Minutes v1.0
LSI-VC-9 Teleconference #4: GEOGLAM, Forests & Biomass, CEOS ARD Strategy, Loose Ends, Wrap-up

Wednesday 13 May 2020

Participants

ESA:	Ferran Gascon
EC/JRC:	Zoltan Szantoi
Forests & Biomass Subgroup:	Stephen Ward, George Dyke
GA:	Adam Lewis, Andreia Siqueira, Medhavy Thankappan
GEOGLAM Subgroup:	Ian Jarvis
Labsphere:	Chris Durell, Brandon Russell
JAXA:	Takeo Tadono, Ake Rosenqvist
KARI:	Daehoon Yoo
LAPAN:	Kustiyo, Danang
LSI-VC Sec:	Matt Steventon (Chair)
NOAA:	Kevin Gallo
SEO:	Brian Killough
UK Catapult for UKSA:	Electra Panagoulia
USGS:	Steve Labahn, Jenn Lacey
WGISS:	Robert Woodcock

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

Introduction

- Matt Steventon (LSI-VC Secretariat, Chair) welcomed everyone to the meeting and summarised the key topics to be covered (slide 2).

GEOGLAM Subgroup

- Ian Jarvis (GEOGLAM Secretariat) presented on GEOGLAM (slides 3-9). He noted that the Essential Agriculture Variables (EAVs) are a key way forward for GEOGLAM support to multiple policy drivers. GEOGLAM sees itself as a link between space agencies and decision makers, with EAVs as the connection. EAVs are fundamental driving data needs and therefore have implications on ARD and CARD4L. EAVs can be a step towards understanding integrated requirements across many policy drivers.
- Adam Lewis (GA, LSI-VC Co-Lead) asked how LSI-VC can connect with the infrastructure group of GEOGLAM. Ian noted they are meeting for the first time shortly. He would be happy to make the connection if desired.

Forests & Biomass Subgroup

- Stephen Ward (Forests & Biomass Subgroup Secretariat) presented on the Forests & Biomass Subgroup's activities: the Biomass Workshop, CEOS Biomass Protocol, AFOLU Roadmap, and the team's Work Plan (slides 10-15).
- Ian Jarvis (GEOGLAM Secretariat) commented on the AFOLU Roadmap and the potential for GEOGLAM to contribute to the Agriculture part. He noted that there are existing crop masks of varying quality. In the near future the World Cover and World Cereal products (ESA funded activities) are expected to be released. The EAVs will also include a "State Change of Agricultural Land Use" parameter, which would be useful. Looking at change over time is a clear overlap between the AFOLU Roadmap and the EAVs.
- Adam Lewis (GA, LSI-VC Co-Lead) asked about the links between GFOI and SEPAL. SEPAL has been developed by FAO over the years as a part of OpenForis, funded by Norway and running in Google Earth Engine. It is intended to simplify uptake of EO data for countries that FAO works with on forestry applications. It is promoted in the GFOI Tools Registry and is endorsed to be compliant with the GFOI Methods and Guidance Documentation (MGD).

CEOS ARD Strategy Stocktake

- Matt Steventon (LSI-VC Secretariat) reviewed progress against each of the main tasks in the CEOS ARD Strategy (slides 16-25).
- There may be a question for future discussion around potential CEOS engagement with Big Data providers on hosting and uptake of CEOS ARD products.
- Adam Lewis (GA, LSI-VC Co-Lead) shared a link to the most recent draft of the CEOS Analysis Ready Data – Involving the Private Sector paper.
- Adam suggested it would be useful to trace the links from ARD to the Essential Agricultural Variables.
- Steve Labahn (USGS, LSI-VC Co-Lead) noted that the ARD provided to VNSC's Mekong Data Cube was from Collection 1 (a pre-CARD4L-compliant form) and so an update may be needed.
- Brian Killough (NASA, SEO) has been speaking with Google about setting up an ODC instance on Google Cloud, leveraging the datasets they hold there.
- Steve suggested identifying a clear primary owner of each of the CEOS ARD Strategy items.

CEOS Interoperability Terminology

- Steve Labahn (USGS, LSI-VC Co-Lead) and Robert Woodcock (CSIRO, WGISS Chair) presented on the CEOS Interoperability Terminology Report (slides 26-29). In late 2019, a multi-disciplined team led by WGISS and including LSI-VC and WGCV IVOS was formed to address the broader interoperability related terminology challenge, building on past work completed in LSI-VC.
- WGISS plans to begin circulating the latest draft report through its team along with the most interested/engaged parties (LSI-VC, WGCV, IVOS, SIT Chair Team)
- Another recommendation is to pursue a few follow-on pilot activities (CEOS-COAST, Landsat/Sentinel-2 HLS/Sen2Like, DEAfrica, others?) to test each of the types/items in the report.

- Robert noted a related development from the WGISS-49 meeting – a proposal from himself and Brian Killough (NASA, SEO) regarding the establishment of a CEOS Earth Analytics Interoperability Lab. WGISS was approached by a number of CEOS entities about a variety of types of interoperability discussed in the report (from CARD4L through interoperability and analysis) and have proposed the Lab as a means to address the challenges related to executing these activities (i.e., eliminating the need to rely on *ad hoc* solutions from a collection of different agency resources). The SEO will host the Lab as an extension of the CEOS Open Data Cube Facility. It will provide a sandbox for these different projects and prototyping.
- Matt Steventon (LSI-VC Secretariat) forwarded the proposal to the LSI-VC mailing list for information following the call.

CARD4L Supply, User Access, User Experiences and DEAfrica

- Adam Lewis (GA, LSI-VC Co-Lead) presented on CARD4L supply and access, and user experiences (slides 30-32) and on some potential CARD4L pilot ideas (slide 33). Pilots could be explored through UNCCD / GEO LDN, WGDisasters (GEO-LEO-SAR Flood Pilot), and CEOS-COAST.
- There is little structured feedback on CARD4L because we have not yet asked in a structured way. The Copernicus Sentinel Data Access Annual Report is one exception. In 2018 the report noted that: *"Due to the ramp up of (Sentinel-2) L2A production over the year, there has been an even larger increase in the Archive Exploitation Ratio"*. This indicates a user-preference toward analysis-ready data rather than lower levels of processing. The widespread interest in analysis-ready data from across communities indicates that this is an important concept.
- Informal discussions with users working with forests (FAO SEPAL) have highlighted a desire for BRDF corrections in ARD.
- Adam again highlighted the case of Digital Earth Africa, noting that reliable, systematic supplies of CEOS ARD are vital if Earth Observation is to have impact. Digital Earth Africa will use various CEOS ARD datasets. Continental scale is key.
- Chris Durell (Labsphere) noted that the PACE team is creating a Center of Excellence for coastal observations at Wallops Island. Susanne Craig at NASA GSFC is the POC. Steve Labahn (USGS, LSI-VC Co-Lead) will check whether this is already connected to CEOS-COAST. CEOS-COAST presents a really good prospect for a CEOS ARD pilot across multiple domains (land, coastal).

LSI-VC-9-14	Andreia to follow up UNCCD contacts (including Neil Sims, CSIRO / SDG-AHT) regarding their possible engagement with CEOS ARD (pilot or otherwise).	**ASAP**
LSI-VC-9-15	Steve Labahn to check whether the PACE Center of Excellence is connected to CEOS-COAST.	**ASAP**

WGCapD Collaboration

- Zoltan Szantoi (EC/JRC, LSI-VC Co-Lead) presented on the CEOS Working Group on Capacity Building and Data Democracy (WGCapD) and potential collaborations for the purpose of CARD4L outreach and education (slides 39-43).
- Robert Woodcock (CSIRO, WGISS Chair) noted that WGISS has spoken to WGCapD about developing Jupyter Notebook training materials on using CEOS ARD and FDA infrastructure to access and analyse data. These could be developed and used as part of the CEOS Interoperability Lab and also assist CEOS project teams in various aspects of the technologies involved.
- Zolti asked whether WGCapD could support pilots of CEOS ARD. Feedback based on WGCapD experience would be welcomed. Also, as we are looking for future target products, feedback from the groups that WGCapD works with regarding user needs/demand would be helpful.
- Brian Killough (NASA, SEO) noted that WGCapD will not produce materials for us. They can help with advertisement of capacity building opportunities through their networks and provide lessons learned regarding how to run capacity building activities, etc. LSI-VC would need to take the initial steps, develop webinars, etc.
- It was suggested that WGCapD could simply advertise / direct users towards CARD4L in their existing activities. This promotion doesn't necessarily need any large investment or new materials.
- We would need to check whether WGCapD could support our industry outreach goals.
- Steve Labahn (USGS, LSI-VC Co-Lead) suggested that LSI-VC needs to finalise its own outreach activities before extending to the WGCapD network. It was agreed that we should re-use the introductory parts of the CEOS-Industry ARD Webinar (explanation of the CARD4L Framework, how things work, stocktake, assessment pipeline, etc.). Once we have this material we can enlist the help of WGCapD for its use and promotion. This can also be used as a general webinar ahead of the CEOS-Industry ARD Webinar, if there is time.

LSI-VC-9-16	Matt to spin off from the CEOS-Industry ARD Webinar materials a more general set of slides to serve as a general introduction to ARD, which can be used for a general webinar ahead of the CEOS-Industry ARD Webinar (if there is time) as well as for engagement with the WGCapD network.	**ASAP**

Wrap-up

<u>Review of Actions and Decisions</u>

- Matt Steventon (LSI-VC Secretariat, Chair) presented a recap of the actions and decisions recorded so far (slides 45-53). Only changes and extra actions are recorded below.

LSI-VC-9-17	LSI-VC Leads to engage Planet on ARD20. Steve Labahn to do the same for JACIE. The objective is to have CEOS ARD well represented in any upcoming meetings – preferably through specific sessions and having LSI-VC representatives chairing discussions.	**ASAP**

- It would be helpful if the SIT Chair Team coordinated a joint teleconference in response to **LSI-VC-9-02**.
- Robert Woodcock (CSIRO, WGISS Chair) shared some slides from WGISS-49 on cloud optimized data formats here.
- **LSI-VC-9-12** was agreed to be complete. **LSI-VC-9-17** (below) was recorded in response.

LSI-VC-9-18	Steve Labahn to share lessons learned and user feedback from the Landsat Collection 2 implementation on AWS.	**July LSI-VC Team Call**

Revisiting Some Decisions and Discussions

Standardisation

- The following decision was agreed regarding the standardisation of CARD4L:

DECISION 03	A best practices (or similar) document through OGC could be a good middle ground. The possibility of this will be explored via our existing involvement in OGC Testbed-16. The standards process is a big investment, and it isn't clear it will definitely help us achieve our goal with CARD4L (uptake and impact). Standards don't necessarily keep pace with current innovation rates. "Pseudo-standards" which fill a gap are just as valued and used (e.g., the WGCV Protocols).

- Ake Rosenqvist (JAXA) confirmed that the SAR PFS team has no desire to pursue a formal standardisation process either. They do however wish to ensure consistent terminology wherever possible.

Expanding the CARD4L Framework

- Matt Steventon (LSI-VC Secretariat, Chair) raised again the question of whether we need to consider adding 'Advisory Notes' as a fourth component of the CARD4L Framework to address data policy, data formats, interoperability, etc.
- Adam Lewis (GA, LSI-VC Co-Lead) presented some background on the origin of this question (feedback received in response to the *CEOS ARD – Involving the Private Sector* paper that questioned

whether the omission of these topics in the PFS undermines the goal of CARD4L) and reviewed the current CARD4L Framework (slides 58-63).

- Adam noted that the ocean and atmosphere communities perhaps have more focus on some of these other aspects.
- The IT innovators are evolving standards for data formats and catalogues (COG, STAC, etc.).
- Adam noted that the SAR PFS team has already introduced metadata format specifications to suggest how data could be formatted.
- Steve Labahn (USGS, LSI-VC Co-Lead) noted that he has heard similar feedback through WGCV IVOS and WGISS. He believes these aspects need to be included in the CARD4L Framework somehow.
- Robert Woodcock (CSIRO, WGISS Chair) noted that some of these types of guidance materials are expected to come out of a 2019-2021 CEOS Work Plan Task assigned to WGISS (FDA-8). This action is being rewritten for the next CEOS Work Plan to make it more manageable. Adam noted the need for the SIT Chair to work out how to tie this work to CEOS ARD under the CEOS ARD Strategy and CARD4L Framework.

DECISION 04	LSI-VC will seek to add 'Advisory Notes' as a fourth component of the CARD4L Framework to address issues like data policy, data formats, interoperability, etc.	
LSI-VC-9-19	Adam Lewis and the LSI-VC Leads to work with Rob Woodcock and the SIT Chair Team to consider how to tie the work of WGISS on guidance materials related to data policy, data formats, interoperability, etc. to CEOS ARD under the CEOS ARD Strategy and CARD4L Framework. **Context:** These documents are seen as a possible existing way to address the feedback that we need to consider adding 'Advisory Notes' as a fourth component of the CARD4L Framework to address data policy, data formats, interoperability, etc. Other new documents could also be used if these WGISS documents are found to be unsuitable.	**ASAP**

- Ake Rosenqvist (JAXA) suggested that some of these aspects could be integrated easily enough, noting the example of metadata formats incorporated in the SAR CARD4L PFS. He cautioned against being too prescriptive on things like data format, as this risks limiting the appeal of the specifications. Adam agreed, highlighting that these are expected to be advisory notes only, not prescriptive requirements.
- Steve suggested that the use of these best practices / guides / advisory notes would move products along the interoperability spectrum.

Accommodating Lower and Higher Resolution Datasets under the Existing PFS

- Matt Steventon (LSI-VC Secretariat, Chair) noted that there is a need to revisit the specifications in regard to accommodating lower and higher resolution datasets. The LSI-VC Leads don't see this

being a major departure from what has been established, rather a small tweak to what we already have. The PFS have, to date, been resolution agnostic and we wouldn't wish to move away from that approach.

DECISION 05	LSI-VC will review the suitability of the PFS for lower and higher resolution datasets ahead of the 2021 PFS revision cycle and work to make any adjustments needed to accommodate these types of data.	
LSI-VC-9-20	Andreia to lead the review and revision of the PFS in the 2021 revision cycle to accommodate lower and higher resolution datasets.	**2021 PFS Revision Cycle**

- This would be a good topic for our industry engagement activities, given they generally operate higher resolution missions.

AOB and Closing

- Ake Rosenqvist (JAXA) asked about the possibility of changing the cut-off date for updates to the PFS to March instead of December, perhaps two weeks before the first LSI-VC meeting of the year.

LSI-VC-9-21	All to share feedback on the virtual meeting approach. Some feedback already shared: should include greater ability for remote access and chat interventions in face-to-face meetings, shared slide deck is a good approach, virtual break-out discussions could be useful, comfort breaks for longer sessions would be good, encourage people to switch on their cameras.	**June LSI-VC Team Call**
LSI-VC-9-22	Andreia to confirm the change in cut-off date for updates to the PFS as two weeks before the annual LSI-VC meeting in March.	**ASAP**

- Matt Steventon (LSI-VC Secretariat, Chair) thanked everyone for their attendance and contributions to the discussions.

Appendix A: Meeting Presentation Slides

LSI-GEOGLAM, LSI-Forests & Biomass, CEOS ARD Strategy, Loose Ends & Wrap-up

LSI-VC-9 Teleconference #4

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Overview

- LSI-GEOGLAM
- LSI-Forests & Biomass
- CEOS ARD Strategy stocktake
- CEOS interoperability terminology work and status
- Evaluating CARD4L supply, user access, and user experiences
  - Review lessons and experiences from Digital Earth Africa
  - Reflect on the requirements and feedback from external groups (if presented at SIT-35)
  - Discuss opportunities for pilots
- WGCapD collaboration discussion
- Wrap-up

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LSI-GEOGLAM

GEOGLAM
GLOBAL AGRICULTURAL MONITORING

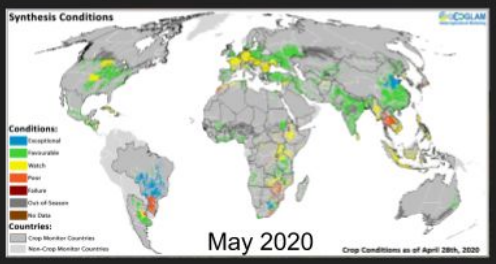
3

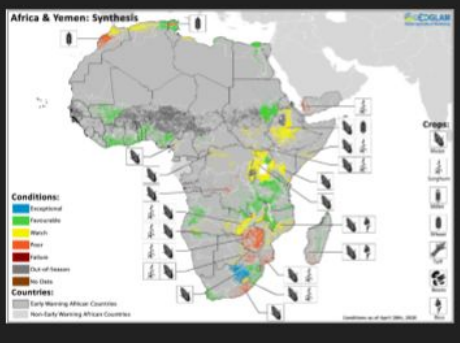
GEOGLAM Top Highlights Since Sep 2019

GEOGLAM Response to COVID 19:

- The usual array of bio-physical challenges are being exacerbated by supply chain disruption-Recipe for a food security disaster
  World Food Program Insight

- The GEOGLAM Crop Monitors are more important than ever, along with the need for more quantitative metrics
  - G20 Extraordinary Agriculture Ministers Meeting
    Special Statement on COVID 19
  - Featured in Bloomberg Green
  - GEOGLAM tracking COVID-19 impacts on food security





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GEOGLAM Top Highlights Since Sep 2019

Updates from Relevant Working Groups:

GEOGLAM CapDev Team best-practices document in process

- Linked to CEOS and GEO CapDev Working Groups

GEOGLAM Infrastructure Working Group – Federated Approach to ICT

- Cube, cloud, data access, tools, etc…

GEOGLAM EAV WG held 3 day workshop in October 2019

- Variables selected and aiming to have completed this year. Stewards Identified
- Stewards call 12 May, Beta Version by end Summer 2020
- Impact assessment on downstream data needs and data processing (ARD, ARD+)
- Considering participation in the Carbon AFOLU initiative (Ag land use state and change)

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How is GEOGLAM Dealing with the Complexity of the Policy Landscape?

Lots of success with in season crop condition, but policy landscape has shifted

- Information produced by the GEOGLAM community can support a multitude of policy targets (create once use many places)
- Almost all targets and goals require information integrated across multiple science communities
- Need for a common approach across communities to enable integration and information sharing

GEOGLAM believes Essential Agricultural Variables (EAV's) are the way forward

GEOGLAM
Global Agricultural Monitoring

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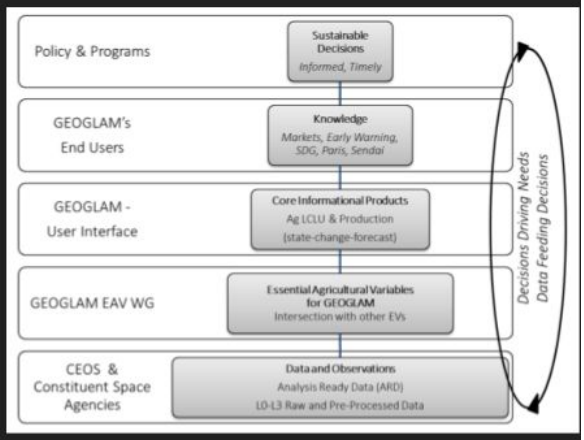
Essential Variables in Support of Multiple Policy Drivers

Essential Agricultural Variables for GEOGLAM

- The concept of Essential Variables (EV's) suggests a minimum set of fundamental variables required to characterize state and change in a system
- In the continuum of Data to Decisions we see GEOGLAM in the middle, in partnership linking space agency data products to the information that drives better policy and program decisions
- List of preliminary EAV's in Annex



GEOGLAM Global Agricultural Monitoring

@G20_GEOGLAM
www.geoglam.org

Implications for CEOS

GEOGLAM's Vision:

1. EAV's are fundamental to driving data needs that address community activities and ultimately inform policy

2. EAV's drive observation needs and by extension they have implications for ARD-ARD+

3. EAV's drive the R&D priorities (incl. new data streams, new missions)

4. EAV's can help address many policy drivers, but much integration is required across science disciplines…The LSI-VC CARD4L can be a step towards understanding integrated requirements

GEOGLAM Global Agricultural Monitoring

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ANNEX – Preliminary List of Core and Supporting EAV's

Core EAV	Supporting EAV
Utilized agricultural areas mask	Current Crop Stage
Annual Crop Mask	Historical Crop Calendars
Crop type map	Irrigation Timing
Crop type area estimate	Tillage (timing & type TBC)
Crop Yield estimation	Cover crop
Crop yield forecast	Crop rotation
Crop condition assessment	Agricultural Burned Area
Water Productivity	Field delineation
Fallow mask	Evapotranspiration
Rangeland Mask	Seasonal Dynamics of Surface Water Availability
Rangeland Condition	Agromet Variables
	Agricultural Biomass
	LAI (ECV)
	fAPAR (ECV)
	Fractional cover
	Land surface temp (ECV)
	Air Temperature (ECV)
	Precipitation (ECV)
	Wind Speed (ECV)
	Surface Soil Moisture (ECV)
	Root Zone Soil Moisture (ECV)

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LSI-VC
Forests & Biomass Team

Brief Update May 2020

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Update from Forests & Biomass Team

- **Biomass Workshop**
- **CEOS Biomass Protocol**
- **AFOLU Roadmap**
- **F&B team WP**

Biomass Workshop

- **Hosted by SIT Chair in Canberra in early March**
- *35 key scientists and practitioners from the CEOS LPV biomass validation team to representative from in-situ biophysical measurement networks from around the world. Some outcomes of the workshop include the potential extension of the population of biomass validation reference sites to fill critical gap in the tropics and Asia with contributions from partners such as ISRO, JAXA and the willingness of ecosystem networks such as TERN or ICOS to work with the earth observation land product validation communities to extend the number of variables measured and to adapt their protocols for earth observation validation purposes*
- **Presentations etc available here**

- The Biomass Validation Team within WGCV LPV has been working on the development of a good practices protocol for validation of above ground biomass products to ensure users are able to access quantitative and seamless data across these missions
- Protocol now expected mid-year
- Scope and purpose previewed at SIT-35 Virtual Meeting
- Working team assembled to develop a business case to put to Principals at Plenary for support for measures to realise the full benefits of the Protocol and ensure max. policy relevance for our new datasets
- Draft will be presented at SIT TW 2020 Virtual Meeting

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- Short paper on
  - The opportunity for CEOS & space agencies presented by Global Stocktake process
  - What datasets might be valuable for land sector
  - What is in train and could be suitably directed, or what needs work
- Volunteer team based on LSI F&B: JAXA (Osamu), ESA (Frank-Martin), USGS (Steve L), NASA (TBC), UK (Shaun Quegan?), SEC
- GFOI keen on collaboration
- GEOGLAM engagement and Ag. scope TBD

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F&B Team WP

LSI Forest & Biomass Work Plan			
		Lead	Partners
1	**Global Baseline Acquisitions**	**Frank-Martin, Chris**	
a	Low-level annual maintenance of core data stream charts to be consistent with MIM	SEC	ESA MIM team
b	No need for coverage updates other than exceptional circumstances	ESA, USGS	
2	**Data access and uptake**	**Brian**	
a	National annual coverage reports by SEO. Data discovery tools such as COVE.	SEO	USGS, ESA, CALM registry
b	CEOS ARD education, trials and feedback from GFOI - inc Landsat Collection 2, SAR	USGS, JAXA, SEO, ESA	LSI-VC Co-Chairs
c	Pilots with GFOI Partners in support of access and uptake - inc SEPAL/DE-Africa, ODC and cloud	SEO+	FAO, ODC, LSI-VC
d	GFOI Space Data blog established & maintained	SEC	CB Component
e	Customised data support as requested by individual countries (eg Vietnam)	SEO, agencies	User countries
3	**Biomass data**	**Stephen, George**	
a	Education & comms materials for practitioners, users and conventions (eg SBSTA) on new datasets	SEC+	WGCV LPV, Mission managers
b	Serve as bridge to CB component to establish data supply, user needs and feedback	USGS Co-Chair	SilvaCarbon, FAO, WB
c	Establish coverage outlook materials for relevant missions	SEC	WGCV LPV, Mission managers
d	Promote CEOS Biomass Protocol and advocate uptake	All	WGCV LPV
e	Explore CEOS ARD possibilities for new biomass data inc CARD4Lidar	NASA, ESA, JAXA	Australia SIT Team, LSI-VC
		Lead	Partners
4	**CB Component Collaboration**	**Chris**	
a	Needs and capabilities dialogue through USGS Co-Chair	USGS Co-Chair	SilvaCarbon, FAO, WB
b	Support space data aspects of de facto systems such as SEPAL and GEE & GFOI tools registry	All	SilvaCarbon, FAO, WB
c	CB and Space Data events - at Plenary or stand-alone	USGS Co-Chair	SilvaCarbon, FAO, WB
5	**Convention engagement**	**Frank-Martin**	
a	Support AFOLU aspects of CEOS push on convention engagement, inc for global stocktake role, RAMSAR, SDGs	ESA	Australia SIT team, EC
b	Support 2020 Workshop at JRC as GFOI rep	ESA	EC
6	**MGD support**	**Ake**	
a	Support representation of space agency data in MGD updates	JAXA	MGD Component

USGS Rep & support TBC

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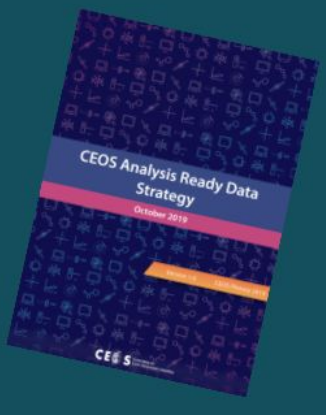
CEOS ARD Strategy Stocktake

M. Steventon



http://ceos.org/ard/files/CEOS_ARD_Strategy_v1.0_1-Oct-2019.pdf

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1.1 Continue development of the CARD4L Product Family Specifications

– SR, ST, NRB SAR, POL SAR ✔

– Interferometric and Geocoded SLC SAR in development

– Aquatic Reflectance PFS

– LIDAR terrain and canopy height PFS in early stages of discussion

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1.2 Identify the need for and prioritise development of future target products as the basis for new CEOS ARD specifications

– SST-VC proposed a new CEOS WP Task to survey state of ARD-like products in ocean communities. Focusing first on the SST and OCR-VC, adding other VCs to the review in the second half of 2020.

– CEOS-COAST uptake of ARD will be driven by findings from SST-VC.

– Expect SST-VC to approach LSI-VC for guidance at some point.

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1.3 Develop further CEOS ARD technical specifications based on established need and prioritisation

– Need to push for some kind of consistency in ARD approach across the domains (e.g., CARD4L Framework and PFS approach)

– SIT-35-08: The SIT Chair Team to consider the potential for an activity to prototype the CEOS ARD approach for one exemplar ocean variable and one exemplar atmospheric variable.

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1.4 CEOS Interoperability Terminology Report

– CEOS Glossary of Terms Related to Analysis Ready Data, Future Data Architectures, and Interoperability – added to CEOS WP with WGISS as lead.

– Discussed later on this call

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2.1 Engage Big Data hosts and aggregators and establish formal pipelines and procedures to promote CEOS ARD hosting and uptake on their platforms

– Nothing done at CEOS-level

– USGS working with AWS on Collection 2

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2.2 Facilitate discovery of and access to CEOS Agency ARD

– WGISS task

2.3 Survey users' needs with regard to ARD accessibility and provide feedback to all data providers

2.4 CEOS Paper on the Interplay of Industry and CEOS ARD ✔

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3: Pilots and Feedback

3.1 Production of CEOS ARD and supply to data aggregators and platforms

– Landsat and Sentinel-2 progressing through the CARD4L assessment process

– USGS Collection 2 AWS example

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3.2 – 3.6: CEOS ARD Pilots

Digital Earth Africa:

- Paper proposed on DEAfrica lessons learned, requirements and recommendations for CEOS
- Discussed later

GFOI Pilot: Awaits DEAfrica and FAO progress

GEOGLAM Pilot: Nothing to report

Mekong Data Cube Pilot: Preliminary 'ARD' from Landsat and ALOS-2 provided during 2019 CEOS Chair year.

Other Pilots: UNCCD LDN? CEOS-COAST. WGDisasters GEO-LEO-SAR Flood Pilot?

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4: Communication & Promotion

4.1: GEO Week Side Event: Analysis Ready Data ✔

4.2: CEOS–Industry ARD ~~Workshop~~ Webinar

4.3: CEOS ARD stocktake and outlook – on hold, awaiting assessments

4.4: Engagement with standards organisations – to be decided today

4.5: Promotion of CEOS ARD to data providers

4.6: Communication with CEOS ARD users

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CEOS Interoperability Terminology

S. Labahn

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Background & History

- In 2018-2019, ESA and USGS partnered to define an initial set of interoperability related definitions and an interoperability continuum, as follows:
  - Analysis Ready Data (ARD)
  - CEOS ARD for Land (CARD4L) Products
  - Interoperable Products
  - Harmonised Products
  - Fused Products

- At the 2019 LSI-VC-7 meeting in Hanoi, LSI-VC endorsed these definitions
- As part of the broader CEOS ARD Strategy led by the current SIT Chair Team, a comprehensive CEOS Interoperability Terminology Report is now desired (and needed!)

1.4: CEOS Interoperability Terminology Report	LSI-VC, WGCV (IVOS), WGISS, CEOS Agencies	Q2 2020
In the context of Earth remote sensing, the terms Analysis Ready Data (ARD), interoperability, and harmonization are often used and, to a large extent, used inconsistently. To rectify this, CEOS will produce a report discussing and providing examples of the following five terms drawing on work previously done by a subset of the LSI-VC, WGCV (IVOS), and WGISS: 1. Analysis Ready Data (ARD) 2. CEOS ARD for Land (CARD4L) Products 3. Interoperable Products 4. Harmonized Products 5. Fused Products		

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Recent Activities

- In late 2019, a multi-disciplined team led by WGISS and including LSI-VC and WGCV IVOS was formed to address the broader interoperability related terminology challenge
- WGISS met and mostly adopted the previous LSI-VC work (retitled the document and made one word change) and expanded it to include additional aspects:
  - Analysis, Access, and Analysis Ready Data
  - Cloud Data Formats and ARD in the Cloud
    1) Cloud-friendly formats, 2) Cloud-native formats, 3) Cloud data access API
  - Types of Analysis Interoperability
    1) Executable code, 2) Source code, 3) Algorithm
- IVOS-32 met in March 2020 and conducted a survey amongst the attendees on what the definition of interoperability was - quite a range of ideas (supports need for better understood and adopted definition)
  - Planned to re-circulate survey across IVOS and include commercial entities
  - Several definitions introduced new terms that would need to be defined
  - Interoperability definition needs to recognize that it is ***application-specific***

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Next Steps

- Continuing to learn about previous work done and to identify overlaps with existing industry standard definitions (i.e., ISO, OGC, IEEE) - ***data*** vs. ***services*** difference
  - **OGC:** Capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units ISO 2382-1. "The ability for a system or components of a system to provide information portability and interapplication, cooperative process control. Interoperability, in the context of the OpenGIS Specification, is software components operating reciprocally (working with each other) to overcome tedious batch conversion tasks, import/export obstacles, and distributed resource access barriers imposed by heterogeneous processing environments and heterogeneous data. (http://defs.opengis.net/elda-common/ogc-def/resource?uri=http://www.opengis.net/def/glossary/term/Interoperability)
  - **WGISS:** The capability of the user interface and administrative software of one instance of a service to interact with other instances of same type of services. Services are said to be interoperable if they allow for interoperability as previously defined. And systems are said to be interoperable if they are effective implementations of interoperable services. (http://ceos.org/document_management/Working_Groups/WGISS/Documents/WGISS_CEOS-Interoperability-Handbook_Feb2008.pdf)
- WGISS plans to begin circulating the latest draft report through its team along with the most interested/engaged parties (LSI-VC, WGCV, IVOS, SIT Chair Team)
- Another recommendation is to pursue a few follow-on pilot activities (CEOS-COAST, Landsat/Sentinel-2 HLS/Sen2Like, DEAfrica, others?) to test each of the types/items in the report

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CARD4L Supply, User Access, User Experiences

A. Lewis

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CARD4L Supply, User Access, User Experiences

- Review lessons and experiences from Digital Earth Africa
- Reflect on the requirements and feedback from external groups (if presented at SIT-35)
- Discuss opportunities for pilots (UNCCD, WGDisasters GEO-LEO-SAR, CEOS-COAST)

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Feedback

There is little structured feedback because we have not yet 'asked' in a structured way.

The copernicus Sentinel Data Access Annual Report is one exception. In 2018 the report noted that "*Due to the ramp up of (sentinel-2) L2A production over the year, there has been an even larger increase in the Archive Exploitation Ratio*". This indicates a user-preference toward analysis ready data rather than lower levels of processing.

The widespread interest in analysis ready data from across communities indicates that this is an important concept.

Informal discussion with users in forests (Sepal) "do a BRDF correction".

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Opportunities for pilots

- UNCCD - Convention on Combating Desertification
  - Driving methods around Land Degradation Neutrality
  - Active community, resourced, well organised, committed to rigour in data sources
  - Driving from data through to formal UN reporting
  - Wishing to connect with CEOS / CARD
  - Key meeting in March 2020 cancelled ? - Andreia to engage...
- WGDisasters
  - ?
- GEO-LEO-SAR
  - Experience shows that interoperability is key, but we don't have a clear way forward
- CEOS-COAST
  - Aquatic Reflectance provisional product is a great opportunity for a pilot in the coastal zone

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Digital Earth Africa (DE Africa) (A. Lewis)

Reliable supplies of CEOS ARD are vital if Earth Observation is to have impact in Africa, supporting *Agenda 2063: The Africa We Want*.

Digital Earth Africa is based on the ODC Model

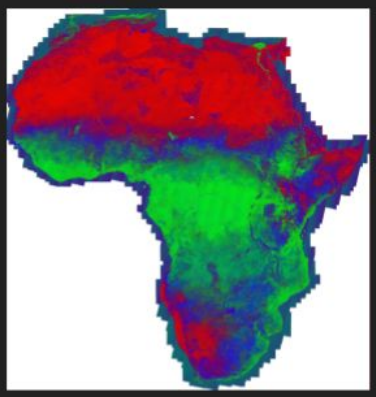
DE Africa has / will use continental ~CARD :

- ALOS continental PALSAR mosaics - NRB (JAXA)
- Provisional Landsat-Collection-2 - Surface Reflectance (USGS)
- From May 4th, Sentinel-2 - Surface Reflectance (*DIY)
- From July?, Landsat Collection-2 - Surface Reflectance (USGS)
- From Late 2020?, Sentinel-1 - NRB, with Sinergise (*DIY)

*DIY = "Demonstrate-It-Yourself" 34

To have impact with EO data, we need to be able to

Produce operational full-resolution products like this:
(fractional cover, Peter Scarth, May 2020), or
This (median surface reflectance, 2018, DE Africa):



Geomedian 2018: the 'average' image for Africa from all available Landsat-8 images in 2018

~ 30,000 scenes
~ 18 TB data
Overnight processing on Amazon
< $200 US

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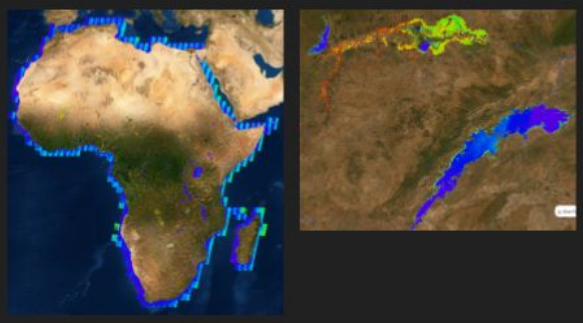
… in order to generate unique continental-scale information

Like this:
(automatic, continental water summary, Africa, routinely updated)



Or this:
(automatic, continental assessment - measurement - of coastal change, Australia)

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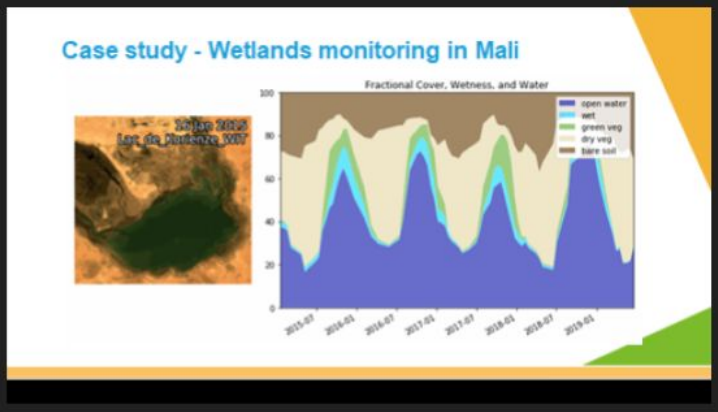
… or rapidly produce site-specific information such as:

Like this:
(Measuring, and visualising, the area of water, bare soil, dry vegetation, green vegetation through time)



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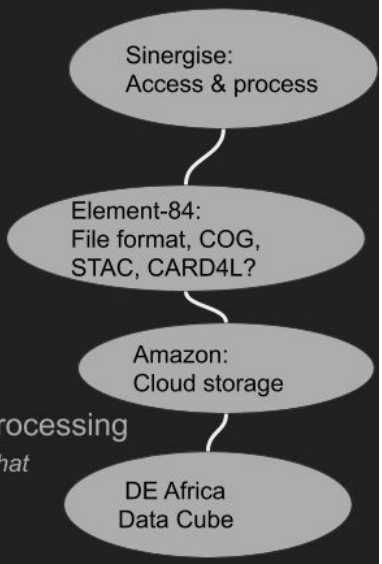
We need CEOS-ARD pipelines!

- Committing to using USGS Landsat Collection-2
- Demonstrating the necessary Sentinel data pipelines:
  - Free and open data
  - Full coverage (all of continent, all passes)
  - Low latency
  - Consistent processing with authoritative and available methods
  - Cloud-performant formats (cloud optimised geotiff; STAC)
  - Cloud-accessible
  - Assured supply of consistent product
- Considering a study of user preferences for levels of processing
  - *Do user behaviours, business models, or case studies indicate that analysis ready data is advantageous to users?*
  - *Interested in your views on such a study!*



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WGCapD Collaboration

Z. Szantoi

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What is Working Group on Capacity Development and Data Democracy (WGCapD)?

Created in 2011, WGCapD undertakes activities based on the four pillars of the Data Democracy Initiative Mission and aims to unify CEOS efforts toward:

- Providing wider and easier access to Earth Observation data
- Increasing the sharing of software tools such as the use of open source software and open systems interface
- Increasing data dissemination capabilities and transferring relevant technologies to end users
- Providing intensive capacity building, education, and training (including awareness and outreach) for enabling end users to gather the information they need and for increasing communication on achieved results

Past collaborations between LSI-VC and CapD groups include:

- None. CEOS WGCapD has provided training events on agriculture, which is related to GEOGLAM AHT which is now part of LSI-VC.
- 9th Working Group on Capacity Building and Data Democracy Annual Meeting
  - Identifying Opportunities for Synergies and Innovation (10 to 12 March 2020)

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WGCapD Objectives

1. Establishing effective coordination and partnerships among CEOS Agencies offering EO education/training
   a. Partner with locally-based partners to increase effectiveness
   b. Use threads to build capacity through discussion of a focused subject (CARD4L?)
   c. Focus on user needs for data and capabilities, including IT infrastructure, to inform actions/plans for delivering the appropriate data and training for the effective use of EO data
   d. Conduct remote sensing workshops and seminars to foster the use of EO and increase workforce capacity

2. Working with CEOS entities to address data accessibility
   a. Publicize resources, datasets, and software made available to under-served communities
   b. Promote the use of dissemination systems (e.g. GEONETCast and other systems) to effectively reach areas that lack consistent internet access or redundant systems in case of emergencies
   c. Organize workshops and training activities to provide individual and institutional capacity to effectively use available Earth Observation resources

3. Work with other capacity building networks to build capacity

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Opportunities for current and future collaborations

- Planned joint deliverables
  - CB-44: CARD4L Awareness Webinar
  - CB-50: Capacity Development Guidance Document for GEOGLAM
- Future CB Deliverables of interest to LSI-VC:
  - CB-56: SAR training for forest and rice monitoring
  - CB-58: CB support to AGEOS on forest monitoring
  - CB-60: Regional training in South Asia on forest biomass

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Seed Questions

1. *Could WGCapD support piloting CEOS ARD? This is in LSI-VC's tasks: "Evaluate CARD4L supply, user access, and user experiences via pilot activities". Feedback based on WGCapD experience is welcomed.*

2. *Also, as we are looking for future target products, feedback from the groups WGCapD works with regarding user needs/demand would be helpful.*

Possible interest for additional collaboration

1. CEOS Paper on the Interplay of Industry and CEOS ARD (CEOS ARD Strategy – Item 2.4)
2. VC-X5: CEOS–Industry ARD Workshop (CEOS ARD Strategy – Item 4.2)
3. VC-X7: Communication with CEOS ARD Users (CEOS ARD Strategy – Item 4.6)

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Wrap-up

M. Steventon

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Actions and Decisions So Far...

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Actions and Decisions So Far...

- Make sure we have a seat at the table for all existing fora: LSI-VC should be directly involved in JACIE, VH-RODA, and IVOS, among others. Leverage these existing meetings as much as possible for CEOS ARD industry engagement.
  - Actions? Leads to meet with OC for ARD20
- Ferran Gascon to follow up VH-RODA organiser Valentina Boccia of ESA to check whether there is the possibility of including more CEOS ARD related topics in support of industry engagement and also whether the meetings might be held more frequently going forward.
- LSI-VC Leads to ask the SIT Chair Team for their assistance providing oversight and coordination of CEOS engagement with industry regarding ARD.
  - There are currently multiple avenues, which may be confusing (IVOS, JACIE, LSI-VC, VH-RODA, etc.)

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Actions and Decisions So Far...

- Replace CEOS-Industry ARD Workshop with online webinar
- Matt to initiate planning for an initial CEOS-Industry ARD webinar, building on the original plan for the workshop and tailoring content to fit the format. This will include preparing presentation materials, compiling a list of invitees, an informational page on the website for advertisement, etc.
  - Late June
  - Webinars should be lightweight and invite significant Q&A and discussion
  - Approximately one hour in duration
  - Two more webinars will be targeted over the months following
  - Broaden participation
  - WGCapD collaboration?
  - Various offers of support to help distribute the announcement - thanks!

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Actions and Decisions So Far...

- SR and ST updates shared via the LSI mailing lists last week
  - https://tinyurl.com/y8empss3
- Details on each update:
  - Surface Reflectance: https://tinyurl.com/y8qxblhd
  - Land Surface Temperature: https://tinyurl.com/y84ftwmz
- Action to please send all feedback to Andreia by May 22.
- Virtual endorsement via email targeted for June 2020.

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Actions and Decisions So Far...

- NRB PFS v4.8 endorsed
- USGS to undertake editorial check of NRB v4.8, before advancing the document to v5.0
- Matt to post NRB v5.0 on ceos.org/ard

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Actions and Decisions So Far...

- POL PFS v2.9 endorsed
- USGS to undertake editorial check of POL v2.9, before advancing the document to v3.0
- Matt to post POL v3.0 on ceos.org/ard
- Matt and Ake to revisit action on hosting and linking sample datasets for SAR products.

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Actions and Decisions So Far...

Aquatic Reflectance PFS

- All to consider nominations for the Aquatic Reflectance PFS Science expert review planned by end-June.
- Steve to send Ferran some more information regarding how USGS is handling the Landsat Aquatic Reflectance provisional products and how the approach differs from land cover observations.

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Actions and Decisions So Far...

- LSI-VC Leads to coordinate a communication from LSI-VC to EC/Copernicus regarding the need for Sentinel-1 NRB CARD4L as a core product, citing examples of various 'ad hoc' efforts ongoing to create Sentinel-1 NRB CARD4L – as evidence of demand for this type of product.
  - Zolti to confirm best approach.
  - Brian and Adam to share their examples (e.g., Sinergise, DEAfrica, other use cases) to help inform
  - Convincing Copernicus services of utility could be another approach
- Steve/USGS to follow up NASA LSI-VC contacts regarding the possibility of assessing MODIS and VIIRS products against the CARD4L specifications.

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Actions and Decisions So Far...

- Andreia to set up a telecon between the LSI-VC Leads and WGCV contacts to review the points on slide 55 of the LSI-VC-9 Telecon #3 presentation (Summary of Feedback from CARD4L Evaluation)
- Steve to share USGS Collection 2 work done around COG and STAC (including the format study, slides from ARD19) to support other agencies interested in working in this direction (e.g., ESA/Ferran, EC/Zolti) – including any user feedback / examples of demand. Inputs from others also welcome.

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Revisiting Some Decisions and Discussions...

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Revisiting Some Decisions and Discussions...

On standardisation:

- A best practices document through OGC could be a good middle ground
- Standards process seems like a big investment, and it isn't clear it will definitely help us achieve our goal (uptake and impact)
- Standards don't necessarily keep pace with current innovation rates
- "Pseudo-standards" which fill a gap are just as valued and used (e.g., the WGCV Protocols)

DECISION NEEDED

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Revisiting Some Decisions and Discussions...

On industry engagement:

- JACIE
  - Additional JACIE 2020 topics if there is something we would like to raise related to CEOS ARD?
  - Possibility of bringing the JACIE and Planet ARD workshops closer together?

ACTION?

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Revisiting Some Decisions and Discussions...

DECISION: Do we need to consider adding 'Advisory Notes' as a fourth component of the CARD4L Framework to address data policy, data formats, interoperability, etc.?

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LSI-VC CARD4L Framework

http://ceos.org/ard/

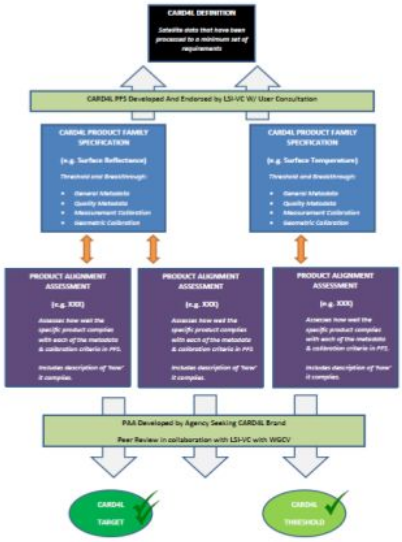
Analysis Ready Data is about improving interoperability -> (comparability of observations through time, between instruments, and across space)

Product Family Specifications ask that we deliver a geophysical measurement, at a known place and time, and with known uncertainty or methods.

But is that enough? So far we have set certain questions to one side:

- Data policy
- Data supply assurance
- Data format
- Data interoperability
- Standards

"So with that general context, in the paper itself I think "Section 3.2, Matters Not Covered in the Specifications" undermines the whole goal of ARD. "



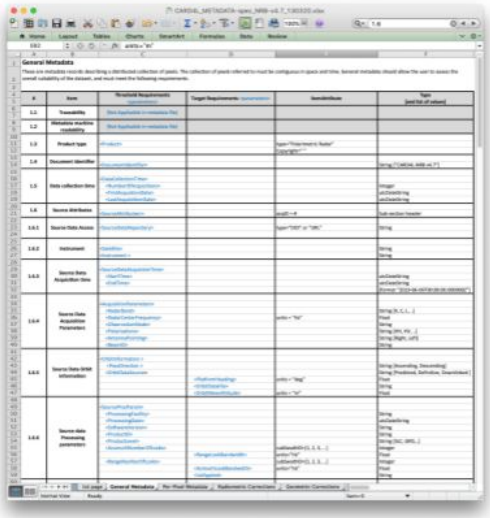
CARD and Interoperability

- For ocean and atmosphere communities (GHRSST), the need is less on the measurement and more on some of these other aspects:
  - Data policy
  - Data supply assurance
  - Data format
  - Data interoperability
  - Standards
- The 'IT innovators' (Radiant, Planet, Element84, etc.) are evolving standards for data formats and catalogs that support machine to machine interoperability and performance in the cloud:
  - Cloud Optimised GeoTiffs (COG)
  - Spatio-Temporal Asset Catalog (STAC)
-

CARD4L SAR NRB Metadata Specs

Metadata Specifications

- Metadata specification developed to accompany the NRB PSF
- Specs for XML format but data provider may select other metadata formats (yaml, json, etc.)
- Non-mandatory (Target req.)



#	Item	Threshold (Minimum) Requirements	Target (Desired) Requirements
1.2	Metadata Machine Readability	Metadata is provided in a structure that enables a computer algorithm to be used to consistently and automatically identify and extract each component part for further use.	As threshold, but metadata is formatted in accordance with CARD4L NRB Metadata Specifications, v.5.0, or a community endorsed standard that facilitates machine-readability, such ISO 19115-2

CARD and Interoperability

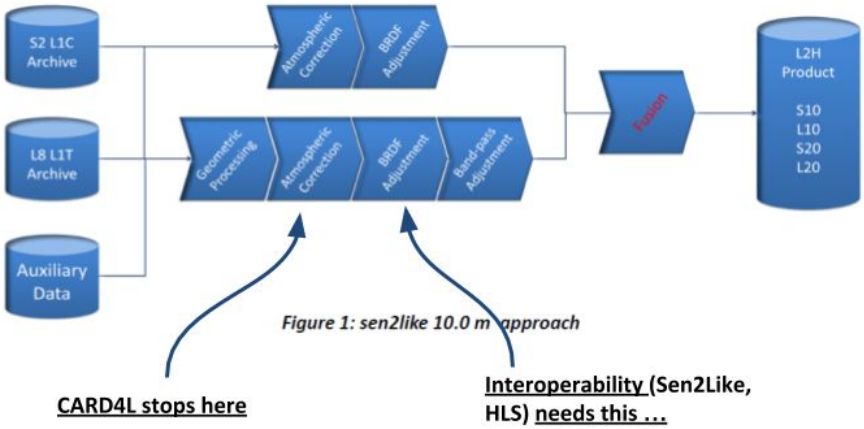


Figure 1: sen2like 10.0 m approach

CARD4L stops here

Interoperability (Sen2Like, HLS) needs this …

Moderate Resolution Sensor Interoperability Initiative

Version 1.0, October 2017

MRI study looks at the interoperability consequences of our decisions

Interoperability consequences

Component	Items	Consequences
Data Measurements	Measurements	Absolute calibrated measurement units with or without corrections below.
	Measurement normalisation	Radiometry viewed through time is significantly impacted by variation in solar and viewing angles.
	Aerosol/water vapor/ozone corrections	Different atmospheric models can introduce significant between-sensor variability.
	Spectral band difference corrections	Different spectral response curves will introduce differences between products.
Geolocation	Geometric corrections	Residual misregistration between images introduces variability in the radiometry measurements.
	Resampling	The number and type of spatial resampling will impact the radiometric signal.

LSI-VC CARD4L Framework

http://ceos.org/ard/

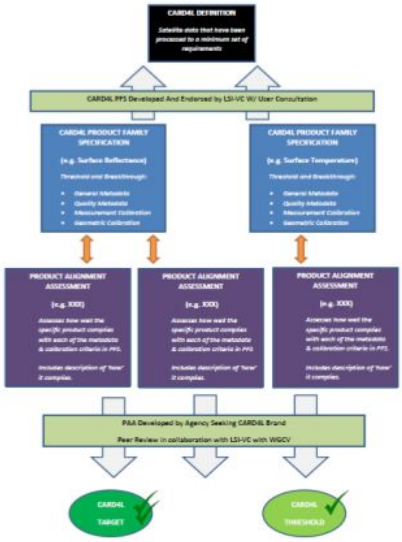
What do we need to <u>add to</u> this framework?

- **NOT proposing to change the PFS**

<u>Industry paper:</u>

"Although the matters above are not included in the CEOS specifications, given their importance both within CEOS and to industry and other stakeholders, CEOS may choose to address them within the broader *CEOS Strategy for ARD*. For example additional advice elements could be included alongside the specifications, and indeed the Radar specifications are already including such advice. Advice might relate for example to preferred data formats, or to the use of Spatio Temporal Asset Catalogue (STAC), to open data licences, or to the provisioning of data as 'on-demand' v. 'pre-processed'. "

<u>Who should we work with - in CEOS. Outside CEOS?</u>



LSI-VC-9 Telecon #3, 12 May 2020

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Revisiting Some Decisions and Discussions...

On accommodating lower and higher resolution datasets under the existing PFS:

- Clearly a need to revisit the specifications in this regard
- Don't see this being a major departure from what has been established, rather a small tweak to what we already have.
- The PFS have, to date, been resolution agnostic and we wouldn't wish to move away from that approach.

DECISION NEEDED

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