions are two potential common themes among the different fora.
- Steve Labhan noted some data providers have announced CARD4L products/processes without discussing with us or completing a self-assessment. This is a good problem to have, however addressing this should be discussed.
- Chris Durell suggested offering a forum for people to coalesce around these issues. One of the common issues is that it is not clear on who to contact to bring forward issues. Could the team consider some sort of outreach event or support location? There is awareness and excitement, but people might not know how to reach out, get involved, provide CARD4L self-assessments, etc. Could the team make a public announcement, make it apparent how these types of resources could be made available and participate.
- Support for the webinar idea was expressed, and to share POC details, etc.
- Ferran Gascon suggested adding to the CEOS ARD website a POC email, helpdesk/contact form, etc.

LSI-VC-10-15	Matt to add a contact form / details to the CEOS ARD website and consider additional ways to increase connections and communication channels with the community, including through mailing lists, webinars, etc.	**ASAP**

- Steve Labhan noted that it can be difficult for private sector companies to have input into the PFS development, and the team could look at making this side of the activity more collaborative too.
- Matt Steventon will start looking at topics for the webinar, as well as members for a community email list.

- Ake Rosenqvist asked whether the team should do more to recommend and promote COG, STAC, etc.

Assessment Streamlining / Revised Peer Review Process

Matt Steventon presented a summary of the recognised issues with the peer review process (from the 16th March LSI-VC teleconference). It is recognised that the turnaround for CARD4L peer reviews is not optimal or sustainable. There have also been issues with incomplete submissions for peer review which has resulted in wasted effort for a known outcome. More members are also needed for the CARD4L peer review panel member pool.

At the March 16 LSI-VC teleconference, the streamlining proposal was agreed in principle, with exact details to be worked out over the coming months. Medhavy Thankappan (GA) will be presenting this proposal and all feedback to the WGCV-49 meeting (June 29 to July 2).

Discussion

- Steve Labhan noted that as more data providers get involved, and the specifications continue to evolve, there should be a mechanism to allow an incremental re-assessment. Re-assessment against incremental PFS updates needs to be streamlined.
- Adam Lewis suggested that mechanisms should exist to allow groups that have gone through self-assessments to publicise that fact. Some mechanism where data providers (with a letter from e.g., a CEOS Principal) can claim that they meet the threshold requirement, with a separate tick for passing the peer review. Following a self-declaration approach, agencies are accountable for their own assessment. Steve Labhan noted that an independent review was the original desire/intent.
- It was proposed to revisit self-declaration in the new CEOS ARD Governance Framework.
- Wolfgang Lueck commented in chat: *"Would be great if there was an automated way of checking if the data is CEOS ARD."*

LSI-VC-10-16	Matt to communicate the outcomes of the discussions on assessment streamlining and revision of the CARD4L peer review process to Medhavy, as input for his WGCV-49 planning.	**COMPLETE**

DECISION 04	Streamlining of the assessment process for CEOS ARD compliance is a priority and a range of options should be considered to achieve a good balance of efficiency, timelines and rigour. The option of data providers making a written declaration of self-assessment / compliance with Threshold levels should be included.

Closing

- Steve Labahn (USGS, LSI-VC Co-Lead) noted that the final LSI-VC-10 call will be held tomorrow and will provide time for further topics, discussion and wrap-up.

Appendix A: Meeting Presentation Slides

Looking Forward on CEOS ARD

LSI-VC-10 Teleconference #3

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Overview

- CARD4L Advisory Note progress [for information and discussion]
  - WGISS: STAC, COGs
  - WGCV-IVOS: traceability, uncertainty, etc.
- CEOS ARD beyond land [for information and discussion]
- CEOS ARD Strategy v2 [for discussion - what should be updated, and what is needed from LSI?]
- CARD4L “Inclusivity vs. scientific rigour” (discussion)
- VH-RODA follow-up: commercial sector involvement (discussion)
- Assessment streamlining / revised peer-review process [for discussion]

2

CARD4L Advisory Notes

Matt Steventon

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CARD4L Advisory Note Progress

- Advisory Notes are intended to provide guidance on aspects, such as data formats, without compromising the non-prescriptive nature of the CARD4L Framework
  - Fourth component of the CARD4L Framework to address data policy, data formats, interoperability, etc.
- See these being developed by various expert groups within CEOS, as need arises. To date WGISS and WGCV have been engaged on topics previously raised.
- Report from WGISS:
  - Best practice COGS and STAC are on our task list with the Data and Interop Interest group,
  - Includes some vocabs for stac measurements (e.g. band names).
- No report from WGCV on traceability, uncertainty

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CARD4L Advisory Note Progress

Questions

- To data providers: are there any topics where such an Advisory Note would be helpful as you work towards CARD4L?
  - Any topics raised during various industry engagements? VH-RODA?
- Does LSI-VC see the need for any other Advisory Notes on the horizon?
- Are there Advisory Notes that LSI-VC should be directly working on?
  - High resolution and downsampling topic?
  - Anything related to the SAR geolocation accuracy topic?
- Do we have interest and capacity in LSI-VC to accelerate the already identified topics? Or happy to wait?

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CEOS ARD Beyond Land

Adam Lewis, Ed Armstrong

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CEOS ARD Beyond Land

- From the CEOS ARD Strategy:
  - Task 1.2: Identify the need for and prioritise development of future target products as the basis for new CEOS ARD specifications
  - Task 1.3: Develop further CEOS ARD technical specifications based on established need and prioritisation
    - Following the example of LSI-VC with CARD4L, and based on the outcomes of task 1.2, CEOS thematic groups to initiate CEOS ARD specifications for their own domains (e.g., geostationary, LIDAR, inland and coastal water surface reflectance, others).

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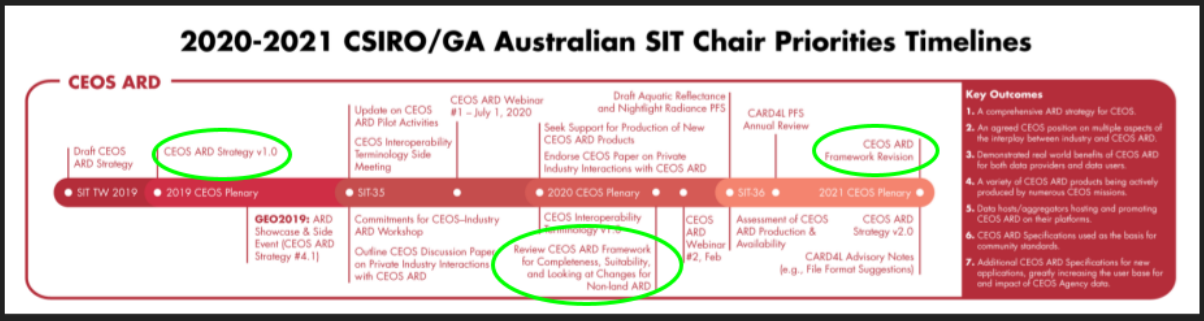
CEOS ARD Beyond Land



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ARD Beyond Land, Review and Status

- ARD Beyond Land presentations from CEOS SIT-TW encouraged review of CARD4L from non-Land discipline perspectives
  - Covered SST, atmospheric, coastal and inland waters use cases
- Decision CEOS-34-13 (2020 Plenary):
  - SIT Chair and Ed Armstrong (SST-VC Co-Lead) to form a team of experts to review the CEOS ARD Framework (Definition, Specifications and processes around CEOS ARD) for completeness and suitability (including looking at changes that make it amenable to non-land domains)
- Team formed from VC and other Working Group stakeholders December 2020 (SST, LSI, P-VC, AC, WGCV, SIT, COAST and COVERAGE)

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ARD Beyond Land, Review and Status

- Themes of discussion so far
  - Converge on key data requirements rather than on data packaging or services (for now). This is consistent with CARD4L.
  - Communities work with different processing levels and datasets that have differing co-registration and accuracy characteristics - clarity is needed on if and how the ARD framework caters for these
  - There are, or appear to be, competing and diverging needs in the ARD spectrum. The challenge is to satisfy them.
  - A significant amount of the discussion is around finding a common language and understanding of the existing CARD4L framework
- Next steps
  - Move the discussion from ‘divergence’ to ‘convergence’
  - The LSI and WGCV teams will document and share the governance approaches around CARD4L
  - Identified a need to converge across different disciplines to “core” PFS requirements - LSI team will provide a ‘bare bones’ PFS

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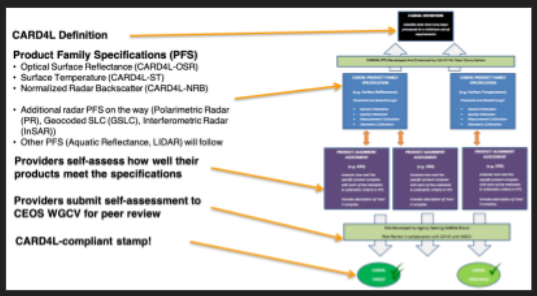
CEOS ARD Governance Framework



\+ Other aspects not yet formally documented

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CEOS ARD Governance Framework

- The CEOS ARD Governance Framework aims to capture all aspects of the governance of CEOS Analysis Ready Data (ARD), including:
  - Generalised CEOS ARD definition
  - The role of the PFS
  - PFS core elements
  - Development process for new PFS
  - Self-assessments and CEOS roles in the process
  - General process for peer review of self-assessments and approval of CEOS ARD datasets
  - Classification and promotion of CEOS ARD datasets
  - The role of Advisory Notes in providing guidance on aspects like file formats, etc. which are not part of the core, non-prescriptive Framework

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CEOS ARD Governance Framework

- Built on the foundation of CEOS Analysis Ready Data for Land (CARD4L)
- Developed by members of the LSI-VC and SST-VC.
- Revealed at last week's Working Teams All Hands Call; in the weeks following organising dedicated follow-up with the VCs.
  - Key theme: role of the VCs, which would serve as the expert groups that would develop PFS in response to needs/demand and coordinate the assessment of datasets against the specifications for their particular domain
- Document will be presented to SIT Technical Workshop later this year, ahead of a targeted endorsement at CEOS Plenary 2021.

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CEOS ARD Governance Framework

- Framework, governance processes, strategy, and implementation will be coordinated between the CEOS Executive Officer, SIT Chair, and nominated representatives from each of the Virtual Constellations, WGCV, and WGISS.
  - No additional new CEOS entities are proposed.
- CEOS ARD (CARD) coordination meetings including the above participants and others as appropriate will be held annually in the wings of the SIT and SIT Technical Workshop meetings to consider approvals, cross-cutting matters and other leadership matters related to CEOS ARD.
- The team is also working on a generic template PFS that captures all of the elements expected to be common to all types of CEOS ARD.
  - The PFS remain flexible based on the needs of the authors and domains.

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CEOS ARD Strategy v2

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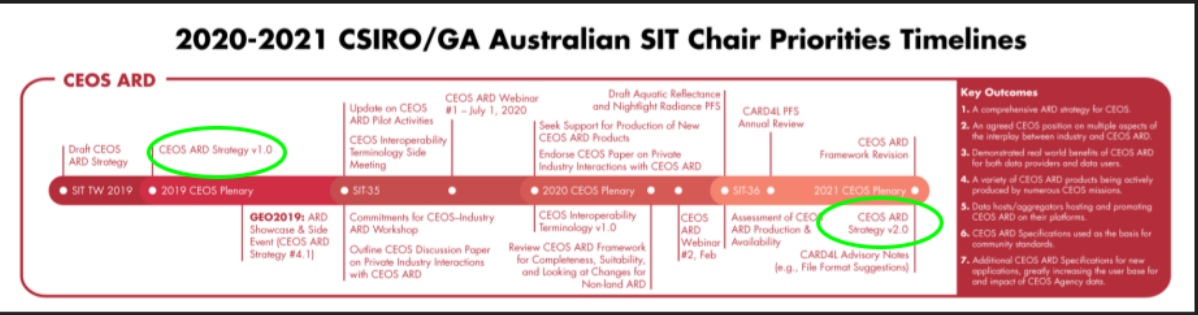
CEOS ARD Beyond Land



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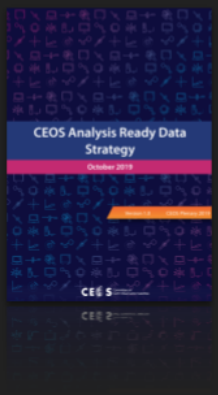
CEOS ARD Strategy v1

- The first version of the CEOS ARD Strategy has been a helpful resource to direct and focus CEOS efforts on ARD.
- We are seeing good traction on the development and continued evolution of Product Family Specifications
- Initial CARD4L assessments have been completed, CARD4L products out in the wild (e.g., Landsat Collection 2), increasing number of assessments in progress
- Two key documents accomplished:
  - CEOS Interoperability Terminology Report
  - CEOS Paper on the Interplay of Industry and CEOS ARD
- Held talks regarding standardisation and agreed a position on this question
- Extensive communication and promotion at key events and dedicated CEOS ARD webinars.
- Increasing awareness of CEOS ARD across community including industry
- Significant resources being collated: https://ceos.org/ard/



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Early ideas for v2 – for discussion and development

- Update the Strategy to reflect progress and developments in the space
- Formalisation of a comprehensive framework for CEOS ARD in general (i.e., beyond land)
- Continued promotion to users, data providers, data distributors
  - webinars, key meetings
  - SDG applicability
- Advisory Notes to provide guidance on key topics as complements to the non-prescriptive PFS
- Continued pilot activities (incl. EAIL)
- Increased linkage between WGISS systems and CEOS ARD and the cloud – discovery of and access to CEOS Agency ARD
  - MIM Database links to CEOS ARD products

In general: topics related to accessibility and utilisation of CEOS ARD – increasing impact of CEOS data, including via an increased scope of the CEOS ARD concept

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CARD4L "Inclusivity vs. Scientific Rigour"

Ake Rosenqvist
JAXA/soloEO

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CARD4L - Inclusivity vs. scientific rigour

- CARD4L definition: *EO data that have been processed to a minimum set of requirements and organized into a form that allows immediate analysis with a minimum of additional user effort. Provides interoperability both through time and with other datasets.*
- Standards: all metadata in one place, requirements for geometric and radiometric quality, relevant per-pixel metadata.
- Key drivers:
  - Broaden the user base - especially reaching out to non-expert users
  - Encourage CEOS agencies - as well as other data providers - to generate and distribute standardised EO data products
  - Increase CEOS visibility
  - etc.
- Balance: Provision of products that meet a certain standard (scientific rigour), *at the same time* as accommodating broad adoption of CARD4L standard amongst data providers (in particular CEOS agencies).

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CARD4L - Inclusivity vs. scientific rigour

Discussion points:

1. The intended role of “Threshold” and “Target” requirements
2. The *minimum* level of the Threshold requirement
   - A requirement is set at a level may exclude certain CEOS agencies or missions from participating, but while lowering the level may (or not) compromise data quality?
     - Example 1:
       - NRB geometric accuracy - threshold beyond reach for several key SAR missions (e.g. ALOS, NISAR, RCM, BIOMASS, SAOCOM, NovaSAR)
       - As **Threshold**, should the requirement be, e.g. data provider indicates an estimate of the geometric accuracy (bias & std), OR set a level “liberal” enough for key (CEOS) missions, OR maintaining high scientific rigour at the expense of certain (CEOS) missions/data providers
     - Example 2: What constitutes *Threshold* Per-pixel metadata?
       - Not available would render the product unuseful?
       - Used by a sufficiently large user community?
       - Useful, but not critical? (or not critical for common users?)

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VH-RODA Follow-up: Commercial Sector Involvement

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VH-RODA Follow-up: Commercial Sector Involvement

- Commercial sector brought additional concepts/thoughts like:
  - ARS (Analysis Ready Services), going beyond the notion of product that limits the range of downstream applications, or
  - the need to move towards product Levels 4 and 5.
- Commercial space involvement
  - General consensus that sensor agnostic, standardised and easy-to-use products are interesting for non-expert users.
  - Commercial sector is showing some support to CEOS-lead CARD4L initiative (2 commercial products under certification: Sinergise Sentinel-1 and Element 84 Sentinel-2).
  - Need to reinforce CEOS-led initiatives to promote ARD in general and CARD4L in particular (e.g. in venues like ARD workshop, JACIE, VH-RODA) to foster adoption of CARD4L by the commercial sector.
  - Need to reinforce the promotion of the benefits brought by existing and future CARD4L products in the general effort towards facilitating missions interoperability + advantage of being first movers.

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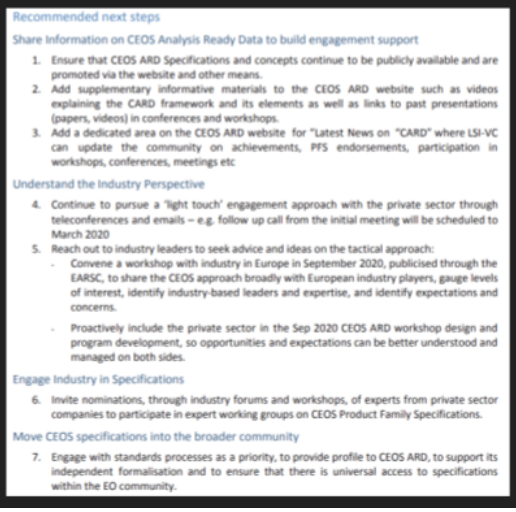
CEOS Analysis Ready Data: Involving the Private Sector

- Document endorsed at CEOS Plenary 2020, here



Recommended next steps

Share Information on CEOS Analysis Ready Data to build engagement support

1. Ensure that CEOS ARD Specifications and concepts continue to be publicly available and are promoted via the website and other means.
2. Add supplementary informative materials to the CEOS ARD website such as videos explaining the CARD framework and its elements as well as links to past presentations (papers, videos) in conferences and workshops.
3. Add a dedicated area on the CEOS ARD website for "Latest News on "CARD" where LSI-VC can update the community on achievements, PFS endorsements, participation in workshops, conferences, meetings etc

Understand the Industry Perspective

4. Continue to pursue a 'light touch' engagement approach with the private sector through teleconferences and emails – e.g. follow up call from the initial meeting will be scheduled to March 2020
5. Reach out to industry leaders to seek advice and ideas on the tactical approach:
   - Convene a workshop with industry in Europe in September 2020, publicised through the EARSC, to share the CEOS approach broadly with European industry players, gauge levels of interest, identify industry-based leaders and expertise, and identify expectations and concerns.
   - Proactively include the private sector in the Sep 2020 CEOS ARD workshop design and program development, so opportunities and expectations can be better understood and managed on both sides.

Engage Industry in Specifications

6. Invite nominations, through industry forums and workshops, of experts from private sector companies to participate in expert working groups on CEOS Product Family Specifications.

Move CEOS specifications into the broader community

7. Engage with standards processes as a priority, to provide profile to CEOS ARD, to support its independent formalisation and to ensure that there is universal access to specifications within the EO community.

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VH-RODA Follow-up: Commercial Sector Involvement

- Possible actions:
  - Revisit the *CEOS Analysis Ready Data: Involving the Private Sector* paper recommendations and devise an action plan for LSI-VC
  - Establish an email list through LSI to have the commercial sector involved and updated on CARD4L. Perhaps using the VH-RODA participant list and WGCV/IVOS contacts.
  - ARD Webinar #3 targeted specifically at the commercial sector?
    - Promotion of the benefits brought by existing and future CARD4L products in the general effort towards facilitating missions interoperability + advantage of being first movers
    - CEOS ARD architectures; DIAS, ODC, etc.
    - How CARD4L fits with new approaches related to cloud hosting/processing, online analysis platforms, COG, STAC, machine learning, etc., and what would be beneficial or necessary to ensure ongoing relevance.

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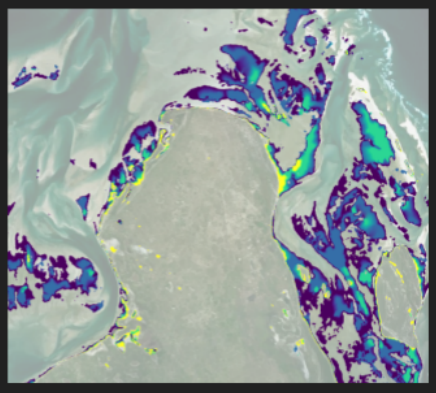
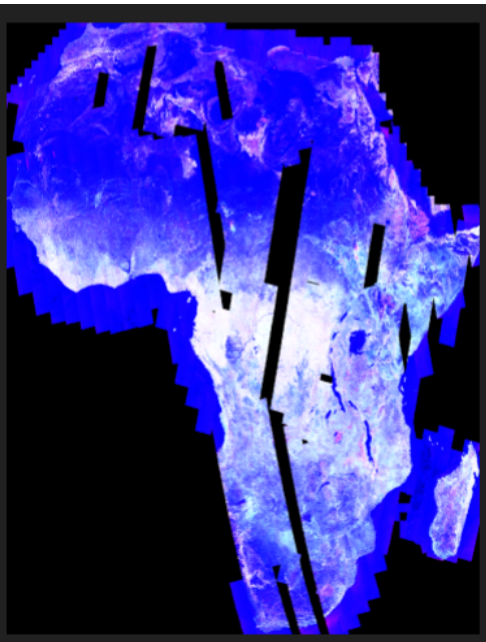
Sentinel 1



Mozambique - S1 intertidal elevation notebook first proof of concept!



S1 coverage composite for January 2021

Assessment streamlining / Revised Peer-review Process

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Known CARD4L assessment issues

Turnaround for CARD4L reviews not optimal / sustainable

- *relevance of review feedback vs data provider product development cycles*
- review preparation is a front-loaded effort, WGCV PoC availability critical
- interactions with the data provider to complete documentation currently 2-4 weeks
- panel assessment turnaround currently 6 weeks
- lead time for vote by WGCV membership is currently 4 weeks

Incomplete submissions for peer-review

- *wasted effort for known outcome (as non-compliance is known at the time of submission)*
- likelihood of 'review fatigue'

CARD4L Review Panel Member Pool

- *need more members / specialist panels*
- a WGCV review member pool in place, but with low redundancy for domain coverage
- availability of panel members at the time of assessment

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Options for modification

- 'Lightweight' review for CARD4L submissions at "threshold"; typically 34 - 43% PFS items with no requirement to fulfil (e.g. 16/37 for SR, 10/29 for ST)
- For "threshold" submissions, LSI-VC + WGCV PoCs review through 1-on-1 session(s) with data provider (**Total turnaround ~4-5 weeks**)
- No partial submissions for Threshold or Target submissions
- Evaluation by WGCV Review Panel only for fully completed self-assessment at "Target"
- WGCV to tweak CARD4L review process to reduce turnaround times (potential gains: 1-on-1 sessions with data providers, shorter peer-review period and review vote process) **(Total turnaround ~8-10 weeks)**

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Assessment Streamlining / Revised Peer-review Process

- Discussion from 16 March teleconference:
  - Lately in excess of 18 weeks turnaround.
  - Long turnaround presents problems for data providers (e.g., hinders any necessary adjustments to work flows / product development). Need to streamline, at least for the threshold level perhaps.
  - The assessment workload for WGCV is high and perhaps unsustainable. It was suggested that for the threshold level assembling the peer review panel is perhaps not necessary. Instead, this might be handled by the single WGCV POC alone, through self-declaration and one-on-one discussions.
  - The threshold requirements and their often qualitative nature make them amenable to a self-declaration and lightweight review. The Target requirements are often more quantitative and require a more rigorous review.
  - The streamlining proposal was agreed in principle, with exact details to be worked out over the coming months.

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Assessment Streamlining / Revised Peer-review Process

- Further discussion time if needed
- Additional input for Medhavy to take to WGCV-49 (June 29 - July 2, 2021)

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Wrap-up

LSI-VC Leads

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