**Compiled FDA Responses with key phrase highlights V1.3**

**29 March 2017**

1. **What should CEOS agencies do together?**

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| - **Definition of analysis ready data (ARD)** for various types of datasets and applications,  - Development and management of **data access and management approaches (e.g. Data Cube, CWIC).**  - Provide **guidance to users on interoperability.** How should users combine datasets from multiple CEOS missions? |
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| Define jointly a **common approach to make EO data easily accessible to user**s, i.e. reduce and eliminate barriers to find, access and use EO data. This common approach should address any user type (general public, public services, scientist) with adapted solutions and shall **not be limited to the traditional EO optical data**. Progress further **on standardisation of data access, management, and data/metadata**.  Progress on creating an ecosystem of **open-source standard tools for basic processing** which are useful to a range of user communities and application / processing paradigms. Sharing of codes and results. Develop a joint **repository of successful processes and tools**, which have proven to expand the user base. Develop **user take-up and appreciation metrics** in order to reduce ambiguity in judging user take-up effectiveness and efficiency. **Consider the implications of expanding from the “Data going to users” via data download towards also “Bringing users to the data” via cloud computing and exploitation platforms.** |
| CEOS Agencies can work ensemble to **lower the barriers to effective application of CEOS data**. It is a core interest of CEOS agencies that the impact of data produced is maximised. Approached this way, the focus of FDA becomes clearer.  Barriers to use and impact can be seen as sequential from acquisition of observations to delivery of information. Barriers may be legal, technical, expertise-based or due to a lack of scientific knowledge. Some barriers have been removed already, e.g., through landmark steps such as free and open data policies. However, each time a barrier is removed, the next barrier becomes the limiting factor. **The value of FDA is in helping to remove barriers further down the value-add chain.**  **An analysis of barriers gives context for the work of FDA.** |
| Work toward a common objectives to **make EO data easily accessible to every users, i.e reduce and eliminate barriers to find, access and exploit EO data**  Adopt and test common **standard on** EO data that will **facilitate EO data analysis by expert and non-expert users: Analysis Ready Data**  Assess and test the optimal environment to achieve this goal: DataCube, Virtual Lab, etc …  **Define Analysis Ready Data** for various types of EO Data  **Expand ARD definitions to incorporate ancillary data** pertinent to analytics (e.g. observed climate data,climate scenarios, elevation datasets, etc)  **Develop procedures handbook for integrating existing datasets** in applications  Develop **public data access approaches**  Define data for public good in contrast with commercially valuable data  Promote the use of EO data in others domains where this kind of data is not widely used  **Development of tools and approaches for processing EO data** and generation of EO value-added products |
| CEOS agencies shall clearly define together the **requirements and baseline for inputs for ARDs** but also **Exploitation Platform applications based on a traceable documentation** including the description of usability and caveats. explore also on a **common baseline an information‐oriented approach instead of a data‐oriented**, because most users are interested to retrieve  certain information content. **Guidelines for users** which not only provide the definitions (for example **about ARD**s) but **also the composition of each data set** which origin is from different missions. This goes beyond the definition of an aggregation of data sets but is **needed to clarify against the user the source of information** including quality estimation. **A more generalized definition for a data approach like ARDs.** It is seen that a more general and abstract definition will need in a concrete case more work load, but it can be an opener for future applications in all fields of Earth Observations. |
| CEOS agencies should cooperate to **lower barriers to the effective analysis and application of EO data**, moving beyond discovery and access to data. The exploitation of data is challenged by the significant and valuable investments in new EO missions which increase the volume an velocity of data acquisition and benefited by increasing awareness of the benefit this data can have on the society at large, for Govt and Industry. CEOS can assist this by:  Cooperatively **creating reference architectures and implementations (that test and demonstrate) for interoperable use of CEOS services** that directly support analysis across the industry, govt, research and space agency in order to encourage cooperation and innovation across the EO data analysis ecosystem  Developing, in cooperation, **standards for Analysis Ready Data, Cloud ready data collections and mechanisms to synchronise these** effectively at scale (in conjunction with industry providers) |
| Discuss how to **facilitate** that **data** from different missions (different agencies) could be effectively **used together in a complementary way**. For example, they could provide baselines for quality and fitness to use in (terms of geometry and radiometry), for the data to be shared.  **Support Application Pilots** that show the use of multiple datasets from different missions.  Collect demands and organize (prioritize) the **Pre-processed Analysis Ready Data datasets** that should be provided by the agencies.  Discuss and defend **innovative infrastructures that allow the prototyping of applications** based on large amounts (big-data) of EO data. |
| Progress further on standardization of data access, management and data/metadata itself. |
| Define a **flexible framework that allows integrating regional initiatives**. Focus on selected areas of work where this can be developed and demonstrated eg Land Services. Establish a **principle of interoperability of "data services"** (i.e. data as part of a regional architecture) **and data to allow distributed (further) derivation of value add products**. Establish related **best practices or standards for interoperability** on the basis of application-oriented pilot initiatives. Objective: allow agencies to optimize regionally and ensure interoperability not only of data but also of data as part of "data services" eg. Data cubes – enabling configurable Grid Processing on demand. **Share usage intelligence and integrate user guidance in CEOS information base**. **Share best practices how to manage interactions with large scale ICT suppliers** and how to accommodate related business practices.  **Define and publish CEOS agency future user needs** in form of a road-map. This to cover i.a. computing resources such as storage, storage speed, cost, compute, compute capacity, cost. To serve as a challenge to ICT communities. |

1. **What should CEOS encourage that individual agencies do better on their own (e.g. best practices, etc.)?**

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| - Gain a **better understanding of their data users, their needs and expectations**. This may go beyond those users that are currently obtaining the data, but considers those that desire the data and may have challenges with its access or use. For example, not all users have good internet and many users want to “own” the data and will not use internet platforms.  - Make efforts to **simplify data access and minimize data processing for users**. If possible, **routinely produce ARD.** MOST global users want ARD and they do NOT want to make it themselves.  - Release more satellite data **free/open for global users.** |
| **Make data easily and widely available**; **ensure the best possible data quality** in the spirit of simplifying data access and usage. |
| Better **understand users needs** and more importantly how they integrate and ingested geospatial information within their own environment. The goal is make sure, that any **users can have free access to EO data ready to be used and analyzed to extract information and knowledge that are subsequently used into their own applications** and environment for their specifics purposes.  Make an effort to develop, test and implement an environment (data infrastructure, ARD, analytic capacity, etc.) that will **simplify and democratize access** to EO data for users.  **Gain a better understanding of the information products** that the data is needed to support. This is key to understanding the need for data integration and the different levels of Analysis Ready Data.  **Aim at producing ARD particularly for any ‘public good’ observation** and facilitate the access to this data making as much as possible free and open.  **Develop, encourage, and support methods and analytics development under open-licensing frameworks (e.g. GPL/LGPL)** |
| **Process** (and re‐process) their **data on base of CEOS guidelines** if any  Include a **quality management on data products**  Produce either (a) **ARD similar approaches** or (b) allow **inclusion of users in the higher‐level information retrieval** (exploitation platforms or similar)  Think in general about how to **include data of commercial providers**: National agencies will have to interact in the future with commercial providers, because they are sometimes partner on the same market and **cannot exclude those.** |
| Develop a better and shared **understanding of the impacts and opportunities of new data analysis capabilities now available** to the EO ecosystem (most notably Cloud computing and ubiquitous use of spatial data) and the role of a CEOS agency in this ecosystem beyond the transitional access and download paradigm which can’t easily deal with the step change in data acquisition rate from new satellites.In doing so work towards developing and supporting **new standards and interoperable architectures for EO data analysis** as part of Business-As-Usual operations for their agency and contribute the agency part to this ecosystem. Consider moving to **dynamic, on-demand data preparation pipelines (with caching) for the creation of ARD (or other products).** |
| Provide as much **documentation and open interfaces to access** their data.  Develop their own **mechanisms to support the access** to their data using the agreed standards. |
| **Simplification of data access and usage.** |
| Establish **best practices** in their own environment **for hosted processing approaches** involving private sector suppliers. Definition and implementation of **individual agencies' own ARD contribution** to serve selected 'verticals'. For other areas: **establish the 'sweet spot' of pre-processing towards ARD level by individual agencies as a basis for further value add by other actors** (public, science, business). Set-up **interfaces with the private sector as part of a regional architecture** that interfaces with the CEOS FDA.  Publish a **CEOS contribution directory of data and services**. Establish **appropriate IPR and licensing frameworks** at regional level. Promote proper interfacing of regional systems with CEOS FDA. Skill development. |

1. **What should be considered ‘out of scope’ for CEOS?**

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| - Requiring agencies to comply with ARD formats. Though CEOS may formulate a common definition of ARD and a desire to produce that ARD, agencies will need to evaluate its own capabilities and resources to develop ARD, sustain its production and deliver it to the users.  - In-situ data coordination |
| Develop a unique solution, which is suitable for any type of users and any type of EO data**. Embark on single-path evolution strategies.** **Avoid initiatives in competition with industry.** |
| Avoid working on the development of a data infrastructure that would compete with commercial data and services providers (ex: Google Earth Engine, Planet lab, etc.). Rather, we should work on developing an environment that would make it easier for these providers to access our EO data, but also to all other potential users. Let us work to become a unique and diversify sources of geospatial information (EO data) essential for all.  Any regulatory role. CEOS is about collaboration and guidelines and standards can be key in facilitating collaborations but enforcing a standard should not be the role of CEOS. |
| CEOS is the right body to prepare example for combined, well‐recognized and sustained approaches, but not in terms of defining the silver bullet by two reasons:   * The technology change is increasingly rapid so that such a “technological” CEOS silver bullet will be out of state of the art when being recommended and finally implemented; * It is quite difficult to judge about the different existing models especially if those different applications and “markets”. CEOS must be open to different models to submit the EO data of its agencies in their possible variety of applications and information.   It is also out of scope for CEOS **to define at which data product level the users may get their information.** Is it wishful to provide only derived information or better to provide well‐calibrated radiances to allow sophisticated users their research or application? **The question about the spread to be served cannot be answered in general. This is a decision to be taken by the individual agency**(ies) in correspondence with the user community. |
| Creation of entire **monolithic workflows from source data to application in closed systems**. Focus on the CEOS agency contribution to a more open ecosystem of value adding providers of both infrastructure, analysis and applications |
| Local storage and local infrastructure behind of what is exposed through agreed standards. Agencies will continue to have their own data in different formats, including their historical archive, but they can commit to an interoperable way to expose some of the data, or products. |
| Defining scope of involvement of EO agencies and interfaces with the private sector. |

1. **Which aspect of FDA has the biggest potential to transform how satellite data is exploited?**

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| - For users in "developed" countries with good internet, **cloud computing and exploitation platforms** have the biggest impact on satellite data exploitation.  - For users in "developing" countries with poor or non-existant internet, **analysis ready data** has the biggest impact on satellite data exploitation. |
| Enabling **“common” ARD** among agencies in the cloud.  Enabling **common tools to exploit ARD**, modernizing access to Satellite data.   * Tools such as Google Earth Engine have already proven the amount of vast exploration that is enabled on satellite data. (e.g. see the Global Surface Water Explorer provided by the European Commission at <https://global-surface-water.appspot.com/> and corresponding paper <http://www.nature.com/nature/journal/v540/n7633/full/nature20584.html>). * An **open toolset to exploit ARD** that can be deployed in various cloud providers or smaller hybrid clouds on agency systems will modernize access to Satellite data. Geoscience Australia Data Cube is an example that has already proven this possible through the deployment of small CEOS cubes and a national scale deployment in their HPC center. |
| **Ensure EO data to be widely used in connection with any other type** of (geospatial) data. “**Bringing users to the data**” **via cloud computing and platforms** in well-balanced combination with ARD and Data Cube initiatives. This would facilitate this inter-connection. Coordination between agencies can **support user communities with knowledge and basic tools** to facilitate the communities’ paths towards ARD and Data Cubes for their needs**. Facilitation of data access,** especially when considering large-volume missions, including identification of duplicated, reprocessed and deleted products. |
| CEOS agencies are currently facing a potentially important evolution in the type (and thus number) of users of EO data.  There are numerous factors that have combined as the origin of these changes – an ever increasing digital economy, increasingly digital/connected populations, huge volumes of free and open EO data.  This (r)evolution begins with “accessible” EO data like imagery (optical and radar) and will extend to higher level products derived from other EO data.  FDA’s of various types hold the key to facilitating access and use of these EO data sources by all of these new users whether they be “general public” users with little or no specific domain knowledge or “specialized science / expert” users. In our opinion this first question is “back-to-front” in that, because of the factors listed these changes are happening and FDAs will need to be invented to facilitate this evolution.  If the FDAs are well designed the changes will come about sooner and happen more smoothly, otherwise this will all take more time and restrict the uptake of EO data by these potential new users.  **CEOS’s job here is to identify areas where interagency exchanges are required to make sure the FDAs that we all put in place can talk to each other/access the datasets that are available in a compatible way.** |
| **Accessibility to computational platforms** that overcome the expertise, cost and technical barriers that users, at a range of scales, may otherwise experience. |
| **Agreement on the ARD definitions** for many EO domains  **Agreement on standards for data search, data formats, metadata formats, provenance, data quality**  Multi agency agreement on **high level design for advanced storage and distribution** architecture for high data volumes |
| **Data cube, cloud computing, exploitation platforms** for the transformation of EO data into information products and knowledge.  EO is evolving from a state where you need experts to be able to analyse and extract meaningful information to a state where **users seek to analyze prepared information products without possessing the detailed knowledge required for the production of those products**. It’s something akin to the evolution of the computer where users no longer need to be programmers. The FDA is key to expanding the use of satellite data beyond the few initiates. The value of any data is proportional to the quantity and quality of the information/knowledge that we can extract. For the EO, information have to be extracted using sometimes very specialized tools that experts from others domains are not able to use. So the **development of well-designed EO tools, accessible to the community can have a big impact and facilitate the use of EO data in others domains.** |
| The idea behind is the highest potential: It demonstrates against the users that their needs are taken seriously and CEOS agencies like to serve a larger community on the base of an aggregation of homogeneous produced data, on the perspective of applications, and on the perspective of information flow. |
| **“Bringing users to the data” via cloud computing** will transform how satellite data is exploited. Possibly even in developing countries where reasonable internet access is available.  **Simple to use tools and analytics built on top of ARD** to provide common products from EO data. E.g. land usage monitoring, water detection, coastal monitoring…  **Delivering a service based architecture**, i.e. Platform as a Service, Software as a Service, Data as a Service. |
| The creation of **an open systems architecture (FDA) and reference implementations that supports the exploitation** (in particular analysis) ecosystem in the presence of Big Data. This is linked to ARD but includes the superset of services required to achieve actual exploitation (e.g. The Open Data Cube open source project as a reference implementation for one component, algorithm registry for sharing of analytics routines, standards for analytics services interfaces). |
| The inclusion of the need for **preprocessed Analysis Read Data**. This will generate better products and allow the community of users (commercial, academia, government) to invest resources in the final application. Most applications need a lot of research, methodology, non-EO data collection and verification. |
| **Simple navigation/ access** of satellite data. **Store data in optimized way to avoid processing**. Simple unique identification of products and its version (product copies in many places). |
| Definition of a **suitable level of ARD products and availability of flexible ICT (cloud) resources** on commercial basis. |

1. **When you first read the interim report, what struck you as the action CEOS should most urgently take in the FDA area?**

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| There are MANY things CEOS can do, but we will need to focus our efforts. As always, we should continue to promote free/open access to our data, as this has the most potential benefit. Next, we should gain a **better understanding of user needs and challenges** so that we (CEOS) can have the greatest global impact and societal benefit. In the end, we will need to decide where to focus. Should we focus on **ARD, cloud computing, data access and application platforms, developing countries**? |
| Need to **understand user needs**. Need to **develop ARD access use cases**. |
| CEOS should aim at **reconciling the apparent divergence of approaches into a unified and harmonized approach.** This is a straightforward exercise once it becomes clear **that all initiatives represent complementary elements towards common objectives** (e.g. lowering the obstacles to broader and more sustainable data use). An **assessment on the budget impact** of some approaches is lacking. |
| **Anticipating data-cube architectures that will work for a range of user-types**, such as:   * Developing countries where infrastructure and skills may be limited but needs for information are high * Advanced countries with high levels of skills and ICT but whose focus is on extracting information rather than remote sensing expertise. * **International efforts under GEO and UN programs** to deliver evidence and information to tackle global problems in forests, food production, water, land degradation and community safety; possibly modelled on the   The pilots seem to address the first two of these |
| Get **agreement on ARD definitions** for varied EO domains (land, ocean, coastal water, etc.)  Get **agreement on more detailed  project objectives** that are implementable in the short term (1-3 years). |
| All agencies are facing the same problems, they collect a phenomenal amount of data that will continue to increase in the future, and that they are still not easily accessible for everyone. There are still **technical barriers limiting the full exploitation** of EO data acquired by Agencies that **needs to be solved** collectively.  **Defining ARD through test cases**. This is by no means the single action that CEOS should consider urgently, nevertheless it is instrumental to future EO mission products. **Planning for observational data with a data architecture in mind is a lot more efficient than trying to convert archived data.** |
| CEOS shall take into account as first action the **challenge of big data under the perspective to deliver timely homogenous data and/or information**. This includes **all kind of models dealing with homogeneous product provision as for example ARD or information uptake (exploitation platforms).** |
| There is a **lack of understanding of the EO user needs** across the globe. This would allow the use cases in point b. below to be focused accordingly to support the uptake of satellite data.  **Translating the benefits of EO into demonstrable use cases** focused on user needs and societal benefits, to promote the uptake of satellite data. |
| The pressing **need to build a better shared understanding of the impacts of changing user expectations on the ease of EO analysis**, the **ubiquitous use of Cloud** computing at scale, and the **dramatically increasing velocity and volume of data** from new EO missions on the entire EO ecosystem. From this shared understanding comes the need to understand the **changing role of CEOS agencies in this** (e.g. From product, or end to end solution providers to contributors and facilitators in the broader ecosystem) |
| The coordination (best practices, expertize exchange) of efforts related to the **production of Analysis-Ready Data.** CEOS should work better in the issue of **cloud computing**. Most of the examples shown refer to commercial cloud environments. Each agency (country) can have their own policies and liberties regarding of the use of these environments. |
| **Focus**. The broad range of opportunities will need to be served by many, not only CEOS agencies. **Application-rooted priorities need to be set and best practices and interoperability approaches piloted** in those domains. Uptake and investment from other sectors needs to be stimulated. |

1. **Which of CEOS’s strategic priorities could benefit most from the application of FDA?**

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| The primary strategic goal of CEOS is to promote the global use of satellite data through international coordination. The application of FDA has the potential to **increase the use of CEOS satellite data** by exploring modern technologies and gaining a better understanding of global user needs and challenges |
| **Common ARD** is the input to exploitation of data. Once we get common ARD, **standardized tools for exploiting it** (including APIs) will benefit the community. |
| The **Promotion of Data Democracy (by facilitation access and processing).** Remaining responsive to Earth Observations Users’ needs. |
| In recent years CEOS has shifted focus from making sure that satellite systems were being developed and producing well “CalValed” (WGCalVal) widely published (WGISS) datasets to thematic areas either through WG’s (Climate/Disasters) or Ad-hoc groups (GFOI, GEOGLAM, …).  The interest in FDAs is a clear continuation of this **data access focus for user communities.  Broadening access to EO data for disasters, forest-carbon, agriculture etc. are all CEOS strategic priorities that will benefit from fit-for-purpose FDAs** |
| **Promoting the use of satellite data --- allowing domain experts to get on with it** |
| **Agree with A statement** on that  — copied below  "The primary strategic goal of CEOS is to promote the global use of satellite data through international coordination. The application of FDA has the potential to increase the use of CEOS satellite data by exploring modern technologies and gaining a better understanding of global user needs and challenges." |
| We support A’s suggestion: “*The primary strategic goal of CEOS is to promote the global use of satellite data through international coordination. The application of FDA has the potential* ***to increase the use of CEOS satellite data*** *by exploring modern technologies and gaining a better understanding of global user needs and challenges*.” |
| **Increase the use of CEOS satellite data** by users  Open data initiatives have increased accessibility but FDA is the opportunity. The primary strategic goal of CEOS is to increase the usability of the data and therefore increase the impact of observations in evidence-based decision making. |
| **Increased use of and value from EO data** on global user applications and needs |
| The development of a **“standardised” approach to the collection, use, exchange and analysis of satellite data across CEOS agencies will contribute to the increased use** and uptake of satellite data across the globe. |
| **Proactively engage in global discussions on the critical challenges** that face society, such as the achievement of the Global Goals for Sustainable Development. |
| **User uptake** for CEOS data |

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1. **From the perspective of a user, where is coordinated effort by CEOS agencies on FDA most critical?**

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| Users will look to CEOS as the "leader in space data". We must **consider and accommodate all types of users with diverse capacit**y (developed vs. undeveloped), diverse applications and diverse knowledge. |
| We need to **understand the use needs more and document those**. We should establish a **federated set of use cases**. **Modernizing access** to the data (based on established use cases). **New methods to access** all of the data that the user wishes to exploit (rather than traditional download of mass amount of data). Also, generate **open tools** including standard APIs **to enable fusion** of data. |
| By expanding the perspective of the “Data going to users” via data download towards also **“Bringing users to the data” via cloud computing** (which will reinforce the paradigm “Information going to users”). **Providing knowledge and basic tools to enable data usage and help communities define their ARD and Data Cube needs** |
| The user will benefit most from coordination between CEOS agencies where the coordination allows him to **access data or processing services from many agencies** as seamlessly as possible.  Because of data volumes, we will most likely not be transferring data from one platform to another, so the **interoperability issues here may be focused on data discovery and processing services**  We must also think about the role of the national agencies where there will also be services proposed by private companies.  **Where does the role of the public sector national agency stop and the private sector begin?** Does this vary by data types/thematic areas?  (more public in climate datasets, less in VHR optical data?)  Are there common messages (ex. on climate or disasters) that are common to CEOS agencies and that the public sector must take the lead? |
| In **removing barriers to exploitation** of CEOS data. See the diagram above. This implies that good coordination of related initiatives is essential – **FDA, CARD4L, MRI at least**. |
| **Open data**  **ARD definitions** for many EO domains  **Agreement on standards for data discovery, data formats, metadata formats, provenance, data quality,….** |
| EO data users can have different levels of know‐how about satellite data generation. The criticality is to **serve all user communities with their needs**. Some user communities are fully compliant to get the higher‐level information from EO observations; others like to have the original data sources to retrieve the needed information. It is the broad variety of users to be served: as more open the FDA approaches the more user perspectives are served and CEOS as leading instance will be recognized. |
| Make CEOS satellite data easily **accessible and available** to all users.    As touched in the interim report, users can come from a developed or undeveloped data user context. An experienced user will seek efficiency in absorbing more data sources into products while the emerging user will seek to make the minimum investment for maximum sustainability. |
| Making the **link between satellite data providers and application developers** is critical, including **breaking down the barriers to exploiting satellite data** by promoting the ways of accessing satellite data and the myriad uses for it, and the development of **simple, open source tools and analytics.** |
| **Modernising data preparation and access ready for exploitation** as part of the broader ecosystem (not product generation by CEOS agency in closed system, or raw data). From the user perspective it is about achieving **greater preparedness of the data for use and smooth connection to the broader ecosystem** (e.g. Connections through to the Cloud providers where many EO businesses would operate services – doing this with a shared store (rather duplicate per business) manner would greatly facilitate such businesses and users in general). This should be extended beyond data access alone into providing EO data analysis service as components in this environment (this is often done as open source software tools but these can be difficult to make part of an automated workflow or a business operation). |
| **Pre-processed Analysis Ready Data.** |
| **Diverse data formats and its usage**. |
| Provision of **flexible intermediate products based on data from several CEOS agencies in ARD formats**. This will allow further value-add activities by various user communities |

1. **What is one thing your agency is already doing in this area that you would like to see contribute to future CEOS efforts in this area?**

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| The SEO (with GA, CSIRO, and USGS) is developing **Data Cube prototypes** and testing this FDA approach with a diverse set of global users. |
| **Understand community needs and tools required** to meet these needs. - The USGS has established a Land Change Science project based on all available U.S. pixels in the Landsat archive. Through this effort, the **USGS has established Landsat Analysis Ready Data** to meet U.S. Land change science needs. The **USGS plans to establish ARD globally** and is in the early stages of determining specifications for the Landsat Global ARD (working with LS-IVC, Landsat science team, other government agencies and industry partners). The USGS hopes to deploy tools to exploit the global ARD based on findings from the U.S. Land Change Science Project and feedback from FDA pilots, industry, the science team, universities, and the community. |
| The overall European activities leading to a wider use of EO data, as embedded in the **C “EO-Innovation Europe” concept** elaborated within the ESA-led European Ground Segment Coordination Body (GSCB) and shared with the European Commission. This includes infrastructure elements (“back office”), which is manifest in a major investment of the EC in the (**Data Information and Access Service – DIAS which is currently under procurement**). and many value-adding elements (**Sentinel Collaborative Ground Segment, data cubes, data visualisation tools, data handling tools, etc…**). We are also scaling up and further developing the various data hubs. |
| **Data processing as web services to allow interfaces between FDA platforms.** A demonstrator was developed by B for the ESA-led Ground Segment Coordination Body (GSCB) and could be presented here as an example of how to provide interoperability between processing platforms.  We have seen that there is a **strong push for ARD products even on historic datasets** and have noted with interest that SPOT ARD product and datacube ingestion software is being looked at by the SEO in collaboration with university partners.  While we understand the need for standard ARD products, atmospheric correction on historical SPOT images presents certain challenges, and care must be taken not to apply atmospheric correction codes blindly with inaccurate parameterizations. The difficulty being that the parameters depend on the atmospheric conditions at the time the image was acquired.  We are willing to review what can be done to generate ARD products and datacube ingestion software for historical SPOT imagery, given the limitations just described. |
| **The Australian Geoscience Data Cube** |
| NASA has a number of wide ranging **cloud computing prototypes** that explore the use of cloud computing for everything from processing to archive to  data distribution to end user data analysis.  Lessons learned from these prototype can make a valuable contribution to future CEOS efforts in this area. **Contribute data systems standards** that NASA uses |
| Presently, the E is supporting the Canadian Center for Earth Observation and Mapping (CCMEO, formerly the CCRS) for the development and demonstration of National Geospatial Data Analytics Infrastructure of EO data. This environment will provide a **data infrastructure, ARD, and analytical tools to fully exploit EO data.** The system will be an open-access enabling government, academia, and commercial sectors to develop value added products and services.  The E with Natural Resources Canada (NRCan) are working on **big geospatial data integration approaches and data visualization platform** (Federal Geospatial Platform). We see this as the context for contribution not necessarily in terms of tools but certainly in terms of exchange and experimentation. |
| DLR is implementing in the context of COPERNICUS it’s **collaborative ground segment CODE‐DE** which provides not only a **platform for intelligent access of Sentinel data products but also the opportunity to include and to run applications** within the environment to serve users with derived information. **CODE‐ DE is open for testing suitable FDA approaches.** |
| **Contributing to the CEOS FDA and the Open Data Cube** activities and developing **an Earth Analytics Industry Hub** which use these to directly support innovation by Industry and Government. |
| **UK-GEOS** is a good example of what the UK is doing to try to bring EO data into the heart of government policy and decision making. The UK Space Agency is also looking at the feasibility and potential options for developing a **national EO Data Access and Exploitation Capability**. This is closely aligned with UK-GEOS, but focuses on the commercial and general public sectors as well as linking into the research community. |
| INPE is historically committed to free source and free data as a policy. More recently we have ongoing initiatives with aimed at **designing and building an open source knowledge platform for describing, accessing and analyzing big Earth observation data**. From the application point of view we intent to produce large-scale land use and land cover change information on tropical forests and global agricultural production using the knowledge platform, with significant better quality than current methods. Analysis of time series and change detection is crucial to achieve this results.  And we also want promote the knowledge platform for adoption by researchers and students, emphasizing the benefits of large-scale data sharing and reproducibility of scientific results |
| Working on **data services roadmap** in order to improve data services for benefit of end users. |
| Provision of **high-level products through Copernicus Services**.  The provision of a new data access service focused on but not limited to **Copernicus: DIAS.** |

1. **What could be the key blockers that prevent your agency from participating in CEOS efforts to promote the benefits of FDA?**

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| For many agencies, the "key blocker" is likely **resources**. There may also be conflicts with agency **priorities**. |
| **Resources** |
| **Resources** |
| The main issue for B will be securing sufficient **human resources** to participate in CEOS efforts.  With the ramp-up of activities in this area generally, resources are very stretched.  Commonality with current internal B activities will be necessary in order to contribute. |
| **A ‘closed’ approach would be difficult**. An **open source** data cube code-base and community that allows a growing number of contributors, and invites participation from beyond the satellite and CEOS community, is **essential** to success. |
| Lack of **resources**  **Lack of implementable project plan** that aligns with agency internal objectives and that has identified outputs for the next 1-3 years. |
| Agency **priorities**  **Resources** (human and financial)  Just as in the A sample answers, key blocker is **resources: human and financial.** These are limited and are subject to changing priorities. This may highlight that the first direction that we should promote the benefits of FDA is towards decision-makers who drive the priorities.  For that the **EO tools have to be more end-users-oriented in order to facilitate their use** in various domains. |
| **Resources** |
| **Resource** limitations are the key blocker, but the work the UK is doing nationally is inherently aligned with CEOS efforts. |
| **Resources** – we need a sustainable business model for this activity, but this is contingent on CEOS cooperation on FDA. Continuation and communication from CEOS on FDA is assisting is reducing the risk on this aspect. **A “closed” approach by CEOS agencies in developing systems** – this applies architecture and design. It could also apply to some source code, open source reference implementations are useful in this environment. |
| **Resources**. Currently the amount of resources available to participate in the CEOS efforts is very limited. The real benefits from the participation in CEOS efforts are not clear to the management level. |
| Human **Resources**. |
| **Transition from heritage approaches and infrastructure** to FDA. **Coordination with ICT and Big Data Analytics sectors**. **Definition of boundaries** and (EO) scope. **Resources** |

1. **What might be the main technical barriers?**

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| **Data volume**: The ever-increasing volume of EO data has a direct impact on the cost and maintenance of data infrastructures. This is becoming an issue for all governmental organizations. |
| Proliferation of **silo technical implementations with incompatible interfaces** leading to a incoherent architecture at global scale (CEOS and the EO ecosystem). |
| I don’t see any significant technical barrier that prevents INPE from participating in CEOS efforts to promote FDA. |